May 5, 1964 W. D. MYERS 3,131,765

CONVERTIBLE WELL PACKER AND BRIDGE PLUG

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FIG. 1.

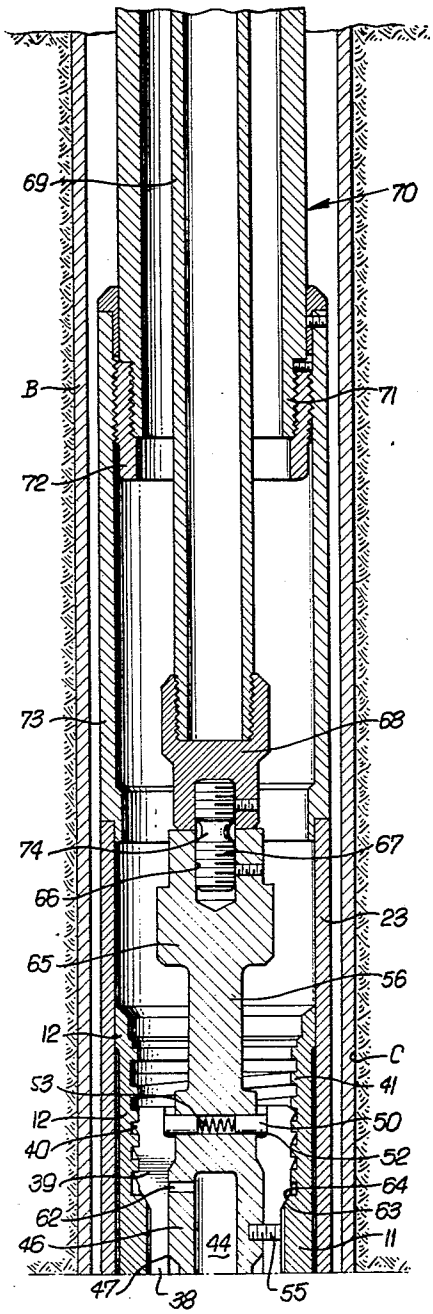
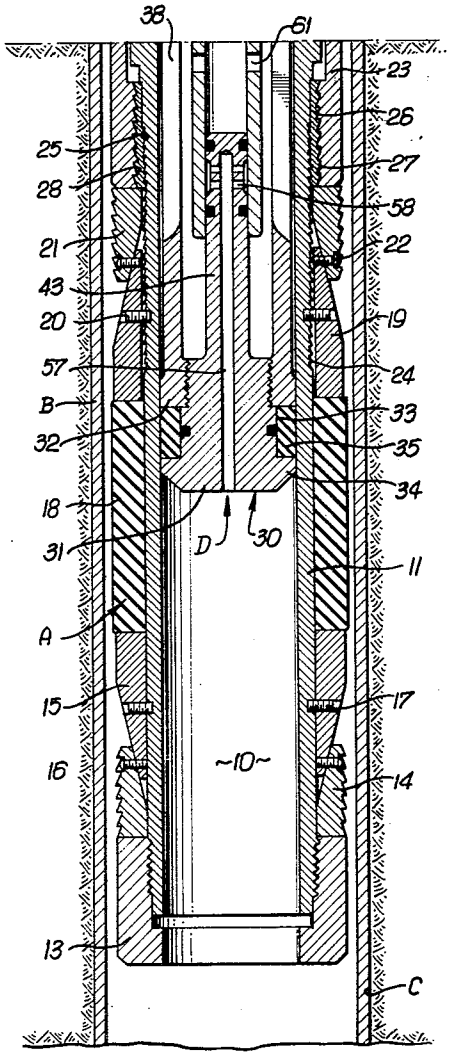


FIG. 1a.



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FIG. 2.

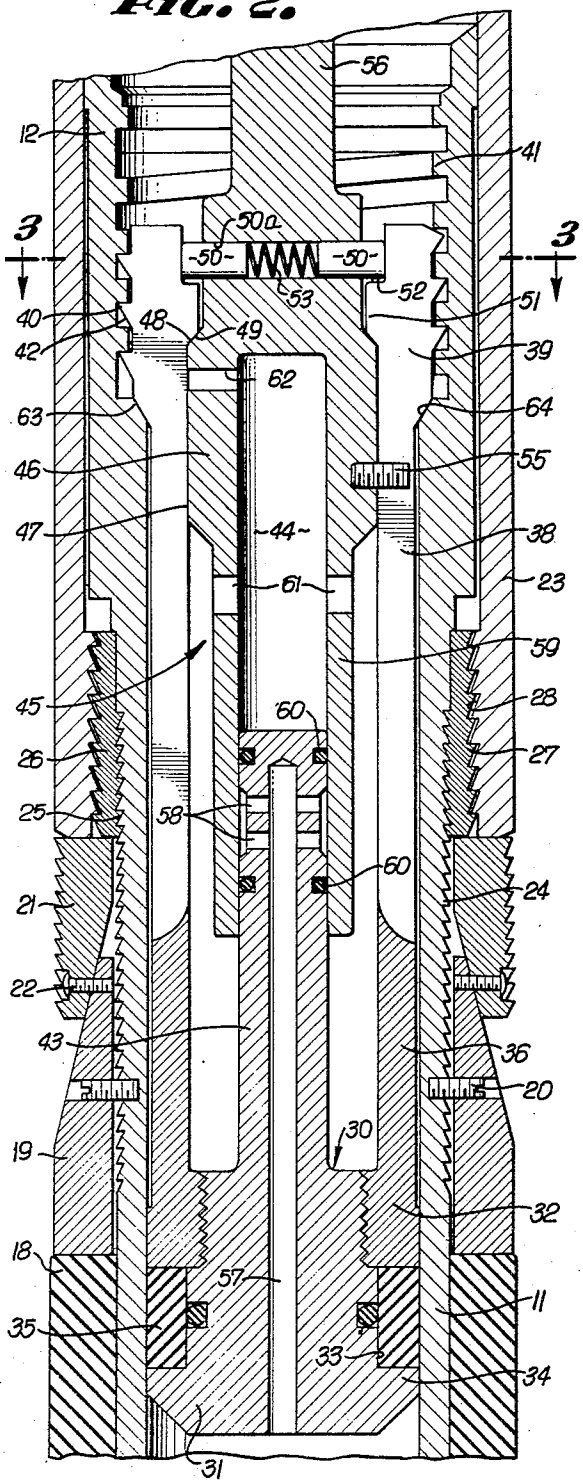
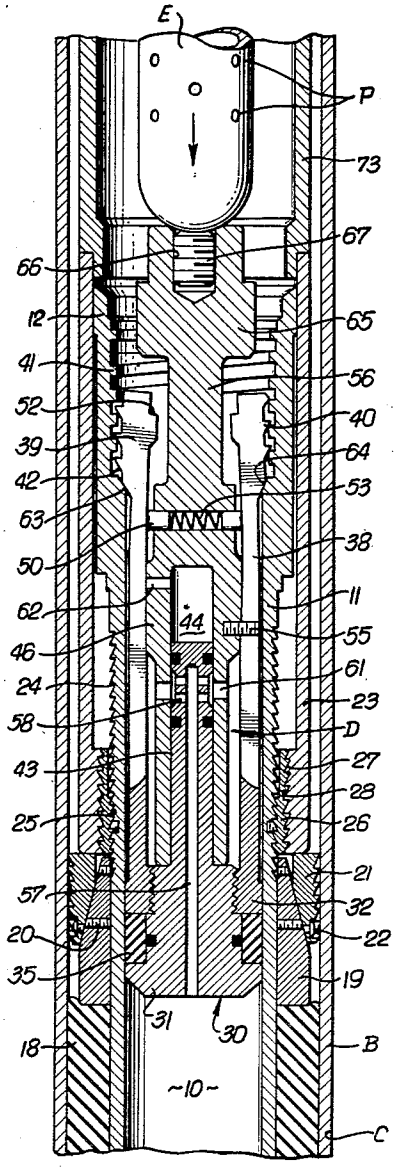


