CPC COOPERATIVE PATENT CLASSIFICATION

E FIXED CONSTRUCTIONS

EARTH DRILLING; MINING

E21 EARTH OR ROCK DRILLING; MINING

E21B EARTH OR ROCK DRILLING; OBTAINING OIL, GAS, WATER, SOLUBLE OR MELTABLE MATERIALS OR A SLURRY OF MINERALS FROM WELLS

WARNINGS

1. The following IPC groups are not in the CPC scheme. The subject matter for these IPC groups is classified in the following CPC groups:

E21B 7/08	covered by	E21B 7/06
E21B 43/22	covered by	C09K 8/58

2. {In this subclass non-limiting references (in the sense of paragraph 39 of the Guide to the IPC) may still be displayed in the scheme.}

Methods or apparatus for drilling

1/00 Percussion drilling

NOTE

When classifying in groups E21B 1/12 - E21B 1/38, a symbol from one of the following main groups of B25D should also be given:

- B25D 9/00 Portable percussive tools with fluid-pressure drives
- B25D 11/00 Portable percussive tools with motor drive
- B25D 16/00 Portable percussive machines with superimposed rotation
- B25D 17/00 Details of, or accessories for, portable power-driven percussive tools

1/02 . Surface drives for drop hammers {or percussion drilling}, e.g. with a cable

1/04 . . Devices for reversing the movement of the rod or cable at the surface

1/12 . with a reciprocating impulse member (E21B 1/02, E21B 1/38 take precedence)

1/14 . . driven by a rotating mechanism

1/16 . . . with spring-mounted reciprocating masses, e.g. with air cushion

1/18 . . . . with elastic joining of the drive to the push-rod by double buffer springs

1/20 . . . formed as centrifugal hammers

1/22 . . driven by electromagnets

1/24 . . the impulse member being a piston driven directly by fluid pressure

1/26 . . . by liquid pressure

1/28 . . . . working with pulses

1/30 . . . by air, steam or gas pressure

1/32 . . . . working with pulses

1/34 . . . . . the impulse member being a piston of an internal-combustion engine

1/36 . Tool-carrier piston type, i.e. in which the tool is connected to an impulse member

1/38 . Hammer piston type, i.e. in which the tool bit or anvil is hit by an impulse member

3/00 Rotary drilling

3/02 . Surface drives for rotary drilling

3/022 . . {Top drives}

3/025 . . with a to-and-fro rotation of the tool

3/03 . . with an intermittent unidirectional rotation of the tool

3/035 . . with slipping or elastic transmission

3/04 . . Rotary tables

3/045 . . . {movably mounted on the drilling structure or platform (derricks adapted to be moved on their substructure E21B 15/003)}

3/06 . . . Adaptation of rotary draw works to drive rotary tables

4/00 Drives for drilling, used in the borehole

4/003 . {Bearing, sealing, lubricating details (for roller bits E21B 10/22)}

4/006 . {Mechanical motion converting means, e.g. reduction gearings (E21B 4/10 takes precedence)}

4/02 . Fluid rotary type drives

4/04 . Electric drives (E21B 4/12 takes precedence)

4/06 . Down-hole impacting means, e.g. hammers (boring rams E21B 11/02)

4/08 . . impact being obtained by gravity only, e.g. with lost-motion connection

4/10 . . continuous unidirectional rotary motion of shaft or drilling pipe effecting consecutive impacts

4/12 . . Electrically operated hammers

4/14 . . Fluid operated hammers

4/145 . . . {of the self propelled-type, e.g. with a reverse mode to retract the device from the hole}

4/16 . Plural down-hole drives, e.g. for combined percussion and rotary drilling (E21B 4/10 takes precedence); Drives for multi-bit drilling units

4/18 . Anchoring or feeding in the borehole

4/20 . combined with surface drive (E21B 4/10 takes precedence)

6/00 **Drives for drilling with combined rotary and percussive action**

6/02 . the rotation being continuous

6/04 . . Separate drives for percussion and rotation

6/06 . the rotation being intermittent, e.g. obtained by ratchet device

6/08 . . Separate drives for percussion and rotation

7/00 **Special methods or apparatus for drilling**

7/001 . {Drilling a non circular hole (excavating trenches E02F 5/02; cutting machines for slitting E21C 25/00)}

7/002 . {Drilling with diversely driven shafts extending into the borehole (E21B 7/001 takes precedence)}

7/003 . {Drilling with mechanical conveying means}

7/005 . . {with helical conveying means (E21B 7/201 takes precedence; augers E21B 10/44; drilling rods or pipes with helical structure E21B 17/22)}

7/006 . . . {combined with a bucket-type container}

7/007 . {Drilling by use of explosives (underwater drilling using explosives E21B 7/1245)}

7/008 . {Drilling ice or a formation covered by ice}

7/02 . Drilling rigs characterised by means for land transport {with their own drive}, e.g. skid mounting or wheel mounting

7/021 . . {With a rotary table, i.e. a fixed rotary drive for a relatively advancing tool}

7/022 . . {Control of the drilling operation; Hydraulic or pneumatic means for activation or operation (control circuits for drilling masts E21B 15/045)}

7/023 . . {the mast being foldable or telescopically retractable}

7/024 . . {having means for adapting to inclined terrain; having means for stabilizing the vehicle while drilling}

7/025 . . {Rock drills, i.e. jumbo drills}

7/026 . . {having auxiliary platforms, e.g. for observation purposes}

7/027 . . {Drills for drilling shallow holes, e.g. for taking soil samples or for drilling postholes}

7/028 . . . {the drilling apparatus being detachable from the vehicle, e.g. hand portable drills}

7/04 . Directional drilling

7/043 . . {for underwater installations}

7/046 . . {horizontal drilling (drilling with mechanical conveying means E21B 7/003)}

7/06 . . Deflecting the direction of boreholes

7/061 . . . {the tool shaft advancing relative to a guide, e.g. a curved tube or a whipstock}

7/062 . . . {the tool shaft rotating inside a non-rotating guide travelling with the shaft (E21B 7/067 and E21B 7/068 take precedence)}

7/064 . . . {specially adapted drill bits therefor}

7/065 . . . {using oriented fluid jets}

7/067 . . . {with means for locking sections of a pipe or of a guide for a shaft in angular relation, e.g. adjustable bent sub}

7/068 . . . {drilled by a down-hole drilling motor (down-hole drives per se E21B 4/00, E21B 7/067 takes precedence)}

7/10 . . Correction of deflected boreholes

7/12 . Underwater drilling (using heave compensators E21B 19/09)

7/122 . . {with submersible vertically movable guide}

7/124 . . with underwater tool drive prime mover, e.g. portable drilling rigs for use on underwater floors

