

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

- 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
- {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-expandable roller cutters
- 10/30 . . . Longitudinal axis roller reamers, e.g. reamer stabilisers
- 10/32 . . with expandable 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	<ul style="list-style-type: none"> • 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) 	21/02	<ul style="list-style-type: none"> • Swivel joints in hose-lines
19/143	<ul style="list-style-type: none"> • . {specially adapted for underwater drilling} 	21/06	<ul style="list-style-type: none"> • Arrangements for treating drilling fluids outside the borehole
19/146	<ul style="list-style-type: none"> • . {Carousel systems, i.e. rotating rack systems} 	21/062	<ul style="list-style-type: none"> • . {by mixing components}
19/15	<ul style="list-style-type: none"> • . Racking of rods in horizontal position; Handling between horizontal and vertical position 	21/063	<ul style="list-style-type: none"> • . {by separating components}
19/155	<ul style="list-style-type: none"> • . . {Handling between horizontal and vertical position} 	21/065	<ul style="list-style-type: none"> • . . {Separating solids from drilling fluids}
19/16	<ul style="list-style-type: none"> • Connecting or disconnecting pipe couplings or joints (E21B 19/20 takes precedence) 	21/066	<ul style="list-style-type: none"> • . . . {with further treatment of the solids, e.g. for disposal}
19/161	<ul style="list-style-type: none"> • . {using a wrench or a spinner adapted to engage a circular section of pipe (E21B 19/168 takes precedence)} 	21/067	<ul style="list-style-type: none"> • . . . {Separating gases from drilling fluids}
19/162	<ul style="list-style-type: none"> • . . {cathead actuated} 	21/068	<ul style="list-style-type: none"> • . {using chemical treatment}
19/163	<ul style="list-style-type: none"> • . . {piston-cylinder actuated} 	21/07	<ul style="list-style-type: none"> • . for treating dust-laden gaseous fluids
19/164	<ul style="list-style-type: none"> • . . {motor actuated (E21B 19/162 and E21B 19/163 take precedence)} 	21/08	<ul style="list-style-type: none"> • 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)
19/165	<ul style="list-style-type: none"> • . {Control or monitoring arrangements therefor} 	21/082	<ul style="list-style-type: none"> • . {Dual gradient systems, i.e. using two hydrostatic gradients or drilling fluid densities}
19/166	<ul style="list-style-type: none"> • . . {Arrangements of torque limiters or torque indicators} 	21/085	<ul style="list-style-type: none"> • . {Underbalanced techniques, i.e. where borehole fluid pressure is below formation pressure}
19/167	<ul style="list-style-type: none"> • . {using a wrench adapted to engage a non circular section of pipe, e.g. a section with flats or splines} 	21/10	<ul style="list-style-type: none"> • Valve arrangements in drilling-fluid circulation systems
19/168	<ul style="list-style-type: none"> • . {using a spinner with rollers or a belt adapted to engage a well pipe} 	21/103	<ul style="list-style-type: none"> • . {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)}
19/18	<ul style="list-style-type: none"> • Connecting or disconnecting drill bit and drilling pipe 	21/106	<ul style="list-style-type: none"> • . {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)}
19/20	<ul style="list-style-type: none"> • Combined feeding from rack and connecting, e.g. automatically 	21/12	<ul style="list-style-type: none"> • using drilling pipes with plural fluid passages, e.g. closed circulation systems
19/22	<ul style="list-style-type: none"> • 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)} 	21/14	<ul style="list-style-type: none"> • using liquids and gases, e.g. foams
19/24	<ul style="list-style-type: none"> • Guiding or centralising devices for drilling rods or pipes 	21/16	<ul style="list-style-type: none"> • using gaseous fluids (E21B 21/14 takes precedence)
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)	21/18	<ul style="list-style-type: none"> • Preventing exhaust air from the drill motor from blowing-off towards the working face
21/001	<ul style="list-style-type: none"> • {specially adapted for underwater drilling (dual gradient drilling E21B 21/082)} 	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)
21/002	<ul style="list-style-type: none"> • {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)} 	23/001	<ul style="list-style-type: none"> • {Self-propelling systems or apparatus, e.g. for moving tools within the horizontal portion of a borehole}
21/003	<ul style="list-style-type: none"> • {Means for stopping loss of drilling fluid (plastering the borehole wall E21B 33/138)} 	23/004	<ul style="list-style-type: none"> • {Indexing systems for guiding relative movement between telescoping parts of downhole tools}
21/01	<ul style="list-style-type: none"> • Arrangements for handling drilling fluids or cuttings outside the borehole, e.g. mud boxes 	23/006	<ul style="list-style-type: none"> • . {"J-slot" systems, i.e. lug and slot indexing mechanisms}
21/011	<ul style="list-style-type: none"> • . {Dust eliminating or dust removing while drilling} 	23/01	<ul style="list-style-type: none"> • for anchoring the tools or the like (E21B 23/02 - E21B 23/06 take precedence; anchoring of drives in the borehole E21B 4/18)
21/012	<ul style="list-style-type: none"> • . . {using exhaust air from the drilling motor for blowing off the dust at the borehole entrance} 	23/02	<ul style="list-style-type: none"> • 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)
