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[54] Title: HYDRAULIC RELEASE OIL TOOL

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U. S. Pat. Nos. 4,525,233	7/1985	Stout
4,545,434	10/1985	Higgins

[57] (see abstract next page)

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setting assembly and the coupling member.

In a more detailed aspect, the present invention provides a hydraulic release tool that has a shear out setting assembly and a running head as the coupling member. [illegible] assembly and the coupling member. The shear out assembly includes a body that receives a piston. The piston couples to the body through shear pins. The top [illegible] the drill string [illegible] of the piston has a face that [illegible] hydraulic pressure within the drill pipe. The bottom of the piston also has such a face, but [illegible] than the top face. Accordingly, hydraulic pressure tends to move the piston towards the bottom of the string, but the piston is prevented from moving because of the shear pins. Dogs mount to the body and extend radially outward from it into engagement with sockets in the running head. This engagement rotationally and translationally couples the shear out assembly and the running head together. Springs act on the dogs to bias them inward towards the axis of the body and the shear out assembly. A land of the piston engages the back end of the dogs to keep them extended and in engagement in the sockets.

The hydraulic release tool thus directly couples to a liner and rotates the liner so that it can overcome frictional resistance between it and the well bore, particularly in high angle and extended reach holes. The hydraulic release tool also rotates the liner during cementing. When it is time to pull the drill pipe, hydraulic

pressure in the pipe is increased sufficiently to shear the shear pins. This happens after a liner wiper plug has been forced through the liner to wipe cement off the walls of the liner. This wiper plug lands on a landing collar and pressure is raised sufficiently to shear the pins. When the pins shear, the piston moves within the body to allow the land from the bore of the dogs. When the dog breaks free of the land, the springs withdraw the dogs from the recesses, releasing the setting tool assembly from the [illegible]. A chamfer on the heads of the dogs [illegible] from the recesses [illegible] applied to the dogs by the running [illegible] through the chamfers [illegible] interacting [illegible] the dogs.

Sometimes, the pressure in the work string cannot be increased enough to shift the piston and release the dogs. For example, if the wiper dart does not land on the landing collar, work string pressure cannot be raised sufficiently. When this happens, a pump down dart with a plug is pumped down the work string and lands on the piston of the hydraulic release tool, sealing the [illegible] opening at the point. With a seal at the piston, a lower pressure [illegible] the same than the pressure otherwise required because no area of the piston is exposed for the pressure to act the other way to oppose shearing force. Further, the bore through the piston has been closed by the seal, [illegible] of the seal [illegible] increases the force on the piston [illegible] to shear the pins.

The hydraulic release tool can also be [illegible] drill string release tool. The release tool is modified from the liner release tool only to adapt it for placement in the drill string through a drill string release sub.

In use, the drill string release adaptation works just like its liner release counterpart. Hydraulic pressure is increased sufficiently to shear the pins that immobilize the piston, and the piston moves to clear a land from the back of dogs that engage sockets in a release sub. The release sub corresponds to the running tool. Springs act on the dogs to retract them from the sockets, and the drill string is separated from its stuck portion. The separated portion of the drill string can then be pulled from the hole and the stuck portion [illegible] end of the string removed from the hole through standard techniques, as through [illegible] and fishing.

These and other features, aspects and advantages of the present invention will become more apparent from the following description, appended claims and drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGURE 1 shows the hydraulic release tool of the present invention, especially suitable for liner run in cementing, partly in half-section;

FIGURE 2 shows a hydraulic release tool especially suitable for a drill string release, again partly in half-section;

FIGURE 3 illustrates schematically the use of the tool of the invention, and

FIGURE 4 shows a pump down part that may be used with the present invention to increase the pressure on the piston to move it and release the release fluid in the event that conventional techniques do not work.

DESCRIPTION OF THE PREFERRED EMBODIMENT

With reference to FIGURE 1, a hydraulic release tool 10 of the present invention is run in and secured in the attachment normally on a work string between a drill pipe and the liner. The tool has a shear nut setting assembly 17 with a coupling member in the form of a running head 18 and a mandrel 14. The shear nut setting assembly and the running head have clear through bores for running fluids used in lining and completing a well.

The shear out setting assembly has four radially extended legs 19 that attach the shear out assembly to the running head 18 in a retracted and release the tool when retracted. A spring 16 for each of these legs biases its leg inward toward a longitudinal axis 17 of the assembly. Out of the extended position shown in FIGURE 1 for the release of the running head. Each leg has a lip or flange 12.

Shear out setting assembly 13 includes a body 15 and a piston 20 within the body. The piston has a threaded ring 22 on the body in response to a

a reduction in the fluid hydraulic pressure applied to the piston from a setting position to a release position. The setting position of FIGURE 1 is the setting position. The piston is retained in the setting position of FIGURE 1 by a plurality of shear pins 32. The shear pins are retained in a ring 34 and extended into the piston. Ring 34 mounts an interior shoulder 36 of body 18. An annular, internally beveled 38 normally engages the interior area of ring 34 to extend the dogs against the retracting force of springs 40. Annular recesses 27 and 29 on the upper and downward sides of the ring provide the diameter of the piston at the middle. In this specification, words of direction such as upward and downward refer to the tool string and well bore.

