

CPC COOPERATIVE PATENT CLASSIFICATION

E FIXED CONSTRUCTIONS

EARTH DRILLING; MINING

E21 EARTH OR ROCK DRILLING; MINING

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

WARNINGS

- The following IPC groups are not in the CPC scheme. The subject matter for these IPC groups is classified in the following CPC groups:

E21D 13/02	covered by	E21D 13/00
E21D 13/04	covered by	E21D 13/00
E21D 15/582	covered by	E21D 15/58
E21D 15/59	covered by	E21D 15/44 , E21D 15/58
E21D 17/022	covered by	E21D 17/02
E21D 17/05	covered by	E21D 17/0206 , E21D 17/04
E21D 17/054	covered by	E21D 17/04
E21D 19/06	covered by	E21D 19/02 , E21D 19/04
- In this subclass non-limiting references (in the sense of paragraph 39 of the Guide to the IPC) may still be displayed in the scheme.

Shafts

- | | | | |
|-------------|--|-------------|---|
| 1/00 | Sinking shafts | 5/012 | • Use of fluid-tight or anti-friction material on outside of, or between, lining layers |
| 1/02 | • by hand | 5/016 | • Bearer curbs |
| 1/03 | • mechanically, {e.g. by loading shovels or loading buckets, scraping devices, conveying screws} (E21D 1/08 takes precedence) | 5/02 | • with wood (E21D 5/01 , E21D 5/012 , E21D 5/016 take precedence) |
| 1/04 | • . with grabs {(boring grabs E21D 1/04 , E21B 27/00 ; grab buckets for digging in general E02F 3/47)} | 5/04 | • with brick, concrete, stone, or similar building materials (E21D 5/01 , E21D 5/012 , E21D 5/016 take precedence) |
| 1/06 | • . with shaft-boring cutters (drilling machines E21B , E21C) | 5/06 | • with iron or steel (E21D 5/01 , E21D 5/012 , E21D 5/016 take precedence) |
| 1/08 | • while moving the lining downwards {(lowering the lining into a ready shaft E21D 5/01 ; sheet piles E02D 5/02)} | 5/08 | • . in the form of profiled parts |
| 1/10 | • Preparation of the ground {(for galleries or tunnels E21D 9/001 ; improving or preserving foundation soil or rock E02D 3/00)} | 5/10 | • . in the form of tubing {or of rings composed of profile elements} |
| 1/105 | • . {by water level modification} | 5/11 | • with combinations of different materials, e.g. wood, metal, concrete (E21D 5/01 , E21D 5/012 , E21D 5/016 take precedence) |
| 1/12 | • . by freezing {(freezing of foundation soil E02D 3/115)} | 5/12 | • Accessories for making shaft linings, e.g. suspended cradles, shutterings |
| 1/14 | • . . Freezing apparatus | 7/00 | Shaft equipment, e.g. timbering within the shaft {(lifts in hoistways or mines B66B 15/00 - B66B 19/00)} |
| 1/16 | • . by petrification (grouting anchoring-bolts E21D 20/02 ; consolidating foundation soil by placing solidifying or pore-filling substances in the soil E02D 3/12)} | 7/005 | • {Determination of shaft lining deformation} |
| 3/00 | Raising shafts, i.e. working upwards from the bottom | 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) |
| 5/00 | Lining shafts; Linings therefor (E21D 11/00 takes precedence ; sinking with simultaneous lowering of the lining E21D 1/08) | 8/00 | Shafts not provided for in groups E21D 1/00 - E21D 7/00 |
| 5/01 | • using prefabricated lining lowered into a hole filled with liquid or viscous mass | | |

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](#); tunnels or galleries specially adapted to house conduits in general [E02D 29/10](#); sewers [E03F](#))

9/00 Tunnels or galleries, with or without linings; Methods or apparatus for making thereof

([E02D 29/045](#), [E02D 29/063](#) take precedence; linings *per se* [E21D 11/00](#)); **Layout of tunnels or galleries**

