A re-equitable well packer having a body with expansible sealing means thereon; gripping means expandable for holding the sealing means against downward movement, a mandrel movable in said body; a setting member on the mandrel engageable with the body to expand the sealing means against said gripping means; and holddown lock means on said mandrel and body coacting with said gripping means to lock said body and sealing means against longitudinal movement in the well bore, and releasable and releasable to permit the packer to be anchored, released, and reset in different locations during a single trip. Said holddown means comprises expander means on said body normally resiliently held in expanded position, a locking sleeve movable with the mandrel to be engageable with said expander means to prevent movement thereof from said normal expanding position, and removable from such position to permit contraction of said expander means, and gripping means including a plurality of gripping slips on the mandrel movable into engagement with said expander means for expansion of said slips to gripping position, said locking sleeve preventing contraction of said expander means during expansion of said slips. Biasing means on the mandrel is movable to engage said gripping means for urging said gripping slips toward said expander means during movement of setting member to expand the sealing means, whereby the gripping slips are resiliently biased toward gripping position during expansion of the sealing means, and are positioned to grip and lock the packer against upward movement when the sealing means has been fully expanded, without damaging wear of the teeth of the gripping slips during such movement. A bypass flow passage between the body and mandrel is closable by sealable valve means on the setting member and body when the packer is set. Latch means on the mandrel and body holds said holddown means and sealing means in locking sealing position, and releasable means between said mandrel and latch means permits said mandrel to be moved to release said holddown locking means, seal means and gripping means for removal of the packer from the well bore if the latch means cannot be released.
WELLPACKER AND HOLD DOWN MEANS

This invention relates to well tools, and more particularly to locking and holddown means therefor.

Another object of the invention is to provide a well packer for sealing the annulus between a string of well tubing and the wall of the well bore, and having means for anchoring it against movement in either longitudinal direction.

Another object of the invention is to provide a well packer of the character described which can be set, released and reset repeatedly in various locations during a single trip of the packer into the well bore, without removal of the packer from the well bore.

A further object is to provide a packer of the character set forth having gripping means for holding the same against downward movement and hold down lock means coaching therewith to lock said packer in sealing position against movement in either longitudinal direction in the well bore, said holddown lock means being releasable and resettable to permit the packer to be anchored, released, and reset as described.

Yet another object is to provide a packer of the character described having means providing a fluid bypass passageway therethrough to facilitate lowering of the packer through the well bore and means for closing said bypass passageway when said packer is set, said passageway being reopenable during releasing of the packer to equalize any difference in fluid pressures existing thereacross and to facilitate removal of the packer from the well bore.

Another object is to provide a well packer of the character described wherein the holddown lock means comprises collapsible frustoconical expander means normally resiliently held in expanding position and a support or locking sleeve movable within said expander means to prevent collapsing movement thereof and movable from within said expander means to be retracted from expanding position, and a plurality of gripping slips engageable with said expander means for movement thereby to gripping hold down position.

A further object is to provide a well packer of the character described having latch means on the mandrel and body engageable to latch said packer in set position with said bypass passageway closed, said latch means being releasable to permit movement of the mandrel to release the packer.

A particular object of the invention is to provide a well packer of the character described wherein the expander for the holddown lock means comprises a cylinder having a plurality of resilient fingers having external bosses on their upper ends providing a frustoconical cam expander surface normally resiliently held in expanding position for moving said holddown sleeves outwardly into gripping position upon relative movement of said upper sleeves toward said expander means, and supporting or lock sleeve means movable to a position to engage said fingers to prevent inward movement of the bosses at the upper end thereof, said lock sleeve means being movable during releasing of said packer to a position out of position to engage said expander fingers to permit said fingers to yield inwardly, and engageable with said slips to move said slips out of engagement with said expander surface to released position.

Another important object is to provide a holddown lock mechanism for a well packer having a body with expansible sealing means thereon and a mandrel having a setting member thereon movable with said mandrel to expand said seal means, said body having the invented gripping slips actuated by setting movement of the mandrel expanding the sealing means, and resiliently biased toward gripping position during such setting movement; and means for latching the mandrel and body in gripping sealing position until the latch is disengaged and the mandrel and setting member are moved away from the body.