Piston 20 has an upper face 50 normal to axis 17 of the assembly in the communication with, and acted upon by, hydraulic pressure in the work string that applies a downward force on the piston to the right in FIGURE 1.

The piston also has a second face 52 which receives hydraulic pressure in the work string that applies an upward force on the piston that tends to force the piston to the left in FIGURE 1. The area of face 52 is larger than the area of face 50 so that the net force on the piston from the hydraulic pressure in the string is upward. When the net pressure corresponds to a downhole force sufficient to shear the shear pins 32, the pins shear. (This pressure corresponds with the force required to shear out in mountains informed to in the

specification ... [illegible] ... pressure."

A conical head 32 at the upper end of [illegible] bore through the piston provides a seat for [illegible] of FIGURE 4, if one is necessary. A plurality of longitudinal [illegible] 27 in the wall of the piston that define the [illegible] 29 [illegible] liner pressure [illegible] pressure [illegible] between the liner and the casing under circumstances of hydraulic [illegible] tool. When the piston shifts to the [illegible] position, the bleeder slots [illegible] communicate the liner and the annulus through [illegible] that receive the [illegible].

Running head 34 has four sockets 36. These sockets receive spring-loaded dogs 18 to attach the liner hanger setting assembly to the running head. Chamfer 19 of the dogs permits axial engagement of the dogs by the running head to force the dogs to retract if the spring force is not enough.

A top sub 38 of the [illegible] setting assembly 10 connects to body 12 through thread 39 between them. [illegible] 38 has an internal thread 40 for connection to drill pipe.

Running head 34 has a standard [illegible] release sub 42. The release sub has socket 36. Release sub 44 may couple to bottom sub 42 through [illegible] threaded connection 45. The bottom sub connects typically with a liner assembly.

Before proceeding with the detailed description [illegible] the operation of the hydraulic release tool [illegible].

of use with a liner will be briefly described.

With the cut out setting assembly 12 and running tool 14 attached together by dogs 15 engaged in socket 74, the tool is lowered by drill pipe, the running tool [illegible] to the liner assembly. The liner assembly is run into the well hole while being turned. Accordingly, the friction between the wall of the well hole and the liner will be lower than it would be if the liner were not rotating. Because of the rotation, the problem that friction creates in high angle, extended reach well holes is eliminated, or at least substantially reduced.

When the liner has been run into the well hole and well cementing completed, hydraulic pressure within the work string is increased sufficiently to fail shear pin 72, and the piston moves downward. When the piston moves downward, it presents relief 27 to the base of dogs 15. The dogs, not being restrained by land 28, respond to the radially inward force of springs 16 and move out of socket 74 and out of engagement with the running tool 14. If [illegible] chamfer 17 engaging the edge of socket 74, the dogs are forced to retract because of the resulting radial inward force. The cut out assembly is then free of the running tool. [illegible] setting assembly together with the [illegible] can be pulled out of the hole.

Completing the detailed description of the invention shown in FIGURE 1, body 12 has a lower [illegible] end 46. The lower end has an external chamfer 48 at [illegible]

pressure in the cylinder 140 the same as that [illegible] outside the tool. When flange 150 passes [illegible] port 174, [illegible] string pressure is relieved, signalling the uncoupling of the shear out setting assembly from release sub 120.

As before, the body has an external flange 156 that has a right angle face 158 that engages the end of release sub 120. The trailing end of the flange is conical, as shown, to keep debris out of the connection between the hydraulic release tool and the interior of the running head.

The piston and body of the shear out setting assembly also seal at an interface at their leading ends by flange 150 carried on an internal flange 162 of the body engaging a cooperating surface at the leading end of the piston.

Release sub 120 has an internal thread 132 for a drill pipe connection after the shear out assembly is pulled from the hole. The leading end of the release sub has an external thread 134 also for a drill pipe connection.

With reference to FIGURE 3, a typical application of the embodiment of the invention shown in FIGURE 1 is illustrated. In FIGURE 3, a string of drill pipe 180 connects directly to the hydraulic release tool 10. With reference to FIGURE 1, that connection would be through an external thread on the end of the drill pipe and internal thread 40. The hydraulic release tool, in turn,

[illegible] components in the [illegible]. The components shown are a running tool 182, a safety joint 184, a liner hanger 186, liner 188, a landing collar 190, a float collar 192, and a float shoe 194. Depending on the application, the safety joint and liner hanger can be eliminated. A top drive or power swivel 196 rotates the work string. A rotating cement head 198 enables cement to enter the drill pipe string.

FIGURE 4 shows a pump down wiper dart used in the event that hydraulic release tool does not [illegible] because of an inability to increase work string pressure sufficiently to shear the shear pins. A wiper dart 200 has a head 204 and a plurality of conical rubber wipers 206 aft of the head. The wipers clean the bore of the working string. The nose of the dart is conventional [illegible] ball 202 spaced from the wipers of the wiper by [illegible] 207 and [illegible] against seat 27 of the [illegible] assembly shown in FIGURE 1.