- 9/001 . {Improving soil or rock, e.g. by freezing; Injections (for sinking shafts [E21D 1/10](#); injection of liquids for binding dust [E21F 5/18](#); improving or preserving foundation soil or rock [E02D 3/00](#); borehole closures, i.e. packers, for use during the injection process [E21B 33/12](#))}
- 9/002 . . {Injection methods characterised by the chemical composition used}
- 9/003 . {Arrangement of measuring or indicating devices for use during driving of tunnels, e.g. for guiding machines}
- 9/004 . . {using light beams for direction or position control}
- 9/005 . {by forcing prefabricated elements through the ground, e.g. by pushing lining from an access pit (driving shields [E21D 9/06](#))}
- 9/006 . {by making use of blasting methods (explosive compositions [C06B](#); blasting *per se* [F42](#))}
- 9/008 . {Driving transverse tunnels starting from existing tunnels}
- 9/01 . Methods or apparatus for enlarging or restoring the cross-section of tunnels, e.g. by restoring the floor to its original level
- 9/02 . Driving inclined tunnels or galleries
- 9/03 . {Driving non-circular tunnels}
- 9/04 . Driving tunnels or galleries through loose materials; Apparatus therefor not otherwise provided for ([E21D 9/005](#), [E21D 9/06](#) take precedence; soil improvement [E21D 9/001](#); provisional protective covers [E21D 19/04](#))}
- 9/06 . Making by using a driving shield {, i.e. advanced by pushing means bearing against the already placed lining (pushing prefabricated elements through the ground from an access pit [E21D 9/005](#))}
- 9/0607 . . {the shield being provided with devices for lining the tunnel, e.g. shuttering ([E21D 9/0873](#), [E21D 9/0879](#) take precedence; tail sealing means used as end shuttering [E21D 9/0635](#))}
- 9/0609 . . . {with means for applying a continuous liner, e.g. sheets of plastics, between the main concrete lining and the rock}
- 9/0621 . . {Shield advancing devices}
- 9/0635 . . {Tail sealing means, e.g. used as end shuttering}
- 9/0642 . . {the shield having means for additional processing at the front end}
- 9/065 . . . {with devices for provisionally supporting the front face}
- 9/0657 . . . {structurally associated with rock crushers}
- 9/0664 . . . {with means for applying a coating layer to the front face, e.g. by spraying}
- 9/0671 . . . {with means for consolidating the rock in front of the shield by injection of consolidating substances through boreholes}

- 9/0678 . . . {Adding additives, e.g. chemical compositions, to the slurry or the cuttings}

NOTE

When classifying in this group, bentonite shall not be classified

- 9/0685 {Foaming agents}
- 9/0692 . . {Cutter drive shields}
- 9/08 . . with additional boring or cutting means {other than the conventional cutting edge of the shield}
- 9/087 . . . with a rotary drilling-head cutting simultaneously the whole cross-section, i.e. full-face machines
- 9/0873 {the shield being provided with devices for lining the tunnel, e.g. shuttering}
- 9/0874 . . . {with rotary drilling heads having variable diameter}
- 9/0875 . . . {with a movable support arm carrying cutting tools for attacking the front face, e.g. a bucket}
- 9/0879 {the shield being provided with devices for lining the tunnel, e.g. shuttering}
- 9/093 . . Control of the driving shield {, e.g. of the hydraulic advancing cylinders (arrangement of measuring or indicating devices for use during driving of tunnels [E21D 9/003](#))}
- 9/10 . Making by using boring or cutting machines ([E21D 9/08](#) takes precedence; mining picks [E21C 35/18](#))
- 9/1006 . . {with rotary cutting tools (for cutting simultaneously the whole cross-section [E21D 9/11](#); drill bits [E21B 10/00](#))}
- 9/1013 . . . {on a tool-carrier supported by a movable boom}
- 9/102 {by a longitudinally extending boom being pivotable about a vertical and a transverse axis}
- 9/1026 {the tool-carrier being rotated about a transverse axis}
- 9/1033 {by a transversely extending boom being pivotable about a longitudinal axis}
- 9/104 . . . {Cutting tool fixtures (devices with percussive tools [E21D 9/106](#))}
- 9/1046 {Vibrating}
- 9/1053 . . {for making a slit along the perimeter of the tunnel profile, the remaining core being removed subsequently, e.g. by blasting}
- 9/106 . . {with percussive tools, e.g. pick-hammers}
- 9/1066 . . {with fluid jets (projecting hot gases [E21D 9/1073](#); drilling by liquid or gas jets [E21B 7/18](#); slitting by liquid jets [E21C 25/60](#))}
- 9/1073 . . {applying thermal energy, e.g. by projecting flames or hot gases, by laser beams (flame drilling [E21B 7/14](#))}
- 9/108 . . {Remote control specially adapted for machines for driving tunnels or galleries (for machines for slitting or completely freeing the mineral [E21C 35/24](#))}
- 9/1086 . . {Drives or transmissions specially adapted therefor}
- 9/1093 . . {Devices for supporting, advancing or orientating the machine or the tool-carrier (measuring devices for guiding machines [E21D 9/003](#); anchoring in the borehole [E21B 4/18](#))}

