

5 Mining

5a	Deep boring for mining or extraction of oil, gas or water; methods and equipment for extraction of oil and gas from deep bore holes
5a	(IPC: E21B) Deep drilling; Obtaining oil, gas, water or soluble materials from deep wells
5b	Mining work, equipment, methods
5b	(IPC: E21C) Machinery for, or methods of, mining or quarrying
5c	Mine opening and forewinning: sinking of shafts, sumps, raises, drifts, crosscuts, working methods, mine supporting
5c	(IPC: E21D) Shafts; Sinking shafts; Galleries; Lining galleries
5d	Mine ventilation, prevention of mine accidents, haulage, filling, etc.
5d	(IPC: E21F) Ventilation; Safety devices; Transport; Filling-up; Rescue

5a	Deep boring for mining or extraction of oil, gas or water; methods and equipment for extraction of oil and gas from deep bore holes (pumps for lifting oil and water from finished wells 59; boring of shafts and making other penetrations of large diameter such as raises, drifts, ventilation breakthroughs by boring 5c; drills for boring blast holes 5b; plant drills 45f-4/09; post hole diggers 84c-1)
5a-1	Percussion drilling with rigid rods in general
5a-2	Cable drilling, general
5a-3	Above-ground power drive for percussion drilling with rods or cables
5a-4	Rocking beam structure and mounting
5a-5	Percussion drilling with flushing
5a-6/10	Jars, free-fall instruments
5a-6/20	Above-ground reversing devices
5a-6/30	Reversing devices in the borehole
5a-7	Feeding devices
5a-8	Rod suspensions
5a-9	Rod weight balancing, rod weighting and relieving
5a-10	Rotary drilling with solid rods, general
5a-11	Rotary drilling with flushing, especially diamond drilling
5a-12/10	Above-ground rotary drill drives
5a-12/20	Rotary tables
5a-12/30	Hoisting gear
5a-13	Combination drives for rotary and percussion drilling
5a-14/10	Percussion drill drives within the borehole
5a-14/20	Rotary drill drives within the borehole
5a-15	Flush drilling without drilling tools
5a-16	Borehole linings
5a-17	Horizontal, high, and oblique drilling for prospecting (5c-6; 5d-18)
5a-18/10	Borehole inclinometers (42c-25/01; 42c-25/50; 42c-25/51)
5a-18/20	Correction of deflected boreholes
5a-18/30	Borehole side and tubing testing, depth and temperature determination

5a-18/40	Samplers
5a-19/10	Special methods and drives for deep boring
5a-19/20	Mobile superficial drilling equipment
Drills and bits for deep boring	
5a-20	Hollow rotary non-coring drills
5a-21	Worm and screw rotary drills (45f-4/09; 84c-1)
5a-22	Disk drills (45f-4/09; 84c-1)
5a-23/10	Rotary solid bits
5a-23/20	Rolling solid bits
5a-24/10	Rotary core bits
5a-24/20	Rolling core bits
5a-24/30	Double core barrels
5a-25/10	Reaming rotary bits
5a-25/20	Reaming rolling bits
5a-26	Miscellaneous rotary bits for deep boring
5a-27	Percussion solid bits
5a-28	Percussion core bits
5a-29	Reaming percussion bits
5a-30	Stroke valve drills: spoons, sludge extractors, sludge boxes
5a-30/10	Grabs
5a-30/20	Flushing drills without cutters

Miscellaneous tools and equipment for deep boring

5a-31/10	Flushing heads
5a-31/20	Flushing muds
5a-31/30	Miscellaneous flushing equipment
5a-32/10	Rods, also borehole pump rods (pumps 59a – 59e)
5a-32/20	Pipes
5a-32/30	Rod and pipe couplings
5a-32/40	Connections between rods and tools
5a-32/50	Special equipment on rods and pipes
5a-32/60	Cables and cable clamps (47d; 47e-35; 73)
5a-33/10	Rod holders above the borehole
5a-33/20	Equipment for screwing and unscrewing pipe elements
5a-33/30	Holding and manipulating devices within the borehole
5a-34/10	Hoisting devices for pipes and rods
5a-34/20	Rod lifting and lowering apparatus
5a-35/10	Casing grabs
5a-35/20	Pipe cutters, slitters, straighteners, cable cutters
5a-36	Catchers for rods, cables, tools and broken parts
5a-37	Core breakers, lifters
5a-38/10	Rigs and derricks
5a-38/20	Equipment for rigs
5a-38/30	Derrick rollers
5a-39/10	Seals and packings for boreholes (85d-1)
5a-39/20	Cementing equipment
5a-39/30	Borehole cleaners (85d-1)
5a-40/10	Casing heads
5a-40/20	Devices for preventing and extinguishing probe fires
5a-40/30	Separators in the borehole (85d-1; 23b-1/01; 23b-1/02; 23b-1/05; 23b-2/01)
5a-41	Methods for extracting oil, brine, sulphur, phosphorus from deep boreholes (5b-42; pumps 59a – 59e)

5a (IPC: E21B) Deep drilling; Obtaining oil, gas, water or soluble materials from deep wells**Devices or methods for deep-drilling****5a-1/00 Percussion drilling**

- 5a-1/02 . Surface drives for percussion drilling
- 5a-1/04 . . Devices for reversing the movement of the rod or cable at the surface
- 5a-1/06 . Drives for percussion drilling in the borehole
- 5a-1/08 . . Devices for reversing the movement of the rod or cable in the borehole
- 5a-1/10 . Drilling jars, i.e. lost-motion connections

5a-3/00 Rotary drilling

- 5a-3/02 . Surface drives for rotary drilling
- 5a-3/04 . . Rotary tables
- 5a-3/06 . . Adaptation of rotary draw works to drive rotary tables (connecting or disconnecting couplings or joints using cat-heads 5a-19/16)
- 5a-3/08 . Drives used in the borehole
- 5a-3/10 . . Electric drives
- 5a-3/12 . . Hydraulic or pneumatic drives

5a-5/00 Drives for combined percussion and rotary drilling, whether for use on surface or in the borehole**5a-7/00 Special methods or apparatus for deep-drilling**

- 5a-7/02 . Portable drilling rigs, truck or skid mounted, with their own drive
- 5a-7/04 . Directional drilling
- 5a-7/06 . . Deflecting the direction of boreholes
- 5a-7/08 . . . Special apparatus for deflecting the boring, e.g. special drill bits, knuckle joints, (knuckle joints for fishing tools 5a-31/00)
- 5a-7/10 . . Correction of deflected boreholes
- 5a-7/12 . Underwater drilling
- 5a-7/14 . Flame drilling (flame piercing of blast holes 5b-21/00)
- 5a-7/16 . Applying separate balls or pellets by the pressure of the drill, so-called shot-drilling
- 5a-7/18 . Drilling by liquid or gas jets, with or without entrained pellets (5a-7/14 takes precedence)

Drilling-tools**5a-9/00 Drill bits, e.g. retractable without withdrawing drill pipe (for deflecting the boring 5a-7/08; valve drill bits 5a-27/00; augers for making post-holes or for making foundations 84c-17/14; augers for mine drilling 5b-1/14; drill bits for making blast holes 5b-13/00)**

