# 21 Electrical engineering

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| (21a | Electric telecommunications) |
| **21a1** | **Electric telegraphy** |
| **21a2** | **Telephony; electric acoustical sound recording and reproduction** |
| **21a3** | **Telephone exchange systems** |
| **21a4** | **Signal transmission by means of high-frequency electric oscillations** |
| **21b** | **Primary and secondary batteries, thermoelements** |
| **21c** | **Electric lines and equipment: cables and overhead lines, insulators, switches, regulators, switching methods, line protection, safety devices and lightning protection** |
| (21d | Electric machines, generators, motors, converters and distribution systems) |
| **21d1** | **Direct current** |
| **21d2** | **Alternating current** |
| **21d3** | **Special arrangements independent of type of current** |
| **21e** | **Devices and processes for measuring electric and magnetic magnitudes** |
| **21e** | **(IPC: G01R) Measuring electric variables; Measuring magnetic variables** |
| **21f** | **Electric illumination** |
| **21g** | **General electrical accessory devices and methods, except electrochemical devices and methods: magnets, automatic circuit breakers, capacitors, valves, discharge tubes, X-ray apparatus, equipment for electro-and radio-therapy, photocells** |
| **21g4** | **(IPC: G21F) Protection against X-radiation, gamma radiation, corpuscular radiation, or particle bombardment; Decontamination arrangements; Treating radioactively-contaminated waste material** |
| **21h** | **Methods and devices for electric heating, cooking, melting, welding and soldering** |
| **21k9** | **(IPC: H01M) Batteries; Accumulators** |
| **21n7** | **(IPC: H04N) Pictorial communication; Television** |

## 21a1 Electric telegraphy

**Receivers for Morse telegraphs and similar writing telegraphs**

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| 21a1-1/01 | Morse telegraphs and similar writing telegraphs |
| 21a1-1/02 | Paper feeding and writing devices (21a1-32/01) |
| 21a1-1/03 | Ink writers, powder writers, chemical telegraphs |
| 21a1-1/04 | Selective calling of telegraph stations (21a3-52) |
| 21a1-1/05 | Automatic emergency receivers, call selectors (21a4-57) |

21a1-2 Gray-type writing telegraphs, telautographs

**Transmitters for Morse telegraphs and similar writing telegraphs**

21a1-3/01 Transmitters with keyboards and automatic Morse-signal transmitters
21a1-3/02 Transmitters without keyboards
21a1-3/03 Morse keys and other transmitter keys
21a1-3/04 Training apparatus
21a1-3/05 Emergency-call transmitters, time-signal transmitters (74c-12)
21a1-4 Switching mechanisms for pointer telegraphs and for similar telegraphs along the same line

**Circuits for exchange telegraph systems**

21a1-5/01 Manual exchanges (21a3-1 – 21a3-13)
21a1-5/02 Automatic exchanges (21a3-16/01 – 21a3-80)
21a1-5/03 Control devices for exchanges, combined writing operations, answer back devices (21a2-31; 21a3-68)
21a1-5/04 Remote connection or disconnection of stations, station motors, batteries, etc. (21c-45)
21a1-5/05 Current supply for telegraph systems (21a3-64)

**Automatic telegraphy**

21a1-6/01 Circuits for automatic telegraphy
21a1-6/02 Transmission between line sections, delayed retransmission devices (21a2-31/02; 21a3-32)
21a1-6/03 Wave recorders
21a1-6/04 Correction of the zero line

**Telegraphy over long lines and cables; increase of the telegraphing speed; signal amplification and signal distortion correction; artificial networks** (21e-31)

21a1-7/01 Signal generation, pulse correction (21a3-67)
21a1-7/02 Cable telegraphy with reception amplification
21a1-7/03 Alternating-current telegraphy
21a1-7/04 Artificial lines and submarine-land conductors
21a1-7/05 Measuring of the distortion
21a1-7/06 Interference elimination (21a4-22)
21a1-7/07 Control of transmission-current curves
21a1-7/08 Carrier-current telegraphy
21a1-8 Devices for the perforation of transmitting tapes
21a1-9/01 Multiplex telegraphy with resonance, general
21a1-9/02 Voice-frequency telegraphy and voice-frequency generators
21a1-9/03 Receiving relays for resonance telegraphy
21a1-9/04 Filters, mechanical filter chains for resonance telegraphy

Intermittent multiplex telegraphy (74b-11)

21a1-10/01 with rotating distributors
21a1-10/02 without rotating distributors
21a1-10/03 with inertia-less distributors

**Type-printing telegraphs printing on paper tape**

21a1-11/01 Structural arrangements
21a1-11/02 Structural arrangements for start-stop devices
21a1-11/03 Type-changing devices
21a1-11/04 Step-by-step switches
21a1-11/05 Combined printing and perforating devices
21a1-11/06 Circuits for type printers

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| 21a1-12 | Printing telegraphs utilising perforated tapes |
| | **Synchronising devices and circuits for telegraphic systems** |
| 21a1-13/01 | Local synchronisation, oscillation generators (21a1-35/01; 21a1-35/02; 21a1-35/12) |
| 21a1-13/02 | Special synchronisation signals, start-stop (21a1-35/13) |
| 21a1-13/03 | Permanent synchronising current (21a1-35/11) |
| 21a1-13/04 | Central synchronisation (21a1-35/30) |
| 21a1-13/05 | Synchronisation checking, especially stroboscopically (21a1-35/40) |
| 21a1-14 | Regulating, braking and winding mechanisms and clutches for printing telegraphs (21a1-35/03; 21a1-35/05; 21c-59) |
| 21a1-15 | Conversion of the Morse signals into printed type |
| | **Remote control of typewriters** |
| 21a1-16/01 | by means of different pulse combinations |
| 21a1-16/02 | by means of different frequencies |
| 21a1-16/03 | by means of different current intensities and voltages |
| 21a1-16/04 | by means of different pulse durations |
| 21a1-16/05 | Typewriters for the printing of spoken sounds |
| 21a1-17 | Page-printing telegraphs (15e-5; 15e-9) |
| 21a1-18 | Type-printing telegraphy, Rowland method |
| 21a1-19 | Ground telegraphy (21a4-66/02) |
| | **Relays for telegraphy, structures and circuits** (21g-4) |
| 21a1-20/01 | Polarised relays (20i-29; 21a3-61; 21g-4) |
| 21a1-20/02 | Neutral relays (21a3-61; 21g-4) |
| 21a1-20/03 | Alternating-current relays (20i-29; 21a3-61/10) |
| 21a1-20/04 | Pneumatic and mechanical relays |
| 21a1-20/05 | Relays with liquids, powders or gases |
| 21a1-20/06 | Electrostatic relays, time relays, delayed-action relays, interrupters (20i-29; 21a3-61; 21g-4) |
| 21a1-20/07 | Relays with several armatures, step relays (21a9-61; 21g-4) |
| 21a1-20/08 | Relay contacts (20i-29; 21a3-61/30; 21g-4) |
| 21a1-20/09 | Relay circuits (20i-29) |
| 21a1-20/10 | Repeaters |
| 21a1-21 | Secret telegraphy (21a1-33/60; 21a2-37/01; 21a4-52) |
| 21a1-22 | Telegraphic sounders and ringers |
| 21a1-23 | Utilisation of power lines for telegraphy (21a2-39/20; 21a4-59) |
| | **Duplex and quadruplex telegraphy, two-way communication** (21a4-50; 21a4-51) |
| 21a1-24/01 | Duplex and quadruplex telegraphy, direct current |
| 21a1-24/02 | Duplex communications, alternating current |
| 21a1-24/03 | Duplex communications, direct or alternating current |
| 21a1-24/04 | Semiduplex |
| 21a1-24/05 | Test circuits for duplex communications |
| | **Telegraphy and telephony over the same wire** |
| 21a1-25/01 | General |
| 21a1-25/02 | Infrasonic telegraphy |
| 21a1-27/01 | Protection against interferences from other lines (21c-68) |
| 21a1-27/02 | Arrangements for the protection of telegraph systems against lightning (21c-72) |
| 21a1-31 | Telegraphy with photographic means of recording (57d-1) |

**Electrical picture transmission and electric television** (photoelectric cells 21g-29; light relays 21g-4/06; light valves and modulators 21g-4/07)

**Arrangements for analysing, picking up and reproducing**

Telegraphic apparatus for the transmission of pictures, print and writing

21a1-32/01 Writing devices, styluses, electrodes, tapes
21a1-32/02 Drum designs
21a1-32/03 Driving mechanism, continuous switching (motors and clock movements 21a1-35/03; 21a1-35/04)
21a1-32/04 Special developments in transmission methods

Non-optical intermediate recording (films 21a1-34/50)

21a1-32/10 Intermediate recordings of general type
21a1-32/11 Magnetic and capacitor recordings
21a1-32/12 Statistical methods

Methods of picture analysis

21a1-32/20 Simple scanning, point, line, irregular scanning
21a1-32/21 Multiple scanning, picture subdivision
21a1-32/22 Whole picture pickup, simultaneous

Means for picture analysis and synthesis

21a1-32/30 Rotating disks
21a1-32/31 Endless bands
21a1-32/32 Drums with holes and lenses or mirrors
21a1-32/33 Rotating mirrors or mirror wheels
21a1-32/34 Oscillating, mechanically or frequency-exciting mirrors or crystals (21a1- 35/01; 21a4-8/02; 21a4-10)
21a1-32/35 Inertia-less analysing devices, cathode-ray tubes (21g-13/21 – 21g-13/29; 42g-9/01; relaxation oscillations 21a1-35/21)
21a1-32/36 Invisible and X-rays

Optical energy pickup

21a1-32/40 Selenium-and photocells (21g-29/01; 21g-29/10)
21a1-32/41 Cell-current amplification, cell circuits (21a2-41/01; carrier-frequency generation 21a1-33/10)

Optical energy reproduction

21a1-32/50 Light relays, Kerr cells (21a1-34/02; 21g-4/06)
21a1-32/51 Gas-discharge tubes with negative glow (21f-85; 21g-12/01)
21a1-32/52 Gas-discharge tubes with positive column (21f-82/01 – 21f-82/06; 21g-12/01)
21a1-32/53 Mercury-vapour tubes (21f-82/01)
21a1-32/54 Cathode-ray tubes (21g-13/21 – 21g-13/29; 21g-29/30; 42g-9/01)
21a1-32/55 Other light sources (21f-86)

**Arrangements for transmission**

21a1-33/01 Commutator transmission
21a1-33/10 Electro-optical and electric carrier-frequency generation
21a1-33/11 Optical-mechanical carrier-frequency generation
21a1-33/12 General modulation methods (21a4-14/01)
21a1-33/21 Utilisation of intermediate frequencies
21a1-33/22 Utilisation of auxiliary transmitters, relay circuits (21a4-55; 21a4-56)
21a1-33/30 Frequency suppression, frequency spectrum transmission (21a4-54)
21a1-33/31 Frequency division
21a1-33/40 Pulse and picture-current distortion and correction, line control
21a1-33/50 Interference prevention, fading phenomena (21a1-22/01; 21a1-22/06)

21a1-33/51 Regulation of the reception current and of the amplification factor (21a4-21; image inversion 21a1-34/22)
21a1-33/52 Transmission range, properties of transmission channels
21a1-33/60 Secret transmission (21a1-21; 21a2-37/01; 21a4-52)
21a1-33/70 Calling and receiving circuits (21a4-57)
21a1-33/71 Amplification and rectification

**Accessory equipment of transmitters and receivers**

21a1-34/01 Mirrors, glass plates and rods, neutral wedges, lenses, quartz
21a1-34/02 Screens, stops, picture windows (42h-23/27)
21a1-34/03 Diaphragms, interference phenomena
21a1-34/04 Closed-circuit and two-way television, monitors

Picture improvement

21a1-34/10 Optical means for brightening the image, raster-line elimination, haze elimination
21a1-34/11 Electric means therefor
21a1-34/12 Picture boasting, fading in and out

Picture property modification, picture reversal

21a1-34/20 by optical means prior to the transmission
21a1-34/21 by optical means after the transmission
21a1-34/22 by electric means

Colour pictures

21a1-34/30 Transmission of pictures in various shades by means of punched tape
21a1-34/31 Transmission of colour pictures
21a1-34/32 Colour effects of light sources, colour filters, coloured tints

21a1-34/40 Stereoscopic and plastic pictures

Picture and sound

21a1-34/50 Transmission of picture and sound recording (57a-61)
21a1-34/51 Direct picture-sound transmission
21a1-34/52 Optophonic methods
21a1-34/53 Design of the pickup and reproducing equipment in picture-sound broadcasting
21a1-34/60 Combination of picture pickup and reproducing apparatus

**Synchronisation**

Drive means

21a1-35/01 Mechanical oscillation generation, tuning forks
21a1-35/02 Optical and electrical oscillation generation (deflecting voltages 21a1-35/20)
21a1-35/03 Motors, also in combination with regulating mechanisms and brakes
21a1-35/04 Clock mechanisms, pendulums
21a1-35/05 Clutches

Pulse generation and correction of the local drive

21a1-35/10 Pulse amplification, separation of the picture and synchronisation pulses
21a1-35/11 Drive control by means of the transmitted currents
21a1-35/12 Drive control by the formation of correction magnitudes
21a1-35/13 Start-stop system (21a1-13/02)
21a1-35/20 Generation of deflecting voltages for oscillating systems (21g-13/23)
21a1-35/21 Relaxation oscillations (relaxation oscillations, general 21g-38; for other special purposes 21e-28/02; 51f-2/03; 74d-8/04, 74d-8/54; 83d-5)
21a1-35/30 Central synchronisation and circuit control (21a1-13/04)

Synchronism testing and phase adjustment

21a1-35/40 Stroboscopic methods (21a1-13/05)

21a1-35/41 Mechanical phase adjustment also by means of clutches

21a1-35/42 Electrical phase adjustment

21a1-35/50 Synchronisation of the picture-record media with the analysing device

21a1-35/51 Synchronous picture and sound reproduction

21a1-36 Electrical pulses generally applicable for telecommunication purposes, generation, amplification, shaping and transmission (pulse generation, correction and transmission for telegraphy 21a1-7; picture pulse shaping 21a1-33/40; synchronisation pulses for picture telegraphy and television 21a1-35/10; current-impulse generator for telephone exchange selectors 21a3-16, 21a3-17, 21a3-67; oscillation generation by means of tube transmitters 21a4-8; high-frequency keying circuits 21a4-16; pulse direction finding 21a4-48/23; range determination and reflected wave direction finding by means of pulses 21a4-48/61, 21a4-48/63, 74d-6/14; remote control by means of electric pulses 21c-45 – 21c-47; pulses for power currents 21d3-3/ 01 – 21d3-3/03; relaxation oscillations, generation, general, multivibrators 21g-38; range finding by means of pulses 74b-8/05 – 74b-8/08)

## Electrical pulse technique

21a1-36/00 Methods or apparatus for generating, amplifying, converting or transmitting electrical pulses for transmission of information, in general (measuring of pulses 21e-36/10)

21a1-36/02 Pulse generator or oscillation generators, e.g. multivibrators, blocking oscillators etc. (for telegraphy 21a1-7; for telephone switches 21a3-16, 21a3-17, 21a3-67; tube transmitters 21a4-8; power current surge generators 21d3-3; optical signal generators 74d-8; electromagnetic circuit breakers 21g-7/01; generation of deflecting voltages for television systems 21a1-35/20; for measuring purposes 21e-28/01, 21e-28/02)

21a1-36/04 Pulse amplifying, pulse shaping; pulse restricting, decreasing distortion, steepening leading or trailing edges, delaying (for telegraphy 21a1-7; picture-current distortion and correction 21a1-33/40; amplification of synchronisation pulses for picture transmission or television 21a1-35/10)

21a1-36/06 Modulating pulses with continuous modulating signal (modulation of sinusoidal carrier frequencies 21a4-14/01; tube transmitter modulation circuits 21a4-15; keying circuits 21a4-16; multiplex traffic with pulse modulation 21a4-49; transmission of measured values for remote indication using pulse modulation 74b-8/05 – 74b-8/08)

21a1-36/08 Demodulating pulses with continuous modulating signal (receiving circuits for information transmitted via sinusoidal high-frequency carrier waves 21a4-21; 21a4-29)

21a1-36/10 Transforming types of pulse modulation

21a1-36/12 Modulating or demodulating pulses with step-type signals, pulse code modulation (for transmission of measured values for remote indication 74b-8; code conversion for telegraphy 21a1-7/01; information and code conversion for electronic counters 42m-14)

21a1-36/14 Electronic pulse memories (in connection with transmission and control circuits for electric and electronic counters and computers 42m-14; memory tubes in general, circuits therefor 21g-13/01 – 21g-13/60; memory tubes and magnetic or dielectric memories for television signals and similar high-frequency signals 21a1-32/11; ferromagnetic or ferroelectric pulse memories 21a1-36/16; shift registers 42m-14, 21a1-37/64; circuits for memories in telephone systems 21a3-32)

21a1-36/16 Ferromagnetic or ferroelectric memories (in connection with transmission and control circuits for electric and electronic counters and computers 42m-14; electronic pulse memories 21a1-36/14; sound recording 42g; magnetic and electric image recording 21a1-32/11; photographic recording 57b-12)

21a1-36/18 Electronic pulse switches, gate circuits, selector circuits, distributor circuits, logical circuits, e.g. and-, or- or not-circuits, bistable switches (logical circuits for electronic counting apparatus and digital circuits for information processing or calculation 42m-14, 42m3-7/00; switches, switching tubes 21c-28 – 21c-45; automatically acting electric controls 21c-46/31 – 21c-46/34; program control for electric calculating machines 42m-14, 42m3-9/00)

21a1-36/20 Pulse code switches (information or code processing for electronic calculating machines 42m-14; code processing for telegraphy 21a1-7/01)

21a1-36/22 Pulse counter circuits and pulse reducer circuits with indication of the number of pulses by electronic means (pulse counters with mechanical or electromechanical counting and indicating machines, e.g. traffic counters, particle counters, counters for packaging machines etc. 42p-3; frequency converters for sinusoidal or similar continuous oscillations 21a4-6; counting of telephone connections 21a3-75, 21a3-76; pulse counting circuits as parts of counting machines or electronic calculators 42m-14, 42m3-7/38; shift registers 21a1-37/64, 42m-14, 42t2-19)

21a1-36/24 Recognition, correction or monitoring of errors in digitally coded information by self-checking codes or by check counting (special adaptations see the special classes, e.g. in digital calculators 42m3-5/00; in telegraphy 21a1-7/06; errors in pulse modulation 21a1-36/12; errors in form or phase of pulses 21a1-36/04)

21a1-36/26 Ensuring error-free coding or decoding, e.g. by parity checking (special adaptations see the special classes, e.g. in digital calculators 42m3-5/00; in telegraphy 21a1-7/06)

## Electrical information storage

**21a1-37/00 Methods and devices for storing electrical information for general use, recording or reproducing by electronic means, in general** (memories or stores for special purposes, see special places: telegraphy 21a1-5 ; automatic telegraphy 21a1-6; electrical picture transmission and television 21a1-32; electrical pulse technique 21a1-36; telecommunication, especially telephony 21a3; devices for recording measurements 42d-3; sound recording 42g-10, 42g-18; electrical calculators 42m-14; non-electric memories for calculators 42m-22; punched-card machines etc. 43a-41)

21a1-37/02 . Devices for storing electrical information
21a1-37/04 . . Ferromagnetic stores (ferromagnetic layers, magnetic cores, memory cores, memory core matrices 21g-31/02, 21g-31/03)
21a1-37/06 . . . static
21a1-37/08 . . . dynamic
21a1-37/10 . . . . with drum-shaped information carrier
21a1-37/12 . . . . with ribbon-shaped information carrier
21a1-37/14 . . . . with disc-shaped information carrier
21a1-37/16 . . . . with foil-like information carrier, e.g. sheet- or sleeve-shaped information carrier
21a1-37/18 . . . Structural details
21a1-37/20 . . . . Magnetic heads, including erasing heads
21a1-37/22 . . . . Holders and bearings for magnetic heads
21a1-37/24 . . . . . with gaps
21a1-37/26 . . . . . without gaps
21a1-37/28 . . . . Control of magnetic heads
21a1-37/30 . . . . Magnetic information carriers
21a1-37/32 . . . . . Magnetic drums
21a1-37/34 . . . . . Magnetic ribbons (production of thermoplastic ribbons 39a3)
21a1-37/36 . . . . Holders, guides and bearings for magnetic information carriers (for ribbon-shaped material in general 47k)
21a1-37/38 . . . . Driving devices specially adapted for electrical stores (driving devices for ribbon-shaped material in general 47k)
21a1-37/40 . . Ferroelectric stores (electric condensers with ferroelectric dielectric material 21g-10/05)
21a1-37/42 . . Parametric stores
21a1-37/44 . . Condenser stores (electric condensers 21g-10/02, 21g-10/03, 21g-10/05)
21a1-37/46 . . Tube stores (multiple cathode glow tubes 21g-12/01; construction of charging or store electrodes 21g-13/25; cathode ray tube stores 21g-13/27; pulse counting circuits with discharge tube stores 21a1-36/22)
21a1-37/48 . . . Electron tube stores
21a1-37/50 . . . Gas discharge tube stores
21a1-37/52 . . Semiconductor stores (semiconductor elements, e.g. diodes, transistors etc. 21g-11/02; electrical semiconductor condensers with voltage-dependent capacitance 21g-10/05; pulse counter circuits with semiconductor stores 21a1-36/22)

21a1-37/54 . . . Transistor stores
21a1-37/56 . . Thermoplastic stores (production of thermoplastic ribbons 39a3)
21a1-37/58 . . Delay stores, circulating stores
21a1-37/60 . . Matrix stores, insofar as the construction of the matrix is concerned (ferromagnetic layers, magnetic cores, memory cores, memory core matrices 21g-31/02, 21g-31/03)
21a1-37/62 . . Relay stores (relay counting chains and relay selectors for telecommunications, especially for telephony 21a3-22/01)
21a1-37/64 . . Shift registers, shift register stores (electronic pulse counting chains 21a1-36/22)
21a1-37/66 . . Stores using special physical effects, e.g. spin resonance, superconductivity, polarisation, electroluminescence, Hall effect
21a1-37/68 . . Stores using special chemical effects, e.g. electrolytic stores
21a1-37/80 . Methods for storing electrical information, transmission circuits
21a1-37/82 . . storing
21a1-37/88 . . reading
21a1-37/94 . . re-storing

## 21a2 Telephony; electric acoustical sound recording and reproduction (sound recording and phonographs 42g)

### Microphones, telephones, loudspeakers

21a2-1/01 Electromagnetic acoustical apparatus, general
21a2-1/02 with devices for balancing the attractive force, with balanced armature, four-pole magnet systems, etc.
21a2-1/03 with adjusting devices for the magnet poles and armature
21a2-1/04 with magnetostriction

21a2-2/01 Electrodynamic acoustic apparatus (42g-5/02; 74d-6/05)
21a2-2/02 with special devices for supporting the moving coil

21a2-3 Electrostatic acoustic apparatus (42g-5/02; 74d-6/10)

21a2-4 Electrothermal acoustic apparatus

21a2-5/01 Microphones with variable resistance (42g-5/02)
21a2-5/02 with single electrodes, without carbon-granule filler
21a2-5/03 with several carbon granule chambers
21a2-5/04 with the filling penetrated perpendicularly to the direction of the sound
21a2-5/05 with plastic filler
21a2-5/06 in differential circuit
21a2-5/07 Vibrating microphones
21a2-5/08 Breast microphones
21a2-5/09 Multidirectional microphones
21a2-5/10 Power-current microphones with and without cooling
21a2-5/11 Liquid microphones
21a2-5/12 Fillers for microphones

21a2-6 Compressed-air loudspeakers including flame loudspeakers (42g-4/05; 74d-3/01)
21a2-7 Acoustical apparatus with ionised gas space
21a2-8 Piezoelectric acoustical apparatus (42g-5/02; 74d-6/06)
21a2-9 Microphones with photoelectric cells
21a2-10 Acoustic apparatus with several actuating systems (21a2-16/05)
21a2-11 Diaphragms for acoustic apparatus (42g-3/01; 42g-3/03)
21a2-12/01 Holders for large diaphragms (42g-3/02)
21a2-12/02 Holders for small diaphragms (42g-3/02)
21a2-12/03 Stretching devices for large diaphragms
21a2-12/04 Stretching devices for small diaphragms
21a2-12/05 Closures for microphones and telephones (21a2-19/01; 21a2-24/04)
21a2-13/01 Damping holders for diaphragm edges (42g-3/02)

21a2-13/02 Special diaphragm-damping structures (42g-3/01)
21a2-13/03 Variable diaphragm damping
21a2-14/01 Sound guides, cavity resonators, floors and acoustic walls (42g-6/05; 42g-6/07)
21a2-14/02 Acoustic horns (42g-6/02)
21a2-14/03 Sound-guiding through large diaphragms
21a2-14/04 Multiple sound guides (42g-6/06)
21a2-14/05 Microphone acoustic inlets

**Auxiliary equipment**

21a2-15/01 Speaking tubes, monitoring devices (42g-6/06)
21a2-15/02 Telephone supports
21a2-15/03 Telephone padding
21a2-15/04 Head gear (21a2-23/01)
21a2-15/05 Hoods
21a2-15/06 Antiseptic filters (30i-1 – 30i-6)
21a2-15/07 Antiseptic closures
21a2-15/08 Disinfecting devices on telephones

**Systems and circuits for the transmission of acoustic performances, such as concerts, theatre, lectures, etc.** (21a3-49/10; high frequency 21a4)

21a2-16/01 Microphone and loudspeaker circuits, distribution systems, monitoring microphone circuits (42g-1/03)
21a2-16/02 Loudspeaker systems
21a2-16/03 Stereoacoustic listening
21a2-16/04 Arrangements for high-fidelity reproduction, special selection and arrangement of the loudspeakers
21a2-16/05 Differently tuned recording and reproduction equipment (21a2-10)
21a2-16/06 Remote conducting

**Hearing aids, electrical structure** (medical section 30d-28, 30d-29)

21a2-17/01 Bone-conduction telephones (21a2-19/02)
21a2-17/02 Miniature telephones
21a2-17/03 Microphone-telephone apparatus

**Amplifiers and amplifier circuits**

21a2-18/01 Tube amplifiers for audio frequencies and tube amplifiers, general (tube amplifiers in combination with high-frequency receivers and amplifiers 21a4-29/01)
21a2-18/02 Direct-current and photocell amplifiers (21a1-7/01; 21a1-33/71; 21a1-35/10)
21a2-18/03 Telephone-microphone amplifier
21a2-18/04 Coupling and distortion correction circuits (21a2-36/13; 21a2-41/04; 21a4-74)
21a2-18/05 Feedback circuits (21a4-29/02)
21a2-18/06 Circuits for the suppression of instability (21a2-41/05; 21a4-29/05)
21a2-18/07 Volume control (21a1-33/51; 21a2-36/14; 21a2-41/06; 21a4-29/03; 42g-8/01 – 42g-8/06)
21a2-18/08 Amplifiers and amplifier circuits of various kinds (21a4-27; 42g-1/04)
21a2-18/50 Electric methods for testing electroacoustic sound-recording and reproducing equipment (42g-1/01)
21a2-19/01 Microtelephones of various designs
21a2-19/02 Bone-conduction microtelephones
21a2-19/03 Watertight and divers' microphones
21a2-20/01 Assembly and structure of telephone instruments with the exception of the dials and accessory parts for automatic telephones (21a3-16/40), housings
21a2-20/02 Hooks
21a2-20/03 Automatic switching devices actuated by hand telephones
21a2-20/04 Switching devices actuated by the subscriber, e.g. line selectors (21a3-13)