FIG. 5.



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CONVERTIBLE WELL PACKER AND BRIDGE PLUG

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FIG. 4.

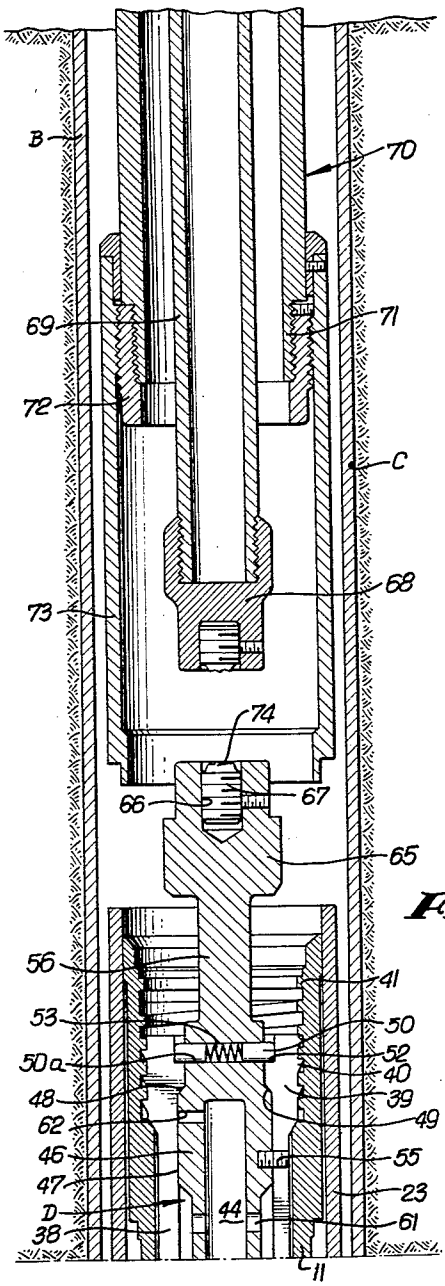


FIG. 4a.

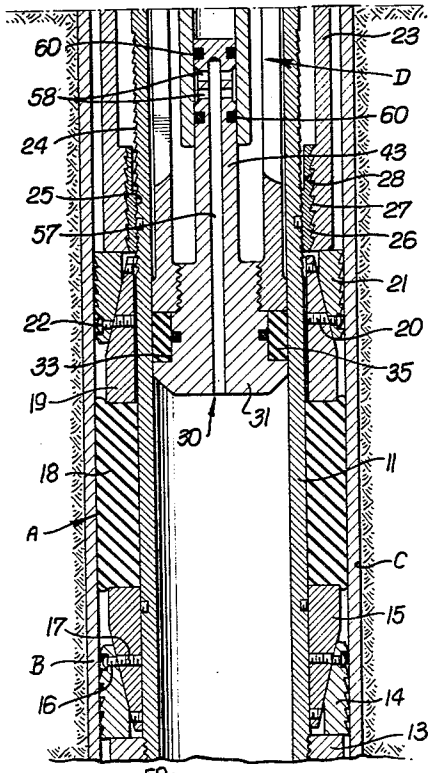
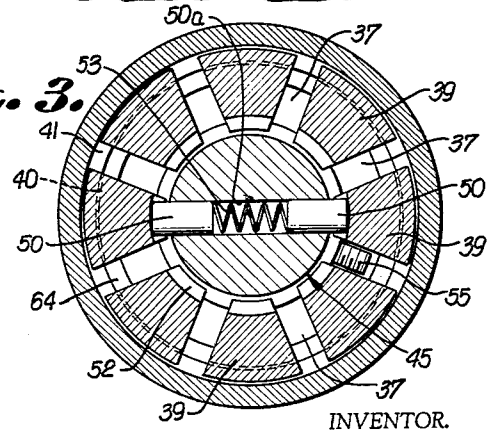


FIG. 3.



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FIG. 7.

