

**E21 EARTH OR ROCK DRILLING; MINING****E21B EARTH OR ROCK 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** [5]

- (1) This subclass covers: [7]  
 – primarily equipment for drilling of earth or rock in their natural formation; [7]  
 – similar equipment for drilling of man-made structures in situ, e.g. of road surfaces or concrete structures. [7]
- (2) This subclass does not cover: [7]  
 – hand-held drilling machines, e.g. for domestic use; [7]  
 – drilling equipment for manufacturing operations, i.e. where an article is worked, e.g. for further processing; [7]  
 which are covered by relevant subclasses of section B, e.g. B23B; [7]  
 – compositions for drilling of boreholes or wells or for treating boreholes or wells, which compositions are covered by group C09K 8/00, e.g. compositions for enhanced recovery methods for obtaining hydrocarbons C09K 8/58. [8]
- (3) Processes using enzymes or micro-organisms in order to: [8]  
 (i) liberate, separate or purify a pre-existing compound or composition, or to [8]  
 (ii) treat textiles or clean solid surfaces of materials [8]  
 are further classified in subclass C12S. [8]

|                                                                              |                                           |                                                           |                               |
|------------------------------------------------------------------------------|-------------------------------------------|-----------------------------------------------------------|-------------------------------|
| METHODS OR APPARATUS FOR<br>DRILLING .....                                   | 1/00 7/00                                 | Flushing or cleaning; sealing;<br>heating or cooling..... | 21/00, 37/00;<br>33/00; 36/00 |
| DRILLING TOOLS; ACCESSORIES<br>THEREFOR .....                                | 10/00, 11/00;<br>12/00                    | Valve arrangements; fire-fighting .....                   | 34/00; 35/00                  |
| OTHER EQUIPMENT OR DETAILS FOR<br>DRILLING; WELL EQUIPMENT OR<br>MAINTENANCE |                                           | Other equipment or details .....                          | 23/00 31/00, 40/00, 41/00     |
|                                                                              |                                           | OBTAINING FLUIDS FROM WELLS .....                         | 43/00                         |
|                                                                              |                                           | CONTROL; SURVEYING OR TESTING .....                       | 44/00;<br>45/00 49/00         |
|                                                                              | Derricks; drilling rods or the like ..... |                                                           | 15/00; 17/00,<br>19/00        |

**Methods or apparatus for drilling**

- 1/00 Percussion drilling** (drives used in the borehole E21B 4/00) [3]
- 1/02 . Surface drives for drop hammers, e.g. with a cable [1,7]
- 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) [7]
- 1/14 . . driven by a rotating mechanism [7]
- 1/16 . . . with spring-mounted reciprocating masses, e.g. with air cushion [7]
- 1/18 . . . . with elastic joining of the drive to the push-rod by double buffer springs [7]
- 1/20 . . . formed as centrifugal hammers [7]
- 1/22 . . driven by electromagnets [7]
- 1/24 . . the impulse member being a piston driven directly by fluid pressure [7]
- 1/26 . . . by liquid pressure [7]
- 1/28 . . . . working with pulses [7]
- 1/30 . . . by air, steam or gas pressure [7]
- 1/32 . . . . working with pulses [7]
- 1/34 . . . . . the impulse member being a piston of an internal-combustion engine [7]
- 1/36 . Tool-carrier piston type, i.e. in which the tool is connected to an impulse member [7]
- 1/38 . Hammer piston type, i.e. in which the tool bit or anvil is hit by an impulse member [7]

- 3/00 Rotary drilling** (drives used in the borehole E21B 4/00; rotary drilling machines in general B23B) [3]
- 3/02 . Surface drives for rotary drilling
- 3/025 . . with a to-and-fro rotation of the tool [7]
- 3/03 . . with an intermittent unidirectional rotation of the tool [7]
- 3/035 . . with slipping or elastic transmission [7]
- 3/04 . . Rotary tables
- 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) [3]
- 4/00 Drives for drilling, used in the borehole** [3]
- 4/02 . Fluid rotary type drives (hydraulic turbines for drilling wells F03B 13/02) [3]
- 4/04 . Electric drives (E21B 4/12 takes precedence) [3]
- 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) [3]
- 4/08 . . impact being obtained by gravity only, e.g. with lost-motion connection [3]
- 4/10 . . continuous unidirectional rotary motion of shaft or drilling pipe effecting consecutive impacts [3]
- 4/12 . . Electrically operated hammers [3]
- 4/14 . . Fluid operated hammers [3]
- 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 [3]