- 9/11 . . with a rotary drilling-head cutting simultaneously the whole cross-section, i.e. full-face machines
- 9/111 . . . {by means of heads or tool-carrying sectors implementing an oscillating rotary motion}
- 9/112 . . . {by means of one single rotary head or of concentric rotary heads ([E21D 9/111](#) takes precedence)}
- 9/113 {having a central part for making a pilot tunnel and a follow-up part for enlarging the pilot tunnel ([E21D 9/115](#) takes precedence; similar apparatus for enlarging drilled boreholes [E21B 7/28](#))}
- 9/115 {with cutting tools mounted pivotably or slidable on the head}
- 9/116 . . . {by means of non-concentric rotary heads ([E21D 9/111](#) takes precedence)}
- 9/117 {mounted for orientating or sideways shifting relative to the frame}
- 9/118 {with independently driven central head}
- 9/12 . . Devices for removing or hauling away excavated material or spoil; Working or loading platforms ([underground transport E21F 13/00](#))
- 9/122 . . {Working or loading platforms ([underground transport E21F 13/00](#))}
- 9/124 . . {Helical conveying means therefor ([E21D 9/13](#) takes precedence)}
- 9/126 . . {Loading devices or installations (loading platforms [E21D 9/122](#); soil-shifting machines [E02F 3/00](#))}
- 9/128 . . . {Loader-conveyors with gathering arms}
- 9/13 . . using hydraulic or pneumatic conveying means
- 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
- 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](#); {driving shields in combination with means for lining the tunnel [E21D 9/06](#)}; lining pressure water galleries, linings therefor [E02B 9/06](#))**
- 11/003 . . {Linings or provisions thereon, specially adapted for traffic tunnels, e.g. with built-in cleaning devices ([E21D 11/38](#) takes precedence)}
- 11/006 . . {Lining anchored in the rock (setting anchoring-bolts [E21D 20/00](#); anchoring-bolts [E21D 21/00](#))}
- 11/02 . . Lining predominantly with wood
- 11/03 . . using timber- setting machines
- 11/04 . . Lining with building materials ([E21D 11/02](#), [E21D 11/14](#) take precedence ; compositions of mortars, concrete or like building materials [C04B](#); placing filling-up materials in underground workings [E21F 15/00](#))}
- 11/05 . . using compressible insertions
- 11/06 . . with bricks
- 11/07 . . . using brick- laying machines ({brick-laying machines *per se* [E04G 21/22](#))}
- 11/08 . . with preformed concrete slabs ({backfilling the space between the slabs and the rock [E21D 11/105](#))}
- 11/083 . . . {Methods or devices for joining adjacent concrete segments}
- 11/086 . . . {Methods of making concrete lining segments}
- 11/10 . . with concrete cast *in situ*; Shuttering {also lost shutterings, e.g. made of blocks, of metal plates} or other equipment adapted therefor
- 11/102 . . . {Removable shuttering; Bearing or supporting devices therefor}
- 11/105 . . . {Transport or application of concrete specially adapted for the lining of tunnels or galleries ([in building E04F 21/08](#), [E04G 21/02](#)); Backfilling the space between main building element and the surrounding rock, e.g. with concrete}
- 11/107 . . . {Reinforcing elements therefor; Holders for the reinforcing elements}
- 11/12 . . Temporary supports for use during building ({removable shutterings [E21D 11/102](#)}); Accessories ({provisional protective covers [E21D 19/04](#))}
- 11/14 . . Lining predominantly with metal ({backfilling the space between the lining elements and the rock [E21D 11/105](#))}
- 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](#))
- 11/152 . . . {Laggings made of grids or nettings}
- 11/155 . . . {Laggings made of strips, slats, slabs or sheet piles (longitudinal struts for mine arches [E21D 11/28](#))}
- 11/157 . . . {Laggings making use of fluid cushions, e.g. the fluid containing a hardenable material (chocks made of flexible containers [E21D 15/483](#))}
- 11/18 . . Arch members ; Network made of arch members ([E21D 11/36](#) takes precedence); Ring elements; Polygon elements; Polygon elements inside arches (caps for arches [E21D 17/00](#))}
- 11/183 . . . {Supporting means for arch members, not provided for in [E21D 11/22](#)}
- 11/186 . . . {Pre-stressing or dismantling devices therefor}
- 11/20 . . . Special cross- sections, e.g. corrugated ({for props [E21D 15/502](#); for caps [E21D 17/01](#))}
- 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 {, i.e. longitudinal connections between adjoining arches}
- 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](#) ; retaining plates on caps for engaging the tops of pit-props [E21D 17/10](#))}
- 11/36 . . Linings or supports specially shaped for tunnels or galleries of irregular cross-section
- 11/362 . . . {for loading areas (lining shafts [E21D 5/00](#))}
- 11/365 . . . {for intersecting galleries}
- 11/367 . . . {for junction with the longwall coal face (walking supports therefor [E21D 23/0091](#))}
- 11/38 . . Waterproofing ([in general E02D 31/00](#)); Heat insulating; Soundproofing; Electric insulating (for building constructions in general [E04B 1/62](#))}

