

## EARTH OR ROCK DRILLING; MINING

### E21 EARTH OR ROCK DRILLING; MINING

#### Note

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]

#### Notes

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

#### Subclass Index

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

#### Methods or apparatus for drilling

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

## E21B

- 4/00 Drives used in the borehole [3]**
- 4/02 . Fluid rotary type drives (hydraulic turbines for drilling wells F03B 13/02) [3]
  - 4/04 . Electric drives (E21B 4/12 takes precedence) [3]
  - 4/06 . Down-hole impacting means, e.g. hammers (percussion drill bits E21B 10/36; boring rams E21B 11/02; releasing-jars E21B 31/107) [3]
  - 4/08 . . impact being obtained by gravity only, e.g. with lost-motion connection [3]
  - 4/10 . . continuous unidirectional rotary motion of shaft or drilling pipe effecting consecutive impacts [3]
  - 4/12 . . Electrically operated hammers [3]
  - 4/14 . . Fluid operated hammers [3]
  - 4/16 . Plural down-hole drives, e.g. for combined percussion and rotary drilling (E21B 4/10 takes precedence); Drives for multi-bit drilling units [3]
  - 4/18 . Anchoring or feeding in the borehole [3,7]
  - 4/20 . combined with surface drive (E21B 4/10 takes precedence) [3]
- 6/00 Drives for drilling with combined rotary and percussive action** (drives used in the borehole E21B 4/00; portable percussive machines with superimposed rotation B25D 16/00) [3]
- 6/02 . the rotation being continuous [7]
  - 6/04 . . Separate drives for percussion and rotation [7]
  - 6/06 . the rotation being intermittent, e.g. obtained by a ratchet device [7]
  - 6/08 . . Separate drives for percussion and rotation [7]
- 7/00 Special methods or apparatus for drilling** (supports for the drilling machine, e.g. derricks or masts, E21B 15/00) [1,7]
- 7/02 . Drilling rigs characterised by means for land transport, e.g. skid mounting or wheel mounting (portable drilling rigs for use on underwater floors E21B 7/124) [1,7]
  - 7/04 . Directional drilling
  - 7/06 . . Deflecting the direction of boreholes
  - 7/08 . . . Special apparatus for deflecting the boring, e.g. special drill bits, knuckle joints, whipstocks (directional window cutting E21B 29/06; deflecting the direction of fishing tools E21B 31/14)
  - 7/10 . . Correction of deflected boreholes
  - 7/12 . Underwater drilling (telescoping joints E21B 17/07; using heave compensators E21B 19/09; well heads specially adapted for underwater installations E21B 33/035) [1,7]
  - 7/124 . . with underwater tool drive prime mover, e.g. portable drilling rigs for use on underwater floors [3]
  - 7/128 . . from floating support with independent underwater anchored guide base [3]
  - 7/132 . . from underwater buoyant support [3]
  - 7/136 . . from non-buoyant support (E21B 7/124 takes precedence) [3]
  - 7/14 . Drilling by use of heat, e.g. flame drilling
  - 7/15 . . of electrically generated heat [3]
  - 7/16 . Applying separate balls or pellets by the pressure of the drill, so-called shot-drilling
  - 7/18 . Drilling by liquid or gas jets, with or without entrained pellets (E21B 7/14 takes precedence; hydraulic monitors E21C 45/00) [5]

- 7/20 . Driving or forcing casings or pipes into boreholes, e.g. sinking; Simultaneously drilling and casing boreholes (surface means for applying to-and-fro rotation movements to the casing E21B 3/025; placing piles E02D 7/00; sinking shafts while moving the lining downwards E21D 1/08) [3]
- 7/24 . Drilling using vibrating or oscillating means, e.g. out-of-balance masses (percussion drilling E21B 1/00) [3]
- 7/26 . Drilling without earth removal, e.g. with self-propelled burrowing devices (E21B 7/30 takes precedence; down-hole drives E21B 4/00) [3,6]
- 7/28 . Enlarging drilled holes, e.g. by counterboring (drill bits for enlarging the borehole E21B 10/26) [3]
- 7/30 . . without earth removal [6]