21/013	<ul style="list-style-type: none"> • . . . {by liquids} 	23/03	<ul style="list-style-type: none"> • for setting the tools into, or removing the tools from, laterally offset landing nipples or pockets
21/0135	<ul style="list-style-type: none"> • {Liquid flushing installations} 	23/04	<ul style="list-style-type: none"> • operated by fluid means, e.g. actuated by explosion (E21B 23/08 takes precedence)
21/014	<ul style="list-style-type: none"> • . . . {Preventing exhaust air from the drill motor from blowing-off towards the working face} 	23/0411	<ul style="list-style-type: none"> • . {specially adapted for anchoring tools or the like to the borehole wall or to well tube}
21/015	<ul style="list-style-type: none"> • . Means engaging the bore entrance, e.g. hoods for collecting dust 	23/04115	<ul style="list-style-type: none"> • . . . {using radial pistons}
21/019	<ul style="list-style-type: none"> • . {Arrangements for maintaining circulation of drilling fluid while connecting or disconnecting tubular joints} 	23/0412	<ul style="list-style-type: none"> • . {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)}	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)
23/0414	. . {using explosives}		
23/0415	. . {using particular fluids, e.g. electro-active liquids}	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
23/0416	. . {characterised by force amplification arrangements}		
23/0417	. . {Down-hole non-explosive gas generating means, e.g. by chemical reaction}	29/002	. {Cutting, e.g. milling, a pipe with a cutter rotating along the circumference of the pipe}
23/0418	. . {specially adapted for locking the tools in landing nipples or recesses}	29/005	. . {with a radially-expansible cutter rotating inside the pipe, e.g. for cutting an annular window}
23/0419	. . {using down-hole motor and pump arrangements for generating hydraulic pressure}	29/007	. . {with a radially-retracting cutter rotating outside the pipe}
23/042	. . {using a single piston or multiple mechanically interconnected pistons}	29/02	. by explosives or by thermal or chemical means {(freeing stuck objects by explosives E21B 31/002)}
23/0421	. . {using multiple hydraulically interconnected pistons}	29/04	. Cutting of wire lines or the like (E21B 29/02 takes precedence)
23/0422	. . {characterised by radial pistons (using radial pistons for anchoring E21B 23/04115)}	29/06	. Cutting windows, e.g. directional window cutters for whipstock operations ({ E21B 29/005 and E21B 29/08 take precedence})
23/0423	. . {using step motors}	29/08	. Cutting or deforming pipes to control fluid flow
23/06	. for setting packers	29/10	. Reconditioning of well casings, e.g. straightening
23/065	. . {setting tool actuated by explosion or gas generating means}	29/12	. specially adapted for underwater installations (E21B 29/08 takes precedence)
23/08	. Introducing or running tools by fluid pressure, e.g. through-the-flow-line tool systems		
23/10	. . Tools specially adapted therefor	31/00	Fishing for or freeing objects in boreholes or wells
23/12	. . Tool diverters	31/002	. {Destroying the objects to be fished, e.g. by explosive means}
23/14	. for displacing a cable or a cable-operated tool, e.g. for logging or perforating operations in deviated wells	31/005	. {using vibrating or oscillating means}
25/00	Apparatus for obtaining or removing undisturbed cores, e.g. core barrels or core extractors (core bits E21B 10/02)	31/007	. {fishing tools with means for attaching comprising fusing or sticking}
25/005	. {Above ground means for handling the core, e.g. for extracting the core from the core barrel}	31/03	. Freeing by flushing
25/02	. the core receiver being insertable into, or removable from, the borehole without withdrawing the drilling pipe	31/035	. {controlling differential pipe sticking}
25/04	. . the core receiver having a core forming cutting edge or element, e.g. punch type core barrels	31/06	. using magnetic means
25/06	. the core receiver having a flexible liner or inflatable retaining means	31/08	. using junk baskets or the like
25/08	. Coating, freezing, consolidating cores (E21B 25/06 takes precedence); Recovering uncontaminated cores or cores at formation pressure	31/107	. using impact means for releasing stuck parts, e.g. jars
25/10	. Formed core retaining or severing means (E21B 25/06 , E21B 25/08 take precedence)	31/1075	. . {using explosives}
25/12	. . of the sliding wedge type	31/113	. . hydraulically-operated
25/14	. . mounted on pivot transverse to core axis	31/1135	. . . {Jars with a hydraulic impedance mechanism, i.e. a restriction, for initially delaying escape of a restraining fluid}
25/16	. for obtaining oriented cores	31/12	. Grappling tools, e.g. tongs or grabs
25/18	. the core receiver being specially adapted for operation under water	31/125	. . {specially adapted for parted wire line or ropes}
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	31/14	. . with means deflecting the direction of the tool, e.g. by use of knuckle joints
27/005	. {Collecting means with a strainer}	31/16	. . combined with cutting or destroying means
27/02	. Dump bailers, i.e. containers for depositing substances, e.g. cement or acids	31/18	. . gripping externally, e.g. overshot
27/04	. where the collecting or depositing means include helical conveying means	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 . . Graveling 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 CO₂ 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 (CO₂ 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