7/1245 . . . {using explosive means (anchors driven in by explosive charges B63B 21/28)}

7/128 . . from floating support with independent underwater anchored guide base

7/132 . . from underwater buoyant support

7/136 . . from non-buoyant support (E21B 7/124 takes precedence)

7/14 . Drilling by use of heat, e.g. flame drilling

7/143 . . {underwater}

7/146 . . {Thermal lances}

7/15 . . of electrically generated heat

7/16 . Applying separate balls or pellets by the pressure of the drill, so-called shot-drilling

7/18 . Drilling by liquid or gas jets, with or without entrained pellets (E21B 7/14 takes precedence)

7/185 . . {underwater}

7/20 . Driving or forcing casings or pipes into boreholes, e.g. sinking; Simultaneously drilling and casing boreholes

7/201 . . {with helical conveying means}

7/203 . . . {using down-hole drives}

7/205 . . {without earth removal (E21B 7/30 takes precedence)}

NOTE

Special methods or apparatus for drilling without earth removal E21B 7/26

7/206 . . . {using down-hole drives}

7/208 . . {using down-hole drives (E21B 7/203 and E21B 7/206 take precedence)}

7/24 . Drilling using vibrating or oscillating means, e.g. out-of-balance masses (percussion drilling E21B 1/00)

7/26 . Drilling without earth removal, e.g. with self-propelled burrowing devices (E21B 7/30 takes precedence)

7/265 . . {Combined with earth removal}

7/267 . . {Drilling devices with senders, e.g. radio-transmitters for position of drilling tool}

7/28 . Enlarging drilled holes, e.g. by counterboring

7/30 . . without earth removal

Drilling tools

10/00 **Drill bits** (specially adapted for deflecting the direction of boring {E21B 7/064}; with means for collecting substances E21B 27/00)

10/003 . {with cutting edges facing in opposite axial directions}

10/006 . {providing a cutting edge which is self-renewable during drilling}

10/02 . Core bits (characterised by wear resisting parts E21B 10/48)

10/04 . . with core destroying means

10/06 . . Roller core bits

10/08 . Roller bits (E21B 10/26 takes precedence; roller core bits E21B 10/06; characterised by wear resisting parts E21B 10/50)

10/083 . . {with longitudinal axis, e.g. wobbling or nutating roller bit (longitudinal axis roller reamers E21B 10/30)}

10/086 . . {with excentric movement}

10/10 . . with roller axle supported at both ends
10/12 . . with discs cutters
10/14 . . combined with non-rolling cutters other than of leading-portion type
10/16 . . characterised by tooth form or arrangement
10/18 . . characterised by conduits or nozzles for drilling fluids
10/20 . . characterised by detachable or adjustable parts, e.g. legs or axles
10/22 . . characterised by bearing, lubrication or sealing details
10/23 . . . with drilling fluid supply to the bearings
10/24 . . . characterised by lubricating details (E21B 10/23 takes precedence)
10/246 . . . . {with pumping means for feeding lubricant}
10/25 . . . characterised by sealing details
10/26 . Drill bits with leading portion, i.e. drill bits with a pilot cutter; Drill bits for enlarging the borehole, e.g. reamers (percussion drill bits with leading portion E21B 10/40)
10/265 . . {Bi-center drill bits, i.e. an integral bit and eccentric reamer used to simultaneously drill and underream the hole}
10/28 . . with non-expansible roller cutters
10/30 . . . Longitudinal axis roller reamers, e.g. reamer stabilisers
10/32 . . with expansible cutting tools
10/322 . . . {cutter shifted by fluid pressure (E21B 10/345 takes precedence)}
10/325 . . . {the cutter being shifted by a spring mechanism}
10/327 . . . {the cutter being pivoted about a longitudinal axis (E21B 10/34 takes precedence)}
10/34 . . . of roller-cutter type
10/345 . . . . {cutter shifted by fluid pressure}
10/36 . Percussion drill bits ({with helical conveying portion E21B 10/445;} characterised by wear resisting parts E21B 10/46)
10/38 . . characterised by conduits or nozzles for drilling fluids
10/40 . . with leading portion
10/42 . Rotary drag type drill bits with teeth, blades or like cutting elements, e.g. fork-type bits, fish tail bits (characterised by wear resisting parts E21B 10/46; by conduits or nozzles for drilling fluid E21B 10/60; by detachable or adjustable parts E21B 10/62)
10/43 . . characterised by the arrangement of teeth or other cutting elements
10/44 . Bits with helical conveying portion, e.g. screw type bits; Augers with leading portion or with detachable parts (E21B 10/42 takes precedence)
10/445 . . {percussion type, e.g. for masonry}
10/46 . characterised by wear resisting parts, e.g. diamond inserts
10/48 . . the bit being of core type
10/485 . . . {with inserts in form of chisels, blades or the like}
10/50 . . the bit being of roller type
10/52 . . . with chisel- or button-type inserts
10/54 . . the bit being of the rotary drag type, e.g. fork-type bits
10/55 . . . with preformed cutting elements
10/56 . . Button-type inserts (E21B 10/52 takes precedence)
10/567 . . . with preformed cutting elements mounted on a distinct support, e.g. polycrystalline inserts
10/5671 . . . . {with chip breaking arrangements}
10/5673 . . . . {having a non planar or non circular cutting face}
10/5676 . . . . {having a cutting face with different segments, e.g. mosaic-type inserts}
10/573 . . . . characterised by support details, e.g. the substrate construction or the interface between the substrate and the cutting element
10/5735 . . . . . {Interface between the substrate and the cutting element}
10/58 . . Chisel-type inserts ({E21B 10/485,} E21B 10/52 take precedence)
10/60 . characterised by conduits or nozzles for drilling fluids (for roller bits E21B 10/18; for percussion drill bits E21B 10/38)
10/602 . . {the bit being a rotary drag type bit with blades}
10/605 . . {the bit being a core-bit}
10/61 . . characterised by the nozzle structure
10/62 . characterised by parts, e.g. cutting elements, which are detachable or adjustable (E21B 10/64 takes precedence; for roller bits E21B 10/20; for augers E21B 10/44)
10/627 . . with plural detachable cutting elements
10/633 . . . independently detachable
10/64 . characterised by the whole or part thereof being insertable into or removable from the borehole without withdrawing the drilling pipe
10/66 . . the cutting element movable through the drilling pipe and laterally shiftable

11/00 Other drilling tools
11/005 . {Hand operated drilling tools}
11/02 . Boring rams
11/04 . Boring grabs
11/06 . with driven cutting chains or similarly driven tools

12/00 Accessories for drilling tools
12/02 . Wear indicators
12/04 . Drill bit protectors
12/06 . Mechanical cleaning devices