### Drilling tools

- 10/00 Drill bits** (specially adapted for deflecting the direction of boring E21B 7/08; with means for collecting substances E21B 27/00) [3,8]
- 10/02 . Core bits (characterised by wear resisting parts E21B 10/46; obtaining undisturbed cores E21B 25/00) [3]
  - 10/04 . . with core destroying means [3]
  - 10/06 . . Roller core bits [3]
  - 10/08 . Roller bits (roller core bits E21B 10/06; with leading portion E21B 10/26; characterised by wear resisting parts E21B 10/46) [3]
  - 10/10 . . with roller axle supported at both ends (with disc cutters E21B 10/12) [3]
  - 10/12 . . with disc cutters [3]
  - 10/14 . . combined with non-rolling cutters other than of leading-portion type [3]
  - 10/16 . . characterised by tooth form or arrangement [3]
  - 10/18 . . characterised by conduits or nozzles for drilling fluids (drilling fluid supply to the bearings E21B 10/23) [3,8]
  - 10/20 . . characterised by detachable or adjustable parts, e.g. legs or axles (cross axle roller bits E21B 10/10) [3]
  - 10/22 . . characterised by bearing, lubrication or sealing details [3,8]
  - 10/23 . . . with drilling fluid supply to the bearings [8]
  - 10/24 . . . characterised by lubricating details (E21B 10/23 takes precedence) [3,8]
  - 10/25 . . . characterised by sealing details [8]
  - 10/26 . Drill bits with leading portion, i.e. drill bits with a pilot cutter; Drill bits for enlarging the borehole, e.g. reamers (percussion drill bits with leading portion E21B 10/40; augers with leading portion E21B 10/44) [3]
  - 10/28 . . with non-expandable roller cutters [3]
  - 10/30 . . . Longitudinal axis roller reamers, e.g. reamer stabilisers [3]
  - 10/32 . . with expandable cutting tools [3]
  - 10/34 . . . of roller-cutter type [3]
  - 10/36 . Percussion drill bits (characterised by wear resisting parts E21B 10/46) [3]
  - 10/38 . . characterised by conduits or nozzles for drilling fluids [3]
  - 10/40 . . with leading portion [3]
  - 10/42 . Rotary drag type drill bits with teeth, blades or like cutting elements, e.g. fork-type bits, fish tail bits (characterised by wear resisting parts E21B 10/46, by conduits or nozzles for drilling fluid E21B 10/60, by detachable parts E21B 10/62) [3,8]