### Accessories for telephone stations

21a2-23/01 Headphone holders (21a2-15/04)
21a2-23/02 Headphone holders with arms and hinges (21a2-15/02)
21a2-23/03 Arm supports (21a2-15/02)
21a2-23/04 Cord protectors and guides (8d-21/13; 21c-21/03)
21a2-23/05 Cord winders
21a2-23/06 Shelves and tables in connection with telephone apparatus
21a2-23/07 Subscriber directories in connection with telephone apparatus (11e-28)
21a2-23/08 Illumination of telephone apparatus (21a3-16/31)
21a2-23/09 Locking devices (21a3-16/32; 21a3-77; 21a3-80)
21a2-24/01 Prevention of overhearing, special mouthpieces
21a2-24/02 Telephone booths
21a2-24/03 Head enclosures, recesses
21a2-24/04 Closures on the mouthpieces

### Construction and details of manual switchboards

21a2-27/01 Telephone switchboards and accessories, cabinets and switching devices (21a3-26)
21a2-27/02 Jacks, jack strips and plugs
21a2-27/03 Toggle switches
21a2-27/04 Push buttons
21a2-27/05 Switches of special structure
21a2-27/06 Soldering terminal strips
21a2-27/07 Fuses
21a2-29/01 Signalling devices, magnetic coils (21a3-63; 74a-5)
21a2-29/02 Drop indicators and strips
21a2-29/03 Lamps and lamp strips
21a2-29/04 Visual signals
21a2-29/05 Call buzzers (21a3-63/40; 74a-11)
21a2-30 Low-frequency transmitters for general electroacoustic purposes, voice and choke coils for station circuits (21a4-28; 21a4-74; 21c-5/23; 21d2-48; 21d2-49; 21d2-50; 21g-31/01 – 21g-31/03)

### Recording the telephone call and automatic answering

21a2-31/01 Recording the telephone call by means of computers (42p-3)
21a2-31/02 Telegraphs on telephones (74c-1)
21a2-31/03 Ringing signal devices
21a2-31/01 Recording on cylinders, discs
21a2-31/02 Recording on steel tape or wire
21a2-31/03 Automatic answering devices
21a2-31/04 Automatic answering devices with call recording (in combination with picture display apparatus 57a-64, 57a-72; photographic recording of the telephonic sound waves 42g-9)

### Circuits for telephone subscriber stations

21a2-34/01 Microphone and earphone circuits, general
21a2-34/02 Use of different ringing currents
21a2-34/03 Connection of amplifiers, loudspeakers and accessory microphones
21a2-34/04 Protective circuits against line noise and voltage surges
21a2-34/05 Circuits for the prevention of the distinction of individual voices in the telephone, equalising transformers and hybrid sets (for lines 21a2-36/03)

### Circuits for telephone traffic over long lines (telegraphy and television 21a1; telemetering 74b; remote control 21c)

21a2-36/01 Transmission systems, two-wire and four-wire submarine cable connections (21a1-7/01 – 21a1-7/08; 21a1-25/01; 21a1-25/02)

21a2-36/02 Conference circuits, central hybrid systems (21a3-49/01; 21a3-49/10; 21a2-16/01)
21a2-36/03 Balancing transformers and hybrid networks (for subscriber stations 21a2-34/05)
21a2-36/04 Equivalent networks (21a1-7/04; 21a1-25/01; 21a1-25/02; 21g-34)
21a2-36/05 Matching circuits, impedance-transformer networks, repeating coils (21 c-5/11; 21c-5/23)
21a2-36/06 Arrangements for ringing current conversion (call receivers 21a3-57/40; ringing current generators 21a4- 63/30)
21a2-36/07 Switching of amplifiers and the like, according to the direction of the call
21a2-36/10 Fault elimination in telephone circuits and the pertinent measuring methods (21a1-71, 21e-29/10; 21e-30; 21e-32)
21a2-36/11 Cross talk measurement and prevention (21c-4/01)
21a2-36/12 Echo and feedback suppressors (21a1-49 – 21a1-51)
21a2-36/13 Measuring and correction of amplitude (21a2-18/04; 42g-8/01 – 42g-8/06), phase correction (21a1-6/04; 21a1-7/05)
21a2-36/14 Limitation and regulation of amplitude (21a2-18/07; 21a2-41/06; 21a4-11; 21a4-29/03)
21a2-36/15 Suppressing interference (21c-4/10 – 21c-4/14)
21a2-36/20 Phantom circuits on lines (21a1-7/08; 21a1-25/01; 21a1-25/02)
21a2-36/21 Double-band and multiplex telephony on lines (21a4-58)
21a2-36/22 Frequency division (21a2-37/01; 21a2-37/02)
21a2-36/13 Frequency-dependent amplitude measuring, regulation and correction (21a2-18/04; 42g-8/01 – 42g-8/06), phase correction (21a1-6/04; 21a1-7/05)
21a2-36/14 Frequency-independent amplitude measuring and regulation, compounding (21a2-41/06; 21a4-11; 21a4-29/03)
21a2-36/15 Interference-suppressing circuits (21c-4/10 – 21c-4/14)
21a2-36/20 Multiplex utilisation of the lines by means of special connection of the lines, phantom-circuit formation
21a2-36/21 Multiplex utilisation of the lines by means of alternating transmission (21a1-10/05, 21a2-37; 21a4-49)
21a2-36/22 Narrowing and widening of the frequency range
21a2-36/23 Transmission over several channels, variation of the frequency distribution (21a2-37/02)

**Secret-telephony circuits** (21a1-21; 21a4-52)

21a2-37/01 General secret transmission systems
21a2-37/02 Interchanging the frequency bands
21a2-37/03 Periodical transmission shift
21a2-38 Safety circuits for maintaining traffic in the case of line breakdown

**Carrier-frequency line telecommunication** (telegraphy and television 21a1; telemetering 74b; remote control 21c)

21a2-39/10 over telephone lines
21a2-39/20 over power lines, power-station telephony
21a2-39/30 Wire broadcasting (low-frequency distribution equipment 21a2-16/01)
21a2-39/40 Traffic with vehicles, especially with trains, by utilising the lines along the tracks, train telephony (20i-35)
21a2-39/50 along dielectric conductors, e.g. hollow guides

**Telephone amplifiers**

21a2-41/01 General amplifier circuits, two-wire, four wire, one-way and submarine cable amplifiers (21a1-7/01; 21a2-18/01; 21a2-36/01; 21a3-57/01)
21a2-41/02 Terminal amplifiers (21a3-57/01; 21a3-57/10)
21a2-41/03 Matching circuits in the transmitter or the load (21a1-14/01; 21a1-29/06; wave filters 21g-34)
21a2-41/04 Coupling circuits between two tubes and distortion correcting circuits (21a2-18/04; 21a2-36/13; 21a4-74)

21a2-41/05 Circuits for the suppression of instability (21a2-18/06; 21a4-29/051)
21a2-41/06 Volume control (21a1-33/51; 21a2-18/07; 21a2-36/14; 21a4-29/03; 42g-8/01 – 42g-8/06)
21a2-41/07 Amplifier testing and checking circuits (21a4-71)

## 21a3 Telephone exchange systems

### Manual exchange apparatus

21a3-1 with individual call and individual microphone battery
21a3-2 with individual call and central microphone battery
21a3-3 with central call and individual microphone battery
21a3-4 at operator position, local traffic

Auxiliary equipment for operator positions, local traffic

21a3-5/01 for night service
21a3-5/10 Signalling from the subscriber to the exchange and vice versa
21a3-5/20 Miscellaneous
21a3-6 Facilities for linking the positions of a local exchange, service-line communications

Connecting apparatus among several exchanges

21a3-8/01 for call and disconnect signals
21a3-8/10 for signalling, special signals
21a3-8/20 Miscellaneous
21a3-11 Connecting apparatus with group selection by the subscriber connecting apparatus for extension

Connecting apparatus for extension stations with central operator position

21a3-12/01 General arrangements
21a3-12/10 Ring-back arrangements
21a3-12/20 Signalling at the exchange, call relaying

Connecting apparatus for extension stations without central operator position

21a3-13/01 Line selector system (21a2-20/04)
21a3-13/10 Intercommunicating system
21a3-13/20 Parallel switching arrangements
21a3-13/30 Stations of special construction, pre-selector stations, interconnecting stations
21a3-13/40 Ring-back circuits
21a3-13/50 Special circuits, call relaying
21a3-13/60 Structural details of these systems

### Connecting apparatus for automatic or semiautomatic operation

Pulse transmitters in subscribers' instruments

21a3-16/01 Devices for the transmission of pulses, transmitting a pulse train on single actuation of a switch
21a3-16/10 Devices for transmitting pulses set on the selected number, and automatically transmitting all the pulse trains necessary for the call
21a3-16/20 Devices for transmitting pulses which, apart from transmitting the pulse trains necessary for the call, can serve also for the relaying of special signals to the subscriber called
21a3-16/21 Structural details of pulse transmitting devices
21a3-16/30 Accessories for pulse transmitting devices
21a3-16/31 Illumination of pulse transmitting devices (21a2-23/08)
21a3-16/32 Blocking of pulse transmitting devices (21a3-77)
21a3-16/40 Mounting of pulse transmitting devices

Pulse transmitters at the exchange

21a3-17/01 Automatic pulse generators (21a3-63/01)

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|---|---|
| 21a3-17/10 | Rotary switch pulse generators |
| 21a3-17/20 | Relay pulse generators (21a3-63/20) |
| | Selectors with wipers moving in one direction |
| 21a3-20/01 | Stepwise switch drives with circular wiper motion |
| 21a3-20/02 | Stepwise switch drives with linear wiper motion |
| 21a3-20/03 | Structural details of these selectors |
| 21a3-20/04 | Circuit arrangements for the operation of these selectors |
| 21a3-20/10 | Uniform drive and circular wiper setting motion |
| 21a3-20/11 | Uniform drive and linear wiper setting motion |
| 21a3-20/12 | Structural details of these selectors |
| 21a3-20/13 | Circuit arrangements for the operation of these selectors |
| | Selectors with wipers moving in several directions |
| 21a3-21/01 | Stepwise switch drives with linear and circular wiper setting motion |
| 21a3-21/02 | Stepwise switch drives with two linear wiper setting motions |
| 21a3-21/03 | Stepwise switch drives with two circular wiper setting motions |
| 21a3-21/04 | Structural details of these selectors |
| 21a3-21/05 | Connection arrangements for the operation of these selectors |
| 21a3-21/10 | Uniform drives for one linear and one circular wire setting motion |
| 21a3-21/11 | Uniform drives for two linear wiper setting motions |
| 21a3-21/12 | Uniform drives for two circular wiper setting motions |
| 21a3-21/13 | Structural details of these selectors |
| 21a3-21/14 | Circuit arrangements for the operation of these selectors |
| | Selectors with stationary connecting devices |
| 21a3-22/01 | Relay selectors |
| 21a3-22/10 | Coordinate selectors |
| | Selectors of special structure |
| 21a3-23/01 | Pneumatic selectors |
| 21a3-23/10 | Large-group selectors |
| 21a3-23/20 | Miscellaneous selector structures |
| | Assembly of selectors and relays (21a2-27/01) |
| 21a3-26/01 | Cylindrical contact banks for selectors |
| 21a3-26/02 | Flat contact banks |
| 21a3-26/03 | Contact banks of special structure, bare-wire multiple banks |
| 21a3-26/04 | Wiring of contact banks |
| 21a3-26/10 | Selector racks and accessories |
| 21a3-26/20 | Relay racks and accessories |
| | Circuit arrangements for number pulse receivers |
| 21a3-28/01 | Circuit details, testing, calling |
| 21a3-28/02 | Selector signals, full rotation, trap circuits |
| 21a3-28/10 | Group selectors, long-distance group selectors |
| 21a3-28/20 | Long-distance and local line selectors |
| 21a3-28/30 | Multiple line selectors |
| 21a3-28/40 | Line selectors with pulse retransmission |
| 21a3-28/50 | Double-operation selectors |
| 21a3-28/60 | Assignment selectors |
| | Circuit arrangements for free selectors |
| 21a3-29/01 | Preselectors |
| 21a3-29/10 | with common call and cut-off relay |
| 21a3-30/01 | Line finders |

| | |
|---|---|
| 21a3-30/10 | with common call and cut-off relay |
| 21a3-30/20 | with division into main and subgroups |
| 21a3-30/30 | Finder selectors, call distributors, relay chain connections (21a3-59/01) |
| | Circuit arrangements for multiple free selection |
| 21a3-31/01 | in the second preselection stage |
| 21a3-31/10 | in the second line finder stage |
| 21a3-31/20 | after the group-selection stage, mixed and intermediate selectors |
| 21a3-31/30 | after the line selectors, hunting switches |
| | Circuit arrangements for register operation |
| 21a3-32/01 | with direct pulses |
| 21a3-32/10 | with revertive pulses |
| 21a3-32/20 | with translating operation |
| 21a3-32/30 | with number indication (21a3-62/10) |
| 21a3-32/40 | with auxiliary registers |
| 21a3-32/50 | with voice-frequency pulse transmission |
| | Trunk lines and arrangements between exchanges in the same or in different areas |
| 21a3-34/01 | with routing over non-predetermined idle lines |
| 21a3-34/10 | with automatic pulsing for the routing |
| 21a3-34/20 | for two-wire trunk traffic |
| 21a3-34/30 | for two-way trunk lines |
| | Connection of subscribers with different priorities |
| 21a3-36/01 | with special arrangement of the subscriber's apparatus |
| 21a3-36/02 | without special arrangement of the subscriber's apparatus |
| | Connection of local offices to central offices |
| 21a3-37/01 | by release of the first engaged connecting device of the local office |
| 21a3-37/10 | by switching over the first engaged connecting device of the local office and releasing the next busy trunk line |
| 21a3-38 | Connecting devices with separate supervisory and communication paths |
| 21a3-41 | Automatic-to-manual communication traffic |
| 21a3-42 | Manual-to-automatic communication traffic |
| 21a3-45 | Positions in toll central offices |
| | Connecting devices for multiple-use lines (21a1-25) |
| 21a3-46/01 | Simultaneous transmission of several signals over the same line |
| 21a3-46/10 | Time-shifted transmission of several signals over the same line |
| | Connecting devices for high-frequency telephone systems (21a2-39) |
| 21a3-47/01 | Devices for connecting several high-frequency telephone systems |
| 21a3-47/10 | Devices for connecting high and low-frequency telephone systems |
| | Transmission of special calls or signals over telephone lines |
| 21a3-49/01 | Group, conference call transmission (21a2-36/02) |
| 21a3-49/10 | Radio transmission (21a1-55; 21a1-56) |
| 21a3-49/20 | Emergency call transmission (74c-15 – 74c-17) |
| 21a3-49/30 | Person-to-person call transmission (74c-12/21) |
| | Circuit arrangements for subscriber stations centrally linked to connecting lines, group stations (21a3-54/01; 21a3-54/10) |
| 21a3-51/01 | without intercommunication among the subscribers |
| 21a3-51/10 | with intercommunication among the subscribers |

Party lines, selective call

21a3-52/01 with stepwise controlled step-by-step switching devices at each subscriber station
21a3-52/02 with registers and translators
21a3-52/03 with special balancing devices
21a3-52/10 with extensions and consecutive line connecting at the subscriber stations
21a3-52/20 with relay selectors at each subscriber station
21a3-53/01 with selection of the subscriber through different kinds of currents
21a3-53/10 with intercommunication among the subscribers

Automatic branch exchanges [PABX] (21a3-51/10)

21a3-54/01 with operator
21a3-54/10 without operator

Connecting devices for telephone systems with amplifiers (21a2-34/03; 21a2-36/03; 21a2-36/04; 21a2-36/06; 21a2-41/01; 21a2-41/02; 21a2-41/07)

21a3-57/01 Amplifiers attached to subscriber stations and connected by a switching operation of the subscriber 21a2-41/01; 21a2-41/02)
21a3-57/10 Amplifiers attached to terminal or intermediate toll centres, and connected by a switching operation of the operator (21a2-41/01; 21a2-41/02)
21a3-57/20 Amplifiers in automatic connection systems, switched on automatically in dependence of the selected line in automatic connections set up by selectors
21a3-57/30 Selection of balancing devices (21a2-36/03; 21a2-36/04)
21a3-57/40 Ring-through and voice-frequency call circuits (21a2-36/06)

Distribution and grouping

21a3-59/01 Call distribution and call ordering in the exchange (21a3-30/30)
21a3-59/10 Indication of the group data of the caller in the exchange (21a3-36; 21a3-80)
21a3-59/20 Check on the number of the caller, indication of the number of engaged communication lines (21a3-62)
21a3-59/30 Grading, slipping

Telephone relays (21a1-20/01 – 21a1-1/10; 21g-2/01; 21g-2/02; 21g-4/01; 21g-4/02; 21g-4/05)

21a3-61/01 Direct-current relays
21a3-61/10 Alternating-current relays
21a3-61/20 Relays of special construction
21a3-61/30 Elements of relays, coils, armatures, contact springs

Call number display by means of number pulses

21a3-62/01 at the calling station
21a3-62/10 at the exchange (21a3-32/30)
21a3-62/20 at the called station

Auxiliary devices for selector operations

21a3-63/01 Automatic interrupters
21a3-63/10 Pole changers
21a3-63/20 Relay interrupters
21a3-63/30 Automatic ringers and signalling devices
21a3-63/40 Relay buzzer, tube buzzer

Current supply arrangements for telephone systems

21a3-64/01 at the exchange, subscriber-controlled
21a3-64/10 at the exchange, independently of the subscriber (21c-51)
21a3-64/20 at the subscriber's station
21a3-64/30 Extension station supply

Circuit arrangements for traffic supervision

21a3-66/01 Monitoring devices and observation desks
21a3-66/10 Traffic measuring and counting

Circuit arrangements for transmitting number pulses

21a3-67/01 with pulse-type adaptation
21a3-67/10 with pulse-improving devices
21a3-67/20 for alternating-current selection
21a3-67/30 for inductive direct-current selection
21a3-67/40 for voice-frequency selection
21a3-67/50 with rectifiers, glow tubes, tubes

Testing devices and fault indicators

21a3-68/01 Manual testing apparatus, test boards
21a3-68/20 Automatic subscriber line testing devices
21a3-68/30 Automatic devices for testing of connection devices
21a3-68/40 Automatic devices for testing of connection lines
21a3-68/50 Fault signalling in unmanned local offices
21a3-69 Circuit arrangements for automatic subscriber stations

Time-switch devices

21a3-70/01 Call limitation without registering
21a3-70/10 Control of the operation of circuit elements, selectors
21a3-70/20 Control of the operation of telephone relays, delaying, accelerating

Circuit arrangements for registering (42p-3)

21a3-75/01 the number of calls
21a3-75/10 the number and duration of calls, time registering
21a3-75/20 the number of and charges for, connections, zone registering
21a3-75/30 the number, duration of, and charges for, calls, time and zone registering
21a3-75/40 unsuccessful, uncompleted calls (21a3-66/10)
21a3-75/50 with register suppression for charge-free calls and in case of disconnection at toll
21a3-75/60 Central office call register and call timer structures
21a3-76/01 with call registers at the subscriber station, controlled from the exchange
21a3-76/10 with time registering
21a3-76/20 with time and zone registering
21a3-77 Automatic loading devices at subscriber stations without cooperation of the exchange (21a2-23/09; 21a3-16/32)

Prepayment telephones

21a3-80/01 for equal-charge calls
21a3-80/10 for different charge calls
21a3-80/20 Special arrangements for the prevention of charge defrauding
21a3-80/30 Prepayment telephone structures

## 21a4 Signal transmission by means of high-frequency electric oscillations

### Processes and devices for the generation of oscillations

21a4-1/01 Transmitter circuits of general type (20i-35/20)
21a4-1/02 Transmitter circuits with means for the elimination of interference waves (21a4-22)
21a4-2 Spark transmitter circuits (for short waves 21a4-9/01)
21a4-3/01 Spark gaps with stationary electrodes, also for short waves
21a4-3/02 Spark gaps with rotating electrodes
21a4-4 Electric-arc transmitters and circuits

| | |
|---|---|
| 21a4-5 | Transmitter circuits with high-frequency generators (speed control 21c-59; high-frequency generator structures 21d2-1 – 21d2-5; mechanical structure 21d1-45 – 21d1-68) |
| 21a4-6/01 | Stationary frequency converters with transformers (for low frequency 21d2-51) |
| 21a4-6/02 | Stationary frequency converters with tubes |
| 21a4-7 | Oscillation generation by mechanical means |
| 21a4-8/01 | Tube transmitters with any tube type, with self-or separate excitation, with electric and magnetic control, and with one or several tubes (20i-35/20; tube structure 21g-12; 21g-13) |
| 21a4-8/02 | Tube transmitters with constant frequency, in particular electromechanically, also piezoelectrically, controlled transmitters (20i-35/20) |
| 21a4-8/03 | Tube transmitters with special supply energy sources, transmitters supplied from power lines (20i-35/20; 21a4-35) |
| 21a4-9/01 | Short-wave transmitter circuits of all transmitter types (20i-35/20) |
| 21a4-9/02 | Tube-contained short-wave transmitter circuits (short-wave tubes 20i-35/20; 21g-13/17) |
| 21a4-10 | Piezo-elements, manufacture and structure |
| 21a4-11 | Methods for fading compensation at the transmitting end |
| 21a4-13 | Other processes for the generation of oscillations |

### Processes and devices for controlling oscillations in telegraphy and telephony

| | |
|---|---|
| 21a4-14/01 | Modulation types and circuits regardless the type of transmitter: multiphase-generator modulation, frequency and phase modulation, remote modulation, differential modulation, modulation with load equalisation, modulation by means of saturatable reactors, modulation by means of photocells, films and the like, modulation with suppressed carrier wave |
| 21a4-14/02 | Supervision, measuring and regulation of the degree of modulation |
| 21a4-15 | Tube transmitter modulation circuits: grid-voltage, grid-current, plate-circuit-modulation, double-grid tubes and multiple-grid tube modulation, filament circuit modulation (multiple-grid tubes 21g-13/13) |
| 21a4-16/01 | Keying circuits for transmitters without tubes |
| 21a4-16/02 | Keying circuits for all types of tube transmitters |
| 21a4-16/03 | Keys and keying relays for keying circuits |
| 21a4-17 | Sound transmitters |

### Processes and devices for the reception of oscillations

| | |
|---|---|
| 21a4-21 | General receiving circuits (tube receiver circuits 221a4-29) |
| 21a4-22/01 | Interference suppression by means of compensation circuits |
| 21a4-22/02 | Interference suppression by means of wave traps and by piezoelectric means |
| 21a4-22/03 | Interference suppression by means of bridge circuits |
| 21a4-22/04 | Interference suppression by signal repetition and storage |
| 21a4-22/05 | Interference suppression by other means (suppression of the interference at its source 21a4-76) |
| 21a4-22/06 | Fading compensation at the receiving end, e.g. by reception through several aerials (elimination of fading at the transmitting end 21a4-11; by means of volume control regulation 21a4-29/03) |

#### Receivers operating with the aid of auxiliary oscillations

| | |
|---|---|
| 21a4-23 | Sound generation at the reception of undamped oscillations (heterodyne reception 21a4-24/01) |
| 21a4-24/01 | Heterodyne receivers |
| 21a4-24/02 | Superregenerative receivers |
| 21a4-25 | Visual reception |
| 21a4-26 | Circuits and devices for listening in and monitoring (audio-frequency distribution 21a2-16; link connections for multiple connections 21a3-49/10) |

| | |
|---|---|
| 21a4-27 | Relays and special amplifying arrangements (tube amplifiers 21a2-18; 21a2-41; 21a4-29) |
| 21a4-28 | Low-frequency tuning and mechanical resonance |
| | Tube receiver and amplifier circuits (amplifier circuits, general, and for audio frequencies 21a2-18; 21a2-41) |
| 21a4-29/01 | General (electron tubes for the optical indication of the magnitude of voltages and currents 21g-13/60) |
| 21a4-29/02 | with feedback |
| 21a4-29/03 | with volume control (21a1-33/51; 21a2-18/07; 21a2-36/14; 21a2-41/06; 42g-8/01 – 42g-8/06) |
| 21a4-29/04 | with special means for increasing the selectivity |
| 21a4-29/05 | with means for the suppression of free oscillations (means for the prevention of acoustic feedback 21a4-76) |
| 21a4-29/06 | with special means for connecting phonographs, microphones and the like (connection with phonographs 21a4-75; 42g-7/02; 42g-24/02) |
| 21a4-29/07 | with and for multiple-unit tubes (multiple-system tubes 21g-13/14) |
| 21a4-29/50 | for shortwaves (short-wave tubes 21g-13/17) |
| 21a4-32 | Arrangements for the prevention of radiation from receivers |
| | Supply of the voltages necessary for operation, filament plate, grid voltages for amplifiers, receivers and the like, insofar as they do not serve for high-frequency signal transmission (special arrangements in special classes) |
| 21a4-35/01 | from batteries, storage cells, thermoelements and the like |
| 21a4-35/10 | from distribution networks, generators and the like |
| 21a4-35/11 | from direct-current power lines |
| 21a4-35/12 | from alternating-current power lines through rectifiers |
| 21a4-35/13 | Smoothing arrangements |
| 21a4-35/14 | Regulating, maintaining constant, etc. the operating voltages, e.g. by means of discharge tubes, bias cells |
| 21a4-35/15 | Removal of interferences caused by the power circuit itself or penetrating into it from the outside, e.g. balanced circuits |
| 21a4-35/16 | Combination of power-line supply circuits with battery circuits: buffer batteries, charging circuits for filament batteries and the like |
| 21a4-35/17 | Safety devices for power-line supply circuits |
| 21a4-35/18 | Arrangements for matching different voltages and power supplies |
| 21a4-35/30 | Other circuits |
| | **Wave indicators** (tube receivers 21a4-29; tube structures 21g-12, 21g-13) |
| 21a4-36 | Coherers |
| 21a4-37 | Tickers and slide wires |
| 21a4-38 | Contact detectors |
| 21a4-39 | Magnetic detectors |
| 21a4-40 | Electrolytic detectors |
| 21a4-41 | Thermal detectors, e.g. bolometers |
| 21a4-42 | Special detectors |
| | **Special processes and devices for communication between stations** |
| | Directional transmission and reception (direction finding 21a4-48/01; loop antennas 21a4-47) |
| 21a4-46/01 | General arrangements (wireless power transmission 21d2-42) |
| 21a4-46/02 | Reflectors and reflector antennas |
| 21a4-46/03 | Standing wave radiators |
| 21a4-46/04 | Beverage and fishbone antennas |
| 21a4-46/05 | Antennas for cyclic, circularly, or elliptically polarised waves |

21a4-46/06 Feed lines for short-wave antennas, Lecher wires (high-frequency conductors 21a4-73; leads to high antennas 21a4-64/04)

21a4-47 Loop antennas

Direction and location determination by means of high-frequency waves (acoustic direction finding 74d-6/12 – 74d-6/14; by means of heat rays 42c-39/15; by means of light rays 74d-8/01; remote indication 74b-7/01 – 74b-8)

21a4-48/01 Fundamental direction-finding methods

21a4-48/02 Electromechanical structure of direction-finding stations

21a4-48/03 Remote-control and remote-indication apparatus for direction-finding stations

21a4-48/04 Sense finding and improvement of direction-finding sharpness, minimum sharpening, clutter elimination

21a4-48/05 Structure of direction-finding goniometers

21a4-48/06 Methods for preventing bearing taking

Radio beacon apparatus (radio beacons mounted on ships, combined with buoys, when the structure and improvement are substantially modified by location on board; 65a2-70; arrangement and utilisation of radio beacons on airfields and the like 62c-25/08; light beacons 65a2-70; with sound waves 74d-6/12 – 74d-6/16)

21a4-48/11 Transmitting devices for the generation of directional beams for field force comparison, localiser beams

21a4-48/12 Receiving equipment for field strength comparison

21a4-48/13 Auxiliary devices for shifting the transmitter or receiver circuits in field strength comparison

21a4-48/14 Other guidance systems operating with directional transmitters or receivers

21a4-48/15 Rotating or oscillating radio beacons

21a4-48/16 Receivers for radio beacons, including field strength comparison

Elimination of erroneous indications from direction-finding systems, direction-finding correction