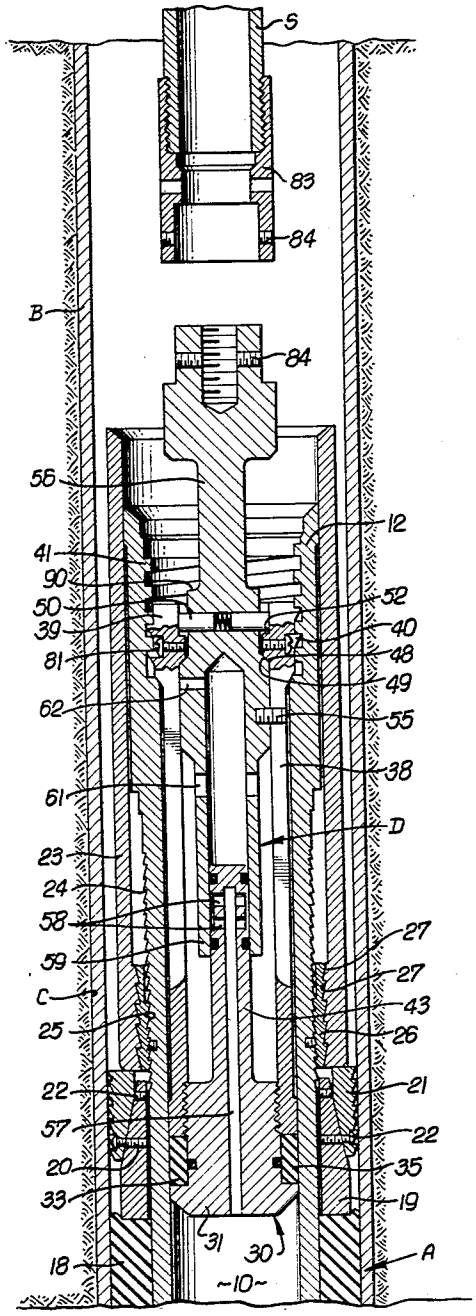
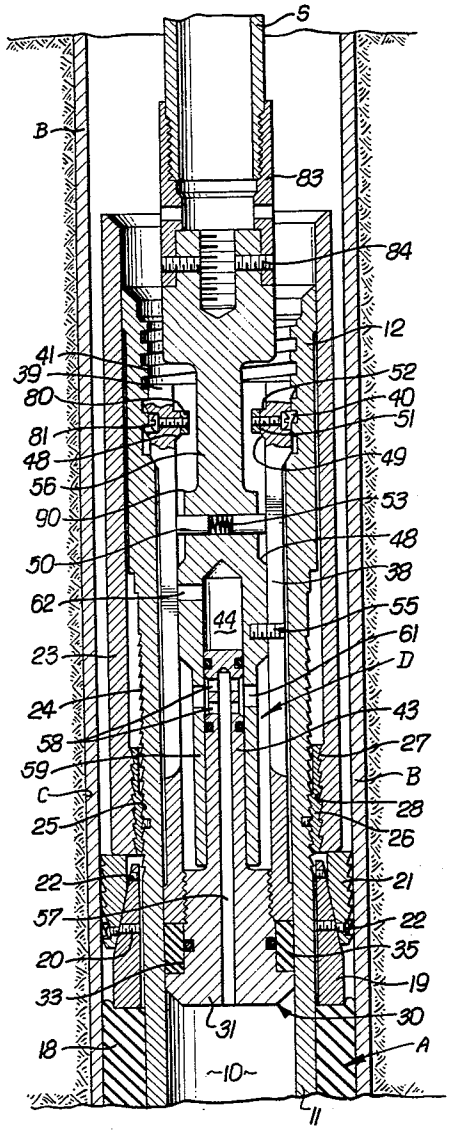


FIG. 6.



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United States Patent Office 3,131,765 Patented May 5, 1964

3,131,765
CONVERTIBLE WELL PACKER AND BRIDGE PLUG

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Filed Apr. 13, 1962, Ser. No. 187,307
15 Claims. (Cl. 166—133)

The present invention relates to subsurface equipment for use in well bores, and more particularly to well packers adapted to be set in such well bores to perform divers purposes therewithin, such as functioning as a bridge plug or a production packer.

An object of the invention is to provide an improved well packer adapted to be set in a well bore and capable of conversion between a bridge plug state and a packer state with the packer having a passage therethrough.

Another object of the invention is to convert a well packer set in a well bore and having a passage therethrough into a bridge plug and then reconverting the device to its original well packer state, all while the packer remains in the well bore.

This invention possesses many other advantages, and has other objects which may be made more clearly apparent from a consideration of several forms in which it may be embodied. Such forms are shown in the drawings accompanying and forming part of the present specification. These forms will now be described in detail for the purpose of illustrating the general principles of the invention; but it is to be understood that such detailed description is not to be taken in a limiting sense, since the scope of the invention is best defined by the appended claims.

Referring to the drawings:

FIGURES 1 and 1*a* together constitute a longitudinal section through a well packer lowered in a well casing set in a well bore prior to anchoring of the well packer in packed-off condition in the well casing, FIG. 1*a* being a lower extension of FIG. 1;

FIG. 2 is an enlarged vertical section of a portion of the well packer illustrated in FIGS. 1 and 1*a*;

FIG. 3 is a cross-section taken along the line 3—3 on FIG. 2;

FIGS. 4 and 4*a* are views similar to FIGS. 1 and 1*a* of the well packer anchored in packed-off condition in the well casing and the setting mechanism released therefrom, FIG. 4*a* being a lower extension of FIG. 4;

FIG. 5 is a longitudinal section through the set well packer, disclosing the central plug portion being released and ejected therefrom;

FIG. 6 is a longitudinal section through a modified form of plug device adapted to be run in and latched to the well packer, with the parts in one relative position;

FIG. 7 is a view similar to FIG. 6 illustrating the plug device fully latched in the well packer and the tubing string released therefrom.

As shown in the drawings, a well packer A is to be set or has been set in a well casing B disposed in a well bore C, this well packer having a passage **10** therethrough that is to be closed by a suitable plug device D capable of converting the packer into a bridge plug. Thereafter, the plug device D can be ejected from the packer passage **10** to open the latter and permit flow of fluids through it or through a tubing string E (FIG. 5) extending therethrough.

As disclosed in FIGS. 1 to 5, inclusive, the plug device D is embodied in the well packer A when the latter is being run in the well casing B, the plug device assisting in setting of the well packer in packed-off condition in the well casing. Thereafter, the plug device can be removed, as by being ejected, from the packer passage **10**. In the

form of invention illustrated in FIGS. 6 and 7, the plug device D can be lowered through the well casing and then securely locked in place within the central passage **10** through a previously installed well packer A. In the event the well packer passage **10** is to be opened at a later date, the plug device D is readily removable therefrom in the same manner as the plug device illustrated in FIGS. 1 to 5, inclusive.

As shown in FIGS. 1 to 5, inclusive, the well packer A is provided which includes a main body member **11** having the central passage **10** therethrough. The well packer may be of any desired form. The one specifically disclosed has an upper threaded box **12** and a lower body guide **13** threadedly attached to the lower portion of the main body. A set of lower segmental slips **14** rest upon the body guide, coacting with a lower expander **15** for anchoring the well packer against the wall of the well casing B against downward movement therewithin. The lower slips **14** are held initially in retracted position by shear screws **16** attaching them to the lower expander **15**, the lower expander being initially releasably secured to the body **11** by shear screws **17**. An initially retracted packing structure **18** of any suitable type encompasses the main body **11**, with its lower portion engaging the lower expander **15** and its upper portion engaging an upper expander **19** surrounding the body, which is initially attached thereto by one or more shear screws **20**. This upper expander coacts with a plurality of upper segmental slips **21** for anchoring the well packer against upward movement in the well casing, the slips being held initially in retracted position by shear screws **22** attaching them to the upper expander **19**. The upper ends of the upper slips **21** engage the lower end of a setting sleeve **23** slidable along the body **11**, this setting sleeve extending above the upper end of the main body of the packer.

