

Jan. 17, 1967

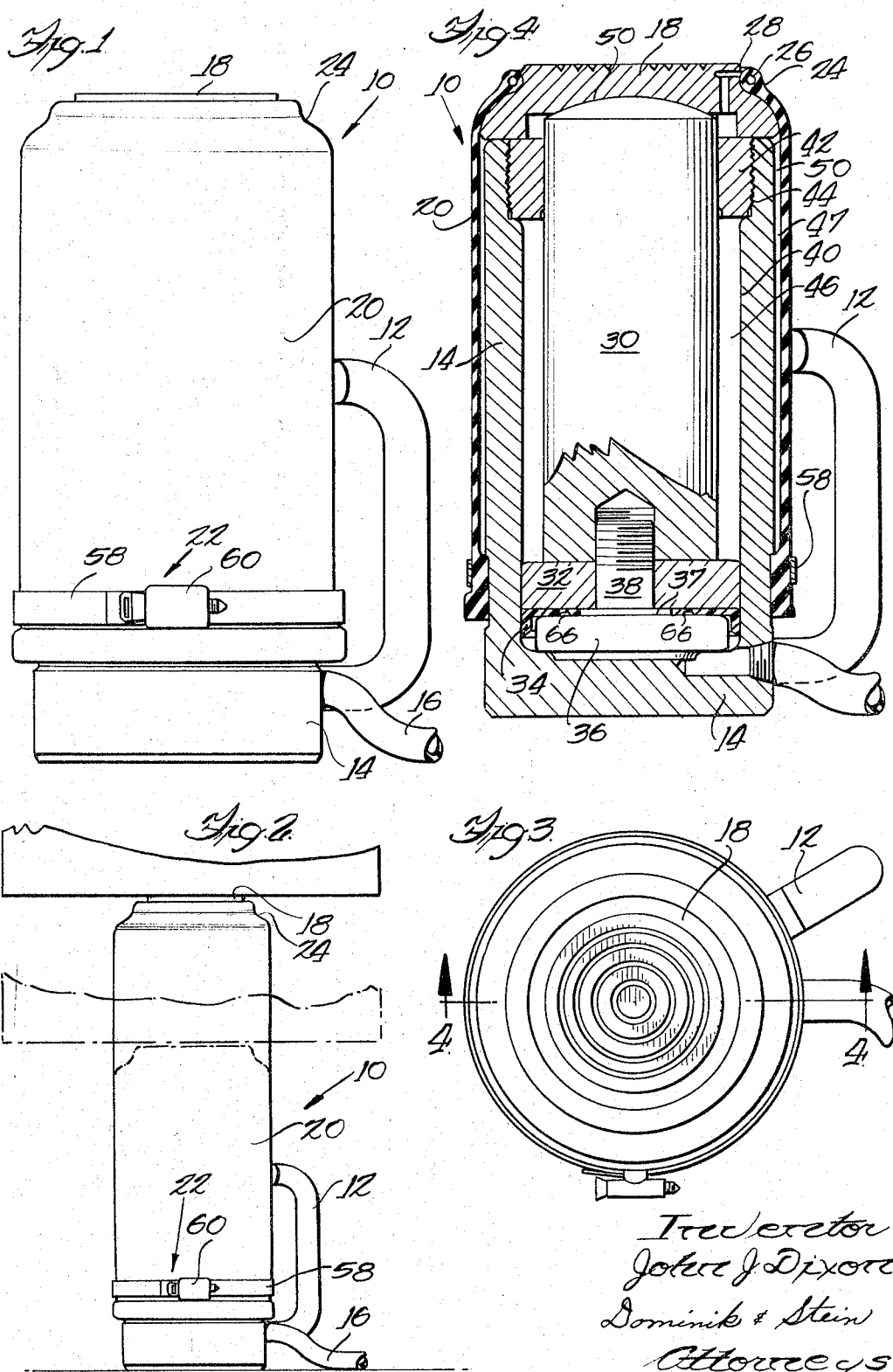
J. J. DIXON

3,298,664

SHIELDED JACK

Filed Aug. 27, 1964

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