- 5a-9/02 . Full drill bits
- 5a-9/04 . . Twist drill bits
- 5a-9/06 . . Fish-tail bits
- 5a-9/08 . . Roller full drill bits
- 5a-9/10 . . . with conical cutting tools only
- 5a-9/12 . . . with separate inner and outer cutting tools, either cylindrical or conical
- 5a-9/14 . . with disc-shaped cutting tools only
- 5a-9/16 . Core bits
- 5a-9/18 . . Roller core bits
- 5a-9/20 . . Core bits with inner tube for receiving or retaining the core
- 5a-9/22 . Drill bits for enlarging the borehole locally or throughout the whole length
- 5a-9/24 . . with non-expansible cutting tools revolving in relation to the drilling rods
- 5a-9/26 . . with expansible cutting tools
- 5a-9/28 . . . revolving in relation to the drilling rods
- 5a-9/30 . . . at the circumference of the bit
- 5a-9/32 . . . cutting also the bottom of the borehole
- 5a-9/34 . for drilling holes sideways from, or at an angle to, the main borehole
- 5a-9/35 . Parts or details

5a-9/36	. . Special construction of diamond drill bits or wear-resisting inserts
5a-11/00	Other drilling tools
5a-11/02	. Boring rams
5a-11/04	. Boring grabs
5a-11/06	. with driven cutting chains or similarly-driven tools
5a-13/00	Wear indicators for drilling tools
<u>Other details for deep-drilling</u>	
5a-15/00	Derricks; Masts
5a-15/02	. for underwater drilling
5a-17/00	Drilling rods or pipes; Flexible drill strings; Kellies; Drill collars; Sucker rods; Casings; Tubings (tubes in general 47f1)
5a-17/02	. Couplings; Joints
5a-17/04	. . between rod and bit, or between rod and rod
5a-17/042	. . . threaded
5a-17/043 with locking means
5a-17/046	. . . with ribs, pins, or jaws, and complementary grooves or the like, e.g. bayonet catches
5a-17/05	. . . Swivel joints
5a-17/06	. . . Releasing-joints, e.g. safety joints
5a-17/08	. . Casing joints
5a-17/10	. Wear protectors; Centralising devices
5a-17/12	. . Devices for placing or drawing out wear protectors
5a-17/14	. Casing shoes
5a-19/00	Handling rods, casings, tubes or the like in the derrick (surface drives 5a-1/02, 5a-3/02)
5a-19/02	. Rod or cable suspensions
5a-19/04	. . Hooks
5a-19/06	. . Elevators, i.e. rod or tube gripping devices
5a-19/07	. . . Slip-type elevators (slips in rotary tables 5a-19/10)
5a-19/08	. Devices for feeding the rods or cables (hoisting drums 35c-1/74); Devices for increasing or decreasing the pressure on the drill; Devices for counterbalancing the weight of the rods
5a-19/10	. Slips; Spiders
5a-19/12	. Rope clamps (rope clamps in general 47d-11/00)
5a-19/14	. Racks, ramps, troughs or bins for holding the lengths of rod singly or connected as joints; Handling between storage and borehole
5a-19/16	. Connecting or disconnecting pipe couplings or joints
5a-21/00	Devices or methods for flushing boreholes (mud screens 1a)
5a-21/02	. Swivel joints in hose lines
5a-21/04	. Selection of drilling fluids (drilling fluids per se 23c)
5a-23/00	Devices for setting, locking, releasing or removing tools, packers etc. in boreholes (setting of casings, screens, or liners 5a-43/10)
5a-23/02	. for locking the tools or the like in landing nipples or in recesses between adjacent sections of tubing (5a-23/04, 5a-23/06 take precedence)
5a-23/04	. operated by fluid means, e.g. actuated by explosion (5a-23/06 takes precedence)
5a-23/06	. for setting packers
5a-25/00	Core barrels; Core breakers; Core extractors
5a-27/00	Bailers (cement bailers 5a-33/132); Valve drill bits
5a-29/00	Cutting of pipes, packers, plugs, or wire lines, located in boreholes, e.g. of damaged pipes, making windows (perforators 5a-43/11); Reconditioning e.g. straightening of well casings while in the ground
5a-29/02	. by explosives

5a-31/00	Fishing tools for rods, casings, ropes, bits fragments, etc.
5a-31/02	. for tubular, cylindrical, or conical objects, rods, pipes, drill-bit shans, casings, packers, linings (5a-31/12 takes precedence)
5a-31/04	. for irregularly-shaped objects, e.g. bailers, pump parts, instruments, drill-bit bodies, stones (5a-31/12 takes precedence)
5a-31/06	. . gripping magnetically
5a-31/08	. . using junk baskets or the like
5a-31/10	. for parted wire lines or ropes
5a-31/12	. Fishing tools; Fishing grabs
5a-33/00	Sealing or packing boreholes
5a-33/02	. Surface sealing or packing
5a-33/03	. . Well heads
5a-33/035	. . . specially adapted for underwater installations
5a-33/04	. . . Casing heads
5a-33/05 Cementing-heads, e.g. with provisions for introducing cementing plugs
5a-33/06 Blow-out preventers
5a-33/08	. . Wipers; Oil savers
5a-33/10	. in the borehole
5a-33/12	. . Packers; Plugs (used for cementing 5a-33/134, 5a-33/16)
5a-33/122	. . . Multiple-string packers
5a-33/124	. . . Units with longitudinally-spaced plugs for isolating the intermediate space
5a-33/126	. . . with fluid-pressure-operated elastic cup or skirt (5a-33/122, 5a-33/124 take precedence)
5a-33/127	. . . with inflatable sleeve (5a-33/122, 5a-33/124 take precedence)
5a-33/128	. . . with a member expanded radially by axial pressure (5a-33/122, 5a-33/124 take precedence)
5a-33/129	. . . with mechanical slips for hooking into the casing (5a-33/122, 5a-33/124 take precedence)
5a-33/13	. . Methods or devices for cementing, for plugging holes, crevices, or the like
5a-33/132	. . . Cement bailers
5a-33/134	. . . Bridging plugs
5a-33/136	. . . Baskets, e.g. of umbrella type
5a-33/138	. . . Plastering the borehole wall; Injecting into the formation
5a-33/14	. . . for cementing casings into boreholes
5a-33/16 using plugs for isolating cement charge; Plugs therefor
5a-35/00	Devices or methods for preventing or extinguishing fires (fire-fighting in general 61a, 61b)
5a-37/00	Cleaning devices for boreholes (5a-21/00 takes precedence)
5a-37/02	. Scrapers
5a-39/00	Gas or water separators or the like for use in the borehole
5a-40/00	Tubing catchers, automatically arresting the fall of oil-well tubing
5a-41/00	Other details not mentioned before for deep-drilling
<u>Obtaining oil, water, or the like</u>	
5a-43/00	Devices or methods for obtaining oil, gas, water or soluble materials from deep wells (mining of oil-bearing deposits 5b-41/10; pumps 59a – 59e)
5a-43/01	. specially adapted for obtaining from underwater installations
5a-43/02	. Subsoil filtering (5a-43/11 takes precedence)
5a-43/04	. . Graveling of wells
5a-43/08	. . Screens or liners
5a-43/10	. . Setting of casings, screens, or liners in wells (setting of tools, packers or the like 5a-23/00)
5a-43/11	. Perforators; Permeators
5a-43/112	. . Perforators with extendable perforating members, e.g. actuated by fluid means
5a-43/114	. . Perforators using direct fluid action, e.g. abrasive jets
5a-43/116	. . Gun or shaped charge perforators