- 4/18 . Anchoring or feeding in the borehole [3,7]
- 4/20 . combined with surface drive (E21B 4/10 takes precedence) [3]
- 6/00 Drives for drilling with combined rotary and percussive action** (drives used in the borehole E21B 4/00; portable percussive machines with superimposed rotation B25D 16/00) [3]
  - 6/02 . the rotation being continuous [7]
  - 6/04 . . Separate drives for percussion and rotation [7]
  - 6/06 . the rotation being intermittent, e.g. obtained by a ratchet device [7]
  - 6/08 . . Separate drives for percussion and rotation [7]
- 7/00 Special methods or apparatus for drilling** (supports for the drilling machine, e.g. derricks or masts, E21B 15/00) [1,7]
  - 7/02 . Drilling rigs characterised by means for land transport, e.g. skid mounting or wheel mounting (portable drilling rigs for use on underwater floors E21B 7/124) [1,7]
  - 7/04 . Directional drilling
    - 7/06 . . Deflecting the direction of boreholes
    - 7/08 . . . Special apparatus for deflecting the boring, e.g. special drill bits, knuckle joints, whipstocks (directional window cutting E21B 29/06; deflecting the direction of fishing tools E21B 31/14)
    - 7/10 . . Correction of deflected boreholes
    - 7/12 . Underwater drilling (telescoping joints E21B 17/07; using heave compensators E21B 19/09; well heads specially adapted for underwater installations E21B 33/035) [1,7]
    - 7/124 . . with underwater tool drive prime mover, e.g. portable drilling rigs for use on underwater floors [3]
    - 7/128 . . from floating support with independent underwater anchored guide base [3]
    - 7/132 . . from underwater buoyant support [3]
    - 7/136 . . from non-buoyant support (E21B 7/124 takes precedence) [3]
    - 7/14 . Drilling by use of heat, e.g. flame drilling
    - 7/15 . . of electrically generated heat [3]
    - 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; hydraulic monitors E21C 45/00) [5]
    - 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; placing piles E02D 7/00; sinking shafts while moving the lining downwards E21D 1/08) [3]
    - 7/24 . Drilling using vibrating or oscillating means, e.g. out-of-balance masses (percussion drilling E21B 1/00) [3]
    - 7/26 . Drilling without earth removal, e.g. with self-propelled burrowing devices (E21B 7/30 takes precedence; down-hole drives E21B 4/00) [3,6]
    - 7/28 . Enlarging drilled holes, e.g. by counterboring (drill bits for enlarging the borehole E21B 10/26) [3]
    - 7/30 . . without earth removal [6]

## Drilling tools

- 10/00 Drill bits** (specially adapted for deflecting the direction of boring E21B 7/08; with means for collecting substances E21B 27/00) [3,8]
  - 10/02 . Core bits (characterised by wear resisting parts E21B 10/46; obtaining undisturbed cores E21B 25/00) [3]
  - 10/04 . . with core destroying means [3]
  - 10/06 . . Roller core bits [3]
  - 10/08 . Roller bits (roller core bits E21B 10/06; with leading portion E21B 10/26; characterised by wear resisting parts E21B 10/46) [3]
  - 10/10 . . with roller axle supported at both ends (with disc cutters E21B 10/12) [3]
  - 10/12 . . with disc cutters [3]
  - 10/14 . . combined with non-rolling cutters other than of leading-portion type [3]
  - 10/16 . . characterised by tooth form or arrangement [3]
  - 10/18 . . characterised by conduits or nozzles for drilling fluids (drilling fluid supply to the bearings E21B 10/23) [3,8]
  - 10/20 . . characterised by detachable or adjustable parts, e.g. legs or axles (cross axle roller bits E21B 10/10) [3]
  - 10/22 . . characterised by bearing, lubrication or sealing details [3,8]
  - 10/23 . . . with drilling fluid supply to the bearings [8]
  - 10/24 . . . characterised by lubricating details (E21B 10/23 takes precedence) [3,8]
  - 10/25 . . . characterised by sealing details [8]
  - 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) [3]
  - 10/28 . . with non-expansible roller cutters [3]
  - 10/30 . . . Longitudinal axis roller reamers, e.g. reamer stabilisers [3]
  - 10/32 . . with expansible cutting tools [3]
  - 10/34 . . . of roller-cutter type [3]
  - 10/36 . Percussion drill bits (characterised by wear resisting parts E21B 10/46) [3]
  - 10/38 . . characterised by conduits or nozzles for drilling fluids [3]
  - 10/40 . . with leading portion [3]
  - 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 parts E21B 10/62) [3,8]
  - 10/43 . . characterised by the arrangement of teeth or other cutting elements [8]
  - 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; drilling rods with helical structure E21B 17/22) [3,8]
  - 10/46 . characterised by wear resisting parts, e.g. diamond inserts [3]
    - 10/48 . . the bit being of core type [3]
    - 10/50 . . the bit being of roller type [3]
    - 10/52 . . . with chisel- or button-type inserts [3]
    - 10/54 . . the bit being of the rotary drag type, e.g. fork-type bits [3,8]
    - 10/55 . . . with preformed cutting elements (inserts per se E21B 10/56, E21B 10/58) [8]