21a4-48/21 with electrical means

21a4-48/22 with mechanical means

21a4-48/23 Direction-finding, transmitting and receiving equipment for the suppression of undesired polarised waves, pulse direction finding, Adcock apparatus (pulse generation for electric power 21d3-3/01 – 21d3-3/03)

21a4-48/31 Mechanically or electrically rotated direction finders with direct, e. g. optical, or recording indication

21a4-48/32 Direction finders with automatic adjustment of the directional system in the direction-finding direction

21a4-48/33 Direction finders with automatic indication of location on maps (devices for picking up the time variations of electrical magnitudes 21e-11)

Transmitting and receiving arrangements for locating and guiding of vehicles in a plane and in space by means of high-frequency waves, when the invention relates to the field of high-frequency engineering (guiding of ships, when the arrangement and application are determined by navigational considerations 65c-70; arrangement and application of such equipment for guiding aircrafts 62c-25/08)

21a4-48/41 through field-strength measurement or comparison

21a4-48/42 by means of guide cables

21a4-48/43 by means of interference fields

21a4-48/44 by other methods,

Transmitting and receiving equipment, when the invention relates to the high-frequency field (devices for the evaluation of transmitted control pulses, see

special classes 62c-29, 65d-3, 65f2-18, 72f; guarding enclosed spaces against robbery and burglary 74a-21/12; remote radio control, general 21c-47/52)

21a4-48/51 for the prevention of collisions of vehicles
21a4-48/52 for guiding groups of vehicles
21a4-48/53 for street traffic supervision
21a4-48/54 for overtaking traffic
21a4-48/55 for vehicles remotely or automatically controlled by means of high-frequency waves

Transmitting and receiving equipment for high-frequency waves and pulses (measuring devices for distance above ground 42c-40/01, 42c-40/05; barometric altimeters 42k-8 – 42k-14; balloon theodolites 42c-5/01, vertical angle-measuring devices with aiming line 42c-6/01; location by means of heat rays 42c-39/15; distance-measuring devices, general 42c-14 – 42c-23; acoustic direction and distance determination 74d-6/12 – 74d-6/15; detection of objects underground or under water 21g-30/01 – 21g-30/10; pulse generation for power current 21d3-3/01 – 21d3-3/03)

21a4-48/61 for altitude and distance measurement by reflected beam principle
21a4-48/62 for altitude and distance measurement by other methods
21a4-48/63 for reflected-beam direction finding, also in combination with range or velocity measurement and detection of objects above ground or above water

21a4-49 Multiplex traffic
21a4-50/01 Duplex traffic over the same wave
21a4-50/02 Duplex traffic over different waves
21a4-51 Simple traffic
21a4-52 Secret traffic
21a4-53 Jamming of telecommunications
21a4-54 Improvement of telecommunications
21a4-55 Repeaters and shared-channel broadcasting (connecting arrangements between radio station and line connection 21a3-8; for multiple-line connections 21a3-49)
21a4-56 Central stations (connecting arrangements between radio station and line connection 21a3-8; for multiple-line connections 21a3-49)
21a4-57 Calling devices
21a4-58 High-frequency transmission over lines other than power lines (21a3-46; 21a3-47)
21a4-59 High-frequency transmission over power lines (21a1-23)
21a4-60 Special methods of telecommunication

**Auxiliary high-frequency telecommunication equipment**

High antennas and their mounting, masts

21a4-64/01 General type
21a4-64/02 Masts and buildings as antenna supports (masts, structural design 21c-12; 37b-3; 37f-4)
21a4-64/03 High-antenna fastening (insulators 21c-13)
21a4-64/04 High-antenna leads (tuned 21a4-16/06; high-frequency conductors 21a4-73, 21c-5/03)
21a4-64/05 High-antenna coupling and decoupling (21a4-21; 21a4-22; 21a4-29)
21a4-65 Grounding and counterpoises

Special antennas

21a4-66/01 General type and auxiliary aerials
21a4-66/02 Ground antennas, non-directional (grounding 21a4-65; beverage antennas 21a4-46/04)
21a4-66/03 Interwoven antennas (interwoven loop antennas 21a4-47)
21a4-66/04 Helical and coil antennas, antennas with increased output capacitance (coils 21a4-68; loop antennas 21a4-47)

| | |
|---|---|
| 21a4-66/05 | Antennas for vehicles, ships and aircraft (aircraft direction finding 21a4-48/02; antenna reels for aircrafts 62c-15/01; ground exploration 21g -30) |
| 21a4-68 | Self-inductance coils for high frequency, variometers (coils, in general, and manufacture of coils 21g-1) |
| 21a4-69 | Combined tuning devices |
| 21a4-70 | Rough and fine adjusting devices for tuning and control devices (directly connected to capacitors 21g-10; precision mechanics adjusting devices 47i-2) and reading devices (reading devices in the form of adjustable tables 42n-13/03; precision mechanics indicating and reading devices 47i-6; electron tubes for the optical display of the magnitude of voltages or currents 21g-13/60) |
| 21a4-71 | Measuring and testing arrangements (high-frequency signal generators 21a4-8; supervision of the modulation degree in transmitters 21a4-14/02;testing instruments for tubes 21g-13/50; electron tubes for the display of the magnitude of voltages and currents 21g-13/60) |
| | Switches for radio apparatus |
| 21a4-72/01 | of general construction (switches 21c-22, 21c-28/01 – 21c-42) |
| 21a4-72/02 | Drum switches, multiple switches, wave band switches |
| 21a4-72/03 | Feed current switches, transmitting and receiving switches (for sets operating on power lines 21a4-35) |
| 21a4-72/04 | Antenna-ground switches |
| 21a4-72/05 | Remote switches, relay switches, time switches (21c, 43) |
| 21a4-73 | High-frequency conductors (feed lines for short-wave antennas 21a4-46/06; high-antenna leads 21a4-64/04) |
| 21a4-74 | Coupling devices, transformers for high frequency (low-frequency transmitters for acoustic purposes 21a2-30) |
| 21a4-75 | Mechanical structure of radio sets and combination with phonographs (42g-24/02) |
| 21a4-76 | Safety and protecting devices, interference suppressors at the interference source, prevention of acoustic feedback (arrangements in sets, when the structure is modified thereby, cf. special classes) |
| 21a4-77 | Special accessories, e.g. filament and grid-lead resistors for tubes and other accessory equipment |

## 21b Primary and secondary batteries, thermoelements

### Primary and secondary cells, general

| | |
|---|---|
| 21b-1/01 | Containers, closures and covers |
| 21b-1/02 | Carrying devices, shock absorbers |
| 21b-1/03 | Degassing devices |
| | Diaphragms and insulating devices for primary and secondary cells (diaphragms for electrolytic purposes 12h-3) |
| 21b-2/01 | Shape and construction |
| 21b-2/02 | Use and processing of various materials |
| | Electrode connections (connections of electric conductors 21c-20 – 21c-22) |
| 21b-3/01 | for primary cells, carbon caps and contact lugs |
| 21b-3/02 | for secondary cells |
| 21b-3/03 | Corrosion protection |
| 21b-4/01 | Filling and emptying devices for primary and secondary cells |
| 21b-4/02 | Circulation devices for primary and secondary cells |
| | Non-liquid electrolytes for primary and secondary cells |
| 21b-5/01 | Absorbents |
| 21b-5/02 | Concentrating materials |

**Primary cells, in particular**

21b-6/01 Activating and depolarising liquids
21b-6/02 Solid depolarisers

Electrodes for primary cells (electrodes for electrolysis 12h-2; 40c-3; 40c-4; 40c-1/02)

21b-7/01 Carbon electrodes with or without covering, metal electrodes
21b-7/02 Machines for the manufacture of carbon rods, presses and capping machines, machines for covering carbon rods
21b-7/03 Machines for the manufacture of metal electrodes, soldering and welding machines (soldering and welding machines in general 21h-29 – 21h-31, 49h-32 – 49h-35)
21b-8 Primary cells with one electrolytic liquid
21b-9 Primary cells with two electrolytic liquids

Dry cells and voltaic cells

21b-10/01 General structure
21b-10/02 Storage dry cells
21b-10/03 Plate-, band- or disk-shaped elements with bipolar plates and elements with interchangeable components
21b-11 Galvanic tilting and immersion cells
21b-12/01 Batteries immersed in liquid elements
21b-12/02 Batteries and flashlight batteries
21b-12/03 Batteries with easily interchangeable cells

Special processes and devices for depolarisation and for operation of primary cells

21b-13/01 Heating and movement of electrodes; brushes for cleaning; regeneration and processing of waste from used cells
21b-13/02 Water and earth cells
21b-14/01 Fuel cells
21b-14/02 Gas cells

**Secondary cells, in particular**

21b-15/01 Processes and devices for pasting electrode plates
21b-15/02 Processes and devices for casting electrode plates
21b-15/03 Processes and devices for rolling and pressing of electrode plates
21b-15/04 Processes and devices for separating, roughening and cutting of electrode plates
21b-16 Forming processes and machines
21b-17 Mixing of materials and carrier materials
21b-18 Grid and frame plates
21b-19 Core plates
21b-20 Grids made of wire, strips, fabric, etc.
21b-21/01 Pocket and button type grids
21b-21/02 Plate grids with pockets and buttons as envelopes
21b-22 Grids made of non-flat solid bodies

21b-23/01 General structure of lead cells
21b-23/02 Suspension and supporting of electrodes
21b-23/03 Electrolytes
21b-24/01 General structure of semi-lead cells
21b-24/02 Electrolytes
21b-25/01 General structure of non-lead cells
21b-25/02 Zinc cells
21b-25/03 Nickel, iron, cobalt and cadmium cells
21b-25/04 Electrolytes

Special processes for operation of primary batteries

21b-26/01 Processes and devices for cleaning

21b-26/02 Charging and charging devices (charging of primary cells in general 21c-48 – 21c-51)

21b-26/03 Checking of level and concentration of the electrolyte; devices and processes for testing batteries (measuring instruments 21e-6/01)

**Thermoelectric couples and piles**

21b-27/01 General structure

21b-27/02 Heating devices, also electric

21b-27/03 Materials for electrodes (heat-measuring devices, general 42i-8)

**Thermoelectric energy converters**

**21b-27/00 Thermo-elements and thermo-piles, the function of which depends on Seebeck or Peltier effects** (measuring heat in general 42i-8)

21b-27/02 . General construction and manufacture

21b-27/04 . Heating devices, means for heat transfer

21b-27/06 . Materials

**Thermo-electronic energy converters**

21b-29/00 Thermo-ionic converters

21b-31/00 Thermo-electronic converters based on glow emission of electrons without ionisation

21b-33/00 Thermo-electronic converters, the function of which depends on temperature-dependent dielectricity constant or magnetic permeability

## 21c Electric lines and equipment: cables and overhead lines, insulators, switches, regulators, switching methods, line protection, safety devices and lightning protection

**Electric lines and their installation**

Electric conductors (resistors 21c-54/01 – 21c-56; heating conductors 21h-1; cables, etc. 21c-3; high-frequency conductors 21a4-73)

21c-1/01 Materials for conductors (alloy composition 18d, 40b; refining 18c, 40d)

21c-1/02 Single conductors

21c-1/03 Solid rope cables (ropes, general 73)

21c-1/04 Hollow cables

21c-1/05 Overhead lines of special structure, e.g. with means for producing or preventing corona discharge

Electrically insulating materials

21c-2/01 Brick, glass, ceramic materials

21c-2/02 Mica products

21c-2/03 Asbestos, cement, metallic oxides and other inorganic products

21c-2/10 Natural resins, waxes and drying oils

21c-2/11 Rubber, gutta-percha, balata, both natural and synthetic

21c-2/12 Hydrocarbons, bitumen, insulating oils

21c-2/13 Cellulose derivatives

21c-2/14 Products of condensation and polymerisation, synthetic resins

21c-2/15 Other organic substances, except fibres

21c-2/20 Wood, paper, pressboard, except solid paper

21c-2/21 Solid paper and indurated fabrics, and their manufacturing

21c-2/22 Other organic fibres and fabrics, e.g. varnished cambric, insulating tapes

21c-2/30 Manufacture of insulating materials and bodies

21c-2/31 Drying and impregnation of insulating materials and bodies

21c-2/32 Surface treatment of insulating materials, protective coatings

| | |
|---|---|
| 21c-2/33 | Manufacture of insulating coatings on conducting materials (for lines 21c-3/01, 21c-7/01; for capacitors 21g-10/1, 21g-10/02; for resistors 21c-54/01) |
| 21c-2/34 | Insulating materials and bodies with conductive adjuncts, e.g. layers (for capacitor bushings 21c-10/04; for capacitors 21g-10/01, 21g-10/02; for resistors 21c-54/05, 21c-55/01; for electric heaters 21h-2/01 – 21h-2/03) |
| 21c-2/35 | Cements for insulating bodies |
| | Mechanical structure of insulated electric lines and cables (insulating and sheathing 21c-7; overhead lines 21c-13) |
| 21c-3/01 | Mechanical structure of insulated electric lines and cables |
| 21c-3/02 | Mechanical structure of flexible electric lines and cords |
| 21c-3/03 | Structure of conductors in power cables arranged to avoid skin effect and great potential variations |
| 21c-3/04 | Cable-stranding machines for power cables (for ropes, general 73) |
| 21c-3/05 | Concentric and capacitor cables |
| 21c-3/06 | Cables with radiation protection |
| 21c-3/07 | Rigid tubular cables |
| 21c-3/08 | Flat and ribbon-type cables |
| 21c-3/09 | Contact cables |
| 21c-3/10 | Expansion cables |
| 21c-3/11 | Cables with devices for heat dissipation |
| 21c-3/12 | Cables provided with devices for detecting and signalling faults and wire failure (fault location 21e-29/10) |
| 21c-3/13 | Cables, conductors and cords for special purposes |
| 21c-3/14 | Identification and length markings (for telephone lines 21c-4) |
| | Arrangements for attenuating mutual inductance and mutual capacitance effects of electric lines |
| 21c-4/01 | Reduction of crosstalk in telephone cables by capacitive or inductive balancing of circuits along the line, i.e. during manufacturing the conductor groups or the cable, or during or after cable laying; twisting, crossing and stranding processes as well as devices for intermediate tests (devices mounted at stations for balancing of crosstalk and measurements 21a2-36/11) |
| 21c-4/02 | Machines for the manufacture of cables according to 21c-4/01 |
| 21c-4/03 | Capacitive balancing by means of additional capacitors, inductive balancing by means of additional loops (balancing of Pupin coils 21c-5/23; capacitors, general 21g-10/02) |
| 21c-4/04 | Electrostatic and electromagnetic shielding of telecommunication circuits by means of metal sheaths |
| 21c-4/05 | Systems to prevent crosstalk caused by differences in paper coloration and conductor marking |
| | Protection of telecommunication lines against influences of electric and magnetic fields of high-voltage lines |
| 21c-4/10 | by special design of the lead sheath, or sheathing of messenger cables in case of overhead lines |
| 21c-4/11 | by installation of a special protection line or special protection sheaths on telecommunication conductors |
| 21c-4/12 | by balancing the ground capacitance or by means of compensation or amplification circuit (amplifiers 21a2-36/15) |
| 21c-4/13 | by means of arrangements in high-voltage circuits, e.g. additional circuit elements: choke coils, resonance circuits, wave filters |
| 21c-4/14 | Devices for measuring the interference factor of a high-voltage line, i.e. for determining the probable effect of interference |
| 21c-4/15 | Prevention of mutual influence of high-voltage lines by balancing capacitive and inductive asymmetries |

| | |
|---|---|
| 21c-4/16 | Reduction of dangerous voltages or losses in the lead sheath and in the shields of high-voltage cables |
| 21c-4/20 | Prevention of corrosion in lines, caused by induced currents (stray AC 21c-19/09; cathodic protection in general 48d1-13/00) |

## Electric lines and cables of special design or structure for the production of specific and capacitance values

| | |
|---|---|
| 21c-5/01 | Air ducts for telecommunication cables |
| 21c-5/02 | Devices for the manufacture of air ducts (21c-7/02) |
| 21c-5/03 | Hollow conductors with air insulation for high-voltage and high-frequency purposes (the latter 21a4-46/06; 21a4-64/04; 21a4-73) |
| 21c-5/10 | Systems for producing specific capacitance values in telecommunication lines |
| 21c-5/11 | Matching of impedance or characteristic impedance |
| 21c-5/13 | Elimination of transient phenomena in telephone lines by suitably adjusting coil [Pupin] (loading stations 21a2-36/13) |
| 21c-5/20 | Continuously loaded [Krarup] conductors |
| 21c-5/21 | Machines and processes for the manufacture of continuously loaded [Krarup] conductors, special annealing processes (heat treatment of ferromagnetic materials 18c, 40b, 40d; iron alloys 18b, 40b; magnetic materials, general 21g-31/02, 21g-31/03) |
| 21c-5/22 | Loaded [Pupin] conductors, general (repeating-coil 21a2-36/05) |
| 21c-5/23 | Pupin coils: structure, windings, circuitry, core shapes, core materials (balancing of coils 21c-4/03; induction coils, general, for telecommunication systems 21a2-30; dust cores 21g-31/03) |
| 21c-5/24 | Loading [pupinisation], in simultaneous low-frequency and carrier-frequency operations |
| 21c-5/25 | Coil cases and cable joints |
| 21c-5/26 | Loaded [Pupin] submarine cables |
| 21c-5/27 | Coil coupling sleeves for submarine cables (cable sleeves, general 21c-23/07) |
| 21c-5/28 | Telecommunication lines with mixed, Krarup and Pupin loading |
| 21c-5/40 | Systems in lines for reduction or increase of impedance and for attenuation of travelling waves in power distribution lines |
| 21c-5/50 | Compensation for loading current of high-voltage lines, particularly of cables, by inductive leading, half-wave lines (21d2-42/03) |
| 21c-6 | Damping of mechanical oscillations and sound damping in tensioned lines and poles (for tracks 19a-23, 19a-25/00; 20a-12) |

## Insulation and sheathing of electric lines and cables

| | |
|---|---|
| 21c-7/01 | Insulation of electric lines according to insulating material |
| 21c-7/02 | Processes for application of insulation (ribbon and thread spinning devices 25c-1/01, 25c-1/05, 25c-1/10) |
| 21c-7/03 | Insulating machines |
| 21c-7/04 | Machines and processes for insulation stripping |
| 21c-7/05 | Tools for insulating, insulation stripping, bending and cutting (21c-18/02; 21c-20; 21c-23/03) |
| 21c-7/06 | Processes and devices for drying and impregnating |
| 21c-7/07 | Special devices in presses for the manufacture of electric lines (lead sheathing presses 7b-11/01, 7b-11/20, 7b-11/80) |
| 21c-7/50 | Sheathing of electric lines and cables |
| 21c-7/51 | Pressure protection |
| 21c-7/52 | Cables filled with impregnating substances; cables with ducts for impregnating materials; equalisation of impregnating material pressure within the cable (in accessories 21c, 23) |
| 21c-7/53 | Conduit wires and lead sheath lines |
| 21c-7/54 | Mechanical protective devices for individual parts of lines and cords |

| | |
|---|---|
| 21c-8/01 | Laying of overhead lines and accessories therefor, tensioning devices |
| 21c-8/02 | Devices for emergency current tapping from overhead lines and short-circuit rods (perforating point contacts 21c-22) |
| 21c-8/03 | Removal of ice and snow from overhead electric lines |
| 21c-9 | Prevention of breakdowns and accidents due to wire failure (for contact lines of electric railroads 20k-11; electromagnetic safety devices 21c-71) |
| | Lead-in and lead-through arrangements for electric lines |
| 21c-10/01 | Wall lead-through arrangements for low-voltage lines |
| 21c-10/02 | Lead-in insulators for low-voltage lines |
| 21c-10/03 | Lead-through arrangements for high-voltage lines |
| 21c-10/04 | Capacitor bushings (capacitors 21g-10/02) |
| 21c-10/05 | Seals |
| 21c-11/01 | Ground (voltage surge dissipators 21c-72) |
| 21c-11/02 | Ground wires and busses (protection from extreme voltages 21c-72) |
| 21c-11/03 | Lightning arresters on buildings, and their fastening; counting and indicating devices for lightning |
| 21c-12 | Poles and towers for electric lines, electric features only (structure of towers 37b-3; suspension of high antennas 21a4-64) |
| | Suspension of overhead lines and aerial cables (suspension of trolley contact wires 20k-9) |
| 21c-13/01 | Cap-and-pin suspension insulators |
| 21c-13/02 | Link-type insulators |
| 21c-13/03 | Pin insulators |
| 21c-13/04 | Composite insulators |
| 21c-13/05 | Clevis-type insulators |
| 21c-13/06 | Oil insulators |
| 21c-13/07 | Other designs of insulators |
| 21c-13/10 | Fittings and fastening thereof to suspension insulators by cementing |
| 21c-13/11 | Cement-less fastening of fittings to suspension insulators |
| 21c-13/12 | Control of voltage distribution in individual insulators and suspension chains |
| 21c-13/13 | Special structure of suspension chains, including multiple chains |
| 21c-13/20 | Suspension of lines and aerial cables from messenger cables, suspension hooks |
| | Support insulators for electric lines |
| 21c-14/01 | Overhead support insulators for telecommunication lines |
| 21c-14/02 | Overhead support insulators for high-voltage lines |
| 21c-14/03 | Overhead support insulators of special design, e.g. oil insulators |
| 21c-14/04 | Indoor support insulators |
| 21c-14/05 | Support insulators for particularly heavy lines and bus bars (for electric railroads 20k-8) |
| 21c-14/06 | Bonding of insulator fragments |
| 21c-14/10 | Fittings and their fastening to support insulators by cementing |
| 21c-14/11 | Cementless fastening of fittings to support insulators |
| 21c-14/12 | Control of voltage distribution on support insulators |
| | Protection and fastening of insulators mounted on poles |
| 21c-15/01 | Surface treatment of insulators |
| 21c-15/02 | Protection against electric-arc discharges |
| 21c-15/03 | Devices for protection against other disturbances, e.g. heating and cleaning devices |
| 21c-15/04 | Fastening of insulators to towers, also by using additional insulators (for electric railroads 20k-9) |
| 21c-16 | Fastening of overhead lines to insulators, particularly to support insulators |

| | |
|---|---|
| 21c-17 | Fastening of electric lines and conduits to walls, especially by clamps, plugs and reel insulators (well dowels, general 37b-5/04; tubular clamps, general 47f-2/02) |
| 21c-18/01 | Insulating tubes, insulating conduits and rods for fishing of conductors through conduits; structure, manufacture and connection |
| 21c-18/02 | Tools for processing insulating conduits, particularly bending pliers (pliers, general 49h-19) |
| | Laying of underground lines |
| 21c-19/01 | Cable coverings |
| 21c-19/02 | Cable ducts (conduits, general 85e) |
| 21c-19/03 | Manholes and cable vaults |
| 21c-19/04 | Metal coverings and conduits |
| 21c-19/05 | Fastening of cables in ducts and vaults |
| 21c-19/06 | Cable drums, cable reels, take-up reels, general (for electric irons 8d-21/13, for telephones 21a2-23/05; for illumination 21f-59) |
| 21c-19/07 | Cable-laying machines, trench diggers, ploughs, cable transport trucks with booms (transport vehicles for cable drums also 63a-36; as rail vehicles 20c; excavators, general 84d; ploughs, general 45a) |
| 21c-19/08 | Draw-in devices for cables in cable ducts |
| 21c-19/09 | Ground-current protection devices on cables (inductive protection 21c-4) |
| 21c-19/10 | Laying of underwater cables; equipment for cable-laying vessels |
| | **Connections for electric lines** (joints in precision mechanics, general 47i-4) |
| 21c-20 | Permanent connections for electric lines, sleeves, twisted, soldered and terminal connections including spliced joints for cables (sleeves 21c-23) |
| 21c-21/01 | Detachable cable connections, clamps including switchboard clamps (line couplings for electric railroad cars 20l-26) |
| 21c-21/02 | Supporting and tensioning clamps for overhead electric lines |
| 21c-21/03 | Pivoted and rotatable cable joints |
| 21c-22 | Plug contacts, bayonet, mating and screw -type contacts, suspension contacts |
| | Cable accessories |
| 21c-23/01 | Cable shoes (for spark plugs 46c3-35) |
| 21c-23/02 | Cable connections, stuffing boxes, fastening of armouring wires |
| 21c-23/03 | Taped or wrapped connections |
| 21c-23/04 | Filling and filling devices |
| 21c-23/05 | Cable terminals, general, tower cable terminals, expanding (cable) heads |
| 21c-23/06 | Terminal distributors, distribution boxes and cabinets, terminal boards therefor |
| 21c-23/07 | Cable sleeves, general, sleeve housings for land and submarine cables |
| 21c-23/08 | Cable sleeves, special designs, and as insulating sleeves, expansion sleeves, etc. |
| 21c-23/09 | Junction boxes |
| 21c-23/10 | Accessories with radiation protection, capacitor protection, shielding |
| 21c-23/11 | Accessories for oil-filled cables, expansion vessels, closing sleeves, auxiliary pipes |
| 21c-23/12 | Cable accessories, special structures, accessories with transformers, testing and protecting devices |
| 21c-24/01 | Casings for electrical apparatus, general, house transfer boxes |
| 21c-24/02 | Cable and conduit connection to casings |
| 21c-24/03 | Concealed sockets, flush mounting thereof, and spacers for fastening of apparatus or devices in concealed sockets |
| 21c-25/01 | Junction boxes, distribution panels, ceiling rosettes for electric lines |
| 21c-25/02 | Holders for electric apparatus, general |
| 21c-25/03 | Covers and caps for casings of electric apparatus |
| 21c-25/04 | Fastening of electric apparatus to walls |
| 21c-26 | Plug contacts with switches, plug switches |
| 21c-27/01 | Switchboards, frames, desks, as well as distribution, safety, and electric meter boards |

21c-27/02 Connection strips, clamping systems, also for testing and measuring purposes, general
21c-27/03 Structural arrangement of electric systems in switchgear including overhead line systems
21c-27/04 Enclosed distribution systems, switchboxes (enclosed high-voltage switchgear 21c-40/08)
21c-27/05 Electronic circuit boards (manufacture of printed conducting boards 21c-2/34; apparatus special to radio technique 21a4-75)

**Electric connection and regulation** (47i-1; 47i-2; 47i-4; 47i-5)

Switching on and connection and disconnection

21c-28/01 Lever switches
21c-28/02 Toggle switches
21c-28/03 Disconnecting switches
21c-29 Rotary switches
21c-30 Push-button switches
21c-31 Pull switches
21c-32 Slide switches (toggle switches with slide 21c-28/02; sliding disconnecting switches 21c-28/03; switches with sliding pushbuttons 21c-30; plug switches 21c-22; telephone plugs 21a2-27/02)
21c-33/01 Mercury switches without displacement block
21c-33/02 Mercury switches with displacement block (mercury circuit breakers 21c-45/03; mercury relays 21g-4/05)
21c-34 Humidity-proof switches

Switches with contact interruption and electric-arc extinction in gas

21c-35/01 by means of an insulating element interposable between the contacts
21c-35/02 on secondary contacts and arcing horns, by multiple interruption, as well as by means of series resistors
21c-35/03 by means of counter electromotive force
21c-35/05 by electromagnetic blowout
21c-35/06 in electric-arc chambers, de-ionising devices
21c-35/07 Special devices or processes
21c-35/08 Gas and vapour discharge tubes (discharge tubes 21g-12 – 21g-14)
21c-35/09 Vacuum switches
21c-35/10 Pressure fluid flow

Switches with contact interruption and electric-arc extinction in liquids

21c-36/01 with insulating switch liquid, particularly oil switches (insulating oils, general, 21c-2/12)
21c-36/02 with semiconductor liquids, liquid-resistance switches, electrolytic switches
21c-36/03 by sudden pressure release (expansion) of the vapour formed by the arc
21c-36/04 Switch liquids for electric switches