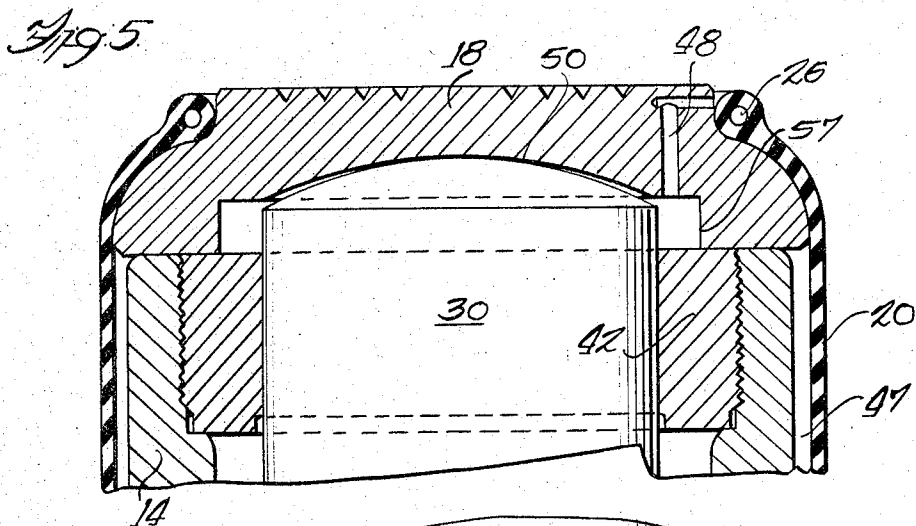
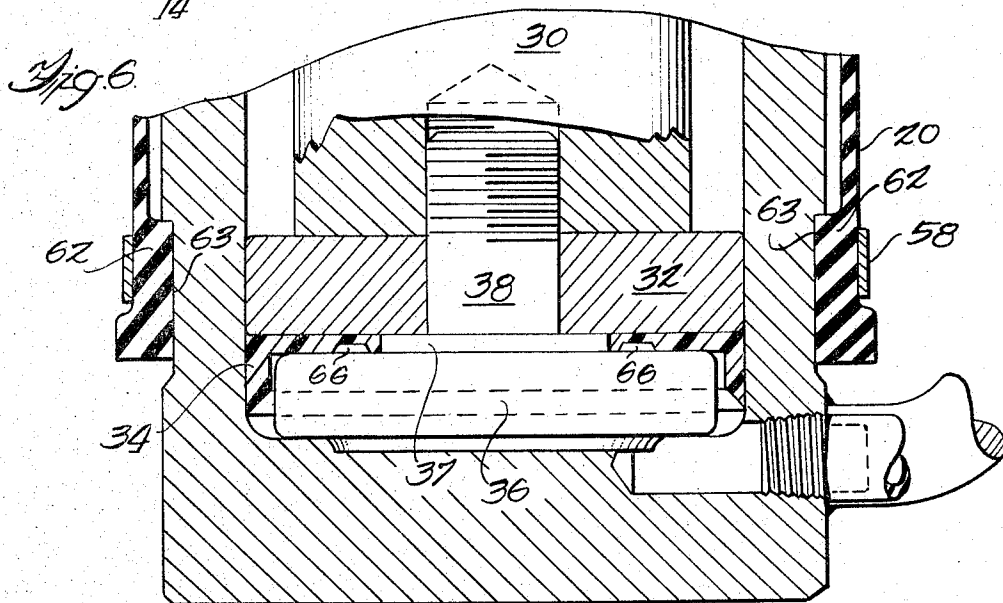
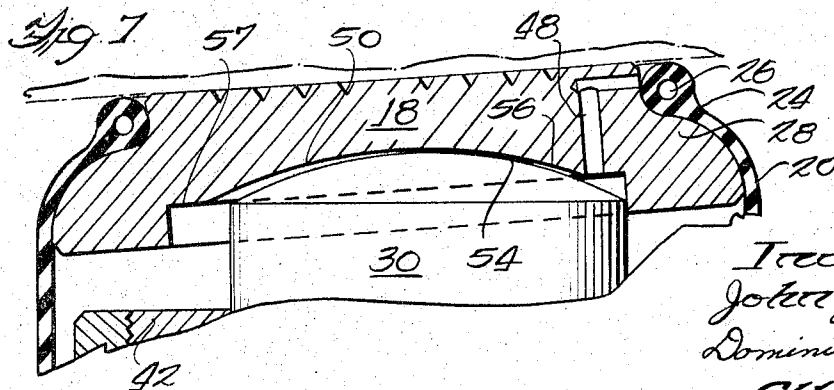
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Fig. 8

