

SECTION E — FIXED CONSTRUCTIONS

E21 EARTH OR ROCK DRILLING; MINING

Note(s)

In this class, the following term is used with the meaning indicated:

- "drilling" covers boring and vice versa.

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)

1. 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.
2. 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.

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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, 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]

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) [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, 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]

E21B

- 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]
- 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]

- 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]

E21C MINING OR QUARRYING

Subclass index

CUTTING; SLITTING; DISLODGING

General structure of machines.....25/00, 27/00

Details.....29/00, 31/00, 35/00

Other devices.....33/00, 37/00, 39/00

METHODS OF MINING OR QUARRYING; OPEN-PIT MINING.....41/00, 45/00, 47/00, 49/00

OBTAINING MINERALS FROM UNDERWATER.....	50/00
WINNING MATERIALS FROM EXTRATERRESTRIAL SOURCES.....	51/00

Cutting; Slitting; Dislodging

25/00	Cutting machines, i.e. for making slits approximately parallel or perpendicular to the seam (dislodging machines with slitting means E21C 27/02, E21C 27/10, E21C 27/18)	25/66	• Machines for making slits with additional arrangements for drilling
25/02	• Machines slitting solely by one or more percussive tools moved through the seam	25/68	• Machines for making slits combined with equipment for removing, e.g. by loading, material won by other means (slitting machines combined with planing means E21C 27/18; removing chippings E21C 35/20)
25/04	• • Cutting crowns or other tools (percussion drill bits E21B 10/36)	27/00	Machines which completely free the mineral from the seam
25/06	• Machines slitting solely by one or more cutting rods or cutting drums which rotate, move through the seam, and may or may not reciprocate	27/01	• specially adapted for removing overhanging coal
25/08	• • Mountings for the rods or drums	27/02	• solely by slitting (rods, drums, for same E21C 25/10; saws, discs, wheels E21C 25/18; chains, chain guides, for same E21C 25/28)
25/10	• • Rods; Drums [6]	27/04	• • by a single chain guided on a frame with or without auxiliary slitting means
25/14	• • with equipment for cleaning the slit (associated with cutter chain machines E21C 25/50)	27/06	• • • with a slewing frame
25/16	• Machines slitting solely by one or more rotating saws, cutting discs, or wheels	27/08	• • with additional means for cutting the mineral into blocks
25/18	• • Saws; Discs; Wheels	27/10	• by both slitting and breaking-down
25/20	• Machines slitting solely by one or more reciprocating sawing implements or reciprocating cutter chains; Shaker conveyers with cutting means	27/12	• • breaking-down effected by acting on the vertical face of the mineral, e.g. by percussive tools
25/22	• Machines slitting solely by one or more cutter chains moving unidirectionally along jibs	27/14	• • breaking-down effected by force or pressure applied to side of slit, e.g. by wedges (breaking-down by means inserted in boreholes E21C 37/00)
25/24	• • with flat jibs only	27/16	• • • with means for both slitting and breaking-down
25/26	• • with curved jibs only	27/18	• by both slitting and planing
25/28	• • Chains or chain guides [6]	27/20	• Mineral freed by means not involving slitting
25/30	• • • Chain guides	27/22	• • by rotary drills with breaking-down means, e.g. wedge-shaped drills
25/32	• • • specially adapted for curved jibs	27/24	• • by milling means acting on the full working face
25/34	• • • Chains	27/26	• • by closely adjacent cutter chains acting on the full working face
25/36	• • • Couplings for links	27/28	• • by percussive drills with breaking-down means, e.g. wedge-shaped tools
25/40	• • • having links with integrally formed picks	27/30	• • by jaws, buckets, or scoops that scoop-out the mineral
25/50	• • with equipment for cleaning the slit (associated with rotary-rod or rotary-drum machines E21C 25/14)	27/32	• • by adjustable or non-adjustable planing means with or without loading arrangements (by percussed planing means E21C 27/46)
25/52	• Machines incorporating two or more of the slitting means according to groups E21C 25/02, E21C 25/06, E21C 25/16, E21C 25/20 and E21C 25/22	27/34	• • • Machine propelled along the working face by cable or chain
25/54	• Slitting by unguided cutter cables or cutter chains or by unguided tools drawn along the working face by cables or the like (dislodging by planing means E21C 27/32; propulsion by haulage cables E21C 29/14)	27/35	• • • Ram-ploughs
25/56	• Slitting by cutter cables or cutter chains or by tools drawn along the working face by cables or the like, in each case guided parallel to the face, e.g. by a conveyer, by a guide parallel to a conveyer (pressing the conveyer equipped with tools toward the working face E21C 35/14)	27/36	• • • Machine self-propelled along the working face
25/58	• Machines slitting by drilling hole on hole	27/38	• • • Machine stationary while planing in an arc
25/60	• Slitting by jets of water or other liquid (picks with arrangement of fluid-spraying nozzles E21C 35/187; distribution of spraying fluids in rotating cutter-heads E21C 35/23) [6]	27/40	• • • Machine and its planing tool making alternative step-wise movements along the working face
25/62	• Machines for making slits approximately perpendicular to the seams either level with, or above or below the level of, the machine	27/42	• • • combined with scraper or collector box
25/64	• Slitting machines guided solely by hand and either carried by hand or mounted on supports (hand-held power-operated tools E21C 37/22)	27/44	• • • Planing knives (mining picks E21C 35/18)
		27/46	• • by percussed planing means
		29/00	Propulsion of machines for slitting or completely freeing the mineral from the seam
		29/02	• by means on the machine exerting a thrust against fixed supports
		29/04	• by cable or chains
		29/06	• • anchored at one or both ends to the mine working face
		29/08	• • • Anchoring arrangements (for anchoring of conveyers only E21F 13/00)