- 5a-43/117 . . . Shaped charge perforators (5a-43/118 takes precedence)
- 5a-43/118 . . . characterised by lowering in vertical position and subsequent tilting to operating position
- 5a-43/119 . . Details, e.g. for locating perforating place or direction
- 5a-43/12 . Methods or apparatus for regulating the flow of oil to or in well (5a-43/25 takes precedence)
- 5a-43/14 . Obtaining from a multiple-zone well
- 5a-43/16 . Secondary recovery methods of oil (pumps 59a-e)
- 5a-43/18 . . Repressuring or vacuum methods
- 5a-43/20 . . Displacing by water
- 5a-43/22 . . Use of chemicals or bacteria activity (5a-43/27 takes precedence; chemical features in extracting oils from oil sands or shales 23b; 26a-18/10)
- 5a-43/24 . . Use of heat
- 5a-43/25 . Methods for stimulating production
- 5a-43/26 . . by forming crevices, e.g. by shooting, by blasting
- 5a-43/27 . . . by use of eroding chemicals, e.g. acids
- 5a-43/28 . Dissolving soluble minerals, e.g. salt

Surveying or testing

5a-45/00 Measuring the drilling time or rate of penetration

5a-47/00 Survey of wells (geophysical logging 42c)

- 5a-47/02 . Determining slope or direction (clinometers or direction meters 42c)
- 5a-47/022 . . of the borehole
- 5a-47/024 . . of devices in the borehole (5a-47/022 takes precedence)
- 5a-47/026 . . of penetrated ground layers (formation testing 5a-49/00)
- 5a-47/04 . Measuring depth or liquid level (measuring liquid level in general 42e)
- 5a-47/06 . Measuring temperature or pressure (measuring temperature in general 42i; measuring pressure in general 42k)
- 5a-47/08 . Measuring the diameter (measuring diameter in general 42b)
- 5a-47/10 . Locating fluid leaks, intrusions, or movements
- 5a-47/12 . Means for transmitting measuring-signals from the well to the surface (remote indicating in general 74)

5a-49/00 Testing the nature of borehole walls; Formation testing

- 5a-49/02 . by mechanically taking samples of the soil (devices for taking samples in general 42l)
- 5a-49/04 . . with projectiles penetrating the wall
- 5a-49/06 . . with side-wall drilling tools or scrapers

5b Mining work, equipment, methods (blasting with explosives and expanding working fluids 78e)

Making blast holes (drills and drilling equipment for stone working 80d; wall borers 37d-40)

- 5b-1 Rotary rock drilling machines, compressed-air, steam or fluid-motor driven
- 5b-2 Rotary rock drilling machines, hand-driven
- 5b-3/01 Rotary rock drilling machines, electrically driven
- 5b-3/10 Differential feed for rotary drilling machines
- 5b-3/20 Coupling of drill and machine in rotary drilling machines
- 5b-4/01 Percussion rock drilling machines in which the drill is coupled to the driving piston or pushrod so as to advance and be retracted with steam or compressed-air drive
- 5b-4/10 with drive by means of reciprocating air columns
- 5b-5 Percussion rock drilling machines driven by means of an internal combustion motor
- 5b-6 Percussion rock drilling machines driven by means of water pressure
- 5b-7 Percussion rock drilling machines with electric drive, especially solenoid drilling machines
- 5b-8/01 Percussion rock drilling machines driven by spring-biased lifting elements
- 5b-8/10 with elastic coupling of the drive with the pushrod through double buffer springs

- 5b-8/20 Reversing devices for percussion drilling machines
5b-8/30 Couplings between pushrods and drills in percussion drilling machines
- Pneumatic hammer drills**
- 5b-9/01 General (control for the impact motion 87b-2)
5b-9/02 with lubricating devices
5b-9/03 with devices for the dry blasting out of the bore dust
5b-9/04 with wet flushing apparatus
5b-9/05 with drive of the impacting piston by means of a reciprocating air column
5b-9/06 with automatic stopping devices operating when the drill is lifted away from the work face
5b-9/07 with apparatus to prevent the escape of outgoing air against the direction of the drill stroke
- 5b-10 Hammer drills, hammer driven by internal combustion engine
5b-11 Hammer drills, hammer driven by hydraulic pressure
5b-12 Hammer drills, hammer directly electric driven
5b-13 Other hammer-drilling machines
5b-14/01 Reversing devices for hammer-drilling machines with torque bar and brake unit
5b-14/10 with special reversing motor
5b-14/20 Other reversing devices for hammer-drilling machines
5b-14/30 Devices for retaining the drill in hammer-drilling machines
5b-15/01 Feed mechanisms for percussion and hammer-drilling machines with feed spindle and hand crank
5b-15/10 Automatic feed for hammer-drilling machines by forward or rearward thrusts of the machine
5b-15/20 with pneumatic feed cylinder receiving an impact from the machine
5b-15/30 Other feed devices for percussion and hammer-drilling machines
5b-16 Dust prevention and suppression in rock drills (5b-9/04; 5b-9/07)
5b-17 Holding and guiding mechanisms for drilling machines
5b-18 Drills for rotary drilling
5b-19 Drills for percussion drilling
5b-20 Drills with hard metal (carbide) tips
5b-21/01 Other equipment for making blast holes; auxiliary equipment and accessories for drilling, also underwater drilling and bore-dust scrapers
5b-21/10 Reamers, especially for making blast chambers in the borehole
5b-21/20 Devices for extracting stuck or broken drills from the borehole
- Cutting and shearing in mining operations**
- 5b-22 Large cutting machines with cutter bars equipped with picks or the like along their entire length including impact machines and the cutter bars and picks pertaining thereto
5b-23/01 Large cutting machines with cutting chains and simply pivoted cutter booms
5b-23/10 Large cutting machines with cutter booms pivoted about two relatively perpendicular axes, rotary head machines and machines rotatable around their longitudinal axis
5b-23/20 Short-wall chain cutting machines
5b-23/30 Cutting chains, cutting chain retainers and cutter picks for cutting chains, also cutter picks suitable for bars as well as chains (38a-6/11)
5b-23/40 Disk cutting machines
5b-25/01 Small cutting machines with cutter disks or wheels rotating along cutting plane (5b-23/40)
5b-25/02 Cutting machines with cutting heads rotating perpendicularly to the cutting plane
5b-25/03 Percussion cutting machines (5b-22)
5b-25/04 Percussion crown cutters
5b-25/05 Bar and chain cutting machines mounted on supports or used as mobile manual tools