- 10/43 . . . characterised by the arrangement of teeth or other cutting elements [8]
- 10/44 . Bits with helical conveying portion, e.g. screw type bits; Augers with leading portion or with detachable parts (E21B 10/42 takes precedence; drilling rods with helical structure E21B 17/22) [3,8]
- 10/46 . characterised by wear resisting parts, e.g. diamond inserts [3]
- 10/48 . . . the bit being of core type [3]
- 10/50 . . . the bit being of roller type [3]
- 10/52 . . . with chisel- or button-type inserts [3]
- 10/54 . . . the bit being of the rotary drag type, e.g. fork-type bits [3,8]
- 10/55 . . . with preformed cutting elements (inserts per se E21B 10/56, E21B 10/58) [8]
- 10/56 . . . Button-type inserts (E21B 10/52 takes precedence) [3]
- 10/567 . . . with preformed cutting elements mounted on a distinct support, e.g. polycrystalline inserts [8]
- 10/573 . . . . characterised by support details, e.g. the substrate construction or the interface between the substrate and the cutting element [8]
- 10/58 . . . Chisel-type inserts (E21B 10/52, E21B 10/54 take precedence) [3]
- 10/60 . characterised by conduits or nozzles for drilling fluids (for roller bits E21B 10/18; for percussion drill bits E21B 10/38) [3]
- 10/61 . . . characterised by nozzle structure [8]
- 10/62 . characterised by parts, e.g. cutting elements, which are detachable or adjustable (E21B 10/64 takes precedence; for roller bits E21B 10/20; for augers E21B 10/44) [3,8]
- 10/627 . . . with plural detachable cutting elements [8]
- 10/633 . . . . independently detachable [8]
- 10/64 . characterised by the whole or part thereof being insertable into or removable from the borehole without withdrawing the drilling pipe (retrievable core receivers E21B 25/02) [3]
- 10/66 . . . the cutting element being movable through the drilling pipe and laterally shiftable [3]
- 11/00 Other drilling tools**
- 11/02 . Boring rams (percussion drives used in the borehole E21B 4/06; percussion drill bits E21B 10/36)
- 11/04 . Boring grabs
- 11/06 . with driven cutting chains or similarly-driven tools
- 12/00 Accessories for drilling tools [3]**
- 12/02 . Wear indicators [3]
- 12/04 . Drill bit protectors [3]
- 12/06 . Mechanical cleaning devices [3]
- Other equipment or details for drilling; Well equipment or well maintenance**
- 15/00 Supports for the drilling machine, e.g. derricks or masts [1,7]**
- 15/02 . specially adapted for underwater drilling (E21B 15/04 takes precedence; floating drilling platforms B63B 35/44; drilling platforms on legs E02B 17/00) [3]
- 15/04 . specially adapted for directional drilling, e.g. slant hole rigs [3]
- 17/00 Drilling rods or pipes; Flexible drill strings; Kellies; Drill collars; Sucker rods; Casings; Tubings** (rod couplings in general F16D; tubes or tube couplings in general F16L)
- 17/01 . Risers (riser connectors E21B 33/038) [3]
- 17/02 . Couplings; Joints
- 17/03 . . . between drilling rod or pipe and drill motor, e.g. between drilling rod and hammer [7]
- 17/04 . . . between rod and bit, or between rod and rod
- 17/042 . . . . threaded
- 17/043 . . . . with locking means
- 17/046 . . . . with ribs, pins, or jaws, and complementary grooves or the like, e.g. bayonet catches
- 17/05 . . . . Swivel joints
- 17/06 . . . . Releasing-joints, e.g. safety joints
- 17/07 . . . . Telescoping joints for varying drill string lengths; Shock absorbers (heave compensators in the derrick E21B 19/09; releasing-jars E21B 31/107) [3]
- 17/08 . . . Casing joints
- 17/10 . Wear protectors; Centralising devices (drives used in the borehole with anchoring means E21B 4/18; guiding or centralising devices outside the borehole E21B 19/24)
- 17/12 . . . Devices for placing or drawing out wear protectors
- 17/14 . Casing shoes
- 17/16 . Drill collars [3]
- 17/18 . Pipes provided with plural fluid passages (circulation of drilling fluid by means of such pipes E21B 21/12) [3]
- 17/20 . Flexible or articulated drilling pipes [3]
- 17/22 . Rods or pipes with helical structure (drill bits with helical conveying portion E21B 10/44) [3]
- 19/00 Handling rods, casings, tubes or the like outside the borehole, e.g. in the derrick; Apparatus for feeding the rods or cables** (surface drives E21B 1/02, E21B 3/02)
- 19/02 . Rod or cable suspensions (load-engaging elements for hoisting or lowering purposes in general B66C 1/00; crown blocks or pulley blocks B66D; cable guides B66D 1/36)
- 19/04 . . . Hooks
- 19/06 . . . Elevators, i.e. rod- or tube-gripping devices
- 19/07 . . . . Slip-type elevators (slips in rotary tables E21B 19/10)
- 19/08 . Apparatus for feeding the rods or cables (E21B 19/22 takes precedence; automatic feed E21B 44/02; hoisting drums B66D); Apparatus for increasing or decreasing the pressure on the drilling tool; Apparatus for counterbalancing the weight of the rods [3,7]
- 19/081 . . . Screw-and-nut feed mechanisms [7]
- 19/083 . . . Cam, rack or like feed mechanisms [7]
- 19/084 . . . with flexible drawing means, e.g. cables [7]
- 19/086 . . . with a fluid-actuated cylinder (E21B 19/084, E21B 19/087, E21B 19/09 take precedence) [7]
- 19/087 . . . by means of a swinging arm [7]
- 19/089 . . . with a spring or an additional weight [7]
- 19/09 . . . specially adapted for drilling underwater formations from a floating support using heave compensators supporting the drill string (drilling-pipe telescoping joints E21B 17/07) [3]
- 19/10 . Slips; Spiders
- 19/12 . Rope clamps (rope clamps in general F16G 11/00)