- 10/56 . . . Button-type inserts (E21B 10/52 takes precedence) [3]
- 10/567 . . . with preformed cutting elements mounted on a distinct support, e.g. polycrystalline inserts [8]
- 10/573 . . . . characterised by support details, e.g. the substrate construction or the interface between the substrate and the cutting element [8]
- 10/58 . . Chisel-type inserts (E21B 10/52, E21B 10/54 take precedence) [3]
- 10/60 . characterised by conduits or nozzles for drilling fluids (for roller bits E21B 10/18; for percussion drill bits E21B 10/38) [3]
- 10/61 . . characterised by nozzle structure [8]
- 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) [3,8]
- 10/627 . . with plural detachable cutting elements [8]
- 10/633 . . . independently detachable [8]
- 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) [3]
- 10/66 . . the cutting element being movable through the drilling pipe and laterally shiftable [3]
- 11/00 Other drilling tools**
- 11/02 . Boring rams (percussion drives used in the borehole E21B 4/06; percussion drill bits E21B 10/36)
- 11/04 . Boring grabs
- 11/06 . with driven cutting chains or similarly-driven tools
- 12/00 Accessories for drilling tools [3]**
- 12/02 . Wear indicators [3]
- 12/04 . Drill bit protectors [3]
- 12/06 . Mechanical cleaning devices [3]
- Other equipment or details for drilling; Well equipment or well maintenance**
- 15/00 Supports for the drilling machine, e.g. derricks or masts [1,7]**
- 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) [3]
- 15/04 . specially adapted for directional drilling, e.g. slant hole rigs [3]
- 17/00 Drilling rods or pipes; Flexible drill strings; Kellies; Drill collars; Sucker rods; Casings; Tubings (rod couplings in general F16D; tubes or tube couplings in general F16L)**
- 17/01 . Risers (riser connectors E21B 33/038) [3]
- 17/02 . Couplings; Joints
- 17/03 . . between drilling rod or pipe and drill motor, e.g. between drilling rod and hammer [7]
- 17/04 . . between rod and bit, or between rod and rod
- 17/042 . . . threaded
- 17/043 . . . . with locking means
- 17/046 . . . with ribs, pins, or jaws, and complementary grooves or the like, e.g. bayonet catches
- 17/05 . . . Swivel joints
- 17/06 . . . Releasing-joints, e.g. safety joints
- 17/07 . . . Telescoping joints for varying drill string lengths; Shock absorbers (heave compensators in the derrick E21B 19/09; releasing-jars E21B 31/107) [3]
- 17/08 . . Casing joints
- 17/10 . Wear protectors; Centralising devices (drives used in the borehole with anchoring means E21B 4/18; guiding or centralising devices outside the borehole E21B 19/24)
- 17/12 . . Devices for placing or drawing out wear protectors
- 17/14 . Casing shoes
- 17/16 . Drill collars [3]
- 17/18 . Pipes provided with plural fluid passages (circulation of drilling fluid by means of such pipes E21B 21/12) [3]
- 17/20 . Flexible or articulated drilling pipes [3]
- 17/22 . Rods or pipes with helical structure (drill bits with helical conveying portion E21B 10/44) [3]
- 19/00 Handling rods, casings, tubes or the like outside the borehole, e.g. in the derrick; Apparatus for feeding the rods or cables (surface drives E21B 1/02, E21B 3/02)**
- 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)
- 19/04 . . Hooks
- 19/06 . . Elevators, i.e. rod- or tube-gripping devices
- 19/07 . . . Slip-type elevators (slips in rotary tables E21B 19/10)
- 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 [3,7]
- 19/081 . . Screw-and-nut feed mechanisms [7]
- 19/083 . . Cam, rack or like feed mechanisms [7]
- 19/084 . . with flexible drawing means, e.g. cables [7]
- 19/086 . . with a fluid-actuated cylinder (E21B 19/084, E21B 19/087, E21B 19/09 take precedence) [7]
- 19/087 . . by means of a swinging arm [7]
- 19/089 . . with a spring or an additional weight [7]
- 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) [3]
- 19/10 . Slips; Spiders
- 19/12 . Rope clamps (rope clamps in general F16G 11/00)
- 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) [3]
- 19/15 . . Racking of rods in horizontal position; Handling between horizontal and vertical position [3]
- 19/16 . Connecting or disconnecting pipe couplings or joints (E21B 19/20 takes precedence; pipe wrenches or the like B25B) [3]
- 19/18 . Connecting or disconnecting drill bit and drilling pipe [3]
- 19/20 . Combined feeding from rack and connecting, e.g. automatically [3]
- 19/22 . Handling reeled pipe or rod units, e.g. flexible drilling pipes [3]
- 19/24 . Guiding or centralising devices for drilling rods or pipes [7]