Additional objects and advantages of the invention will be readily apparent from the following description of a device constructed in accordance with the invention, and reference to the accompanying drawings thereof, wherein:
Also mounted on the slip carrier below the slips is a friction mechanism 66 comprising a plurality of friction shoes 67 which are radially mounted in radially opening longitudinally extending slots 68 formed in the slip carrier and which bear ears 70 which engage an annular retaining ring 71 at the upper end of the recesses and an annular longitudinally extending upstanding flange 72 on the upper end of a J-latch pin carrier 74 threaded onto the lower end of the slip carrier. Helical coiled springs 76 disposed in recesses 77 formed in the inner faces 76 of the shoes and engaging a leaf spacer or support member 79 in the inner portion of the recess bias the friction shoes outwardly to frictionally engage the wall of the well casing for holding the slip carrier stationary during setting of the lower slips. The sub 13 at the lower end of the mandrel 11 is provided with a J-slot 80 in which the inner cylindrical end 81 of the J-latch pin 82 engages to releasably connect the sub with the slip carrier. The lower end 84 of the reduced lower portion 16 of the packer support sleeve engages the upper end 85 of the sub to support the expander wedge member 35 above the slips, while the engagement of the latch pin 82 in the J-slot 80 holds the slips downwardly below the expander wedge so that the slips are not expanded during movement of the packer into the well bore. When the J-latch pin is released from the J-slot, the friction mechanism 66 will hold the slip carrier stationary and when the slips are moved into engagement with such friction conical expander surfaces the slips are moved outwardly into gripping engagement with the wall of the well casing in the usual manner.

A plurality of elongated longitudinally extending slots 88 are formed in the lower reduced portion 16 of the packer support sleeve and a corresponding number of guide pins 89 are threaded into the slip carrier, the packer and the slips. These slots and guide pins 89 engage the elongated slots. This engagement of the inner ends of these pins 89 in the slots prevents rotational movement of the slip carrier with respect to the support sleeve, for a purpose which will be hereinafter explained.

The structure of the packer herebefore described comprises substantially the usual valve-in-head type packer structure.

An improved valve structure and hold down latch or locking means 100 is provided above the expander and latching setting member 21 at the upper end of the packer support sleeve. The upper end of the setting member is provided with an enlarged bore 102 which receives the lower cylindrical portion 104 of the expander member 105. The expander member is formed with a plurality of longitudinally extending slots 106 which provide resilient upstanding fingers 107 having enlarged external bosses 108 at their upper ends providing downwardly facing shoulders 109 which engage the upper end 110 of the setting member. Suitable retainer pins or setscrews 114 are threaded or otherwise secured in radially extending openings in the setting member and engage in corresponding openings formed in the expander sleeve, preferably in the longitudinal slots 106 formed between the fingers, so that the expander member is held against upward displacement from the setting member. The outer surfaces or faces of the bosses are inclined inwardly or taper upwardly above the shoulders 109 to provide an expander surface 116, the plurality of such bosses providing a substantially frustoconical expander means on the expander sleeve. The inner surfaces of the fingers at the bosses are formed with outwardly and upwardly inclined enlarged or relieved bore portions 110 which provide a shoulder 119 at the lower end of such relieved portions, for a purpose to be hereinafter described.

An upper slip assembly 125 includes a slip carrier or sleeve 126 having a plurality of radially extending circumferentially spaced slots 127 provided therein which are substantially T-shaped and which receive the T-shaped handles 129 projecting upwardly from upper gripping slots 130. The T-shaped radial slots in the carrier are formed by means of an internal annular groove or recess 132 turned in the bore 133 of the sleeve and radially extending narrow slots 127 cut through the lower portion of the sleeve into the groove and into the bore of the sleeve below the groove. The T-shaped handles of the slips fit in the slots and the arms 135 of the T-shaped handles engage the lower upwardly facing surface 136 of the internal annular groove or recess 132 of the slip carrier to retain the slips on the mandrel. The serrated external faces 140 of the slips have grooves 141 in their upper portion in which a garter spring 142 is disposed to bias the slips inwardly toward retracted position, as shown in FIG. 1. The inner surfaces 144 of the lower portion of the slips are flared or inclined to correspond substantially to the frustoconical wedge surfaces 116 of the expander member, and when the slips are moved into engagement with such frustoconical expander surfaces the slips are moved outwardly into gripping engagement with the wall of the well casing or well bore to hold the packing supporting sleeve 15 against upward movement therein.