- 5b-26 Cutting devices with cutting cables or saws, and similar cutting machines operating with reciprocating swinging cutting booms
- 5b-27/01 Cutters with percussion and ramming tools, also mechanical picks and cutting hammers, as well as compressed-air operated wedge picks for cutting
- 5b-27/10 Moils and other tools for mining hammers
- 5b-31/01 Advancing large cutting machines by pressure against a rigid support
- 5b-31/10 by means of cable or chain winches
- 5b-31/20 by means of the machine operating running gear
- 5b-31/30 Vehicles for transporting cutting machines
- 5b-32 Supporting, retaining and guiding apparatus for small cutting machines
- 5b-33 Other equipment and methods for cutting and shearing in mining operations; cutting by boring a series of successive holes
- Driving and shoring**
- 5b-34 Blasting wedges, wedging apparatus, shoring devices with quick-release claws or operating with pressure members pressed against the sides of a borehole by mechanical means
- 5b-35/01 Driving by hydraulic means, also shock absorbing, and by means of compressed air
- 5b-35/10 Driving devices with hydraulic pistons which can be pressed against a borehole wall
- 5b-35/20 Firing and other methods and devices depending upon heat effect for loosening and breaking away of rocks
- 5b-36/01 Working machines which cut and shore simultaneously
- 5b-36/10 Coal-working machines which separate the coal face by several cuts and shears in such a way that the sections between the cuts break away continuously by themselves or with the aid of pressure members subsequently introduced into the cuts
- 5b-37 Hand picks, hammers, gads and other hand tools for use in mining
- 5b-38 Working machines for obtaining blocks by cutting and shearing
- 5b-39 Working machines for mining from the solid by working off the face with cutting or percussion tools
- 5b-40 Plough-type working machines slicing coal off a long face
- Opencast mining**
- 5b-41/01 Mining machines for lignite and similar opencast mining (excavators 84d)
- 5b-41/10 Equipment for cutting away shale layers in opencast mining
- 5b-41/20 Opencast mining installations, removing and mining methods with conveyor bridges cooperating with the mining equipment (81e-127)
- 5b-41/30 Opencast installations and work procedures in opencast mining with cable excavators, scrapers, cable cranes, cable conveyors in cooperation with the mining equipment (5d-10; 19a-23; 20a; 35b-1/30 – 35b-1/32)
- 5b-41/40 Other devices and work procedures in opencast mining and removal
- 5b-42/01 Mining of oil sand deposits
- 5b-42/10 special equipment for mining special minerals, and the like, such as salt, sulphur, slate
- 5b-43 Miscellaneous auxiliary tools and equipment for mining, with the exception of 5b-1 – 5b-42/10

5b (IPC: E21C) Machinery for, or methods of, mining or quarrying

Drilling machines

- 5b-1/00 Rotary-drilling machines** (for deep-drilling 5a; for sinking shafts 5c; for tunnelling 19f; for working stone 80d; for working metal 49a; for woodworking 38b)
- 5b-1/02 . with a continuous rotation of the tool with or without variable speed gearing
- 5b-1/04 . . with slipping or elastic transmission
- 5b-1/06 . with a to-and-fro rotation of the tool
- 5b-1/08 . with an intermittent unidirectional rotation of the tool
- 5b-1/10 . with a built-in feeding device (feeding devices 5b-5/00)

- 5b-1/12 . with percussive action superimposed on a continuously-rotating tool always in contact with the working face
- 5b-1/14 . Rotary core-boring machines; Auger drilling machines (blades or crown bits for auger mining machines 5b-13/04)

5b-3/00 Drilling machines with reciprocating tool that is intermittently turned when out of contact with the working face

- 5b-3/02 . Machines in which the tool is connected to an impulse member
- 5b-3/04 . Hammer drilling machines in which the tool is hit by an impulse member
- 5b-3/06 . Means for driving the impulse member
 - 5b-3/08 . . by a rotating mechanism
 - 5b-3/10 . . . formed as centrifugal hammers
 - 5b-3/12 . . . with spring-mounted reciprocating masses
 - 5b-3/14 with elastic joining of the drive to the push-rod by double buffer springs
 - 5b-3/16 . . by electromagnets
 - 5b-3/18 . . directly by a piston of an internal-combustion engine
 - 5b-3/20 . . directly by liquid pressure
 - 5b-3/22 . . . working with pulses
 - 5b-3/24 . . directly by air, steam, or gas pressure
 - 5b-3/26 . . . working with pulses
 - 5b-3/28 . Intermittent turning of tool obtained by rifled-bar or ratchet device
 - 5b-3/30 . . driven by separate motor
 - 5b-3/32 . with arrangements for automatic stopping when the tool is lifted from the working face or suffers excessive bore resistance (pick hammers 5b-37/24)
 - 5b-3/34 . Arrangements for locking the drill to the hammer or to the machine

Details of drilling apparatus

5b-5/00 Devices for feeding tool to working face (feeding devices for metal-boring machines 49a)

- 5b-5/02 . Screw-and-nut feed mechanism
- 5b-5/04 . Cam, rack, or like feed mechanism
- 5b-5/06 . Flexible drawing means, e.g. cables
- 5b-5/08 . Means for driving feed mechanism
 - 5b-5/10 . . Separate motor, e.g. compressed-air motor or cylinder (5b-5/11 takes precedence)
 - 5b-5/11 . . combined with supporting means, e.g. feed legs
 - 5b-5/12 . . Weight or spring drive
 - 5b-5/14 . . Automatic feed by jump or recoil of the drilling machine
 - 5b-5/16 . with arrangements for automatically interrupting the feed when the tool suffers excessive bore resistance

5b-7/00 Dust eliminating or dust removing while drilling (equipment for preventing the formation of dust by slitting or dislodging machines 5b-35/22; exhausting dust from mines 5d-5/20)

- 5b-7/02 . by exhausting dust-loaded air
- 5b-7/04 . using exhaust air from the drill motor for blowing-off the dust
- 5b-7/06 . by foam
- 5b-7/08 . by liquids
 - 5b-7/10 . . Liquid flushing installations
 - 5b-7/12 . Preventing exhaust air from the drill motor from blowing-off towards the working face

5b-9/00 Supporting, guiding or centralising devices for boring rods

- 5b-11/00 **Supports or guides for drilling machines; Columns to which the machine is clamped** (feed legs 5b-5/11; slitting machines mounted on supports 5b-25/64; guiding, slitting, or dislodging machines 5b-35/08)
 - 5b-11/02 . Drill wagons (trucks for slitting or dislodging machines 5b-29/24)