- 11/381 . . {Setting apparatus or devices}
- 11/383 . . {by applying waterproof flexible sheets; Means for fixing the sheets to the tunnel or cavity wall}
- 11/385 . . {Sealing means positioned between adjacent lining members (for joints in foundation structures [E02D 29/16](#); for sewers [E03F 3/04](#); for building structures in general [E04B 1/68](#))}
- 11/386 . . . {inflatable sealing means}
- 11/388 . . . {having longitudinal cavities communicating with the exterior on the outer side of the lining elements}
- 11/40 . Devices or apparatus specially adapted for handling or placing units of linings {or supporting units} for tunnels or galleries {(combined with tunnelling shields [E21D 9/06](#))}
- 11/403 . . {combined with the head machine}
- 11/406 . . {Placing endless lining elements, e.g. from reels (in combination with a tunneling shield [E21D 9/0609](#))}
- 13/00 Large underground chambers; Methods or apparatus for making them ([lining E21D 11/00](#))**

Working-face supports

- 15/00 Props (in the building art [E04G 25/00](#)); Chocks {, e.g. made of flexible containers filled with backfilling material}**
- 15/002 . {Auxiliary devices in which the prop type is not essential (setting or withdrawing props or chocks [E21D 15/58](#), [E21D 15/60](#))}
- 15/005 . {characterised by the material}
- 15/007 . . {spark-reducing}
- 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 {([E21D 15/08](#) and [E21D 15/10](#) take precedence)}
- 15/14 . Telescopic props (general means for fixing telescopic parts together {[F16B 7/10](#)})
- 15/15 . . Means counteracting entry of dirt; Built-in cleaning devices
- 15/155 . . . {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 {(clamping pressure between telescopic prop elements by means of granular material [E21D 15/303](#))}
- 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
- 15/285 . . . {by means of wedges or wedge combinations (details of wedges [E21D 15/43](#))}
- 15/30 . . . by means expanded or contracted by pressure applied through the medium of a fluid or quasi-fluid, e.g. rubber {(setting props [E21D 15/588](#), [E21D 15/589](#))}
- 15/303 {by means of granular material (supporting by means of granular material [E21D 15/18](#))}
- 15/306 {by means of a liquid}
- 15/32 . . . by a deformable collar {or clamping means applied symmetrically inside a locking ring}
- 15/325 {by a clamping ring}
- 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](#))
- 15/435 {hydraulic}
- 15/44 . . Hydraulic, pneumatic, or hydraulic-pneumatic props {(see also [E21D 15/51](#))}
- 15/445 . . . {comprising a fluid cushion}
- 15/45 . . . having closed fluid system, e.g. with built-in pumps or accumulators
- 15/46 . . with load-measuring devices; with alarm devices
- 15/465 . . . {with essential hydraulic or pneumatic details}
- 15/48 . Chocks or the like
- 15/483 . . {made of flexible containers, e.g. inflatable, with or without reinforcement, e.g. filled with water, backfilling material or the like (laggings making use of fluid cushions [E21D 11/157](#))}
- 15/486 . . {with essential hydraulic or pneumatic details}
- 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 {(not used, see subgroups and [E21D 15/44](#))}
- 15/512 . . . {Arrangement of valves (external control of roof support installations [E21D 23/12](#), [E21D 23/26](#))}
- 15/515 . . . {Particular fluids not covered by any chemical subdivision}
- 15/517 . . . {Extension elements}
- 15/52 . . Extensible units located above or below standard props (for allowing step-by-step movement of cap [E21D 23/06](#); setting props or chocks [E21D 15/58](#))
- 15/523 . . . {with hydraulic or pneumatic control}
- 15/526 . . . {for step-by-step extension of the prop}