Other equipment or details for drilling; Well equipment or well maintenance

15/00 Supports for the drilling machine, e.g. derricks or masts
15/003 . {adapted to be moved on their substructure, e.g. with skidding means; adapted to drill a plurality of wells}
15/006 . {Means for anchoring the drilling machine to the ground}
15/02 . specially adapted for underwater drilling (E21B 15/04 takes precedence)
15/04 . specially adapted for directional drilling, e.g. slant hole rigs
15/045 . . {Hydraulic, pneumatic or electric circuits for their positioning}

17/00 Drilling rods or pipes; Flexible drill strings; Kellies; Drill collars; Sucker rods; {Cables;} Casings; Tubings
17/003 . {with electrically conducting or insulating means (E21B 17/028 and E21B 17/023 take precedence)}

17/006 . {Accessories for drilling pipes, e.g. cleaners (wear protectors E21B 17/10; handling drilling pipes E21B 19/00; thread protectors B65D 59/00)}
17/01 . Risers
17/012 . . {with buoyancy elements (E21B 17/015 takes precedence)}
17/015 . . {Non-vertical risers, e.g. articulated or catenary-type}
17/017 . . {Bend restrictors for limiting stress on risers}
17/02 . Couplings; joints {(expandable couplings or joints E21B 43/106)}
17/021 . . {Devices for subsurface connecting or disconnecting by rotation}
17/023 . . {Arrangements for connecting cables or wirelines to downhole devices}
17/025 . . . {Side entry subs}
17/026 . . . {Arrangements for fixing cables or wirelines to the outside of downhole devices}
17/028 . . {Electrical or electro-magnetic connections}
17/0283 . . . {characterised by the coupling being contactless, e.g. inductive}
17/0285 . . . {characterised by electrically insulating elements}
17/03 . . between drilling rod or pipe and drill motor {or surface drive}, e.g. between drilling rod and hammer
17/04 . . between rod {or the like} and bit or between rod and rod {or the like}
17/041 . . . {specially adapted for coiled tubing}
17/042 . . . Threaded
17/0423 . . . . {with plural threaded sections, e.g. with two-step threads}
17/0426 . . . . {with a threaded cylindrical portion, e.g. for percussion rods}
17/043 . . . . with locking means
17/046 . . . with ribs, pins, or jaws, and complementary grooves or the like, e.g. bayonet catches
17/0465 . . . . {characterised by radially inserted locking elements}
17/05 . . . Swivel joints
17/06 . . . Releasing-joints, e.g. safety joints
17/07 . . . Telescoping joints for varying drill string lengths; Shock absorbers
17/073 . . . . {with axial rotation}
17/076 . . . . {between rod or pipe and drill bit}
17/08 . . Casing joints
17/085 . . . {Riser connections (connectors for wellhead E21B 33/038)}
17/0853 . . . . {Connections between sections of riser provided with auxiliary lines, e.g. kill and choke lines}
17/10 . Wear protectors; Centralising devices {, e.g. stabilisers}
17/1007 . . {for the internal surface of a pipe, e.g. wear bushings for underwater well-heads}
17/1014 . . {Flexible or expansible centering means, e.g. with pistons pressing against the wall of the well (E21B 17/1042 takes precedence)}
17/1021 . . . {with articulated arms or arcuate springs}
17/1028 . . . . {with arcuate springs only, e.g. baskets with outwardly bowed strips for cementing operations}
17/1035 . . {for plural rods, pipes or lines, e.g. for control lines}
17/1042 . . {Elastomer protector or centering means}
17/105 . . . {split type}
17/1057 . . {Centralising devices with rollers or with a relatively rotating sleeve (E21B 17/1014 takes precedence)}
17/1064 . . . {Pipes or rods with a relatively rotating sleeve}
17/1071 . . {specially adapted for pump rods, e.g. sucker rods}
17/1078 . . {Stabilisers or centralisers for casing, tubing or drill pipes (devices for off-center positioning E21B 17/10; E21B 17/1007 - E21B 17/1064 take precedence)}
17/1085 . . {Wear protectors; Blast joints; Hard facing}
17/1092 . . {Gauge section of drill bits}
17/12 . . Devices for placing or drawing out wear protectors
17/14 . Casing shoes {for the protection of the bottom of the casing}
17/16 . Drill collars
17/18 . Pipes provided with plural fluid passages {(E21B 17/203 takes precedence)}
17/20 . Flexible or articulated drilling pipes {, e.g. flexible or articulated rods, pipes or cables}
17/203 . . {with plural fluid passages}
17/206 . . {with conductors, e.g. electrical, optical}
17/22 . Rods or pipes with helical structure

19/00 Handling rods, casings, tubes or the like outside the borehole, e.g. in the derrick; Apparatus for feeding the rods or cables

19/002 . {specially adapted for underwater drilling (E21B 19/09, E21B 19/143 take precedence)}
19/004 . . {supporting a riser from a drilling or production platform}
19/006 . . . {including heave compensators}
19/008 . {Winding units, specially adapted for drilling operations}
19/02 . Rod or cable suspensions
19/04 . . Hooks
19/06 . . Elevators, i.e. rod- or tube-gripping devices
19/07 . . . Slip-type elevators
19/08 . Apparatus for feeding the rods or cables (E21B 19/22 takes precedence; automatic feed E21B 44/02); Apparatus for increasing or decreasing the pressure on the drilling tool; Apparatus for counterbalancing the weight of the rods
19/081 . . Screw-and-nut feed mechanisms
19/083 . . Cam, rack or like feed mechanisms
19/084 . . with flexible drawing means, e.g. cables
19/086 . . with a fluid-actuated cylinder (E21B 19/084, E21B 19/087, E21B 19/09 take precedence)
19/087 . . by means of a swinging arm
19/089 . . with a spring or an additional weight
19/09 . . specially adapted for drilling underwater formations from a floating support using heave compensators supporting the drill string
19/10 . Slips; Spiders {; Catching devices (rotary tables with master bushing or kelly bushing E21B 3/04)}
19/102 . . {using rollers or spherical balls as load gripping elements}
19/12 . Rope clamps {; Rod, casings or tube clamps not secured to elevators}