One application of the liner release tool will be described with reference to FIGURES 3 and [illegible]. Liner 188 is run into a well hole while rotating drill pipe [illegible] through top drive or power swivel 196. Rotation of the drill pipe rotates the hydraulic release tool. Because the hydraulic release couples to the liner, the liner also rotates. The string moves downhole as it rotates. Rotation reduces the friction that would otherwise occur between the liner and the well hole wall [illegible] and [illegible]. After the liner is properly

lowered in the drill hole, it is time to cement [illegible] liner continues to rotate during cementing under [illegible] power of top drive or power swivel.

Cement is pumped [illegible] the interior of the drill pipe string and into the liner to fill them. Then a drill pipe wiper dart is released into the drill pipe. A fluid under pressure behind the drill pipe wiper dart forces the dart through the drill pipe string, wiping the cement from the interior of the drill pipe. When the drill pipe wiper dart reaches the bottom of the drill pipe string and the top of the liner, it latches into a larger diameter wiper plug, and the combination of the two plugs is pumped through the liner to wipe and displace the cement from its interior wall. The liner wiper plug finally bumps into the landing collar and stops.

When the liner wiper plug bumps into the landing collar, pressure in the work string is increased, say to 2,000 psi, to actuate liner hanger 106, which engages the top of the liner with the inside of the previously run casing so that the weight of the liner is taken by the wall when the hanger engages it. Pressure in the work string is then increased, say to 3,2[illegible]0 psi, to shear the shear out setting assembly from the running head. The drill pipe and released shear out setting assembly are then pulled from the hole.

In the event that the wiper plug does not land on the landing collar so that work string pressure

increased, [illegible] 202 [illegible] string to release the setting assembly from the [illegible] member. In use and with reference to FIGURES [illegible] and [illegible], dart 202 is pumped down the work string. Head 204 and rubber [illegible] 206 pass through the bore of the piston, and ball plug 200 lands on seat 33, sealing the work string downstream of the seat. With the seal, hydraulic pressure upstream of the ball is not opposed by pressure downstream of the ball or face 31. Further, the area of the piston bore through the ball seat [illegible] work string pressure, increasing the shearing force on the shear pins. Accordingly, the shear pins shear at a lower pressure, and the piston moves for the retraction of the dogs.

With ball 200 on seat 33, back pressure valves in float collar 192 and float shoe 194 force the ball into a tighter seal on the seat when an attempt is made to pull the setting assembly from the running tool. At this time, bleeder ports 75 are radially inside of O-rings [illegible] because the piston is in the shifted position. Accordingly, the pressure downhole can bleed down through the bleeder ports 75 across the interface between lands [illegible] and the adjacent wall of the body and out windows 74.

The drill string release tool operates much in the same manner as the liner running release tool [illegible], but is used for a different purpose. The drill string release tool provides a convenient way to [illegible] the drill string in the event that its lower [illegible]

Claim

1. A [illegible] tool comprising:

(a) a setting assembly including:

(i) a body having a longitudinal axis and a longitudinal bore along the axis;

(ii) a piston translatable in the bore of the body between a setting position and a release position, the piston also having a longitudinal bore and a differential area to effect a net force on the piston in response to hydraulic pressure in the bore of the body that tends to move the piston from the setting position to the release position;

(iii) a plurality of dogs in the body pivotable radially with the axis between a retracted position closer to the axis and an outward position further away from the axis and movable by the piston;

(iv) biasing means for biasing the dogs toward the retracted position;

(v) means on the piston engaging the bore of the dogs to extend the dogs outside the body when the piston is in the setting position;

(vi) means on the piston to disengage the bore of the dogs so that the dogs have a [illegible] position in response to the ring biasing means when the piston moves to the release position; and

(vii) means between the piston and the body to [illegible] the piston from setting the tool until a

piston from the hydraulic pressure exerted in the body bore and to release the piston when the hydraulic pressure exceeds the predetermined pressure so that the piston moves to its release position;

(c) a coupling member for coupling the drill string or primemover product or instrumentality, the coupling member having a plurality of sockets for receiving the ball or ball extension portion and obtaining the coupling member in the setting orientation whereby the ball assembly is held in the coupling member by engagement of the rings in the sockets and released from the engagement the coupling member upon movement of the piston from the setting position to the release position in response to the pressure of the body in excess of the predetermined minimum pressure; and

(d) a valve body mean within the body with its bore and port to provide communication between the ball port and the bore of the body axially of the piston when the piston is in the setting position and to substantially such communication upon movement of the piston from the setting position to the release position and reduce the pressure in the body axially of the piston primarily the reduction of the pressure signals that the tool has released the coupling member.

2. The hydraulic release tool of claim 1 wherein the means on the piston for engaging the head of the ball

including a land on the piston positioned to abut the top of the dogs in the locking position of the piston.

7. The hydraulic release tool of claim 3 wherein the means on the piston to disengage the base of the dogs includes a relief of the piston behind the land that pushes under the nose of the dogs when the piston moves from the locking position to the release position.

8. The hydraulic release tool of claim 3 wherein the biasing means includes individual springs between the dogs and the body.

9. The hydraulic release tool of claim 1 wherein the holding means includes a plurality of shear pins between the body and the piston that fail at the predetermined pressure upon the predetermined pressure.