## E21B

- 19/14 . Racks, ramps, troughs or bins, for holding the lengths of rod singly or connected; Handling between storage place and borehole (E21B 19/20, E21B 19/22 take precedence) [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 to 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 to E21B 23/06 take precedence) [3]
- 23/03 . for setting the tools into, or removing the tools from, laterally offset landing nipples or pockets [3]
- 23/04 . operated by fluid means, e.g. actuated by explosion (E21B 23/06, E21B 23/08 take precedence) [3]
- 23/06 . for setting packers
- 23/08 . Introducing or running tools by fluid pressure, e.g. through-the-flow-line tool systems (special provisions on heads therefor E21B 33/068; cementing plugs E21B 33/16; scrapers operated by fluid pressure E21B 37/04) [3]
- 23/10 . . Tools specially adapted therefor [3]
- 23/12 . . Tool diverters [3]
- 23/14 . for displacing a cable or a cable-operated tool, e.g. for logging or perforating operations in deviated wells (by fluid pressure E21B 23/08; provision on well heads for introducing or removing cable-operated tools E21B 33/072, E21B 33/076) [6]
- 25/00 Apparatus for obtaining or removing undisturbed cores, e.g. core barrels, core extractors** (core bits E21B 10/02; using explosives or projectiles in boreholes E21B 49/04; side-wall sampling or coring E21B 49/06)
- 25/02 . the core receiver being insertable into, or removable from, the borehole without withdrawing the drilling pipe (retrievable drill bits E21B 10/64) [3]
- 25/04 . . the core receiver having a core forming cutting edge or element, e.g. punch type core barrels [3]
- 25/06 . the core receiver having a flexible liner or inflatable retaining means [3]
- 25/08 . Coating, freezing, consolidating cores (E21B 25/06 takes precedence); Recovering uncontaminated cores or cores at formation pressure [3]
- 25/10 . Formed core retaining or severing means (E21B 25/06, E21B 25/08 take precedence) [3]
- 25/12 . . of the sliding wedge type [3]
- 25/14 . . mounted on pivot transverse to core axis [3]
- 25/16 . for obtaining oriented cores [3]
- 25/18 . the core receiver being specially adapted for operation under water [3]
- 27/00 Containers for collecting or depositing substances in boreholes or wells, e.g. bailers for collecting mud or sand; Drill bits with means for collecting substances, e.g. valve drill bits [6,8]**
- 27/02 . Dump bailers, i.e. containers for depositing substances, e.g. cement or acids [6,8]
- 27/04 . where the collecting or depositing means include helical conveying means [8]
- 28/00 Vibration generating arrangements for boreholes or wells, e.g. for stimulating production** (for drilling E21B 7/24; for transmitting measuring-signals E21B 47/14; for geophysical measurements G01V 1/02) [6]
- 29/00 Cutting or destroying pipes, packers, plugs, or wire lines, located in boreholes or wells, e.g. cutting of damaged pipes, of windows (perforators E21B 43/11); Deforming of pipes in boreholes or wells; Reconditioning of well casings while in the ground**
- 29/02 . by explosives or by thermal or chemical means (destroying objects in boreholes or wells by explosives E21B 31/16)
- 29/04 . Cutting of wire lines or the like (E21B 29/02 takes precedence) [3]
- 29/06 . Cutting windows, e.g. directional window cutters for whipstock operations (E21B 29/08 takes precedence; whipstocks E21B 7/08) [3]
- 29/08 . Cutting or deforming pipes to control fluid flow (blow-out preventers E21B 33/06) [3]
- 29/10 . Reconditioning of well casings, e.g. straightening [3]
- 29/12 . specially adapted for underwater installations (E21B 29/08 takes precedence) [3]
- 31/00 Fishing for or freeing objects in boreholes or wells** (provisions on well heads for introducing or removing objects E21B 33/068; locating or determining the position of objects in boreholes or wells E21B 47/09)
- 31/03 . Freeing by flushing [3]
- 31/06 . using magnetic means [3]