19/14 . Racks, ramps, troughs or bins, for holding the lengths of rod singly or connected; Handling between storage place and borehole (E21B 19/20, E21B 19/22 take precedence)
19/143 . . {specially adapted for underwater drilling}
19/146 . . {Carousel systems, i.e. rotating rack systems}
19/15 . . Racking of rods in horizontal position; Handling between horizontal and vertical position
19/155 . . . {Handling between horizontal and vertical position}
19/16 . Connecting or disconnecting pipe couplings or joints (E21B 19/20 takes precedence)
19/161 . . {using a wrench or a spinner adapted to engage a circular section of pipe (E21B 19/168 takes precedence)}
19/162 . . . {cathead actuated}
19/163 . . . {piston-cylinder actuated}
19/164 . . . {motor actuated (E21B 19/162 and E21B 19/163 take precedence)}
19/165 . . {Control or monitoring arrangements therefor}
19/166 . . . {Arrangements of torque limiters or torque indicators}
19/167 . . {using a wrench adapted to engage a non circular section of pipe, e.g. a section with flats or splines}
19/168 . . {using a spinner with rollers or a belt adapted to engage a well pipe}
19/18 . Connecting or disconnecting drill bit and drilling pipe
19/20 . Combined feeding from rack and connecting, e.g. automatically
19/22 . Handling reeled pipe or rod units, e.g. flexible drilling pipes {(lifting or hauling appliances using two or more cooperating endless chains B66D 3/003)}
19/24 . Guiding or centralising devices for drilling rods or pipes

21/00 Methods or apparatus for flushing boreholes, e.g. by use of exhaust air from motor (freeing objects stuck in boreholes by flushing E21B 31/03)
21/001 . {specially adapted for underwater drilling (dual gradient drilling E21B 21/082)}
21/002 . {Down-hole drilling fluid separation systems (containers comprising collecting means with a strainer E21B 27/005; subsoil filtering E21B 43/02; down-hole production separators E21B 43/38)}
21/003 . {Means for stopping loss of drilling fluid (plastering the borehole wall E21B 33/138)}
21/01 . Arrangements for handling drilling fluids or cuttings outside the borehole, e.g. mud boxes
21/011 . . {Dust eliminating or dust removing while drilling}
21/012 . . . {using exhaust air from the drilling motor for blowing off the dust at the borehole entrance}
21/013 . . . {by liquids}
21/0135 . . . . {Liquid flushing installations}
21/014 . . . {Preventing exhaust air from the drill motor from blowing-off towards the working face}
21/015 . . Means engaging the bore entrance, e.g. hoods for collecting dust
21/019 . . {Arrangements for maintaining circulation of drilling fluid while connecting or disconnecting tubular joints}
21/02 . Swivel joints in hose-lines
21/06 . Arrangements for treating drilling fluids outside the borehole
21/062 . . {by mixing components}
21/063 . . {by separating components}
21/065 . . . {Separating solids from drilling fluids}
21/066 . . . . {with further treatment of the solids, e.g. for disposal}
21/067 . . . {Separating gases from drilling fluids}
21/068 . . {using chemical treatment}
21/07 . . for treating dust-laden gaseous fluids
21/08 . Controlling or monitoring pressure or flow of drilling fluid, e.g. automatic filling of boreholes, automatic control of bottom pressure (valve arrangements therefor E21B 21/10)
21/082 . . {Dual gradient systems, i.e. using two hydrostatic gradients or drilling fluid densities}
21/085 . . {Underbalanced techniques, i.e. where borehole fluid pressure is below formation pressure}
21/10 . Valve arrangements in drilling-fluid circulation systems
21/103 . . {Down-hole by-pass valve arrangements, i.e. between the inside of the drill string and the annulus (valves specifically for maintaining circulation of drilling fluid while connecting or disconnecting tubular joints E21B 21/019)}
21/106 . . {Valve arrangements outside the borehole, e.g. kelly valves (valves specifically for maintaining circulation of drilling fluid while connecting or disconnecting tubular joints E21B 21/019)}
21/12 . using drilling pipes with plural fluid passages, e.g. closed circulation systems
21/14 . using liquids and gases, e.g. foams
21/16 . using gaseous fluids (E21B 21/14 takes precedence)
21/18 . Preventing exhaust air from the drill motor from blowing-off towards the working face

23/00 Apparatus for displacing, setting, locking, releasing or removing tools, packers or the like in boreholes or wells (setting of casings, screens or liners E21B 43/10)
23/001 . {Self-propelling systems or apparatus, e.g. for moving tools within the horizontal portion of a borehole}
23/004 . {Indexing systems for guiding relative movement between telescoping parts of downhole tools}
23/006 . . {"J-slot" systems, i.e. lug and slot indexing mechanisms}
23/01 . for anchoring the tools or the like (E21B 23/02 - E21B 23/06 take precedence; anchoring of drives in the borehole E21B 4/18)
23/02 . for locking the tools or the like in landing nipples or in recesses between adjacent sections of tubing (E21B 23/03 - E21B 23/06 take precedence)
23/03 . for setting the tools into, or removing the tools from, laterally offset landing nipples or pockets
23/04 . operated by fluid means, e.g. actuated by explosion (E21B 23/08 takes precedence)
23/0411 . . {specially adapted for anchoring tools or the like to the borehole wall or to well tube}
23/04115 . . . {using radial pistons}
23/0412 . . {characterised by pressure chambers, e.g. vacuum chambers}

23/0413 . . {using means for blocking fluid flow, e.g. drop balls or darts (using balls or the like for actuating downhole valves E21B 34/142)}
23/0414 . . {using explosives}
23/0415 . . {using particular fluids, e.g. electro-active liquids}
23/0416 . . {characterised by force amplification arrangements}
23/0417 . . {Down-hole non-explosive gas generating means, e.g. by chemical reaction}
23/0418 . . {specially adapted for locking the tools in landing nipples or recesses}
23/0419 . . {using down-hole motor and pump arrangements for generating hydraulic pressure}
23/042 . . {using a single piston or multiple mechanically interconnected pistons}
23/0421 . . {using multiple hydraulically interconnected pistons}
23/0422 . . {characterised by radial pistons (using radial pistons for anchoring E21B 23/04115)}
23/0423 . . {using step motors}
23/06 . for setting packers
23/065 . . {setting tool actuated by explosion or gas generating means}
23/08 . Introducing or running tools by fluid pressure, e.g. through-the-flow-line tool systems
23/10 . . Tools specially adapted therefor
23/12 . . Tool diverters
23/14 . for displacing a cable or a cable-operated tool, e.g. for logging or perforating operations in deviated wells

25/00 Apparatus for obtaining or removing undisturbed cores, e.g. core barrels or core extractors (core bits E21B 10/02)
25/005 . {Above ground means for handling the core, e.g. for extracting the core from the core barrel}
25/02 . the core receiver being insertable into, or removable from, the borehole without withdrawing the drilling pipe
25/04 . . the core receiver having a core forming cutting edge or element, e.g. punch type core barrels
25/06 . the core receiver having a flexible liner or inflatable retaining means
25/08 . Coating, freezing, consolidating cores (E21B 25/06 takes precedence); Recovering uncontaminated cores or cores at formation pressure
25/10 . Formed core retaining or severing means (E21B 25/06, E21B 25/08 take precedence)
25/12 . . of the sliding wedge type
25/14 . . mounted on pivot transverse to core axis
25/16 . for obtaining oriented cores
25/18 . the core receiver being specially adapted for operation under water