- 29/10 • • • Cable or chain co-operating with a winch or the like on the machine
 - 29/12 • • • Machines propelled by thrust or pull against a part alternately anchored to, and released from, a cable or chain
 - 29/14 • • by haulage cable or chain pulling the machine along the working face
 - 29/16 • • • Winches or other means for pulling cable or chain (winches in general B66D)
 - 29/18 • • • Coupling and uncoupling machine to cable or chain
 - 29/20 • • with safety devices operating in the event of breakage of the cable or chain
 - 29/22 • by wheels, endless tracks, or the like
 - 29/24 • • Trucks carrying the machine while working
 - 29/26 • • • with means for adjustably positioning the machine on the truck
 - 29/28 • • • • adjusting the height of the whole machine
 - 31/00 Driving means incorporated in machines for slitting or completely freeing the mineral from the seam**
 - 31/02 • for cutting or breaking-down devices
 - 31/04 • • imparting both a rotary and reciprocating motion
 - 31/06 • • actuated by an endless cable or chain
 - 31/08 • for adjusting parts of the machines
 - 31/10 • for slewing parts of the machines
 - 31/12 • Component parts
 - 33/00 Trucks or other devices for transporting machines for slitting or completely freeing the mineral from the seam**
 - 33/02 • with equipment for loading or unloading the machine on to, or from, the truck
 - 35/00 Details of, or accessories for, machines for slitting or completely freeing the mineral from the seam, not provided for in groups E21C 25/00-E21C 33/00, E21C 37/00 or E21C 39/00**
 - 35/02 • Locking equipment for slewable parts
 - 35/04 • Safety devices (operating in the event of breakage of a haulage cable or chain E21C 29/20)
 - 35/06 • Equipment for positioning the whole machine in relation to its sub-structure
 - 35/08 • Guiding the machine
 - 35/10 • • by feelers contacting the working face
 - 35/12 • • along a conveyer for the cut material
 - 35/14 • • • Equipment for pressing the conveyer towards the working face
 - 35/16 • • by making use of the timbering, filling, or other supports
 - 35/18 • Mining picks; Holders therefor (planing knives E21C 27/44) [6]
 - 35/183 • • with inserts or layers of wear-resisting material [6]
 - 35/187 • • with arrangement of fluid-spraying nozzles (supply of fluid to the nozzles E21C 35/22) [6]
 - 35/19 • • Means for fixing picks or holders [6]
 - 35/193 • • • using bolts as main fixing elements [6]
 - 35/197 • • • using sleeves, rings or the like, as main fixing elements [6]
 - 35/20 • General features of equipment for removal of chippings, e.g. for loading on conveyer
 - 35/22 • Equipment for preventing the formation of, or for removal of, dust (picks with arrangement of fluid-spraying nozzles E21C 35/187; methods or apparatus for flushing boreholes E21B 21/00)
