

**CPC****COOPERATIVE PATENT CLASSIFICATION****E21B**

**EARTH DRILLING, e.g. DEEP DRILLING** (mining, quarrying [E21C](#); making shafts, driving galleries or tunnels [E21D](#)); **OBTAINING OIL, GAS, WATER, SOLUBLE OR MELTABLE MATERIALS OR A SLURRY OF MINERALS FROM WELLS**

**WARNING**

The following IPC groups are not used in the CPC scheme. Subject matter covered by these groups is classified in the following CPC groups:

[E21B 1/12](#) to [E21B 1/38](#) covered by [E21B 1/00](#)

[E21B 7/08](#) covered by [E21B 7/06](#)

[E21B 11/04](#) covered by [E21B 27/00](#)

[E21B 23/12](#) covered by [E21B 23/002](#)

[E21B 31/08](#) covered by [E21B 27/00](#)

[E21B 43/22](#) covered by [C09K 8/58](#)

**Methods or apparatus for drilling****E21B 1/00**

**Percussion drilling** (drives used in the borehole [E21B 4/00](#); rotary drilling machines in general [B23B](#))

[E21B 1/02](#)

- Surface drives for percussion drilling

[E21B 1/04](#)

- • Devices for reversing the movement of the rod or cable at the surface {(not used, see [E21B 1/02](#))}

**E21B 3/00**

**Rotary drilling** (drives used in the borehole [E21B 4/00](#); rotary drilling machines in general [B23B](#))

[E21B 3/02](#)

- Surface drives for rotary drilling

[E21B 3/025](#)

- • with a to-and-fro rotation of the tool

[E21B 3/03](#)

- • with an intermittent unidirectional rotation of the tool

[E21B 3/035](#)

- • with slipping or elastic transmission

[E21B 3/04](#)

- • Rotary tables {(portable drilling rigs with rotary tables [E21B 7/021](#))}

[E21B 3/045](#)

- • • {movably mounted on the drilling structure or platform (derricks adapted to be moved on their substructure [E21B 15/003](#); specially adapted for underwater drilling, [E21B 15/02](#))}

[E21B 2003/05](#)

- • • {with a to-and-fro rotation of the drill pipe or casing}

[E21B 3/06](#)

- • • Adaptation of rotary draw works to drive rotary tables (connecting or disconnecting couplings or joints [E21B 19/16](#); rope, cable, or chain winding mechanisms, capstans [B66D](#))

**E21B 4/00**

**Drives used in the borehole**

[E21B 4/003](#)

- {Bearing, sealing, lubricating details (for roller bits [E21B 10/22](#); bearings in general [F16C](#); sealing in general [F16J](#); lubricating in general [F16N](#))}

[E21B 4/006](#)

- {Mechanical motion converting means, e.g. reduction gearings ([E21B 4/10](#) takes precedence; gearings in general [F16H](#))}

- E21B 4/02 . Fluid rotary type drives (hydraulic turbines for drilling wells [F03B 13/02](#))
- E21B 4/04 . Electric drives ([E21B 4/12](#) takes precedence)
- E21B 4/06 . Down-hole impacting means, e.g. hammers (percussion drill bits [E21B 10/36](#); boring rams [E21B 11/02](#); releasing-jars [E21B 31/107](#))
- E21B 4/08 . . impact being obtained by gravity only, e.g. with lost-motion connection
- E21B 4/10 . . continuous unidirectional rotary motion of shaft or drilling pipe effecting consecutive impacts
- E21B 4/12 . . Electrically operated hammers
- E21B 4/14 . . Fluid operated hammers
- E21B 4/145 . . . {of the self propelled-type, e.g. with a reverse mode to retract the device from the hole}
- E21B 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
- E21B 4/18 . Anchoring or feeding in the borehole
- E21B 4/20 . combined with surface drive ([E21B 4/10](#) takes precedence)
  
- E21B 6/00** **Drives for combined percussion and rotary drilling (drives used in the borehole [E21B 4/00](#))**
- E21B 6/02 . the rotation being continuous
- E21B 6/04 . . Separate drives for percussion and rotation
- E21B 6/06 . the rotation being intermittent, e.g. obtained by ratchet device
- E21B 6/08 . . Separate drives for percussion and rotation
  
- E21B 7/00** **Special methods or apparatus for drilling**
- E21B 7/001 . {Drilling a non circular hole (excavating trenches [E02F 5/02](#); cutting machines for slitting [E21C 25/00](#))}
- E21B 7/002 . {Drilling with diversely driven shafts extending into the borehole (simultaneously drilling and casing [E21B 7/20](#); plural down-hole drives [E21B 4/16](#); [E21B 7/001](#) takes precedence)}
- E21B 7/003 . {Drilling with mechanical conveying means (bailers, e.g. baskets, buckets [E21B 27/00](#); tunnelling [E21D](#))}
- E21B 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](#))}
- E21B 7/006 . . . {combined with a bucket-type container (bailers with helical conveying means [E21B 27/04](#))}
- E21B 7/007 . {Drilling by use of explosives (underwater drilling using explosives [E21B 7/1245](#); setting-tools actuated by explosives [E21B 23/04](#), [E21B 23/065](#); cutting or destroying objects in boreholes by explosives [E21B 29/02](#); freeing objects using explosives [E21B 31/1075](#); gun or shaped-charge perforators [E21B 43/116](#); fracturing by explosives [E21B 43/263](#), [E21B 43/248](#); taking samples using explosives [E21B 49/04](#))}
- E21B 7/008 . {Drilling ice or a formation covered by ice}
- E21B 7/02 . Portable drilling rigs, truck-or skid-mounted, with their own drive (portable drilling rigs for use on underwater floors [E21B 7/124](#))
- E21B 7/021 . . {With a rotary table, i.e a fixed rotary drive for a relatively advancing tool (rotary tables [E21B 3/04](#))}

- E21B 7/022 . . {Control of the drilling operation; Hydraulic or pneumatic means for activation or operation ([control circuits for drilling masts E21B 15/045](#))}
- E21B 7/023 . . {the mast being foldable or telescopically retractable}
- E21B 7/024 . . {having means for adapting to inclined terrain; having means for stabilizing the vehicle while drilling}
- E21B 7/025 . . {Rock drills, i.e. jumbo drills}
- E21B 7/026 . . {having auxiliary platforms, e.g. for observation purposes}
- E21B 7/027 . . {Drills for drilling shallow holes, e.g. for taking soil samples or for drilling postholes}
- E21B 7/028 . . . {the drilling apparatus being detachable from the vehicle, e.g. hand portable drills}
- E21B 7/04 . . Directional drilling ([derricks or masts specially adapted therefor E21B 15/04](#))
- E21B 7/043 . . {for underwater installations}
- E21B 7/046 . . {horizontal drilling ([drilling with mechanical conveying means E21B 7/003](#))}
- E21B 7/06 . . Deflecting the direction of boreholes {([directional window cutting E21B 29/06](#); [deflecting the direction of fishing tools E21B 31/14](#))}
- E21B 7/061 . . . {the tool shaft advancing relative to a guide, e.g. a curved tube or a whipstock}
- E21B 7/062 . . . {the tool shaft rotating inside a non-rotating guide travelling with the shaft ([E21B 7/067](#) and [E21B 7/068](#) take precedence)}
- E21B 7/064 . . . {specially adapted drill bits therefor}
- E21B 7/065 . . . {using oriented fluid jets}
- E21B 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}
- E21B 7/068 . . . {drilled by a down-hole drilling motor ([down-hole drives per se E21B 4/00](#), [E21B 7/067](#) takes precedence)}
- E21B 7/10 . . Correction of deflected boreholes
- E21B 7/12 . . Underwater drilling ([derricks or masts specially adapted therefor E21B 15/02](#); [telescoping joints E21B 17/07](#); [using heave compensators E21B 19/09](#))
- E21B 7/122 . . {with submersible vertically movable guide}
- E21B 7/124 . . with underwater tool drive prime mover, e.g. portable drilling rigs for use on underwater floors
- E21B 7/1245 . . . {using explosive means ([Anchors driven in by explosive charges B63B 21/28](#))}
- E21B 7/128 . . from floating support with independent underwater anchored guide base {([guide line systems E21B 41/10](#))}
- E21B 7/132 . . from underwater buoyant support
- E21B 7/136 . . from non-buoyant support ([E21B 7/124](#) takes precedence)
- E21B 7/14 . . Drilling by use of heat, e.g. flame drilling {([by use of explosives E21B 7/007](#))}
- E21B 7/143 . . {underwater}
- E21B 7/146 . . {Thermal lances}
- E21B 7/15 . . of electrically generated heat
- E21B 7/16 . . Applying separate balls or pellets by the pressure of the drill, so-called shot-drilling

