

## SECTION E — FIXED CONSTRUCTIONS

### 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]

#### Note(s)

- This subclass covers:
  - primarily equipment for drilling of earth or rock in their natural formation;
  - similar equipment for drilling of man-made structures in situ, e.g. of road surfaces or concrete structures.
- This subclass does not cover:
  - hand-held drilling machines, e.g. for domestic use;
  - drilling equipment for manufacturing operations, i.e. where an article is worked, e.g. for further processing;
 which are covered by relevant subclasses of section B, e.g. B23B;
  - 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.

#### Subclass index

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

#### Methods or apparatus for drilling

<b>1/00 Percussion drilling</b> (drives used in the borehole E21B 4/00) [3]	1/36 • Tool-carrier piston type, i.e. in which the tool is connected to an impulse member [7]
1/02 • Surface drives for drop hammers, e.g. with a cable [1, 7]	1/38 • Hammer piston type, i.e. in which the tool bit or anvil is hit by an impulse member [7]
1/04 • • Devices for reversing the movement of the rod or cable at the surface	<b>3/00 Rotary drilling</b> (drives used in the borehole E21B 4/00; rotary drilling machines in general B23B) [3]
1/12 • with a reciprocating impulse member (E21B 1/02, E21B 1/38 take precedence) [7]	3/02 • Surface drives for rotary drilling
1/14 • • driven by a rotating mechanism [7]	3/025 • • with a to-and-fro rotation of the tool [7]
1/16 • • • with spring-mounted reciprocating masses, e.g. with air cushion [7]	3/03 • • with an intermittent unidirectional rotation of the tool [7]
1/18 • • • • with elastic joining of the drive to the push-rod by double buffer springs [7]	3/035 • • with slipping or elastic transmission [7]
1/20 • • • formed as centrifugal hammers [7]	3/04 • • Rotary tables
1/22 • • driven by electromagnets [7]	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]
1/24 • • the impulse member being a piston driven directly by fluid pressure [7]	<b>4/00 Drives for drilling, used in the borehole</b> [3]
1/26 • • • by liquid pressure [7]	4/02 • Fluid rotary type drives (hydraulic turbines for drilling wells F03B 13/02) [3]
1/28 • • • • working with pulses [7]	4/04 • Electric drives (E21B 4/12 takes precedence) [3]
1/30 • • • by air, steam or gas pressure [7]	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]
1/32 • • • • working with pulses [7]	4/08 • • impact being obtained by gravity only, e.g. with lost-motion connection [3]
1/34 • • • • • the impulse member being a piston of an internal-combustion engine [7]	

## E21B

- 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, 2006.01]
- 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, 2006.01]
- 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, 2006.01]
- 10/23 • • • with drilling fluid supply to the bearings [2006.01]
- 10/24 • • • characterised by lubricating details (E21B 10/23 takes precedence) [3, 2006.01]
- 10/25 • • • characterised by sealing details [2006.01]
- 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, 2006.01]
- 10/43 • • characterised by the arrangement of teeth or other cutting elements [2006.01]
- 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, 2006.01]
- 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, 2006.01]
- 10/55 • • • with preformed cutting elements (inserts per se E21B 10/56, E21B 10/58) [2006.01]
- 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 [2006.01]
- 10/573 • • • characterised by support details, e.g. the substrate construction or the interface between the substrate and the cutting element [2006.01]
- 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 [2006.01]
- 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, 2006.01]
- 10/627 • • with plural detachable cutting elements [2006.01]
- 10/633 • • • independently detachable [2006.01]
- 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]

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- 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, 2006.01]
- 27/02 • Dump bailers, i.e. containers for depositing substances, e.g. cement or acids [6, 2006.01]
- 27/04 • where the collecting or depositing means include helical conveying means [2006.01]
- 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, 2006.01]
- 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, 2006.01]
- 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, 2006.01]
- 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)