21c-37 Door switches
21c-38 Stage (theatre) switches
21c-39/01 Single-handle multiple switches permitting simultaneous or sequential closing of several circuits, such as step switches, multiple switches, double throw switches, cross-connection switches
21c-39/02 Multiple switches with several separately operated contacts
21c-39/03 Contact drums (21c-61/01)
21c-39/04 Multiple cam contacts

Special electric switches not intended for special purposes (for high-frequency signal transmission 21a4-72/01; for elevators 35a-25/03; ignition switches for internal combustion engines 46c3-18, 46c3-19, switches for electric light advertising 54h-2/04; for illumination systems of motor vehicles 63c-64; plug-in

switches 21c-26; switches built in sockets of electric incandescent lamps 21f-46)

21c-40/01 Oscillating switches, falling-weight switches, switches with rolling bodies, vibration-responsive switches (for burglar and thief alarm 74a-23), load-pressure actuated switches (for burglar and thief alarm 74a-25), switches actuated by changes in position of the switch body, magnetic induction switches

21c-40/02 Float switches (for remote indication of water level 74b-1; as automatic regulator for electric motors 21c-59/33

21c-40/03 Centrifugal switches (as automatic regulators for electric motors 21c-45/09; for remote indication of speed variations 74b-6; as speed-measuring devices with electric contacts 42o-11)

21c-40/04 Switches actuated by pressure, vacuum, flow (as remote-control switches 21c-45/09; as pressure-measuring devices 42k-12/08; for remote indication of pressure fluctuations 74b-2; as automatic regulators for electric motors 21c-59/32; as ignition devices for internal combustion engines 46c3-17/02)

21c-40/05 Thermal switches (as time switches 21c-44; as remote-control switches 21c-45/10; as safety devices 21c-69; as regulators for cooking and heating appliances 21h-13/01 – 21h-13/17; as relays 21g-4/04; as regulators, general 42q)

21c-40/06 Switches in special enclosures, firedamp-proof switches

21c-40/07 Switches with illuminating devices (4b-17)

21c-40/08 Enclosed high-voltage switchgears (21c-27/04)

21c-40/50 Elements for electric switches, general, such as springs, handles, cam disks, indicating devices, drives, drives for power accumulators, linkages and flywheels (electromagnetic and mechanical remote-control for electric switches 21c-45/03, 21c-45/08)

21c-40/51 Pressure-fluid drives for electric switches (as remote control 21c-45/09; general 47h-18, 47h-22)

21c-40/52 Contacts for electric switches (electric contacts, general 21g-32)

21c-41/01 Locking devices for electric switches

21c-41/02 Secret switches with number or letter combinations (as anti-theft devices for motor vehicles 63c-71)

Emergency and equivalent circuits

21c-42/01 Emergency illumination switches and circuits (illumination of rail vehicles 21c-52)

21c-42/02 Switching devices for shifting a load from one current supply source to another in case of failure

21c-42/03 Circuitry of switching systems, e.g. to reduce the number of switches

21c-43 Clock-controlled electric switches, time switches

21c-44 Time switches independent of clock time, with or without driving mechanism

Electric switches and circuit arrangements remotely controlled by an operator

21c-45/01 Remote connection or interruption by current impulse

21c-45/02 Remote control dependent on current direction

21c-45/03 Electromagnetic circuit breakers remotely controlled by holding current (21a1-20/01 – 21a1-20/03; 21a3-61/01 – 21a3-61/30; 21c-58/01 – 21c-58/60; 21c-68/01; 21g-4/01 – 21g-4/05)

21c-45/04 All types of remote-control system and release by power current, structure of remote-control device only (21c-68/01)

21c-45/05 Remote connection or disconnection controlled by variation in line or control voltage, remotely controlled line switches

21c-45/06 Remote connection or disconnection by resonance effect (21a1-9/03; 21a3-61/10; 21e-17/07; 21g-4/02; 21g-4/03; 74b-8/02; 74c-8/10; 83b-2/01)

21c-45/07 with step-by-step remote connection or disconnection (20l-23/05; 21c-48; 21c-49; 21c-59/03; 21d2-53/03; 74c-2)

21c-45/08 Remote connection or disconnection by electric motor (21c-40/50; 21c-53/03; 21c-62/20)

21c-45/09 Remote connection or disconnection by compressed gas or by variation of gas pressure (20l-25; 21c-40/51; 21c-61/05; 74c-11)

21c-45/10 Remote connection or disconnection by thermal effects, twilight switches (21g-4/04 – 21g-4/06)

21c-45/50 Electric indicating devices and circuit arrangements for reporting the position of remotely controlled electric switches to the operator, except for automatic substations (21c-47/01 – 21c-47/03; 74b-12; 74c-13/40)

Electric positive controls with independent remote actuation of any element by the operator (72f-15/06 – 72f-15/08; 74b; 74c)

21c-46/01 with electromagnetic drive (74c-3; 74c-4)

21c-46/02 with electric motor rotating-field drive (74c-7; 74c-8/01)

21c-46/03 with advance and follow-up contacts (47h-20; 74c-9)

21c-46/04 with line selection

21c-46/05 with voltage and current compensation, bridge and differential field controls (74c-5; 74c-6)

Automatically acting electric controls for any controlled variables and for general purposes (controls used for special technological purposes, see special classes)

21c-46/31 in dependence on any physical magnitudes, except time

21c-46/32 in dependence on time

21c-46/33 in dependence on a program, except a pure time program

21c-46/34 in dependence on a pure time program

Automatic electric regulators for any controlled data and for general purposes (nonelectric regulators in 42r; for special technological purposes, see special classes, e.g. 21c-57/01 – 21c-67; 21e-11; 21h-13; 42d-1, 2; 42e-21; 42q; 47g; 74b-1 – 74b-8)

21c-46/50 using electric pulses for automatic remote control

21c-46/51 using reference magnitudes

21c-46/52 using regulating relays

21c-46/53 using hoop-drop regulators

21c-46/54 using schedule regulators

Electric remote-control devices with answer-back signal for selection and actuation of multiple movable components mounted in an automatic substation, remote selectors except for telephony

21c-47/01 by means of relays and relay chains

21c-47/02 by means of electromagnetically controlled wipers moving over contact rows

21c-47/03 by means of contact systems in which wipers driven by other means, such as motors or clock works, move over the contacts rows

Electric selectors and selector systems, remote-controlled by the operator, except for substations and telephony

21c-47/50 Current and line combination without synchronism

21c-47/51 Synchronous transmission, step-by-step switches

21c-47/52 Wireless transmission (21a4-48/55; 21a4-57; 65d-3)

21c-47/53 Transmission by variation of supply line frequency or by beat-frequency alternating currents, frequency selectors (21a1-9/01; 21a1-23; 21a2-39/10; 21a2-39/20; 21a3-53/01; 21a4-58; 21a4-59; 21c-47/01 – 21c-47/03; 21d2-44; 21g-4/02; 21g-4/03; 74b; 74c; 83b-2/01)

21c-48 Hand-operated cell switches for storage batteries

21c-49 Automatic cell switches for storage batteries

21c-50 Charging switches for storage batteries and switching methods therefor

Automatic charging and current-generating units with storage batteries

21c-51/01 Started by battery discharge
21c-51/02 Started by battery variation of current consumption, also with charge limitation
21c-51/03 with semiautomatic starting

21c-52 Switching and regulating devices for electric vehicle lighting with current generation within the vehicle (electric train illumination with external current supply 20l-3; 21d1; 46c3; 63c-63/01; 63c-63/10; 63c-64; 63g-10)
21c-53 Devices for electric vehicle-lighting units with current generation within the vehicle

**Electric resistors, their structure and composition** (industrial alloy compositions 18d, 40b; purification 48c, 40d)

Metallic resistors (21c-1; 21h-1)

21c-54/01 Nonadjustable, wire, tape or mesh type
21c-54/02 Bifilar
21c-54/03 Adjustable, wire or tape type, with directly applied current tap
21c-54/04 Adjustable, wire or tape type with special regulating contacts
21c-54/05 of conducting layers, iron-hydrogen resistors

21c-55/01 Resistors made of non-metallic materials, e.g. carbon-containing materials
21c-55/02 Pressure-regulated resistors made of solid or powdered materials
21c-56 Liquid resistors (21c-60)

**Devices for starting and regulating electric motors**

21c-57/01 Hand starters and regulators for DC motors
21c-57/03 Hand-operated reversing starters for DC motors
21c-57/05 Starting and regulating devices for DC motors with field control
21c-57/07 Hand starters with several control levers
21c-57/09 Starting devices with mechanically controlled contacts
21c-57/15 Starting and regulating devices for AC motors, general
21c-57/18 Hand-operated reversing starters for AC motors
21c-57/20 Starting and regulating devices for AC motors with control of stator voltage
21c-57/22 Starting and regulating devices for AC motors with supply-line frequency control
21c-57/25 Starting devices for AC motors with regulation in the rotor

Starting and regulating devices

21c-57/30 for single-phase motors
21c-57/32 for pole-changing motors (21d2-25)
21c-57/34 for synchronous motors
21c-57/40 for electric motor drives with great starting torque
21c-57/50 Starters and regulators for small motors
21c-57/52 Pedal starters and regulators
21c-57/55 Components for starters and regulators
21c-57/60 Star-delta switches
21c-57/70 On, off and reversing switches connected with starters and regulators for electric motors

**Contactor controls for electric motors**

21c-58/01 Electromagnetic switches for starting and regulating DC motors, automatic starters
21c-58/10 Electromagnetic switches for starting and regulating AC motors
21c-58/20 Structural components of contactor starters

Control of starting and regulating contactors

21c-58/30 by master drum switches
21c-58/40 by push buttons
21c-58/50 particularly for reversing controls

| | |
|---|---|
| 21c-58/60 | Contactor controls with control of starting and regulating process, particularly current, voltage, time, temperature, speed, etc. |
| | Automatic regulators for electric motors |
| 21c-59/01 | for speed regulation, general |
| 21c-59/03 | with servomotors and step-by-step switch gears |
| 21c-59/05 | for non-centrifugal speed regulation |
| 21c-59/10 | for electric motor regulation by means of discharge tubes |
| 21c-59/20 | Arrangements for Ward-Leonard regulators, regulating and reversing control |
| | Speed-dependent automatic controls for electric motors |
| 21c-59/25 | for single-step switching, centrifugal switches (21d2-21; 21d2-37) |
| 21c-59/26 | for multiple-step switching, centrifugal switches |
| 21c-59/27 | Centrifugal contact regulators |
| 21c-59/29 | Vibrating regulators |
| | Devices for automatic regulation of electric motors in dependence on |
| 21c-59/30 | measuring instruments, general |
| 21c-59/32 | pressure |
| 21c-59/33 | liquid level, float |
| 21c-59/34 | distance or time |
| 21c-59/35 | load |
| 21c-59/36 | other electric variables of the motor |
| 21c-59/37 | temperature (variators) |
| | Devices for automatic control of electric motors with safety devices |
| 21c-59/40 | against over-current and overload |
| 21c-59/42 | against overvoltage, voltage drop and fluctuations, phase interruption |
| 21c-59/44 | against speed excess or deficiency |
| 21c-59/46 | against wrong direction of rotation, reverse rotation |
| 21c-59/47 | against premature reconnection |
| 21c-59/50 | Devices for checking and limiting starting current of motors starting without load |
| | Braking devices for electric motors |
| 21c-59/55 | Mechanical or electromagnetic braking |
| 21c-59/56 | Combined mechanical and electric braking |
| 21c-59/58 | with electric generator or regenerative braking |
| 21c-59/59 | with inverse braking (prevention of reverse rotation 21c-59/46) |
| | Special electric regulating devices for single electric motors intended for the drive of machine tools and machines of various types |
| 21c-59/60 | for intermittent operation |
| 21c-59/65 | for periodical reverse operation |
| 21c-60 | Liquid starters for electric motors (liquid resistors 21c-56) |
| 21c-61/01 | Drum starters for starting electric motors (general structure 21c-39/03 – 21c-39/04) |
| 21c-61/03 | Drum starters in series or parallel connection |
| 21c-61/05 | Drum starters operated by compressed air or liquid |
| 21c-61/06 | Drum starters with mechanical and magnetic blocking |
| | Devices for control of interdependently operating electric motors |
| 21c-62/01 | Multiple electric motor drives, general |
| 21c-62/05 | Multiple electric motor drives for mechanically coupled motors, double drives, load equalisation |
| 21c-62/10 | Multiple electric motor drives with common starter |
| 21c-62/15 | Multiple electric motor drives with stepping controls |
| 21c-62/20 | Multiple electric motor drives, alternate drives, auxiliary motors |

21c-62/30 Devices for synchronising and maintaining the synchronisation of electric motors (21d2-24/03)

Multiple electric motor drives for machines processing continuous work

21c-62/40 for papermaking machines
21c-62/45 for printing presses (15d-30/02)
21c-62/50 for rolling mills

Devices for controlling and regulating single or plural electric motors in dependence on definite operations, inventions in the electrical art only (electric railroads 20l; electric hoisting devices 35)

21c-62/60 for rolling apparatus, wire-drawing machines
21c-62/62 for non-cutting machines with reciprocating elements, e.g. presses, punches, shears, etc. (80a-25/80)
21c-62/65 for textile machines
21c-62/70 for feed motors, particularly for wood-grinding machines
21c-62/80 for metal-cutting machines, e.g. lathes, boring machines, milling machines, planing and slotting machines, thread-cutting machines, grinding machines

**Automatic regulators for generators**

Direct-acting regulators for generators

21c-63/01 by means of step resistors
21c-63/02 by means of carbon-pile resistors
21c-63/03 by means of liquid, heat-sensitive or other continuously variable resistors
21c-63/04 by means of electron tubes
21c-63/10 Regulating magnets and components for direct-acting regulators

Indirect-acting regulators for generators

21c-63/20 with electrically controlled auxiliary motor
21c-63/25 with hydraulically controlled auxiliary motor

Periodically acting regulators for generators

21c-64/01 with electromagnetically driven vibrating contacts
21c-64/02 with mechanically driven vibrating contacts
21c-64/10 Regulating magnets and components for periodically acting regulators

Devices for automatic regulation of generators

21c-64/50 for a definite value of voltage and current (21d1-27 – 21d1- 39; 21d2-6/01)
21c-64/53 for a definite value of active power
21c-64/55 for a definite value of reactive power (21d2-7)
21c-64/57 for a definite value of frequency (regulators for power engines 60)

**Devices for parallel operation of generators or power plants**

21c-65/01 for automatic parallel connection
21c-65/02 for automatic synchronisation (synchronisation of power sources 21d2-42/05; synchronisation of converters 21d2-11; synchronism indicators 21e-6/04)
21c-65/03 Devices for prevention of wrong parallel connection
21c-65/05 for load distribution over several generators or power plants (load transfer within and among AC supplies 21d2-42/04)
21c-65/10 for the maintenance of parallel operation (21d2-9)

**Devices for automatic regulation of transformers, converters and rectifiers, as well as of power sources**

21c-67/01 for the regulation of step-by-step transformers
21c-67/02 for the regulation of rotary transformers (step-by step switches for tapped transformers 21d2-53/03)
21c-67/03 for the reduction of no-load losses in transformers

21c-67/10 for the regulation of rectifiers and converters (methods and circuitry for rectifying 21d2-12/02; voltage regulation of converters 21d2-11)

Devices for automatic regulation of power sources (AC networks and their regulation 21d2-42)

21c-67/50 by connection or disconnection of generators and converters

21c-67/55 by connection or disconnection of transformers or rectifiers

21c-67/60 by ohmic load variation

21c-67/65 by capacitive load variation

21c-67/70 by means of voltage-dependent resistors

### Devices and methods for protection of electric lines against electric disturbances

21c-68/01 Electromagnetic safety devices operating in case of maximum or minimum current or voltage, inverse current or other similar electric conditions (electric safety devices operating in case of failure or current disconnection of a line 21c-71)

21c-68/50 Protective connections, particularly for selective disconnection, indication, transfer to an alternate line and reconnection of circuit elements: power supply components, bus bars, transformers and apparatus, in dependence on circuit conditions (ground leakage testing circuits 21e-29/11; machine failure remote-indicator circuits 74b-5/01, 74b-5/02; circuits for protection from faults in electric railroad vehicles 20l-27/09; for electric trolley contact wires 20k-18; transfer to an alternate line 21c-42/02; protective circuits within and close to electric machines, transformers and apparatus 21d3-2)

21c-68/60 Electromagnetic protective relays, particularly those the response and operating of which depends on several operating data, and indirect protective relays for protective circuits not depending directly on electric operating data as in 21c-68/50; special transformer protective circuits with glow lamps and rectified alternating current; circuits for feeding control circuits of protective relays with batteries or transformers, test circuits for protective relays, circuits for increasing relay sensitivity and preventing incorrect release of relays, circuits for the reduction of disconnecting current intensity (common relays 21g-4/01 – 21g-4/05; electrothermal and thermal relays for line protection 21c-69, 21c-70)

21c-68/70 Protective circuits and switches for avoiding the dangerous contact among live components of systems, bus bars, machines, transformers and apparatus, for the disconnection of faulty actions of circuits independent of or dependent on the contact (by means of plug switches 21c-22; for X-ray units 21g-20/11)

21c-69 Heat-actuated, electrothermal, thermal or electromagnetic-thermal safety devices (regulating and automatic connecting devices for electric cooking and heating appliances 21h-13/01 – 21h-13/17; for electric heating pads 30d-25/01 – 30d-25/03; temperature regulators, general 42q; electrothermal and thermal switches, general 21c-40/05; electric safety fuses 21c-70)

21c-70 Electric safety fuses and accessories

21c-71 Electric safety devices operating on interruption or absence of current in a line (prevention of operational disturbances and accidents due to wire break 21c-9; prevention of dropping and grounding of conductors as well as disconnection of broken contact wires of electric railroads 20k-11)

21c-72 Safety devices against excessive voltages caused by lightning, voltage surges, travelling waves, grounding and the like, in particular voltage surge dissipaters, choke coils for voltage surge protection devices, and ground arc extinguishers (building lightning arrestors, 21c-11/03; safety and protection devices for radio stations 21a4-76; fixed and adjustable choke coils, general 21d2-55; protection devices for electric railroads 20k-12)

## 21d1 Direct current

### DC generators with commutators

21d1-1 Basic electromagnetic structure

21d1-2 Machines with both armature and field magnet rotating (21d1-18)

21d1-3 Machines with open armature windings (21d1-19)

**DC generators without commutator, and DC homopolar machines with or without commutator**

21d1-5 Homopolar machines with commutator or liquid conductors

21d1-6 Homopolar machines with sliding contacts at the ends of the current-feeding conductors; cylinder and disk machines; current collector arrangements and windings

21d1-7 DC generators without commutators or sliding contacts

**Arrangement of DC armature windings**

21d1-8 Lap windings, wave windings and the like, equipotential connections (21d1-51 – 21d1-54)

**Small electromagnetic machines for illumination, mine blasting and other similar purposes** (gyroscopes 42c-25/51; electric ignition for explosive charges 78e-3/05; bearings for precision drives for general purpose 47i-1)

21d1-9 Small machines with relatively movable armature and field magnets

21d1-10 Small machines with fixed primary windings and movable conductor elements for lines of force (46c3-8)

21d1-11 Structural components, field magnets, armatures, current collecting devices, drives

21d1-12 Small machines for special purpose, i.e. for illumination of bicycles and the like, as well as for flashlights (ignition and ignition-illumination dynamos in connection with internal combustion engines, particularly for vehicles 21c-52, 21c-53; 46c3-4; 46c5-15; 63g-10)

**Electrostatic and electrostatic induction machines**

21d1-13 Electrostatic friction machines

21d1-14 Disk-type electrostatic induction machines

21d1-15 Drum-type electrostatic induction machines

21d1-16 Structural components, disks, current collectors, and the like

**DC motors with rotating armature or rotating field magnet**

21d1-17 Commutator motors; alternating-current fed direct-current motors (34b-13/10; 42g-17/04)

21d1-18 Motors with double rotation (21d1-2)

21d1-19 Motors with open armature winding (21d1-3), with wound salient pole armature as well as with winding-less armature

21d1-20 Special types of DC motors; thermoelectric, thermomagnetic motors and the like

**Electromagnetic motors with reciprocating armature or field magnet to be connected to DC or AC supply**

21d1-21 Basic structure, generators or converters for feeding electromagnetic motors (21d2-12)

21d1-22 Motors with oscillating armature and/or field magnet

21d1-23 Motors with linear motion of armature or field magnet

**Direct-current to direct-current conversion**

21d1-24 by means of rotary converters and motor generators

21d1-25 by means of transformers or capacitors in connection with switches or electric valves

**Regulation of DC motors by controlling the magnetic circuit**

21d1-27 Miscellaneous regulating devices

21d1-28 Commutating (reversing) poles and compensating windings

21d1-29 Field magnets with slots, split poles, irregularly spaced from armature, also made of materials of different magnetic permeability

21d1-30 Control of the magnetic circuit by shifting or rotating iron masses or by magnetic shunt, stray paths and the like; damper windings

**Regulation of DC motors by variation or control of the excitation**

21d1-31 Basic circuits

21d1-32 Changing or disconnection of individual poles or pole pairs, field rotation; simultaneous application of different regulating methods

21d1-33 DC machines with auxiliary brushes as well as single or double main brushes, cross field machines; excitation by means of alternating currents (21d1-37)

21d1-34 Quick-response excitation and de-excitation, also elimination of remanence

21d1-35 Oppositely or reinforcing exciter windings or voltages

### Regulation of DC machines by armature circuit control

21d1-36 Regulation by various means

21d1-37 Regulation by shifting the main and auxiliary brushes with respect to the excitation field and vice versa (21d1-33)

21d1-38 DC machines with adjustable armature circuit, Ward-Leonard circuits, direct or reverse connection machines; DC machines with multiple armature circuits and commutators

21d1-39 Special arrangements and connections within the armature circuit to suppress spark formation on the commutator; electric valves as substitutes for mechanical commutators

### Coupling of shafts by means of electric machines with inducing and induced systems, dynamoelectric clutches

21d1-40 Clutches, no electric power derived from induced systems (47c-15)

21d1-41 Clutches, electric power derived from induced system

21d1-42 Brake circuits in DC motors, short-circuit braking, regenerative braking; electromechanic and electromagnetic brakes, eddy-current brakes (20f-44; 20h-4; 20l-2; 20l-28; 20l-29; 21c-55/01 – 21c-59/59; 21e-23; 35b-7; 47c-17/06; 63c-51/06)

21d1-43 Regulation of DC motors by means of mechanical and electromechanical friction clutches

21d1-44 Regulation of DC motors by means of shifting friction gear or belts, also by means of friction gear or belts with variable contact pressure, or by mechanical braking

### Mechanical structure of DC and AC electric machines

### Stationary part

21d1-45 General structure of active iron, field magnets, stators, special materials (18b-20; 21g-31), sheet metal disks, their insulation (punching of sheet metal for electric machines 7c-10); machines, devices and methods for assembling the stationary part without winding

21d1-46 Enclosing casings, partial or complete enclosing and accessories: underwater motors, protection from explosive atmosphere, slip-ring enclosing, heating of electric machines

21d1-47 Fixed, elastic and movable supporting of the stationary part; mounting and centering of bearings, particularly of bearings for fast rotating rotors (29a-6/14; 47i-1; 76c-13/01; 82b);combination with gear drives (21d1-40 – 21d1-44; 47h-20; 49a-21/02; 49a-41/01) and other machines, where a modification of electric machine structure is involved (indication of bearing currents 21c-68/50)

### Rotary part

21d1-49 General structure of active iron, armature cores, rotors, special materials (21d1-45; punching of sheet metal 7c-10)

21d1-50 Fastening of rotary part on the shaft, rigid and flexible fastening; machines, devices and methods for assembling rotary parts without winding; fitting of means for balancing the rotary part (42k-32; 42k-33)

### Devices mounted on stationary and rotary parts

21d1-51 Winding structures (21g-1/02); machines, devices and methods for preparing the winding coils (21d1-59; 21g-1/01); machines, devices and processes for mounting the windings on the active iron, testing devices (21d3-2; 21e-29/11)

21d1-53 Insulation of windings (21g-1/02); glow protection; machines, devices and methods for applying the insulation

21d1-54 Fastening of windings

**Cooling of electric machines**

Heat dissipation in open machines

21d1-55/01 Heat dissipation from the rotor
21d1-55/02 Heat dissipation from the stator
21d1-55/03 Cool-air flows separate for rotor and stator

Devices for dissipating heat in enclosed machines with circulation cooling

21d1-55/50 without separate re-cooling units and without additional external air flow
21d1-55/51 without separate re-coolers, with additional external air flow
21d1-55/60 Cooling units for large electric machines with special liquid coolers where the electric machine structure is modified thereby (in combination with steam turbines and steam boilers 14c-10/04, 14c-13/02, 14h-3; heat exchangers 17f-11)

Heat dissipation from electric machines

21d1-56/01 by water fed to the heated area
21d1-56/02 by oil
21d1-56/04 by gases
21d1-57/01 Devices for regulation of cooling processes
21d1-57/10 Protection devices in connection with cooling
21d1-57/50 Devices for purifying cooling air in electric machines, filters (air filters, general 50e)

Heat dissipation

21d1-58/01 from commutators
21d1-58/02 from slip rings
21d1-58/03 from the brushes of electric machines

**Devices for collecting current from, or supplying current to, electric machines**

21d1-59 Commutors, processes and devices for their manufacture
21d1-60 Slip rings
21d1-61/01 Devices for splitting commutors
21d1-61/02 Devices for smoothing, e.g. wiper blocks, brush attachments and brushes; for lubricating commutators and slip rings (grinding of commutators 67a-11); generation of axial oscillations
21d1-61/03 Soldering of winding ends in commutators (testing for connection and insulation faults 21d1-51)
21d1-62 Metal brushes
21d1-63/01 Composition of carbon brushes, processes and devices for their manufacture
21d1-63/02 Reinforcement of carbon brushes, caps and supply leads
21d1-64/01 Special current collectors
21d1-64/02 Means for improvement of current transmission, special forms, holders, setting devices
21d1-65 Brush holders with brushes movable in the holder
21d1-66 Brush holders with brushes fixed in the holder
21d1-67/01 Special brush holder structures
21d1-67/02 Devices for protection from, and prevention of, flashovers
21d1-67/03 Special structure of components of brush holders
21d1-67/04 Devices for limiting brush wear
21d1-67/05 Testing devices for brushes and brush holders
21d1-68 Brush shifting and lifting devices

**Distribution of direct current, wiring systems, connection and elimination of interference harmonics, circuits for generators and batteries, load balancing in direct-current systems**

21d1-69 Two-wire systems (for AC 21d2-42)

21d1-70 Multiple-wire systems (for AC 21d2-42)
21d1-71 Connection of electric batteries to the line and the current source (21a3-64; 21c-51)
21d1-72/01 Connection of direct-current machines to other current sources, e.g. mercury vapour rectifiers, parallel operation
21d1-72/02 Elimination of interference harmonics in DC supply systems (21a4-35/15; 21a4-76; 21c-4/13; 21d2-43; 21g-34)
21d1-73 Load balancing through flywheel machines, balancing batteries and the like (21c-65/05; 21d2-47)

## 21d2 Alternating current

### Rotary and stationary alternators

21d2-1 Alternators with DC excitation (mechanical structure 21d1-45 – 21d1-68)
21d2-2 Alternators with AC excitation (mechanical structure 21d1-45 – 21d1-68)
21d2-3 Alternators for medium (21g-63/30) and high frequencies (21a4-5)
21d2-4 Conductor rods for AC machines
21d2-5/01 Alternators of special design
21d2-5/50 Electron-tube oscillators, general (for signal transmission 21a1-9/02, 21a4-8/01 – 21a1-8/03)

Current and voltage regulation, compounding

21d2-6/01 of synchronous alternators (21c-64/50)
21d2-6/02 of asynchronous alternators (21c-64/50)
21d2-7 Phase regulation, compensation of alternators, compensators (21d1-6; 21d1-16)
21d2-9 Period regulation and parallel operation for synchronous and asynchronous alternators, synchronising and damping devices for synchronous alternators (21c, 65)

