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**

1. 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 15/58 covered by E21D 15/44, E21D 15/58
   - E21D 17/022 covered by E21D 17/02
   - E21D 17/05 covered by E21D 17/04, E21D 17/006
   - E21D 17/054 covered by E21D 17/04
   - E21D 19/06 covered by E21D 19/02, E21D 19/04

2. 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

1/02 by hand

1/03 mechanically, [e.g. by loading shovels or loading buckets, scraping devices, conveying screws] (E21D 1/08 takes precedence)

1/04 with grabs (boring grabs E21D 1/04, E21B 27/00; grab buckets for digging in general E02F 3/47)

1/06 with shaft-boring cutters (drilling machines E21B, E21C)

1/08 while moving the lining downwards { (lowering the lining into a ready shaft E21D 5/01; sheet piles E02D 3/02)}

1/10 Preparation of the ground { (for galleries or tunnels E21D 9/001; improving or preserving foundation soil or rock E02D 3/00)}

1/105 [by water level modification]

1/12 by freezing { (freezing of foundation soil E02D 3/115)}

1/14 Freezing apparatus

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)

3/00 Raising shafts, i.e. working upwards from the bottom

5/00 Lining shafts; Lining therefor (E21D 11/00 takes precedence { (sinking with simultaneous lowering of the lining E21D 1/08))

5/01 using prefabricated lining lowered into a hole filled with liquid or viscous mass

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 { or of rings composed of profile elements}

5/11 with combinations of different materials, e.g. wood, metal, concrete (E21D 5/01, E21D 5/012, E21D 5/016 take precedence)

5/12 Accessories for making shaft linings, e.g. suspended cradles, shutterings

7/00 Shaft equipment, e.g. timbering within the shaft (lifts in hoistways or mines B66B 15/00 - B66B 19/00)

7/005 [Determination of shaft lining deformation]

7/02 . Arrangement of guides for cages in shafts; Connection of guides for cages to shaft walls (guideways or guides for elevators B66B 7/02)

8/00 Shafts not provided for in groups E21D 1/00 - E21D 7/00
Tunnels; Galleries; Large underground chambers; Linings therefor

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)]]

9/067 . . . [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)]

9/069 . . . [with means for applying a continuous liner, e.g. sheets of plastics, between the main concrete lining and the rock]

9/061 . . . [Shield advancing devices]

9/0635 . . . [Tail sealing means, e.g. used as end shuttering]

9/065 . . . [with devices for provisionally supporting the front end]

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)]
Tunnels; Galleries; Large underground chambers; Linings therefor

11/00 Lining tunnels, galleries or other underground caverns, e.g. large underground chambers; Linings therefor; Making such linings in situ, e.g. by assembling (E21D 15/00; E21D 23/00 take precedence; especially 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 (checks 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 23/009)]

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 1/08))
11/386 . . . (infatable 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 counteringacthing 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)
Working-face supports

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)}
20/002 ... with provisions for grouting
20/0021 ... {Grouting with inorganic components, e.g. cement}
20/0023 ... {Cartridges; Grouting charges}
20/0025 ... {Grouting with organic components, e.g. resin}
20/0026 ... {Cartridges; Grouting charges}
20/0028 ... {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 constructive 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 therefore ([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}
Working-face supports

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 spars (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)]

**WARNING**

Group E21D 23/0481 is not complete. See also other groups of E21D 23/00

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