5b-13/00	Drill cutting blades, crown bits, or roller-cutter bits (for deep-drilling 5a-9/00); Wear-resisting inserts for blades or bits (uniting inserts to blades or bits 49h-31/04, 49l-3/26; materials 18c, 40b)
5b-13/01	. Wear-resisting inserts (5b-13/02, 5b-13/06 to 5b-13/12 take precedence; for deep-drilling 5a-9/36)
5b-13/02	. for rotary drilling; for core boring (dislodging machines with rotary drills 5b-27/22; augers for making post-holes for foundation purposes 84c)
5b-13/04	. . for auger mining machines with a rotatable and advanceable cutter element having a passage-way for cut material
5b-13/06	. for rotary percussion drilling
5b-13/08	. for percussion drilling
5b-13/10	. for drilling holes for anchor devices
5b-13/12	. for drilling approximately vertical holes of large diameter
5b-15/00	Boring rods; Joining rods to one another; Joining rods to driving means; Joining rods to bits; Rods with flushing channels (for deep-drilling 5a-17/00, 5a-21/00)
5b-15/02	. Bit shanks; Chisel shanks
5b-17/00	Bore reamers
5b-19/00	Equipment or accessories for use otherwise than in normal drilling, e.g. in boring test holes, sub-aqueous drilling, boring holes for rescue purposes, drift boring
5b-19/02	. Devices for extracting jammed or broken drill bits from holes; Magnetic fishing devices for drills
5b-19/04	. Devices for removing crown bits from boring rods
5b-21/00	Flame piercing (dislodging by fire-setting 5b-37/16; for deep-drilling 5a-7/14)
5b-23/00	Enlarging drilled holes; Enlarging by chemical action; Counterboring or forming chambers in boreholes to receive explosive charge
<u>Cutting; Slitting; Dislodging</u>	
5b-25/00	Cutting machines, i.e. for making slits approximately parallel or perpendicular to the seam (dislodging machines with slitting means 5b-27/02, 5b-27/10, 5b-27/18)
5b-25/02	. Machines slitting solely by one or more percussive tools moved through the seam
5b-25/04	. . Cutting crowns or other tools (crowns for percussion drilling 5b-13/08)
5b-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
5b-25/08	. . Mountings for the rods or drums
5b-25/10	. . Rods; Drums; Picks
5b-25/12	. . . Picks (general features of picks 5b-35/18)
5b-25/14	. . with equipment for cleaning the slit (associated with cutter chain machines 5b-25/50)
5b-25/16	. Machines slitting solely by one or more rotating saws, cutting discs, or wheels
5b-25/18	. . Saws; Discs; Wheels
5b-25/20	. Machines slitting solely by one or more reciprocating sawing implements or reciprocating cutter chains; Shaker conveyers with cutting means
5b-25/22	. Machines slitting solely by one or more cutter chains moving unidirectionally along jibs
5b-25/24	. . with flat jibs only
5b-25/26	. . with curved jibs only
5b-25/28	. . Chains or chain guides; Picks for same
5b-25/30	. . . Chain guides
5b-25/32	. . . specially adapted for curved jibs
5b-25/34	. . . Chains
5b-25/36	. . . Couplings for links
5b-25/38	. . . Picks (general features of picks 5b-35/18)

- 5b-25/40 integral with links of chains
- 5b-25/42 Attachment of the picks to the links of chains
- 5b-25/44 by wedge or taper
- 5b-25/46 by resilient means
- 5b-25/48 by means of screws or pins
- 5b-25/50 . . with equipment for cleaning the slit (associated with rotary-rod or rotary-drum machines 5b-25/14)
- 5b-25/52 . Machines incorporating two or more of the slitting means according to groups 5b-25/02, 5b-25/06, 5b-25/16, 5b-25/20 and 5b-25/22
- 5b-25/54 . Slitting by unguided cutter-cables or cutter-chains or by unguided tools drawn along the working face by cables, etc. (dislodging by planing means 5b-27/32; propulsion by haulage cables 5b-29/14)
- 5b-25/56 . Slitting by cutter-cables or cutter-chains or by tools drawn along the working face by cables, etc. and 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 5b-35/14)
- 5b-25/58 . Machines slitting by drilling hole-on-hole
- 5b-25/60 . Slitting by jets of water or other liquid
- 5b-25/62 . Machines for making slits approximately perpendicular to the seams either level with, or above or below the level of, the machine
- 5b-25/64 . Slitting machines guided solely by hand and either carried by hand or mounted on supports (supports or guides for drilling machines 5b-11/00; hand-held power-operated tools 5b-37/22)
- 5b-25/66 . Machines for making slits with additional arrangements for drilling
- 5b-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 5b-27/18; removing chippings 5b-35/20)
- 5b-27/00 **Machines which completely free the mineral from the seam****
- 5b-27/01 . specially adapted for removing overhanging coal
- 5b-27/02 . solely by slitting (rods, drums, picks for same 5b-25/10; saws, discs, wheels 5b-25/18; chains, chain guides, picks for same 5b-25/28)
- 5b-27/04 . . by a single chain guided on a frame with or without auxiliary slitting means
- 5b-27/06 . . . with a slewing frame
- 5b-27/08 . . with additional means for cutting the mineral into blocks
- 5b-27/10 . by both slitting and breaking-down
- 5b-27/12 . . breaking-down effected by acting on the vertical face of the mineral, e.g. by percussive tools
- 5b-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 5b-37/00)
- 5b-27/16 . . . with means for both slitting and breaking-down
- 5b-27/18 . by both slitting and planing
- 5b-27/20 . Mineral freed by means not involving slitting
- 5b-27/22 . . by rotary drills with breaking-down means, e.g. wedge-shaped drills
- 5b-27/24 . . by milling means acting on the full working face
- 5b-27/26 . . by closely adjacent cutter-chains acting on the full working face
- 5b-27/28 . . by percussive drills with breaking-down means, e.g. wedge-shaped tools
- 5b-27/30 . . by jaws, buckets, or scoops that scoop-out the mineral
- 5b-27/32 . . by adjustable or non-adjustable planing means with or without loading arrangements (by percussed planing means 5b-27/46)
- 5b-27/34 . . . Machine propelled along the working face by cable or chain
- 5b-27/35 Ram-ploughs
- 5b-27/36 . . . Machine self-propelled along the working face
- 5b-27/38 . . . Machine stationary while planing in an arc
- 5b-27/40 . . . Machine and its planing tool making alternative step-wise movements along the working face
- 5b-27/42 . . . combined with scraper or collector box
- 5b-27/44 . . . Planing knives
- 5b-27/46 . . by percussed planing means