- 31/08 . . . using junk baskets or the like [3]
- 31/107 . . . using impact means for releasing stuck parts, e.g. jars (telescoping joints E21B 17/07) [3]
- 31/113 . . . hydraulically operated [3]
- 31/12 . . . Grappling tools, e.g. tongs or grabs
- 31/14 . . . with means deflecting the direction of the tool, e.g. by use of knuckle joints (apparatus for deflecting the boring E21B 7/08) [3]
- 31/16 . . . combined with cutting or destroying means (cutting or destroying means *per se* E21B 29/00) [3]
- 31/18 . . . gripping externally, e.g. overshot [3]
- 31/20 . . . gripping internally, e.g. fishing spears [3]
- 33/00 Sealing or packing boreholes or wells**
- 33/02 . . . Surface sealing or packing
- 33/03 . . . Well heads; Setting-up thereof (valve arrangements therefor E21B 34/02)
- 33/035 . . . specially adapted for underwater installations (E21B 33/043, E21B 33/064, E21B 33/076 take precedence) [3]
- 33/037 . . . . Protective housings therefor [3]
- 33/038 . . . . Connectors used on well heads, e.g. for connecting blow-out preventer and riser (connecting a production flow line to an underwater well head E21B 43/013) [3]
- 33/04 . . . Casing heads; Suspending casings or tubings in well heads (setting of casings in wells E21B 43/10)
- 33/043 . . . . specially adapted for underwater well heads (E21B 33/047 takes precedence) [3]
- 33/047 . . . . for plural tubing strings [3]
- 33/05 . . . . Cementing-heads, e.g. having provision for introducing cementing plugs
- 33/06 . . . Blow-out preventers [3]
- 33/064 . . . . specially adapted for underwater well heads (connectors therefor E21B 33/038) [3]
- 33/068 . . . . having provision for introducing objects or fluids into, or removing objects from, wells (cementing-heads E21B 33/05) [3]
- 33/072 . . . . for cable-operated tools (E21B 33/076 takes precedence) [3]
- 33/076 . . . . specially adapted for underwater installations [3]
- 33/08 . . . Wipers; Oil savers
- 33/10 . . . in the borehole
- 33/12 . . . Packers; Plugs (used for cementing E21B 33/134, E21B 33/16)
- 33/122 . . . Multiple-string packers
- 33/124 . . . Units with longitudinally-spaced plugs for isolating the intermediate space
- 33/126 . . . with fluid-pressure-operated elastic cup or skirt (E21B 33/122, E21B 33/124 take precedence)
- 33/127 . . . with inflatable sleeve (E21B 33/122, E21B 33/124 take precedence)
- 33/128 . . . with a member expanded radially by axial pressure (E21B 33/122, E21B 33/124 take precedence)
- 33/129 . . . with mechanical slips for hooking into the casing (E21B 33/122, E21B 33/124 take precedence)
- 33/1295 . . . . actuated by fluid pressure [6]
- 33/13 . . . Methods or devices for cementing, for plugging holes, crevices, or the like (dump bailers E21B 27/02; chemical compositions therefor C09K 8/00) [1,8]
- 33/134 . . . Bridging plugs
- 33/136 . . . Baskets, e.g. of umbrella type
- 33/138 . . . Plastering the borehole wall; Injecting into the formation
- 33/14 . . . for cementing casings into boreholes
- 33/16 . . . . using plugs for isolating cement charge; Plugs therefor
- 34/00 Valve arrangements for boreholes or wells** (in drilling fluid circulation systems E21B 21/10; blow-out preventers E21B 33/06; oil flow regulating apparatus E21B 43/12; valves in general F16K) [3]
- 34/02 . . . in well heads [3]
- 34/04 . . . in underwater well heads [3]
- 34/06 . . . in wells [3]
- 34/08 . . . responsive to flow or pressure of the fluid obtained (E21B 34/10 takes precedence) [3]
- 34/10 . . . operated by control fluid supplied from outside the borehole (control means being outside the borehole E21B 34/16) [3]
- 34/12 . . . operated by movement of casings or tubings [3]
- 34/14 . . . operated by movement of tools, e.g. sleeve valves operated by pistons or wire line tools [3]
- 34/16 . . . Control means therefor being outside the borehole [3]
- 35/00 Methods or apparatus for preventing or extinguishing fires** (cutting or deforming pipes to control fluid flow E21B 29/08; controlling flow of fluid to or in wells E21B 43/12; fire fighting in general A62C, A62D)
- 36/00 Heating, cooling, or insulating arrangements for boreholes or wells, e.g. for use in permafrost zones** (drilling by use of heat E21B 7/14; secondary recovery methods using heat E21B 43/24) [3]
- 36/02 . . . using burners [3]
- 36/04 . . . using electrical heaters [3]
- 37/00 Methods or apparatus for cleaning boreholes or wells** (E21B 21/00 takes precedence; cleaning pipes in general B08B 9/02)
- 37/02 . . . Scrapers specially adapted therefor
- 37/04 . . . operated by fluid pressure, e.g. free-piston scrapers (operating other tools by fluid pressure E21B 23/08) [3]
- 37/06 . . . using chemical means for preventing or limiting the deposition of paraffins or like substances (chemical compositions therefor C09K 8/52) [3,8]
- 37/08 . . . cleaning *in situ* of down-hole filters, screens, or gravel packs (E21B 37/06 takes precedence) [3]
- 37/10 . . . Well swabs [3]
- 40/00 Tubing catchers, automatically arresting the fall of oil-well tubing**
- 41/00 Equipment or details not covered by groups E21B 15/00 to E21B 40/00**
- 41/02 . . . *in situ* inhibition of corrosion in boreholes or wells (dump bailers E21B 27/02; chemical compositions therefor C09K 8/54; inhibiting corrosion in general C23F) [3,6,8]
- 41/04 . . . Manipulators for underwater operations, e.g. temporarily connected to well heads (manipulators in general B25J) [3]
- 41/06 . . . Work chambers for underwater operations, e.g. temporarily connected to well heads (in general B63C 11/00) [3]
- 41/08 . . . Underwater guide bases, e.g. drilling templates; Levelling thereof [7]
- 41/10 . . . Guide posts, e.g. releasable; Attaching guide lines to underwater guide bases [7]