 - 35/23 • • Distribution of spraying-fluids in rotating cutter-heads [6]
 - 35/24 • Remote control specially adapted for machines for slitting or completely freeing the mineral (control in general G05)
 - 37/00 Other methods or devices for dislodging with or without loading** (breaking-down by means inserted in slits E21C 27/14)
 - 37/02 • by wedges
 - 37/04 • by devices with parts pressed mechanically against the wall of a borehole
 - 37/06 • by making use of hydraulic or pneumatic pressure in a borehole
 - 37/08 • • Devices with pistons, plungers, or the like pressed locally against the wall of the borehole
 - 37/10 • • Devices with expanding elastic casings
 - 37/12 • • by injecting into the borehole a liquid, either initially at high pressure or subsequently subjected to high pressure, e.g. by pulses, by explosive cartridges acting on the liquid (slitting by jets of water E21C 25/60; blasting by explosives F42D)
 - 37/14 • • by compressed air; by gas blast; by gasifying liquids
 - 37/16 • by fire-setting or by similar methods based on a heat effect (drilling by use of heat E21B 7/14)
 - 37/18 • by electricity
 - 37/20 • by ultrasonics
 - 37/22 • Hand tools or hand-held power-operated tools specially adapted for dislodging minerals (slitting machines guided solely by hand E21C 25/64)
 - 37/24 • • Pick hammers (pneumatic hammers in general B25D; percussion drilling E21B 1/00)
 - 37/26 • Chisels or other cutting tools not mentioned before
 - 39/00 Devices for testing *in situ* the hardness or other properties of minerals, e.g. for giving information as to the selection of suitable mining tools**
- Methods of mining or quarrying; Open-pit mining; Layouts therefor**
- 41/00 Methods of underground or surface mining** (E21C 45/00 takes precedence); **Layouts therefor** (for peat E21C 49/00) [5]
 - 41/16 • Methods of underground mining (winning machines therefor E21C 25/00-E21C 39/00); Layouts therefor [5]
 - 41/18 • • for brown or hard coal [5]
 - 41/20 • • for rock salt or potash salt [5]
 - 41/22 • • for ores, e.g. mining placers [5]
 - 41/24 • • for oil-bearing deposits [5]
 - 41/26 • Methods of surface mining (machines for obtaining, or the removal of, materials in open-pit mines E21C 47/00); Layouts therefor [5]
 - 41/28 • • for brown or hard coal [5]
 - 41/30 • • for ores, e.g. mining placers [5]
 - 41/32 • Reclamation of surface-mined areas (machines or methods for treating or working soil for agricultural purposes A01B 77/00, A01B 79/00; machines for back-filling E02F 5/22) [5]
 - 45/00 Methods of hydraulic mining; Hydraulic monitors** (E21C 25/60 takes precedence) [5]
 - 45/02 • Means for generating pulsating fluid jets [5]
 - 45/04 • • by use of highly pressurised liquid [5]
 - 45/06 • • by use of compressed gases [5]
 - 45/08 • Automatic or remote control of hydraulic monitors [5]

