

March 11, 1958

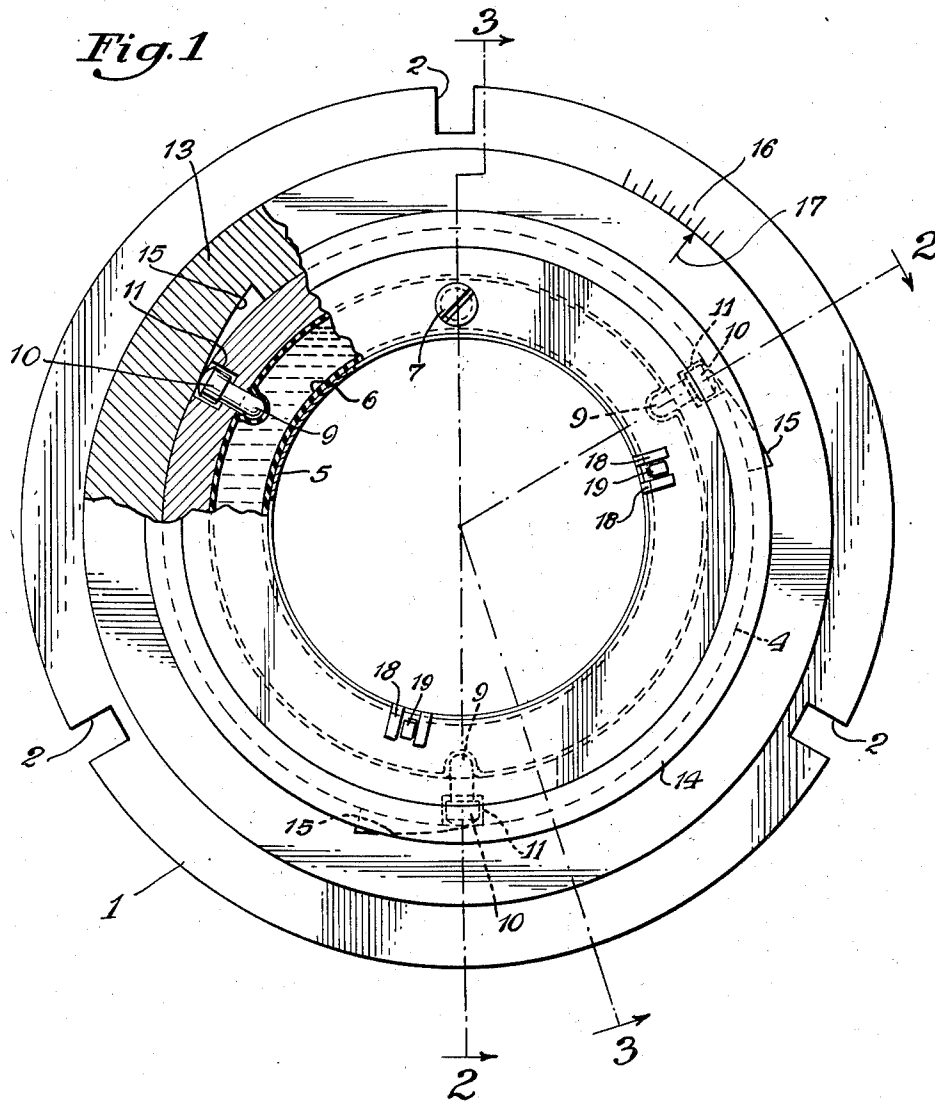
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2,826,420