- 15/54 . . Details of the ends of props ([for permitting step-by-step movement E21D 23/06](#))
- 15/545 . . . {hydraulic or pneumatic}
- 15/55 . . . of prop heads {or feet}
- 15/56 . . Details of locks of telescopic props
- 15/563 . . . {by which a series of similarly shaped props can obtain an almost equal load-capacity ([setting props or chocks E21D 15/584, E21D 15/589](#))}
- 15/566 . . . {comprising a fluid cushion}
- 15/58 . Devices for setting props or chocks
- 15/581 . . {in which the props are pre- loaded ([extensible elements at strut extremities E21D 15/52](#))}
- 15/5813 . . . {by means of power accumulators to be pre-charged by rock pressure ([by means of hydraulically operated devices E21D 15/587](#))}
- 15/5817 . . . {in which the lock is also activated}
- 15/584 . . {in which a series of similarly shaped props obtain an almost equal load capacity by removable devices ([idem for extensible props E21D 15/563](#))}
- 15/585 . . {by means of hydraulically operated devices for mechanical props, or hydraulic props in which the hydraulic part is not important ([hydraulic props in which the hydraulic part is important E21D 15/44](#))}
- 15/586 . . . {the props being pre-loaded}
- 15/587 {by means of power accumulators to be pre-charged by rock pressure}
- 15/588 {the lock also being activated}
- 15/589 . . . {in which a series of similarly shaped props are given almost equal load capacity by removable devices}
- 15/60 . Devices for withdrawing props or chocks
- 15/603 . . {by means of hydraulic devices}
- 15/606 . . {the props being moved systematically ([mine roof supports for step-by-step movement E21D 23/00](#))}

- 17/00 Caps for supporting mine roofs**
- 17/003 . {with essential hydraulic elements}
- 17/006 . {characterised by the material}
- 17/01 . characterised by the shape of the cap, e.g. of specified cross-section
- 17/02 . Cantilever extension or similar protecting devices
- 17/0206 . . {Hydraulically operated extension devices}
- 17/0213 . . {Assembling devices for pivoting caps upwardly}
- 17/03 . . Brackets for roof-supporting bars
- 17/04 . . for use in longwall working
- 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 . . . or 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](#))**
- 19/02 . for use in longwall working
- 19/04 . for use in drifting galleries

- 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](#))
- 20/003 . {Machines for drilling anchor holes and setting anchor bolts}
- 20/006 . . {having magazines for storing and feeding anchoring-bolts ([combined feeding from racks and connecting of drill rods or the like E21B 19/20](#))}
- 20/02 . with provisions for grouting
- 20/021 . . {Grouting with inorganic components, e.g. cement}
- 20/023 . . . {Cartridges; Grouting charges}
- 20/025 . . {Grouting with organic components, e.g. resin}
- 20/026 . . . {Cartridges; Grouting charges}
- 20/028 . . {Devices or accessories for injecting a grouting liquid in a bore-hole ([E21D 20/003 takes precedence](#); improving soil or rock by injections [E21D 9/001](#))}