10. A hydraulic release tool of claim 1 wherein:

(a) the means on the piston for engaging the base of the dogs includes a land on the piston positioned to abut the base of the dogs in the locking position of the locking dogs;

(b) the means on the piston to disengage the base of the dogs includes a relief of the piston behind the land that passes under the nose of the dogs when the piston moves from the locking position to the release position.

11. The hydraulic release tool of claim 3 wherein the holding means includes a plurality of shear pins

releasing the body to the piston that fall at a pressure above the predetermined pressure.

6. The hydraulic release tool of claim 7 wherein the biasing means includes individual springs between the dogs and the body and each dog has a chamfered end so as to partially deliver a force to apply a radial force toward the longitudinal axis by engagement of such end with the wall of the recess in the coupling member.

9. The hydraulic release tool of claim 1 wherein the coupling member comprises a running nose, the running tool having means to detach from a latch to permit the retraction and translation of the inner running liner run in and retrieval of the tool during removal.

10. The hydraulic release tool of claim 1 wherein:

(a) the means on the piston for engaging the base of the dogs includes a land on the piston positioned to shut the base of the dogs in the setting position of the piston, and

(b) The means on the piston to disengage the base of the dogs includes a relief of the piston behind the land such that fluid under the base of the dogs when the piston moves from the setting position to the release position.

11. The hydraulic release tool of claim 10 wherein:

(a) the biasing means includes individual springs between the dogs and the body; and

(b) the biasing means includes a plurality of shear pins

between the body and the piston that fail at the predetermined pressure above the predetermined pressure.

12. The hydraulic release tool of claim 1 wherein the coupling member comprises a release sub, the release sub having threads to engage with a drill pipe, whereby the hydraulic release tool pivots in a drill string separates the string upon release of the release sub by the setting assembly.

13. The hydraulic release tool of claim 12 wherein:

(a) the means on the piston for engaging the base of the dogs includes a land on the piston positioned to push the base of the dogs in the running position of the piston; and

(b) the means on the piston for engaging the base of the dogs includes a relief of the piston behind the land that passes under the base of the dogs when the piston moves from the running position to the release position.

14. The hydraulic release tool of claim 13 wherein:

(a) the biasing means includes individual springs between the dogs and the body; and

(b) the biasing means includes a plurality of shear pins between the body and the piston that fail at the pressure above the predetermined pressure.

15. A hydraulic release tool comprising:

(a) a running assembly including:

(i) a body having a longitudinal axis and a

longitudinal axis of the body)

(iii) a piston translatable in the bore of the body between a setting position and a release position, the piston also having a longitudinal bore and differential areas to effect a net force on the piston in the presence of hydraulic pressure in the bore of the body that tends to move the piston from the setting position to the release position;

(iv) a plurality of dogs in the body extendable radially of the axis between a retracted position closer to the axis and an extended position further from the axis and radially of the body;

(v) biasing means for biasing the dogs inward into the body;

(vi) means on the piston engaging the base of the dogs to extend the dogs outside the body when the piston is in the setting position;

(vii) means on the piston to disengage the base of the dogs so that the dogs move to their retracted position in response to the dog biasing means when the piston moves into its release position; and

(viii) means between the piston and the body to hold the piston in the setting position until a predetermined hydraulic pressure exists in the body bore and to release the piston when the hydraulic pressure exceeds the predetermined pressure so that the piston moves to the release position.

(c) a coupling member for coupling the drill pipe to the petroleum production components, the coupling member having a plurality of grooves for receiving a ball in their uncamped position and retaining the coupling member to the running assembly;

(d) a relief port through the body and into the bore and valve to prevent communication between the relief port and the bore of the body axially of the piston, the port being in a position where, on movement of the piston from the setting position to the release position, the relief port is pressurised by the pressure in the body bore axially of the piston, thereby the reduction of the pressure signal that the tool has released the coupling member.

17. A method of running in a liner in a well comprising the steps of:

(a) providing a liner string, attaching the liner to the running head of a hydraulic setting and release tool that has a setting assembly of a body having an axial bore, a piston having an axial bore, the piston being in the bore of the body, and a plurality of radially moveable dogs, the piston responding to a predetermined pressure force on the piston produced by hydraulic pressure to move from a setting position to a release position to retract the dogs from engagement with the running head;

(b) running liner into position in the well bore by running it onto moving it through the hole by force

applied through the fluid,

(c) urging the liner to its desired position in the well hole, releasing the running head from the setting assembly by increasing the pressure in the work string to create the predetermined force to move the piston to the release position, retract the dogs, and disengage the running head; and

(d) relieving the increased pressure in the work string through a relief port in the body after disengaging the running tool to signal the disengagement of the running head.

17. The method of running in a liner claimed in claim 16 including the step, before the releasing step of cementing the liner in the well hole after the inner mandrel has measured pressure while rotating the liner through the cement.

18. The method of running in a liner claimed in claim 16 wherein the step of relieving the increased pressure including the step of venting the pressure in the work string with movement of the piston to signal release of the running head.

19. The method of running in a liner claimed in claim 16 including in the releasing step landing a sealing dart on the piston to travel the piston's axial bore and thereafter the dart would be forced in order the predetermined force at a lower work string pressure than is necessary without the dart.