HYDRAULIC HOLDING MEANS FOR CHUCKS AND THE LIKE

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3 Sheets-Sheet 1



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Fig. 2

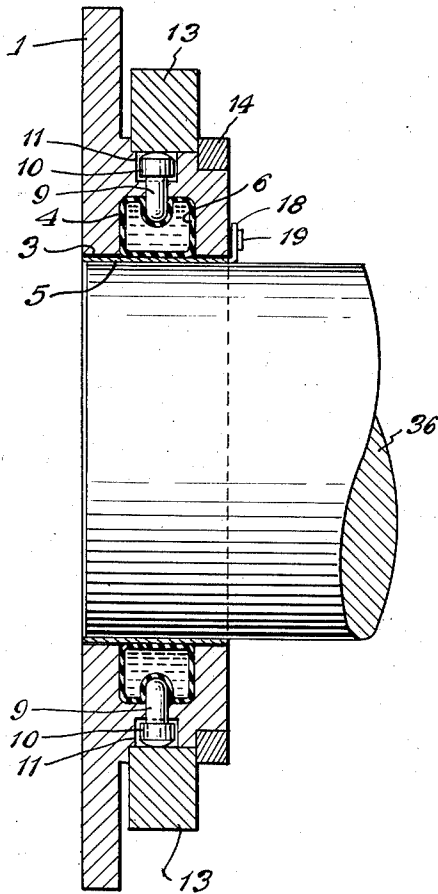


Fig. 3

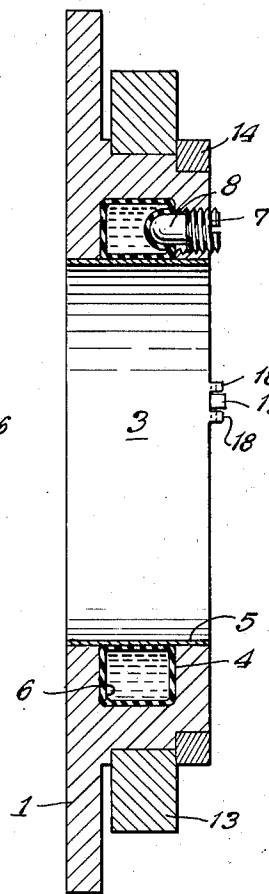
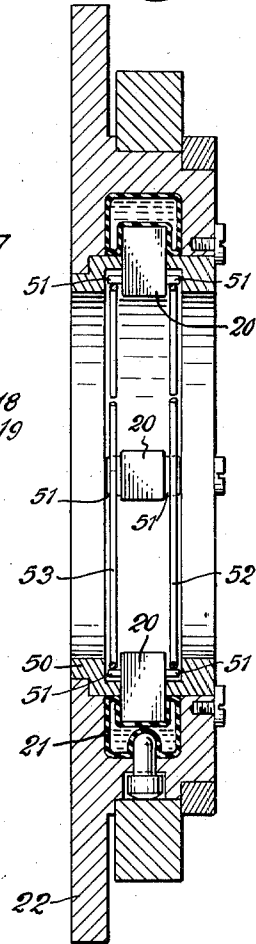