- E21B 7/18
    - Drilling by liquid or gas jets, with or without entrained pellets ([E21B 7/14](#) takes precedence; {obtaining a slurry of minerals [E21B 43/29](#)}; hydraulic monitors [E21C 45/00](#))
  - E21B 7/185
    - . {underwater}
  - E21B 7/20
    - Driving or forcing casings or pipes into boreholes, e.g. sinking; Simultaneously drilling and casing boreholes (surface means for applying to-and-fro rotation movements to the casing [E21B 3/025](#); {pushing means outside of the borehole [E21B 19/08](#)}; placing piles [E02D 7/00](#); sinking shafts while moving the lining downwards [E21D 1/08](#); {making galleries by forcing prefabricated elements through the ground [E21D 9/005](#)})
  - E21B 7/201
    - . {with helical conveying means (drilling with helical conveying means [E21B 7/005](#); augers [E21B 10/44](#); drilling rods or pipes with helical structure [E21B 17/22](#))}
  - E21B 7/203
    - . . {using down-hole drives (down-hole drives per se [E21B 4/00](#))}
  - E21B 7/205
    - . {without earth removal ([E21B 7/30](#) takes precedence)}
- NOTE**
- Special methods or apparatus for drilling without earth removal  
[E21B 7/26](#)
- E21B 7/206
    - . . . {using down-hole drives (down-hole drives per se [E21B 4/00](#))}
  - E21B 7/208
    - . {using down-hole drives (down-hole drives per se [E21B 4/00](#); [E21B 7/203](#) and [E21B 7/206](#) take precedence)}
  - E21B 7/24
    - Drilling using vibrating or oscillating means, e.g. out-of-balance masses (percussion drilling [E21B 1/00](#))
  - E21B 7/26
    - Drilling without earth removal, e.g. with self-propelled burrowing devices ({[E21B 7/205](#) and} [E21B 7/30](#) take precedence; down-hole drives [E21B 4/00](#), {e.g. self-propelled fluid-operated hammers [E21B 4/145](#)})
  - E21B 7/265
    - . {Combined with earth removal}
  - E21B 7/28
    - Enlarging drilled holes, e.g. by counterboring (drill bits for enlarging the borehole [E21B 10/26](#))
  - E21B 7/30
    - . without earth removal

### **Drilling tools**

- E21B 10/00
  - **Drill bits** (specially adapted for deflecting the direction of boring [E21B 7/064](#); with means for collecting substances [E21B 27/00](#))
- E21B 10/003
  - {with cutting edges facing in opposite axial directions}
- E21B 10/006
  - {providing a cutting edge which is self-renewable during drilling}
- E21B 10/02
  - Core bits (characterised by wear resisting parts [E21B 10/46](#); obtaining undisturbed cores [E21B 25/00](#))
- E21B 10/04
  - . with core destroying means
- E21B 10/06
  - . Roller core bits
- E21B 10/08
  - Roller bits (roller core bits [E21B 10/06](#); with leading portion [E21B 10/26](#); characterised by wear resisting parts [E21B 10/46](#))
- E21B 10/083
  - . {with longitudinal axis, e.g. wobbling or nutating roller bit (longitudinal axis roller reamers [E21B 10/30](#))}

- E21B 10/086 . . {with excentric movement}
- E21B 10/10 . . with roller axle supported at both ends (with disc-cutters [E21B 10/12](#))
- E21B 10/12 . . with discs cutters
- E21B 10/14 . . combined with non-rolling cutters other than of leading-portion type
- E21B 10/16 . . characterised by tooth form or arrangement
- E21B 10/18 . . characterised by conduits or nozzles for drilling fluids (drilling fluid supply to the bearings [E21B 10/23](#))
- E21B 10/20 . . characterised by detachable or adjustable parts, e.g. legs or axles (cross axle roller bits [E21B 10/10](#))
- E21B 10/22 . . characterised by bearing, lubrication or sealing details
- E21B 2010/225 . . . {sealing details}
- E21B 10/23 . . . with drilling fluid supply to the bearings
- E21B 10/24 . . . characterised by lubricating details
- E21B 2010/243 . . . . {with drilling fluid supply to the bearing}
- E21B 10/246 . . . . {with pumping means for feeding lubricant}
- E21B 10/25 . . . characterised by sealing details
- E21B 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](#); augers with leading portion [E21B 10/44](#))
- E21B 10/28 . . with non-expansible roller cutters
- E21B 10/30 . . . Longitudinal axis roller reamers, e.g. reamer stabilisers
- E21B 10/32 . . with expansible cutting tools
- E21B 10/322 . . . {cutter shifted by fluid pressure ([E21B 10/345](#) takes precedence)}
- E21B 10/325 . . . {the cutter being shifted by a spring mechanism}
- E21B 10/327 . . . {the cutter being pivoted about a longitudinal axis ([E21B 10/34](#) takes precedence)}
- E21B 10/34 . . . of roller-cutter type
- E21B 10/345 . . . . {cutter shifted by fluid pressure}
- E21B 10/36 . . Percussion drill bits (characterised by wear resisting parts [E21B 10/46](#) {with helical conveying portion [E21B 10/445](#)})
- E21B 10/38 . . characterised by conduits or nozzles for drilling fluids
- E21B 10/40 . . with leading portion
- E21B 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 10/54](#), by conduits or nozzles for drilling fluid [E21B 10/60](#), by detachable or adjustable parts [E21B 10/62](#))
- E21B 2010/425 . . {characterised by teeth or cutter arrangement}
- E21B 10/43 . . characterised by the arrangement of teeth or other cutting elements
- E21B 10/44 . . Bits with helical conveying portion, e.g. screw type bits; Augers with leading portion or with detachable parts ({Rotary drag type drill bits [E21B 10/42](#); drilling rods with helical structure [E21B 17/22](#))
- E21B 10/445 . . {percussion type, e.g. for masonry (percussion drill bits in general [E21B 10/36](#))}

- E21B 10/46
  - characterised by wear resisting parts, e.g. diamond inserts [{\(drill bits with self-renewable cutting edge E21B 10/006\)}](#)
- E21B 10/48
  - • the bit being of core type [{\(saw cylinders having their cutting rim equipped with abrasive particles for drilling stone or glass B28D 1/041\)}](#)
- E21B 10/485
  - • • [{with inserts in form of chisels, blades or the like}](#)
- E21B 10/50
  - • the bit being of roller type
- E21B 10/52
  - • • with chisel or button type inserts
- E21B 10/54
  - • the bit being of the rotary drag type, e.g. fork-type bits
- E21B 2010/545
  - • • [{with blades having performed cutting elements mounted on a distinct support, e.g. polycrystalline inserts}](#)
- E21B 10/55
  - • • with preformed cutting elements [{with blades having preformed cutting elements mounted on a distinct support, e.g. polycrystalline inserts}](#)
- E21B 10/56
  - • Button type inserts [\(E21B 10/52 takes precedence\)](#)
- E21B 2010/561
  - • • [{Inserts with performed cutting elements mounted on a distinct support, e.g. polycrystalline inserts}](#)
- E21B 2010/562
  - • • • [{having a non planar or non circular cutting face}](#)
- E21B 2010/563
  - • • • [{having a cutting face with different segments, e.g. mosaic-type inserts}](#)
- E21B 2010/564
  - • • • [{characterised by support details}](#)
- E21B 2010/565
  - • • • • [{Interface between the substrate and the cutting element}](#)
- E21B 2010/566
  - • • • [{with chip breaking arrangements}](#)
- E21B 10/567
  - • • with preformed cutting elements mounted on a distinct support, e.g. polycrystalline inserts
- E21B 10/5673
  - • • • [{having a non planar or non circular cutting face}](#)
- E21B 10/5676
  - • • • [{having a cutting face with different segments, e.g. mosaic-type inserts}](#)
- E21B 10/573
  - • • • characterised by support details
- E21B 10/5735
  - • • • • [{Interface between the substrate and the cutting element}](#)
- E21B 10/58
  - • Chisel type inserts [\({E21B 10/485,} E21B 10/52, E21B 10/54 take precedence\)](#)
- E21B 10/60
  - characterised by conduits or nozzles for drilling fluids [\(for roller bits E21B 10/18; for percussion drill bits E21B 10/38; {mining picks with arrangement of fluid-spraying nozzles E21C 35/187}\)](#)
- E21B 10/602
  - • [{the bit being a rotary drag type bit with blades}](#)
- E21B 10/605
  - • [{the bit being a core-bit}](#)
- E21B 2010/607
  - • [{characterised by the nozzle structure}](#)
- E21B 10/61
  - • characterised by the nozzle structure
- E21B 10/62
  - characterised by parts, e.g. cutting elements, which are detachable or adjustable [\(E21B 10/64 takes precedence; for roller bits E21B 10/20; {for rotary drag type drill bits E21B 10/42}; for augers E21B 10/44\)](#)
- E21B 2010/622
  - • [{with plural separable cutter elements}](#)
- E21B 2010/624
  - • • [{independently attachable}](#)
- E21B 10/627
  - • with plural detachable cutting elements
- E21B 10/633
  - • • independently detachable

- E21B 10/64
  - characterised by the whole or part thereof being insertable into or removable from the borehole without withdrawing the drilling pipe ([retrievable core receivers E21B 25/02](#))
- E21B 10/66
  - . the cutting element movable through the drilling pipe and laterally shiftable
- E21B 11/00**
**Other drilling tools {(boring grabs [E21B 27/00](#))}**
- E21B 11/005
  - {[Hand operated drilling tools](#)}
- E21B 11/02
  - Boring rams ([percussion drives used in the borehole E21B 4/06](#); [percussion drill bits E21B 10/36](#))
- E21B 11/06
  - with driven cutting chains or similarly driven tools
- E21B 12/00**
**Accessories for drilling tools {(connecting and disconnecting drill bit and drilling pipe [E21B 19/18](#); sharpening stone drill bits [B24B 3/33](#))}**
- E21B 12/02
  - Wear indicators
- E21B 12/04
  - Drill bit protectors
- E21B 12/06
  - Mechanical cleaning devices