As illustrated, the body **11** has a plurality of downwardly facing ratchet teeth **24** thereon adapted to engage with companion upwardly facing internal ratchet teeth **25** on a split body lock ring **26** disposed within the lower portion of the setting sleeve **23** and having external cam teeth **27** coacting with internal cam teeth **28** in the setting sleeve. The coengagement between the cam teeth **27, 28** urges the ratchet teeth **25** in the sleeve **26** into full mesh with the ratchet teeth **24** of the body **11**. However, upward movement of the body ratchet teeth **24** can expand the sleeve **26** sufficiently to allow the body **11** to move upwardly relative to the setting sleeve **23**, or, for that matter, permit the setting sleeve to move downwardly along the packer body. With the ratchet teeth **24, 25** fully meshed, there is sufficient lateral clearance between the cam teeth **27, 28** on the latch ring **26** and sleeve **23** to permit full disengagement between the ratchet teeth **24, 25** to occur.

As illustrated in the form of invention shown in FIGS. 1 to 5, inclusive, the central passage **10** through the main body is initially closed by the plug device D, which is also used in expanding the slips **21, 14** and packing structure **18** against the well casing B. As shown, the plug device D includes a plug body **30** formed of an inner body section **31** extending upwardly into an outer body section **32** to which it is threadedly attached. A groove **33** is defined between a lower flange **34** on the lower body section **31** and the lower end of the outer body section **32** in which a seal ring **35** of rubber or rubber-like material is disposed adapted to sealingly engage the wall of the main packer body **11**. The lower portion **36** of the outer body section **32** is circumferentially continuous, its upper portion being provided with circumferentially spaced longitudinal slots **37** opening through the upper end of the outer body section, providing latch arms **38** terminating in upper latch fingers or dogs **39** having male thread elements or outer projections **40** thereon adapted to mesh

with the female thread 41 of the body box 12. As shown, the upper side of the male threads or teeth 40 conform to the lower side of the box thread 41, whereas the lower sides 42 of the male threads are tapered in a downward and inward direction so as to engage the female thread 41 and cam the latch fingers or dogs 39 inwardly when such action is permitted.

The inner body section 31 includes an upwardly projecting stem 43 piloted within a central passage or bore 44 in a latch retainer 45. This latch retainer 45 includes an enlarged diameter portion 46 providing a cylindrical holding surface 47 adapted to be disposed behind the latch arms 38 and latch fingers 39, in order to hold the male threads 40 fully meshed with the female thread 41 of the packer body box 12. With the holding surface 47 in the position illustrated in FIGS. 1 and 2, an upwardly tapering thrust shoulder 48 on the retainer member 45 engages a companion internal shoulder 49 formed on an inwardly projecting portion 51 of the latch fingers, so that any upwardly directed forces imposed on the latch retainer 45 are transmitted through the thrust shoulders 48, 49 to the latch fingers 39, and from the threads 40 of the latter to the packer body box 12.

The thrust shoulders 48, 49 are maintained contiguous one another with the cylindrical holding surface 47 disposed behind the latch fingers 39 by a releasable connection in the form of generally radial shear pins 50 disposed in a transverse bore 51*a* extending through the latch retainer 45, the outer ends of the shear pins engaging the latch fingers 39 and being disposed above upwardly facing shoulders 52 on the inward projections 51 of the latter. The shear pins 50 are urged in an outward direction by an intervening helical compression spring 53 disposed in the bore 51, but the shear pins may retract within the bore, as described hereinbelow in connection with the form of invention illustrated in FIGS. 6 and 7. In view of the circumferentially spaced slots 37 between adjacent latch fingers 39 and latch arms 38, the shear pins 50 are appropriately oriented or held immediately above the upwardly facing shoulders 52 of the latch fingers or dogs by an orienting screw 55 threaded into the latch retainer 45 and disposed in one of the slots 37 between adjacent latch arms 38.

It is apparent that with the shear pins 50 disposed immediately above the finger shoulders 52, the latch retainer 45 cannot shift downwardly along the dogs or fingers 39, upward movement of the latch retainer 45 being prevented by the coengagement of the thrust shoulders 48, 49 and the fact that the male threads 40 are fully meshed with the female box threads 41. However, upon shearing of the pins 50, as described hereinbelow, the latch retainer 45 can be shifted downwardly along the latch arms 38 and the inner body stem 43 to place the enlarged cylindrical holding portion 46 of the latch retainer substantially below the fingers or dogs 39, at which time a reduced diameter or relief portion 56 of the retainer is disposed opposite the latch fingers or dogs, such as disclosed in FIG. 5, permitting the arms 38 and fingers 39 to deflect inwardly, the inclined lower cam surfaces 42 on the male threads 40 effecting a camming of the fingers inwardly from meshing relation to the box threads 41.

When the shear pins 50 are intact and above the shoulders 52 of the latch fingers 39, the passage 10 through the plug body 11 is fully closed. The closing action occurs because of the sealing engagement of the plug body ring 35 against the wall of the packer body 11, and also because of the closing of a central equalizer passage 57 in the inner body section 31 extending upwardly from its lower end and terminating at the side ports 58 through its stem 43. The passage 57 is closed by a lower sleeve valve portion 59 of the latch retainer 45, which extends across the ports 58 and in engagement with the side seal rings 60 mounted on the stem on opposite sides of the ports. The sleeve valve 59 also has equalizer side ports 61 and an upper bleeder port 62 at its uppermost portion, establishing fluid communication between the central passage or bore 44 of the latch retainer and the exterior thereof.

With the plug D in its latched condition within the packer body 11, such as illustrated in FIG. 2, fluid pressure differential above the well packer within the well casing cannot shift the latch retainer 45 in a downward direction, since the pressure above and below the retainer is equalized, passing through the equalizer ports 61 into the passage or bore 44, so that such pressure acts over equal and opposite areas of the latch retainer. Any pressure differential above the well packer, however, will act in a downward direction over the full cross-sectional area of the plug body 30, tending to shift it downwardly in the body passage. However, such downward shifting cannot occur because of the engagement of a downwardly facing inclined shoulder 63 at the lower portion of the latch fingers or dogs 39 with a companion inclined body shoulder 64 immediately below the box threads 41.