5b-29/00	Propulsion of machines for slitting or completely freeing the mineral from the seam
5b-29/02	. by means on the machine exerting a thrust against fixed supports
5b-29/04	. by cable or chains
5b-29/06	. . anchored at one or both ends to the mine working
5b-29/08	. . . Anchoring arrangements (for anchoring of conveyers only 5d-13/00)
5b-29/10	. . . Cable or chain co-operating with a winch or the like on the machine
5b-29/12	. . . Machines propelled by thrust or pull against a part alternately anchored to, and released from a cable or chain
5b-29/14	. . by haulage cable or chain pulling the machine along the working face
5b-29/16	. . . Winches or other means for pulling cable or chain (winches per se 35c)
5b-29/18	. . . Coupling and uncoupling machine to cable or chain
5b-29/20	. . with safety devices operating in the event of breakage of the cable or chain
5b-29/22	. by wheels, endless tracks, or the like
5b-29/24	. . Trucks carrying the machine while working
5b-29/26	. . . with means for adjustably positioning the machine on the truck
5b-29/28 adjusting the height of the whole machine
5b-31/00	Driving means incorporated in machines for slitting or completely freeing the mineral from the seam
5b-31/02	. for cutting or breaking-down devices
5b-31/04	. . imparting both a rotary and reciprocating motion
5b-31/06	. . actuated by an endless cable or chain
5b-31/08	. for adjusting parts of the machines
5b-31/10	. for slewing parts of the machines
5b-31/12	. Component part
5b-33/00	Trucks or other devices for transporting machines for slitting or completely freeing the mineral from the seam
5b-33/02	. with equipment for loading or unloading the machine on to or from the truck
5b-35/00	Miscellaneous items relating to machines for slitting or completely freeing the mineral from the seam
5b-35/02	. Locking equipment for slewable parts
5b-35/04	. Safety devices (operating in the event of breakage of a haulage cable or chain 5b-29/20)
5b-35/06	. Equipment for positioning the whole machine in relation to its substructure
5b-35/08	. Guiding the machine
5b-35/10	. . by feelers contacting the working face
5b-35/12	. . along a conveyer for the cut mineral
5b-35/14	. . . Equipment for pressing the conveyer towards the working face
5b-35/16	. . by making use of the timbering, filling, or other supports
5b-35/18	. General features of picks, e.g. use of special materials (picks for slitting machines 5b-25/12, 5b-25/38)
5b-35/20	. General features of equipment for removal of chippings, e.g. for loading on conveyer
5b-35/22	. Equipment for preventing the formation of, or for removal of, dust (removing dust while drilling 5b-7/00)
5b-35/24	. Remote control specially adapted for machines for slitting or completely freeing the mineral (control in general 42r)
5b-37/00	Other methods or devices for dislodging with or without loading (breaking-down by means inserted in slits 5b-27/14)
5b-37/02	. by wedges
5b-37/04	. by devices with parts pressed mechanically against the wall of a borehole
5b-37/06	. by making use of hydraulic or pneumatic pressure in a borehole
5b-37/08	. . Devices with pistons, plungers, etc. pressed locally against the wall of the borehole
5b-37/10	. . Devices with expanding elastic casings
5b-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 5b-25/60; blasting by explosives 78e)

- 5b-37/14 . . by compressed air; by gas blast; by gasifying liquids
- 5b-37/16 . by fire-setting or by similar methods based on a heat effect (flame piercing 5b-21/00)
- 5b-37/18 . by electricity
- 5b-37/20 . by ultrasonics
- 5b-37/22 . Hand tools or hand-held power-operated tools specially adapted for dislodging minerals (slitting machines guided solely by hand 5b-25/64)
- 5b-37/24 . . Pick hammers (drilling machines with reciprocating tool 5b-3/00; pneumatic hammers in general 87b)
- 5b-37/26 . Chisels or other cutting tools not mentioned before

5b-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

5b-41/00 Methods of mining with or without movable mining chambers or shields (working shields 5c-19/00); Lay-outs

- 5b-41/02 . for brown coal
- 5b-41/04 . for hard coal
- 5b-41/06 . for ores
- 5b-41/08 . for rock salt; for potash salts (obtaining by dissolving out of boreholes 5a-43/28)
- 5b-41/10 . for oil-bearing deposits
- 5b-41/12 . for stone, e.g. marble
- 5b-41/14 . for other specified minerals, e.g. gold, mercury, other heavy metals, sulphur, slate; for clay

5b-43/00 Methods for preparing for the gasification of coal underground (methods for generating gas 10a, 26a)

5b-45/00 Methods of mining placers; Hydraulic monitors or other hydraulic machines for obtaining minerals out of alluvial deposits

5b-47/00 Machines for obtaining, or the removal of materials in open-pit mines (obtaining peat 5b-49/00)

- 5b-47/02 . for coal, brown coal, or the like (dredgers 84d)
- 5b-47/04 . . Conveyer bridges used in co-operation with the winning apparatus (overburden conveyer bridges 81e)
- 5b-47/06 . . Cableway conveyers used in co-operation with the winning apparatus (underground hauling 5d-13/00)
- 5b-47/08 . . Devices for cutting-out partings, e.g. layers of sand between seams of coal
- 5b-47/10 . for quarrying stone, sand, gravel, or clay

5b-49/00 Obtaining peat; Machines therefor (treating peat 10a, 10c, 82a)

- 5b-49/02 . by excavating
- 5b-49/04 . by digging in the form of peat sods

5c Mine opening and forewinning: sinking of shafts, sumps, raises, drifts, crosscuts, working methods, mine supporting (5d-4)

- 5c-1/01 Shaft sinking in general, also rock drainage pertaining thereto
- 5c-1/20 Shaft sinking with drop casings (84c-3)
- 5c-1/30 Shaft sinking by the petrification process (84c-6)
- 5c-2 Shaft sinking by the freezing process (84c-1)
- 5c-3 Shaft borers (5a; 5b; 84c-1; 45f-4/09)
- 5c-4 Drift driving in general (shield driving 19f-2)
- 5c-5 Drift borers and boring machines (tunnel boring machines 19f-3; machines and borers for making blast holes during the driving of drifts 5b-1 – 5b-21/20)
- 5c-6 Raise driving, raise drills
- 5c-7 Work processes (opencast mining 5b-41)
- 5c-8 Shaft supporting

5c-9/01	Drift supporting, general (19f-1)
5c-9/10	Iron drift supports
5c-9/20	Knee joints
5c-9/30	Cap shoes
5c-10/01	Mine props (37e-13/03)
5c-10/10	Special devices for prop robbing
5c-11	Roof-supporting and similar safety devices against rock and coal collapsing in working and drift driving

5c (IPC: E21D) Shafts; Sinking shafts; Galleries; Lining galleries

Shafts

5c-1/00 Sinking shafts

- 5c-1/02 . by hand
- 5c-1/03 . mechanically (5c-1/08 takes precedence)
- 5c-1/04 . . with grabs
- 5c-1/06 . . with shaft-boring cutters (drilling machines 5a, 5b)
- 5c-1/08 . while moving the lining downwards
- 5c-1/10 . Preparation of the ground
- 5c-1/12 . . by freezing
- 5c-1/14 . . . Freezing apparatus
- 5c-1/16 . . by petrification (grouting anchoring-bolts 5c-20/02)

5c-3/00 Raising shafts, i.e. working upwards from the bottom

5c-5/00 Lining shafts

- 5c-5/01 . using prefabricated lining lowered into a hole filled with liquid or viscous mass
- 5c-5/012 . use of fluid-tight or anti-friction material on outside of, or between, lining layers
- 5c-5/016 . Bearer curbs
- 5c-5/02 . with wood (5c-5/01, 5c-5/012, 5c-5/016 take precedence)
- 5c-5/04 . with brick, concrete, stone, or similar building materials (5c-5/01, 5c-5/012, 5c-5/016 take precedence)
- 5c-5/06 . with iron or steel (5c-5/01, 5c-5/012, 5c-5/016 take precedence)
- 5c-5/08 . . in the form of profiled parts
- 5c-5/10 . . in the form of tubing
- 5c-5/11 . with combinations of different materials, e.g. wood, metal, concrete (5c-5/01, 5c-5/012, 5c-5/016 take precedence)
- 5c-5/12 . Accessories for making shaft linings, e.g. suspended cradles, shutterings

5c-7/00 Shaft equipment, e.g. timbering within the shaft

- 5c-7/02 . Arrangement of guides for cages in shafts; Connection of guides for cages to shaft walls (guides or shoes fixed on cages 35a)