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

- E21B 15/00**
**Derricks; Masts; {Other supports (drill rigs with movable understructures [E21B 7/02](#))}**
- E21B 15/003
  - {[adapted to be moved on their substructure, e.g. with skidding means; adapted to drill a plurality of wells \(slant-hole rigs \[E21B 15/04\]\(#\)\)](#)}
- E21B 15/006
  - {[Means for anchoring the drilling machine to the ground](#)}
- E21B 15/02
  - specially adapted for underwater drilling ([E21B 15/04 takes precedence](#); [floating drilling platforms B63B 35/44](#); [drilling platforms on legs E02B 17/00](#); {with skidding means [E21B 15/003](#)})
- E21B 15/04
  - specially adapted for directional drilling, e.g. slant hole rigs {(with skidding means [E21B 15/003](#))}
- E21B 15/045
  - . {[Hydraulic, pneumatic or electric circuits for their positioning](#)}
- E21B 17/00**
**Drilling rods or pipes; Flexible drill strings; Kellies; Drill collars; Sucker rods; {Cables}; Casings; Tubings (rod couplings in general [F16D](#); tubes or tube couplings in general [F16L](#))**
- E21B 17/003
  - {[with electrically conducting or insulating means \(\[E21B 17/028\]\(#\) and \[E21B 17/023 take precedence\]\(#\)\)](#)}
- E21B 17/006
  - {[Accessories for drilling pipes, e.g. cleaners \(wear protectors \[E21B 17/10\]\(#\); handling drilling pipes \[E21B 19/00\]\(#\); thread protectors \[B65D 59/00\]\(#\)\)](#)}
- E21B 17/01
  - Risers ({[connections between riser sections E21B 17/085](#); supporting a riser from a drilling or production platform [E21B 19/004](#); riser connectors {on well heads} [E21B 33/038](#))
- E21B 17/012
  - . {[with buoyancy elements \(\[E21B 17/015 takes precedence\]\(#\)\)](#)}
- E21B 17/015
  - . {[Non-vertical risers, e.g. articulated or catenary-type](#)}
- E21B 17/017
  - . {[Bend restrictors for limiting stress on risers](#)}
- E21B 17/02
  - Couplings; joints {([Expandable couplings or joints \[E21B 43/106\]\(#\)](#))}



- E21B 17/021 . . {Devices for subsurface connecting or disconnecting by rotation (connecting or disconnecting pipe couplings or joints [E21B 19/16](#); fishing tools for frozen rods, casings, ropes, bits or the like [E21B 31/00](#))}
- E21B 17/023 . . {Arrangements for connecting cables or wirelines to downhole devices}
- E21B 17/025 . . . {Side entry subs}
- E21B 17/026 . . . {Arrangements for fixing cables or wirelines to the outside of downhole devices (protectors and centralisers for cables and control lines [E21B 17/1035](#))}
- E21B 17/028 . . {Electrical or electro-magnetic connections}
- E21B 17/03 . . between drilling rod or pipe and drill motor, e.g. between drilling rod and hammer
- E21B 17/04 . . between rod {or the like} and bit or between rod and rod {or the like}
- E21B 17/042 . . . threaded {(readily releasing joints [E21B 17/06](#))}
- E21B 17/0423 . . . . {with plural threaded sections, e.g. with two-step threads}
- E21B 17/0426 . . . . {with a threaded cylindrical portion, e.g. for percussion rods}
- E21B 17/043 . . . . with locking means
- E21B 17/046 . . . with ribs, pins or jaws, and complementary grooves or the like, e.g. bayonet catches
- E21B 17/05 . . . Swivel joints
- E21B 17/06 . . . Releasing-joints, e.g. safety joints
- E21B 17/07 . . . Telescoping joints for varying drill string lengths; Shock absorbers (heave compensators in the derrick [E21B 19/09](#); releasing-jars [E21B 31/107](#); {shock-absorbers in general [F16F](#)})
- E21B 17/073 . . . . {with axial rotation}
- E21B 17/076 . . . . {between rod or pipe and drill bit}
- E21B 17/08 . . Casing joints
- E21B 17/085 . . . {Riser connections (connectors for wellhead [E21B 33/038](#))}
- E21B 17/10 . . Wear protectors; Centralising devices, {e.g. stabilisers} (drives used in the borehole with anchoring means [E21B 4/18](#); guiding or centralising devices outside the borehole [E21B 19/24](#))
- E21B 17/1007 . . {for the internal surface of a pipe, e.g. wear bushings for underwater well-heads}
- E21B 17/1014 . . {Flexible or expansible centering means, e.g. with pistons pressing against the wall of the well ([E21B 17/1042](#) takes precedence)}
- E21B 17/1021 . . . {with articulated arms or arcuate springs (measuring the diameter [E21B 47/08](#))}
- E21B 17/1028 . . . . {with arcuate springs only, e.g. baskets with outwardly bowed strips for cementing operations}
- E21B 17/1035 . . {for plural rods, pipes or lines, e.g. for control lines}
- E21B 17/1042 . . {Elastomer protector or centering means}
- E21B 17/105 . . . {split type}
- E21B 17/1057 . . {Centralising devices with rollers or with a relatively rotating sleeve ([E21B 17/1014](#) takes precedence)}
- E21B 17/1064 . . . {Pipes or rods with a relatively rotating sleeve}



- E21B 17/1071 . . {specially adapted for pump rods, e.g. sucker rods}
- E21B 17/1078 . . {Stabilisers or centralisers for casing, tubing or drill pipes (devices for off-center positioning [E21B 17/10](#); [E21B 17/1007](#) to [E21B 17/1064](#) take precedence)}
- E21B 17/1085 . . {Wear protectors; Blast joints; Hard facing (wear protection included in centralising devices, see relevant subgroups)}
- E21B 17/1092 . . {Gauge section of drill bits}
- E21B 17/12 . . Devices for placing or drawing out wear protectors
- E21B 17/14 . Casing shoes {for the protection of the bottom of the casing}
- E21B 17/16 . Drill collars
- E21B 17/18 . Pipes provided with plural fluid passages ({[E21B 17/203](#) takes precedence;} circulation of drilling fluid by means of such pipes [E21B 21/12](#); {general [F16L 39/00](#)})
- E21B 17/20 . Flexible or articulated drilling pipes, {e.g. flexible or articulated rods, pipes or cables (risers [E21B 17/01](#); swivel joints [E21B 17/05](#))}
- E21B 17/203 . . {with plural fluid passages}
- E21B 17/206 . . {with conductors, e.g. electrical, optical (hoses with electrically conducting means in general [F16L 11/127](#))}
- E21B 17/22 . Rods or pipes with helical structure (drill bits with helical conveying portion [E21B 10/44](#))
  
- E21B 19/00 Handling rods, casings, tubes or the like outside the borehole, e.g. in the derrick (surface drives [E21B 1/02](#), [E21B 3/02](#))**
- E21B 19/002 . {specially adapted for underwater drilling ([E21B 19/09](#), [E21B 19/143](#) take precedence; risers with buoyancy elements [E21B 17/012](#), [E21B 17/015](#))}
- E21B 19/004 . . {supporting a riser from a drilling or production platform}
- E21B 19/006 . . . {including heave compensators}
- E21B 19/008 . {Winding units, specially adapted for drilling operations (capstans, winches [B66D](#); cathead actuated pipe wrenches or spinners [E21B 19/162](#))}
- E21B 19/02 . Rod or cable suspensions (load-engaging elements for hoisting or lowering purposes in general [B66C 1/00](#); Crown blocks or pulley blocks [B66D](#); cable guides [B66D 1/36](#))
- E21B 19/04 . . Hooks
- E21B 19/06 . . Elevators, i.e. rod or tube gripping devices
- E21B 19/07 . . . Slip-type elevators (slips [E21B 19/10](#))
- E21B 19/08 . Apparatus for feeding the rods or cables ([E21B 19/22](#) takes precedence; automatic feed [E21B 44/02](#); hoisting drums [B66D](#)); Apparatus for increasing or decreasing the pressure on the drilling tool; Apparatus for counterbalancing the weight of the rods
- E21B 19/081 . . Screw-and-nut feed mechanisms
- E21B 19/083 . . Cam, rack or like feed mechanisms
- E21B 19/084 . . with flexible drawing means, e.g. cables
- E21B 19/086 . . with a fluid-actuated cylinder ([E21B 19/084](#), [E21B 19/087](#), [E21B 19/09](#) take precedence)
- E21B 19/087 . . by means of a swinging arm