30. The method of running in a liner disposed in claim 29 wherein the sealing dart includes a ball mounted on a shaft and the piston has a seat facing uphole, the sealing step including engaging the ball on the piston seat.

31. A release tool comprising a coupling member and cutting assembly; the cutting assembly moving on actuating means, the tool comprising:

(a) a coupling member for coupling to the cutting assembly, the coupling member having means for mating with the actuating means;

(b) a cutting assembly including:

(i) a body having a longitudinal axis and a longitudinal bore substantially along the axis;

(ii) means for releasably attaching the body to the coupling member's cutting assembly; and

(iii) means for relieving pressure in the body bore upon the release of the attaching means from the cutting assembly, the relieving means for relieving pressure a relief port from the body bore to the exterior of the body.

32. The tool of claim 31 wherein the means for attaching includes a piston translatable longitudinally in the body bore from an attachment position to a detachment position, the piston being in the attachment position when the body is attached to the coupling member.

33. The tool of claim 32 wherein the piston has a

substantially longitudinally along the body bore.

24. The tool of claim 21 wherein the actuating means is movable from the disengagement position to the detachment position in response to a change in hydraulic pressure in the body bore.

25. A method of hydraulically releasing a coupling member from a setting assembly in a well comprising:

(a) in a work string, releasably connecting a coupling member to a setting assembly, the coupling member for releasably attaching the setting assembly to the coupling member and for releasing the coupling member in response to a reduction in hydraulic pressure;

(b) running the setting assembly into a well;

(c) increasing the hydraulic pressure in the work string to release the attachment between the coupling member and the setting assembly; and

(d) releasing the increase in hydraulic pressure in the work string through a relief port to signal the release of the coupling member.

26. The method of claim 25 wherein the step of releasing the increase in hydraulic pressure includes driving a piston within the body bore in response to the pressure increase to uncover a relief port opening in the body bore.

27. A method of setting a well tool in a well comprising:

(a) in a work string, releasably connecting the tool to the running

[illegible] of a setting [illegible] release [illegible] [illegible] having an axial bore and means for releasably attaching the liner to the setting [illegible], the [illegible] releasing the liner in response to an increase in hydraulic pressure;

(b) running the liner into position in the well;

(c) after the liner is in a desired position in the well, releasing the running head from the setting assembly by increasing the hydraulic pressure in the work string; and

(d) relieving the increase in hydraulic pressure in the work string through a relief port after releasing the liner to signal the release of the liner.

[illegible]. The method of claim [illegible] wherein the step of relieving the increase in hydraulic pressure includes driving a piston within the body bore in response to the pressure increase to uncover a relief port opening in the body bore.

[illegible]. A hydraulic release tool having a coupling member and a setting assembly, the setting assembly having an attaching means, the tool comprising:

(a) a coupling member for coupling to the setting assembly, the coupling member having means for mating with the attaching means; and

(b) a setting assembly including:

(i) a body having a longitudinal axis and a longitudinal bore along the axis;

(ii) means for attaching the body to the coupling

member of setting means, the attaching means having motion from an attachment position to a detachment position, the attaching means engaging the coupling assembly setting means to attach the coupling and setting assemblies in the attachment position;

(iii) means for allowing the attaching means to move from the attachment position to the detachment position in response to change in hydraulic pressure in the body bore; and

(iv) ported means for relieving pressure in the body bore to outside the body upon release of the attaching means.

30. The tool of claim 29 wherein the allowing means allows the attaching means to move from the attachment position in response to an increase in hydraulic pressure in the body bore.

31. The tool of claim 29 wherein the attaching means includes a plurality of dogs extendably radially of the body axis.

32. The tool of claim 31 wherein the setting means includes a plurality of sockets for receiving the dogs when the dogs are radially extended to the attachment position.

33. The tool of claim 32 wherein the sockets include side walls engageable by the dogs for transmitting motion rotational about the longitudinal axis from the setting

assembly to the coupling assembly.

74. The tool of claim 70 wherein the mating means includes means for rotationally locking motion, rotational about the longitudinal axis, from the mating assembly to the coupling assembly.

75. The tool of claim 70 wherein the allowing means is a piston translatable along the longitudinal axis in the body bore between a setting position and a release position, the piston having a first surface of engaging the locking means and urging the attaching means to the attachment position when the piston is in the setting position and a second surface not engaging the attaching means when the piston is in the release position.

76. The tool of claim 70 including means for holding the piston in the setting position until a predetermined hydraulic pressure exists in the body bore and for releasing the piston when the hydraulic pressure exceeds the predetermined pressure.

77. The tool of claim 76 wherein the holding means includes a plurality of shear pins between the body and the piston that fail when the hydraulic pressure exceeds the predetermined pressure.

78. The tool of claim 70 wherein the piston includes a landing seat for receiving and sealing against a dart so that when a tubing dart is received the hydraulic

[illegible]

39. The tool of claim 37 including a landing collar in the body for receiving and seating against a dart, the landing ball being positioned so that when a landing dart is received, the hydraulic pressure in the body bore is increased.

40. The tool of claim 39 including means for biasing the latching means toward the detachment position.

41. The tool of claim 40 wherein the biasing means includes a spring.

42. The tool of claim 39 wherein the coupling member comprises a running head, the running head having means to attach the liner to permit the rotation and translation of the liner during liner run in and rotation of the liner during cementing.

