

body. However, as distinguished from such other pipe rams, the ram 70 includes a one-way clutch 75 adjacent the recess 72 and thus in position to engage and resist lefthand rotation of the lower pipe section 58 supported thereon.

As best shown in FIGS. 10 and 11, the one-way clutch comprises a finger 76 pivotally mounted within a pocket 77 in the recess 72 above the cross seal 73. As shown in FIG. 11, the pocket 77 is of such shape in a horizontal direction that it permits the finger 76 to swing between the position shown, in which one side thereof is engaged against a wall 79 of the pocket and a sharp point on its inner end 78 extends into the recess, and another position (not shown) wherein the finger lies against the wall 80 of the socket with its inner end 78 withdrawn from the recess 72. Thus, when pipe section 58 is disposed in the recess 72, the finger grippingly engages shoulder 56 to resist its rotation in a lefthand direction, while permitting rotation in a righthand direction. As shown, the finger is urged against shoulder 79 and thus into a position for resisting lefthand rotation of the pipe section, by means of a coil spring 81 engaging it and a recess 82 in wall 80.

As shown in FIG. 10, the pocket 77 is also of such shape in a vertical direction as to permit the finger 76 to be moved vertically between limited positions engaging a top wall 83 and a bottom wall 84 of the socket. Normally, however, the finger is caused to assume an intermediate position, shown in FIG. 10, by means of coil springs 85 engaging its upper and lower surfaces and recesses formed in the top and bottom walls 83 and 84. In this manner, the finger is free to move downwardly, as shoulder 56 on the bottom section of the tool joint engages it, to an extent dependent on the amount of weight which the string imposes on the joint and thus on the pipe rams, and to move upwardly as the lower pipe section is raised, and thus to allow the pointed end 78 thereon to be moved out of a groove which it forms in the shoulder on the lower tool joint section.

The finger is pivotally mounted for such movement in both vertical and horizontal directions by means of a ball 86 on its inner end received within a correspondingly shaped socket 87 in the inner end of the pocket 77. The body of the ram includes a portion 88 removably connected to the remainder thereof and disposed above the pocket to provide the top wall 83 of the pocket 77, and thus releasably retain the finger and springs in the positions shown.

As shown in FIGS. 1 and 2, blind rams 90 are mounted within guideways 91 extending outwardly from the bore 22 of the housing 21. As in the case of the back-off and pipe rams, the blind rams 90 include bodies which are of a cross-sectional shape for fitting closely within the guideways 91 and thus for guidably sliding therein between positions removed from the bore 22, as shown in FIG. 1, and extended positions across the bore and engaging one another along their inner ends. The blind rams are caused to be moved between extended and retracted positions by means of operators 94, which, similarly to the operators 59 for the pipe rams, may be of the same type and construction as the operators 35 for the back-off rams. Seal means are carried by the bodies of the blind rams for sealing with respect to one another as well as with respect to the guideways 91 for closing off the bore of an open hole when moved into the latter position. Thus, as previously described, these rams are useful in closing off an open hole, either when a drill string or other pipe is not disposed therein,

or after disconnection of the upper section of the drill string from the lower section thereof in the manner previously described. For this purpose, the seal means carried on the bodies of rams 90 includes portions 92 extending across the inner ends of the ram bodies, and portions 93 cooperating with the portions 92 and the guideways for closing off the bore in the manner previously described in connection with the pipe rams.

As shown in FIGS. 1 and 2, the guideways 91 for the blind rams extend at a right angle with respect to the guideways 31 for the back-off rams. In this manner, it is possible to place the two sets of guideways quite close together, thereby reducing the overall height of the body 21. In the particular embodiment of the invention illustrated, the guideways 55 for the pipe rams extend in directions parallel to the guideways for the blind rams, and thus at right angles to the guideways for the back-off rams.

From the foregoing it will be seen that this invention is one well adapted to attain all of the ends and objects hereinabove set forth, together with other advantages which are obvious and which are inherent to the apparatus.

It will be understood that certain features and sub-combinations are of utility and may be employed without reference to other features and sub-combinations. This is contemplated by and is within the scope of the claims.

As many possible embodiments may be made of the present invention without departing from the scope thereof, it is to be understood that all matter herein set forth or shown in the accompanying drawings is to be interpreted as illustrative and not in a limiting sense.

The invention having been described, what is claimed is:

1. Apparatus for disconnecting the lower threaded end of an upper section from the upper threaded end of a lower section of a pipe string which is held against movement within the bore of an underwater wellhead through which the strings extends, comprising a housing adapted to be connected as a part of the wellhead, said housing having a bore therethrough alignable with the bore of the wellhead to receive the ends of said sections, and guideways extending outwardly from the bore, and a ram guidably movable longitudinally within each guideway toward and away from the bore, each ram including means arranged to grippingly engage and move along a side of the end of the upper section, and thereby exert a force on said upper section tending to rotate it about its axis, as the ram is moved in one direction, and to be relieved from said grippingly engagement, as the ram is moved in the opposite direction, whereby said ram may be returned to a position from which it may again be moved in said one direction for exerting force on said upper section.

2. Apparatus of the character defined in claim 1, wherein there are a pair of oppositely disposed guideways and rams.

3. Apparatus for disconnecting the lower threaded end of an upper section from the upper threaded end of the lower section of a pipe string extending through the bore of an underwater wellhead, comprising a housing adapted to be connected as a part of the wellhead, said housing having a bore therethrough alignable with the bore of the wellhead to receive the ends of said sections, and guideways extending outwardly from the bore, means in the housing for holding said lower section against movement within the bore, and a ram guidably