### AC converters

21d2-10 Motor-generators, synchronous converters and cascade converters for AC-DC and DC-AC conversion (DC-DC conversion 21d1-24)
21d2-11 Starting, synchronisation and voltage regulation of converters (21d2-16)

Circuits and connection methods for conversion of alternating into direct current and vice versa (rectifier structures 21g-11 – 21g-15)

21d2-12/01 by means of rotary or other mechanical contactors
21d2-12/02 by means of discharge gaps with electron or ion discharges, without control means affecting the discharge paths, e.g. control grids, magnetic control fields, rotary diaphragms, and the like
21d2-12/03 by means of discharge gaps with electron and ion discharges, with control means affecting the discharge gap, e.g. control grids, magnetic control fields, rotary diaphragms, etc.
21d2-12/04 by means of other fixed conversion devices
21d2-13 Phase converters (phase transformers 21d2-52)
21d2-14/01 Frequency converters (frequency transformers 21d2-51)
21d2-14/02 Frequency conversion by means of tubes
21d2-15 Methods and circuits for regulation of synchronous and induction motors, speed regulated by variation of the supply frequency (regulation by means of discharge tubes 21c-59/10; regulating devices 21c-57/01 – 21c-62)

AC motors (gyroscopes 42c-45/51)

21d2-16 Synchronous motors with salient poles; starting, prevention of desynchronisation (21d2-11; starting as commutator motor 21d2-37;starting and regulating devices 21c-57/34; 42g-17/04)
21d2-17 Synchronised and double-fed asynchronous motors, starting and prevention of desynchronisation (starting as commutator motor 21d2-37)
21d2-18/01 Induction motors for single-phase current

21d2-18/02 Starting and braking of single-phase induction motors (devices for starting and regulating 21c-57/30)
21d2-18/03 Connection of poly-phase induction motors to single-phase supply
21d2-19/01 Induction motors for poly-phase current
21d2-19/02 Poly-phase induction motors of special design
21d2-20 Squirrel cage armatures, double cage, eddy current armatures for induction motors
21d2-21 Short-circuit and brush-lifting devices as well as other structural details for induction motors (21c-59/25; 21d1-45 – 21d1-68)
21d2-23/01 Starting of poly-phase induction motors (21c-57/01 – 21c-62)
21d2-23/02 Braking of poly-phase induction motors (21c-59/55 – 21c-59/59; 35b-7/02; 35b-7/05)
21d2-24/01 Speed control for induction motors (regulation by frequency variation 21d2-15)
21d2-24/02 Regulation of other induction motor specifications (torque, power factor)
21d2-24/03 Synchronisation of induction motors (21c-62/30)
21d2-25 Windings for pole changing in induction motors (21c-57/32)

Cascade connection of induction motors

21d2-26 with induction or synchronous motors (cascade connection of induction motors with synchronous motors for frequency conversion 21d2-14/01)
21d2-27/01 with rotor-excited commutator machines
21d2-27/02 with stator-excited commutator machines
21d2-27/03 with double or shunt excitation commutator machines
21d2-27/04 Starter connections for 21d2-27/01 – 21d2-27/03
21d2-28 with three-phase exciters, phase shifters
21d2-29 with frequency converters
21d2-30 with synchronous converters

21d2-31 Compensated induction motors
21d2-33 Single-phase commutator machines for series and shunt connection
21d2-34 Arrangements on stator on rotor for spark prevention in AC commutator machines, e.g. auxiliary fields, double windings and double brushes
21d2-35 AC commutator machines with single or multiple short-circuit commutator, repulsion motors
21d2-36 Series and shunt connected motors with multiple-fed armature, compensated repulsion motors
21d2-37 Reconnection of commutator motors for other types of operation, repulsion-induction motors (21c-59/25)

Poly-phase commutator machines

21d2-38 Series connection
21d2-39/01 Shunt connection and stator feed
21d2-39/02 Shunt connection and rotor feed
21d2-40 Special regulation of AC commutor machines
21d2-41 Electron-tube controlled AC motors, regulating motors without commutator (21c-59/10)

## Alternating-current distribution

## AC networks and their regulation

21d2-42/01 AC systems; network connections, drawing of constant current and voltage from variable-voltage networks (21d2-53; 21d2-54), power transmission over cables only or combined with overhead lines, transmission of multiple frequencies over a single power line
21d2-42/02 Voltage regulation by means of compensating devices (by means of transformers 21d2-53; 21d2-54), by means of choke coils (21d2-55) and resistors, loading of networks
21d2-42/03 Setting and elimination of reactive power, compensation of long transmission lines, load current compensation in cables

21d2-42/04 Power shifting in or among AC networks, capacitive power transmission (by means of converters 21d2-45)

21d2-42/05 Synchronisation and parallel connection of networks

21d2-43 Elimination of asymmetry and harmonics in AC networks

21d2-44 Superposition on AC or DC power lines of weak currents of extraneous frequency, in particular voice frequency, for actuating connection relays, impressing devices, generation of extraneous frequency, barriers and bridges (telegraphy 21a1-23; carrier-frequency telephony 21a2-39/20)

### AC networks with converters

21d2-45/01 Converters in AC networks and between AC networks of same or different frequency (mechanical converters and tube converters 21d2-14)

21d2-45/02 Converters between AC and DC networks (rotary converters and tube converters 21d2-10, 21d2-12)

### Load compensation in AC networks

21d2-47/01 Energy storage

21d2-47/02 Buffer machines and buffer batteries with converters, also with rectifiers, flywheel machines (21d1-73)

### Transformers

21d2-48 Transformer cores: materials, shape, assembly, frames, supporting and pressing devices (manufacture of materials 18b-20, 18c; 40b; for high frequency 21a4-74; special arrangements for low frequency, for telegraphy, radio and telephony 21a2-30; AC magnets, in general 21g-2/02)

21d2-49 Transformer windings: structure, insulation, voltage control, small transformers, measuring transformers (for high frequency 21a4-74; special arrangements for low frequency, for telegraphy, radio and telephony 21a2-30 ;coil-winding processes 21g-1/01; electric coils, general 21g-1/02; means for improving measuring precision, determination of error curves 21e-27/01)

21d2-50 Cooling and ventilation, cleaning and preservation of insulating materials within and on the transformer, mechanical accessories

21d2-51 Frequency transformers (converters) (stationary frequency converters 21a4-6/01)

21d2-52 Phase transformers (phase transformers for rectifiers 21d2-12/02)

21d2-53/01 Connection of transformer windings

21d2-53/02 Regulating transformers with fixed windings

21d2-53/03 Step-by-step switches for step-by-step transformers (automatic 21c-67/01, for toys 77f-19/02, 77f-19/13)

21d2-54 Regulating transformers with adjustable iron core and windings (automatic 21c-67/02)

21d2-55 Choke coils (for telephony 21a2-30; high frequency 21a4-68; overvoltage protection 21c-72; arc lamps 21f-11; incandescent lamps 21f-63)

## 21d3 Special arrangements independent of type of current

21d3-1/01 General arrangements of electric current generating units with respect to energy sources or special operating conditions (21c-65/05; 21d1-73; 21d2-47)

21d3-1/02 Structural arrangements of electric current generating units, when modified by electrical apparatus

21d3-1/03 General layout and connection of auxiliary electric systems of electric current generating units

21d3-2 Protection devices within or directly mounted on electric machines, transformers and apparatus, checking arrangements therefor, e.g. temperature, state of insulation, efficiency; testing methods and circuits for electric machines and transformers (measuring devices, see special classes; testing and calibration units for measuring transformers 21e; protection devices separate from machines 21c-68 – 21c-72)

Generation of surge voltage and currents for heavy current (21a4-48/23; 21a4-48/61 – 21a4-48/63)

21d3-3/01 Single impulses

21d3-3/02 Periodically repeated impulses with controlled discharge devices
21d3-3/03 Periodically repeated impulses with uncontrolled, or without, discharge device

## 21e Devices and processes for measuring electric and magnetic magnitudes

### Electric measuring instruments

Galvanometers

21e-1/01 Moving coil
21e-1/02 Needle
21e-1/03 Differential
21e-1/04 Vibration
21e-1/05 String
21e-1/06 Loop
21e-1/07 Eddy current

Electrodynamometers

21e-2/01 Coreless
21e-2/02 Core shielded
21e-2/03 Core enclosed
21e-2/04 Moving-coil measuring instruments with permanent magnets

Electromagnetic measuring instruments

21e-3/01 Moving-magnet measuring instruments
21e-3/02 Moving-core measuring instruments

Thermoelectric measuring instruments

21e-4/01 Hot wire and hot body instruments
21e-4/02 Thermogalvanometers
21e-4/03 Bimetallic measuring instruments

Electrostatic measuring instruments

21e-5/01 Reed-type instruments
21e-5/02 Filament-type measuring instruments
21e-5/03 Needle-type measuring instruments
21e-5/04 Quadrant electrometers
21e-5/05 Calibrated spark gaps (21e-33)

Induction measuring instruments

21e-6/01 for current and voltage measuring
21e-6/02 for power measuring
21e-6/03 for measuring phase angle and power factor
21e-6/04 Synchronism indicators (21d2-9)

Frequency meters (mechanical oscillations 42c-42; frequency velocity meters 42o; frequency measuring procedures (21e-36/03)

21e-7/01 Reed-type instruments
21e-7/02 Indicator instruments
21e-7/03 Recording instruments;
21e-7/04 Electrostatic instruments

Maximal current measuring instruments

21e-8/01 General type
21e-8/02 Thermal type

Devices for recording the time variation of electric magnitudes (direction finders 21a4-48/31 – 21a4-48/33)

21e-11/01 Recording devices for electric measuring instruments (general 42d)
21e-11/10 Bifiliar oscillographs (electrocardiographs 30a-4/03)
21e-11/11 Glow oscillographs (glow lamps as tuning indicators 21g-12/01)
21e-11/12 Cathode-ray oscillographs (cathode-ray tubes, general 21g-13/21 – 21g-13/29; for television 21a1-32/35, 21a1-32/54, 21a1-35/20, 21a1-35/21; sweep (time base) circuits 21e-28/02)
21e-11/13 Miscellaneous oscillograph systems employing the Kerr or piezoelectric effect, etc. (for sound recordings 42g-9/02)
21e-11/20 Harmonic analysers
21e-12 Devices for measuring the field intensity of magnets (testing the magnetic properties of sheet metal and the like, 21e-37/10; magnetic measurements of the terrestrial field 42c-43)
21e-13 Current direction, pole and rotating field indicators (21d2-42)

**Electric meters** (42p)

Direct and alternating-current motor meters

21e-14/01 Watt-hour meters
21e-14/02 Ampere-hour meters
21e-15 Induction meters for single-phase currents, Ferrari principle (induction motors 21d2-18/01; 42g-17/04)
21e-16 Polyphase current meters (21d2-19)

Special rate counters (rate apparatus, general 42d-4/10)

21e-17/01 Subtraction meters or peak meters
21e-17/02 Excess consumption meters with counter-torque
21e-17/03 Light and power meters
21e-17/04 Maximum meters
21e-17/05 Discount and rebate meters
21e-17/06 Meters for special purposes
21e-17/07 Reversing devices for multiple-rate meters

21e-18 Electrolytic and calorimetric meters
21e-19 Electric time meters
21e-20 Electric-clock, pendulum and oscillation meters
21e-21 Special meter structures (except 21e-14 – 21e-20, 21e-22)

Electric integrating meters

21e-22/01 Varhour meters
21e-22/02 Effective-power meters
21e-22/03 Apparent-power meters, also with power factor indication
21e-22/04 Complex meters

Testing and calibrating methods for electric meters and devices for same

21e-22/50 Elements (21e-27/03; 21e-25/01; 21c-27)
21e-22/51 Circuits (21e-27/03)
21e-22/52 Stroboscopic methods

**Auxiliary devices and components**

21e-23 Braking and damping devices for electric measuring instruments and meters
21e-24 Bearings and bearing relievers for electric measuring instruments and meters (general, 47b-4)
21e-25/01 Components and special devices for electric measuring instruments and meters (21c-27)
21e-25/02 Temperature compensation for electric measuring instruments, also for meters

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| 21e-25/03 | Anti-tampering devices for meters |
| 21e-26 | Measuring resistors (resistors, general 21c-54 – 21c-56) |
| 21e-27/01 | Structures of instrument transformers for alternating current in relation to the error curve (21d2-48 – 21d2-55) |
| 21e-27/02 | Instrument transformers for direct current |
| 21e-27/03 | Testing and calibrating devices for instrument transformers |
| 21e-28/01 | Generation and control of current and voltages for measuring purposes, in particular arrangements for generation of alternating currents of particular frequency and curve shapes, phase control systems |
| 21e-28/02 | Operating circuits for cathode-ray oscillographs for time base, brightness control and transfer in the recording of several processes (relaxation oscillations, general 21g-38, 21a1-36/02) |
| | **Processes and circuit arrangements of general type for measuring electric magnitudes** (for special purposes see special classes) |
| | Measuring of direct and alternating current resistances |
| 21e-29/01 | Self-indicating resistance meters, in particular double-coil instruments (crossed-coil instruments) (for temperature measurement 42 i, 701) |
| 21e-29/02 | Resistance measurement in bridges |
| 21e-29/03 | Measurement of capacitance |
| 21e-29/04 | Measurement of inductance |
| 21e-29/10 | Fault locators |
| 21e-29/11 | Short-circuit, ground and winding continuity testers (protective devices 21c, 68) |
| 21e-29/12 | Line testers, test lamps, sensors, testing instruments with magnets |
| 21e-30 | Tube voltmeters and tube galvanometers (21a2-18/01; 21a4-71) |
| | Amplifiers for measuring purposes (amplifiers, general 21a2-8) |
| 21e-30/10 | Tube voltmeters and tube amplifiers for measuring purposes |
| 21e-30/20 | Amplifiers for measuring purposes based on other principles, e.g. magnetic amplifiers |
| 21e-30/30 | Measuring amplifiers with automatic compensation by means of a null-method instrument connected to the input, e.g. bolometer amplifiers and photoelectric amplifiers with such compensation (21e-32) |
| 21e-31 | Measuring arrangements with tubes |
| 21e-32 | Compensation-measuring methods (21e-30/30; 74b-8/01) |
| 21e-33 | High-voltage measurement by capacitive, inductive and ohmic voltage division (21e-5/05; 21a4-71) |
| 21e-34 | Klydonographs |
| 21e-35 | Sum and difference measuring methods and devices (42d-4; 74b-10) |
| 21e-36/01 | Current and voltage measurement |
| 21e-36/02 | Power measurement |
| 21e-36/03 | Frequency and phase measurement, also for harmonics |
| 21e-36/04 | Asymmetry measurement in three-phase and multiphase systems, rotating field dividers |
| 21e-36/10 | Other, not hitherto mentioned methods and circuits for measuring electric magnitudes |
| | **Electric and magnetic testing of raw materials and electrical engineering apparatus** |
| 21e-37/01 | Generation of testing voltages |
| 21e-37/03 | Test circuits |
| 21e-37/04 | Special auxiliary devices for testing, e.g. test vessels, test rods |
| 21e-37/05 | Preparation of the test objects |
| 21e-37/06 | Fault-indicating apparatus |
| 21e-37/07 | Testing devices mounted on apparatus, e.g. field indicators |

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| 21e-37/10 | Testing of magnetic properties, hysteresis losses, permeability, coercive force, remanence in iron samples, sheet metal and the like (testing of permanent magnets and measurement of magnetic field intensity, general 21e-12) |

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| **21e** | **(IPC: G01R) Measuring electric variables; Measuring magnetic variables** (measuring physical variables of any kind by conversion into electric variables relevant subclasses for physical variables, see concerned subclasses; measuring diffusion of ions in an electric field, e.g. electrophoresis, electro-osmosis, 42l; investigating non-electric or non-magnetic properties of materials by using electric or magnetic methods 42l; indicating correct tuning of resonant circuits 21a4-69, 21a4-70; monitoring electric counters 21a1-36; monitoring operation of communication systems 21a) |
| | **Notes:**<br>**1. This subclass deals with**<br>**(a) measuring all kinds of electric and magnetic variables directly or by derivation from other electric or magnetic variables;**<br>**(b) measuring all kinds of electric and magnetic properties of materials;**<br>**(c) testing electric and magnetic devices, apparatus, and networks (e.g. discharge tubes, amplifiers) and measuring their characteristics;**<br>**(d) indicating presence or sign of current or voltage;**<br>**(e) equipment for generating signals to be used for carrying out such tests and measurements.**<br>**2. In this subclass:**<br>**(a) The expression "arrangements for measuring" is used to mean "apparatus, circuits, and/or methods for measuring".**<br>**(b) Electric measuring instruments of the general types dealt with in groups 21e-5/00, 21e-7/00, 21e-9/00 but specially adapted for measuring a specific variable, e.g. frequency, phase, impedance, are dealt with in the main groups relevant to such variables.**<br>**(c) Group 21e-17/00 takes precedence over groups 21e-19/00 to 21e-31/00** |
| **21e-1/00** | **Details of instruments of the types included in groups 21e-5/00, 21e-7/00, 21e-9/00** |
| 21e-1/02 | . General constructional details (details of a kind applicable to indicating instruments in general 42d) |
| 21e-1/04 | . . Housings; Supporting members; Arrangements of terminals (terminals 21c; terminal strips or boards 21c; housings for electrical apparatus 21c) |
| 21e-1/06 | . . Measuring loads; Measuring probes (end pieces for leads 21c) |
| 21e-1/08 | . . Pointers; Scales, Scale illumination |
| 21e-1/10 | . . Arrangements of bearings (bearings in general 47b) |
| 21e-1/12 | . . . of strip or wire bearings |
| 21e-1/14 | . . Braking arrangements; Damping arrangements |
| 21e-1/16 | . . Magnets (in general 21g) |
| 21e-1/18 | . . Screening arrangements against electric or magnetic fields, e.g. against earth's field |
| 21e-1/20 | . Modifications of basic electric elements for use in electric measuring instruments; Structural combinations of such elements with such instruments (instrument transformers per se 21d2-49) |
| 21e-1/22 | . . Tong testers acting as secondary windings of current transformers |
| 21e-1/24 | . . Transmission-line measuring sections, e.g. slotted section |
| 21e-1/26 | . . . with linear movement of probe |
| 21e-1/28 | . Provision in measuring instruments for reference values, e.g. standard voltage, standard waveform |
| 21e-1/30 | . Structural combination of electric measuring instruments with basic electronic circuits, e.g. with amplifier |

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| 21e-1/36 | . Overload-protection arrangements or circuits for electric measuring instruments (in general 21c-68) |
| 21e-1/38 | . Arrangements for altering the indicating characteristic, e.g. by modifying the air gap (circuits 21e-15/10) |
| 21e-1/40 | . Modifications of instruments to indicate the maximum reached in a time interval, e.g. by maximum indicator pointer |
| 21e-1/42 | . . thermally operated |
| **21e-3/00** | **Apparatus or processes specially adapted for the manufacture of measuring instruments** |
| **21e-5/00** | **Instruments for converting a single current or a single voltage into a mechanical displacement** (vibration galvanometers 21e-9/02) |
| 21e-5/02 | . Moving-coil instruments |
| 21e-5/04 | . . with magnet external to the coil |
| 21e-5/06 | . . with core magnet |
| 21e-5/08 | . . specially adapted for wide angle deflection; with eccentrically-pivoted moving coil |
| 21e-5/10 | . String galvanometers |
| 21e-5/12 | . Loop galvanometers |
| 21e-5/14 | . Moving-iron instruments |
| 21e-5/16 | . . with pivoting magnet |
| 21e-5/18 | . . with pivoting soft iron, e.g. needle galvanometer |
| 21e-5/20 | . Induction instruments e.g. Ferraris instruments |
| 21e-5/22 | . Thermoelectric instruments (thermocouple instruments 21e-19/24) |
| 21e-5/24 | . . operated by elongation of a strip or wire or by expansion of a gas or fluid |
| 21e-5/26 | . . operated by deformation of a bimetallic element |
| 21e-5/28 | . Electrostatic instruments (combined with radiation detector 21g-18) |
| 21e-5/30 | . . Leaf electrometers |
| 21e-5/32 | . . Wire electrometers; Needle electrometers |
| 21e-5/34 | . . Quadrant electrometers |
| **21e-7/00** | **Instruments capable of converting two or more currents or voltages into a single mechanical displacement** (21e-9/00 takes precedence) |
| 21e-7/02 | . for forming a sum or a difference |
| 21e-7/04 | . for forming a quotient (for measuring resistance 21e-27/08) |
| 21e-7/06 | . . moving-iron type |
| 21e-7/08 | . . moving-coil type, e.g. crossed-coil type |
| 21e-7/10 | . . . having more than two moving coils |
| 21e-7/12 | . for forming product |
| 21e-7/14 | . . moving-iron type |
| 21e-7/16 | . . having both fixed and moving coils, i.e. dynamometers |
| 21e-7/18 | . . . with iron core magnetically coupling fixed and moving coils |
| **21e-9/00** | **Instruments employing mechanical resonance** |
| 21e-9/02 | . Vibration galvanometers, e.g. for measuring current |
| 21e-9/04 | . using vibrating reeds, e.g. for measuring frequency |
| 21e-9/06 | . . magnetically driven |
| 21e-9/08 | . . piezo-electrically driven |
| **21e-11/00** | **Instruments for measuring the time integral of electric power or current** |
| 21e-11/02 | . Constructional details (applicable to electric measuring instruments in general 21e-1/00) |
| 21e-11/04 | . . Housings; Supporting racks; Arrangements of terminals |
| 21e-11/06 | . . Magnetic circuits of induction meters; Coils therefor |
| 21e-11/08 | . . . Disc armatures for induction meters; Coils therefor |
| 21e-11/10 | . . Braking magnets; Damping arrangements |
| 21e-11/12 | . . Arrangements of bearings (bearings in general 47b) |
| 21e-11/14 | . . . with magnetic relief |
| 21e-11/16 | . . Adaptations of counters to electricity meters (counters per se 42m7) |
| 21e-11/18 | . . Compensating for variations in ambient conditions, e.g. temperature |
| 21e-11/20 | . . Compensating for phase errors in induction meters |
| 21e-11/22 | . . Adjusting starting torque |

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| 21e-11/24 | . Arrangements for avoiding or indicating fraudulent use |
| 21e-11/30 | . Dynamo-electric motor meters (21e-11/48, 21e-11/56 take precedence) |
| 21e-11/32 | . . Watt-hour meters |
| 21e-11/34 | . . Ampère-hour meters |
| 21e-11/36 | . Induction meters, e.g. Ferraris meters (21e-11/48, 21e-11/56 take precedence; Ferraris instruments 21e-5/20) |
| 21e-11/38 | . . for single-phase operation |
| 21e-11/40 | . . for polyphase operation |
| 21e-11/42 | . . . Circuitry therefor |
| 21e-11/44 | . Electrolytic meters; Calorimetric meters (21e-11/48, 21e-11/56 take precedence) |
| 21e-11/46 | . Electrically-operated clockwork meters; Oscillatory meters; Pendulum meters (21e-11/48, 21e-11/56 take precedence) |
| 21e-11/48 | . Meters specially adapted for measuring real or reactive components |
| 21e-11/50 | . . for measuring real component |
| 21e-11/52 | . . for measuring reactive component |
| 21e-11/54 | . . for measuring simultaneously at least two of the following three variables: real component, reactive component, apparent energy |
| 21e-11/56 | . Special tariff meters |
| 21e-11/58 | . . Tariff-switching devices |
| 21e-11/60 | . . Subtraction meters; Meters measuring maximum- or minimum-load hours |
| 21e-11/62 | . . Over-consumption meters with opposing-torque which comes into effect when a predetermined power level is exceeded |
| 21e-11/64 | . . Maximum meters, e.g. tariff for a period is based on maximum demand within that period |
| 21e-11/66 | . . . Circuitry |
| **21e-13/00** | **Instruments for displaying electric variables or waveforms** (display by mechanical displacement only 21e-5/00, 21e-7/00, 21e-9/00; recording frequency spectrum 21e-23/18; indicating or recording measured values in general 42d) |
| 21e-13/02 | . Instruments for displaying measured electric variables in digital form (counters 42m7; analogue/digital conversion 21a1-36/20) |
| 21e-13/04 | . Arrangements for producing permanent records of electric variables or waveforms |
| 21e-13/06 | . . Modifications for recording transient disturbances, e.g. by starting or accelerating a recording medium |
| 21e-13/08 | . . Electromechanical recording system using a mechanical direct-writing method |
| 21e-13/10 | . . . with intermittent recording by representing the variable by the length of a stroke or by the position of a dot |
| 21e-13/12 | . . Chemical recording, e.g. clydonographs (21e-13/14 takes precedence) |
| 21e-13/14 | . . Recording on a light-sensitive material |
| 21e-13/16 | . . Recording on a magnetic medium |
| 21e-13/18 | . . . using boundary displacement |
| 21e-13/20 | . Cathode-ray oscilloscopes (cathode-ray tubes 21g-13/21) |
| 21e-13/22 | . . Circuits therefor (generating pulses, e.g. sawtooth waveforms 21a1-36) |
| 21e-13/24 | . . . Time-base deflection circuits |
| 21e-13/26 | . . . Circuits for controlling the intensity of the electron beam (brilliance control 21g-13/40) |
| 21e-13/28 | . . . Circuits for simultaneous or sequential presentation of more than one variable (electronic switches 21a1-36/18) |
| 21e-13/30 | . . . Circuits for inserting reference markers, e.g. for timing, for calibrating, for frequency marking |
| 21e-13/32 | . . . Circuits for displaying non-recurrent functions such as transients; Circuits for triggering; Circuits for synchronisation; Circuits for time-base expansion |
| 21e-13/34 | . . . Circuits for representing a single waveform by sampling, e.g. for very high frequencies |
| 21e-13/36 | . Instruments using length of glow discharge, e.g. glowlight oscilloscopes (discharge tubes 21g) |

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| 21e-13/38 | . Instruments using the steady or oscillatory displacement of a light beam by an electromechanical measuring system (such measuring systems per se 21e-5/00, 21e-7/00, 21e-9/00) |
| 21e-13/40 | . Instruments using modulation of a light beam otherwise than by mechanical displacement, e.g. by Kerr effect |
| 21e-13/42 | . Instruments using length of spark discharge, e.g. by measuring maximum separation of electrodes to produce spark |
| **21e-15/00** | **Details of measuring arrangements** (details of instruments 21e-1/00; overload protection arrangements or circuits 21e-1/36) |
| 21e-15/02 | . Adaptation for high-voltage networks; Adaptation for high-current networks (instrument transformers 21d2-49) |
| 21e-15/04 | . . using voltage dividers |
| 21e-15/06 | . . . having reactive components |
| 21e-15/08 | . Circuits for altering the measuring range |
| 21e-15/10 | . Circuits for altering the indicating characteristic, e.g. making it non-linear |
| 21e-15/12 | . Circuits for multi-testers, e.g. for measuring voltage, current, or impedance at will |
| **21e-17/00** | **Measuring arrangements involving comparison with a reference value, e.g. bridge** |
| 21e-17/02 | . Arrangements in which the value to be measured is automatically compared with a reference value |
| 21e-17/04 | . . in which the reference value is continuously or periodically swept over the range of values to be measured |
| 21e-17/06 | . . Automatic balancing arrangements |
| 21e-17/08 | . . . in which a force or torque representing the measured value is balanced by a force or torque representing the reference value |
| 21e-17/10 | . AC or DC measuring bridges (automatic comparison or re-balancing arrangements 21e-17/02) |
| 21e-17/12 | . . using comparison of currents, e.g. bridges with differential current output |
| 21e-17/14 | . . with indication of measured value by calibrated null indicator, e.g. percent bridge, tolerance bridge (21e-17/12, 21e-17/16 take precedence) |
| 21e-17/16 | . . with discharge tubes or semiconductor devices in one or more arms of the bridge, e.g. voltmeter using a difference amplifier |
| 21e-17/18 | . . with more than four branches |
| 21e-17/20 | . AC or DC potentiometric measuring arrangements (automatic comparison or re-balancing arrangements 21e-17/02) |
| 21e-17/22 | . . with indication of measured value by calibrated null indicator |
| **21e-19/00** | **Arrangements for measuring currents or voltages or for indicating presence or sign thereof** (for measuring bio-electric currents or voltages 30a-4) |
| 21e-19/02 | . Measuring effective values, i.e. root-mean-square values |
| 21e-19/04 | . Measuring peak values non-sinusoidal waveforms |
| 21e-19/06 | . Measuring real component; Measuring reactive component |
| 21e-19/08 | . Measuring current density |
| 21e-19/10 | . Measuring sum, difference, or ratio |
| 21e-19/12 | . Measuring rate of change |
| 21e-19/14 | . Indicating direction of current; Indicating polarity of voltage |
| 21e-19/16 | . Indicating presence of current; Indicating presence of voltage; Indicating current or voltage in excess of a predetermined level (tubes therefor 21g-13/60; indicating presence of electrostatic charges 21g) |
| 21e-19/18 | . using conversion of AC into DC, e.g. with choppers |
| 21e-19/20 | . . using transductors |
| 21e-19/22 | . using conversion of AC into DC |
| 21e-19/24 | . . using thermocouples |
| 21e-19/26 | . using conversion of current or voltage into frequency or pulse characteristic (analogue/digital conversion per se 21a1-36/20) |
| 21e-19/28 | . adapted for measuring in circuits having distributed constants |