**Obtaining fluids from wells [3]**

- 43/00 Methods or apparatus for obtaining oil, gas, water, soluble or meltable materials or a slurry of minerals from wells** (applicable only to water E03B; obtaining oil-bearing deposits or soluble or meltable materials by mining techniques E21C 41/00; pumps F04)
- 43/01 . . . specially adapted for obtaining from underwater installations (underwater well heads E21B 33/035)
  - 43/013 . . . Connecting a production flow line to an underwater well head [3]
  - 43/017 . . . Production satellite stations, i.e. underwater installations comprising a plurality of satellite well heads connected to a central station (underwater separating arrangements E21B 43/36) [3]
  - 43/02 . . . Subsoil filtering (E21B 43/11 takes precedence; chemical compositions for consolidating loose sand or the like around wells C09K 8/56) [1,8]
  - 43/04 . . . Graveling of wells
  - 43/08 . . . Screens or liners
  - 43/10 . . . Setting of casings, screens or liners in wells (driving or forcing casings into boreholes, simultaneously drilling and casing boreholes E21B 7/20; setting of tools, packers or the like E21B 23/00; suspending casings in well heads E21B 33/04)
  - 43/11 . . . Perforators; Permeators
  - 43/112 . . . Perforators with extendable perforating members, e.g. actuated by fluid means
  - 43/114 . . . Perforators using direct fluid action, e.g. abrasive jets
  - 43/116 . . . Gun or shaped-charge perforators
  - 43/117 . . . . Shaped-charge perforators (E21B 43/118 takes precedence)
  - 43/118 . . . . characterised by lowering in vertical position and subsequent tilting to operating position
  - 43/1185 . . . . Ignition systems [3]
  - 43/119 . . . Details, e.g. for locating perforating place or direction
  - 43/12 . . . Methods or apparatus for controlling the flow of the obtained fluid to or in wells (E21B 43/25 takes precedence; valve arrangements E21B 34/00)
  - 43/14 . . . Obtaining from a multiple-zone well
  - 43/16 . . . Enhanced recovery methods for obtaining hydrocarbons (fracturing E21B 43/26; obtaining slurry E21B 43/29; reclamation of contaminated soil *in situ* B09C)
  - 43/17 . . . Interconnecting two or more wells by fracturing or otherwise attacking the formation (E21B 43/247 takes precedence) [3]
  - 43/18 . . . Repressuring or vacuum methods
  - 43/20 . . . Displacing by water
  - 43/22 . . . Use of chemicals or bacterial activity (E21B 43/27 takes precedence; chemical or bacterial compositions therefor C09K 8/58; chemical features in extracting oils from oil sands or shales C10G) [1,8]
  - 43/24 . . . using heat, e.g. steam injection (heating, cooling or insulating wells E21B 36/00)
  - 43/241 . . . . combined with solution mining of non-hydrocarbon minerals, e.g. solvent pyrolysis of oil shale [5]
  - 43/243 . . . . Combustion *in situ* [3]
  - 43/247 . . . . . in association with fracturing processes [3]
  - 43/248 . . . . . using explosives [5]
  - 43/25 . . . Methods for stimulating production (dump bailers E21B 27/02; vibration generating arrangements E21B 28/00; chemical compositions therefor C09K 8/60) [1,8]
  - 43/26 . . . . by forming crevices or fractures
  - 43/263 . . . . . using explosives [3]
  - 43/267 . . . . . reinforcing fractures by propping [3]
  - 43/27 . . . . . by use of eroding chemicals, e.g. acids
  - 43/28 . . . Dissolving minerals other than hydrocarbons, e.g. by an alkaline or acid leaching agent (E21B 43/241 takes precedence) [5]
  - 43/285 . . . Melting minerals, e.g. sulfur (E21B 43/24 takes precedence; heating, cooling or insulating arrangements for wells E21B 36/00) [5]
  - 43/29 . . . Obtaining a slurry of minerals, e.g. by using nozzles [5]
  - 43/295 . . . Gasification of minerals, e.g. for producing mixtures of combustible gases (E21B 43/243 takes precedence) [5]
  - 43/30 . . . Specific pattern of wells, e.g. optimizing the spacing of wells (production satellite stations E21B 43/017) [3]
  - 43/32 . . . Preventing gas- or water-coning phenomena, i.e. the formation of a conical column of gas or water around wells [3]
  - 43/34 . . . Arrangements for separating materials produced by the well (separating apparatus *per se*, see the relevant subclasses) [3]
  - 43/36 . . . Underwater separating arrangements (E21B 43/38 takes precedence) [3]
  - 43/38 . . . in the well [3]
  - 43/40 . . . Separation associated with re-injection of separated materials [3]
- Automatic control; Surveying or testing [3]**
- 44/00 Automatic control systems specially adapted for drilling operations, i.e. self-operating systems which function to carry out or modify a drilling operation without intervention of a human operator, e.g. computer-controlled drilling systems** (for non-automatic drilling control, see the operation controlled; automatic feeding from rack and connecting of drilling pipes E21B 19/20; controlling pressure or flow of drilling fluid E21B 21/08); **Systems specially adapted for monitoring a plurality of drilling variables or conditions** (means for transmitting measuring-signals from the well to the surface E21B 47/12) [3]
- 44/02 . . . Automatic control of the tool feed (E21B 44/10 takes precedence) [7]
  - 44/04 . . . in response to the torque of the drive [7]
  - 44/06 . . . in response to the flow or pressure of the motive fluid of the drive [7]
  - 44/08 . . . in response to the amplitude of the movement of the percussion tool, e.g. jump or recoil [7]
  - 44/10 . . . Arrangements for automatic stopping when the tool is lifted from the working face [7]
- Surveying or testing**
- 45/00 Measuring the drilling time or rate of penetration**