27/00 Containers for collecting or depositing substances in boreholes or wells, e.g. bailers, {baskets or buckets} for collecting mud or sand; Drill bits with means for collecting substances, e.g. valve drill bits
27/005 . {Collecting means with a strainer}
27/02 . Dump bailers, i.e. containers for depositing substances, e.g. cement or acids
27/04 . where the collecting or depositing means include helical conveying means

28/00 Vibration generating arrangements for boreholes or wells, e.g. for stimulating production ({for fishing for or freeing objects E21B 31/005;} for transmitting measuring-signals E21B 47/14; for geophysical measurements G01V 1/02)

29/00 Cutting or destroying pipes, packers, plugs or wire lines, located in boreholes or wells, e.g. cutting of damaged pipes, of windows; Deforming of pipes in boreholes or wells; Reconditioning of well casings while in the ground
29/002 . {Cutting, e.g. milling, a pipe with a cutter rotating along the circumference of the pipe}
29/005 . . {with a radially-expansible cutter rotating inside the pipe, e.g. for cutting an annular window}
29/007 . . {with a radially-retracting cutter rotating outside the pipe}
29/02 . by explosives or by thermal or chemical means {(freeing stuck objects by explosives E21B 31/002)}
29/04 . Cutting of wire lines or the like (E21B 29/02 takes precedence)
29/06 . Cutting windows, e.g. directional window cutters for whipstock operations ({E21B 29/005 and} E21B 29/08 take precedence)
29/08 . Cutting or deforming pipes to control fluid flow
29/10 . Reconditioning of well casings, e.g. straightening
29/12 . specially adapted for underwater installations (E21B 29/08 takes precedence)

31/00 Fishing for or freeing objects in boreholes or wells
31/002 . {Destroying the objects to be fished, e.g. by explosive means}
31/005 . {using vibrating or oscillating means}
31/007 . {fishing tools with means for attaching comprising fusing or sticking}
31/03 . Freeing by flushing
31/035 . {controlling differential pipe sticking}
31/06 . using magnetic means
31/08 . using junk baskets or the like
31/107 . using impact means for releasing stuck parts, e.g. jars
31/1075 . . {using explosives}
31/113 . . hydraulically-operated
31/1135 . . . {Jars with a hydraulic impedance mechanism, i.e. a restriction, for initially delaying escape of a restraining fluid}
31/12 . Grappling tools, e.g. tongs or grabs
31/125 . . {specially adapted for parted wire line or ropes}
31/14 . . with means deflecting the direction of the tool, e.g. by use of knuckle joints
31/16 . . combined with cutting or destroying means
31/18 . . gripping externally, e.g. overshot
31/20 . . gripping internally, e.g. fishing spears

33/00 Sealing or packing boreholes or wells
33/02 . Surface sealing or packing
33/03 . . Well heads; Setting-up thereof
33/035 . . . specially adapted for underwater installations (E21B 33/043, E21B 33/064, E21B 33/076 take precedence)
33/0353 . . . . {Horizontal or spool trees, i.e. without production valves in the vertical main bore}
33/0355 . . . . {Control systems, e.g. hydraulic, pneumatic, electric, acoustic, for submerged well heads}

33/037 . . . . Protective housings therefor
33/0375 . . . . . {Corrosion protection means}
33/038 . . . . Connectors used on well heads, e.g. for connecting blow-out preventer and riser
33/0385 . . . . . {electrical connectors}
33/0387 . . . . {Hydraulic stab connectors}
33/04 . . . Casing heads; Suspending casings or tubings in well heads
33/0407 . . . . {with a suspended electrical cable}
33/0415 . . . . {rotating or floating support for tubing or casing hanger}
33/0422 . . . . {a suspended tubing or casing being gripped by a slip or an internally serrated member}
33/043 . . . . specially adapted for underwater well heads ({E21B 33/0407,} E21B 33/047 take precedence)
33/047 . . . . for plural tubing strings
33/05 . . . . Cementing-heads, e.g. having provision for introducing cementing plugs
33/06 . . . Blow-out preventers {, i.e. apparatus closing around a drill pipe, e.g. annular blow-out preventers (rotating blow-out preventers E21B 33/085)}
33/061 . . . . {Ram-type blow-out preventers, e.g. with pivoting rams}
33/062 . . . . . {with sliding rams}
33/063 . . . . . {for shearing drill pipes (cutting of wireline E21B 29/04)}
33/064 . . . . specially adapted for underwater well heads
33/068 . . . having provision for introducing objects or fluids into, or removing objects from, wells (cementing-heads E21B 33/05)
33/072 . . . . for cable-operated tools (E21B 33/076 takes precedence)
33/076 . . . . specially adapted for underwater installations
33/08 . . Wipers; Oil savers
33/085 . . . {Rotatable packing means, e.g. rotating blow-out preventers}
33/10 . in the borehole {(sealing the junction between main bore and laterals E21B 41/0042)}
33/12 . . Packers; Plugs (used for cementing E21B 33/134, E21B 33/16)
33/1204 . . . {permanent; drillable}
33/1208 . . . {characterised by the construction of the sealing or packing means (E21B 33/1277 takes precedence)}
33/1212 . . . . {including a metal-to-metal seal element}
33/1216 . . . . {Anti-extrusion means, e.g. means to prevent cold flow of rubber packing}
33/122 . . . Multiple string packers
33/124 . . . Units with longitudinally-spaced plugs for isolating the intermediate space
33/1243 . . . . {with inflatable sleeves}
33/1246 . . . . . {inflated by down-hole pumping means operated by a pipe string}
33/126 . . . with fluid-pressure-operated elastic cup or skirt (E21B 33/122, E21B 33/124 take precedence)
33/1265 . . . . {with mechanical slips}
33/127 . . . with inflatable sleeve (E21B 33/122, E21B 33/124 take precedence)
33/1272 . . . . {inflated by down-hole pumping means operated by a pipe string}
33/1275 . . . . {inflated by down-hole pumping means operated by a down-hole drive}
33/1277 . . . . {characterised by the construction or fixation of the sleeve}
33/128 . . . with a member expanded radially by axial pressure (E21B 33/122, E21B 33/124 take precedence)
33/1285 . . . . {by fluid pressure}
33/129 . . . with mechanical slips for hooking into the casing (E21B 33/122, E21B 33/124 take precedence)
33/1291 . . . . {anchor set by wedge or cam in combination with frictional effect, using so-called drag-blocks (E21B 33/1295 takes precedence)}
33/1292 . . . . . {with means for anchoring against downward and upward movement}
33/1293 . . . . {with means for anchoring against downward and upward movement (E21B 33/1291, E21B 33/1295 take precedence)}
33/1294 . . . . {characterised by a valve, e.g. a by-pass valve}
33/1295 . . . . actuated by fluid pressure
33/12955 . . . . . {using drag blocks frictionally engaging the inner wall of the well}
33/13 . . Methods or devices for cementing, for plugging holes, crevices or the like
33/134 . . . Bridging plugs
33/136 . . . Baskets, e.g. of umbrella type
33/138 . . . Plastering the borehole wall; Injecting into the formation
33/14 . . . for cementing casings into boreholes
33/143 . . . . {for underwater installations}
33/146 . . . . {Stage cementing, i.e. discharging cement from casing at different levels}
33/16 . . . . using plugs for isolating cement charge; Plugs therefor {(stage cementing E21B 33/146; spacer compositions C09K 8/424)}
33/165 . . . . . {Cementing plugs specially adapted for being released down-hole (cementing heads E21B 33/05)}
33/167 . . . . . {Cementing plugs provided with anti-rotation mechanisms, e.g. for easier drill-out}