- E21B 19/089
  - with a spring or an additional weight
- E21B 19/09
  - specially adapted for drilling underwater formations from a floating support using heave compensators supporting the drill string ([drilling-pipe telescoping joints E21B 17/07](#); {heave compensators for supporting a riser [E21B 19/006](#)})
- E21B 19/10
  - Slips; Spiders; {[Catching devices](#) (rotary tables with master bushing or kelly bushing [E21B 3/04](#); slip-type elevators [E21B 19/07](#); casing heads with slips [E21B 33/0422](#))}
- E21B 19/12
  - Rope clamps ([rope clamps in general F16G 11/00](#) ) {rod, casings or tube clamps not secured to elevators}
- E21B 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; {storing elongated articles in general [B65G 1/0442](#)})
- E21B 19/143
  - {specially adapted for underwater drilling}
- E21B 19/146
  - {Carousel systems, i.e. rotating rack systems}
- E21B 19/15
  - Racking of rods in horizontal position; Handling between horizontal and vertical position
- E21B 19/155
  - {Handling between horizontal and vertical position}
- E21B 19/16
  - Connecting or disconnecting pipe couplings or joints ([E21B 19/20](#) takes precedence; Pipe wrenches or the like [B25B](#))
- E21B 19/161
  - {using a wrench or a spinner adapted to engage a circular section of pipe ([E21B 19/168](#) takes precedence)}
- E21B 19/162
  - {cathead actuated}
- E21B 19/163
  - {piston-cylinder actuated}
- E21B 19/164
  - {motor actuated ([E21B 19/162](#) and [E21B 19/163](#) take precedence)}
- E21B 19/165
  - {Control or monitoring arrangements therefor}
- E21B 19/166
  - {Arrangements of torque limiters or torque indicators}
- E21B 19/167
  - {using a wrench adapted to engage a non circular section of pipe, e.g. a section with flats or splines}
- E21B 19/168
  - {using a spinner with rollers or a belt adapted to engage a well pipe}
- E21B 19/18
  - Connecting or disconnecting drill bit and drilling pipe
- E21B 19/20
  - Combined feeding from rack and connecting, e.g. automatically
- E21B 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](#))}
- E21B 19/24
  - Guiding or centralising devices for drilling rods or pipes
- E21B 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](#); well drilling compositions [C09K 8/02](#))
- E21B 21/001
  - {specially adapted for underwater drilling}
- E21B 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](#))}
- E21B 21/003
  - {Means for stopping loss of drilling fluid (plastering the borehole wall [E21B 33/138](#))}

- E21B 2021/005 . {using gaseous fluids}
- E21B 2021/006 . {Underbalanced techniques, i.e. where borehole fluid pressure is below formation pressure}
- E21B 2021/007 . {Arrangements for handling drilling fluids or cuttings outside the borehole, e.g. mud boxes}
- E21B 2021/008 . . {Means engaging the bore entrance, e.g. hoods for collecting dust}
- E21B 21/01 . Arrangements for handling drilling fluids or cuttings outside the borehole, e.g. mud boxes ({swivel joints in hose-lines [E21B 21/02](#);} arrangements for treating drilling fluids [E21B 21/06](#); {waste disposal systems [E21B 41/005](#)})
- E21B 21/012 . . {using exhaust air from the drilling motor for blowing off the dust at the borehole entrance}
- E21B 21/015 . . Means engaging the bore entrance, e.g. hoods for collecting dust
- E21B 21/02 . Swivel joints in hose-lines {(hose connections in general [F16L 31/00](#), [F16L 33/00](#))}
- E21B 21/06 . Arrangements for treating drilling fluids outside the borehole (treating steps per se, see the relevant subclasses)
- E21B 2021/061 . . {for treating dust-loaded gaseous fluids}
- E21B 21/062 . . {by mixing components}
- E21B 21/063 . . {by separating components}
- E21B 21/065 . . . {Separating solids from drilling fluids}
- E21B 21/066 . . . . {with further treatment of the solids, e.g. for disposal}
- E21B 21/067 . . . {Separating gases from drilling fluids}
- E21B 21/068 . . {using chemical treatment}
- E21B 21/07 . . for treating dust-laden gaseous fluids
- E21B 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](#))
- E21B 21/10 . Valve arrangements in drilling fluid circulation systems (valves in general [F16K](#))
- E21B 21/103 . . {Down-hole by-pass valve arrangements, i.e. between the inside of the drill string and the annulus}
- E21B 21/106 . . {Valve arrangements outside the borehole, e.g. kelly valves}
- E21B 21/12 . using drilling pipes with plural fluid passages, e.g. closed circulation systems (pipes with plural fluid passages [E21B 17/18](#))
- E21B 21/14 . using liquids and gases, e.g. foams
- E21B 21/16 . using gaseous fluids ([E21B 21/14](#) takes precedence; arrangements for handling drilling fluids outside the borehole [E21B 21/01](#); arrangements for treating drilling fluids [E21B 21/06](#))
- E21B 21/18 . Preventing exhaust air from the drill motor from blowing-off towards the working face
  
- E21B 23/00** **Apparatus for displacing, setting, locking, releasing, or removing tools, packers or the like in the boreholes or wells (setting of casings, screens or liners [E21B 43/10](#))**
- E21B 23/002 . {Tool diverters, e.g. for through-the-flow line tool systems or for wire-line tools ([E21B 23/03](#) takes precedence; for drilling [E21B 7/06](#))}

- E21B 23/004 . {Indexing systems for guiding relative movement between telescoping parts of downhole tools}
- E21B 23/006 . . {"J-slot" systems, i.e. lug and slot indexing mechanisms}
- E21B 2023/008 . {Self propelling system or apparatus, e.g. for moving tools within the horizontal portion of a borehole}
- E21B 23/01 . for anchoring the tools or the like ([E21B 23/02](#) to [E21B 23/06](#) take precedence; anchoring of drives in the borehole [E21B 4/18](#); {packers [E21B 33/12](#)})
- E21B 23/02 . for locking the tools or the like in landing nipples or in recesses between adjacent sections of tubing ([E21B 23/03](#) to [E21B 23/06](#) take precedence)
- E21B 23/03 . for setting the tools into, or removing the tools from, laterally offset landing nipples or pockets
- E21B 23/04 . operated by fluid means, e.g. actuated by explosion ([E21B 23/06](#), [E21B 23/08](#) take precedence)
- E21B 23/06 . for setting packers
- E21B 23/065 . . {setting tool actuated by explosion or gas generating means}
- E21B 23/08 . Introducing or running tools by fluid pressure, e.g. through-the-flow-line tool systems ({tool diverters [E21B 23/002](#)}; special provisions on heads therefor [E21B 33/068](#); cementing plugs [E21B 33/16](#); scrapers operated by fluid pressure [E21B 37/04](#))
- E21B 23/10 . . Tools specially adapted therefor
- E21B 23/14 . for displacing a cable or cable-operated tool, e.g. for logging or perforating operations in deviated wells ({side entry sub [E21B 17/025](#); control line protectors [E21B 17/1035](#)}; by fluid pressure [E21B 23/08](#); provision on well heads for introducing or removing cable-operated tools [E21B 33/072](#), [E21B 33/076](#))
  
- E21B 25/00** **Apparatus for obtaining or removing undisturbed cores, e.g. core barrels, core extractors** (core bits [E21B 10/02](#); using explosives or projectiles in boreholes [E21B 49/04](#); side-wall sampling or coring [E21B 49/06](#))
- E21B 25/005 . {Above ground means for handling the core, e.g. for extracting the core from the core barrel}
- E21B 25/02 . the core receiver being insertable into, or removable from, the borehole without withdrawing the drilling pipe (retrievable drill bits [E21B 10/64](#))
- E21B 25/04 . . the core receiver having a core forming cutting edge or element, e.g. punch type core barrels
- E21B 25/06 . the core receiver having a flexible liner or inflatable retaining means
- E21B 25/08 . Coating, freezing, consolidating cores ([E21B 25/06](#) takes precedence); Recovering uncontaminated cores or cores at formation pressure
- E21B 25/10 . Formed core retaining or severing means ([E21B 25/06](#), [E21B 25/08](#) take precedence)
- E21B 25/12 . . of the sliding wedge type
- E21B 25/14 . . mounted on pivot transverse to core axis
- E21B 25/16 . for obtaining oriented cores
- E21B 25/18 . the core receiver being specially adapted for operation under water