E21C

- 47/00 Machines for obtaining, or the removal of, materials in open-pit mines** (obtaining peat E21C 49/00)
- 47/02 • for coal, brown coal, or the like (dredgers or soil-shifting machines in general E02F) [3]
- 47/04 • • Conveyer bridges used in co-operation with the winning apparatus [3]
- 47/06 • • Cableway conveyers used in co-operation with the winning apparatus (underground hauling E21F 13/00)
- 47/08 • • Devices for cutting-out partings, e.g. layers of sand between seams of coal
- 47/10 • for quarrying stone, sand, gravel, or clay
- 49/00 Obtaining peat; Machines therefor** (treating peat C10F)
- 49/02 • by excavating
- 49/04 • by digging in the form of peat sods
- 50/00 Obtaining minerals from underwater, not otherwise provided for** (suction dredgers or component parts thereof E02F 3/88; equipment for conveying or separating excavated material E02F 7/00; dippers G01N 1/12) [5]
- 50/02 • dependent on the ship movements (vessels or floating structures adapted for special purposes B63B 35/00) [5]
- 51/00 Apparatus for, or methods of, winning materials from extraterrestrial sources** (cosmonautics B64G) [2]

E21D SHAFTS; TUNNELS; GALLERIES; LARGE UNDERGROUND CHAMBERS (soil-conditioning or soil-stabilising materials C09K 17/00; cutting machines for mining or quarrying E21C; safety devices, transport, rescue, ventilation or drainage E21F) [2, 6]

Note(s)

1. This subclass covers methods or apparatus for making or lining tunnels, galleries or large underground chambers, using underground mining methods only, i.e. not involving disturbance of the ground surface.
2. This subclass does not cover underground spaces made by foundation engineering, i.e. involving disturbance of the ground surface, which are covered by subclass E02D.

Subclass index

MAKING SHAFTS; LININGS THEREFOR.....	1/00, 3/00, 7/00, 8/00, 5/00
MAKING TUNNELS OR GALLERIES; LININGS THEREFOR.....	9/00, 11/00
MAKING UNDERGROUND CHAMBERS; LININGS THEREFOR.....	13/00, 11/00
WORKING-FACE SUPPORTS OR COVERS.....	15/00, 17/00, 19/00, 21/00
SUPPORTS FOR STEP-BY-STEP MOVEMENT.....	23/00
SETTING ANCHORING BOLTS.....	20/00

Shafts

- 1/00 Sinking shafts**
- 1/02 • by hand
- 1/03 • mechanically (E21D 1/08 takes precedence)
- 1/04 • • with grabs
- 1/06 • • with shaft-boring cutters (drilling machines E21B)
- 1/08 • while moving the lining downwards
- 1/10 • Preparation of the ground
- 1/12 • • by freezing
- 1/14 • • • Freezing apparatus
- 1/16 • • by petrification (grouting anchoring-bolts E21D 20/02)
- 3/00 Raising shafts, i.e. working upwards from the bottom**
- 5/00 Lining shafts; Linings therefor** (E21D 11/00 takes precedence) [3]
- 5/01 • using prefabricated lining lowered into a hole filled with liquid or viscous mass
- 5/012 • Use of fluid-tight or anti-friction material on outside of, or between, lining layers
- 5/016 • Bearer curbs
- 5/02 • with wood (E21D 5/01, E21D 5/012, E21D 5/016 take precedence)
- 5/04 • with brick, concrete, stone, or similar building materials (E21D 5/01, E21D 5/012, E21D 5/016 take precedence)
- 5/06 • with iron or steel (E21D 5/01, E21D 5/012, E21D 5/016 take precedence)
- 5/08 • • in the form of profiled parts
- 5/10 • • in the form of tubing
- 5/11 • with combinations of different materials, e.g. wood, metal, concrete (E21D 5/01, E21D 5/012, E21D 5/016 take precedence)
- 5/12 • Accessories for making shaft linings, e.g. suspended cradles, shutterings
- 7/00 Shaft equipment, e.g. timbering within the shaft**
- 7/02 • Arrangement of guides for cages in shafts; Connection of guides for cages to shaft walls (guideways or guides for elevators B66B 7/02)
- 8/00 Shafts not provided for in groups E21D 1/00-E21D 7/00 [2006.01]**
- Tunnels; Galleries; Large underground chambers; Linings therefor [3, 6]**
- 9/00 Tunnels or galleries, with or without linings; Methods or apparatus for making thereof** (linings per se E21D 11/00; galleries protecting against falling rocks or avalanches E01F 7/04); **Layout of tunnels or galleries [3]**
- 9/01 • Methods or apparatus for enlarging or restoring the cross-section of tunnels, e.g. by restoring the floor to its original level [7]