As stated above, the ejectable or removable plug device D is also employable for the purpose of setting the well packer in the well bore. In accomplishing this purpose, the upper portion 65 of the latch retainer 45 has a threaded bore 66 in which a release or disruptable stud 67 is threaded, the upper end of this stud being threaded into a sub 68 threadedly secured to a tension mandrel 69 forming part of a wire line pressure actuating mechanism used for setting the bridge plug A fully in the well casing B. This setting mechanism also includes an outer actuating sleeve structure 70, the upper portion 71 of which is threaded onto a nut 72, which is, in turn, threaded onto an adapter sleeve 73 resting upon the upper end of the setting sleeve 23 of the bridge plug. The setting mechanism forms no part of the present invention. A description of one form thereof may be found in United States Patent No. 2,640,546. It is sufficient to state that the setting mechanism exerts an upward pull on the tension mandrel 69 and a downward force on the actuating sleeve structure 70. The upward force on the tension mandrel is transmitted through the sub 68 to the release stud 67, that has a central weakened section 74, which exerts an upward pull on the latch retainer 45, this upward pull being transmitted through the thrust shoulders 48, 49 to the latch fingers 39, and from the latter to the packer body 11, tending to urge the body in an upward direction. At the same time, the setting mechanism (not shown) is exerting a downward force on the actuating sleeve structure 70, which exerts a downward force on the packer setting sleeve 23. It is by virtue of the upward movement of the body 11 and the relative downward shifting of the setting sleeve 23 that the well packer A is anchored in packed-off condition in the well casing B.

The apparatus illustrated in FIGS. 1 to 5, inclusive, is run in the well casing on a wire line (not shown) until the well packer A is located at the desired setting depth in the well bore. The setting mechanism is then appropriately actuated to cause the tension mandrel 69 to move upwardly and the actuating sleeve structure 70 to move downwardly. Such action causes the shear screws 22 attaching the upper slips 21 to the upper expander 19 to be disrupted, the setting sleeve 23 shifting the upper slips downwardly along the upper expander and outwardly against the wall of the well casing. A continuation of the upward movement of the tension mandrel 69 will effect an upward shifting of the body 11, through the agency of the ejectable plug device D. The upward force on the body shears the screws 20 securing the upper expander 19 to the body, allowing the lower expander 15 to be shifted toward the upper expander, which shortens the packing structure 18 and expands it against the wall of the well casing B. A continuation of the upward movement of the body 10 then shears the screws 16, 17 holding the lower slips 14 to the lower expander 15 and the lower expander to the body 11,

shifting the lower slips **14** upwardly along the lower expander and outwardly against the wall of the well casing. The setting force in the setting mechanism (not shown) continues to increase to more firmly wedge the upper expander **19** behind the upper slips **21** and the lower expander **15** behind the lower slips **14**, to embed the slips more firmly in the wall of the well casing, and also more firmly compressing the packing structure **18** into sealing engagement with the wall of the well casing and against the periphery of the body **11**. Eventually, the tensile strength of the release stud **67** will be exceeded and this member will part at its weakened section **74**, effecting a disconnection between the setting mechanism and the well packer, the setting mechanism then being withdrawn from the well casing, including its tension mandrel **69**, sub **68**, upper portion of the disrupted release stud **67**, and the actuating sleeve structure **70** surrounding the mandrel (FIG. 4). The well packer A is now anchored in packed-off condition in the well casing B against movement in both directions therewithin, the ratchet ring **26** preventing relative downward movement of the body **11** with respect to the setting sleeve **23** and the other parts of the well packer surrounding the body.

Since the plug device D is latched in the packer body **11**, the passage **10** through the latter is closed. Accordingly, the well packer is now constituted as a bridge plug, forming a solid barrier across the well casing B. A suitable pressuring operation can now be performed in the well bore above the anchored bridge plug, such pressuring operation being incapable of shifting the plug D downwardly of the packer and out of the body passage **10**. In the event that there is any pressure differential below the well packer A, such pressure cannot shift the plug device D upwardly from the passage **10**, since the pressure acts on the plug body **30** and is transmitted through its arms **38** and latch fingers **39** to the packer body. Since the seal diameter of the seal rings **60** on opposite sides of the side ports **58** through the stem **43** are equal, there can be no pressure acting on the valve sleeve **59** tending to shift it upwardly. Even if such pressure were present, upward shifting could not occur since the upward forces would be transmitted from the thrust shoulder **48** directly to the latch fingers **39** and through its threads **40** to the threads **41** of the packer body box **12**. The plug device D remains in the main body passage **10** and cannot be shifted by fluid pressure in either direction within the packer body passage.

After a pressuring operation has been completed, it may be desired to open the passage **10** through the well packer by removing the plug device D therefrom, as, for example, when the well packer is to be used as a production packer. Production tubing E can be lowered through the well casing (FIG. 5). When its lower end engages the upper end of the latch retainer **45**, a sufficient downward force can be imposed thereon to exceed the shear strength of the shear pins **50**. Any downward force imposed on the latch retainer is transmitted through the shear pins **50** to the latch fingers or dogs **39** and through the latter to the body shoulder **64**. When the shear strength of the shear pins is exceeded, the outer portions of the pins are sheared away from their inner portions, which then permits the latch retainer **45** to shift downwardly along the latch fingers **39**, latch arms **38** and body stem **43** to the extent limited by engagement of the lower end of the sleeve valve portion **59** of the latch retainer with the inner body section **31**, such as illustrated in FIG. 5, at which time the equalizer port **61** will be disposed between the seal rings **60** and in alignment with the stem ports **58**, allowing the pressures above and below the well packer to equalize, since there is an open passage **57**, **58**, **61** through the plug device. To insure the downward movement of the latch retainer **45** to its full extent, the bleeder hole or port **62** is provided in the latch retainer **45** at the upper end of its passage **44**, the relative movement of the upper end of the stem **43** into the latch retainer passage **44** above the latch retainer equalizer ports **61** resulting in the fluid in the passage above the equalizer ports being discharged through the bleeder port.