- E21B 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
- E21B 27/005 . {Collecting means with a strainer}
- E21B 27/02 . Dump bailers, i.e. containers for depositing substances, e.g. cement or acids
- E21B 27/04 . where the collecting or depositing means including helical conveying means {(drilling with helical conveying means combined with bucket-type container [E21B 7/006](#))}
- E21B 28/00** Vibration generating arrangements for boreholes or wells, e.g. for stimulating production (for drilling [E21B 7/24](#); {for fishing for or freeing objects [E21B 31/005](#)}; for transmitting measuring-signals [E21B 47/14](#); for geophysical measurements [G01V 1/02](#))
- WARNING**
- Group [E21B 28/00](#) is not complete. See also [E21B 43/003](#)
- E21B 29/00** Cutting or destroying pipes, packers, plugs, or wire lines, located in boreholes or wells, e.g. cutting of damaged pipes, of windows (perforators [E21B 43/11](#)); Deforming of pipes in boreholes or wells; Reconditioning of well casings while in the ground {(by enlarging drilled holes or counterboring [E21B 7/28](#))}
- E21B 29/002 . {Cutting, e.g. milling, a pipe with a cutter rotating along the circumference of the pipe}
- E21B 29/005 . . {with a radially-expansible cutter rotating inside the pipe, e.g. for cutting an annular window}
- E21B 29/007 . . {with a radially-retracting cutter rotating outside the pipe}
- E21B 29/02 . by explosives or by thermal or chemical means ({freeing stuck objects by explosives [E21B 31/002](#)}; destroying objects in boreholes or wells by explosives [E21B 31/16](#))
- E21B 29/04 . Cutting of wire lines or the like ([E21B 29/02](#) takes precedence)
- E21B 29/06 . Cutting windows, e.g. directional window cutters for whipstock operations ({[E21B 29/005](#) and} [E21B 29/08](#) take precedence {; whipstocks [E21B 7/061](#)})
- E21B 29/08 . Cutting or deforming pipes to control fluid flow (shear type blow-out preventers [E21B 33/063](#))
- E21B 29/10 . Reconditioning of well casings, e.g. straightening
- E21B 29/12 . specially adapted for underwater installations ([E21B 29/08](#) takes precedence)
- E21B 31/00** Fishing for or freeing objects in boreholes or wells ({using junk baskets or the like [E21B 27/00](#)}; provisions on well heads for introducing or removing objects [E21B 33/068](#); Locating or determining the position of objects in boreholes or wells [E21B 47/09](#))
- E21B 31/002 . {Destroying the objects to be fished, e.g. by explosive means (cutting by explosives [E21B 29/02](#))}
- E21B 31/005 . {using vibrating or oscillating means (vibration generating arrangements for boreholes or wells [E21B 28/00](#))}
- E21B 31/007 . {fishing tools with means for attaching comprising fusing or sticking}

- E21B 31/03 . Freeing by flushing; {Controlling differential pipe sticking}
- E21B 31/06 . using magnetic means
- E21B 31/107 . using impact means for releasing stuck parts, e.g. jars (telescoping joints [E21B 17/07](#))
- E21B 31/1075 . . {using explosives}
- E21B 31/113 . . hydraulically-operated
- E21B 31/1135 . . . {Jars with a hydraulic impedance mechanism, i.e. a restriction, for initially delaying escape of a restraining fluid}
- E21B 31/12 . Grappling tools, e.g. tongs or grabs
- E21B 31/125 . . {specially adapted for parted wire line or ropes}
- E21B 31/14 . . with means deflecting the direction of the tool, e.g. by use of knuckle joints (apparatus for deflecting the boring [E21B 7/06](#))
- E21B 31/16 . . combined with cutting or destroying means (cutting or destroying means per se [E21B 29/00](#))
- E21B 31/18 . . gripping externally, e.g. overshot
- E21B 31/20 . . gripping internally, e.g. fishing spears
  
- E21B 33/00 Sealing or packing boreholes or wells**
- E21B 2033/005 . {Sealings characterised by their shape}
- E21B 33/02 . Surface sealing or packing
- E21B 33/03 . . Well heads; Setting-up thereof (valve arrangements therefor [E21B 34/02](#))
- E21B 33/035 . . . specially adapted for underwater installations ([E21B 33/043](#), [E21B 33/064](#), [E21B 33/076](#) take precedence)
- E21B 33/0355 . . . . {Control systems, e.g. hydraulic, pneumatic, electric, acoustic, for submerged well heads}
- E21B 33/037 . . . . Protective housing therefor
- E21B 33/0375 . . . . . {Corrosion protection means (in general [C23F](#))}
- E21B 33/038 . . . . Connectors used on well heads, e.g. for connecting blow-out preventer and riser (connecting a production flow-line to an underwater well head [E21B 43/013](#))
- E21B 33/0385 . . . . . {electrical connectors (underwater electrical connections in general [H01R 13/523](#))}
- E21B 33/04 . . . Casing heads; Suspending casings or tubings in well heads (setting of casings in wells [E21B 43/10](#))
- E21B 33/0407 . . . . {with a suspended electrical cable}
- E21B 33/0415 . . . . {rotating or floating support for tubing or casing hanger}
- E21B 33/0422 . . . . {a suspended tubing or casing being gripped by a slip or an internally serrated member (slips in rotary table [E21B 19/10](#))}
- E21B 33/043 . . . . specially adapted for underwater well heads ({[E21B 33/0407](#),} [E21B 33/047](#) take precedence)
- E21B 33/047 . . . . for plural tubing strings
- E21B 33/05 . . . . Cementing-heads, e.g. having provision for introducing cementing plugs



- E21B 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](#); valves [E21B 34/00](#))}
- E21B 33/061 . . . . {Ram-type blow-out preventers, e.g. with pivoting rams}
- E21B 33/062 . . . . . {with sliding rams}
- E21B 33/063 . . . . . {for shearing drill pipes (cutting of wireline [E21B 29/04](#); cutting pipes [E21B 29/08](#))}
- E21B 33/064 . . . . specially adapted for underwater well heads (connectors therefor [E21B 33/038](#); {control systems for submerged well-heads [E21B 33/0355](#))}
- E21B 33/068 . . . having provision for introducing objects or fluids into, or removing objects from, wells (cementing heads [E21B 33/05](#); {wipers, oil savers [E21B 33/08](#))}
- E21B 33/072 . . . . for cable-operated tools ([E21B 33/076](#) takes precedence)
- E21B 33/076 . . . . specially adapted for underwater installations
- E21B 33/08 . . Wipers; Oil savers
- E21B 33/085 . . . {Rotatable packing means, e.g. rotating blow-out preventers}
- E21B 33/10 . in the borehole {(sealing the junction between main bore and laterals [E21B 41/0042](#))}
- E21B 2033/105 . . {characterised by sealing the junction between a lateral and a main bore}
- E21B 33/12 . . Packers; Plugs {(locking packers or plugs in landing nipples [E21B 23/02](#)); used for cementing [E21B 33/134](#), [E21B 33/16](#)}
- E21B 33/1204 . . . {permanent; drillable}
- E21B 33/1208 . . . {characterised by the construction of the sealing or packing means ([E21B 33/1277](#) takes precedence)}
- E21B 33/1212 . . . . {including a metal-to-metal seal element}
- E21B 33/1216 . . . . {Anti-extrusion means, e.g. means to prevent cold flow of rubber packing}
- E21B 33/122 . . . Multiple string packers
- E21B 33/124 . . . Units with longitudinally-spaced plugs for isolating the intermediate space
- E21B 33/1243 . . . . {with inflatable sleeves}
- E21B 33/1246 . . . . . {inflated by down-hole pumping means operated by a pipe string}
- E21B 33/126 . . . with fluid-pressure-operated elastic cup or skirt ([E21B 33/122](#), [E21B 33/124](#) take precedence)
- E21B 33/1265 . . . . {with mechanical slips}
- E21B 33/127 . . . with inflatable sleeve ([E21B 33/122](#), [E21B 33/124](#) take precedence)
- E21B 33/1272 . . . . {inflated by down-hole pumping means operated by a pipe string}
- E21B 33/1275 . . . . {inflated by down-hole pumping means operated by a down-hole drive}
- E21B 33/1277 . . . . {characterised by the construction or fixation of the sleeve}
- E21B 33/128 . . . with a member expanded radially by axial pressure ([E21B 33/122](#), [E21B 33/124](#), {[E21B 33/129](#)} take precedence; {characterised by the construction of the sealing means [E21B 33/1208](#))}
- E21B 33/1285 . . . . {by fluid pressure}



- E21B 33/129 . . . with mechanical slips for hooking into the casing ([E21B 33/122](#), [E21B 33/124](#) take precedence)
- E21B 33/1291 . . . . {anchor set by wedge or cam in combination with frictional effect, using so-called drag-blocks ([E21B 33/1295](#) takes precedence)}
- E21B 33/1292 . . . . . {with means for anchoring against downward and upward movement}
- E21B 33/1293 . . . . . {with means for anchoring against downward and upward movement ([E21B 33/1291](#), [E21B 33/1295](#) take precedence)}
- E21B 33/1294 . . . . . {characterised by a valve, e.g. a by-pass valve}
- E21B 33/1295 . . . . . actuated by fluid pressure
- E21B 33/12955 . . . . . {using drag blocks frictionally engaging the inner wall of the well}
- E21B 33/13 . . Methods or devices for cementing, for plugging holes, crevices, or the like (dump bailers [E21B 27/02](#); {methods or apparatus for grouting offshore structures [E02B 17/0008](#)} chemical compositions therefor [C09K 8/00](#))
- E21B 33/134 . . . Bridging plugs {(packers [E21B 33/12](#))}
- E21B 33/136 . . . Baskets, e.g. of umbrella type
- E21B 33/138 . . . Plastering the borehole wall; Injecting into the formations {(packers [E21B 33/12](#); consolidation of loose sand or the like round the wells without excessively decreasing the permeability thereof [E21B 43/025](#), compositions therefor [C09K 8/56](#))}
- E21B 33/14 . . . for cementing casings into boreholes {(using special cement compositions [C09K 8/42](#); control of cementation quality or level [E21B 47/0005](#))}
- E21B 33/143 . . . . {for underwater installations}
- E21B 33/146 . . . . {Stage cementing, i.e. discharging cement from casing at different levels}
- E21B 33/16 . . . . using plugs for isolating cement charge; Plugs therefor {(spacer compositions [C09K 8/424](#); stage cementing [E21B 33/146](#))}
  