- 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) [2,7]
- 21/01 . Arrangements for handling drilling fluids or cuttings outside the borehole, e.g. mud boxes (arrangements for treating drilling fluids E21B 21/06) [7]
- 21/015 . . Means engaging the bore entrance, e.g. hoods for collecting dust [7]
- 21/02 . Swivel joints in hose lines
- 21/06 . Arrangements for treating drilling fluids outside the borehole (treating steps per se, see the relevant subclasses) [3]
- 21/07 . . for treating dust-laden gaseous fluids [7]
- 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) [3]
- 21/10 . Valves arrangements in drilling-fluid circulation systems (valves in general F16K) [3]
- 21/12 . using drilling pipes with plural fluid passages, e.g. closed circulation systems (pipes with plural fluid passages E21B 17/18) [3]
- 21/14 . using liquids and gases, e.g. foams [3]
- 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) [7]
- 21/18 . Preventing exhaust air from the drill motor from blowing-off towards the working face [7]
- 23/00 Apparatus for displacing, setting, locking, releasing or removing tools, packers or the like in boreholes or wells** (setting of casings, screens, or liners E21B 43/10)
- 23/01 . for anchoring the tools or the like (E21B 23/02 E21B 23/06 take precedence; anchoring of drives in the borehole E21B 4/18) [6]
- 23/02 . for locking the tools or the like in landing nipples or in recesses between adjacent sections of tubing (E21B 23/03 E21B 23/06 take precedence) [3]
- 23/03 . for setting the tools into, or removing the tools from, laterally offset landing nipples or pockets [3]
- 23/04 . operated by fluid means, e.g. actuated by explosion (E21B 23/06, E21B 23/08 take precedence) [3]
- 23/06 . for setting packers
- 23/08 . Introducing or running tools by fluid pressure, e.g. through-the-flow-line tool systems (special provisions on heads therefor E21B 33/068; cementing plugs E21B 33/16; scrapers operated by fluid pressure E21B 37/04) [3]
- 23/10 . . Tools specially adapted therefor [3]
- 23/12 . . Tool diverters [3]
- 23/14 . for displacing a cable or a cable-operated tool, e.g. for logging or perforating operations in deviated wells (by fluid pressure E21B 23/08; provision on well heads for introducing or removing cable-operated tools E21B 33/072, E21B 33/076) [6]
- 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)
- 25/02 . the core receiver being insertable into, or removable from, the borehole without withdrawing the drilling pipe (retrievable drill bits E21B 10/64) [3]
- 25/04 . . the core receiver having a core forming cutting edge or element, e.g. punch type core barrels [3]