Fig. 4



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Fig. 5

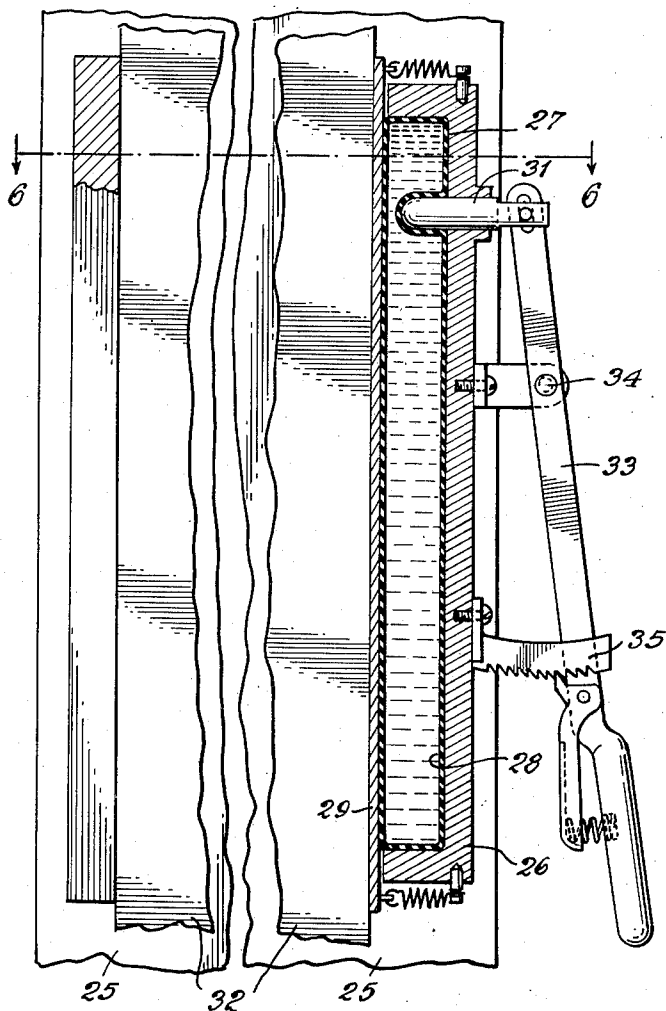


Fig. 7

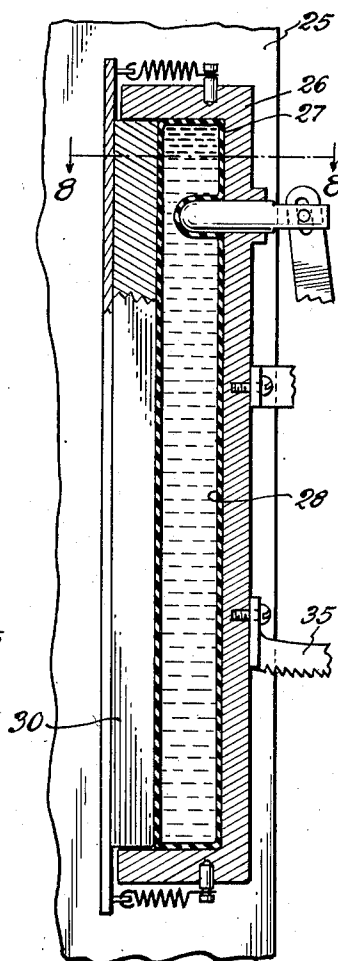


Fig. 6

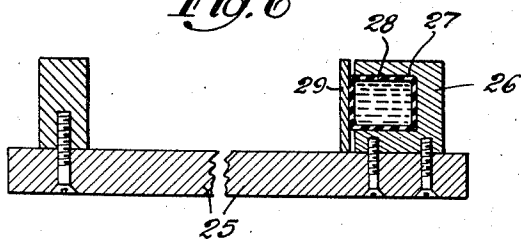
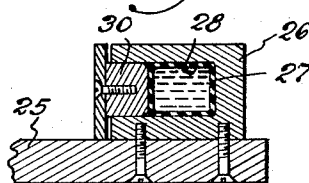


Fig. 8



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HYDRAULIC HOLDING MEANS FOR CHUCKS AND THE LIKE

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Application January 8, 1954, Serial No. 402,931

7 Claims. (Cl. 279-4)

My invention relates to improvements in hydraulic holding means which may be used for machine tool chucks or other purposes where micrometrically accurate control of holding or tightening pressures is desired.

My invention is primarily illustrated in connection with a chuck wherein accurately controlled gripping or holding pressures extending through a comparatively limited range of movement are desired though the invention is also illustrated in connection with wider range of movement.

In general, I propose a closed flexible walled hydraulic container enclosed within a rigid supporting structure wherein by one adjusting element, play may be removed and thereafter by one or more adjusting elements, the pressure applied for gripping or other purposes may be micrometrically controlled. I propose to take advantage of the well known laws of hydraulics that pressure applied on hydraulic fluid in a closed system produces equal unit pressure throughout the entire system.

Other objects will appear from time to time throughout the specification and claims.

My invention is illustrated more or less diagrammatically in the accompanying drawings, wherein—

Figure 1 is a side elevation in part section of a chuck embodying my invention;

Figure 2 is a section along the line 2—2 of Figure 1;

Figure 3 is a section along the line 3—3 of Figure 1;

Figure 4 is a section similar to the section of Figure 2 showing a modified form of the device;

Figure 5 is a plan view in part section of a further modification;

Figure 6 is a section along the line 6—6 of Figure 5;

Figure 7 is a plan view in part section of a further modification similar to that of Figure 5;

Figure 8 is a section along the line 8—8 of Figure 7.

Like parts are indicated by like characters throughout the specification and drawings.