9/02	• Driving inclined tunnels or galleries [3]	11/40	• Devices or apparatus specially adapted for handling or placing units of linings for tunnels or galleries [2]
9/04	• Driving tunnels or galleries through loose materials; Apparatus therefor not otherwise provided for	13/00	Large underground chambers; Methods or apparatus for making them (lining E21D 11/00) [6]
9/06	• Making by using a driving shield [2]	13/02	• Methods
9/08	• • with additional boring or cutting means [2]	13/04	• Special equipment; Accessories
9/087	• • • with a rotary drilling-head cutting simultaneously the whole cross-section, i.e. full-face machines [7]		
9/093	• • Control of the driving shield [7]		
9/10	• Making by using boring or cutting machines (E21D 9/08 takes precedence; similar machines for mining E21C 27/20; mining picks E21C 35/18) [3]		
9/11	• • with a rotary drilling-head cutting simultaneously the whole cross-section, i.e. full-face machines [7]		
9/12	• Devices for removing or hauling away excavated material or spoil; Working or loading platforms (underground transport E21F 13/00) [2]		
9/13	• • using hydraulic or pneumatic conveying means [7]		
9/14	• Layout of tunnels or galleries; Constructional features of tunnels or galleries, not otherwise provided for, e.g. portals, day-light attenuation at tunnel openings [3]		
11/00	Lining tunnels, galleries or other underground cavities, e.g. large underground chambers; Linings therefor; Making such linings in situ, e.g. by assembling (E21D 15/00-E21D 23/00 take precedence; specially for shafts E21D 5/00; lining pressure water galleries, linings therefor E02B 9/06) [2]		
11/02	• Lining predominantly with wood [2]		
11/03	• • using timber-setting machines		
11/04	• Lining with building materials (E21D 11/02, E21D 11/14 take precedence) [2]		
11/05	• • using compressible insertions		
11/06	• • with bricks		
11/07	• • • using brick-laying machines		
11/08	• • with preformed concrete slabs		
11/10	• • with concrete cast <i>in situ</i> ; Shuttering or other equipment adapted therefor		
11/12	• • Temporary supports for use during building; Accessories		
11/14	• Lining predominantly with metal [2]		
11/15	• • Plate linings; Laggings, i.e. linings designed for holding back formation material or for transmitting the load to main supporting members (insulation E21D 11/38) [2]		
11/18	• • Arch members		
11/20	• • • Special cross-sections, e.g. corrugated		
11/22	• • • Clamps or other yieldable means for interconnecting adjacent arch members either rigidly, or allowing arch member parts to slide when subjected to excessive pressure		
11/24	• • • Knuckle joints or links between arch members		
11/26	• • • Shoes for connecting arch members to longitudinal struts		
11/28	• • Longitudinal struts		
11/30	• • Bases for lower arch members (for props E21D 15/54)		
11/34	• • Joints between vertical props and horizontal top bars (end caps forming part of the props E21D 15/54)		
11/36	• • Linings or supports specially shaped for tunnels or galleries of irregular cross-section [2, 3]		
11/38	• Waterproofing (in general E02D 31/00); Heat insulating; Soundproofing; Electric insulating (for building constructions in general E04B 1/62) [2]		
		Working-face supports	
		15/00	Props (in the building art E04G 25/00); Chocks
		15/02	• Non-telescopic props
		15/04	• • with wooden prop parts joined by double conical connectors
		15/06	• • with parts joined by a lock, with or without slight axial adjustability
		15/08	• • • with toggle joint connection
		15/10	• • • with dog-clutch or pin-and-hole connection
		15/12	• • • with locking devices located near head or foot
		15/14	• Telescopic props (general means for fixing telescopic parts together F16B)
		15/15	• • Means counteracting entry of dirt; Built-in cleaning devices
		15/16	• • with parts held together by positive means, with or without relative sliding movement when the prop is subject to excessive pressure
		15/18	• • • with one part resting on a supporting medium, e.g. rubber, sand, bitumen, lead, located in the other part, with or without expulsion or displacement of the medium upon excessive pressure
		15/20	• • • with pawl, pin, cross-piece, or the like engaging with ratchet teeth, notches, holes, or the like spaced apart at intervals
		15/22	• • • with member, pin, cross-piece, or the like ruptured, sheared through, or permanently deformed upon excessive pressure
		15/24	• • • with axial screw-and-nut, rack-and-worm, or like mechanism
		15/26	• • • with screw, worm, or the like not self-locking but normally prevented from rotation by friction members which slip upon excessive pressure
		15/28	• • with parts held relatively to each other by friction or gripping, e.g. using wedges
		15/30	• • • by means expanded or contracted by pressure applied through the medium of a fluid or quasi-fluid, e.g. rubber
		15/32	• • • by a deformable collar
		15/34	• • • by axially-moving balls, rollers, or the like
		15/36	• • • by a tiltable collar surrounding one or both parts
		15/38	• • • with longitudinally-divided upper or lower prop parts, e.g. interfitting laminations
		15/40	• • • Collar or other support gripped to one or both parts by toggle-action, cam, or other member pivoted or similarly mounted
		15/42	• • • with special parts to influence the friction
		15/43	• • • Details of wedges (friction linings or pads E21D 15/42)
		15/44	• • Hydraulic, pneumatic, or hydraulic-pneumatic props
		15/45	• • • having closed fluid system, e.g. with built-in pumps or accumulators
		15/46	• • with load-measuring devices; with alarm devices
		15/48	• Chocks or the like