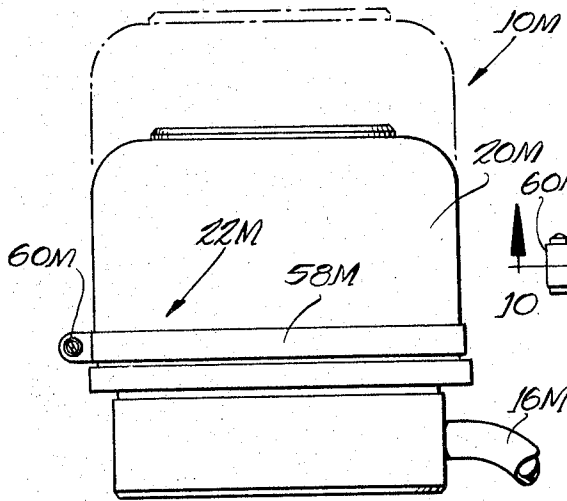


Fig. 9

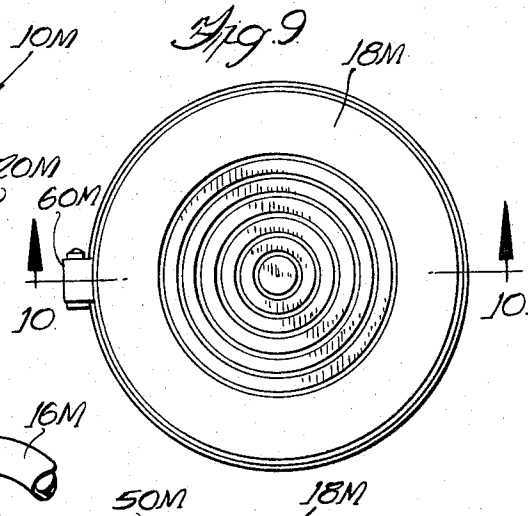


Fig. 10

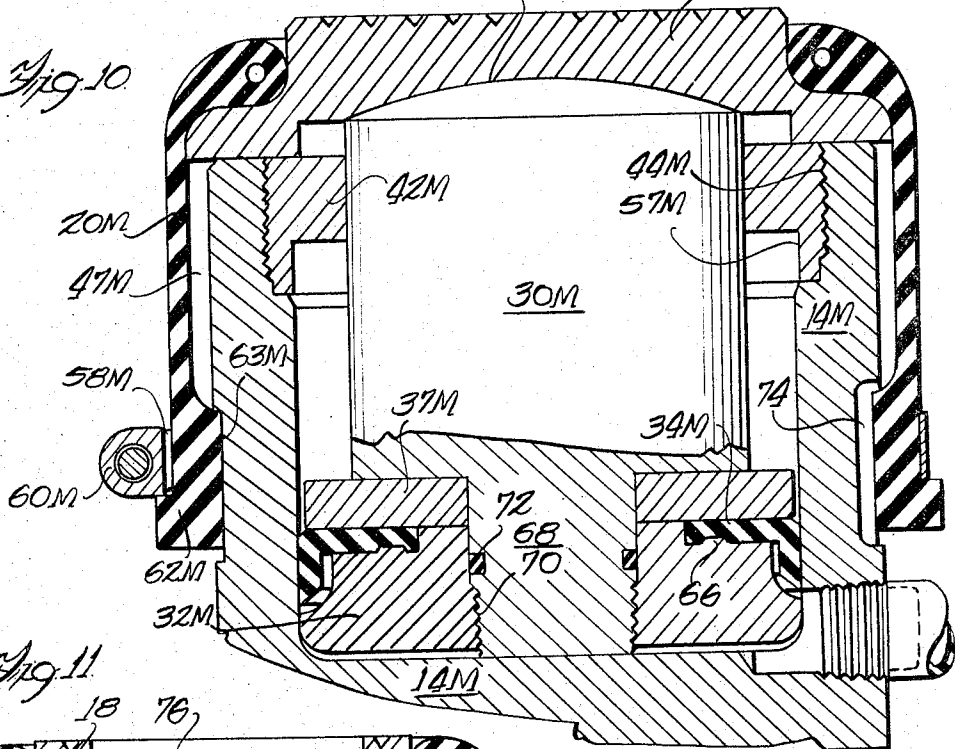
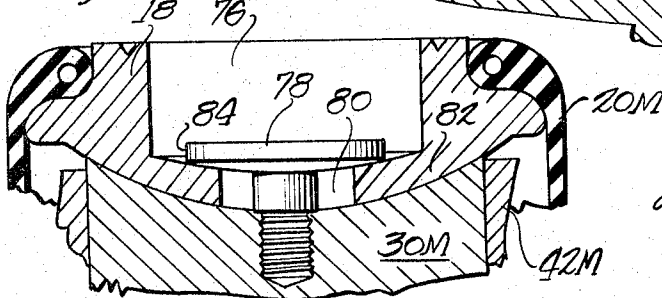


Fig. 11



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3,298,664

SHIELDED JACK

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12 Claims. (Cl. 254—93)

The present invention relates to a shielded jack, and more particularly that type of jack or ram which receives pressure fluid operating against a piston within a cylinder, and is capable of capacities ranging up to 100 tons in general commercial application, and 500 tons for special applications.