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- 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]
  - 43/02 • Subsoil filtering (E21B 43/11 takes precedence; chemical compositions for consolidating loose sand or the like around wells C09K 8/56) [1, 2006.01]
  - 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, 2006.01]
  - 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, 2006.01]
- 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]

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- 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) [1, 2012.01]

- 47/001 • for underwater installations [2012.01]
- 47/002 • by visual inspection [2012.01]
- 47/003 • Determining well or borehole volumes (determining depth E21B 47/04; diameter E21B 47/08) [2012.01]
- 47/005 • Monitoring or checking of cementation quality or level [2012.01]
- 47/007 • Measuring stresses in a pipe string or casing (for locating blocked portions of pipes E21B 47/09) [2012.01]
- 47/008 • Monitoring of down-hole pump systems, e.g. for the detection of "pumped-off" conditions [2012.01]
- 47/009 • • Monitoring of walking-beam pump systems [2012.01]
- 47/01 • • Devices for supporting measuring instruments on drill bits, pipes, rods or wirelines; Protecting measuring instruments in boreholes against heat, shock, pressure or the like [6, 2012.01]
- 47/013 • • • Devices specially adapted for supporting measuring instruments on drill bits [2012.01]
- 47/017 • • • Protecting measuring instruments [2012.01]
- 47/02 • Determining slope or direction
- 47/022 • • of the borehole, e.g. using geomagnetism [1, 2012.01]
- 47/0224 • • • using seismic or acoustic means [2012.01]
- 47/0228 • • • using electromagnetic energy or detectors therefor [2012.01]
- 47/0232 • • • • at least one of the energy sources or one of the detectors being located on or above the ground surface [2012.01]
- 47/0236 • • • using a pendulum [2012.01]
- 47/024 • • of devices in the borehole (E21B 47/022 takes precedence)
- 47/026 • • of penetrated ground layers
- 47/04 • Measuring depth or liquid level [1, 2012.01]
- 47/047 • • Liquid level (E21B 47/053 takes precedence) [2012.01]
- 47/053 • • using radioactive markers [2012.01]
- 47/06 • Measuring temperature or pressure [1, 2012.01]
- 47/07 • • Temperature [2012.01]
- 47/08 • Measuring diameters or related dimensions at the borehole [1, 2012.01]
- 47/085 • • using radiant means, e.g. acoustic, radioactive or electromagnetic [2012.01]
- 47/09 • Locating or determining the position of objects in boreholes or wells; Identifying the free or blocked portions of pipes [3, 2012.01]
- 47/092 • • by detecting magnetic anomalies [2012.01]
- 47/095 • • by detecting acoustic anomalies, e.g. using mud-pressure pulses [2012.01]
- 47/098 • • using impression packers, e.g. to detect recesses or perforations [2012.01]
- 47/10 • Locating fluid leaks, intrusions or movements [1, 2012.01]
- 47/103 • • using thermal measurements [2012.01]
- 47/107 • • using acoustic means [2012.01]
- 47/11 • • using tracers; using radioactivity [2012.01]
- 47/113 • • using electrical indications; using light radiation [2012.01]
- 47/117 • • Detecting leaks, e.g. from tubing, by pressure testing [2012.01]
- 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 [1, 2012.01]
- 47/125 • • using earth as an electrical conductor (E21B 47/13 takes precedence) [2012.01]
- 47/13 • • by electromagnetic energy, e.g. of radio frequency range [2012.01]
- 47/135 • • • using light waves, e.g. infrared or ultraviolet waves [2012.01]
- 47/14 • • using acoustic waves [6]
- 47/16 • • • through the drill string or casing [6]
- 47/18 • • • through the well fluid [6, 2012.01]
- 47/20 • • • • by modulation of mud waves, e.g. by continuous modulation [2012.01]
- 47/22 • • • • by negative mud pulses using a pressure relief valve between drill pipe and annulus [2012.01]
- 47/24 • • • • by positive mud pulses using a flow restricting valve within the drill pipe [2012.01]
- 47/26 • Storing data down-hole, e.g. in a memory or on a record carrier [2012.01]
- 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]