E21D

- 15/50 • Component parts or details of props (E21D 15/43, E21D 15/58, E21D 15/60 take precedence)
- 15/502 • • Prop bodies characterised by their shape, e.g. of specified cross-section
- 15/51 • • specially adapted to hydraulic, pneumatic, or hydraulic-pneumatic props, e.g. arrangements of relief valves
- 15/52 • • Extensible units located above or below standard props
- 15/54 • • Details of the ends of props (for permitting step-by-step movement E21D 23/06)
- 15/55 • • • of prop heads
- 15/56 • • Details of locks of telescopic props
- 15/58 • Devices for setting props
- 15/582 • • for mechanical props
- 15/59 • • for hydraulic, pneumatic, or hydraulic-pneumatic props
- 15/60 • Devices for withdrawing props or chocks

17/00 Caps for supporting mine roofs

- 17/01 • characterised by the shape of the cap, e.g. of specified cross-section
- 17/02 • Cantilever extension or similar protecting devices
- 17/022 • • Auxiliary devices for temporary support of roof-supporting beams whilst assembling
- 17/03 • • Brackets for roof-supporting bars
- 17/04 • • for use in longwall working
- 17/05 • • • hydraulically extensible
- 17/054 • • • hydraulically pivotable
- 17/06 • • for use in drifting galleries
- 17/08 • • Cap joints for obtaining a coal-face free of pit-props
- 17/082 • • • of sliding type
- 17/086 • • • of articulated type
- 17/10 • Details of mine caps for engaging the tops of pit-props, with or without retaining-plates; Retaining-plates