Jacks and rams designed for loads up to 100 tons are used in a wide variety of applications ranging from house moving to employment in shipyards, and in railroad yards. Necessarily, the extensible portions of any rams or jacks employed in such usages are subjected to the ravages of weather, salt spray, sand, scale, grit, and corrosion which cause pitting of the rams and eventual scoring to the point where the jack or ram is rendered inoperable. Furthermore, the costs of rendering such jacks or rams double-acting either by hydraulic means, or spring return means, is substantial as opposed to a single acting unit. The double acting springs add substantially to the weight of such units as well. In addition, the loads which are handled by such large capacity rams or jacks for the applications referred to above and other applications are seldom ideally positioned upon the center of the longitudinal axis of the ram plunger or cylinder. The side loads are such as to cause binding at the support glands, and often on the piston where it bears against the inner wall of the ram cylinder.

With the foregoing difficulties and shortcomings of the commercially available jacks or rams in mind, it is the general object of the present invention to provide a shielded jack or ram which substantially reduces wear attributable to corrosion and contamination. An additional and important related object of the invention is to provide a shielded ram which is double-acting under no-load conditions in order to lower the top plate back to the fully lowered position without the employment of additional hydraulic valving, or return springs.

Another closely related and important object of the invention, and advantage achieved thereby, is the employment of a swivel head on the top of the ram plunger or piston to accommodate loads which are not perfectly oriented for perfectly horizontal or perpendicular relationship with the ram plunger and ram cylinder.

Additional objects of the invention include providing a shielded jack or ram construction with reduces scoring, holds corrosion to a minimum, and is inexpensive to manufacture.

Still another object of the invention looks to the construction of a shielded jack or ram which renders the same inherently susceptible of manufacture out of aluminum, and other light-weight materials to thereby substantially reduce the weight for a given capacity.

Another object of the invention looks to the provision of a shielded jack or ram in which the expendable parts can be readily replaced in the field in the event of their failure.

Further objects and advantages of the present invention will become apparent as the following description of an illustrative embodiment proceeds, taken in conjunction with the accompanying drawings in which:

FIGURE 1 is a front elevation view of a typical jack or ram illustrative of the present invention.

FIGURE 2 is a front elevation on a reduced scale from the jack or ram shown in FIG. 1, illustrating sequentially

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with phantom lines the lowered and raised position of the jack or ram and its external configuration in both positions.

FIGURE 3 is a top view of the jack or ram shown in FIG. 1.

FIGURE 4 is a transverse sectional view of the jack or ram shown in FIGS. 1 through 3 inclusive taken along section line 4—4 of FIG. 3.

FIGURE 5 is an enlarged partially broken transverse sectional view taken along section line 4—4 of FIG. 3 illustrating in detail with slight exaggeration the upper portion of the ram or jack as shown in FIG. 4.

FIGURE 6 is an enlarged transverse sectional partially broken view taken along section line 4—4 of FIG. 3 illustrating the lower portion of the ram or jack in its details.

FIGURE 7 is an enlarged view of the upper portion of the ram or jack taken along section line 4—4 of FIG. 3 and similar to the top portion of FIG. 5 but in which the swivel top plate has been shown in exaggerated form in a cocked or angled position.

FIGURE 8 is a front elevation of a modified configuration of the subject shielded jack, showing the jack or ram in its extended position in phantom lines.

FIGURE 9 is a top elevation of the jack shown in FIG. 8 in the same scale as shown in FIG. 8.

FIGURE 10 is an enlarged scale transverse sectional view of the jack shown in FIGS. 8 and 9 taken along section line 10—10 of FIG. 9.

FIGURE 11 is an enlarged partially broken transverse sectional view of the upper portion of the modified jack shown in FIGS. 8 through 10, showing an alternative embodiment of the top plate.