When the latch retainer **45** has been shifted to its lower position, such as disclosed in FIG. 5, the reduced diameter portion **56** of the latch retainer is disposed opposite the latch fingers **39**. Accordingly, the imposition of a downward force on the latch retainer through the tubing string E will cause such downward force to be transmitted to the latch body **30**, pulling the latch arms **38** and latch fingers **39** downwardly, the female thread **41** and inclined body shoulder **64** engaging the inclined surfaces **42**, **63** on the latch fingers, which will deflect the latch fingers inwardly so that they clear the inner portions of the threads **41**, and also the body shoulder **64**, the finger threads **40** being shifted inwardly within the body passage **10**. A continuation of the downward movement of the tubular string E can then push the entire plug structure D down through the body passage **10** for ejection from its lower end, the plug device then dropping to the bottom of the hole free from interference with the ability of the well production to flow into the well casing B and then through the ports P in the tubing string E and up through the latter to the top of the well bore. The tubing string E will usually carry seal devices (not shown), or the like, adapted to seal against the wall of the packer body **11**.

In the form of invention illustrated in FIGS. 6 and 7, essentially the same ejectable plug device D is used as illustrated in FIGS. 1 to 5, inclusive. However, the plug device has been conditioned so that it can be lowered in the well casing B and inserted into a well packer A that has previously been anchored in packed-off condition in the well casing. In this manner, the central passage **10** through the packer body **11** can be closed, in order to convert the packer into a bridge plug and allowing a pressuring operation, or the like, to take place in the well bore above such bridge plug. Thereafter, the bridge plug can be reconverted into a packer having an open central passage **10** therethrough, in the same manner as described in connection with FIG. 5.

As shown in FIGS. 6 and 7, the ejectable plug device D comprises the same parts as in the ejectable plug device in the other form of the invention. Initially, however, the shear pins **50** are disposed substantially below the latch fingers **39**, such as shown in FIG. 6, the intervening spring **53** constantly tending to urge the shear pins outwardly. The inwardly directed portions **51** of a pair of opposed latch fingers have segments **80** of a relatively small arcuate extent releasably secured thereto, as by means of shear screws **81**, these segments extending inwardly toward the reduced diameter portion **56** of the latch retainer. The distance between the inner surface of each latch segment **80** and the reduced diameter periphery **56** of the latch retainer is such as to permit the latch fingers **39** to deflect inwardly sufficiently to disengage the male thread elements **40** from the box threads **41**, but the segments **80** will engage the reduced diameter peripheral portion **56** before the fingers **39** can move inwardly sufficiently to provide an effective external diameter of the latch fingers **39** which is less than the diameter of the body passage **10**. In other words, the segments **80** will prevent inward collapsing of the fingers **39** to an extent sufficient to cause the lower thrust shoulders **63** on the fingers **39** to move inwardly from engagement with the upwardly facing tapered body shoulder **64**.

The ejectable plug device is releasably secured to a tubular running-in string S, such as a string of tubing, having a sub **83** threaded thereon and attached to the upper portion of the latch retainer **45** by shear screws **84**. As stated above, the well packer A has previously been set in the well bore. The ejectable plug device D can be lowered readily on the tubing string S through the well casing B to the location of the well packer, the plug

parts being disposed in the relative positions illustrated in FIG. 6. The plug body **30** will enter the box portion **12** of the packer and move into its central passage **10**. The retainer **45** exerts a downward force on the plug body **30**, and when the latch fingers **39** engage the box threads **41**, their inclined sides **63**, **42** will cause them to deflect inwardly and allow them to ride past the threads **41** until the thrust shoulder **63** on the fingers engages the body shoulder **64**. As pointed out above, the segments **80** engage the reduced diameter portion **56** of the latch retainer **45** to prevent inward collapse of the fingers **39** to the extent in which they will clear the body shoulder **64** and move down into the body passage **10**.

When the shoulders **63**, **64** are coengaged, further downward movement of the plug cannot occur. Accordingly, the operator at the top of the well bore will then effect an upward movement of the tubular string S, which will carry the latch retainer **45** upwardly with it, the latch body **30** being prevented from moving upwardly by the outward expansion of the latch finger thread elements **40** into mesh with the box threads **41**. During upward movement of the latch retainer **45**, an upwardly facing shoulder **90** at the lower end of its reduced diameter portion **56** will engage the latch segments **80**, whereupon the taking of a sufficient strain on the tubing string S and latch retainer **45** will shear the screws **81** holding the segments to the latch fingers **39**, the latch retainer **45** then being capable of continued upward movement along the latch arms **38** and fingers **39**, its shear pins **50** engaging the tapered inner sides **49** of the latch fingers and shifting inwardly within the transverse bore **51** against the force of the spring **53**. When the pins **50** are disposed above the finger shoulders **52**, the spring **53** will reshift them outwardly to a position above these shoulders, this position being positively determined by engagement of the thrust shoulder **48** on the latch retainer with the companion lower tapered shoulders **49** on the latch fingers. The plugging device D is then in the position illustrated in FIG. 7, which is the same position as shown in FIGS. 1 to 4, inclusive, of the other form of the invention. The taking of a sufficient upward strain on the tubing string S will now effect a disruption of the shear screws **84** securing the sub **83** of the latter to the latch retainer **45**, allowing the tubing strings to be elevated in the well bore (FIG. 7). Such upward strain cannot move the retainer **45** upwardly to any further extent, in view of the coengagement between the thrust shoulders **48**, **49**, the force being transmitted through the fingers **39** and the threads **40**, **41** to the anchored packer body **11**.

The well packer A has now been fully converted to a bridge plug, and subsequent operations can be performed in the well bore, such as described in connection with the other form of the invention. If the well packer is to be reconverted to a device having an open passage **10**, the plug D is ejectable in the same manner as described in connection with the other form of the invention; that is, sufficient downward force is imposed on the latch retainer **45**, as by engaging it by a string of tubing, which may actually be the same tubing string S used in lowering the plug device in the well casing to the location of the previously set packer, the shear pins **50** being disrupted to remove the retainer **45** from its holding relation with respect to the latch fingers **39**, the latter shifting inwardly to a sufficient extent for movement downwardly into the packer passage **10**. The inward shifting of the latch fingers **39** can occur inasmuch as the segments **80** of relatively small arcuate extent have previously been removed as the result of shearing the screws **81** initially holding them to the fingers. The plug device can be ejected completely from the packer passage **10**, opening the latter to the flow of fluids therethrough, or to the flow of fluids upwardly through a tubing string E or S extending through the body passage **10** in suitable sealing relation to the inner wall of the packer body **11**.