43. The tool of claim 39 wherein the coupling member comprises a release sub, the release sub having means to connect it to a drill pipe, wherein the hydraulic release tool placed in a drill string separates the string upon release of the release sub by the setting assembly.

44. A hydraulic release tool having a coupling member and a setting assembly, the setting assembly having an attachment means, the tool comprising:

(a) a coupling member for coupling to the setting assembly, the coupling member having means for mating with the attaching means; and

(c) a latching assembly including:

(i) a body having a first internal wall that defines a longitudinal bore along the axis;

(ii) means for allowing the body to be coupled to a mounting member, the attaching means being movable from an attachment position to a detachment position, the attaching means engaging the mounting assembly mating means to attach the coupling and retaining a member in the attachment position;

(iii) means for allowing the attaching means to move from the attachment position to the detachment position in response to changes in hydraulic pressure in the body bore wherein the allowing means includes an upper face on the body bore a shorter way from the coupling member and a smaller bearing face on the body bore diameter around the coupling member.

4d. A hydraulic release tool having a coupling member and a latching assembly, the latching assembly having an allowing means, the tool comprising:

(a) a coupling member for coupling to the latching assembly, the coupling member having means for mating with the attaching means; and

(b) a latching assembly including:

(i) a body having a longitudinal axis and a longitudinal bore along the axis;

(ii) means for attaching the body to the coupling

17. A hydraulic release tool having a coupling member and a setting assembly, the setting assembly having an attaching means, the tool comprising:

(a) a coupling member for coupling to the setting assembly, the coupling member having means for mating with the attaching means; and

(b) a setting assembly including:

(i) a body having a longitudinal axis and a longitudinal bore along the axis;

(ii) means for attaching the body to the coupling member's mating means, the attaching means being movable from an attachment position to a detachment position, the attaching means engaging the coupling assembly mating means to attach the coupling and setting assemblies in the attachment position;

(iii) means for allowing the attaching means to move from the attachment position to the detachment position in response to change in hydraulic pressure in the body bore, wherein the allowing means includes a piston translatable along the longitudinal axis in the body bore between a setting position and a release position, the piston having a first surface for engaging the attaching means and urging the attaching means to the attachment position when the piston is in the setting position and a second surface not engaging the attaching means when the piston is in the

release position and means [illegible] including a hydraulic pressure relief port from outside the body into the body bore and means for preventing fluid communication between the relief port and the bore when the piston is in the release position.

48. The tool of claim 47 wherein the means for preventing and allowing fluid communication includes a flange on the piston for preventing and allowing fluid flow between the piston and the body [illegible] the relief port in response to the position of the piston.

49. A hydraulic release tool comprising:

(a) setting assembly including:

(i) a body having a longitudinal axis and a longitudinal bore substantially along the axis;

(ii) a piston translatable in the body bore in response to changes in hydraulic pressure therein between a setting position and a release position, the piston having a substantially longitudinal bore and faces with differential areas to effect a net force on the piston in response to hydraulic pressure in the body bore that urges the piston from the setting position to the release position;

(iii) a plurality of dogs in the body extendable radially of the axis between a retracted position closer to the axis and an extended position further from the axis and outwardly of the body;

(iv) a first piston [illegible] engaging the dogs for

[illegible] the dogs to their extended position when the piston is in the holding position;

(v) a second piston [illegible] for allowing the dogs to move to their retracted position when the piston [illegible] its release position;

(vi) means between the piston and the body for holding the piston in the setting position until a predetermined hydraulic pressure exists in the body bore; and

(vii) relief port means for relieving pressure in the body bore to outside the body upon the release of the holding means; and

(b) a coupling member for coupling the setting assembly to [illegible] string, the coupling member having a plurality of sockets for receiving the dogs when in their extended position.

50. The tool of claim 49 including means for biasing the dogs toward the axis and into the body.

51. The hydraulic release tool of claim 50 wherein the biasing means includes individual springs between the dogs and the body.

52. The hydraulic release tool of claim 50 wherein each dog has a chamfered end at its radially outward end to apply a radial force toward the longitudinal axis by engagement of such end with the wall of the socket in the coupling member.

53. The hydraulic release tool of claim 49 wherein the

[illegible] piston surface includes a [illegible] piston position to abut the body in the setting position of the piston.

46. The hydraulic release tool of claim 43 wherein the second piston surface includes a relief behind the land that passes under the dogs when the piston moves from the setting position to the release position.

47. The hydraulic release tool of claim 43 wherein the holding means includes a plurality of shear pins between the body and the piston that fail when the hydraulic pressure exceeds the predetermined pressure.

48. A method of running in a pipe in a well comprising the steps of:

(a) lowering the pipe in a running tool on a tool having a substantially axial bore, a relief port, and a means for responding to hydraulic pressure;

(b) running the pipe to a position in the well causing

(i) movement through the tool, force applied through the tool;

(c) after the pipe is in a position in the well, retrieving the running tool by increasing the hydraulic pressure in the pipe; and

(d) relieving the increased hydraulic pressure by [illegible] through said relief port.