In broad outline the structure of the illustrative embodiment of the invention, as best illustrated in FIGS. 1 and 4, contemplates a generally cylindrical ram 10 with the exterior primarily encased by a tubular sleeve 20, here shown as cylindrical in configuration. A handle 12 is provided for hand-carrying by operators to any position wherein the ram 10 is to be used, whereupon the cylinder 14, and more particularly its flattened base portion, is positioned upon a solid location. The fluid lead 16 supplies pressure fluid which actuates the plunger 30 and directs it upwardly against the swivel top plate 18. The elastomeric sleeve 20 is secured to the cylinder by means of the sleeve clamp 22, and secured to the top plate 18 by means of the sleeve neck 24. Thus as the swivel top plate engages the load, and moves upwardly, the sleeve 20 extends with it and effectively shields the extended portion of the piston 30 from contact with the corrosive atmosphere, grit, and the like. After the end of the lifting stroke is achieved (see FIG. 2) and when the hydraulic pressure is reduced and the fluid is permitted to flow from the cylinder, sufficient potential energy is stored in the extended walls of the sleeve 20 to return the plunger 30 to its retracted position by means of the sleeve neck 24 and its associated neck reinforcing ring 26 bearing on the sleeve neck shoulder 28 which is a peripheral portion of the swivel top plate 18. The curved interface between the swivel top plate 18 and the plunger 30 permits the upper flat face of the swivel top plate to tilt (see FIG. 7) in such a manner as to accommodate loads which are applied at a position other than perfectly aligned with the longitudinal axis of the plunger 30.

Thus the unique inter-action between the sleeve 20 and the top plate 18 achieves a threefold purpose of shielding the jack 10 from exterior corrosive and contaminating elements, providing a no-load double-acting effect to return the plunger 30 to its retracted position, and yieldably and shiftably securing the swivel top plate 18 in engagement with the upper portion of the piston 30. Additional advantages and purposes of the invention will become fur-

ther apparent as this description of the illustrative jack 10 proceeds, and takes into account the minimal number of parts employed for construction. In addition, as will be pointed out hereinafter, this construction admits of manufacture by means of a ram cylinder made of an aluminum alloy which greatly reduces the weight of the overall unit. The inherent characteristics which eliminate corrosion, contamination, and pitting tendencies from the plunger assist in making such a lightweight construction possible. Furthermore, this construction can be achieved within manufacturing tolerances which are inherently economical.

The driving force from the pressure fluid which is led into the cylinder 14 by means of the fluid lead 16 is achieved primarily through the provision of a bronze follower plate 32 at the lower portion of the plunger 30. The outside diameter of the follower plate 32 approximates that of the cylinder wall 40, but leakage of the pressure fluid which bears beneath the follower plate 32 is prevented by means of the cup washer packing 34. The cup washer has an exterior depending flange portion which is self energized into pressure wiping contact with the interior cylinder wall 40. A cup washer retainer 36 is provided to secure the cup washer firmly against the operating head portion of the follower plate 32, and is removably secured in place by the threaded retainer stud portion 38 which threadedly engages the interior of the plunger 30. A separator portion 37 is provided to insure against crushing the annular portion of the cup washer packing 34.

A gland nut 42, preferably manufactured of bronze, is provided in the configuration of a collar having an exterior threaded portion which engages the interior upper threaded portion of the cylinder 14 at a threaded gland connection 44. The bearing surface of the gland approximates one-half of the diameter of the plunger, but may vary to a larger or lesser percentage of that diameter. It will be also noted that the thickness of the follower plate 32 is approximately 20% of the diameter of the follower plate 32. In this manner the length of travel available within a given cylindrical housing 14 is maximized, and yet the ability to carry side thrust is retained.

As will be observed in FIGS. 4 and 5, a sleeve breathing chamber 47 is defined between the interior portion of the sleeve 20 and the exterior wall of the cylinder 14. Open communication is provided between the breathing chamber and atmosphere by means of the breathing port 48 positioned at the upper portion of the cylinder 14 immediately beneath and adjacent to the gland nut 42.

As will be observed in magnified form in FIG. 7, the curved interface 50 between the swivel top plate 18 and the plunger 30 is defined by a convex plunger head 54 mating with a concave top plate seat 56. As illustrated in FIG. 11, and will be described hereinafter, the concave-convex relationship may be reversed. The radius of curvature of the convex plunger head 54, as best illustrated in FIG. 7, is shorter than the radius of curvature of the concave top plate seat 56 thereby providing sufficient tolerance so that, in effect, the top plate 18 can rock on the top of the plunger 30, the same being yieldably urged into a level configuration by the restraining action of the elastomeric cylinder sleeve 20. An annular limiting shoulder 57 is provided beneath the top plate 18 and adjacent the concave seat 56 to limit tilting to 5°.

It will be observed that the sleeve neck 24 and its associated neck reinforcing ring 26 bear down on the peripheral sleeve neck shoulder 28 on the top plate 18. Since the pull of the side walls of the sleeve 20 is relatively even, the tendency in the unloaded position will be for the swivel top plate 18 to assume a relatively level position of repose as illustrated in FIG. 5. No other structural members, or complicated fittings are required to secure the swivel top plate 18 to the plunger 30 apart from the constricted top of the elastomeric sleeve 20. It is contemplated, however, that other techniques for attaching the upper portion of the tubular sleeve 20 to the

swivel top plate 18 may be employed, such as a snap ring into a recessed channeled ring in the swivel top plate 18, or even positive securement to a top plate 18 which does not swivel but rather is in fixed intimate contact with the plunger 30 where the swiveling action is not required in the particular jack construction.