1 is a chuck plate. It is slotted about its periphery as at 2 to receive holding bolts to fasten the plate to any suitable supporting mechanism or apparatus, for instance, a lathe. The chuck plate is centrally apertured as indicated at 3. The inner periphery of the chuck plate is grooved as indicated at 4. 5 is a thin filler ring socketed in the plate 1 and closing the inboard side of the annular groove 4. 6 is a flexible walled, continuous, closed, hydraulic container encircling the ring 5 and filling the annular groove 4. 7 is a take up screw threaded in the chuck plate 1 and having a curved ended cylindrical piston portion 8 engaging the flexible side wall of the hydraulic container 6.

When the hydraulic container is located in the annular ring or channel 4 and the flexible ring 5 is socketed in the central aperture of the chuck plate 1, it is necessary in order that assembly be made that there be some clearance between the incompressible hydraulic fluid contained within the container and the relatively rigid chuck plate 1 and ring 5. After assembly, the screw 7 is rotated to engage the flexible wall of the container 6 to

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take up such slack and clearance and insure that the annular chamber or ring 4 is completely filled.

9 indicates radially disposed pistons slidable in the chuck plate 1 adapted to engage the flexible walled container 6. Each piston is provided with a head 10 adapted to be socketed in an aperture 11 in the chuck plate 1. The heads 10 are of substantial thickness so that they will always be in register with the pockets 11. 13 is a ring rotatably mounted on the chuck plate 1, held against axial movement by the fixed holding ring 14. The adjusting ring 13 contains a plurality of cam pockets 15, the surfaces of which are adapted to engage the heads 10, the pockets 15 being of such depth that even at maximum outward radial movement of the pistons 9, the heads 10 will penetrate the pockets 11.

On the face of that portion of the chuck plate which extends radially beyond the ring 13 is scribed a series of index lines 16 associated with an index 17 so that the operator may rotate the ring 13 with respect to the chuck plate 1 to move the pistons 9 in or out through a predetermined excursion.

When a cylindrical object to be held is placed in the ring 5, then the adjusting ring 13 may be rotated, applying pressure through the pistons 9 to the hydraulic material in the container 6 and compressing the flexible ring 5 against the entire outer periphery of the object contained within the ring.

Such a chuck as this is adapted to contain cylindrical objects, the diameter of which is just enough to permit the object to penetrate the ring 5 so that the ring 5 will be constricted within its elastic limit to grip the object but slight movement of the pistons being required. The pockets 15 are so designed that a substantial angular motion of the ring 13 will produce limited piston movement, thus giving a substantial mechanical advantage and insuring that a firm grip of the ring 5 is exerted on the object held by the chuck. The ring 5 is provided about its periphery with a plurality of outwardly extending fingers 18 interlocking with legs 19 on the plate 1 so that relative angular movement of the rings is effectively prevented without interference with the contraction of the ring 5 under the influence of the hydraulic pressure.

Figure 4 shows a modification of the device, which is applicable to a wider range of size and shape of object being held. In this case instead of the ring 5, a plurality of pistons 20 or jaw members are socketed in the chuck plate liner ring 50 for radial movement. These pistons extend into the hydraulic flexible container 21 and project inwardly through the wall of a similar chuck plate 22, to grip the work. In this case, a greater range of size of work may be handled, the hydraulic container being so far as its outer periphery is concerned and so far as the original take up is concerned, the same as the hydraulic container of Figures 1, 2 and 3.

The jaw members 20 have fingers 51 projecting axially with respect to the chuck and limiting, by their contact with the chuck plate liner ring 50, their outward movement. 52, 53 are flexible spring rings engaging the fingers 51 and urging them and the jaws or pistons 20 outwardly. These rings are easily overcome by hydraulic pressure but when the hydraulic pressure is relieved, they expand to open the jaws.

In the modified form shown in Figures 5 to 8, 25 is a support for example, the bed of a milling machine. Attached to that support is a housing 26, containing a channel 27 open at one side. Within the channel is a flexible walled, hydraulic fluid container 28. The open wall of the channel is closed by a movable plate 29 which may extend the entire length of the channel in one piece or may be in several sections and may rest against the face of the housing 26 as indicated in Figure 6 or take the form of a plunger 30 as indicated in Figure 8.