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| **21e-21/00** | **Arrangements for measuring electric power, or energy** (monitoring power consumption of electrically-propelled vehicles 20l-27/03) |
| 21e-21/02 | . by calorimetric methods |
| 21e-21/04 | . . in circuits having distributed constants |
| 21e-21/06 | . by measuring current and voltage |
| 21e-21/08 | . . using Hall-effect devices |
| 21e-21/10 | . by using square-law characteristics of diodes, to measure power absorbed by loads of known impedance |
| 21e-21/12 | . . in circuits having distributed constants |
| **21e-23/00** | **Arrangements for measuring frequencies; Arrangements for analysing frequency spectra** (frequency discriminators 21a4-29) |
| 21e-23/02 | . Arrangements for measuring frequency, e.g. pulse repetition rate; Arrangements for measuring period of current or voltage (measuring short time intervals 83d) |
| 21e-23/04 | . . adapted for measuring in circuits having distributed constants |
| 21e-23/06 | . . by converting frequency into current or voltage |
| 21e-23/08 | . . . using response of tuned circuit off resonance |
| 21e-23/10 | . . by converting frequency into a train of pulses, which are then counted (counters per se 42m7, 21a1-36) |
| 21e-23/12 | . . by converting frequency into phase shift |
| 21e-23/14 | . . by heterodyning |
| 21e-23/16 | . Arrangements for analysing the harmonic contents of currents or voltages |
| 21e-23/18 | . . with provision for recording frequency spectrum |
| 21e-23/20 | . . Measurement of non-linear distortion |
| **21e-25/00** | **Arrangements for measuring phase angle between a voltage and/or currents** (measuring position of individual pulses in a pulse train 21e-29/02; phase discriminators 21a4-29) |
| 21e-25/02 | . in circuits having distributed constants |
| 21e-25/04 | . involving adjustment of a phase shifter to produce a predetermined phase difference, e.g. zero difference |
| 21e-25/06 | . employing quotient instrument |
| **21e-27/00** | **Arrangements for measuring resistance, reactance, impedance, or characteristics derived therefrom** |
| 21e-27/02 | . Measuring real or complex resistance, reactance, impedance, or other two-pole characteristics derived therefrom, e.g. time constant (by measuring phase angle only 21e-25/00) |
| 21e-27/04 | . . in circuits having distributed constants |
| 21e-27/06 | . . . Measuring reflection coefficients; Measuring standing-wave ratio |
| 21e-27/08 | . . Measuring resistance by measuring both voltage and current |
| 21e-27/10 | . . . using two-coil or crossed-coil instruments forming quotient |
| 21e-27/12 | . . . . using hand generators, e.g. meggers |
| 21e-27/14 | . . Measuring resistance by measuring current or voltage obtained from a reference source (21e-27/16, 21e-27/20, 21e-27/22 take precedence) |
| 21e-27/16 | . . Measuring impedance of element or network through which a current is passing from another source, e.g. cable, power line |
| 21e-27/18 | . . . Measuring resistance to earth |
| 21e-27/20 | . . Measuring earth resistance; Measuring contact resistance of earth connections, e.g. plates |
| 21e-27/22 | . . Measuring resistance of fluids |
| 21e-27/24 | . . . Construction of measuring vessel; Electrodes therefor |
| 21e-27/26 | . . Measuring inductance or capacitance; Measuring quality factor, e.g. by using the resonance method; Measuring loss factor; Measuring dielectric constants |
| 21e-27/28 | . Measuring attenuation, gain, phase shift, or derived characteristics of electric four-pole networks, i.e. two-port networks; Measuring transient response (in line transmission systems 21a2-36) |
| 21e-27/30 | . . with provision for recording characteristics, e.g. by plotting Nyquist diagram |

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| **21e-29/00** | **Arrangements for measuring or indicating electric quantities not covered by groups 21e-19/00 to 21e-27/00** |
| 21e-29/02 | . Measuring pulse characteristics e.g. deviation from pulse flatness, rise time, duration (of amplitude 21e-19/00; of repetition rate 21e-23/00; phase difference of two cyclic pulse trains 21e-25/00; monitoring pulses 21a1-36/24) |
| 21e-29/04 | . Measuring form factor, i.e. quotient of root-mean-square value and arithmetic mean of instantaneous value; Measuring peak factor, i.e. quotient of maximum value and root-mean-square value |
| 21e-29/06 | . Measuring depth of modulation |
| 21e-29/08 | . Measuring electromagnetic field characteristics |
| 21e-29/10 | . . Radiation diagrams of aerials |
| 21e-29/12 | . Measuring electrostatic fields |
| 21e-29/14 | . . Measuring field distribution |
| 21e-29/16 | . Measuring asymmetry of polyphase networks |
| 21e-29/18 | . Indicating phase sequence; Indicating synchronism |
| 21e-29/20 | . Measuring number of turns; Measuring transformation ratio or coupling factor of windings (calibrating instrument transformers 21e-35/02) |
| 21e-29/22 | . Measuring piezo-electric properties |
| **21e-31/00** | **Arrangements for testing electric properties; Arrangements for locating electric faults** (detecting the presence of an arc or discharge in switches 21c; indicating electrical condition of switchgear or protective devices 21c-27, 21c-40/50, 21c-45/50, 21c-68; indicating condition of fuses 21c-70; testing electric batteries 21k9; testing line transmission systems 21a2-36) |
| 21e-31/02 | . Testing of electric apparatus, lines, and components for short-circuits, discontinuities, leakage, or incorrect line connection |
| 21e-31/04 | . . Testing connections, e.g. of plugs, of non-disconnectable joints |
| 21e-31/06 | . . Testing of electric windings, e.g. for polarity (measuring number of turns, transformation ratio, or coupling factor 21e-29/20) |
| 21e-31/08 | . Locating faults in cables, transmission lines, or networks |
| 21e-31/10 | . . by increasing destruction at fault, e.g. burning-in by using a pulse generator operating a special programme |
| 21e-31/11 | . . using pulse-reflection methods |
| 21e-31/12 | . Testing of articles or specimens of solids or fluids for dielectric strength or breakdown voltage |
| 21e-31/14 | . . Circuits therefor |
| 21e-31/16 | . . Construction of testing vessels; Electrodes therefor |
| 21e-31/18 | . . Subjecting similar articles in turn to test, e.g. go/no-go tests in mass production |
| 21e-31/20 | . . Preparation of articles or specimens to facilitate testing |
| 21e-31/22 | . Testing of discharge tubes; Testing of semiconductor devices |
| 21e-31/24 | . Functional testing of discharge tubes, e.g. of vacuum tubes (during manufacture 21g-13) |
| 21e-31/26 | . . Functional testing of semiconductor devices (measurement of impurity content non-electrically 42l) |
| 21e-31/28 | . Testing of electronic circuits, e.g. by signal tracer |
| 21e-31/30 | . . Marginal testing, e.g. of computers by varying supply voltage |
| **21e-33/00** | **Arrangements or instruments for measuring magnetic variables** |
| 21e-33/02 | . Measuring direction or magnitude of magnetic fields or magnetic flux (measuring direction or magnitude of the earth's field for navigation, surveying or prospecting 42c) |
| 21e-33/04 | . . using the flux-gate principle (21e-33/10 takes precedence) |
| 21e-33/06 | . . using Hall-effect devices (21e-33/10 takes precedence) |
| 21e-33/08 | . . using gyromagnetic resonance (21e-33/10 takes precedence) |
| 21e-33/10 | . . Plotting field distribution |
| 21e-33/12 | . Measuring magnetic properties of articles or specimens of solids or fluids |
| 21e-33/14 | . . Measuring or plotting hysteresis curves |
| 21e-33/16 | . . Measuring susceptibility |
| 21e-33/18 | . . Measuring magnetostrictive properties |

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| **21e-35/00** | **Functional testing or calibrating of apparatus covered by the preceding groups** |
| 21e-35/02 | . of auxiliary devices, e.g. of instrument transformers according to prescribed transformation ratio, phase angle, or wattage rating |
| 21e-35/04 | . of instruments for measuring time integral of power or current |
| 21e-35/06 | . . by stroboscopic methods |

## 21f Electric illumination

### Electric arc lamps

### Electric arc lamps with open arc

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|---|---|
| 21f-1 | with superposed electrodes |
| 21f-2 | with electrodes arranged parallel or obliquely to each other or with particularly shaped electrodes |
| 21f-3 | with several pairs of electrodes |
| 21f-4 | with electrode magazines |

### Electric arc lamps with enclosed arc

| | |
|---|---|
| 21f-5 | Globe sealing and housing structure (21f-20) |
| 21f-6 | Valves for discharging gases and vapours (47g) |
| 21f-7 | Electric arc lamps with special gas filling (tungsten arc lamps 21f-86) |

### Special types of electric arc lamps, searchlights

| | |
|---|---|
| 21f-8 | Incandescent rod and plug arc lamps |
| 21f-9 | Projection and photo-printing lamps (for motion picture projectors 57a-58/01, 57a-58/02; stage illumination 77g-2, 77g-5/06) |
| 21f-10 | Arc lamp searchlights (general 4b-11/01 – 4b-11/12; stage illumination 77g-2, 77g-5/06) |

### Switches and switching devices for electric arc lamps

Connection arrangements, series resistors and choke coils

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|---|---|
| 21f-11 | for single lamps |
| 21f-12 | for several lamps |
| 21f-13 | Disconnecting devices |
| 21f-14 | Short-circuiting devices |
| 21f-15 | Starting and igniting devices |

### Components and accessories for electric arc lamps

| | |
|---|---|
| 21f-16 | Electrode holders and guides |
| 21f-17 | Electromagnets and armatures, glowing, magnets |
| 21f-18 | Damping devices |
| 21f-19 | Economisers, fume exhausting devices, ash collectors, protective screens and frames |
| 21f-20 | Globes and globe closures (21f-5) |
| 21f-21 | Reflectors (general 4b-5/01 – 4b-5/05; 4b-6 – 4b-8) |

### **Hoisting and suspending devices for electric arc lamps** (for incandescent lamps 21f-57 – 21f-59)

| | |
|---|---|
| 21f-22 | Hoisting devices (skeleton and bracket masts 37b-3/01 – 37b-3/03), suspension from transverse wires |
| 21f-23 | Line connections, rope-releasing and catching devices |
| 21f-24 | Guides |

### Adjustment of electric arc lamps

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|---|---|
| 21f-25 | Rack drives |
| 21f-26 | Ropes or chains |
| 21f-27 | Clamping devices |
| 21f-28 | Spindles |

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| 21f-29 | Hydraulic or pneumatic devices |
| 21f-30 | Thermal effect |
| | **Electric incandescent lamps** |
| | **Incandescent bodies, envelopes and bases for electric incandescent lamps** |
| 21f-31 | Carbon filaments and methods for their manufacture |
| 21f-32 | Metal filaments and wires, and methods for their manufacture (7b-6/01) |
| 21f-33 | Incandescent bodies made of second-class conductors, and methods for their manufacture |
| 21f-34 | Incandescent bodies made of carbon or metal in chemical or mechanical combination with other substances, and methods for their manufacture |
| 21f-35 | Incandescent bodies of particular shape and arrangement, e.g. rings, spirals, coils, strips, cables, and methods for their manufacture (for advertising 54h-5) |
| 21f-36 | Devices for the manufacture of incandescent bodies of various kinds (general 7b-5/01) |
| 21f-37 | Incandescent body holders and interconnection or connection to input leads, and devices and machines for these purposes |
| 21f-38 | Particular shapes and designs of glass envelopes, e.g. bulbs, balls, tubes (manufacture of bulbs and frosting, cl. 32) |
| 21f-39 | Lead wires, methods and devices for fusing, cementing and the like in the glass envelope (21g-13/07) |
| 21f-40 | Evacuation, filling, sealing and base assembling for electric incandescent lamps, lamps with special gas filling (21g-13/30) |
| 21f-41 | Rebuilding, calibrating and clearing by combustion |
| 21f-42 | Prevention and elimination of film, binding of the residual gases, getters (for electric-discharge lamps 21f-82/06; 21g-13/31) |
| 21f-43 | Base permanently fixed to glass envelope |
| 21f-44 | Detachable bases |
| | **Sockets for electric incandescent lamps** (21g-13/05) |
| 21f-45 | Ordinary sockets |
| 21f-46 | Special sockets, e.g. adjustable sockets and sockets with automatic cut-out or change-over switches, or fuses |
| 21f-47 | Sockets for ceiling rosettes, canopies, and similar illumination devices |
| 21f-48 | Sockets and fasteners for electric incandescent lamps for illumination and similar purposes, e.g. for tubular lamps |
| 21f-49/01 | Watertight and acid-proof sockets and fittings |
| 21f-49/02 | Sockets with electric shock protection |
| 21f-49/50 | Fastening of leads to sockets |
| 21f-51/01 | Sockets with devices for the prevention of loosening of electric incandescent lamps |
| 21f-51/02 | Sockets with devices for the prevention of unauthorised removal of electric incandescent lamps, theft prevention |
| 21f-52 | Non-interchangeable sockets |
| | **Reflectors, globes and wire guards for electric incandescent lamps** (general 4b-5/01 – 4b-5/05; 4b-6 – 4b-8) |
| 21f-53 | Externally mounted reflectors, rigidly fastened to glass envelope |
| 21f-54 | Detachable reflectors |
| 21f-55 | Shade holders |
| 21f-56 | Globes and wire guards |
| | **Suspension devices for electric incandescent lamps** (arc lamps 21f-22 – 21f-24; general 4a-24 – 4a-31) |
| 21f-57 | Swinging and elastic suspensions |
| 21f-58 | Adjustable, rotatable and flexible supporting arms and stands, fastenings therefor |

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| 21f-59 | Rope suspensions, rope hoists and cable winders, rope relievers |
| | **Electric incandescent lamps with current supply** |
| 21f-60/01 | Pocket, hand, pedestal standing and vehicle lamps with accessories |
| 21f-60/02 | Mine and other explosion-proof lamps |
| 21f-60/03 | Lamps with current-generating machines (structure of the machine 21d1) |
| | **Electric incandescent lamps without current supply** |
| 21f-61/01 | Portable and mobile lamps, e.g. pedestal and hand lamps with accessories, such as cable winders and switches |
| 21f-61/02 | Stationary lamps, such as wall and suspended lamps, explosion-proof lamps and accessories (stage illumination 77g-2, 77g-5/06) |
| 21f-61/03 | Floodlights for the illumination of vehicles, roads, work areas, display windows, signs and the like, floodlight arrangements for particular light distribution, amplification and colouring (headlights for motor vehicles, when modified by, or modifying the structure and operation of the mo tor vehicle 63c-62, 63c-65, 63c-66; stage illumination 77g-2, 77g-5/06; searchlights, general 4b) |
| | **Devices for the regulation and replacement of incandescent lamps** |
| 21f-62 | Multiple incandescent bodies in one incandescent lamp with manual switching devices |
| 21f-63 | Resistors, transformers, choke coils and capacitors |
| 21f-64 | Manual changeover switches for connecting substitute lamps |
| 21f-65 | Automatic changeover switches for connecting substitute lamps or incandescent bodies |
| 21f-66 | Automatic cut-off switches, fuses and short-circuiting devices |
| 21f-67 | Devices for cleaning, inserting and removing incandescent lamps |
| | **Nernst lamps** |
| 21f-68 | Nernst lamps with permanently connected heaters |
| 21f-69 | Manual ignition |
| 21f-70 | Automatic ignition by means of electric arc |
| 21f-71 | Automatic ignition by means of electric heating elements, e.g. electromagnetic, thermal, pneumatic and other switches |
| 21f-72 | Electric heating elements |
| 21f-73 | Series resistors |
| 21f-74 | Globes, sockets, and the like |
| 21f-75 | Circuits, e.g. connections to carbon filament lamps |
| | **Electrodes for arc lamps and methods for their manufacture; accessories** |
| 21f-76 | Ordinary homogeneous and cored carbon |
| 21f-77 | Flame carbon, carbide electrodes, etc. |
| 21f-78 | Metal electrodes |
| 21f-79 | Incandescent bodies |
| 21f-80 | Ignition strips and the like for starting and attachments for extinguishing the electric arc, also indication of electrode consumption |
| 21f-81 | Devices for the manufacture of electrodes, presses, furnaces, etc. (21f-36; 80c) |
| | **Electric discharge lamps** (discharge devices, general 21g-12/01 – 12g-14) |
| 21f-82/01 | Enclosure shapes, materials and electrode grouping in discharge lamps with positive column and arc (glow discharge tubes for advertising purposes 54h-2/01 – 54h-5; for therapeutic purposes 21g-26/01, 21g-26/02; for dairy products 53e; for the sterilisation of water 85b-1/25) |
| 21f-82/02 | Devices filled with gases, vapours and gas-vapour mixtures |
| 21f-82/03 | Electrodes, oxide electrodes (21g-13/02 – 21g-13/04) |
| 21f-82/04 | Device closures and electrode lead-ins, e.g. seals (21f-39; 21g-13/07; 21g-14/11; 32b-10; 32b-17/06; 32b-27/04 also quartz seals) |

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| 21f-82/05 | Special arrangements for controlling the path of the discharge |
| 21f-82/06 | Additional inclusion substances for gas purification and for preventing the blackening of the walls, e.g. getters (21f-42; 21g-13/31; 21g-17/04) |
| | Control of light colour |
| 21f-83/01 | by switching operations, current variations |
| 21f-83/02 | by simultaneous activation of several gases and/or vapours |
| 21f-83/03 | by means of light filters, coloured coatings, envelopes and luminescent materials |
| 21f-83/04 | by connecting discharge lamps together or with incandescent bodies and incandescent lamps, also for the achievement of daylight effect |
| 21f-84/01 | Starter arrangements |
| 21f-84/02 | Operating devices |
| 21f-85 | Cathode glow lamps (for television purposes 21a1-32; for sound film purposes 57a-71; for advertising purposes 54h-5) |
| 21f-86 | Tungsten arc lamps |
| 21f-87 | Lamps and searchlights with electric discharge lamps as light source (stage illumination 77g-2, 77g-5/06) |
| | **Other light sources without electric discharge** |
| 21f-88 | Devices for generating light by exciting light-emitting substances with radioactive rays (4b-17) |
| 21f-89/01 | Devices for generating light by exciting electroluminescent substances and manufacture of such devices |
| 21f-89/02 | Use of special electroluminescent substances (production of luminescent dyes 22f-15) |
| 21f-89/03 | Use of electroluminescent semiconductors |
| 21f-89/04 | Use of transparent electrical conductors as electrodes |
| 21f-89/05 | Use of embedding material for luminescent bodies |
| 21f-90 | Devices for generating light by exciting fluorescent substances |

## 21g General electrical accessory devices and methods, except electrochemical devices and methods: magnets, automatic circuit breakers, capacitors, valves, discharge tubes, X-ray apparatus, equipment for electro-and radio-therapy, photocells

### Electric coils, electromagnets, circuit breakers, capacitors, valves, discharge tubes

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|---|---|
| 21g-1/01 | Winding machines for electric coils (7b-5; 7d-2; 21c-7; 76d-1-13) |
| 21g-1/02 | Electric coils, structure and insulation (21a1-20; 21a2-30; 21a3-61; 21a4-68; 21c-5; 21c-54; 21d1-51 – 21d1-54; 21d2-49; 21d2-53; 21d2-55; 21f-11; 21f-12; 21f-63; 21g-4; 21g-6) |
| 21g-2/01 | Direct-current electromagnets in general (21a1-20; 21a3-61; 21c-58; 21d1-11; 21d1-28; 21d1-29; 21d1-45; 21d1-51; 21f-17; 21g-3; 21g-4; 21g-7; 35b-6; 49c-31) |
| 21g-2/02 | Alternating-current electromagnets in general (21a1-1; 21d2-48; 21d2-55; 21g-4) |
| 21g-3 | Electromagnetic drives (49g-3; 83b; 87b-3) |
| 21g-4/01 | Electromagnetic relays for direct current in general (railroad relays 20i-29; telegraph relays 21a1-20; telephone relays 21a3-61; remote-control relays 21c-45, 21c-58; line safety relays 21c-68) |
| 21g-4/02 | Electromagnetic relays for alternating current in general, frequency relays (21a1-9; 21a3-61; 21c-64; 21e-7; 21g-2; 21g-15) |
| 21g-4/03 | Induction relays (21e-15; 21e-27; 42o-16) |
| 21g-4/04 | Thermal relays (21c-40; 21h-13) |
| 21g-4/05 | Relays of various kinds (21a2-1/04) |
| 21g-4/06 | Light relays (photoelectric cells 21g-29; for sound film 42g-9/02; for picture transmission 21a1-32/50; other domains of application 21c-45/10; 42h-34/06; 74a-21; 74d-8) |

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| 21g-4/07 | Light valves, light modulators (picture converters 21g-29/40; for sound film 42g-9/02; for picture transmission 21a1-32; for light telephony 74d-8) |
| 21g-5 | Devices for magnetising and demagnetising (83a-86; 83c-8) |
| 21g-6 | Induction coils and spark coils (21d2-49; 21g-24) |
| 21g-7 | Automatic electromagnetic circuit breakers (21a3-63; 21g-24; 46c3-19) |
| 21g-7/01 | Automatic electromagnetic circuit breakers (for selectors of telecommunication equipment 21a3-63; for converters 21g-15; for ignition-current generators 46c3-19) |
| 21g-7/02 | Electrical arrangements and construction details of electrical devices for frightening animals, in particular for utilisation in pasture fences (mechanical section 45h-3/00) |
| 21g-7/03 | Electrical arrangements and construction details of electric fish-catching equipment (mechanical section 45h-79/02) |
| 21g-7/04 | Electrical arrangements and construction details of electric devices in connection with harpoons for fish catching (mechanical section 45h-81/02) |
| 21g-8 | Automatic electrolytic and mercury circuit breakers (21c-33) |
| 21g-9 | Motor circuit breakers (21g-15) |
| 21g-10/01 | Electric capacitors with variable capacitance |
| 21g-10/02 | Electric capacitors with constant capacitance, machines for manufacture (8f-3/01; 8f-4; 21c-2; 21c-3/01; 21c-3/05; 21c-10/04; 21c-18/01; 21e-27/01; 21g-11/02; 54c-1 – 54c-4; 55c-2; 55e-7/03; 55f-12/01; 55f-13) |
| 21g-10/03 | Electrolytic capacitors; machines for manufacture (21g-8; 21g-10/02; 21g-11/01; 40c-3; 40c-1/02; 48a-1/03; 48a-1/04; 48b-11/01 – 48b-11/20; 48d-1; 48d-2/10 – 48d-2/20; 48d-4/02; 55f-12/01; 55f-12/10; 55f-13/01; 55f-13/10; 55f-13/20) |
| 21g-10/04 | Electrolytes for electrolytic capacitors (12d-1/04; 12d-1/05; 12h-1; 12h-4; 12o-5; 12o-19/03; 12q; 21b-23/03; 21b-24/02; 21b-25/04; 21g-10/03; 21g-11/01) |
| 21g-10/05 | Electrical capacitors with a dielectric, whose dielectric constant changes in dependence of the applied voltage and/or temperature, capacitors with permanently polarisable dielectric, ferroelectric capacitors, electrets (21c2; 21g-11/02; 21a1-36/16; 21a1-37/40; 21a1-37/44; 21a1-37/52; 21a4-10; 80b-8/13) |
| 21g-11/01 | Electrolytic valves (circuits 21d2-12/02) |
| 21g-11/02 | Dry rectifiers (circuits 21c-50; 21d2-12/02), semiconductor structural elements as rectifiers, transistors or the like |
| 21g-11/03 | Electric valves of various kinds, such as spark-gap rectifiers, arc converters, colloid rectifiers, thermal rectifiers, magnetic rectifiers (circuits 21d2-12/02) |
| 21g-12/01 | Discharge tubes with self-sustained discharge, general structures, electrodes, gas filling, glow tubes as tuning indicators (21a1-32; 21c-35/08; 21f-81 – 21f-85; 21g-13; 21g-14; 21g-26; electron tubes for the optical indication of the magnitude of voltages or currents 21g-13/60) |
| 21g-12/02 | Discharge tubes with self-sustained discharge and hot cathode (21f-82; 21g-13; 21g-26) |
| 21g-12/03 | Discharge tubes as in 21g-12/01, 21g-12/02 with electrostatic and magnetic control (21g-13; 21g-14/27) |
| 21g-12/04 | Operating circuits for tubes as in 21g-12/01 – 21g-12/03 in general (21a4-29; power line connection devices 21a4-35/10 – 21a4-35/18) |
| | Electron tubes (X-ray tubes 21g-17) |
| 21g-13/01 | Anodes and special arrangement of the electrode system |
| 21g-13/02 | Directly heated glow cathodes (21f-82/03; 21g-12/02; 21g-13/24) |
| 21g-13/03 | High-emission cathodes with direct heating; emissive layers for glow cathodes and secondary electrodes (21f-82/03; 21g-12/02; 21g-13/24) |
| 21g-13/04 | Indirectly heated cathodes (21f-82/03; 21g-12/02; 21g-13/24) |
| 21g-13/05 | Bases, sockets and holders for tubes, classified in 21g-12, 21g-13 (21f-45 – 21f-52) |
| 21g-13/06 | Grids: structures, manufacture and arrangement in the electrode system (21g-12/03) |
| 21g-13/07 | Seals, lead-throughs, hermetic connections (21f-39; 21f-82/04; 21g-14/11; 32b-10) |
| 21g-13/08 | Shields, coatings on electrodes and device walls |
| 21g-13/09 | Materials for envelopes and electrodes of electron tubes (21f-82/01) |