The lower portion of the elastomeric sleeve 20 is secured to the walls of the cylinder 14 by means of a clamping band, here shown as a typical Wittek stainless clamp band 58 which is threadedly and firmly constricted by means of the clamp screw 60 (see FIG. 2). The lower end of the elastomeric sleeve 20 is shown with a sleeve mounting shoulder portion 62 in FIG. 6, in a peripheral ring or groove 63 provided around the exterior of the cylinder 14 to matingly and lockingly receive the lower end of the sleeve 20 by means of a physical interlock with the sleeve mounting shoulder portion 62. Various alternative attachment means such as tongue and groove, plural studs, ribbed rubber face, and the like, are contemplated for the lower end of the elastomeric sleeve 20, as indicated with regard to the employment of the neck portion 24 engaging the top swivel plate 18 discussed above. In the construction disclosed and described in detail regarding FIGS. 5 and 6, it will be appreciated that the elastomeric sleeve 20 may be replaced by merely unscrewing the clamp screw 60, physically removing the sleeve from the outer portion of the cylinder 14, and dropping another sleeve in place, and tightening the clamp screw 60. No tools other than a pair of pliers or a screwdriver need be employed for this replacement of the principal element which is subjected to damage from the type of rough handling that jacks and rams of this character are normally subjected to in usage. A similar case of replacement of the remaining parts of the jack or ram 10 is made by removing the gland nut 42, and removing the plunger 30 from its chamber. Thereafter the cup washer retainer 36 may be readily removed to replace the cup washer packing 34, and if need be at this time, a new gland nut 42 placed in the jack or ram 10. In this manner virtually every moving part, every part susceptible of accelerated wear, and every part which is critical from a standpoint of smooth operation can be replaced with simple tools in the field; and more importantly a ready supply of a few spare parts will insure continuous operation in the field.

While various elastomeric materials such as neoprene, synthetic rubbers of all types, extended synthetic rubber, and urethane type rubbers are contemplated for the sleeve 20, good commercial success has been experienced with a black neoprene type rubber. Equivalent constructions such as spring loaded bellows may be substituted for the elastomeric sleeve 20, but are more expensive and must be justified by the particular economics of the application.

The cup washer 34 which serves as a packing beneath the follower plate 32 may be ideally also fabricated from a urethane composition; however, leather packing and other similar substitutes known in the art are contemplated. As pointed out above, the gland nut 42 is preferably machined from bronze to accept the wear of the plunger 30, which is preferably chrome plated for hardness and corrosion resistance. The follower plate 32 is fabricated from bronze the same as the gland nut 42. The inner wall of the cylinder, which is fabricated and machined from a suitable aluminum alloy is preferably coated with Houghton Cindol, thereby providing a very smooth finish which holds hydraulic fluid leakage to an irreducible minimum. The cup washer retainer 36 is secured into position by the threaded interfit between the retainer stud and the threaded plunger bore, and the threads are preferably sealed with Loctite.

Turning now to FIGS. 8 through 10, an alternative embodiment of the shielded jack or ram is shown. The reference characters, where corresponding to the first embodiment described in detail above, are common, are designated by the suffix "M." Where the parts differ,

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they are separately identified. As will be noted in FIG. 8, where the alternative ram 10M is shown in its retracted position, it gives the appearance of being a "shorty" version. In such units the length of travel is relatively shorter than that of the similar capacity units proportioned as the first embodiment. The elastomeric sleeve 20M is secured by means of a sleeve clamp assembly 22M through the clamping band 58M secured by the clamping screw 60M. As observed in FIG. 10, the swivel top plate 18M has a concaved undersurface meeting at a curved interface 50M with the upper portion of the piston 30M. The gland nut 42M has a threaded interface 44M with the cylinder 14M, and is provided at its interior face with an annular limiting shoulder 57 as in the first embodiment.

Differences in structure, however, are employed in the lower or base assembly. As will be seen particularly in FIG. 10, the follower plate 32M has on its upper face a shoulder 66 with an isosceles trapezoidal configuration, the same serving to lockingly engage the cup washer packing 34M. The follower plate mounting stud 68 extends from the bottom of the piston 30M, and is provided with an annular ring in which the seal 72 is seated above the threaded interface 70. A breathing vent 74 is provided adjacent the locking ring 63M of the elastomeric sleeve 20M, adjacent the sleeve mounting shoulder portion 62M. The breathing vent 74 may be formed as a key-way and provides an opening into the sleeve breathing chamber 47M, and connects the same with atmosphere.