An elongate expander and lock sleeve 150 is slidably on the packer mandrel 11 between an upwardly facing shoulder 152 at the upper end of an external annular flange 153 formed on the mandrel and the lower end of a projecting stop ring 155 which is fitted into an external annular groove 156 provided near the upper end in the mandrel above the upper end of the support and lock sleeve. An enlarged support and lock surface 158 is formed on the lower portion of the expander and lock sleeve and the surface is tapered downwardly slightly to fit closely within the sleeve 159 and the reed downwardly. The lower portion of the resilient fingers of the expander member 105, so that the support surface is disposed to engage such inner surfaces of the fingers of the bosses to retain the bosses in their normal operative expanding position shown in FIG. 1. The engagement of the lower end of the lock sleeve 150 with the upwardly facing shoulder 152 on the mandrel holds the sleeve upwardly, and the engaged rings 161 prevent downward movement of the expander member while the packer is being run into the well bore. Also, the upwardly facing shoulder 160 at the upper end of the enlarged lock surface of the lock sleeve engages under downwardly facing shoulders 161 formed on the inner sides of the T-shaped handles of the upper gripping slips, whereby the upper gripping slips are held upwardly out of engagement with the expander surfaces 116 of the expander member as shown in FIG. 1, and the slip carrier and slips are thus supported by such upwardly facing shoulders. A projecting retainer ring 170 is secured within an external annular groove 171 formed in the upper end portion of the expander and lock sleeve to limit upward movement of the slip carrier 126 on said sleeve and to retain the slip carrier in place thereon.

A biasing sleeve 175 is slidably secured on the mandrel 11 above the retainer or stop ring 155, and is slidably thereon below an upper projecting split retainer or stop ring 176 secured in an external annular groove 177 at the upper end of the mandrel, as clearly shown in FIG. 1. The biasing sleeve is formed with an internal annular upwardly facing shoulder 179 in its lower portion which supports a lower biasing and guide ring 180 held in place in the enlarged bore of the biasing sleeve by a retaining screw 181 disposed in an opening in the sleeve and threaded into a threaded opening in said ring. The lower biasing and guide ring engages the upper edge of the retainer or stop ring 155 on the mandrel to limit downward movement of the biasing sleeve, and the retaining screw 181 threaded into the biasing ring holds the biasing sleeve against downward movement beyond that point. A helical coiled spring 184 is supported at one end on the upper face of the biasing ring 180 and has its other end resiliently engaging the lower end of an upper biasing and guide ring 185 which is slidable in the upper portion of the enlarged bore 186 of the biasing sleeve and which engages the lower end of the projecting upper retaining or stop ring 176 on the mandrel. It will, therefore, be seen that the spring 184 acting against the lower biasing ring biases the biasing sleeve 175 downwardly at all times, and that the sleeve may be moved upwardly by compressing the spring between the lower biasing ring and the upper biasing and guide ring. The lower end of the biasing sleeve telescopes over the upper end of the expander and lock.
sleeve 150 and engages the upper end of the slip carrier 126, when the mandrel is moved downwardly with respect to the slip carrier and the expander and lock sleeve as shown in FIG. 4. Such engagement of the biasing sleeve with the slip carrier biases the expander carrier and the slips upward thereby engaging the expand surfaces 116 at the upper end of the expander sleeve 105, so that the slips are biased toward said expander surface by said spring but may move upwardly away from expanded position as the mandrel moves downwardly, for a purpose to be hereinafter more fully explained.

A packing expander and latch sleeve 200 is secured on the mandrel and engaged below the external annular flange 153 of the mentioned portion of the mandrel and is held in such position by a shear pin or screw 202 threaded through the latch sleeve into a threaded recess 204 formed in the exterior of the mandrel so that the expander expander and latch sleeve 200 is held against movement on the mandrel so long as said shear pin or screw 202 is intact. The packing expander and latch sleeve is provided with a plurality of J-slots 208 in the enlarged upper portion 209 thereof and has a downwardly facing boss shoulder 210 in its median portion which is adapted to engage the upper beveled face 212 of the expander ring in the bore of the expander and latching setting member when the mandrel is moved downwardly, whereby the mandrel, acting through the packing and expander and latch sleeve will force said packing supporting sleeve downwardly with respect to the lower expander member 35 and compress the packing rings 33 between said lower expander member and the downwardly facing shoulder 220 at the lower end of the expander bushing at the upper end of said supporting sleeve. The lower expander wedge member 35 is slidable upwardly on the upper enlarged portion 17 of the support sleeve 15 above the external annular flange 37 when the lower slips 46 are expanded into engagement with the well casing, so that the downward movement of the packing supporting sleeve by the mandrel will compress the packing rings 33 and expand the same between the expander wedge 35 and the downwardly facing shoulder 220 on the packing expander bushing 20 to expand the packing rings into sealing engagement with the wall of the well casing. J-pins or lugs 224 are threaded through suitable threaded openings in the expander and latching setting member and have cylindrical inner ends 225 which project into the bore of the setting member and are disposed to engage in the J-slots 208 formed in the expander and latch sleeve. When the J-pins or lugs are engaged in the J-slots, the mandrel is locked to the expander and latch sleeve and the reduced lower portion 206 of the expander and latch sleeve engages the U-shaped opening 30 to close the upper end of the bypass passage 18 through the packing supporting sleeve and prevent fluid flow therethrough.