- 25/06 . the core receiver having a flexible liner or inflatable retaining means [3]
- 25/08 . Coating, freezing, consolidating cores (E21B 25/06 takes precedence); Recovering uncontaminated cores or cores at formation pressure [3]
- 25/10 . Formed core retaining or severing means (E21B 25/06, E21B 25/08 take precedence) [3]
- 25/12 . . of the sliding wedge type [3]
- 25/14 . . mounted on pivot transverse to core axis [3]
- 25/16 . for obtaining oriented cores [3]
- 25/18 . the core receiver being specially adapted for operation under water [3]
- 27/00 Containers for collecting or depositing substances in boreholes or wells, e.g. bailers for collecting mud or sand; Drill bits with means for collecting substances, e.g. valve drill bits** [6,8]
- 27/02 . Dump bailers, i.e. containers for depositing substances, e.g. cement or acids [6,8]
- 27/04 . where the collecting or depositing means include helical conveying means [8]
- 28/00 Vibration generating arrangements for boreholes or wells, e.g. for stimulating production** (for drilling E21B 7/24; for transmitting measuring-signals E21B 47/14; for geophysical measurements G01V 1/02) [6]
- 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**
- 29/02 . by explosives or by thermal or chemical means (destroying objects in boreholes or wells by explosives E21B 31/16)
- 29/04 . Cutting of wire lines or the like (E21B 29/02 takes precedence) [3]
- 29/06 . Cutting windows, e.g. directional window cutters for whipstock operations (E21B 29/08 takes precedence; whipstocks E21B 7/08) [3]
- 29/08 . Cutting or deforming pipes to control fluid flow (blow-out preventers E21B 33/06) [3]
- 29/10 . Reconditioning of well casings, e.g. straightening [3]
- 29/12 . specially adapted for underwater installations (E21B 29/08 takes precedence) [3]
- 31/00 Fishing for or freeing objects in boreholes or wells** (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)
- 31/03 . Freeing by flushing [3]
- 31/06 . using magnetic means [3]
- 31/08 . using junk baskets or the like [3]
- 31/107 . using impact means for releasing stuck parts, e.g. jars (telescoping joints E21B 17/07) [3]
- 31/113 . . hydraulically operated [3]
- 31/12 . Grappling tools, e.g. tongs or grabs
- 31/14 . . with means deflecting the direction of the tool, e.g. by use of knuckle joints (apparatus for deflecting the boring E21B 7/08) [3]
- 31/16 . . combined with cutting or destroying means (cutting or destroying means per se E21B 29/00) [3]
- 31/18 . . gripping externally, e.g. overshot [3]
- 31/20 . . gripping internally, e.g. fishing spears [3]
- 33/00 Sealing or packing boreholes or wells**
- 33/02 . Surface sealing or packing