A second alternative construction, differing from the other embodiments primarily as to the relationship between the swivel top plate 18 and the upper portion of the piston 30M, is disclosed in FIG. 11. There it will be seen that the swivel top plate 18 has a central bore 76, and a mounting stud 78 at its base extending through a mounting port 80 at the top of the convex face 82 of the swivel top plate 18. The locking shoulder 84 of the mounting stud 78 engages the annular wall of the central bore 76 of the top plate 18 when the limit of swivel travel is reached. The elastomeric sleeve 20M is secured to the top plate 18 in a manner similar to the other embodiments, and the base portion may be either of the two base portions of the two previously described embodiments. The third alternative embodiment shown in FIG. 11 illustrates how the convex-concave relationship between the swivel top plate 18 and the piston 30 may be reversed, and how a different annular shoulder may be employed to limit the swivel or travel of the top plate 18. The venting in the construction shown in FIG. 11 may be the same as the first embodiment, or the second embodiment, or in addition venting can be achieved by perforations in the sidewall of the elastomeric sleeve 20, or through a tube (not shown) into a diaphragm chamber so that complete sealing can be achieved, and submerged operation then becomes possible for this particular ram or jack.

While the various embodiments of the jacks 10 shown here have been disclosed as actuated by a hydraulic fluid, it will be appreciated that with differing drive means, such as pneumatic, mechanical, or even electrical solenoid types, a sleeve construction of the character disclosed in combination with a cylinder and plunger will have distinct advantages in operation. The various types of power are contemplated, and there is no intention to limit the invention to the specific embodiments shown. Similarly various materials have been disclosed, and finishing and fabricating techniques referred to as commercially advantageous, but there is no intention to limit the invention to such details of manufacture.

In review it will be seen that a ram or jack has been illustrated and described having a construction which gives an inexpensive, lightweight, durable, and multi-featured product. The provision of the unique sleeve construction provides for double action in no-load con-

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dition, shields the extended plunger from corrosion and contamination, and additionally provides a mount for the adjustable load engaging members.

While the invention has been described in connection with specific embodiments and applications, no intention to restrict the invention to the examples shown is contemplated, but to include within the invention all of that subject matter defined by the spirit as well as the letter of the annexed claims.

I claim:

1. A no-load return shielded jack comprising a plunger, a housing for the plunger, said housing having a support base, power means for activating the plunger in one direction, a load support top plate engaging the plunger outer end, and an elastomeric sleeve exteriorly secured to the housing and at one end to the top plate, said sleeve having sufficient potential energy storage capacity to retract the plunger when deactivated, whereby the sleeve shields the plunger upon extension from the housing, and upon deactivation of the power the elasticity of the sleeve returns the plunger to its retracted position.

2. A shielded jack comprising a plunger, a cylindrical housing for the plunger, said housing having a support base, fluid power means for activating the plunger in one direction, a load support top plate engaging the plunger outer end, and an elastomeric sleeve secured exteriorly at one portion to the housing and secured at one end to the top plate, said sleeve having sufficient potential energy storage capacity to retract the plunger when deactivated, whereby the sleeve shields the plunger upon extension, the elasticity of the sleeve returning the plunger to its retracted position after extension.

3. A shielded jack comprising a plunger having an outer end and piston portion, a cylindrical housing for the plunger from which the outer end of said plunger extends, fluid power means for activating the plunger in one direction by bearing on the piston portion of said plunger, a load support top plate shiftably engaging the plunger outer end, and a tubular elastomeric sleeve secured circumferentially at one portion of the housing and secured at one end to the load support plate; whereby the sleeve shields the plunger upon extension from the cylinder, the elasticity of the sleeve returning the plunger to its retracted position after extension, and the attachment of the sleeve to the top plate serves to yieldably swivel the top plate.

4. A shielded jack comprising, in combination, an elastomeric exterior sleeve, means defining a neck at one end of said sleeve, a rigid body defining a central chamber and having an exterior portion adapted for engagement with said sleeve, said rigid body having a support base, attachment means adapted to circumferentially secure the sleeve to the rigid body at a spaced position from the sleeve neck, plunger means actuated by an applied force within said central chamber and having an upper portion extensible out of said chamber, a load support top plate engaging the plunger outer end, and sleeve attachment means on said top plate adapted to engage the sleeve neck whereby the sleeve shields the extensible portion of the plunger, said sleeve having sufficient potential energy storage capacity to retract the plunger when deactivated.