An O-ring seal member 230 is disposed in an internal annular groove in external flange 153 on the mandrel for sealing between the mandrel and the upper portion of the expander and latch sleeve 200 so that fluids cannot flow exteriorly of the mandrel between the external packing rings on the supporting sleeve 15 in either direction. By varying the thickness of the spacer leaves 79 in the slots 68 in the slots 68 in the slip carrier 44 in which the friction shoes 67 are mounted, it is possible to adjust the load or force of the springs 76 acting on the friction shoes 67. Heavier casing having a smaller bore may not require a spacer leaf, while lighter casing with a larger diameter bore may require the use of a spacer leaf to maintain proper loading on the springs and the friction shoes for correct operation of the packer.

In use, the well tool or packer 10 is connected by means of the coupling 12 at its upper end to the lower end of the tubing string 1; and, if desired, additional lengths of tubing may be connected by the usual couplings to the tubing string 108. The expander end of the sub 13 at the lower end of the mandrel 11 and extend downwardly to a desired depth therebelow. The parts of the packer are disposed in the positions shown in FIGS. 1, 2, and 3, and the packer is lowered into the well casing with the parts in such position.

The friction element shoes 67 will engage the bore wall of the casing C and drag thereagainst as the packer is lowered through the casing. However, the J-slot connection of the pin or lug 82 and slot 80 at the lower end of the mandrel will prevent upward movement of the lower slip carrier 46 engaging slips 46 and so permit the tool to be lowered into the well. The upper slips 130 of the hold down gripping means 125 are held in the retracted position by virtue of the engagement of the lower end of the expander and lock sleeve 50 with the shoulder 152 of the flange 153 on the midportion of the mandrel.

When the desired depth in the well at which the packer is to be set has been reached, the tubing string is turned, normally in a counterclockwise direction, with respect to the friction mechanism 66 to disengage the lug 81 from the J-slot 80, the friction mechanism holding the slip carrier 44 against rotation while the mandrel 11 and the supporting sleeve 15 are rotated with respect thereto, the guide pins 89 engaged in the slots 88 in the lower portion of the supporting sleeve turning said supporting sleeve with respect to the slip carrier 44 and lower slips 46.

When the J-lug and J-slot have been disengaged, in the usual manner, the tubing string T is lowered to lower the mandrel and the supporting sleeve 15 therewith until the lower expander member 35 engages the slips, and the tapered surface 80 of the expander member 35 contacts the well casing within the slips to wedge the same outwardly into gripping engagement with the wall of the well casing in the usual manner. A sufficient downward force applied to the mandrel will then cause the lower expander member, which is held against further downward movement by the slips 46, to move upwardly on the upper portion 17 of the packer supporting sleeve 15 to compress the packing rings 33.

Downward movement of the mandrel with respect to the supporting sleeve moves the packing expander and latch sleeve 200 downwardly with the mandrel until the downwardly facing shoulder 210 on the latch sleeve engages the upwardly facing beveled shoulder 212 at the upper end of the expander ring 25 in the bore of the expander and setting member 21 at the upper end of the packing supporting sleeve. Further downward force applied by the mandrel to the upper end of the supporting sleeve will fully compress the sealing rings 33 on the exterior of the supporting sleeve between the downwardly facing shoulder 220 on the expander bushing 20 and the upwardly facing upper end of the lower expander member 35, and at the same time will force the expander member still more tightly between the slips to provide a tighter gripping engagement of the slips 46 with the well casing, while at the same time the packing rings are fully expanded or deformed into tight sealing engagement with the wall of the well casing.