Galleries

5c-9/00 Driving galleries, e.g. using ripping machines (driving-machines 5b-25/00 to 5b-35/24, especially 5b-27/00; drift boring 5b-19/00)

- 5c-9/02 . Driving inclined galleries
- 5c-9/04 . Driving galleries through loose materials

5c-11/00 Lining galleries, e.g. supporting linings

- 5c-11/02 . with wood
- 5c-11/03 . . using timber-setting machines
- 5c-11/04 . with building materials
- 5c-11/05 . . using compressible insertions
- 5c-11/06 . . with bricks
- 5c-11/07 . . . using brick-laying machines
- 5c-11/08 . . preformed concrete or other lagging slabs
- 5c-11/10 . . with concrete cast in situ; Shuttering or other equipment adapted therefor
- 5c-11/12 . . Temporary supports for use during building; Accessories
- 5c-11/14 . with iron or steel, e.g. with auxiliary parts of other materials, supporting rings

- 5c-11/16 . . Linings specially shaped for galleries of irregular cross-section (road-head supports connected to working-face supports 5c-15/00, 5c-17/00, 5c-23/00)
- 5c-11/18 . . Arch members
- 5c-11/20 . . . Special cross-sections, e.g. corrugated
- 5c-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
- 5c-11/24 . . . Knuckle joints or links between arch members
- 5c-11/26 . . . Shoes for connecting arch members to longitudinal struts
- 5c-11/28 . . Longitudinal struts
- 5c-11/30 . . Bases for lower arch members (for props 5c-15/54)
- 5c-11/32 . . Laggings
- 5c-11/34 . . Joints between vertical props and horizontal top bars (end caps forming part of the props 5c-15/54)

5c-13/00 Driving or making large working spaces, e.g. for pumps, for loading (driving-machines 5b-25/00 to 5b-35/24)

- 5c-13/02 . Methods
- 5c-13/04 . Special equipment; Accessories

Working-face supports

5c-15/00 Props (in the building art 37e-25/00); Chocks

- 5c-15/02 . Non-telescopic props
- 5c-15/04 . . with wooden prop parts joined by double conical connectors
- 5c-15/06 . . with parts joined by a lock, with or without slight axial adjustability
- 5c-15/08 . . . with toggle joint connection
- 5c-15/10 . . . with dog-clutch or pin-and-hole connection
- 5c-15/12 . . . with locking devices located near head or foot
- 5c-15/14 . Telescopic props (general means for fixing telescopic parts together 47a)
- 5c-15/15 . . Means counteracting entry of dirt; Built-in cleaning devices
- 5c-15/16 . . with parts held together by positive means, with or without relative sliding movement when the prop is subject to excessive pressure
- 5c-15/18 . . . with one part resting on a supporting medium, e.g. rubbish, sand, bitumen, lead, located in the other part, with or without expulsion or displacement of the medium upon excessive pressure
- 5c-15/20 . . . with pawl, pin, cross-piece, etc. engaging with ratchet teeth, notches, holes, etc. spaced apart at intervals
- 5c-15/22 . . . with member, pin, cross-piece, etc. ruptured, sheared through, or permanently deformed upon excessive pressure
- 5c-15/24 . . . with axial screw-and-nut, rack-and-worm, or like mechanism
- 5c-15/26 with screw, worm, etc. not self-locking but normally prevented from rotation by friction members which slip upon excessive pressure
- 5c-15/28 . . with parts held relatively to each other by friction or gripping, e.g. using wedges
- 5c-15/30 . . . by means expanded or contracted by pressure applied through the medium of a fluid or quasi-fluid, e.g. rubber
- 5c-15/32 . . . by a deformable collar
- 5c-15/34 . . . by axially-moving balls, rollers, etc.
- 5c-15/36 . . . by a tiltable collar surrounding one or both parts
- 5c-15/38 . . . with longitudinally-divided upper or lower prop parts, e.g. interfitting laminations
- 5c-15/40 . . . Collar or other support gripped to one or both parts by toggle-action, cam, or other member pivoted or similarly mounted
- 5c-15/42 . . . with special parts to influence the friction
- 5c-15/43 . . . Details of wedges (friction linings or pads 5c-15/42)
- 5c-15/44 . . Hydraulic, pneumatic, or hydraulic-pneumatic props
- 5c-15/45 . . . having closed fluid system, e.g. with built-in pumps or accumulators
- 5c-15/46 . . with load-measuring devices; with alarm devices
- 5c-15/48 . Chocks or the like
- 5c-15/50 . Component parts or details of props (5c-15/43, 5c-15/58, 5c-15/60 take precedence)
- 5c-15/502 . . Prop bodies characterised by their shape, e.g. of specified cross-section

5c-15/51	. . specially adapted to hydraulic, pneumatic, or hydraulic-pneumatic props, e.g. arrangements of relief valves
5c-15/52	. . Extensible units located above or below standard props
5c-15/54	. . Details of the ends of props (for permitting step-by-step movement 5c-23/06)
5c-15/55	. . . of prop heads
5c-15/56	. . Details of locks of telescopic props
5c-15/58	. Devices for setting props
5c-15/582	. . for mechanical props
5c-15/59	. . for hydraulic, pneumatic, or hydraulic-pneumatic props
5c-15/60	. Devices for withdrawing props or chocks
5c-17/00	Caps for supporting mine roofs
5c-17/01	. characterised by the shape of the cap, e.g. of specified cross-section
5c-17/02	. Cantilever extension or similar protecting devices
5c-17/022	. . Auxiliary devices for temporary support of roof-supporting beams whilst assembling
5c-17/03	. . Brackets for roof-supporting bars
5c-17/04	. . for use in longwall working
5c-17/05	. . . hydraulically extensible
5c-17/054	. . . hydraulically pivotable
5c-17/06	. . for use in drifting galleries
5c-17/08	. . Cap joints for obtaining a coal-face free of pit-props
5c-17/082	. . . of sliding type
5c-17/086	. . . of articulated type
5c-17/10	. Details of mine caps for engaging the tops of pit-props, with or without retaining-plates; Retaining-plates
5c-19/00	Working shields; Protective covers for working space
5c-19/02	. for use in longwall working
5c-19/04	. for use in drifting galleries
5c-20/00	Setting anchoring-bolts
5c-20/02	. with provisions for grouting
5c-21/00	Anchoring-bolts for roof, floor, or shaft-lining protection
5c-21/02	. having means for indicating tension (screwed connections specially modified for indicating tensile load 47a1-31/02)
5c-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 per se at the working face 5d-13/08)
5c-23/02	. Special mine caps or special tops of pit-props for permitting step-by-step movement
5c-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 (5c-23/14 takes precedence)
5c-23/06	. . Special mine caps or special tops of pit-props for permitting step-by-step movement
5c-23/08	. Advancing mechanisms (5c-23/16 takes precedence)
5c-23/10	. . with advancing-devices separate from the supporting construction
5c-23/12	. Control, e.g. using remote control (5c-23/16 takes precedence)
5c-23/14	. . Effecting automatic sequential movement of supports, e.g. one behind the other
5c-23/16	. Hydraulic or pneumatic features, e.g. circuits, arrangement or adaptation of valves, setting or retracting devices
5c-23/18	. . of advancing mechanisms
5c-23/20	. . . for sequential movement, e.g. one behind the other
5c-23/22	. . . incorporated in mine caps
5c-23/24	. . . the advancing mechanisms being separate from the supporting construction
5c-23/26	. . Hydraulic or pneumatic control