- E21B 34/00** **Valve arrangements for boreholes or wells** (in drilling fluid circulation systems [E21B 21/10](#); {tool diverters [E21B 23/002](#); } blow-out preventers [E21B 33/06](#); oil flow regulating apparatus [E21B 43/12](#); valves in general [F16K](#))
- E21B 2034/002 . {Ball valves}
- E21B 2034/005 . {Flapper valves}
- E21B 2034/007 . {Sleeve valves}
- E21B 34/02 . in well heads
- E21B 34/04 . . in underwater well heads
- E21B 34/045 . . . {adapted to be lowered on a tubular string into position within a blow-out preventer stack, e.g. so-called test trees}
- E21B 34/06 . in wells
- E21B 34/063 . . {Valve or closure with destructible element, e.g. frangible disc ([E21B 34/103](#) takes precedence)}
- E21B 34/066 . . {electrically actuated}
- E21B 34/08 . . responsive to flow or pressure of the fluid obtained ([E21B 34/10](#) takes precedence)
- E21B 34/085 . . . {with time-delay systems, e.g. hydraulic impedance mechanisms}

- E21B 34/10
  - . . operated by control fluid supplied from above ground ({by a dropped ball or piston [E21B 34/14](#);} above-ground control means [E21B 34/16](#))
- E21B 34/101
  - . . . {with means for equalizing fluid pressure above and below the valve}
- E21B 34/102
  - . . . {with means for locking the closing element in open or closed position ([E21B 34/105](#) and [E21B 34/108](#) take precedence)}
- E21B 34/103
  - . . . . {with a shear pin}
- E21B 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}
- E21B 34/106
  - . . . . {the retrievable element being a secondary control fluid actuated valve landed into the bore of a first inoperative control fluid actuated valve}
- E21B 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)}
- E21B 34/108
  - . . . {with time delay systems, e.g. hydraulic impedance mechanisms}
- E21B 34/12
  - . . operated by movement of casings or tubings
- E21B 34/125
  - . . . {with time delay systems, e.g. hydraulic impedance mechanisms}
- E21B 34/14
  - . . operated by movement of tools, e.g. sleeve valves operated by pistons or wire line tools ({[E21B 34/066](#) takes precedence})
- E21B 34/16
  - Above-ground control means therefor {(control systems for submerged well heads [E21B 33/0355](#))}
  
- E21B 35/00**

**Methods or apparatus for preventing or extinguishing fires** (cutting or deforming pipes to control fluid flow [E21B 29/08](#); controlling flow of fluid to or in wells [E21B 43/12](#); fire fighting in general [A62C](#), [A62D](#))
  
- E21B 36/00**

**Heating, cooling, insulating arrangements for boreholes or wells, e.g. for use in permafrost zones** (drilling by use of heat [E21B 7/14](#); secondary recovery methods using heat [E21B 43/24](#))
- E21B 36/001
  - {Cooling arrangements}
- E21B 36/003
  - {Insulating arrangements}
- E21B 36/005
  - {Heater surrounding production tube}
- E21B 36/006
  - {Combined heating and pumping means}
- E21B 36/008
  - {using chemical heat generating means}
- E21B 36/02
  - using burners
- E21B 36/025
  - . . {the burners being above ground or outside the bore hole}
- E21B 36/04
  - using electrical heaters
  
- E21B 37/00**

**Methods or apparatus for cleaning boreholes or wells** ([E21B 21/00](#) takes precedence; {bailers [E21B 27/00](#);} cleaning pipes in general [B08B 9/02](#))
- E21B 37/02
  - Scrapers specially adapted therefor
- E21B 37/04
  - . . operated by fluid pressure, e.g. free-piston scrapers (operating other tools by fluid pressure [E21B 23/08](#))
- E21B 37/045
  - . . . {Free-piston scrapers}
- E21B 37/06
  - using chemical means for preventing, limiting {or eliminating} the deposition of paraffins or like substances (chemical compositions therefor [C09K 8/52](#))

- E21B 37/08
  - cleaning in situ of down-hole filters, screens, {e.g. casing perforations,} or gravel packs ([E21B 37/06](#) takes precedence)
- E21B 37/10
  - Well swabs {(pistons in general [F16J](#))}
- E21B 40/00**      **Tubing catchers, automatically arresting the fall of oil-well tubing {(preventing small objects from falling into the borehole [E21B 41/0021](#))}**
- E21B 41/00**      **Equipment or details not covered by groups [E21B 15/00](#) to [E21B 40/00](#)**
- E21B 41/0007
  - {for underwater installations ([E21B 41/005](#), [E21B 41/04](#), [E21B 41/06](#), [E21B 41/08](#), [E21B 41/10](#) take precedence)}
- E21B 41/0014
  - . {Underwater well locating or reentry systems}
- E21B 41/0021
  - {Safety devices, e.g. for preventing small objects from falling into the borehole}
- E21B 2041/0028
  - {Fuzzy logic, artificial intelligence, neural networks, or the like}
- E21B 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 (whipstocks [E21B 7/061](#); tool diverters [E21B 23/002](#); cutting casing windows [E21B 29/06](#); specific well pattern [E21B 43/30](#))}
- E21B 41/0042
  - . {characterised by sealing the junction between a lateral and a main bore}
- E21B 41/005
  - {Waste disposal systems (treatment of drilling fluid outside the borehole [E21B 21/06](#); collecting oil or the like from a submerged leakage [E21B 43/0122](#))}
- E21B 41/0057
  - . {Disposal of a fluid by injection into a subterranean formation}
- E21B 41/0064
  - . . {Carbon dioxide sequestration (storing fluids in porous layers [B65G 5/005](#))}
- E21B 41/0071
  - . {Adaptation of flares, e.g. arrangements of flares in offshore installations (flares of waste gases or noxious gases [F23G 7/08](#))}
- E21B 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](#); nozzles in general [B05B](#))}
- E21B 41/0085
  - {Adaptations of electric power generating means for use in boreholes (generation of electric power per se [H02](#))}
- E21B 41/0092
  - {Methods relating to program engineering, design or optimisation}
- E21B 41/02
  - in situ inhibition of corrosion in boreholes or wells (dump bailers [E21B 27/02](#); chemical compositions therefor [C09K 8/54](#); inhibiting corrosion in general [C23F](#))
- E21B 41/04
  - Manipulators for underwater operations, e.g. temporarily connected to well heads (manipulators in general [B25J](#))
- E21B 41/06
  - Work chambers for underwater operations, e.g. temporarily connected to well heads (in general [B63C 11/00](#))
- E21B 41/08
  - Underwater guide bases, e.g. drilling templates; Levelling therefor
- WARNING**  
  
This group was introduced in January 2000. Patent documents are continuously being reclassified to this group from groups [E21B 7/12](#), [E21B 33/035](#), [E21B 43/017](#)
- E21B 41/10
  - Guide posts, e.g. releasable; Attaching guide lines to underwater guide bases