As the mandrel moves downwardly in effecting setting movement of the sealing rings 33 and the lower slips 46, the gripping slips 130 of the hold down gripping means 125 above the supporting sleeve 15 are permitted to move downwardly with respect to the expander means 105 at the upper end of the supporting sleeve. The gripping slips of the hold down means will engage the wedge surfaces 116 on the upper ends of the spring fingers 107 of the collapsible expander sleeve 105 and be biased outwardly thereby. At the same time, enlarged support and lock sleeve 158 at the lower end of the support and lock sleeve 150 enters between the enlarged relieved portions 118 within the upper ends of the fingers and is disposed to hold the fingers against inward movement. The lock surface 158 will move downwardly until the shoulder at the lower end thereof engages the upwardly facing shoulder 119 at the lower end of the relieved inner portions of the fingers behind the added diametral surface 158 on the expander and lock sleeve 150 therefore prevents inward collapsing deformation of the resilient fingers 107 of the upper expander member 105 and holds the same in position for the frustoconical wedge surface 116 provided by the bosses at the upper ends of the fingers in position to force
the gripping slips 130 of the hold down means 125 outwardly toward gripping position. It will be noted that the expander lock sleeve 150 is movable longitudinally on the mandrel 11 between the upwardly facing shoulder 152 on the external flanges 153 on the mandrel and the downward facing shoulder at the lower end of the lower stop ring 155 on the mandrel. When the downward facing shoulder on the lower stop ring engages the upper end of the expander and lock sleeve, the sleeve is positively forced downwardly between the upper ends of the fingers of the expander member, while the biasing sleeve 175 yieldably engages the upper end of the lock sleeve 150 of the hold down means 125, so that the slips are not positively forced outwardly on the frustococonical outer or expander surfaces 116 at the upper ends of the fingers 107 by such downward movement of the mandrel. When the expander and latch sleeve 200 and the expander and lock sleeve 150 have been moved downwardly to their lowermost positions, the downward force applied by the tubing to the upper end of the expander 160 and latch sleeve 200 expands or deforms the sealing rings 33 on the supporting sleeve, while at the same time the biasing sleeve 175 yieldably urges but does not force the gripping slips 130 of the hold down means 125 toward gripping position on the wedge surfaces 116 of the expander member 105 of said hold down means.

When such deformation of the tubing string is reduced so that the mandrel 11 may move upwardly slightly, the wedge surfaces 116 of the bosses 108 on the expander member 105 of the hold down means 125 force the gripping slips 130 of said hold down means into tight gripping engagement with the wall of the well casing 200 to prevent upward movement of the upper end of the latch setting member 21 and the supporting sleeve 15, and so lock the mandrel inwardly against the upward movement in the well casing. Simultaneously, the J-slots 208 formed in the enlarged upper portion of the expander and latch sleeve 200 will engage the projecting cylindrical inner portions of the J-lugs 82 carried by the setting member 21 and will turn the tubing slightly until the J-lugs are engaged with said J-slots to prevent upward movement of said latch sleeve 200 and the mandrel 11 connected therewith by means of the shear pin 202. The mandrel is therefore locked in its lower position and the packer is locked in set sealing position.

The yieldable resilient gripping of the slipping slips 130 of the hold down means 125 by the biasing sleeve 175 and the spring acting thereagainst permits such slips to move downwardly with respect to the well casing following the expanding of the expander and lock sleeve 150 of the hold down means 125 and the mandrel 11 until the downward force on the supporting sleeve is released. Thus, the teeth of the gripping slips will not be damaged during such downward movement, and at the same time the slips are positively moved by said resilient means into position to positively grip the wall of the casing when the downward force on the mandrel is reduced or released.