34/00 Valve arrangements for boreholes or wells
34/02 . in well heads
34/025 . . {Chokes or valves in wellheads and sub-sea wellheads for variably regulating fluid flow}
34/04 . . in underwater well heads
34/045 . . . {adapted to be lowered on a tubular string into position within a blow-out preventer stack, e.g. so-called test trees}
34/06 . in wells
34/063 . . {Valve or closure with destructible element, e.g. frangible disc (E21B 34/103 takes precedence)}
34/066 . . {electrically actuated}
34/08 . . responsive to flow or pressure of the fluid obtained (E21B 34/10 takes precedence)
34/085 . . . {with time-delay systems, e.g. hydraulic impedance mechanisms}
34/10 . . operated by control fluid supplied from outside the borehole
34/101 . . . {with means for equalizing fluid pressure above and below the valve}

34/102 . . . {with means for locking the closing element in open or closed position (E21B 34/105 and E21B 34/108 take precedence)}
34/103 . . . . {with a shear pin}
34/105 . . . {retrievable, e.g. wire line retrievable, i.e. with an element which can be landed into a landing-nipple provided with a passage for control fluid}
34/106 . . . . {the retrievable element being a secondary control fluid actuated valve landed into the bore of a first inoperative control fluid actuated valve}
34/107 . . . . {the retrievable element being an operating or controlling means retrievable separately from the closure member, e.g. pilot valve landed into a side pocket (E21B 34/106 takes precedence)}
34/108 . . . {with time delay systems, e.g. hydraulic impedance mechanisms}
34/12 . . operated by movement of casings or tubings
34/125 . . . {with time delay systems, e.g. hydraulic impedance mechanisms}
34/14 . . operated by movement of tools, e.g. sleeve valves operated by pistons or wire line tools {(E21B 34/066 takes precedence)}
34/142 . . . {unsupported or free-falling elements, e.g. balls, plugs, darts or pistons}
34/16 . Control means therefor being outside the borehole {(control systems for submerged well heads E21B 33/0355)}

35/00 Methods or apparatus for preventing or extinguishing fires

36/00 Heating, cooling or insulating arrangements for boreholes or wells, e.g. for use in permafrost zones

36/001 . {Cooling arrangements}
36/003 . {Insulating arrangements}
36/005 . {Heater surrounding production tube}
36/006 . {Combined heating and pumping means}
36/008 . {using chemical heat generating means}
36/02 . using burners
36/025 . . {the burners being above ground or outside the bore hole}
36/04 . using electrical heaters

37/00 Methods or apparatus for cleaning boreholes or wells (E21B 21/00 takes precedence)

37/02 . Scrapers specially adapted therefor
37/04 . . operated by fluid pressure, e.g. free-piston scrapers
37/045 . . . {Free-piston scrapers}
37/06 . using chemical means for preventing or limiting {, e.g. eliminating,} the deposition of paraffins or like substances
37/08 . cleaning in situ of down-hole filters, screens, {e.g. casing perforations,} or gravel packs (E21B 37/06 takes precedence)
37/10 . Well swabs

40/00 Tubing catchers, automatically arresting the fall of oil-well tubing {(preventing small objects from falling into the borehole E21B 41/0021)}

40/001 . {in the borehole (anchoring tools in the borehole E21B 23/01)}

41/00 Equipment or details not covered by groups E21B 15/00 - E21B 40/00

41/0007 . {for underwater installations (E21B 41/005, E21B 41/04, E21B 41/06, E21B 41/08, E21B 41/10 take precedence)}
41/0014 . . {Underwater well locating or reentry systems}
41/0021 . {Safety devices, e.g. for preventing small objects from falling into the borehole}
41/0035 . {Apparatus or methods for multilateral well technology, e.g. for the completion of or workover on wells with one or more lateral branches}
41/0042 . . {characterised by sealing the junction between a lateral and a main bore}
41/005 . {Waste disposal systems}
41/0057 . . {Disposal of a fluid by injection into a subterranean formation}
41/0064 . . . {Carbon dioxide sequestration (storing fluids in porous layers B65G 5/005)}
41/0071 . . {Adaptation of flares, e.g. arrangements of flares in offshore installations (flares of waste gases or noxious gases F23G 7/08)}
41/0078 . {Nozzles used in boreholes (drilling by liquid or gas jets E21B 7/18; drill bits with nozzles E21B 10/60; perforators using direct fluid action E21B 43/114; obtaining a slurry of minerals using nozzles E21B 43/29)}
41/0085 . {Adaptations of electric power generating means for use in boreholes}
41/0099 . {specially adapted for drilling for or production of natural hydrate or clathrate gas reservoirs; Drilling through or monitoring of formations containing gas hydrates or clathrates}
41/02 . in situ inhibition of corrosion in boreholes or wells
41/04 . Manipulators for underwater operations, e.g. temporarily connected to well heads
41/06 . Work chambers for underwater operations, e.g. temporarily connected to well heads
41/08 . Underwater guide bases, e.g. drilling templates; Levelling thereof
41/10 . Guide posts, e.g. releasable; Attaching guide lines to underwater guide bases

Obtaining fluids from wells

43/00 Methods or apparatus for obtaining oil, gas, water, soluble or meltable materials or a slurry of minerals from wells (applicable only to water E03B)

43/003 . {Vibrating earth formations}
43/006 . {Production of coal-bed methane (E21B 43/243 takes precedence)}
43/01 . specially adapted for obtaining from underwater installations
43/0107 . . {Connecting of flow lines to offshore structures (E21B 43/013 takes precedence)}
43/0122 . . {Collecting oil or the like from a submerged leakage (cleaning or keeping clear the surface of open water from oil or the like E02B 15/04)}
43/013 . . Connecting a production flow line to an underwater well head
43/0135 . . . {using a pulling cable}
43/017 . . Production satellite stations, i.e. underwater installations comprising a plurality of satellite well heads connected to a central station
43/0175 . . . {Hydraulic schemes for production manifolds}
43/02 . Subsoil filtering