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| 21g-13/10 | Electrode holders (21g-12/03) |
| 21g-13/11 | Cooling (21g-14/14; 21g-17/03) |
| 21g-13/12 | Tubes with metallic envelopes |
| 21g-13/13 | Multiple-grid tubes and grid arrangements for the creation of a virtual cathode (21a4-15) |
| 21g-13/14 | Multiple-system tubes (21a4-29/07) |
| 21g-13/15 | Special control devices (external control, mechanical, magnetic and other types of control |
| 21g-13/16 | Magnetrons |
| 21g-13/17 | Short-wave and ultrashort-wave tubes (21a4-9; 21a4-29/50) |
| 21g-13/18 | High-voltage tubes (21g-17/01), rectifier tubes (21g-12; 21g-14) |
| 21g-13/19 | Tubes with electron multiplication (secondary emission) (21g-29/20) |
| 21g-13/20 | Discharge tubes with autoelectronic discharge |
| | Cathode-ray tubes in which focused electrons are used (21a1-32/35; 21a1-32/54; 21e-11/12; 42g-9/01; for irradiation purposes 21g-21/01) |
| 21g-13/21 | Envelope and electrode structures, electrode arrangement |
| 21g-13/22 | Devices for spatial or temporal concentration of cathode rays in cathode-ray tubes (21a1-32/35; 21a1-32/54; 21e-11/12; 21g-35) |
| 21g-13/23 | Ray-deflecting devices (21a1-32/54; 21a1-35/20; 21a1-35/21; 21e-28/02) |
| 21g-13/24 | Cathodes (21a1-32/54; 21g-13/02 – 21g-13/04) |
| 21g-13/25 | Structure and arrangement of the luminescent screens and structure of the glow screens in Braun tubes (21a1-32/54; 21e-11/12; chemical composition 57b-12/07) |
| 21g-13/26 | Multiple-cathode-ray tubes (21a1-32/54; 21e-11/12) |
| 21g-13/27 | Cathode-ray tubes for amplification purposes |
| 21g-13/28 | Additional structural arrangements in cathode-ray tubes, such as protection from implosion, enclosing devices for photographic material, carrying cases for Braun tubes |
| 21g-13/29 | Lenard tubes |
| 21g-13/30 | Degassing of discharge tubes classified in 21g-13 only (mercury vapour pumps 27d-3/01, 27d-3/02; de-aeration of incandescent lamps 21f-40; de-aeration of X-ray tubes 21g-17/04) |
| 21g-13/31 | Gettering of discharge tubes classified in 21g-13 only (21f-42; 21f-82/06; 21g-17/04) |
| 21g-13/32 | Electron tubes with gas filling for the elimination of space charges |
| 21g-13/40 | Operating circuits for tubes, classified in 21g-13/01 – 21g-13/29 only, in general (power line connection devices 21a4-35/10 – 21a4-35/30) |
| 21g-13/50 | Testing instruments for tubes classified in 21g-13/01 – 21g-13/29 only (21a4-71) |
| 21g-13/60 | Electron tubes for the optical indication of the magnitude of voltages or currents (tuning indicators) structural design of the tube only (glow tube as tuning indicators 21g-12/01; tuning indicators operating according to the measuring-instrument principle 21a4-70; circuitry for tuning indicators 21a4-29/01) |
| 21g-13/70 | Television receiver tubes |
| 21g-13/72 | Television display tubes |
| 21g-13/74 | Colour television receiver tubes |
| 21g-13/76 | Colour television display tubes |
| | **Structural arrangement of metal vapour converters with metal vapour producing cathode and auxiliary devices concerning their internal operation, permitting the utilisation of these metal vapour discharge tubes in converter circuits** |
| 21g-14/01 | Arrangement and structure of the vessel, general |
| 21g-14/05 | Cathode structure |
| 21g-14/08 | Anode structure |
| 21g-14/11 | Electrode lead-ins and vessel sealing |
| 21g-14/14 | Temperature regulation |
| 21g-14/17 | Vacuum preservation |

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| 21g-14/20 | Ignition devices and circuits |
| 21g-14/27 | Control devices |
| 21g-14/31 | Arc-back prevention and elimination |
| 21g-14/35 | Devices and circuits of general type for maintaining and facilitating the operation |
| 21g-15/01 | Vibrating converters for the transformation of alternating current into direct current and of direct current into alternating current |
| 21g-15/02 | Rotary converters (alternating-current converter machines 21d2-12, 21d2-45; DC-DC converters 21d1-24) |
| 21g-16 | Utilisation of atmospheric and earth electricity (for plant growth 45f-5/02, 45f-5/05, 45f-7/04) |
| | **Methods and devices for the generation and application of X-rays, electron and ion rays, as well as rays of nuclear origin** |
| 21g-17/01 | Structure of X-ray tubes in general (holding devices and accessories 30a-6/04) |
| 21g-17/02 | Cathodes and anti-cathodes for X-ray tubes |
| 21g-17/03 | Cooling of X-ray tubes |
| 21g-17/04 | Generation and control of vacuum in X-ray tubes (21g-13/30; 21g-13/31) |
| 21g-17/10 | X-ray tubes with relatively movable focus spot |
| | **Measuring methods and devices for X-rays, electronic and ionic rays, and for rays o f nuclear origin** (X-ray spectrometers 42h-20/02; measuring, controlling and supervising methods and devices for nuclear reactors 21g-21/31) |
| 21g-18/01 | Intensity measurement and dosimetry based on ionisation effects, ionisation chambers, counter tubes (counter tubes for optical light 21g-29/20) |
| 21g-18/02 | Intensity measurement and dosimetry based on other phenomena, e.g. photoelectric, photographic, chemical, thermic, fluorescence and absorption phenomena (photoelectric cells 21g-29) |
| 21g-18/10 | Methods and devices for measuring electrical magnitudes in the generation and application of X-rays and corpuscular rays (general measuring of electric currents 21e) |
| 21g-19/01 | General operating circuits for the production of fluoroscopic pictures and X-ray photographs, also for the determination of foreign bodies and for material testing (electron-optical picture converters 21g-29/40; mechanical structure 30a-6; testing of materials 42k-46/07; optical analysis by means of X-rays 42l-3/08; devices for X-ray photography, electrical art excluded, 57a-7/10 – 57a-7/13; devices for X-ray motion-picture photography, electrical art excluded, 57a-56; photographic methods 57b-12/08; X-ray photographic materials 57b-8/06; fluorescent screens and intensifying screens 57b-12/07) |
| 21g-19/02 | Electric devices for shifting from X-ray fluorescopy to X-ray photography |
| 21g-19/03 | Exposure meters, electrical operation only, miliampere-second relays (mechanically operating exposure clocks 57a-7/12) |
| 21g-20/01 | General operation circuits for X-ray systems, components, assembly of X-ray devices |
| 21g-20/02 | Circuits for high-frequency operations |
| 21g-20/03 | Rectifier circuits (21d2-12; 21d2-14; 21d2-45; 21g-15) |
| 21g-20/04 | Manual adjustment and regulation of operation conditions |
| 21g-20/05 | Automatic regulation of operation conditions |
| 21g-20/06 | Overload protection, voltage surge protection |
| 21g-20/10 | Protective covers and housings for X-ray tubes for the prevention of shock and irradiation (other mechanical shock-preventing devices 30a-6/01, 30a-6/02, 30a-6/04; other irradiation-preventing devices, also directly in contact with the human body 30a-6/07; chemical radiation protection materials 30i-10) |
| 21g-20/11 | Electric devices for protection against shocks in X-ray installations (general 21c-68/70) |
| 21g-20/15 | X-ray filters and safety filter arrangements (diaphragms for the elimination of damaging rays and compression diaphragms 30a-6/05, 30a-6/06; diaphragms for the elimination of picture-clouding effects 57a-7/13) |

21g-21/01 Methods and devices for the generation and application of electronic and ionic rays, electrophysical relationships only (devices for the multiple acceleration of electrically charged particles 21g-36; cathode-ray tubes 21g-13/21 – 21g-13/29; electron and ion microscopes 21g-37)

21g-21/10 Irradiation; achieving nuclear reactions with beams obtained in connection with nuclear reactions, e.g. radioactive rays and neutron beams, if the electro-physical conditions are of interest (extraction of radioactive substances 40a 51; production of radioactive compounds 12m-9; radioactive pharmaceuticals 30h-2; radioactive dressings 30d-21; containers for radioactive substances 30g-6/02; radioactivation of water 85a-5; devices for inhalation of activated gases 30k-12/10; baths for gasified, including radioactive, liquids 30f-9/01; gas baths, including those with activated gas 30f-10/05; radioactive baths 30h-11; photographic processes 57a-7/01 – 57a-7/13 and 57b-12/01 – 57b-12/08; analytical methods 42b-3/01 – 42b-3/55; investigation of materials 42k-46/07, measuring 21g-18)

**Methods and devices for the generation and application of rays of nuclear origin, and for bringing about and utilising atomic-nucleus reactions, nuclear events only**

21g-21/10 General methods and devices for bringing about nuclear reactions

21g-21/11 Production of radioactive isotopes (extraction of natural radioactive metals 40a-11/01 – 41a-11/14, 40a-18/01 – 40a-51, 40a-11/00 – 40a-61/00; natural radioactive compounds 12m-9, 12n-10; physical and physicochemical methods for the separation of isotopes, general, 12e-6; special methods and devices in the classes and groups in which are separated on the basis of identity of physical or physiochemical principles solid, liquid or gaseous materials, e.g. by diffusion 12e-3/04; for analytical purposes 42l-3/09; chemical and physicochemical methods for the preparation of pure synthetic radioisotopes, in the special classes)

21g-21/12 Irradiation preparations and devices, insofar as no technological problems of other classes are concerned (radioactive medicines 30h-2/01; radioactive bandages 30d-21; devices for the introduction of radioactive preparations into body cavities 30k-19/01; pharmaceutical receptacles for radioactive substances 30g-6/02; radioactivation of water 85a-5; radioactive bath preparations 30h-11/03; bathing apparatus for radioactive liquids 30f-9/01; inhalation devices for radioactive gases 30k-12/10; radioactive gas baths 30f-10/05; geophysical methods and devices 21g-30/04

21g-21/13 Methods and devices for radiography by means of nuclear radiation (by means of X-rays 21g-19/01; photographic apparatus 57a-7/01 – 57a-7/13; photographic methods 57b-12/01 – 57b-12/08; fine-structure investigation 42h-20/02, 42l-3/08; material testing by means of nuclear radiation 42k-46/07; thickness-measuring devices 42b-11, 42b-12/03)

21g-21/20 Structure and operation of nuclear fission reactors; fuel elements; reactor accessories

21g-21/21 Structure and operation of nuclear fusion reactors

21g-21/22 Details of heat-generating nuclear reactors (heat exchangers 17e, 17f; heat pumps, general 24n-1)

21g-21/24 Details of nuclear reactors for feeding of steam-power drives (steam generation, general 13a – 13g; steam-power engines and plants 14a – 14h)

21g-21/26 Details of nuclear reactors for the feeding of other heat engines (combustion engine drives, general 46a – 46f)

21g-21/28 Details of nuclear reactors for the feeding of reaction drives (reaction drives, general 46g; for projectiles 72d-19/01; for aircraft 62b-37/01 – 62b-37/04)

21g-21/30 Direct conversion of nuclear into electric energy

21g-21/31 Processes and devices for measuring, monitoring and controlling nuclear reactors (radiation measurement engineering 21g-18/01 – 21g-18/02)

21g-21/32 Nuclear radiation protection, nuclear conditions only (X-ray radiation protection 21g-20/10 and 30a-6/07; material for radiation protection 32b and 80b; structural arrangements for radiation protection 37a-7/01; structural elements for radiation protection 37b-6; means for treatment of radiation damages 30h; radiation-protection chemicals 30i-10; materials for chemical defence and protection against chemical warfare agents 61b)

21g-21/33 Disposal and recovery of radioactive waste (disposal and neutralisation of radioactive waste water 85c; purification of contaminated drinking and general-purpose water 85b)

### Electrotherapy, magnetotherapy and phototherapy, treatment with infrared and ultraviolet rays

21g-22/01 Electric belts and bands for galvanotherapy without special current source, treatment by static electricity

21g-22/02 Electric belts and bands for galvanotherapy using special current sources (21g-24/01)

21g-23/01 Electrodes for galvanotherapy, faradisation, etc. (21g-22; 21g-24; 30f-8)

21g-23/02 Electrodes for high-frequency therapy, surgical diathermy (21g-24; 30a-13)

21g-23/03 Brushes and combs for electrotherapy (9b-13; 30f-8)

21g-24/01 Apparatus and circuits for galvanotherapy, faradisation, induction apparatus also for electric anesthesia of the human body (21g-6; 21g-7)

21g-24/02 Equipment for high-frequency therapy, radio-interference suppression in electrotherapeutical apparatus (21a4-1/01 – 21a4-9; 21a4-22; 21a4-76; 21g-23)

21g-25 Hydroelectric bath equipment (30f-11)

21g-26/01 Light bath apparatus, irradiation equipment and reflectors for phototherapy (hot-air baths 30f-10; heating devices 30d-25)

21g-26/02 Irradiation lamps and other radiation sources for phototherapy (21f-1 – 21f-4; 21f-82; 21f-83; 21f-85; 21f-86; 21g-12; 21h-1; 21h-2; irradiation lamps for liquids 85b-1; for dairy products 53e; irradiation of plants 45f-5, 45f-7/00, 45f-7/04, 45f-7/06)

21g-26/03 Measuring and controlling devices used in phototherapy (21g-18)

21g-27 Magnetotherapy

21g-28/01 Equipment for Roentgen therapy of electrical nature only (mechanical structure 30a-6)

**Photoelectric cells** (for photometry 42h-17/01 – 42h-19, for sound motion picture 42g-9/05; for picture transmission and television 21a1-32/22, 21a1-32/40, 21a1-32/41, 21a1-32/54; light relays 21g-4/08; for X-ray measurements 21g-18/01 – 21g-18/10; for signal reception 74d-8/02)

21g-29/01 Photoconductive cells

21g-29/10 Barrier layer photoelectric cells, radiation-sensitive crystal detectors, Becquerel cells

21g-29/20 Photocells with external photoelectric effect, counter tubes with photo cathode (counter tubes for radiation measurements 21g-18/01), photocells with secondary electron multiplication (secondary electron multiplier 21g-13/19)

21g-29/30 Photoelectrodes and mosaic electrodes for image converters and amplifiers (mosaic electrodes for television transmission tubes 21a1-32/40; for television receiving tubes 21a1-32/54)

21g-29/40 Electron-optical image converters and amplifiers (electron telescopes) photoelectric electron multipliers (light modulators, light valves 21g-4/07)

### Other auxiliary devices and methods

21g-30/01 Detection of hidden matter by electromagnetic means, with grounded electrodes

21g-30/02 Geo-electric methods with inductive current supply

21g-30/03 Geo-electric methods with electric waves (21a4-48/63)

21g-30/04 special geological exploration methods, e.g. by means of atmospheric electricity, geomagnetism, radioactivity (21e-5; 42c-42 – 42c-44)

21g-30/10 Detection of hidden metallic objects, e.g. ships, pipes, etc. by electromagnetic methods (65b-19)

21g-31/01 Permanent magnets (alloys 18d-2/10; 18c; 40b-14; 40b-19/00; heat treatment 18c; 21d1-9; 40d; 46c3-9)

21g-31/02 Magnetic materials for weak fields (alloys 18d-2/10; 18c; 40b-14; 40b-19/00; heat treatment 18c-8; 21c-5/20; 40d)

21g-31/03 Dust cores (12n-1; 21c-5/23; 21d2-48; 49l-3)

21g-32 Electric contacts, materials and structures, when not intended for special purposes (21c-21; 21c-28; 21c-35/09; 21c-40/52; 46c3-19)

21g-33 Neutralisation of static electricity in textile fabrics (in conveyor belts 81e-2)

21g-34 Electric wave filters in general (21a1-7; 21a1-9; 21a1-27/01; 21a2-30; 21a2-41; 21a4-22/02; 21a4-29/04; 21d2-43)

21g-35 Miscellaneous other not specifically mentioned auxiliary devices and methods

21g-36 Devices and methods for the generation of accelerated electrically charged particles, e.g. canalray tubes, cyclotrons, multiple accelerators (arrangements for irradiation by corpuscular radiations 21g-21/01, 21g-21/12)

Equipment and methods for enlarged reproduction of objects by means of electrically charged corpuscular rays based on the electron-optic principle (equipment for irradiation by corpuscular rays 21g-21/01, 21g-21/12; methods and devices of general type for obtaining pictures by physical-optical methods, e.g. X-ray microscopy, micro-radiography, optical reproduction based on the diffraction principle 42h-38; geometrical and optical design of reproducing systems 42h-1/01 – 42h-9)

21g-37/01 Electron microscopes and other corpuscular-radiation microscopes

21g-37/10 Components for corpuscular-radiation microscopes, e.g. enclosures and slides for specimens

21g-37/20 Electron-optical image reproduction devices, such as lenses, mirrors

21g-38 Arrangements and methods for generation of electric relaxation oscillations, general, e.g. sawtooth generators, multivibrators and the like 21a1-35/21; 21e-28/02; 51f-2/03; 74d-8/04; 74d-8/54; 83d-5)

**21g-39/00 Photoelectric devices in which a photosensitive component with internal photoelectric effect is optically and/or electrically coupled to an electric light source** (electric light sources 21f; electroluminescent light sources and semiconductor light sources 21f-89/90; photo resistors 21g-29/01; photo transistors and photo diodes 21g-29/10; light relays 21g-4/06; logic circuits 21a1-36/18; electronic pulse memories 21a1-36/14; electric stores 42t1; DC amplifiers and photocell amplifiers 21a2-18/02)

21g-39/02 . with control of the light source by the photosensitive component; solid state image converters, image amplifiers or image memories (for X-ray photography, insofar as connected with the operation of the X-ray tube 21g-19/01; electro-optic image amplifiers 21g-29/40; solid state image displays for television purposes 21n7; cathode ray displays 21g-13/25; photosensitive bases with fluorescent layers 57b-1/92; optical amplifiers, lasers 21g-53/00; electroluminescent light sources 21f-89; light valves, light modulators 21g-4/07)

21g-39/04 . with control of the photosensitive component by the light source for converting electrical input to electrical output; "Lumistors" (light telegraphy and light telephony 74d-8)

21g-41/00 Solid state devices for amplifying or switching in general, e.g. dielectric triodes (semiconductor devices for switching and amplifying for which potential barriers, e.g. pn-junctions, are of interest 21g-11/02; solid state devices employing superconductivity 21g-35; opto-electronic elements for switching or amplifying 21g-39/04; resistors 21c-54, 21c-55; capacitors 21g-10; electrolytic valves and switches 21g-11/01)

21g-51/00 Devices for generating, amplifying, modulating, demodulating, frequency conversion or frequency stabilisation of electromagnetic waves by utilising stimulated emission of radiation, so called "maser" effect

**21g-53/00 Devices for generating, amplifying, modulating, demodulating, frequency conversion or frequency stabilisation of phase coherent electromagnetic waves in the optical range by using stimulated emission, so called "laser" effect; optical transmitter or amplifiers** (for measuring rotation speed, e.g. gyroscopes, 42o-13/03; broadcasting using light only 74d-8/01, 74d-8/02; modulation of light outside the light source 21g-4/07; monochromators 42h-20/01)

21g-53/02 . Structure of the optical resonator (optical adjustments 42h-34/13)

21g-53/04 . Selection of materials for the emitter
21g-53/06 . . Solid state materials
21g-53/08 . . . Semiconductor materials (electroluminescence diodes 21f-89/03)
21g-53/10 . . Liquid materials
21g:53/12 . . Gaseous materials (gas discharge light sources in general 21f-82)
21g-53/14 . for modulation (controlled light sources for sound recording 42t1-7; electric image communication and television 21n7; controlling the position and direction of a light spot 42r2-3/02)
21g-53/16 . for demodulation
21g-53/18 . for frequency conversion

21g-61/00 Methods and devices for generating and influencing gaseous plasmas, in particular of gas discharge plasmas, in general (for nuclear fusion 21g-21/21; for working of metal 49l-1/30; for melting 21h-16; for crystallisation in general 12c-2; for production of single crystals or doped semiconductor material 12g-17/00; for coating in general 75c-22/01, for plasma propulsion 88e-1/02, for lighting 21f-82; for test tunnels in general 42k-20)

21g-71 Hall-generators (use of Hall-generators in special classes, e.g. 21a4-14; resistors sensitive to magnetic fields 21c-54/05)

21g-81 Parametrons (use of parametrons in special classes, e.g. 21a1-36/18, 42m3-7/00)

## 21g4 (IPC: G21F) Protection against X-radiation, gamma radiation, corpuscular radiation, or particle bombardment; Decontamination arrangements; Treating radioactively-contamined waste material

(in cosmonautic vehicles 62d; combined with a reactor 21g-21/32; combined with X-ray tubes 21g-20/10; combined with X-ray apparatus 21g-20/01)

**21g4-1/00 Shielding characterised by the composition of the material**
21g4-1/02 . Selection of uniform shielding materials
21g4-1/04 . . Concretes; Other hydraulic hardening materials
21g4-1/06 . . Ceramics; Glasses; Refractories (cermets 21g4-1/08)
21g4-1/08 . . Metals; Alloys; Cermets, i.e. sintered mixtures of ceramics and metals
21g4-1/10 . . Organic substances; Dispersions in organic carriers
21g4-1/12 . Laminated shielding materials

**21g4-3/00 Shielding characterised by its physical form, e.g. granules, or shape of the material**
21g4-3/02 . Clothing (protective garments in general 3b-13/00)
21g4-3/04 . Bricks; Shields made up therefrom

**21g4-5/00 Transportable or portable shielded containers**
21g4-5/02 . with provision for restricted exposure of a radiation source within the container
21g4-5/04 . . Means for controlling exposure, e.g. time, size of aperture

**21g4-7/00 Shielded cells or rooms** (protection against radiation from external sources 37a-1/96; 37f-9/00; doors, windows 37g1-5/18)
21g4-7/02 . Observation devices permitting vision but shielding the observer, e.g. window, periscope (optical systems per se 42h)
21g4-7/04 . Shielded glove-boxes
21g4-7/06 . Structural combination with remotely-controlled apparatus, e.g. with manipulators (remote control in general 42r)

**21g4-9/00 Decontamination arrangements; Treating radioactive waste material**
21g4-9/02 . Treating gaseous waste
21g4-9/04 . Treating liquid waste
21g4-9/06 . . Processing (separating different isotopes of the same chemical element 12e-6)
21g4-9/08 . . . by evaporation; by distillation
21g4-9/10 . . . by flocculation
21g4-9/12 . . . by absorption; by adsorption; by ion-exchange
21g4-9/14 . . . by incineration; by calcination, e.g. desiccation

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| 21g4-9/16 | . . . by fixation in stable solid media |
| 21g4-9/18 | . . . by biological processes |
| 21g4-9/20 | . . Disposal of liquid waste |
| 21g4-9/22 | . . . by storage in a tank or other container |
| 21g4-9/24 | . . . by storage in the ground; by storage under water, e.g. in ocean |
| 21g4-9/26 | . . . by dilution in water, e.g. in ocean, in stream |
| 21g4-9/28 | . Treating solid waste |
| 21g4-9/30 | . . Processing (separating different isotopes of the same chemical element 12e-6) |
| 21g4-9/32 | . . . by incineration |
| 21g4-9/34 | . . Disposal of solid waste |
| 21g4-9/36 | . . . by packaging; by baling |

## 21h Methods and devices for electric heating, cooking, melting, welding and soldering

### Electric heating and cooking appliances, electric heat generation only

| | |
|---|---|
| 21h-1 | Electric heating conductors, compositions (alloy compositions 18d, 40b; refining 18c, 21c-1/01, 21c-54; 40d) |
| 21h-2/01 | Plate-shaped heating elements |
| 21h-2/02 | Bar-shaped heating elements |
| 21h-2/03 | Electrically heated fabrics, heating pads, gloves, shoes, suits, hats and other clothes (for medical treatment 30d-25/01 – 30d-25/03) |
| 21h-3/01 | Electrically heated vessels (34l-1/01 – 34l-9/03) |
| 21h-3/02 | Electric coffee machines (34l-7/01 – 34l-7/04) |
| 21h-4/01 | Electric hot plates |
| 21h-4/02 | Electric cooking ranges (36b) |
| 21h-4/03 | Electric baking ovens and hoods (2a-2/10; 34l-10/01; 34l-10/03; 34l-11/01) |
| 21h-4/04 | Electric waffle irons |
| 21h-4/05 | Electric toasters (34l-10/04) |
| 21h-5 | Electric immersion heaters |
| 21h-6 | Electric water boilers, in particular flow heaters (36e-7) |
| 21h-7 | Electrode heating of liquids, and electric steam generation |
| 21h-8 | Electric flat irons (8d-21/06) |
| 21h-9/01 | Electric air heaters (for medical purposes 30f-10/01; for hair treatment 33c-6/17; for drying the body 34k-4/10) |
| 21h-9/02 | Electric radiators with reflectors |
| 21h-9/03 | Electric furnaces and heating systems, electric water-heating elements, regenerative furnaces |
| 21h-10/01 | Electric curling tongs (33c-1/01) |
| 21h-10/02 | Electrically heated devices for curling tongs (33c-1/02; 33c-2/01) |
| 21h-10/03 | Electrically heated hair curlers (33c-3/19; 33c-3/23; 33c-3/24; flat hair curlers with internal electric heating 33c-3/25) |
| 21h-10/04 | Electrically heated combs (21g-23/03; 33c-3/04; 33c-6/30; 33c-7/03) |
| 21h-10/05 | Electrically heated branding irons and punches |
| 21h-10/06 | Electrically heated rolls |
| 21h-10/07 | Electrical sealing melters |
| 21h-10/08 | Other electrically heated appliances (for therapy 30d-25/01 – 30d-25/03) |
| 21h-11/01 | Electric soldering irons with resistance heating (49h-28/01 – 49h-28/04) |
| 21h-11/02 | Electric soldering irons with electric-arc heating |
| 21h-12 | Induction-heated cooking and heating appliances (devices for induction-heated furnaces 21h-18) |

### Automatic switching and control devices for electric cooking and heating appliances (42i; 42q)

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| 21h-13/01 | actuated by variation in position due to heat of the heating device, by power absorbed, heating time, etc. (21c, 4001, 4002) |

21h-13/10 with solid, liquid or gaseous materials expanding under heat (21c-40/05; 21c-46/50 – 21c-46/54; 21c-69)
21h-13/11 with elements melting under heat (21c-70)
21h-13/12 with contact thermometers (42i)
21h-13/13 with resistances varying under heat
21h-13/14 incorporated in plugs (21c)
21h-13/15 mounted in supports
21h-13/16 for electric flat irons (8d)
21h-13/17 for water heaters (36e, 503-50s)

**Electric devices for electric furnaces used to produce annealing and melting temperatures** (electric furnaces for the chemical industry 12; for iron metallurgy 18; for foundry 31a; for the glass industry 32a; for metallurgy 40; for earthenware 80)

21h-14 Equipment for resistance-heated furnaces in which the heated material is included in the electric circuit

Equipment for resistance furnaces heated by means of special elements

21h-15/01 Solid, bar, strip, or wire-type elements (21h-2/01; 21h-2/02)
21h-15/02 Granular material elements
21h-15/03 Liquid material elements
21h-15/50 Devices for fastening the heating elements on or in the furnace wall (21h-2/01; 21h-2/02)
21h-15/60 Devices for temperature control of electric resistance furnaces (21h-13/01 – 21h-13/17)

Furnace heating by electric discharge

21h-16/01 Devices for feeding and controlling the electric arc in electric arc furnaces
21h-16/30 Arrangement of electrodes in furnaces directly heated by electric arc
21h-16/50 Arrangement of electrodes in furnaces indirectly heated by electric arc
21h-16/60 Devices and processes for heat in furnaces by glow discharge, electric arc-type discharge or electronic bombardment (chemical surface treatment by glow discharge 18c-3, 18c-1/38, 48b-11/00, 48d-4)

Arrangements for electric induction furnaces with iron core

21h-18/01 with open melting trough
21h-18/02 with closed melting trough
21h-18/03 for start and regulation
21h-18/10 Arrangement and structure of coils for coreless induction furnaces
21h-18/15 Switching and control systems for coreless induction furnaces
21h-18/20 Devices for induction furnaces with special induction-heated heating element
21h-18/30 Devices for furnaces in which the material is heated in an electric or magnetic field

21h-19 Devices for furnaces with mixed heating

**Accessories for electric furnaces, when the structure is determined by the electric processes in the production of annealing or melting temperatures**

21h-20/01 Fixed electrodes (12h-2; 12i-33; 12i-31/02; 21b-7/01; 21c-55/01; 21f-76 – 21f-81)
21h-20/05 Continuous electrodes
21h-21/01 Sockets, current supply leads and connections for electrodes
21h-21/05 Supporting and holding devices for electrodes
21h-22 Devices for connecting electrodes
21h-23 Devices for sealing, cooling and guiding electrodes