To release the packer for resetting at another location in the casing or for removal from the well bore, the tubing is rotated to rotate the J-slots of the expander and latch sleeve 200 from locking engagement with the J-lugs 224 of the setting member 21, and the mandrel is moved upwardly. The shoulder 152 on the upper end of the flange 153 in the median portion of the mandrel engages the lower end of the expander and lock sleeve 150 and moved the same upwardly to move the enlarged lock surface 158 thereof from within the downwardly or relieved tapered inner faces 118 at the upper end of the fingers 107 of the expander member 105 of the hold down means. The taper of the inner surfaces of the fingers and the enlarged lock surface of the lock sleeve 150 permits easy removal of such enlarged lock surface from within the fingers. Continued upward movement of the mandrel and the lock sleeve will cause the shoulder 160 at the upper end of the enlarged portion 158 of the lock sleeve to engage the downwardly facing shoulders 161 on the inner faces of the slip handles and lift the slips upwardly off the wedge surfaces 116 on the outer faces of the bosses 108 at the upper ends of the fingers 107 of the expander member 105 of the hold down means. Upward movement of the slips is also facilitated by virtue of the fact that the upper ends of the fingers of the expander member may flex inwardly toward a contracted or collapsed position to permit the gripping slips to move easily from gripping engagement with the wall of the casing, since the enlarged lock slot surface 150 no longer is in position to restrain or prevent such inward flexing movement of the upper ends of the fingers.

Continued upward movement of the mandrel will then move the sub 13 at the lower end of the mandrel into engagement with the lower end 94 of the packing supporting sleeve 15 and lift the supporting sleeve until the upwardly facing shoulder on the flange 37 at the lower end of the enlarged upper portion 17 of the sleeve engages the downwardly facing shoulder 38 in the bore 39 of the lower expander member 35 and lifts such expander member upwardly out of expanding engagement with the lower gripping slips 46 to release the gripping slips for inward movement to retracted position by the garter spring 55 surrounding the slips. Further upward movement moves the J-slots 80 of the sub 13 into engagement with the J-lugs 82 on the lower end of the carrier 74 and the J-lugs may be moved to the lower portion of the J-slots and the tubing rotated, normally in a clockwise direction, to rotate the J-lugs into latching engagement with the J-slots to hold the slips in their lower position. Of course, such movement is not necessary unless the packer is to be moved downwardly in the well casing to a lower position subsequent to releasing the same from its previously locked sealing position. In any event, the packer parts are now again in the position shown in FIGS. 1, 2 and 3, and the packer may be moved either upwardly or downwardly in the well casing to a new location for resetting in the manner already described, or may be removed from the well bore.

Should it ever develop that the latch sleeve 200 on the mandrel cannot be released form the J-pins 224 in the expander and latch setting member 21, the shear pin 202 screw threaded through the latch sleeve into the recess 204 in the mandrel may be sheared, as shown in FIG. 7, to permit the mandrel to move upwardly with respect to said setting member and thus permit the upwardly facing shoulder 152 at the upper end of the flange 153 at the median portion of the mandrel to engage the lower end of the expander and lock sleeve 150 to lift the same, and then continue with the release of the packer in the manner already described to permit complete removal of the packer from the well bore.

From the foregoing it will be seen that a small packer for sealing the annulus between a string of well tubing and the wall of the well bore has been provided, having means for locking it against movement in either longitudinal direction, the packer being settable, releasable, and resettable to permit it to be anchored, released and reset in the well casing during a single trip into the well without removing it from the well. It will also be seen that an improved hold down means has been provided which includes a collapsible frustococonical expander means normally resiliently held in expanding position, and a support or lock sleeve movable with respect to the expander means to prevent collapsing or retracting movement thereof, said support or lock sleeve being removable from within the expander means to permit the same to be retracted when the well tool is to be removed from the well bore. Additionally, the packer has been provided with gripping slips in the hold down means which are resiliently biased toward gripping position during movement of the packer toward expanded position and which are not positively forced toward said expanded position during such movement. It will also be seen that the hold down means is provided with means for easily retracting the slips of the hold down means from engagement with the expanding surfaces of the expander member of the hold down means and that such expander surfaces are contractable inwardly to permit said releasing movement without difficulty. Further, a valve member has been provided for closing an annular bypass between the external seal rings and the mandrel which is operable and closable on movement of the
mandrel with respect to the support for the seal ring. Also, the setting means for setting the seal means is provided with latch means for holding the same in locked sealing position in the well casing and yieldable upon application of a predetermined force thereto to permit the mandrel to be moved to release the hold down means and to retract the packer elements from gripping sealing position.

The foregoing description of the invention is explanatory only, and changes in the details of the constructions illustrated may be made by those skilled in the art, within the scope of the appended claims, without departing from the spirit of the invention.