I claim:

1. A well packer apparatus adapted to be set in a well bore and including a packer body having a passage and means thereon for securing said packer body in the well bore; a plug in said passage to prevent flow of fluid therethrough, including a plug body in said passage having latch means engaging said packer body to hold said plug body against downward movement in said passage, said plug body having an equalizer passage through which fluid can flow between regions above and below said plug body, retainer means engaging said latch means to prevent release of said latch means from said packer body, and valve means on said retainer means piloted over a portion of said plug body to close said equalizer passage when said retainer means engages said latch means, said retainer means being movable to a released position with respect to said latch means and sliding said valve means over said portion of the plug body to a position opening said equalizer passage.

2. A well packer apparatus adapted to be set in a well bore and including a packer body having a passage and means thereon for securing said packer body in the well bore; a plug in said passage to prevent flow of fluid therethrough, including a plug body in said passage having latch means engaging said packer body to hold said plug body against downward movement in said passage, said plug body having an equalizer passage through which fluid can flow between regions above and below said plug body, said equalizer passage terminating in an upper side port, retainer means engaging said latch means to prevent release of said latch means from said packer body, and valve means on said retainer means disposed across said side port to close the same when said retainer means engages said latch means, said retainer means being movable to a released position with respect to said latch means and shifting said valve means to a positoin opening said port.

3. A well packer apparatus adapted to be set in a well bore and including a packer body having a passage and means thereon for securing said packer body in the well bore; a plug in said passage to prevent flow of fluid therethrough, including a plug body in said passage having latch means engaging said packer body to hold said plug body against downward movement in said passage, said plug body having an equalizer passage through which fluid can flow between regions above and below said plug body, said equalizer passage terminating in an upper side port, retainer means engaging said latch means to prevent release of said latch means from said packer body, and a sleeve valve on said retainer means piloted over a portion of said plug body and disposed across said port to close the same when said retainer means engages said latch means, said retainer means being movable to released position with respect to said latch means and shifting said sleeve valve along said portion of the plug body to a position opening said port.

4. A well packer apparatus adapted to be set in a well bore and including a packer body having a passage and means thereon for securing said packer body in the well bore, said body having an upwardly facing shoulder surrounding its passage, a plug in said passage to prevent flow of fluid therethrough, including a plug body in said passage having latch means engaging said shoulder to hold said plug body against downward movement in said passage, said plug body having a stem portion through which an equalizer passage extends which terminates in an upper side port, retainer means engaging said latch means to prevent release of said latch means from said shoulder, and a sleeve valve on said retainer means piloted over said stem and disposed across said port to close the same when said retainer means engages said latch means, said retainer means being movable longitudinally of said latch means to a released position with respect thereto and shifting said sleeve valve longitudinally along said stem to a position opening said port.

5. A well packer apparatus adapted to be set in a well bore and including a packer body having a passage and means thereon for securing said body in the well bore, said body having an upper threaded box and an upwardly facing shoulder adjacent to the lower end of said threaded box; a plug in said passage to prevent flow of fluid therethrough, including a plug body in said passage having latch means engaging said shoulder and threaded box to hold said plug body against downward and upward movement in said passage, and shiftable retainer means engaging said latch means to prevent release of said latch means from said shoulder and threaded box, said retainer means being shiftable from said latch means to permit inward movement of said latch means and its release from said shoulder and threaded box.

6. A well packer apparatus adapted to be set in a well bore and including a packer body having a passage and means thereon for securing said body in the well bore, said body having an upper threaded box and an upwardly facing shoulder adjacent to the lower end of said threaded box; a plug in said passage to prevent flow of fluid therethrough, including a plug body in said passage having latch means engaging said shoulder and threaded box to hold said plug body against downward and upward movement in said passage, shiftable retainer means engaging said latch means to prevent release of said latch means from said shoulder and threaded box, said retainer means being shiftable downwardly of said latch means to permit release of said latch means from said shoulder and threaded box, and coengaging means on said retainer means and latch means for transmitting upwardly directed forces imposed on said retainer means through said latch means to said threaded box.

7. A well packer apparatus adapted to be set in a well bore and including a packer body having a passage and means thereon for securing said body in the well bore, said body having an upper threaded box and an upwardly facing shoulder adjacent to the lower end of said threaded box; a plug in said passage to prevent flow of fluid therethrough, including a plug body in said passage having upwardly extending arms provided with latch fingers at their upper portion engaging said shoulder and threaded box to hold said plug body against downward and upward movement in said passage, a retainer within and engaging said fingers to prevent their inward movement and release from said shoulder and threaded box, said fingers having inward projections engaged by an upwardly facing shoulder on said retainer to transmit upward forces imposed on said retainer through said fingers to said threaded box, and shear means on said retainer engaging said inward projections to prevent downward movement and release of said retainer from said fingers, said shear means being disrupted when subjected to a predetermined downward force imposed on said retainer to allow downward shifting of said retainer along said latch fingers and arms to released position with respect thereto.

8. A well packer apparatus adapted to be set in a well bore and including a packer body having a passage and means thereon securing said packer body in the well bore; a plug adapted to be inserted in said passage to prevent flow of fluid therethrough, including a plug body insertable in said passage and having expansible and retractable latch means engageable with said packer body to hold said plug body against upward and downward movement in said passage, shiftable retainer means engageable with said latch means to prevent release of said latch means from said packer body, said retainer means being adapted to occupy a first longitudinal position along said latch means permitting retraction of said latch means from said packer body and a second longitudinal position along said latch means preventing release of said latch means from said body, releasable coengageable means on said latch means and retainer means limiting the extent of retraction of said latch means and preventing said retainer means from occupying said second position, means on said retainer engageable with said releasable means to release the same and permit movement of said retainer means to said second position, and means releasably holding said retainer means in said second position.

9. A well packer apparatus adapted to be set in a well bore and including a packer body having a passage and means thereon for securing said body in the well bore, said body having an upper threaded box and an upwardly facing shoulder adjacent to the lower end of said threaded box surrounding said passage and having an effective minimum diameter substantially less than the minimum diameter of said threaded box; a plug adapted to be inserted in said passage to prevent flow of fluid therethrough, including a plug body insertable in said passage and having expansible and retractable latch means engageable with said body shoulder and threaded box to hold said plug body against downward and upward movement in said passage, shiftable retainer means engageable with said latch means to prevent release of said latch means from said shoulder and threaded box, said retainer means being adapted to occupy a first longitudinal position along said latch means permitting retraction of said latch means from said packer body to an extent sufficient to permit movement of said latch means in said packer body passage and a second longitudinal position along said latch means to prevent release of said latch means from said shoulder and threaded box, releasable coengageable means on said latch means and retainer means limiting the extent of retraction of said latch means preventing said latch means from entering said passage but permitting release of said latch means from said threaded box and also preventing said retainer means from occupying said second position, means on said retainer engageable with said releasable means to release the same and permit movement of said retainer means to said second position, and means releasably holding said retainer means in said second position.