**5d Mine ventilation, prevention of mine accidents, haulage, filling, etc.
(blowers and fans 27)****Mine ventilation**

- 5d-1 Air ducts, brattices, air dams
- 5d-2/01 Air doors
- 5d-2/10 Devices for the automatic opening of air doors
- 5d-3/01 Air locks for mine ventilation (air locks for foundation work in the building trade 84c-3)
- 5d-3/10 Shaft covers
- 5d-4 Methods and equipment for cooling and maintaining the temperature of mine atmospheres
- 5d-5/01 Other equipment and methods for mine ventilation
- 5d-5/10 Dust removal by suction (5b-16)

Fighting firedamp and coal dust explosions, mine fires and their consequences (firedamp indicators 42l-4/01 – 42l-16)

- 5d-6/01 Mobile devices for liquid sprinkling
- 5d-6/10 Liquid screens actuated in connection with blasts
- 5d-6/20 Liquid screens actuated by explosions
- 5d-6/30 Other stationary devices for liquid sprinkling
- 5d-6/40 Miscellaneous liquids and chemicals for sprinkling
- 5d-7/01 Mobile rock-dust blowing-off devices
- 5d-7/10 Rock-dust blowing-off devices actuated in conjunction with blasts
- 5d-7/20 Rock-dust blowing-off devices actuated by explosion
- 5d-7/30 Other rock-dust blowing-off and dispersing devices
- 5d-7/40 Miscellaneous types of rock dust
- 5d-8 Rescue equipment, rescue chambers, escape ways, etc. (breathing equipment 61a-29; resuscitation equipment 30k-13/04)
- 5d-9/01 Other equipment and methods for preventing and fighting explosions and mine fires as well as their effect
- 5d-9/10 Coal dust and gas suction devices
- 5d-9/20 Fire doors
- 5d-9/30 Devices for spark prevention in mining machinery

Haulage (shaft haulage 35a)

- 5d-10/01 Drift haulage (cable and chain ways, propelling devices 20a; electric railways 20k-1)
- 5d-10/50 Gravity and blind shaft conveying (hoists 35a; winches 35c)
- 5d-11 Conveyance from the working face (shaking chutes and belts for general use 81e; scraper winches 35c)
- 5d-12 Loading machines for underground operations (general 81e)
- 5d-13 Miscellaneous equipment for haulage into and out of deep mines (opencast haulage 5b-41/01 – 5b-41/40, 81e-126, 81e-127)
- 5d-14/01 Mine filling in general (dump cars for general use 20c-13 – 20c-16, 63a; car tippers 81e-92 – 81e-103)
- 5d-14/10 Mine-filling machines
- 5d-15/01 Hydraulic filling
- 5d-15/10 Pneumatic filling
- 5d-17 Power distribution in the mine, pipe conduits, pipe joints (hydraulic and pneumatic filling pipes 5d-15/01, 5d-15/10)
- 5d-18 Miscellaneous devices for mining, hitherto unmentioned: bulkhead doors, trial boring, work lighting, e.g. on the face, countering quicksand etc.

5d (IPC: E21F) Ventilation; Safety devices; Transport; Filling-up; Rescue**Distribution of ventilating currents in mines**

- 5d-1/00 Distribution of ventilating currents (ventilating tunnels 17f-7/02)**
- 5d-1/02 . Test models
 - 5d-1/04 . Air ducts (suspension devices 5d-17/02)
 - 5d-1/06 . . Duct connections (tube connections in general 47f1)
 - 5d-1/08 . Special arrangements or constructions of ventilators in connection with air ducts (ventilators in general 27c)
 - 5d-1/10 . Air doors
 - 5d-1/12 . . Devices for automatically opening air doors
 - 5d-1/14 . Air partitions; Air dams; Air-locks (air-locks for foundations 84c)
 - 5d-1/16 . Shaft covers

5d-3/00 Cooling or drying of air (air-conditioning rooms or spaces in general 36d)**Safety devices (flue-gas indicators 42l); Rescue devices****5d-5/00 Means or methods for preventing, binding, depositing, or removing dust; Preventing explosions or mine fires**

- 5d-5/02 . by wetting or spraying
- 5d-5/04 . . Spraying barriers (spraying in general 85g)
- 5d-5/06 . . Fluids used for spraying
- 5d-5/08 . Rock dusting of mines; Depositing other protective substances
- 5d-5/10 . . Devices for rock dusting
- 5d-5/12 . . Composition of rock dust
- 5d-5/14 . Fluid barriers or rock dusters made to work by, or at the same time as, shots or explosions
- 5d-5/16 . Layers of hygroscopic or other salts deposited on floors, walls, etc. for binding dust; Depositing of such layers
- 5d-5/18 . Impregnating walls, etc., with liquids for binding dust
- 5d-5/20 . Drawing-off or depositing dust (dust-removing while drilling 5b-7/00, while slitting 5b-35/22)

5d-7/00 Methods or devices for drawing-off gases with or without subsequent use of the gas for any purpose**5d-9/00 Devices preventing sparking of machines or apparatus (preventing sparking of electric machines or apparatus 21d)****5d-11/00 Rescue devices or other safety devices, e.g. safety chambers, escape ways (breathing aids for curative purposes 30k-13; respiratory apparatus 61a; revival apparatus 61a)****5d-13/00 Transport specially adapted to underground conditions (mine cars 20c; transport in general, loading 81e)**

- 5d-13/02 . in galleries
- 5d-13/04 . in gravity inclines; in staple or inclined shafts
- 5d-13/06 . at or adjacent to the working face
- 5d-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 5b-35/12; in combination with mine roof supports for step-by-step movement 5c-23/00)

5d-15/00 Methods or devices for placing filling-up materials in underground workings

- 5d-15/02 . Supporting means, e.g. shuttering, for filling-up materials
- 5d-15/04 . . Stowing mats; Goaf wire netting; Partition walls
- 5d-15/06 . Filling-up mechanically
- 5d-15/08 . Filling-up hydraulically or pneumatically (hydraulic or pneumatic transport devices 81e; pipes, pipe couplings 47f1)
- 5d-15/10 . . Hydraulic or pneumatic filling-up machines

5d-17/00	Methods or devices for use in mines, not covered elsewhere (mine lighting 4a, 21f)
5d-17/02	. Suspension devices for tubes or the like, e.g. for ventilating ducts (for piping or cables 47f1-3/00 – 47f1-7/00)
5d-17/04	. Distributing means for power supply in mines
5d-17/06	. . Distributing electric power; Cable networks; Conduits for cables
5d-17/08	. . Distributing hydraulic power; Pipe networks for hydraulic liquid
5d-17/10	. . Distributing pneumatic power; Pipe networks for compressed air
5d-17/12	. Dam doors
5d-17/14	. Mine grainage
5d-17/16	. Modification of mine passages or chambers for storage purposes, especially for liquids or gases
5d-17/18	. Special adaptations of signalling or alarm devices (mine lifts 35a)