19/00 Provisional protective covers for working space (E21D 9/06, E21D 23/00 take precedence) [3]

- 19/02 • for use in longwall working
- 19/04 • for use in drifting galleries
- 19/06 • Arrangements for applying the covers [6]

- 20/00 **Setting anchoring-bolts** (anchoring bolts for shafts, tunnels or galleries E21D 21/00; means for anchoring structural elements or bulkheads specially adapted to foundation engineering E02D 5/74; dowels or other devices fastened in walls or the like by inserting them in holes made therein for that purpose F16B 13/00) [5]
- 20/02 • with provisions for grouting

21/00 Anchoring-bolts for roof, floor, or shaft-lining protection (dowels or other devices fastened in walls or the like by inserting them in holes made therein for that purpose F16B 13/00) [5]

- 21/02 • having means for indicating tension (screwed connections specially modified for indicating tensile load F16B 31/02)

23/00 Mine roof supports for step-by-step movement, e.g. in combination with provisions for shifting of conveyers, mining machines, or guides therefor (shifting of mine conveyers at the working face, per se E21F 13/08)

- 23/03 • having protective means, e.g. shields, for preventing or impeding entry of loose material into the working space or support [4]
- 23/04 • Structural features of the supporting construction, e.g. linking members between adjacent frames or sets of props; Means for counteracting lateral sliding on inclined floor (E21D 23/14 takes precedence)
- 23/06 • • Special mine caps or special tops of pit-props for permitting step-by-step movement
- 23/08 • Advancing mechanisms (E21D 23/16 takes precedence)
- 23/10 • • with advancing devices separate from the supporting construction
- 23/12 • Control, e.g. using remote control (E21D 23/16 takes precedence)
- 23/14 • • Effecting automatic sequential movement of supports, e.g. one behind the other
- 23/16 • Hydraulic or pneumatic features, e.g. circuits, arrangement or adaptation of valves, setting or retracting devices
- 23/18 • • of advancing mechanisms
- 23/20 • • • for sequential movement, e.g. one behind the other
- 23/22 • • • incorporated in mine caps
- 23/24 • • • the advancing mechanisms being separate from the supporting construction
- 23/26 • • Hydraulic or pneumatic control

E21F SAFETY DEVICES, TRANSPORT, FILLING-UP, RESCUE, VENTILATION, OR DRAINAGE IN OR OF MINES OR TUNNELS [2]

Subclass index

VENTILATION.....	1/00, 3/00
DRAINAGE.....	16/00
SAFETY DEVICES, RESCUE DEVICES.....	5/00-11/00
TRANSPORT; FILLING-UP.....	13/00, 15/00
OTHER METHODS OR DEVICES.....	17/00

Ventilation of mines or tunnels

- 1/00 Ventilation of mines or tunnels; Distribution of ventilating currents** (ventilating rooms or spaces in general F24F) [2]
- 1/02 • Test models (analogue computers therefor G06G 7/50)
- 1/04 • Air ducts (suspension devices E21F 17/02)
- 1/06 • • Duct connections (tube connections in general F16L)
- 1/08 • Ventilation arrangements in connection with air ducts, e.g. arrangements for mounting ventilators (ventilators per se F04D)
- 1/10 • Air doors (doors in general E06B)
- 1/12 • • Devices for automatically opening air doors
- 1/14 • Air partitions; Air locks (dams E21F 17/103; air locks for foundations E02D) [6]
- 1/16 • Shaft covers
- 1/18 • Gravity-flow ventilation (E21F 1/02-E21F 1/16 take precedence) [2]
- 3/00 Cooling or drying of air** (air-conditioning rooms or spaces in general F24F)