10. A well packer apparatus adapted to be set in a well bore and including a packer body having a passage and means thereon for securing said body in the well bore, said body having an upper threaded box and an upwardly facing shoulder adjacent to the lower end of said threaded box, said shoulder extending laterally inwardly of said threaded box; a plug in said passage to prevent flow of fluid therethrough, including a plug body insertable in said passage and having expansible and retractable latch means engageable with said shoulder and threaded box to hold said plug body against downward and upward movement in said passage, shiftable retainer means engageable with said latch means to prevent release of said latch means from said shoulder and threaded box, said retainer means being adapted to occupy a first longitudinal position along said latch means permitting retraction of said latch means from said packer body and a second longitudinal position along said latch means preventing release of said latch means from said body, shearable means on said latch means engageable with said retainer means to limit the extent of retraction of said latch means and preventing disengagement of said latch means from said shoulder and also preventing said retainer means from occupying said second position, means on said retainer means engageable with said shearable means to shear the same and thereby permit movement of said retainer means to said second position, and shear means releasably connecting said retainer means to said latch means to hold said retainer means in said second position, said shear means being disruptable upon being subjected to a predetermined force by said retainer means to allow movement of said retainer means to said first position permitting retraction of said latch means from said threaded box and shoulder and longitudinal movement of said latch means in said packer body passage below said shoulder.

11. A well packer apparatus adapted to be set in a well bore and including a packer body having a passage

and means thereon securing said body in the well bore, said body having an upper threaded box and an upwardly facing shoulder adjacent to the lower end of said threaded box and extending inwardly thereof toward the axis of said packer body; a plug insertable in said passage to prevent flow of fluid therethrough, including a plug body insertable in said passage and having upwardly extending arms provided with latch fingers at their upper portion engageable with said shoulder and threaded box to hold said plug body against downward and upward movement in said passage, a retainer within and adapted to occupy a lower position below said fingers permitting retraction of said fingers from said threaded box and shoulder and an upper positioning engaging said fingers to prevent their inward movement and release from said shoulder and threaded box, said fingers having inward projections adapted to be engaged by an upwardly facing shoulder on said retainer to transmit upward forces imposed on said retainer through said fingers to said threaded box, shearable means connected to said projections and engageable with said retainer to limit the extent of retraction of said fingers permitting their release from said threaded box but preventing their movement inwardly sufficiently for disengagement from said packer body shoulder when said retainer occupies said lower position, means on said retainer engageable with said shearable means to disrupt the same and permit movement of said retainer to said upper position, and shear means disposed above and engaging said inward projections to releasably hold said retainer in said upper position.

12. A well packer apparatus adapted to be set in a well bore and including a packer body having a passage and means thereon for securing said body in the well bore, said body having an upper threaded box and an upwardly facing shoulder adjacent to the lower end of said threaded box; a plug in said passage to prevent flow of fluid therethrough, including a plug body in said passage having latch means engaging said shoulder and threaded box to hold said plug body against downward and upward movement in said passage, said plug body having an equalizer passage through which fluid can flow between regions above and below said plug body, retainer means engaging said latch means to prevent release of said latch means from said threaded box and shoulder, and valve means on said retainer means for closing said equalizer passage when said retainer means engages said latch means, said retainer means being movable to a released position with respect to said latch means and shifting said valve means to a position opening said equalizer passage.

13. A wall packer apparatus adapted to be set in a well bore and including a packer body having a passage and means thereon for securing said body in the well bore, said body having an upper threaded box and an upwardly facing shoulder adjacent to the lower end of said threaded box; a plug in said passage to prevent flow of fluid therethrough, including a plug body in said passage having latch means engaging said shoulder and threaded box to hold said plug body against downward and upward movement in said passage, said plug body having an equalizer passage through which fluid can flow between regions above and below said plug body, said equalizer passage terminating in an upper side port, retainer means engaging said latch means to prevent release of said latch means from said shoulder and threaded box, and valve means on said retainer means disposed across said side port to close the same when said retainer means engages said latch means, said retainer means being movable to a released position with respect to said latch means and shifting said valve means to a position opening said port.

14. A well packer apparatus adapted to be set in a well bore and including a packer body having a passage and means thereon for securing said body in the well bore, said body having an upper threaded box and an upwardly facing shoulder adjacent to the lower end of said threaded box; a plug in said passage to prevent flow of fluid therethrough, including a plug body in said passage having upwardly extending arms provided with latch fingers at their upper portion engaging said shoulder and threaded box to hold said plug body against downward and upward movement in said passage, said plug body having a stem portion through which an equalizer passage extends terminating in an upper side port, a retainer within and engaging said fingers to prevent their inward movement and release from said shoulder and threaded box, a sleeve valve on said retainer piloted over said stem and disposed across said passage to close the same when said retainer engages said fingers, said fingers having inward projections engaged by an upwardly facing shoulder on said retainer to transmit upward forces imposed on said retainer through said fingers to said threaded box, and shear means on said retainer engaging said inward projections to prevent downward movement and release of said retainer from said fingers, said shear means being disrupted when subjected to a predetermined downward force imposed on said retainer to allow downward shifting of said retainer along said latch fingers and arms to released position with respect thereto and to shift said sleeve valve longitudinally along said stem to a position opening said port.

15. A well packer apparatus adapted to be set in a well bore and including a packer body having a passage and means thereon securing said packer body in the well bore; a plug adapted to be inserted in said passage to prevent flow of fluid therethrough, including a plug body insertable in said passage and having expansible and retractable latch means engageable with said packer body to hold said plug body against upward and downward movement in said passage, shiftable retainer means engageable with said latch means to prevent release of said latch means from said packer body, said retainer means being adapted to occupy a first longitudinal position along said latch means permitting retraction of said latch means and from said packer body and a second longitudinal position along said latch means preventing release of said latch means from said body, releasable coengageable means on said latch means and retainer means limiting the extent of retraction of said latch means and preventing said retainer means from occupying said second position, means on said retainer engageable with said releasable means to release the same and permit movement of said retainer means to said second position, means releasably holding said retainer means in said second position, said plug body having equalizer passage through which fluid can flow between regions above and below said plug body, valve means on said retainer means closing said equalizer passage when said retainer means occupy said second longitudinal position, said valve means being shifted by said retainer means to a position opening said equalizer passage when said retainer means occupy said first longitudinal position.

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