5. A shielded jack comprising, in combination, an elastomeric tubular sleeve, means defining a neck at one end of said sleeve, a rigid body defining a central chamber and having an exterior portion in circumferential engagement with said sleeve, said rigid body having a support base, plunger means actuated by an applied fluid force within said central chamber and having an upper portion extensible out of said chamber, a load support top plate engaging the plunger outer end, and sleeve attachment means on said top plate adapted to engage the sleeve neck whereby the sleeve shields the extensible portion of the plunger, said sleeve having sufficient potential energy storage capacity to retract the plunger when deactivated.

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6. A shielded jack comprising, in combination, an elastomeric tubular sleeve, means defining a neck at one end of said tubular sleeve, a cylindrical rigid body defining a central chamber and having an exterior portion adapted for engagement with said tubular sleeve, said housing having a support base, clamping means for releasably securing the tubular sleeve to the cylindrical rigid body spaced from the neck portion of the sleeve, plunger means actuated by an applied pressure fluid force within said central chamber and having an upper portion extensible out of said chamber, a load support top plate engaging the plunger outer end, and sleeve attachment means on said top plate adapted to engage the sleeve neck whereby the sleeve shields the extensible portion of the plunger, said sleeve having sufficient potential energy storage capacity to retract the plunger when deactivated.

7. A shielded jack comprising, in combination, a cylinder having an interior cylindrical chamber, a plunger journaled in said chamber for longitudinal movement, a convex end on said plunger, a swivel top plate with a concave base proportioned to matingly engage the plunger convex end, shoulder means on the periphery of the swivel top plate, power means for moving the plunger within the cylinder, an elastomeric sleeve proportioned to surround the cylinder, attachment means for securing said sleeve to the cylinder, and a constricted neck at the upper end of the elastomeric sleeve proportioned to engage the swivel top plate shoulder means so that extension of the plunger and its associated top plate extends the elastomeric sleeve, the extension resulting in a return potential to retract the plunger after the power source directed to the plunger is withdrawn, the extended portion of the plunger being shielded by the sleeve during the motion of the plunger.

8. A shielded jack comprising, in combination, a cylinder having an interior cylindrical chamber, a plunger longitudinally and rotatably journaled in said chamber, a curved end on said plunger extending from said chamber, a swivel top plate with a curved base proportioned to matingly engage the plunger curved end, power means for moving the plunger within the cylinder, an elastomeric imperforate sleeve proportioned to surround the cylinder, attachment means for securing the sleeve to the cylinder, a constricted neck at the upper end of the elastomeric sleeve proportioned to engage the swivel top plate so that extension of the plunger and its associated top plate extends the elastomeric sleeve, the extension resulting in a return potential to retract the plunger after the power source directed on the plunger is withdrawn, the extended portion of the plunger being shielded by the sleeve during the motion of the plunger.

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9. A shielded jack comprising, in combination, a cylinder having an interior cylindrical chamber, a plunger journaled in said chamber, a convex end on said plunger, a piston portion on the other end of said plunger and within said chamber, a swivel top plate with a concave base proportioned to matingly engage said plunger convex end, shoulder means on the periphery of the top plate, power means for moving said plunger within said cylinder, an elastomeric sleeve proportioned to surround the cylinder, attachment means for removably securing said sleeve to the cylinder, and a constricted neck at the upper end of the elastomeric sleeve proportioned to engage the swivel top plate shoulder means.

10. A shielded jack comprising, in combination, a cylinder having an interior cylindrical chamber, a plunger journaled in said cylinder, a piston head removably secured to said plunger, removable and replaceable sealing means held between the piston and plunger proportioned to circumferentially engage the cylindrical chamber wall, a curved end on said plunger, a swivel top plate with a curved base proportioned to matingly engage the plunger curved end, shoulder means on the periphery of the top plate, fluid power means for moving the plunger within the cylinder, an imperforate elastomeric sleeve proportioned to surround the cylinder, circumferential clamping means removably securing the sleeve to the cylinder, and a constricted neck at the upper end of the elastomeric sleeve proportioned to engage the swivel top plate shoulder means so that extension of the plunger and its associated top plate extends the elastomeric sleeve, the extended portion of the plunger being shielded by the sleeve.

11. In the shielded jack of claim 10, a removable gland secured to the upper end of the cylinder journaling the plunger at the swivel plate end, the piston journaling the same at the other end, thereby permitting replacement and disassembly through the sequential release of the sleeve clamp and removal of the gland.

12. In the shielded jack of claim 10, annular shoulder means in the swivel top plate to limit cocking action to 5°.

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