- 47/00 Survey of boreholes or wells** (monitoring pressure or flow of drilling fluid E21B 21/08; geophysical logging G01V)
- 47/01 . Devices for supporting measuring instruments on a drill pipe, rod or wireline (setting or locking tools in boreholes or wells E21B 23/00); Protecting measuring instruments in boreholes against heat, shock, pressure or the like [6]
  - 47/02 . Determining slope or direction (clinometers or direction meters G01C)
  - 47/022 . . of the borehole
  - 47/024 . . of devices in the borehole (E21B 47/022 takes precedence)
  - 47/026 . . of penetrated ground layers (apparatus for obtaining oriented cores E21B 25/16; formation testing E21B 49/00)
  - 47/04 . Measuring depth or liquid level (measuring liquid level in general G01F)
  - 47/06 . Measuring temperature or pressure (measuring temperature in general G01K; measuring pressure in general G01L)
  - 47/08 . Measuring diameter (measuring diameter in general G01B)
- 47/09 . Locating or determining the position of objects in boreholes or wells; Identifying the free or blocked portions of pipes (measuring depth E21B 47/04; measuring diameter E21B 47/08) [3]
  - 47/10 . Locating fluid leaks, intrusions, or movements
  - 47/12 . Means for transmitting measuring-signals from the well to the surface, e.g. for logging while drilling (remote signalling in general G08)
  - 47/14 . . using acoustic waves [6]
  - 47/16 . . . through the drill string or casing [6]
  - 47/18 . . . through the well fluid [6]
- 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
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#### OBTAINING MINERALS FROM UNDERWATER .....

50/00
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#### WINNING MATERIALS FROM

EXTRATERRESTRIAL SOURCES .....	51/00
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### 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)

- 25/02 . Machines slitting solely by one or more percussive tools moved through the seam
- 25/04 . . Cutting crowns or other tools (percussion drill bits E21B 10/36)
- 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
- 25/08 . . Mountings for the rods or drums
- 25/10 . . Rods; Drums [6]
- 25/14 . . with equipment for cleaning the slit (associated with cutter chain machines E21C 25/50)
- 25/16 . Machines slitting solely by one or more rotating saws, cutting discs, or wheels
- 25/18 . . Saws; Discs; Wheels
- 25/20 . Machines slitting solely by one or more reciprocating sawing implements or reciprocating cutter chains; Shaker conveyers with cutting means
- 25/22 . Machines slitting solely by one or more cutter chains moving unidirectionally along jibs
- 25/24 . . with flat jibs only
- 25/26 . . with curved jibs only
- 25/28 . . Chains or chain guides [6]
- 25/30 . . . Chain guides
- 25/32 . . . . specially adapted for curved jibs
- 25/34 . . . Chains
- 25/36 . . . . Couplings for links
- 25/40 . . . . having links with integrally formed picks
- 25/50 . . with equipment for cleaning the slit (associated with rotary-rod or rotary-drum machines E21C 25/14)
- 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
- 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)
- 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)
- 25/58 . Machines slitting by drilling hole on hole