49. A hydraulic release tool comprising:

(a) a setting assembly including:

(i) a body having a longitudinal [illegible] a substantially longitudinal [illegible] body;

[illegible] a release [illegible], the release [illegible] means to connect it to a small pipe, whereby the hydraulic release tool placed in a well [illegible] release of the [illegible] by the setting assembly.

17. A method of releasing a coupling member from a setting assembly in a well comprising:

(a) in a work string, attaching a coupling member to a setting assembly that has a body with a bore substantially along its longitudinal axis, a plurality of extendable dogs for engaging the coupling member, the dogs being retractable to release the coupling member, and a piston translatable in the bore to alternately [illegible] and allow retraction of the dogs;

(b) running the coupling member into position in the well by [illegible] through the tool; and

(c) applying hydraulic pressure in substantially equal amounts to larger and smaller oppositely oriented end faces of the piston in an amount sufficient to translate the piston in the direction of the smaller end face and allow retraction of the dogs.

[illegible]
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Fig. 1.

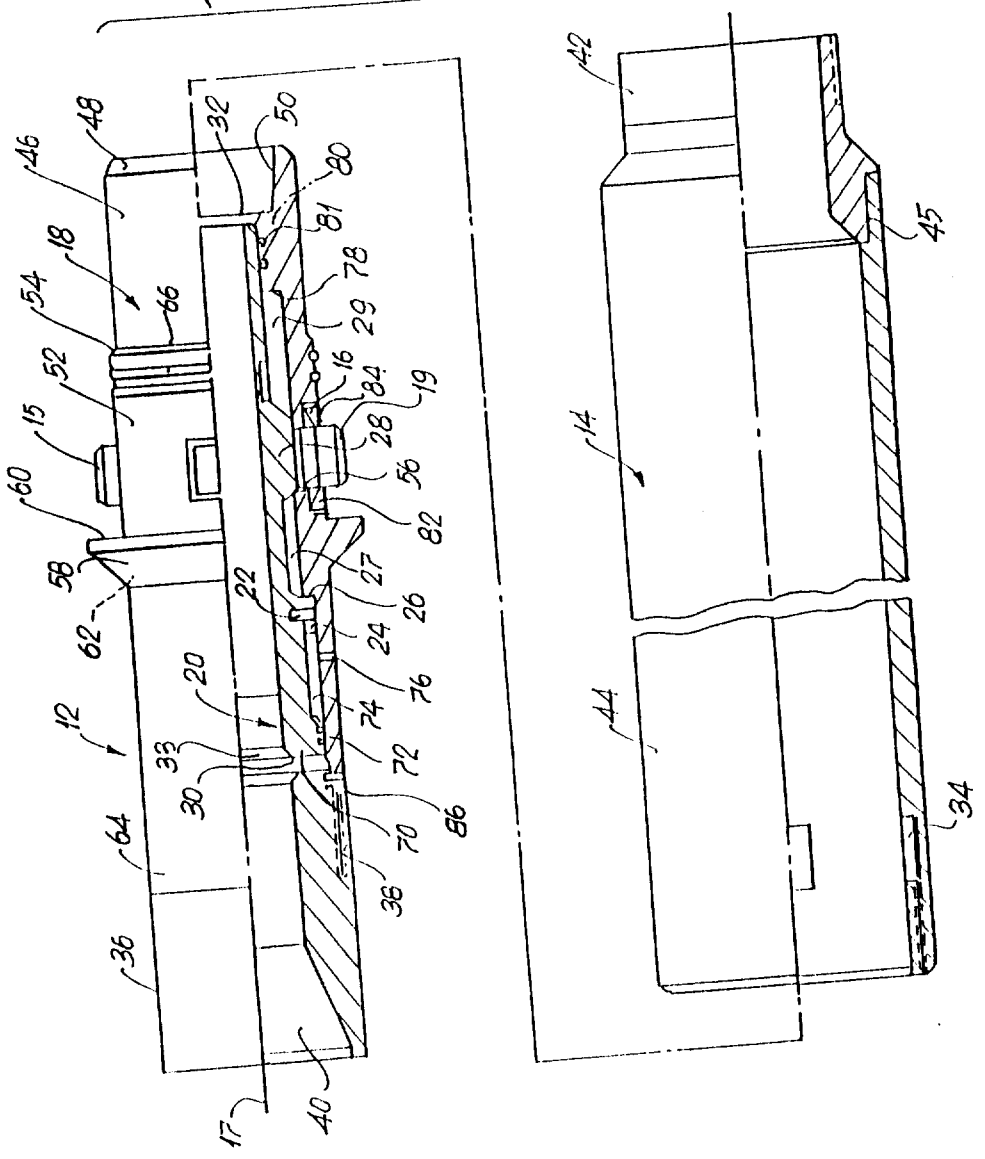

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FIG. 2.