**Obtaining fluids from wells**

<b>E21B 43/00</b>	<b>Methods or apparatus for obtaining oil, gas, water, soluble or meltable materials or a slurry of minerals from wells</b> (applicable only to water <a href="#">E03B</a> ; obtaining oil-bearing deposits or soluble or meltable materials by mining techniques <a href="#">E21C 41/00</a> ; pumps <a href="#">F04</a> )
E21B 43/003	<ul style="list-style-type: none"> <li>• {Vibrating earth formations (vibration generating arrangements for boreholes or wells <a href="#">E21B 28/00</a>)}</li> </ul>
E21B 43/006	<ul style="list-style-type: none"> <li>• {Production of coal-bed methane (<a href="#">E21B 43/243</a> takes precedence; methods or devices for drawing-off gases for safety purposes in mines <a href="#">E21F 7/00</a>)}</li> </ul>
E21B 43/01	<ul style="list-style-type: none"> <li>• specially adapted for obtaining from underwater installations (underwater well heads <a href="#">E21B 33/035</a>)</li> </ul>
E21B 43/0107	<ul style="list-style-type: none"> <li>• • {Connecting of flow lines to offshore structures (<a href="#">E21B 43/013</a> takes precedence)}</li> </ul>
E21B 2043/0115	<ul style="list-style-type: none"> <li>• • {Drilling for or production of natural gas hydrate reservoirs; Drilling through or monitoring of formations containing gas hydrates}</li> </ul>
E21B 43/0122	<ul style="list-style-type: none"> <li>• • {Collecting oil or the like from a submerged leakage (cleaning or keeping clear the surface of open water from oil or the like <a href="#">E02B 15/04</a>)}</li> </ul>
E21B 43/013	<ul style="list-style-type: none"> <li>• • connecting a production flow line to an underwater well head</li> </ul>
E21B 43/0135	<ul style="list-style-type: none"> <li>• • • {using a pulling cable}</li> </ul>
E21B 43/017	<ul style="list-style-type: none"> <li>• • Production satellite stations, i.e. underwater installations comprising a plurality of satellite well heads connected to a central station (underwater separating arrangements <a href="#">E21B 43/36</a>)</li> </ul>
E21B 43/02	<ul style="list-style-type: none"> <li>• Subsoil filtering (<a href="#">E21B 43/11</a> takes precedence, chemical compositions for consolidating loose sand or the like around wells <a href="#">C09K 8/56</a>)</li> </ul>
E21B 43/025	<ul style="list-style-type: none"> <li>• • {Consolidation of loose sand or the like round the wells without excessively decreasing the permeability thereof (sealing borehole walls <a href="#">E21B 33/138</a>)}</li> </ul>
E21B 43/04	<ul style="list-style-type: none"> <li>• • Graveling of wells</li> </ul>
E21B 43/045	<ul style="list-style-type: none"> <li>• • • {Crossover tools}</li> </ul>
E21B 43/08	<ul style="list-style-type: none"> <li>• • Screens or liners {(expandable screens or liners <a href="#">E21B 43/108</a>; obtaining drinking water; filters <a href="#">E03B 3/18</a>)}</li> </ul>
E21B 43/082	<ul style="list-style-type: none"> <li>• • • {Screens comprising porous materials, e.g. prepacked screens}</li> </ul>
E21B 43/084	<ul style="list-style-type: none"> <li>• • • {Screens comprising woven materials, e.g. mesh or cloth}</li> </ul>
E21B 43/086	<ul style="list-style-type: none"> <li>• • • {Screens with preformed openings, e.g. slotted liners (comprising porous materials <a href="#">E21B 43/082</a>)}</li> </ul>
E21B 43/088	<ul style="list-style-type: none"> <li>• • • {Wire screens (comprising porous materials <a href="#">E21B 43/082</a>; comprising woven materials <a href="#">E21B 43/084</a>)}</li> </ul>
E21B 43/10	<ul style="list-style-type: none"> <li>• • Setting of casings, screens, liners {or the like} in wells (driving or forcing casings into boreholes, simultaneously drilling and casing boreholes <a href="#">E21B 7/20</a>; setting of tools, packers or the like <a href="#">E21B 23/00</a>; suspending casings in well heads <a href="#">E21B 33/04</a>)</li> </ul>
E21B 43/101	<ul style="list-style-type: none"> <li>• • • {for underwater installations}</li> </ul>
E21B 43/103	<ul style="list-style-type: none"> <li>• • • {of expandable casings, screens, liners, or the like}</li> </ul>
E21B 43/105	<ul style="list-style-type: none"> <li>• • • • {Expanding tools specially adapted therefor}</li> </ul>
E21B 43/106	<ul style="list-style-type: none"> <li>• • • • {Couplings or joints therefor}</li> </ul>

- E21B 43/108 . . . . {Expandable screens or liners}
- E21B 43/11 . Perforators; Permeators
- E21B 43/112 . . Perforators with extendable perforating members, e.g. actuated by fluid means
- E21B 43/114 . . Perforators using direct fluid action {on the wall to be perforated}, e.g. abrasive jets
- E21B 43/116 . . Gun or shaped charge perforators {(projectiles with shaped or hollow charge [F42B 12/10](#))}
- E21B 43/117 . . . Shaped charge perforators ([E21B 43/118](#) takes precedence)
- E21B 43/118 . . . characterised by lowering in vertical position and subsequent tilting to operating position
- E21B 43/1185 . . . Ignition systems
- E21B 43/11852 . . . . {hydraulically actuated}
- E21B 43/11855 . . . . {mechanically actuated, e.g. by movement of a wireline or a drop-bar ([E21B 43/11852](#) takes precedence)}
- E21B 43/11857 . . . . {firing indication systems}
- E21B 43/119 . . Details, e.g. for locating perforating place or direction
- E21B 43/1195 . . . {Replacement of drilling mud; decrease of undesirable shock waves}
- E21B 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](#))
- E21B 43/121 . . {Lifting well fluids (survey of down-hole pump systems [E21B 47/0007](#))}
- E21B 43/122 . . . {Gas lift}
- E21B 43/123 . . . . {Gas lift valves}
- E21B 43/124 . . . {Adaptation of jet-pump systems}
- E21B 2043/125 . . . {Adaptation of walking-beam pump systems}
- E21B 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](#))}
- E21B 43/127 . . . . {Adaptations of walking-beam pump systems}
- E21B 43/128 . . . {Adaptation of pump systems with down-hole electric drives}
- E21B 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](#))}
- E21B 43/14 . Obtaining from a multiple-zone well
- E21B 43/16 . Enhanced recovery methods for obtaining hydrocarbons (fracturing [E21B 43/26](#); obtaining slurry [E21B 43/29](#); reclamation of contaminated soil in situ [B09C](#); {chemical compositions therefor [C09K 8/58](#)})
- E21B 43/162 . . {Injecting fluid from longitudinally spaced locations in injection well}
- E21B 43/164 . . {Injecting CO<sub>2</sub> or carbonated water (in combination with organic material [C09K 8/594](#))}
- E21B 43/166 . . {Injecting a gaseous medium; Injecting a gaseous medium and a liquid medium (CO<sub>2</sub> injection [E21B 43/164](#); steam injection [E21B 43/24](#))}
- E21B 43/168 . . . {Injecting a gaseous medium}
- E21B 43/17 . . Interconnecting two or more wells by fracturing or otherwise attacking the formation ({[E21B 43/2405](#),} [E21B 43/247](#) take precedence)

- E21B 43/18 . . Repressuring or vacuum methods
- E21B 43/20 . . Displacing by water
- E21B 43/24 . . using heat, e.g. steam injection (heating, cooling or insulating wells [E21B 36/00](#) {; in combination with organic material [C09K 8/592](#)})
- E21B 43/2401 . . . {by means of electricity}
- E21B 43/2403 . . . {by means of nuclear energy (nuclear reactors [G21](#))}
- E21B 43/2405 . . . {in association with fracturing or crevice forming processes ([E21B 43/247](#) takes precedence)}
- E21B 43/2406 . . . {Steam assisted gravity drainage [SAGD]}
- E21B 43/2408 . . . . {SAGD in combination with other methods}

**WARNING**

Not complete pending a reorganisation. See also [E21B 43/24](#) and subgroups

- E21B 43/241 . . . combined with solution mining of non-hydrocarbon minerals, e.g. solvent pyrolysis of oil shale
- E21B 43/243 . . . Combustion in situ
- E21B 43/247 . . . . in association with fracturing processes {or crevice forming processes}
- E21B 43/248 . . . . . using explosives
- E21B 43/25 . Methods for stimulating production (dump bailers [E21B 27/02](#); vibration generating arrangements [E21B 28/00](#) {; by vibrating earth formations [E21B 43/003](#); chemical compositions therefor [C09K 8/60](#))
- E21B 43/255 . . {including the injection of a gaseous medium as treatment fluid into the formation}
- E21B 43/26 . . by forming crevices or fractures {(chemical compositions therefor [C09K 8/62](#))}
- E21B 43/261 . . . {Separate steps of (1) cementing, plugging or consolidating and (2) fracturing or attacking the formation}
- E21B 43/263 . . . using explosives {(Combustion in situ using explosives [E21B 43/248](#))}
- E21B 43/2635 . . . . {by means of nuclear energy (peaceful applications of nuclear explosive devices in general [G21J 3/00](#))}
- E21B 43/267 . . . reinforcing fractures by propping {(chemical compositions therefor [C09K 8/80](#))}
- E21B 43/28 . Dissolving minerals other than hydrocarbons, e.g. by an alkaline or acid leaching agent ([E21B 43/241](#) takes precedence; {using steerable or laterally extendable nozzles [E21B 43/292](#)})
- E21B 43/281 . . {using heat (heating, cooling or insulating wells [E21B 36/00](#))}
- E21B 43/283 . . {in association with a fracturing process}
- E21B 43/285 . Melting minerals, e.g. sulfur ([E21B 43/24](#) takes precedence; heating, cooling or insulating arrangements for wells [E21B 36/00](#))
- E21B 43/29 . Obtaining a slurry of minerals, e.g. by using nozzles
- E21B 43/292 . . {using steerable or laterally extendable nozzles}
- E21B 43/295 . Gasification of minerals, e.g. for producing mixtures of combustible gases ([E21B 43/243](#) takes precedence)



- E21B 43/30
  - Specific pattern of wells, e.g. optimizing the spacing of wells ([production satellite stations E21B 43/017](#))
- E21B 43/305
  - • {[comprising at least one inclined or horizontal well](#)}
- E21B 43/32
  - Preventing gas- or water- coning phenomena, i.e. the formation of a conical column of gas or water around wells
- E21B 43/34
  - Arrangements for separating materials produced by the well ([separating apparatus per se, see the relevant subclasses](#))
- E21B 43/36
  - • Underwater separating arrangements ([E21B 43/38 takes precedence](#))
- E21B 43/38
  - • in the well
- E21B 43/385
  - • • {[by reinjecting the separated materials into an earth formation in the same well](#)}
- E21B 43/40
  - • Separation associated with re-injection of separated materials ([{\(E21B 43/385 takes precedence\)}](#))