- 33/03 . . . Well heads; Setting-up thereof (valve arrangements therefor E21B 34/02)
  - 33/035 . . . specially adapted for underwater installations (E21B 33/043, E21B 33/064, E21B 33/076 take precedence) [3]
  - 33/037 . . . . Protective housings therefor [3]
  - 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) [3]
  - 33/04 . . . Casing heads; Suspending casings or tubings in well heads (setting of casings in wells E21B 43/10)
  - 33/043 . . . . specially adapted for underwater well heads (E21B 33/047 takes precedence) [3]
  - 33/047 . . . . for plural tubing strings [3]
  - 33/05 . . . . Cementing-heads, e.g. having provision for introducing cementing plugs
  - 33/06 . . . Blow-out preventers [3]
  - 33/064 . . . . specially adapted for underwater well heads (connectors therefor E21B 33/038) [3]
  - 33/068 . . . having provision for introducing objects or fluids into, or removing objects from, wells (cementing-heads E21B 33/05) [3]
  - 33/072 . . . . for cable-operated tools (E21B 33/076 takes precedence) [3]
  - 33/076 . . . . specially adapted for underwater installations [3]
  - 33/08 . . Wipers; Oil savers
  - 33/10 . . in the borehole
  - 33/12 . . Packers; Plugs (used for cementing E21B 33/134, E21B 33/16)
  - 33/122 . . . Multiple-string packers
  - 33/124 . . . Units with longitudinally-spaced plugs for isolating the intermediate space
  - 33/126 . . . with fluid-pressure-operated elastic cup or skirt (E21B 33/122, E21B 33/124 take precedence)
  - 33/127 . . . with inflatable sleeve (E21B 33/122, E21B 33/124 take precedence)
  - 33/128 . . . with a member expanded radially by axial pressure (E21B 33/122, E21B 33/124 take precedence)
  - 33/129 . . . with mechanical slips for hooking into the casing (E21B 33/122, E21B 33/124 take precedence)
  - 33/1295 . . . . actuated by fluid pressure [6]
  - 33/13 . . Methods or devices for cementing, for plugging holes, crevices, or the like (dump bailers E21B 27/02; chemical compositions therefor C09K 8/00) [1,8]
  - 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
  - 33/16 . . . . using plugs for isolating cement charge; Plugs therefor
  - 34/00 Valve arrangements for boreholes or wells** (in drilling fluid circulation systems E21B 21/10; blow-out preventers E21B 33/06; oil flow regulating apparatus E21B 43/12; valves in general F16K) [3]
  - 34/02 . . in well heads [3]
  - 34/04 . . in underwater well heads [3]
  - 34/06 . . in wells [3]
  - 34/08 . . responsive to flow or pressure of the fluid obtained (E21B 34/10 takes precedence) [3]
  - 34/10 . . . operated by control fluid supplied from outside the borehole (control means being outside the borehole E21B 34/16) [3]
  - 34/12 . . . operated by movement of casings or tubings [3]
  - 34/14 . . . operated by movement of tools, e.g. sleeve valves operated by pistons or wire line tools [3]
  - 34/16 . . Control means therefor being outside the borehole [3]
  - 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)
  - 36/00 Heating, cooling, or 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) [3]
  - 36/02 . . using burners [3]
  - 36/04 . . using electrical heaters [3]
  - 37/00 Methods or apparatus for cleaning boreholes or wells** (E21B 21/00 takes precedence; cleaning pipes in general B08B 9/02)
  - 37/02 . . Scrapers specially adapted therefor
  - 37/04 . . . operated by fluid pressure, e.g. free-piston scrapers (operating other tools by fluid pressure E21B 23/08) [3]
  - 37/06 . . using chemical means for preventing or limiting the deposition of paraffins or like substances (chemical compositions therefor C09K 8/52) [3,8]
  - 37/08 . . cleaning in situ of down-hole filters, screens, or gravel packs (E21B 37/06 takes precedence) [3]
  - 37/10 . . Well swabs [3]
  - 40/00 Tubing catchers, automatically arresting the fall of oil-well tubing**
  - 41/00 Equipment or details not covered by groups E21B 15/00 E21B 40/00**
  - 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) [3,6,8]
  - 41/04 . . Manipulators for underwater operations, e.g. temporarily connected to well heads (manipulators in general B25J) [3]
  - 41/06 . . Work chambers for underwater operations, e.g. temporarily connected to well heads (in general B63C 11/00) [3]
  - 41/08 . . Underwater guide bases, e.g. drilling templates; Levelling thereof [7]
  - 41/10 . . Guide posts, e.g. releasable; Attaching guide lines to underwater guide bases [7]
- Obtaining fluids from wells [3]**
- 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; obtaining oil-bearing deposits or soluble or meltable materials by mining techniques E21C 41/00; pumps F04)
  - 43/01 . . specially adapted for obtaining from underwater installations (underwater well heads E21B 33/035)
  - 43/013 . . . Connecting a production flow line to an underwater well head [3]
  - 43/017 . . . Production satellite stations, i.e. underwater installations comprising a plurality of satellite well heads connected to a central station (underwater separating arrangements E21B 43/36) [3]