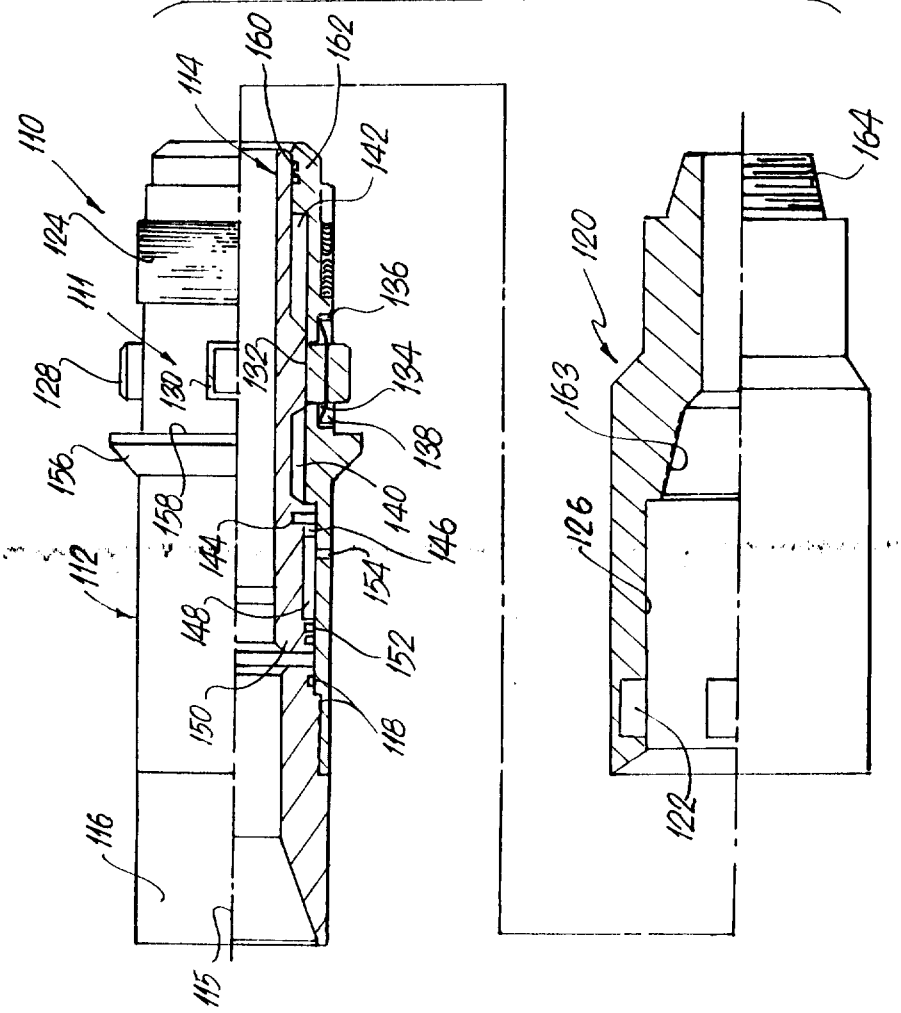

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FIG. 3.

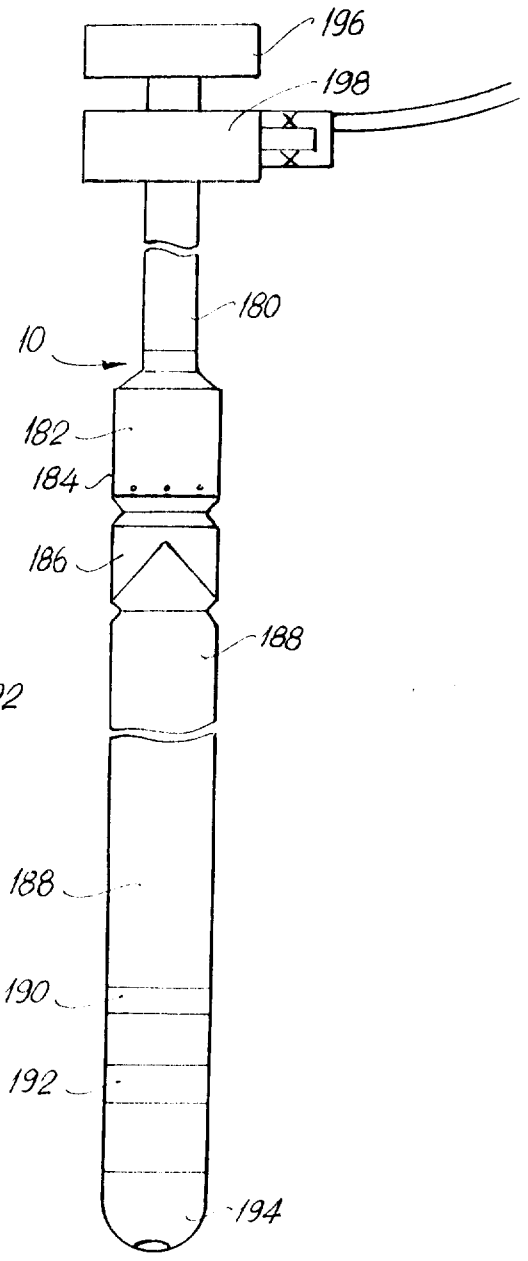
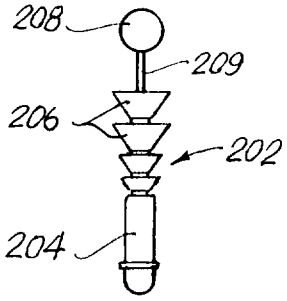


FIG. 4.



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