### **Automatic control, surveying or testing**

- E21B 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** (for non-automatic drilling control, see the operation controlled; automatic feeding from rack and connecting of drilling pipes [E21B 19/20](#); controlling pressure or flow of drilling fluid [E21B 21/08](#); control systems in general [G05](#)); **Systems specially adapted for monitoring a plurality of drilling variables or conditions** (means for transmitting measuring-signals from the well to the surface [E21B 47/12](#))
- E21B 44/005
  - {[Below-ground automatic control systems](#)}
- E21B 44/02
  - Automatic control of the tool feed ([{\(E21B 44/005\), E21B 44/10 take precedence}](#))
- E21B 44/04
  - • in response to the torque of the drive; {[Measuring drilling torque \(E21B 44/06 takes precedence; measuring stresses in a well bore pipe E21B 47/0006\)](#)}
- E21B 44/06
  - • in response to the flow or pressure of the motive fluid of the drive
- E21B 44/08
  - • in response to the amplitude of the movement of the percussion tool, e.g. jump or recoil
- E21B 44/10
  - Arrangements for automatic stopping when the tool is lifted from the working face ([{\(informative reference: arrangements for automatic stopping for portable percussive tools B25D 9/265\)}](#))
- E21B 45/00
 

**Measuring the drilling time or rate of penetration**
- E21B 47/00
 

**Survey of boreholes or wells** (monitoring pressure or flow of drilling fluid [E21B 21/08](#); geophysical logging [G01V](#))
- E21B 47/0001
  - {[for underwater installations](#)}
- E21B 47/0002
  - {[Survey of boreholes or wells by visual inspection](#) (photographing internal surfaces, e.g. of pipes [G03B 37/005](#); closed circuit television systems [H04N 7/18](#))}
- E21B 47/0003
  - {[Determining well or borehole volumes](#) (determining depth [E21B 47/04](#), diameter [E21B 47/08](#); measuring volumes in general [G01F](#))}
- E21B 47/0005
  - {[control of cementation quality or level](#) (measuring temperature [E21B 47/065](#))}



- E21B 47/0006 . {Measuring stresses in a well bore pipe string or casing (for locating stuck pipe [E21B 47/09](#))}
- E21B 47/0007 . {Survey of down-hole pump systems}
- E21B 47/0008 . . {Survey of walking-beam pump systems, e.g. for the detection of so called "pumped-off" conditions}
- E21B 47/01 . Devices for supporting measuring instruments on a drill pipe, rod or wireline (setting or locking tools in boreholes or wells [E21B 23/00](#)); {(flexible centering means per se [E21B 17/1014](#))} 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 47/011](#)

- E21B 47/011 . . {Protecting measuring instruments (cooling or insulating arrangements for boreholes or wells [E21B 36/00](#))}
- E21B 47/02 . Determining slope or direction (clinometers or direction meters [G01C](#))
- E21B 47/022 . . of the borehole, {e.g. using geomagnetism}
- E21B 47/02208 . . . {using seismic or acoustic means}
- E21B 47/02216 . . . {using at least one source of electromagnetic energy and at least one detector therefor}
- E21B 47/02224 . . . . {at least one of the sources or one of the detectors being located above ground}
- E21B 47/02232 . . . {using a pendulum}
- E21B 47/024 . . of devices in the borehole ([E21B 47/022](#) takes precedence)
- E21B 47/026 . . of penetrated ground layers (apparatus for obtaining oriented cores [E21B 25/16](#); formation testing [E21B 49/00](#))
- E21B 47/04 . Measuring depth or liquid level (measuring liquid level in general {and telerecorders for level of liquids} [G01F](#); {measuring depth in general [G01B 7/26](#)})
- E21B 47/042 . . {Measuring or locating liquid level ([E21B 47/044](#) takes precedence)}
- E21B 47/044 . . {using radioactive markers}
- E21B 47/06 . Measuring temperature or pressure (measuring temperature in general [G01K](#); measuring pressure in general [G01L](#) {telerecorders for pressure [G01L](#); telerecorders for temperature [G01K](#)})
- E21B 47/065 . . {Measuring temperature}
- E21B 47/08 . Measuring the diameter (measuring diameter in general [G01B](#))
- E21B 47/082 . . {using radiant means, e.g. acoustic, radioactive, electromagnetic}
- E21B 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 (measuring depth [E21B 47/04](#); measuring diameter [E21B 47/08](#))
- E21B 47/0905 . . {by detecting magnetic anomalies (investigating materials by investigating magnetic variables [G01N 27/72](#))}
- E21B 47/091 . . {by detecting an acoustic anomaly, e.g. a mud-pressure pulse}
- E21B 47/0915 . . {using impression packers, e.g. to detect recesses or perforations}

- E21B 47/10
  - Locating fluid leaks, intrusions or movements [{\(using impression packers E21B 47/0915; flow measurement in general G01E; examining density and leaking in general G01M\)}](#)
- E21B 47/1005
  - • [{using thermal measurements \(measurement temperature E21B 47/065\)}](#)
- E21B 47/101
  - • [{using acoustic energy}](#)
- E21B 47/1015
  - • [{using tracers: using radioactivity}](#)
- E21B 47/102
  - • [{using electrical indications: using light radiations}](#)
- E21B 47/1025
  - • [{Detecting leaks, e.g. of tubing, by pressure testing \(investigating fluid-tightness of structures by using fluid or vacuum G01M 3/02\)}](#)
- E21B 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 [\(remote signalling in general G08\)](#)
- E21B 47/121
  - • [{using earth as an electrical conductor \(E21B 47/122 takes precedence; in general H04B 13/02; electric prospecting G01V 3/00\)}](#)
- E21B 47/122
  - • [{by electromagnetic energy, e.g. radio frequency \(in general H04B magnetic prospecting G01V 3/00\)}](#)
- E21B 47/123
  - • • [{using light waves \(optical transmission in general H04B 10/00; light guides, e.g. optical fibres G02B 6/00\)}](#)
- E21B 47/124
  - • [{Storing data down-hole, e.g. in a memory or on a record carrier \(recording in connection with measuring in general G01D; information storage in general G11\)}](#)
- E21B 47/14
  - • using acoustic waves
- E21B 47/16
  - • • through the drill string or casing, [{e.g. by torsional acoustic waves}](#)
- E21B 47/18
  - • • through the well fluid, [{e.g. mud pressure pulse telemetry}](#)
- E21B 47/182
  - • • • [{by continuous mud waves with modulation of the waves}](#)
- E21B 47/185
  - • • • [{by negative mud pulses using a pressure relieve valve between drill pipe and annulus}](#)
- E21B 47/187
  - • • • [{by positive mud pulses using a flow restricting valve within the drill pipe}](#)
- E21B 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 [\(sampling in general G01N 1/00\)](#)**
- E21B 49/001
  - [{specially adapted for underwater installations}](#)
- E21B 49/003
  - [{by analysing drilling variables or conditions \(E21B 49/005 takes precedence; Systems specially adapted for monitoring a plurality of drilling variables or conditions E21B 44/00\)}](#)
- E21B 49/005
  - [{Testing the nature of borehole walls or the formation by using drilling mud or cutting data \(investigating chemical or physical properties of materials per se G01N\)}](#)
- E21B 49/006
  - [{Measuring wall stresses in the borehole \(investigation of mechanical properties of foundation soil E02D 1/022\)}](#)
- E21B 49/008
  - [{by injection test; by analysing pressure variations in an injection or production test, e.g. for estimating the skin factor \(measuring pressure E21B 47/06; obtaining fluid samples or testing fluids E21B 49/08\)}](#)
- E21B 49/02
  - by mechanically taking samples of the soil [\(apparatus for obtaining undisturbed cores E21B 25/00; investigation of foundation soil in situ E02D 1/00\)](#)

- E21B 49/025
  - • {of underwater soil, e.g. with grab devices ([underwater coring E21B 25/18](#))}
- E21B 49/04
  - • using explosives in boreholes; using projectiles penetrating the wall {(drilling by use of explosives [E21B 7/007](#); gun or shaped charge perforators [E21B 43/116](#))}
- E21B 49/06
  - • with side-wall drilling tools {pressing} or scrapers
- E21B 49/08
  - Obtaining fluid samples or testing fluids, in boreholes or wells {(packers [E21B 33/12](#); valves [E21B 34/00](#); analysing pressure variations in an injection or production test [E21B 49/008](#))}
- E21B 49/081
  - • {with down-hole means for trapping a fluid sample ([E21B 49/10](#) takes precedence)}
- E21B 49/082
  - • • {Wire-line fluid samplers ([E21B 49/083](#) takes precedence)}
- E21B 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}
- E21B 49/084
  - • {with means for conveying samples through pipe to surface}
- E21B 2049/085
  - • {Determining specific physical fluid parameters}
- E21B 49/086
  - • {Withdrawing samples at the surface}
- E21B 49/087
  - • {Well testing, e.g. testing for reservoir productivity or formation parameters}
- E21B 49/088
  - • • {combined with sampling}
- E21B 49/10
  - • using side-wall fluid samplers or testers