## E21B

- 43/02 . Subsoil filtering (E21B 43/11 takes precedence; chemical compositions for consolidating loose sand or the like around wells C09K 8/56) [1,8]
- 43/04 . . Graveling of wells
- 43/08 . . Screens or liners
- 43/10 . . Setting of casings, screens or liners in wells (driving or forcing casings into boreholes, simultaneously drilling and casing boreholes E21B 7/20; setting of tools, packers or the like E21B 23/00; suspending casings in well heads E21B 33/04)
- 43/11 . Perforators; Permeators
- 43/112 . . Perforators with extendable perforating members, e.g. actuated by fluid means
- 43/114 . . Perforators using direct fluid action, 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 [3]
- 43/119 . . Details, e.g. for locating perforating place or direction
- 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)
- 43/14 . Obtaining from a multiple-zone well
- 43/16 . Enhanced recovery methods for obtaining hydrocarbons (fracturing E21B 43/26; obtaining slurry E21B 43/29; reclamation of contaminated soil in situ B09C)
- 43/17 . . Interconnecting two or more wells by fracturing or otherwise attacking the formation (E21B 43/247 takes precedence) [3]
- 43/18 . . Repressuring or vacuum methods
- 43/20 . . Displacing by water
- 43/22 . . Use of chemicals or bacterial activity (E21B 43/27 takes precedence; chemical or bacterial compositions therefor C09K 8/58; chemical features in extracting oils from oil sands or shales C10G) [1,8]
- 43/24 . . using heat, e.g. steam injection (heating, cooling or insulating wells E21B 36/00)
- 43/241 . . . combined with solution mining of non-hydrocarbon minerals, e.g. solvent pyrolysis of oil shale [5]
- 43/243 . . . Combustion in situ [3]
- 43/247 . . . . in association with fracturing processes [3]
- 43/248 . . . . using explosives [5]
- 43/25 . Methods for stimulating production (dump bailers E21B 27/02; vibration generating arrangements E21B 28/00; chemical compositions therefor C09K 8/60) [1,8]
- 43/26 . . by forming crevices or fractures
- 43/263 . . . using explosives [3]
- 43/267 . . . reinforcing fractures by propping [3]
- 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) [5]
- 43/285 . Melting minerals, e.g. sulfur (E21B 43/24 takes precedence; heating, cooling or insulating arrangements for wells E21B 36/00) [5]
- 43/29 . Obtaining a slurry of minerals, e.g. by using nozzles [5]

- 43/295 . Gasification of minerals, e.g. for producing mixtures of combustible gases (E21B 43/243 takes precedence) [5]
- 43/30 . Specific pattern of wells, e.g. optimizing the spacing of wells (production satellite stations E21B 43/017) [3]
- 43/32 . Preventing gas- or water-coning phenomena, i.e. the formation of a conical column of gas or water around wells [3]
- 43/34 . Arrangements for separating materials produced by the well (separating apparatus per se, see the relevant subclasses) [3]
- 43/36 . . Underwater separating arrangements (E21B 43/38 takes precedence) [3]
- 43/38 . . in the well [3]
- 43/40 . . Separation associated with re-injection of separated materials [3]

### Automatic control; Surveying or testing [3]

- 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); **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) [3]
- 44/02 . Automatic control of the tool feed (E21B 44/10 takes precedence) [7]
- 44/04 . . in response to the torque of the drive [7]
- 44/06 . . in response to the flow or pressure of the motive fluid of the drive [7]
- 44/08 . . in response to the amplitude of the movement of the percussion tool, e.g. jump or recoil [7]
- 44/10 . Arrangements for automatic stopping when the tool is lifted from the working face [7]

### Surveying or testing

- 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; geophysical logging G01V)
- 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); Protecting measuring instruments in boreholes against heat, shock, pressure or the like [6]
- 47/02 . Determining slope or direction (clinometers or direction meters G01C)
- 47/022 . . of the borehole
- 47/024 . . of devices in the borehole (E21B 47/022 takes precedence)
- 47/026 . . of penetrated ground layers (apparatus for obtaining oriented cores E21B 25/16; formation testing E21B 49/00)
- 47/04 . Measuring depth or liquid level (measuring liquid level in general G01F)
- 47/06 . Measuring temperature or pressure (measuring temperature in general G01K; measuring pressure in general G01L)
- 47/08 . Measuring diameter (measuring diameter in general G01B)

- 47/09 . Locating or determining the position of objects in boreholes or wells; Identifying the free or blocked portions of pipes (measuring depth E21B 47/04; measuring diameter E21B 47/08) **[3]**
  - 47/10 . Locating fluid leaks, intrusions, or movements
  - 47/12 . Means for transmitting measuring-signals from the well to the surface, e.g. for logging while drilling (remote signalling in general G08)
  - 47/14 . . using acoustic waves **[6]**
  - 47/16 . . . through the drill string or casing **[6]**
  - 47/18 . . . through the well fluid **[6]**
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- 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)
  - 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)
  - 49/04 . . using explosives in boreholes; using projectiles penetrating the wall **[3]**
  - 49/06 . . using side-wall drilling tools or scrapers
  - 49/08 . Obtaining fluid samples or testing fluids, in boreholes or wells **[3]**
  - 49/10 . . using side-wall fluid samplers or testers **[3]**