- 21/00 Anchoring-bolts for roof, floor {in galleries or longwall working}, or shaft-lining protection** ([ground anchors E02D 5/80](#); anchorings for building constructions [E04B 1/41, E21D 21/00](#); dowels or other devices fastened in walls or the like by inserting them in holes made therein for that purpose [F16B 13/00](#) ; bolts with visible load [G01L 1/00](#))
- 21/0006 . {characterised by the bolt material}
- 21/0013 . {Protection against corrosion}
- 21/002 . {using explosives charges}
- 21/0026 . {characterised by constructional features of the bolts}
- 21/0033 . . {having a jacket or outer tube}
- 21/004 . . {Bolts held in the borehole by friction all along their length, without additional fixing means}
- 21/0046 . . {formed by a plurality of elements arranged longitudinally}
- 21/0053 . . {Anchoring-bolts in the form of lost drilling rods}
- 21/006 . . {Anchoring-bolts made of cables or wires}
- 21/0066 . . {Anchoring-bolts formed by a bundle of radially arranged rigid elements}
- 21/0073 . . {Anchoring-bolts having an inflatable sleeve, e.g. hollow sleeve expanded by a fluid}
- 21/008 . {Anchoring or tensioning means}
- 21/0086 . {Bearing plates}
- 21/0093 . {Accessories}
- 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 conveyors, mining machines, or guides therefor** ([transport of mine roof support units E21F 13/008](#);) [shifting of mine conveyors at the working face E21F 13/08](#))
- 23/0004 . {along the working face}
- 23/0008 . . {comprising a pair of joined struts}
- 23/0013 . . {Frame type supports}
- 23/0017 . . {Pile type supports}
- 23/0021 . . . {comprising two walking elements}
- 23/0026 . . . {comprising three walking elements}

- 23/003 . . . {consisting of a rigid pile}
- 23/0034 . . {comprising a goaf shield articulated to a base member}
- 23/0039 . . . {and supported by a strut or by a row of struts parallel to the working face}
- 23/0043 . . . {and supported by two or more rows of struts parallel to the working face}
- 23/0047 . {without essential shifting devices}
- 23/0052 . {with advancing shifting devices connected therewith}
- 23/0056 . {with individual advancing shifting devices}
- 23/006 . {provided with essential hydraulic devices}
- 23/0065 . . {driven, or automatically, e.g. electrically-hydraulically controlled}
- 23/0069 . . {without essential advancing shifting devices}
- 23/0073 . . {with advancing shifting devices connected therewith}
- 23/0078 . . {with individual shifting devices}
- 23/0082 . {specially adapted for vertical or steep gradient seams}
- 23/0086 . {in galleries}
- 23/0091 . . {at the junction with the working face}
- 23/0095 . . {Temporary supports at the driving front}
- 23/03 . having protective means, e.g. shields, for preventing or impeding entry of loose material into the working space or support
- 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](#))
- 23/0409 . . {Aligning or guiding means for the supports or for the constitutive parts of the supports}
- 23/0418 . . {Positioning devices and stabilizing means for the props}
- 23/0427 . . {Shield operating devices; Hinges therefor}
- 23/0436 . . {Means for inclining the base member of the support}
- 23/0445 . . {Extensions of the base member supporting the conveyor}
- 23/0454 . . {Trailing plates; Coal face or goaf side sprags (specially adapted for the placing of filling-up materials [E21D 23/0481](#))}
- 23/0463 . . {Hanging or shifting means for tubes, electric feeding cables or the like}
- 23/0472 . . {Supports specially adapted for people walking or transporting material}
- 23/0481 . . {Supports specially adapted for use in combination with the placing of filling-up materials ([placing filling-up materials in underground workings per se E21F 15/00](#))}
- 23/049 . . {Connecting devices between the head or foot of a prop and the cap or base of the roof support}
- 23/06 . . Special mine caps or special tops of pit-props for permitting step-by-step movement
- 23/063 . . . {Retractable cantilever extensions therefor}
- 23/066 . . . {Pivoted cantilever extensions therefor}
- 23/08 . Advancing mechanisms ([E21D 23/16 takes precedence](#))
- 23/081 . . {forming parts of the roof supports}
- 23/082 . . . {acting solely on the elements of the supports}
- 23/083 . . . {acting on a firm abutment adapted thereto}
- 23/085 . . . {acting on a conveyor or a guide for the mining machine}
- 23/086 {Details of fixing devices therefor}
- 23/087 . . . {acting directly on the walls of the seam}
- 23/088 {by means of wheels, rollers, caterpillars, belts or worm screws}
- 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 ({[advancing of mining machines toward the working face E21C 29/02](#); [advancing of conveyors toward the working face E21D 23/085](#))}
- 23/142 . . . {Measuring the advance of support units with respect to external points of reference}
- 23/144 . . . {Measuring the advance of support units with respect to internal points of reference, e.g. with respect to neighboring support units or extension of a cylinder}
- 23/146 . . . {Transmission of signals and commands by cable}
- 23/148 . . . {Wireless transmission of signals or commands}
- 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