Devices for adjusting electrodes

21h-24/01 with electric control of the adjusting device (21h-30/17)

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| 21h-24/05 | with hydraulic control of the adjusting device (21h-30/17) |
| 21h-25 | Electric devices for rotating, pivoting or tilting electric furnaces, other electrical accessories |
| | **Electric heating of metals, particularly applications to cutting, welding or soldering** (electric soldering irons 21h-11; soldering and welding 49h-25 – 49h-37; welding seam gages 42b; welding seam testing 42k) |
| 21h-29/01 | Resistance heating |
| 21h-29/02 | Resistance heating of strip-shaped bodies in continuous process (18c-6 – 18c-9) |
| 21h-29/03 | Heating by induction or eddy currents |
| 21h-29/04 | Heating of rivets (riveting machines 49g-13 – 49g-17) |
| 21h-29/05 | Branding |
| 21h-29/06 | Cutting, electric severing with electric-resistance heating |
| | Pressure welding |
| 21h-29/10 | Resistance butt welding |
| 21h-29/11 | Resistance spot welding |
| 21h-29/12 | Resistance seam welding |
| 21h-29/13 | Resistance fusion welding |
| 21h-29/14 | Resistance end-on welding |
| 21h-29/15 | Resistance welding of nonferrous metals |
| 21h-29/16 | Resistance welding of dissimilar metals |
| 21h-29/17 | Welding tongs and mobile welding apparatus |
| 21h-29/18 | Electrodes for resistance welding units |
| 21h-29/19 | Cooling devices for resistance welding units |
| 21h-29/20 | Circuit arrangements for resistance welding units |
| 21h-29/30 | Induction welding |
| 21h-30/01 | Electric-arc heating |
| 21h-30/02 | Electric-arc cutting |
| | Fusion welding by means of electric arc |
| 21h-30/10 | Joint welding |
| 21h-30/11 | Building up welding |
| 21h-30/12 | Welding in protective gas atmosphere |
| 21h-30/13 | Separate generation of starting voltage, e.g. high-frequency superposition |
| 21h-30/14 | Magnetic control of the electric are (21f-17) |
| 21h-30/15 | Protective circuits |
| 21h-30/16 | Electrodes (21f-76 – 21f-79; 21f-81; 49h-36/01) |
| 21h-30/17 | Automatic feed of workpiece and electrode |
| 21h-30/18 | Electrode holders and protection shields |
| 21h-31 | Heating of metals, particularly welding and soldering by the electrolytic process |
| 21h-32/01 | Combined electric welding methods |
| 21h-32/02 | Ohmic and inductive resistors for electric welding units (21f-11; 21f-12) |
| 21h-32/03 | Welding transformers, choke coils (21d2-48 – 21d2-55) |
| 21h-32/04 | Welding current generators, particularly circuits for generators and converters (DC welding current generators 21d1-27 – 21d1-39; AC generators 21d2-1 – 21d2-14) |
| 21h-32/10 | Welding of pipes (7b-7) |
| 21h-32/11 | Welding of rail ties and joints (19a-26) |
| 21h-32/12 | Welding of wire gratings, wires, and saw blades (wire gratings 7d-6 ) |

**Heat treatment of dielectrics in electric fields, particularly application to heating, drying, shaping and welding**

21h-35 Methods related to the type and manner of electric heat generation (methods of welding rubber and plastics, class 39a-9, 39a-19, 39a2-19/00; methods of drying wood-type materials 38h-1/02, 38k-4; drying -methods, general 82a)

21h-36 Devices in which the structure is determined by electric processes in the heat treatment of dielectric materials (mechanical structure of sewing-machine type 52a-61/20; other cases, see special classes)

Measurement and regulation

21h-37/01 Electric magnitudes related to the current source utilised for heat treatment

21h-37/02 Other magnitudes determining the heat treatment

21h-38 Electrode arrangements

21h-39 Electrode structures

## 21k9 (IPC: H01M) Batteries; Accumulators (electrochemical processes or apparatus in general 12h)

**Note**
**This subclass deals with galvanic primary or secondary cells or batteries, and fuel cells or batteries.**

**Details of primary or secondary cells or batteries**

**21k9-1/00 Constructional details or processes of manufacture of the non-active parts**

21k9-1/02 . Cases; Lids or covers; Lead-ins; Selection of sealing materials therefor

21k9-1/04 . Mountings; Suspension devices; Shock absorbers; Transport or carrying devices

21k9-1/06 . Vent plugs or other arrangements for facilitating escape of gases

21k9-1/08 . Methods or devices for converting or absorbing gases evolved in the interior or the cases (separation of gases by absorption per se 12e-3/03)

**21k9-3/00 Separators; Diaphragms**

21k9-3/02 . characterised by the material

21k9-3/04 . characterised by the shape

**21k9-5/00 Battery or cell connections or terminals** (electrode connections for primary cells 21k9-13/10; for secondary cells 21k9-35/32; connection of electric conductors 21d)

21k9-5/02 . Methods or arrangements for affording protection against corrosion; Selection of materials therefor

21k9-5/04 . with provision for preventing undesired use or discharge

**21k9-7/00 Arrangements for filling, topping-up, or emptying cases with or of liquid, e.g. for filling with electrolytes, for washing-out**

21k9-7/02 . with external circulating path

**21k9-9/00 Rendering electrolytes in primary or secondary cells or batteries non-fluid or less fluid** (solidifying liquids in general 12c-3)

21k9-9/02 . by absorption

21k9-9/04 . by thickening, e.g. by use of gels

**Primary cells or batteries**

**21k9-11/00 Selection of materials as electrolytes for primary cells** (selection of materials for use as electrolytes in general 12h)

**21k9-13/00 Electrodes for primary cells**

21k9-13/02 . Carbon electrodes with or without sheathing, e.g. dollies

21k9-13/04 . . Apparatus or processes specially adapted for manufacturing

21k9-13/06 . Metal electrodes

21k9-13/08 . . Apparatus or processes specially adapted for manufacturing

21k9-13/10 . Electrode connections (battery or cell connections 21k9-5/00)

**21k9-15/00** **Means or methods for depolarisation in primary cells** (by heating, moving, brushing, or cleaning electrodes 21k9-31/02)
21k9-15/02 . using gaseous depolarisers
21k9-15/04 . using liquid depolarisers
21k9-15/06 . using solid depolarisers

**21k9-17/00** **Primary cells with one electrolytic liquid**
21k9-17/02 . with light-metal electrodes (standard cells 21k9-17/04)
21k9-17/04 . Standard cells
21k9-17/06 . . Cells which may be de-activated after use by separating electrolyte from electrode, e.g. bichromate cells de-activated by turning-over or by raising electrode

**21k9-19/00** **Primary cells with two electrolytic liquids** (cells with a mixture of one electrolyte and a liquid depolariser 21k9-17/00)

**21k9-21/00** **Dry primary cells**
21k9-21/02 . Cells with exchangeable parts
21k9-21/04 . Cells with electrodes shaped as plates, ribbons, or discs
21k9-21/06 . Cells with cup-shaped or tubular electrodes
21k9-21/08 . Inert cells
21k9-21/10 . . for activation by adding electrolytes
21k9-21/12 . . for activation by adding non-electrolytes, e.g. water, to form the electrolyte in the cell
21k9-21/14 . . for activation by heating

**21k9-23/00** **Primary batteries**
21k9-23/02 . consisting of cells with liquid electrolyte
21k9-23/04 . consisting of stacked-plate dry cells, e.g. anode batteries
21k9-23/06 . consisting of cup-shaped or tubular dry cells, e.g. for pocket lamps
21k9-23/08 . having bipolar electrodes common to adjacent cells
21k9-23/10 . with easily exchangeable cells

**21k9-27/00** **Fuel cells or batteries, i.e. arrangements for continuously converting chemicals into electricity through electrochemical reactions and in which the reactants may be supplied continuously from outside**
21k9-27/02 . Details
21k9-27/04 . . Electrodes; Selection of catalytic agents
21k9-27/06 . . . Non-porous electrodes permitting diffusion of specified gases, e.g. palladium membrane for diffusion of hydrogen
21k9-27/08 . . . Raney-type electrodes
21k9-27/10 . . . using noble-metal catalysts, e.g. using platinum (21k9-27/06 takes precedence)
21k9-27/12 . . Auxiliary appliances, e. g for control of pressure, for circulation of fluids
21k9-27/14 . Functional combination of fuel element with means for production of reactants or for treatment of residues (regeneration 21k9-27/26; production of reactants in general Section B, Section C)
21k9-27/16 . having solid self-supporting electrolyte, e.g. using CaO in $ZrO_2$, using glass
21k9-27/18 . . with the cell operating at ambient temperature
21k9-27/20 . using fused salt electrolytes
21k9-27/22 . having aqueous electrolyte operating at elevated temperature and elevated pressure, e.g. above 200 °C
21k9-27/24 . Biochemical fuel cells, i.e. cells in which micro-organisms function as catalysts
21k9-27/26 . Regenerative fuel cells
21k9-27/28 . Indirect fuel cells, i.e. in which at least one chemical reaction occurs before the cell functions as a fuel cell, e.g. Redox cell (21k9-27/26 takes precedence)
21k9-27/30 . in which the fuel is not based on compositions only comprising carbon and/or oxygen and/or hydrogen

**21k9-29/00** **Other cells or batteries dependent on chemical processes for generating electricity** (thermal cells 21k9-21/14, fuel cells or batteries 21k9-27/00)
21k9-29/02 . in which only one reactant is supplied from outside the cell, e.g. air depolarisation cell

21k9-29/04 . . with consumable electrodes, e.g. of zinc (depolarisation in primary cells 21k9-15/00)

**21k9-31/00 Special methods or arrangements for operating or servicing primary cells or batteries**

21k9-31/02 . Heating, moving, brushing, or cleaning electrodes or other parts
21k9-31/04 . Measuring, testing, or indicating the state of cells or batteries (measuring electric values 21e)

**21k9-33/00 Regenerating primary cells or batteries; Working-up waste products of primary cells or batteries**

**Secondary cells or batteries; Accumulators**

**21k9-35/00 Electrodes or plates for accumulators; Apparatus or processes for the manufacture thereof**

21k9-35/02 . characterised by the active material or carrier material
21k9-35/04 . characterised by shape or form
21k9-35/06 . . Plates with large surface and without separate active material, e.g. Planté plate
21k9-35/08 . . Grid or frame plates, i.e. grids or frames supporting separate active material
21k9-35/10 . . Wires strips, meshes, or the like supporting the active material
21k9-35/12 . . Tubes, capsules, trays, or other containers holding the active material
21k9-35/14 . . . enclosing a grid, frame, rod, or other core
21k9-35/16 . . Shapes other than plane or cylindrical, e.g. helical
21k9-35/18 . characterised by process of manufacture (performing single operations or combinations of metal-working operations, see the relevant classes for the operation or operations)
21k9-35/20 . . Casting of electrodes; Trimming of cast electrodes
21k9-35/22 . . Rolling or pressing of electrodes
21k9-35/24 . . Roughening of electrodes
21k9-35/26 . . Pasting of electrodes; Drying of pasted plates (drying after activating 21k9-35/30)
21k9-35/28 . . Sintering of electrodes
21k9-35/30 . . Activating or forming of electrodes; Drying or preserving of electrodes after activating or forming
21k9-35/32 . Electrode connections (battery or cell connections 21k9-5/00)

**21k9-37/00 Assembling a group of activated or formed accumulator electrodes; Relative spatial arrangements of electrodes of opposite polarity in accumulators, e.g. rolled, zigzagged**

**21k9-39/00 Lead accumulators; Construction or manufacture thereof**

21k9-39/02 . Suspending or supporting electrodes or separators in the case
21k9-39/04 . Selection of materials as electrolytes
21k9-39/06 . with bipolar electrodes

**21k9-41/00 Semi-lead accumulators, e.g. lead-zinc; Construction or manufacture thereof**

21k9-41/02 . Selection of materials as electrolytes

**21k9-43/00 Non-lead accumulators; Light metal accumulators, e.g. alkaline; Construction or manufacture thereof**

21k9-43/02 . Zinc or silver accumulators
21k9-43/04 . Nickel, iron, cobalt, or cadmium accumulators
21k9-43/06 . Selection of materials as electrolytes

**21k9-45/00 Special methods or arrangements for operating or servicing accumulators**

21k9-45/02 . Cleaning, cooling, or heating of accumulators or parts thereof
21k9-45/04 . Charging of accumulators; Accumulators structurally combined with charging apparatus (circuits for charging 21c-51)
21k9-45/06 . Measuring, testing, or indicating state of accumulators, e.g. level or density of the electrolyte (measuring electric values 21e, liquid level meters 42e-30 – 42e-36; measuring of density 42l-1 – 42l-2)

**21k9-47/00** **Regeneration of accumulators; Working-up waste products of accumulators**

**21n7** **(IPC: H04N) Pictorial communication; Television** (measuring, testing 42; systems for autographic writing, e.g. writing telegraphy, which involve following an outline 74, 21a1-2; transferring signals by relative movement between record track and a transducer 21g-29; broadcast distribution and the recording of use made thereof 21a4, 42g)

**Notes:**
**1. This subclass deals with the transmission of pictures and/or their transient or permanent reproduction either locally or remotely, by methods involving both the following steps:**
**Step (a):**
**the scanning of a picture, i.e. the analysis of the whole of a picture-containing area by resolving it into an area or a plurality of areas of which at least one of the two dimensions is elemental, simultaneously or in a sequence, and the derivation in response thereto of a picture-representative electric signal;**
**Step (b):**
**the reproduction of the whole of a picture-containing area by the reproduction in response to a picture-representative electric signal of an area or a plurality of areas of which at least one of the two dimensions is elemental, simultaneously or in sequence.**
**2. In this subclass, "pictorial communication systems" are those systems for the transmission and reproduction of arbitrarily composed pictures in which the local light variations composing a picture are not subject to variation with time, e.g. documents (both written and printed), maps, charts, photographs (other than cinematograph films).**
**3. In this subclass, "television systems" are those systems for the transmission and reproduction of arbitrarily composed pictures in which the local light variations composing a picture may change with time, e.g. natural "live" scenes, recordings of such scenes such as cinematograph films.**
**4. This subclass includes circuits specially designed for dealing with television or pictorial communication signals, as distinct from merely signals of a particular frequency range.**
**5. This subclass does not include the following subject matter:**
**(i) Circuits or other parts of systems which form the subject of other subclasses, which are dealt with in the corresponding subclasses, e.g. 21a.**
**(ii) Systems in which legible alphanumeric or like character forms are analysed according to Step (a) to derive an electric signal from which the character is recognised by comparison with stored information, which are dealt with in 42m6.**
**(iii) Systems for the direct photographic copying of an original picture in which an electric signal representative of the picture is derived according to Step (a) and employed to modify the operation of the system, which are dealt with in 57.**
**(iv) Systems for the reproduction according to Step (b) of pictures comprising alphanumeric or like character forms but involving the production of the equivalent of a signal which would be derived by Step (a), e.g. by cams, punched card or tape, coded control signal, or other means, which are dealt with in the subclass for the application, e.g. 42d, 42m, 21a.**

**(v) Systems involving Step (a) and/or Step (b) for producing (1) engraved, indented, apertured, or otherwise formed printing surfaces, or (2) photographs specially arranged for producing such printing surfaces or for use generally in printing or duplication, which are dealt with in 57d.**
**(vi) Systems involving Step (a) and/or Step (b) but otherwise specially modified for printing or duplication, which are dealt with in such subclasses as 15k or 57.**
**(6) Systems for the reproduction according to Step (b) of pictures comprising alphanumeric or like character forms and involving the generation according to Step (a) of picture-representative electric signals from a pre-arranged assembly of such characters, or records thereof, forming an integral part of the systems, are dealt with in the subclass for the application, e.g. 42, 21n7.**

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| **21n7-1/00** | **Pictorial communication, e.g. facsimile transmission** |
| 21n7-1/02 | . System details, e.g. signal generator, signal reproducer |
| 21n7-1/04 | . . Scanning arrangements |
| 21n7-1/06 | . . . using cylindrical picture-bearing surfaces |
| 21n7-1/08 | . . . . Mechanisms for mounting or holding the sheet around the drum |
| 21n7-1/10 | . . . using flat picture-bearing surfaces |
| 21n7-1/12 | . . . using the sheet-feed movement as the slow scanning component |
| 21n7-1/14 | . . . . using a rotating endless belt carrying the scanning heads |
| 21n7-1/16 | . . . . using a rotating helical element |
| 21n7-1/17 | . . . with sampling speed dependent on the image content |
| 21n7-1/18 | . . . arranged for simultaneous transmission of separate parts of one picture |
| 21n7-1/20 | . . . arranged for simultaneous transmission of two or more separate pictures |
| 21n7-1/22 | . . Recording or reproducing arrangements, e.g. scanning head (recording or reproducing in general 42t1) |
| 21n7-1/24 | . . . Details of scanning heads, e.g. electrode, marker, light-source carriage |
| 21n7-1/26 | . . . involving production of an intermediate record |
| 21n7-1/28 | . . . . Magnetic record |
| 21n7-1/30 | . . . . Electrostatic record |
| 21n7-1/32 | . Circuits or arrangements for control or supervision between transmitter and receiver |
| 21n7-1/34 | . . for coin-freed systems |
| 21n7-1/36 | . . for synchronising or phasing transmitter and receiver |
| 21n7-1/38 | . Circuits or arrangements for blanking or otherwise eliminating unwanted parts of pictures |
| 21n7-1/40 | . Picture signal circuits |
| 21n7-1/42 | . Systems for two-way working |
| 21n7-1/44 | . Secrecy systems |
| 21n7-1/46 | . Colour picture communication systems |
| **21n7-3/00** | **Scanning details of television systems** |
| 21n7-3/02 | . by optical-mechanical means only |
| 21n7-3/04 | . . having a moving aperture |
| 21n7-3/06 | . . having a moving lens or other refractor |
| 21n7-3/08 | . . having a moving reflector |
| 21n7-3/10 | . by means not exclusively optical-mechanical |
| 21n7-3/12 | . . by switched stationary formation of lamps, photocells, or light relays |
| 21n7-3/14 | . . by means of electrically scanned solid-state devices |
| 21n7-3/16 | . . by deflecting electron beam in cathode-ray tube (producing sawtooth waveforms 21a1) |
| 21n7-3/17 | . . . using semiconductor devices |
| 21n7-3/18 | . . . Generation of supply voltages e.g. of e.h.t. from deflection waveforms |
| 21n7-3/19 | . . . Producing sawtooth waveforms in connection with the deflection circuit |
| 21n7-3/20 | . . . Prevention of damage to cathode-ray tubes in event of failure of scanning |
| 21n7-3/22 | . . . Circuits for controlling dimensions, shape or centring of picture on screen (control of sawtooth generators 21a1) |
| 21n7-3/24 | . . . Blanking circuits |

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| 21n7-3/26 | . . . Modifications of scanning arrangements to improve focusing (focusing circuits in general 21g) |
| 21n7-3/28 | . . Producing multiple scanning, i.e. using more than one spot at the same time |
| 21n7-3/30 | . . otherwise than with constant velocity or otherwise than in pattern formed by unidirectional, straight, substantially horizontal or vertical lines |
| 21n7-3/32 | . . . Velocity varied in dependence upon picture information |
| 21n7-3/34 | . . . Elemental scanning area oscillated rapidly in direction transverse to main scanning direction |
| **21n7-5/00** | **Details of television systems** (scanning details 21n7-3/00) |
| 21n7-5/02 | . Conversion of standards |
| 21n7-5/04 | . Synchronising |
| 21n7-5/06 | . . Generation of synchronising signals |
| 21n7-5/08 | . . Separation of synchronising signals from picture signals |
| 21n7-5/10 | . . . Separation of line synchronising signal from frame synchronising signal |
| 21n7-5/12 | . . Separator rendered responsive only during predetermined intervals, e.g. flywheel synchronising |
| 21n7-5/13 | . . Synchronisation systems |
| 21n7-5/14 | . Picture signal circuitry, e.g. crispening, aperture distortion correction |
| 21n7-5/16 | . . Circuitry for reinsertion of direct-current and slowly varying components of signal; Circuitry for preservation of black or white level |
| 21n7-5/18 | . . . by means of "clamp" circuit operated by switching circuit |
| 21n7-5/19 | . . Circuitry for compensating for variations in the brightness of the object |
| 21n7-5/191 | . . . by influencing the recording apparatus |
| 21n7-5/193 | . . . by influencing the image signal |
| 21n7-5/20 | . . Circuitry for controlling amplitude response, e.g. gamma control |
| 21n7-5/21 | . . Circuitry for suppressing or minimising disturbance |
| 21n7-5/211 | . . . in the recording apparatus, e.g. Moiré, halo |
| 21n7-5/213 | . . . during transmission, e.g. disturbing pulses or frequencies |
| 21n7-5/215 | . . . in the display device, e.g. geometry errors, lens errors |
| 21n7-5/22 | . . Studio circuit, e.g. mixing, switching, inlay fade-over |
| 21n7-5/24 | . Studio equipment, e.g. arrangement of television cameras (studio equipment in general 77g) |
| 21n7-5/26 | . . Television cameras (optical systems 42h; tubes 21g) |
| 21n7-5/28 | . . Mobile studios |
| 21n7-5/30 | . Transforming light or analogous information into electric information (scanning details 21n7-3/00; light-transforming elements 21a4, 21g) |
| 21n7-5/32 | . . Transforming X-rays |
| 21n7-5/33 | . . Transforming other non visible radiation |
| 21n7-5/34 | . . Circuit details for pick-up tubes |
| 21n7-5/36 | . . in flying-spot scanners |
| 21n7-5/38 | . Transmitter circuitry (picture signal circuitry in general 21n7-5/14) |
| 21n7-5/40 | . . Modulation circuits |
| 21n7-5/42 | . . for transmitting at will black-and-white or colour signals |
| 21n7-5/43 | . Converters |
| 21n7-5/44 | . Receiver circuitry (picture signal circuitry in general 21n7-5/14) |
| 21n7-5/45 | . . HF and IF amplifiers, demodulators |
| 21n7-5/46 | . . for receiving on more than one standard at will |
| 21n7-5/48 | . . for the picture signals |
| 21n7-5/50 | . . . Tuning indicators; Automatic tuning control |
| 21n7-5/52 | . . . Automatic gain control |
| 21n7-5/54 | . . . . for positively-modulated picture signals |
| 21n7-5/56 | . . . . for negatively-modulated picture signals |
| 21n7-5/58 | . . . Picture characteristics, e.g. brightness, controlled in dependence upon ambient light (21n7-5/52 takes precedence) |
| 21n7-5/59 | . . Remote control |
| 21n7-5/60 | . . for the sound signals |
| 21n7-5/62 | . . . Intercarrier circuits, i.e. heterodyning sound and vision carriers |
| 21n7-5/63 | . . Protection circuits, e.g. light spot suppression |
| 21n7-5/64 | . Constructional details of receivers, e.g. cabinets, dust covers (furniture aspects 34i, e.g. 34i-81/06) |

21n7-5/645 . . Mounting of picture tube on chassis or in housing
21n7-5/65 . . Holding-devices for protective discs or for picture masks
21n7-5/655 . . Construction or mounting of chassis, e.g. for varying the elevation of the tube
21n7-5/657 . . Line deflection transformators
21n7-5/66 . Transforming electric information into light information (scanning details 21n7-3/00)
21n7-5/68 . . Circuit details for cathode-ray display tubes
21n7-5/70 . . Circuit details for electroluminescent devices
21n7-5/72 . Modifying the appearance of television pictures by optical filters or diffusing screens (optical filters or diffusing screens per se 42h)
21n7-5/74 . Projection arrangements for image reproduction, e.g. using eidophor (optical systems in general 42h)
21n7-5/741 . . Light modulators for eidophor processes
21n7-5/76 . Television signal recording (recording in connection with measuring 42d; information storage 42t1, 42t2)
21n7-5/78 . . using magnetic recording
21n7-5/80 . . using electrostatic recording
21n7-5/82 . . . using deformable thermoplastic recording medium
21n7-5/84 . . using photographic recording
21n7-5/86 . . . with film moved continuously
21n7-5/88 . . . with film moved intermittently
21n7-5/94 . Film scanning

**21n7-7/00 Television systems** (21n7-9/00 takes precedence; details 21n7-3/00, 21n7-5/00)

21n7-7/02 . Monitoring arrangements
21n7-7/04 . Systems for the transmission of one television signal, i.e. both picture and sound, by a single carrier
21n7-7/06 . Systems for the simultaneous transmission of one television signal, i.e. both picture and sound, by more than one carrier
21n7-7/08 . Systems for the transmission of more than one television signal simultaneously or sequentially, the signals occupying wholly or partially the same frequency band
21n7-7/10 . Adaptations for transmission by cable (21n7-7/12 takes precedence)
21n7-7/12 . Systems in which the picture signal is transmitted via one channel or a plurality of parallel channels, the bandwidth of each channel being less than the bandwidth of the picture signal (by special scanning 21n7-3/00)
21n7-7/14 . Systems for two-way working
21n7-7/16 . Secrecy systems; Subscription systems
21n7-7/18 . Closed-circuit television systems, i.e. systems in which the signal is not broadcast
21n7-7/181 . . Wire television (colour wire television 21n7-9/43)
21n7-7/183 . . Industrial television (industrial colour television 21n7-9/32)

**21n7-9/00 Colour television; Stereoscopic television; Details thereof**

21n7-9/02 . Colour television systems (21n7-9/60 takes precedence)
21n7-9/04 . . Picture signal generators
21n7-9/06 . . . with one pick-up
21n7-9/08 . . . with more than one pick-up tube
21n7-9/10 . . . using mechanical scanning means only
21n7-9/12 . . Picture reproducers
21n7-9/14 . . . using mechanical scanning means only
21n7-9/16 . . . using cathode ray tubes
21n7-9/18 . . . . using separate electron beams for the primary colour signals
21n7-9/20 . . . . . with more than one beam in a tube
21n7-9/22 . . . . using the same gun for more than one primary colour information
21n7-9/24 . . . . . using means, integral with, or external to, the tube, for producing signal indicating instantaneous beam position
21n7-9/26 . . . . . using electron-optical colour selection means, e.g. line grid, deflection means in or near the gun or near the phosphor screen
21n7-9/27 . . . . Projection devices for displaying colour pictures
21n7-9/28 . . . . Arrangements for convergence or focusing
21n7-9/29 . . . . Demagnetising
21n7-9/30 . . . using solid-state colour display devices

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| 21n7-9/32 | . . Transmission systems characterised by the manner in which the individual colour signals are combined |
| 21n7-9/34 | . . . using sequential signals (dot sequential systems 21n7-9/36) |
| 21n7-9/36 | . . . using simultaneous signals |
| 21n7-9/38 | . . . . in which one signal, modulated in phase and amplitude, conveys colour information and a second signal conveys brightness information, e.g. NTSC system |
| 21n7-9/40 | . . . using simultaneous and sequential signals, e.g. SECAM system |
| 21n7-9/42 | . . . . in which simultaneous signals are converted into sequential signals or vice versa |
| 21n7-9/43 | . . . Wire colour television |
| 21n7-9/44 | . . Colour synchronisation |
| 21n7-9/46 | . . . using sub-carrier bursts; using carrier bursts |
| 21n7-9/48 | . . Colour-killing; Colour gain control |
| 21n7-9/49 | . . Adjusting hue, saturation, white balance, brightness, contrast |
| 21n7-9/50 | . . Circuits for synchronous modulators and demodulators; Circuits for matrixing |
| 21n7-9/52 | . . . for matrixing |
| 21n7-9/53 | . . Circuits for modifying the colour signals by gamma correction |
| 21n7-9/54 | . Stereoscopic television systems; Details thereof (21n7-9/60 takes precedence) |
| 21n7-9/56 | . . Picture signal generators |
| 21n7-9/58 | . . Picture reproducers |
| 21n7-9/60 | . Stereoscopic colour television systems |
| 21n7-9/62 | . Colour film scanners |
| 21n7-9/64 | . Devices for measuring and testing |