I claim:

1. A well tool including: an elongate tubular mandrel; a tubular body slidably mounted on said mandrel; sealing means surrounding said body and expansible to seal between said body and a well bore wall; first gripping means on said mandrel and first expander means on said body on one side of said sealing means and engageable to expand said first gripping means to grip said well bore wall to prevent movement of said body in one longitudinal direction; holddown means comprising second gripping means on said mandrel and second expander means on said body on the side of said sealing means opposite to said first gripping means, said second expander means being collapsible inwardly and normally held in expanding position to engage said second gripping means to expand said well bore wall to prevent movement of said body in the opposite longitudinal direction; setting means on said mandrel moveable longitudinally therewith to engage said body upon movement of said mandrel in one longitudinal direction relative to said body for expanding said first gripping means to gripping position and for expanding said sealing means to sealing position; resilient means on said mandrel moveable to bias said second gripping means of said holddown means toward said second expander means to move said holddown means to gripping position, said resilient means being actuable to move said holddown means to gripping position by longitudinal movement of said mandrel in said one longitudinal direction; and latch means on said mandrel and said body coengageable to positively latch the mandrel in position holding said first gripping means, said sealing means and said holddown means in gripping sealing position, said latch means being disengageable for movement of said mandrel longitudinally with respect to said body in a direction opposite said one direction to release said first gripping means, said sealing means and said holddown means from gripping sealing position.

2. The well tool of claim 1, wherein said longitudinal movement of said mandrel in said opposite direction moves said sealing means, said first gripping means, and said holddown means to unexpanded nongripping, nonsealing position, and wherein said mandrel is subsequently movable in said one direction to again move said first gripping means, said sealing means and said holddown means to expanded gripping sealing position.

3. The well tool of claim 1 including: means providing a fluid bypass passageway between said sealing means and said tubular mandrel for equalizing pressures in the well bore above and below said sealing means; and valve closure means on said mandrel and said body engageable for closing said bypass passageway against fluid flow therethrough.

4. The well tool of claim 1 wherein said expander means of said holddown means comprises: resiliently collapsible frustoconical expander wedge means mounted on said body; a support sleeve mounted on said mandrel in a first position spaced from said wedge means and movable to a second position to engage said wedge means to prevent collapsing movement thereof, said support sleeve being moveable to said first position away from said wedge means to permit the same to be collapsed; and second gripping means of said holddown means includes a carrier having a plurality of gripping slips carried thereby and movable toward said wedge means to engage said slips with said wedge means to move said slips to gripping position upon movement of said mandrel in said one direction longitudinally relative to said body.

5. The well tool of claim 1 wherein said second expander means of said holddown means is normally resiliently biased to expanding position and is resiliently contractable from such expanding position to release said second gripping means of said holddown means for movement of said body in the opposite longitudinal direction.

6. A well packer including: an elongate tubular mandrel; tubular support means slidably mounted on said mandrel; sealing means disposed exteriorly on said support means and expandable into sealing engagement with the wall of the well bore; first expansible and retractable gripping means carried on said mandrel and first expander means carried by said support means on one longitudinal side of said sealing means and coengageable to expand said first gripping means into engagement with the well bore wall to prevent longitudinal movement of said support means in one longitudinal direction; holddown means carried on said mandrel and said support means on the opposite longitudinal side of said sealing means from said first gripping means and first expander means and expandable into engagement with the well bore wall to prevent movement of said support means in the opposite longitudinal direction, said holddown means comprising a carrier and a plurality of gripping members carried by one of said tubular mandrel and said support means and second expander means carried by the other of said tubular mandrel and said support means and engageable with said gripping members to move said body to gripping position; said expander means being normally resiliently held in expanding position for engagement with said gripping members and contractable from such expanding position to permit release of said gripping members from gripping position; lock means on said mandrel moveable therewith from a position spaced from said second expander means to a position to engage and support said second expander means in said expanding position; and resilient means on said mandrel moveable therewith from a position spaced from said holddown means to engage the carrier to bias said gripping members toward said second expander means while said lock means is engaged with said second expander means.

7. A well packer of the character set forth in claim 6 including: means providing a fluid bypass passageway between said mandrel and said support means; valve means on said mandrel and said support means for controlling fluid flow therethrough; and valve closure means on the other of said mandrel and said support means engageable to close said bypass passageway against fluid flow therethrough when said well packer is in set position in the well bore.

8. A well packer of the character set forth in claim 7, wherein said valve closure means engages said valve seat means to close said bypass passageway between said mandrel and said support means before said sealing means is moved to sealing position.

9. A well packer of the character set forth in claim 6, wherein said second expander means of said holddown means comprises a collet sleeve having a plurality of resilient fingers with wedge expander means on their free ends normally resiliently held disposed in expanding position by said fingers and contractable by flexing of said fingers to permit release of said gripping members from gripping position.