Safety devices; Rescue devices

- 5/00 Means or methods for preventing, binding, depositing or removing dust; Preventing explosions or fires** (dams E21F 17/103; applying liquids or other fluent materials to surfaces in general B05; flue-gas indicators G01N) [6]
- 5/02 • by wetting or spraying
- 5/04 • • Spraying barriers (spray nipples, spraying in general B05B, B05D; picks with arrangement of fluid-spraying nozzles E21C 35/187)
- 5/06 • • Fluids used for spraying
- 5/08 • Rock dusting; Depositing other protective substances
- 5/10 • • Devices for rock dusting
- 5/12 • • Composition of rock dust
- 5/14 • Fluid barriers or rock dusters made to work by, or at the same time as, shots or explosions
- 5/16 • Layers of hygroscopic or other salts deposited on floors, walls, or the like, for binding dust; Deposition of such layers (dust-absorbing materials in general C09K 3/22)
- 5/18 • Impregnating walls, or the like, with liquids for binding dust
- 5/20 • Drawing-off or depositing dust (methods or apparatus for flushing boreholes E21B 21/00; while slitting E21C 35/22) [1, 7]
- 7/00 Methods or devices for drawing-off gases with or without subsequent use of the gas for any purpose**
- 9/00 Devices preventing sparking of machines or apparatus** (preventing sparking of electric machines or apparatus H01K, H02K)

- 11/00 Rescue devices or other safety devices, e.g. safety chambers, escape ways** (breathing aids for curative purposes A61H 31/00; respiratory apparatus A62B 7/00; revival apparatus A62B 33/00)
- 13/00 Transport specially adapted to underground conditions** (mine cars B61D; transport in general, loading B65G)
- 13/02 • in galleries
- 13/04 • in gravity inclines; in staple or inclined shafts
- 13/06 • at or adjacent to the working face
- 13/08 • Shifting conveyers or other transport devices from one location at the working face to another (guiding mining machines along conveyers for the cut mineral E21C 35/12; in combination with mine roof supports for step-by-step movement E21D 23/00)
- 13/10 • Anchorings for conveyers [2]
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- 15/00 Methods or devices for placing filling-up materials in underground workings** (dams E21F 17/103) [6]
- 15/02 • Supporting means, e.g. shuttering, for filling-up materials
- 15/04 • • Stowing mats; Goaf wire netting; Partition walls
- 15/06 • Filling-up mechanically
- 15/08 • Filling-up hydraulically or pneumatically (hydraulic or pneumatic transport devices B65G; pipes, pipe couplings F16L)
- 15/10 • • Hydraulic or pneumatic filling-up machines
- 16/00 Drainage** (keeping dry foundation sites or other areas in the ground E02D 19/00) [2]
- 16/02 • of tunnels [2]
- 17/00 Methods or devices for use in mines or tunnels, not covered elsewhere** (mine lighting F21, H05B) [2]
- 17/02 • Suspension devices for tubes or the like, e.g. for ventilating ducts (supporting pipes, cables or protective tubing in general F16L 3/00-F16L 7/00)
- 17/04 • Distributing means for power supply [2]
- 17/06 • • Distributing electric power; Cable networks; Conduits for cables (circuit arrangements for supplying or distributing electric power in general H02J)
- 17/08 • • Distributing hydraulic power; Pipe networks for hydraulic liquid (pipe-line systems in general F17D)
- 17/10 • • Distributing pneumatic power; Pipe networks for compressed air (pipe-line systems in general F17D)
- 17/103 • Dams, e.g. for ventilation [6]
- 17/107 • • inflatable [6]
- 17/12 • • Dam doors
- 17/16 • Modification of mine passages or chambers for storage purposes, especially for liquids or gases (storing fluids in natural or artificial cavities or chambers in the earth B65G 5/00)
- 17/18 • Special adaptations of signalling or alarm devices (for elevators, escalators or moving walkways B66B; gas-sensitive devices per se G01N)