31 is a plunger slidable in the wall of the housing 26 adapted to penetrate the channel 27 and apply pressure to the flexible walled container 28 whereby the wall 29 or the plunger 30 may be displaced to cause it to grip a work piece illustrated at 32; and force it against an opposite abutment. The plunger 31 may be moved and held in position by any suitable means diagrammatically illustrated as the lever 33 on pivot 34 supported on the housing 26, with ratchet 35 to hold the lever in work gripping position. Such lever and plunger might, of course, be on the top or the side of the housing 26 as the case may be to suit the particular machine tool or other mechanism with which it is associated.

36 indicates a cylindrical work piece of such diameter as to make a permissible fit in the ring 5. When pressure is applied to the hydraulic fluid, the ring 5 is compressed against the work piece to hold it.

If desired, the work piece could take the form of one element in a clutch in which case, application of pressure to the hydraulic fluid would cause the clutch to grip. Relief of such pressure would permit the clutch to disengage.

I claim:

1. In combination, a cylindrical centrally apertured rigid housing having an annular chamber extending about the aperture therein and open thereto throughout its entire periphery, a closed annular flexible walled container filled with a hydraulic fluid contained in the annular chamber, a flexible ring socketed in the aperture, closing the open side of the chamber, adjustable means for applying and permanently maintaining on the hydraulic fluid such a pressure as will cause the container to expand and completely fill the chamber, means for applying additional pressure to the hydraulic fluid to cause it to apply radial pressure to the ring.

2. In combination, a cylindrical centrally apertured rigid housing having an annular chamber extending about the aperture therein and open thereto throughout its entire periphery, a closed annular flexible walled container filled with a hydraulic fluid contained in the annular chamber, a flexible ring socketed in the aperture, closing the open side of the chamber, means for applying pressure to the hydraulic fluid to cause it to apply radial pressure to the ring.

3. In combination, a cylindrical, centrally apertured rigid housing having an annular chamber extending about the aperture therein and open thereto throughout its entire periphery, a closed annular flexible walled container filled with a hydraulic fluid contained in the annular chamber, a flexible ring socketed in the aperture, closing the open side of the chamber, means for applying pressure to the hydraulic fluid to cause it to apply radial pressure to the ring, said means including at least three equally spaced plungers radially movable in the housing, a ring rotatable on the housing, having cam surfaces in opposition to the outboard ends of the plungers, adapted on rotation of the ring to force the plungers inwardly against the container.

4. In combination, a cylindrical centrally apertured

rigid housing having an annular chamber extending about the aperture therein and open thereto throughout its entire periphery, a closed annular flexible walled container filled with a hydraulic fluid contained in the annular chamber, a flexible ring socketed in the aperture, closing the open side of the chamber, means for applying pressure to the hydraulic fluid to cause it to apply radial pressure to the ring, said means including a plunger longitudinally movable in the housing against the container wall.

5. In combination, a cylindrical centrally apertured rigid housing having an annular chamber extending about the aperture therein and open thereto throughout its entire periphery, a closed annular flexible walled container filled with a hydraulic fluid contained in the annular chamber, a flexible ring socketed in the aperture, closing the open side of the chamber, means for applying pressure to the hydraulic fluid to cause it to apply radial pressure to the ring, said means including a plurality of spaced plungers longitudinally movable in the housing against the container wall.

6. In combination, a rigid apertured housing open at one side, a rigid closure for the open side of the housing supported for movement toward and from the housing, a closed flexible and extensible walled container completely filled with hydraulic fluid enclosed within, substantially filling and in contact with the closure for the opening in the housing, adjustable means for applying and permanently maintaining on the fluid in the container such pressure as will cause the container to expand and fill the aperture in the housing and separate means for applying additional pressure to the hydraulic fluid to cause the container to expand and displace the closure.

7. A chuck comprising a housing having an open sided pocket in the face thereof, a work engaging plate in register with and closing the pocket, yielding means biasing the plate toward the housing, a closed flexible and extensible walled container within the pocket, filled with hydraulic fluid, adjustable means for applying and permanently maintaining on the hydraulic fluid a pressure sufficient to cause the container to expand to completely fill the pocket, separate means for applying pressure to the contents of the container through the wall thereof, to displace the work engaging plate.

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