10. A well packer of the character set forth in claim 6, wherein said resilient means comprises: sleeve means disposed about said mandrel and spaced therefrom, and having means therein providing an internal annular upwardly facing shoulder intermediate the ends of the bore of said sleeve means; means on said mandrel providing a downwardly facing stop and guide means disposed within the bore of said sleeve above said upwardly facing shoulder; and spring means mounted between said mandrel and said sleeve means with the ends thereof engaging said downwardly facing guide means on said mandrel and said upwardly facing shoulder in said sleeve means, whereby said spring means biases the lower end of said sleeve into engagement with said gripping means to urge said gripping means to gripping position when said mandrel is moved to move said packer to set position.
11. A well packer of the character set forth in claim 10 including: operator means on said mandrel movably therewith and engageable with said support means to move said support means through said sealing means toward said first gripping means after said first gripping means has been expanded to gripping position to expand said sealing means into sealing engagement with the wall of the well bore, said resilient means simultaneously yieldably urging said gripping members of said holddown means to gripping position during said movement of said mandrel and support means.

12. A well packer of the character set forth in claim 11, wherein said operator means is slidably carried by said mandrel and engageable with said support means for moving said support means to expand said sealing means; and yieldable connecting means is provided between said operator means and said mandrel releasable to permit said mandrel to move with respect to said operator means to release said packer from expanded locked sealing position.

13. A well packer of the character set forth in claim 10, wherein the spring biased sleeve means of said resilient means is engageable with said gripping members of said holddown means to urge the gripping members thereof into expanding engagement with said second expander means and to maintain said gripping members in expanding engagement with said second expander means during longitudinal movement of said mandrel setting said packer.

14. A well packer of the character set forth in claim 6, including: bore wall engaging friction means connected with said first gripping means; and means releasably connecting said mandrel with said friction means and said first gripping means and releasable to permit movement of said mandrel relative thereto and with respect to said support means; means on said mandrel engageable with said support means to move said support means toward said friction means to expand said first gripping means to gripping position; and means on said mandrel engageable with said support means to move said support means through said sealing means toward said first gripping means to expand said sealing means to sealing position after said first gripping means is moved to gripping position.

15. A well packer of the character set forth in claim 14 wherein: said lock means on said mandrel is movable therewith out of supporting engagement with said second expander means of said holddown means to free said second expander means for movement from expanding position to permitting release of said gripping members of said holddown means from gripping position.

16. As a subcombination: a tubular mandrel; a tubular body surrounding said mandrel and slidably longitudinally with respect thereto; expander means on said body comprising a cylindrical sleeve formed with a plurality of normally expanded resilient fingers having external bosses on their free end providing cam surfaces; locking sleeve means on said mandrel movably therewith from a position out of engagement with said expander fingers to a position to engage and support said expander fingers against movement toward retracted position; gripping means comprising a carrier and a plurality of slips mounted on said mandrel and movable therewith to engage said expander cam surfaces to expand said slips to gripping position; and biasing means on said mandrel movably therewith from a position spaces longitudinally from said gripping means to engage said carrier of said gripping for biasing said gripping means toward said expander cam surfaces to maintain said slips engaged with said cam surfaces when said mandrel is moved relative to said body means in a direction to move said locking sleeve means into position to engage and support said expander fingers against retraction and to move said gripping means toward said expander means.

17. In the subcombination of claim 16, coengageable latch means on said locking sleeve means and on said tubular body releasably engageable to secure said mandrel to said tubular body to hold said gripping means in gripping position and dis-engageable to release said mandrel from connection to said body for longitudinal movement with respect thereto to release said gripping means from gripping position.

18. In the subcombination of claim 17, means providing a longitudinal flow passage between said tubular body and said mandrel; and valve closure and seat means on said mandrel and said body engageable to close off flow through said flow passage when said mandrel is latched to said body.

19. The subcombination of claim 17, wherein said locking sleeve means is slidably longitudinally of said mandrel; and means is provided yieldably securing said locking sleeve means to said mandrel and yieldable upon application of a predetermined longitudinal force to said mandrel to free said mandrel from securement to said locking sleeve means for movement of said mandrel with respect to said locking sleeve means to permit said mandrel to be moved to move said biasing to release said gripping means without disengagement of said latch means.