43/025 . . {Consolidation of loose sand or the like round the wells without excessively decreasing the permeability thereof}
43/04 . . Gravelling of wells
43/045 . . . {Crossover tools}
43/08 . . Screens or liners {(expandable screens or liners E21B 43/108)}
43/082 . . . {Screens comprising porous materials, e.g. prepacked screens}
43/084 . . . {Screens comprising woven materials, e.g. mesh or cloth}
43/086 . . . {Screens with preformed openings, e.g. slotted liners (comprising porous materials E21B 43/082)}
43/088 . . . {Wire screens (comprising porous materials E21B 43/082; comprising woven materials E21B 43/084)}
43/10 . . Setting of casings, screens, liners {or the like} in wells
43/101 . . . {for underwater installations}
43/103 . . . {of expandable casings, screens, liners, or the like}
43/105 . . . . {Expanding tools specially adapted therefor}
43/106 . . . . {Couplings or joints therefor}
43/108 . . . . {Expandable screens or perforated liners}
43/11 . Perforators; Permeators
43/112 . . Perforators with extendable perforating members, e.g. actuated by fluid means
43/114 . . Perforators using direct fluid action {on the wall to be perforated}, e.g. abrasive jets
43/116 . . Gun or shaped-charge perforators
43/117 . . . Shaped-charge perforators (E21B 43/118 takes precedence)
43/118 . . . characterised by lowering in vertical position and subsequent tilting to operating position
43/1185 . . . Ignition systems
43/11852 . . . . {hydraulically actuated}
43/11855 . . . . {mechanically actuated, e.g. by movement of a wireline or a drop-bar (E21B 43/11852 takes precedence)}
43/11857 . . . . {firing indication systems}
43/119 . . Details, e.g. for locating perforating place or direction
43/1193 . . . {Dropping perforation guns after gun actuation}
43/1195 . . . {Replacement of drilling mud; decrease of undesirable shock waves}
43/12 . Methods or apparatus for controlling the flow of the obtained fluid to or in wells (E21B 43/25 takes precedence; valve arrangements E21B 34/00)
43/121 . . {Lifting well fluids (monitoring of down-hole pump systems E21B 47/008)}
43/122 . . . {Gas lift}
43/123 . . . . {Gas lift valves}
43/1235 . . . . . {characterised by electromagnetic actuation}
43/124 . . . {Adaptation of jet-pump systems}
43/126 . . . {Adaptations of down-hole pump systems powered by drives outside the borehole, e.g. by a rotary or oscillating drive (powered by fluid E21B 43/129)}
43/127 . . . . {Adaptations of walking-beam pump systems}
43/128 . . . {Adaptation of pump systems with down-hole electric drives}
43/129 . . . {Adaptations of down-hole pump systems powered by fluid supplied from outside the borehole (gas-lift E21B 43/122; jet pumps E21B 43/124)}
43/13 . . . {specially adapted to dewatering of wells of gas producing reservoirs, e.g. methane producing coal beds}
43/14 . Obtaining from a multiple-zone well
43/16 . Enhanced recovery methods for obtaining hydrocarbons
43/162 . . {Injecting fluid from longitudinally spaced locations in injection well}
43/164 . . {Injecting CO_2 or carbonated water (in combination with organic material C09K 8/594)}
43/166 . . {Injecting a gaseous medium; Injecting a gaseous medium and a liquid medium (CO_2 injection E21B 43/164; steam injection E21B 43/24)}
43/168 . . . {Injecting a gaseous medium}
43/17 . . Interconnecting two or more wells by fracturing or otherwise attacking the formation ({E21B 43/2405,} E21B 43/247 take precedence)
43/18 . . Repressuring or vacuum methods
43/20 . . Displacing by water
43/24 . . using heat, e.g. steam injection
43/2401 . . . {by means of electricity}
43/2403 . . . {by means of nuclear energy}
43/2405 . . . {in association with fracturing or crevice forming processes (E21B 43/247 takes precedence)}
43/2406 . . . {Steam assisted gravity drainage [SAGD]}
43/2408 . . . . {SAGD in combination with other methods}
43/241 . . . combined with solution mining of non-hydrocarbon minerals, e.g. solvent pyrolysis of oil shale
43/243 . . . Combustion in situ
43/247 . . . . in association with fracturing processes {or crevice forming processes}
43/248 . . . . . using explosives
43/25 . Methods for stimulating production {(by vibrating earth formations E21B 43/003)}
43/255 . . {including the injection of a gaseous medium as treatment fluid into the formation}
43/26 . . by forming crevices or fractures
43/2605 . . . {using gas or liquefied gas}
43/2607 . . . {Surface equipment specially adapted for fracturing operations}
43/261 . . . {Separate steps of (1) cementing, plugging or consolidating and (2) fracturing or attacking the formation}
43/263 . . . using explosives
43/2635 . . . . {by means of nuclear energy}
43/267 . . . reinforcing fractures by propping
43/27 . . . by use of eroding chemicals, e.g. acids
43/28 . Dissolving minerals other than hydrocarbons, e.g. by an alkaline or acid leaching agent (E21B 43/241 takes precedence)
43/281 . . {using heat}
43/283 . . {in association with a fracturing process}
43/285 . Melting minerals, e.g. sulfur (E21B 43/24 takes precedence)
43/29 . Obtaining a slurry of minerals, e.g. by using nozzles

43/292 . . {using steerable or laterally extendable nozzles}
43/295 . Gasification of minerals, e.g. for producing mixtures of combustible gases (E21B 43/243 takes precedence)
43/30 . Specific pattern of wells, e.g. optimising the spacing of wells
43/305 . . {comprising at least one inclined or horizontal well}
43/32 . Preventing gas- or water-coning phenomena, i.e. the formation of a conical column of gas or water around wells
43/34 . Arrangements for separating materials produced by the well
43/35 . . {specially adapted for separating solids (down-hole drilling fluid separation systems E21B 21/002; separating solids from drilling fluids E21B 21/065)}
43/36 . . Underwater separating arrangements (E21B 43/38 takes precedence)
43/38 . . in the well
43/385 . . . {by reinjecting the separated materials into an earth formation in the same well}
43/40 . . Separation associated with re-injection of separated materials {(E21B 43/385 takes precedence)}