## E21C

- 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]
- 25/62 . Machines for making slits approximately perpendicular to the seams either level with, or above or below the level of, the machine
- 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)
- 25/66 . Machines for making slits with additional arrangements for drilling
- 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)
- 27/00 Machines which completely free the mineral from the seam**
- 27/01 . specially adapted for removing overhanging coal
- 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)
- 27/04 . . . by a single chain guided on a frame with or without auxiliary slitting means
- 27/06 . . . . with a slewing frame
- 27/08 . . . with additional means for cutting the mineral into blocks
- 27/10 . by both slitting and breaking-down
- 27/12 . . . breaking-down effected by acting on the vertical face of the mineral, e.g. by percussive tools
- 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)
- 27/16 . . . . with means for both slitting and breaking-down
- 27/18 . by both slitting and planing
- 27/20 . Mineral freed by means not involving slitting
- 27/22 . . . by rotary drills with breaking-down means, e.g. wedge-shaped drills
- 27/24 . . . by milling means acting on the full working face
- 27/26 . . . by closely adjacent cutter chains acting on the full working face
- 27/28 . . . by percussive drills with breaking-down means, e.g. wedge-shaped tools
- 27/30 . . . by jaws, buckets, or scoops that scoop-out the mineral
- 27/32 . . . by adjustable or non-adjustable planing means with or without loading arrangements (by percussed planing means E21C 27/46)
- 27/34 . . . . Machine propelled along the working face by cable or chain
- 27/35 . . . . . Ram-ploughs
- 27/36 . . . . Machine self-propelled along the working face
- 27/38 . . . . Machine stationary while planing in an arc
- 27/40 . . . . Machine and its planing tool making alternative step-wise movements along the working face
- 27/42 . . . . combined with scraper or collector box
- 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 to 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** (methods or apparatus for obtaining oil, gas, water, soluble or meltable materials or a slurry of minerals from wells E21B 43/00)
- 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 to 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]
- 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]

#### Notes

- (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. [6]
- (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. [6]

#### 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

## E21D

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

<b>1/00</b>	<b>Sinking shafts</b>
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)
<b>3/00</b>	<b>Raising shafts, i.e. working upwards from the bottom</b>
<b>5/00</b>	<b>Lining shafts; Linings therefor</b> (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
<b>7/00</b>	<b>Shaft equipment, e.g. timbering within the shaft</b>
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)
<b>8/00</b>	<b>Shafts not provided for in groups E21D 1/00 to E21D 7/00</b> [8]

**Tunnels; Galleries; Large underground chambers; Linings therefor** (galleries protecting against falling rocks or avalanches E01F 7/04; pressure galleries, galleries specially adapted to house pressure water conduits E02B 9/06; sewers E03F) [3,6]

<b>9/00</b>	<b>Tunnels or galleries, with or without linings; Methods or apparatus for making thereof</b> (linings <i>per se</i> E21D 11/00); <b>Layout of tunnels or galleries</b> [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]
9/04	. Driving tunnels or galleries through loose materials; Apparatus therefor not otherwise provided for
9/06	. Making by using a driving shield [2]
9/08	. . with additional boring or cutting means [2]

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]
<b>11/00</b>	<b>Lining tunnels, galleries or other underground cavities, e.g. large underground chambers; Linings therefor; Making such linings <i>in situ</i>, e.g. by assembling</b> (E21D 15/00 to 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]
- 11/40 . Devices or apparatus specially adapted for handling or placing units of linings for tunnels or galleries [2]
- 13/00 Large underground chambers; Methods or apparatus for making them** (lining E21D 11/00) [6]
- 13/02 . Methods
- 13/04 . Special equipment; Accessories
- 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
- 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)

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

**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 to E21F 1/16 take precedence) [2]
- 3/00 Cooling or drying of air** (air-conditioning rooms or spaces in general F24F)

**Safety devices** (flue-gas indicators G01N); **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) [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]

**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 to 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)