Automatic control, surveying or testing

44/00 Automatic control systems specially adapted for drilling operations, i.e. self-operating systems which function to carry out or modify a drilling operation without intervention of a human operator, e.g. computer-controlled drilling systems; Systems specially adapted for monitoring a plurality of drilling variables or conditions
44/005 . {Below-ground automatic control systems}
44/02 . Automatic control of the tool feed ({E21B 44/005,} E21B 44/10 take precedence)
44/04 . . in response to the torque of the drive {; Measuring drilling torque (E21B 44/06 takes precedence; measuring stresses in a well bore pipe E21B 47/007)}
44/06 . . in response to the flow or pressure of the motive fluid of the drive
44/08 . . in response to the amplitude of the movement of the percussion tool, e.g. jump or recoil
44/10 . Arrangements for automatic stopping when the tool is lifted from the working face

45/00 Measuring the drilling time or rate of penetration

47/00 Survey of boreholes or wells (monitoring pressure or flow of drilling fluid E21B 21/08)
47/001 . for underwater installation
47/002 . by visual inspection
47/0025 . . {generating an image of the borehole wall using down-hole measurements, e.g. acoustic or electric}
47/003 . Determining well or borehole volumes
47/005 . Monitoring or checking of cementation quality or level
47/006 . {Detection of corrosion or deposition of substances}
47/007 . Measuring stresses in a pipe string or casing (for locating blocked portions of pipes E21B 47/09)
47/008 . Monitoring of down-hole pump systems, e.g. for the detection of "pumped-off" conditions
47/009 . . Monitoring of walking-beam pump systems
47/01 . Devices for supporting measuring instruments on drill bits, pipes, rods or wirelines; Protecting measuring instruments in boreholes against heat, shock, pressure or the like

NOTE

Devices for both supporting and protecting measuring instruments are only classified in E21B 47/017

47/013 . . Devices specially adapted for supporting measuring instruments on drill bits
47/017 . . Protecting measuring instruments
47/0175 . . . {Cooling arrangements}
47/02 . Determining slope or direction
47/022 . . of the borehole, e.g. using geomagnetism
47/0224 . . . using seismic or acoustic means
47/0228 . . . using electromagnetic energy or detectors therefor
47/0232 . . . . at least one of the energy sources or one of the detectors being located on or above the ground surface
47/0236 . . . using a pendulum
47/024 . . of devices in the borehole (determining slope or direction of the borehole E21B 47/022)
47/026 . . of penetrated ground layers
47/04 . Measuring depth or liquid level
47/047 . . Liquid level (measuring depth or liquid level using radioactive markers E21B 47/053)
47/053 . . using radioactive markers
47/06 . Measuring temperature or pressure
47/07 . . Temperature
47/08 . Measuring diameters or related dimensions at the borehole
47/085 . . using radiant means, e.g. acoustic, radioactive or electromagnetic
47/09 . Locating or determining the position of objects in boreholes or wells {, e.g. the position of an extending arm}; Identifying the free or blocked portions of pipes
47/092 . . by detecting magnetic anomalies
47/095 . . by detecting an acoustic anomalies, e.g. using mud-pressure pulses
47/098 . . using impression packers, e.g. to detect recesses or perforations
47/10 . Locating fluid leaks, intrusions or movements
47/103 . . using thermal measurements
47/107 . . using acoustic means
47/11 . . using tracers; using radioactivity
47/111 . . . {using radioactivity}
47/113 . . using electrical indications; using light radiations
47/114 . . . {using light radiation}
47/117 . . Detecting leaks, e.g. from tubing, by pressure testing
47/12 . Means for transmitting measuring-signals or control signals from the well to the surface, or from the surface to the well, e.g. for logging while drilling
47/125 . . using earth as an electrical conductor (by electromagnetic energy E21B 47/13)
47/13 . . by electromagnetic energy, e.g. radio frequency
47/135 . . . using light waves, e.g. infrared or ultraviolet waves

47/138 . . {Devices entrained in the flow of well-bore fluid for transmitting data, control or actuation signals}
47/14 . . using acoustic waves
47/16 . . . through the drill string or casing {, e.g. by torsional acoustic waves}
47/18 . . . through the well fluid {, e.g. mud pressure pulse telemetry}
47/20 . . . . by modulation of mud waves, e.g. by continuous modulation
47/22 . . . . by negative mud pulses using a pressure relieve valve between drill pipe and annulus
47/24 . . . . by positive mud pulses using a flow restricting valve within the drill pipe
47/26 . Storing data down-hole, e.g. in a memory or on a record carrier

49/00 Testing the nature of borehole walls; Formation testing; Methods or apparatus for obtaining samples of soil or well fluids, specially adapted to earth drilling or wells

49/001 . {specially adapted for underwater installations}
49/003 . {by analysing drilling variables or conditions (E21B 49/005 takes precedence; systems specially adapted for monitoring a plurality of drilling variables or conditions E21B 44/00)}
49/005 . {Testing the nature of borehole walls or the formation by using drilling mud or cutting data}
49/006 . {Measuring wall stresses in the borehole}
49/008 . {by injection test; by analysing pressure variations in an injection or production test, e.g. for estimating the skin factor (measuring pressure E21B 47/06)}
49/02 . by mechanically taking samples of the soil
49/025 . . {of underwater soil, e.g. with grab devices}
49/04 . . using explosives in boreholes; using projectiles penetrating the wall
49/06 . . using side-wall drilling tools {pressing} or scrapers
49/08 . Obtaining fluid samples or testing fluids, in boreholes or wells
49/081 . . {with down-hole means for trapping a fluid sample (E21B 49/10 takes precedence)}
49/0813 . . . {Sampling valve actuated by annulus pressure changes}
49/0815 . . . {Sampling valve actuated by tubing pressure changes}
49/082 . . . {Wire-line fluid samplers (E21B 49/083 takes precedence)}
49/083 . . . {Samplers adapted to be lowered into or retrieved from a landing nipple, e.g. for testing a well without removing the drill string}
49/084 . . {with means for conveying samples through pipe to surface}
49/086 . . {Withdrawing samples at the surface}
49/087 . . {Well testing, e.g. testing for reservoir productivity or formation parameters}
49/0875 . . . {determining specific fluid parameters}
49/088 . . . {combined with sampling}
49/10 . . using side-wall fluid samplers or testers

2200/00 Special features related to earth drilling for obtaining oil, gas or water

2200/01 . Sealings characterised by their shape
2200/02 . Down-hole chokes or valves for variably regulating fluid flow
2200/03 . Valves operated by gear mechanisms, e.g. rack and pinion mechanisms
2200/04 . Ball valves
2200/05 . Flapper valves
2200/06 . Sleeve valves
2200/08 . Down-hole devices using materials which decompose under well-bore conditions
2200/09 . Detecting, eliminating, preventing liquid slugs in production pipes
2200/20 . Computer models or simulations, e.g. for reservoirs under production, drill bits
2200/22 . Fuzzy logic, artificial intelligence, neural networks or the like