

SECTION G — PHYSICS

G02 OPTICS

G02B OPTICAL ELEMENTS, SYSTEMS, OR APPARATUS (G02F takes precedence; optical elements specially adapted for use in lighting devices or systems thereof F21V 1/00-F21V 13/00; measuring-instruments, see the relevant subclass of class G01, e.g. optical rangefinders G01C; testing of optical elements, systems, or apparatus G01M 11/00; spectacles G02C; apparatus or arrangements for taking photographs or for projecting or viewing them G03B; sound lenses G10K 11/30; electron and ion "optics" H01J; X-ray "optics" H01J, H05G 1/00; optical elements structurally combined with electric discharge tubes H01J 5/16, H01J 29/89, H01J 37/22; microwave "optics" H01Q; combination of optical elements with television receivers H04N 5/72; optical systems or arrangements in colour television systems H04N 9/00; heating arrangements specially adapted for transparent or reflecting areas H05B 3/84) **[1, 7]**

Note(s)

- In this subclass, the following terms or expressions are used with the meanings indicated:
 - "simple lens or prism" means a single lens or prism;
 - "compound lens or prism" means an optical member, the constituents of which either are close together without air-space or (except in group G02B 11/00) are "in broken contact", i.e. with the air-space between the constituents having no essential optical influence;
 - "objective" means a lens or an optical system designed to produce a real image of a real object;
 - "eyepiece" means a lens or an optical system designed to produce a virtual image for viewing by the eye or by another optical system;
 - "front" or "rear" is determined by looking from the more distant conjugate.
- Attention is drawn to the Notes following the titles of class B81 and subclass B81B relating to "micro-structural devices" and "micro-structural systems".

Subclass index

OPTICAL ELEMENTS

Characterised by their structure: lenses; light guides; other elements.....3/00, 6/00, 5/00
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OPTICAL SYSTEMS

General structure: number and arrangements of optical components.....9/00, 11/00
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STRUCTURAL DETAILS OF ARRANGEMENTS COMPRISING LIGHT GUIDES AND OTHER

OPTICAL ELEMENTS.....6/00

OPTICAL APPARATUS

Condensers.....19/00
 Microscopes.....21/00
 Telescopes, periscopes, instruments for viewing the inside of hollow bodies, viewfinders, aiming or sighting devices.....23/00
 Eyepieces, magnifying glasses.....25/00
 Other apparatus.....27/00

CONTROL OF LIGHT.....26/00

MOUNTINGS, ADJUSTING MEANS, LIGHT-TIGHT CONNECTIONS.....7/00

1/00 Optical elements characterised by the material of which they are made (compositions of optical glasses C03C 3/00); **Optical coatings for optical elements**

- 1/02 • made of crystals, e.g. rock-salt, semiconductors (G02B 1/08 takes precedence)
- 1/04 • made of organic materials, e.g. plastics (G02B 1/08 takes precedence)
- 1/06 • made of fluids in transparent cells
- 1/08 • made of polarising materials
- 1/10 • Optical coatings produced by application to, or surface treatment of, optical elements (G02B 1/08 takes precedence)

1/11 • • Anti-reflection coatings **[6]**

1/12 • • by surface treatment, e.g. by irradiation

3/00 Simple or compound lenses (artificial eyes A61F 2/14; spectacle lenses or contact lenses for the eyes G02C; watch or clock glasses G04B 39/00)

3/02 • with non-spherical faces (G02B 3/10 takes precedence)

3/04 • • with continuous faces that are rotationally symmetrical but deviate from a true sphere

3/06 • • with cylindrical or toric faces

3/08 • • with discontinuous faces, e.g. Fresnel lens

- 3/10 • Bifocal lenses; Multifocal lenses
- 3/12 • Fluid-filled or evacuated lenses
- 3/14 • • of variable focal length
- 5/00 Optical elements other than lenses** (light guides G02B 6/00; optical logic elements G02F 3/00) [4]
 - 5/02 • Diffusing elements; Afocal elements
 - 5/04 • Prisms
 - 5/06 • • Fluid-filled or evacuated prisms
 - 5/08 • Mirrors
 - 5/09 • • Multifaceted or polygonal mirrors [6]
 - 5/10 • • with curved faces
 - 5/12 • Reflex reflectors
 - 5/122 • • cube corner, trihedral or triple reflector type [2]
 - 5/124 • • • plural reflecting elements forming part of a unitary plate or sheet [2]
 - 5/126 • • including curved refracting surface [2]
 - 5/128 • • • transparent spheres being embedded in matrix [2]
 - 5/13 • • • plural curved refracting elements forming part of a unitary body [2]
 - 5/132 • • • with individual reflector mounting means [2]
 - 5/134 • • • including a threaded mounting member [2]
 - 5/136 • • plural reflecting elements forming part of a unitary body (G02B 5/124 takes precedence) [2]
 - 5/18 • Diffracting gratings
 - 5/20 • Filters (polarising elements G02B 5/30; filters specially adapted for photographic purposes G03B 11/00)
 - 5/22 • • Absorbing filters
 - 5/23 • • • Photochromic filters [2]
 - 5/24 • • • Liquid filters (G02B 5/23 takes precedence) [2]
 - 5/26 • • Reflecting filters (G02B 5/28 takes precedence)
 - 5/28 • • Interference filters
 - 5/30 • Polarising elements (light-modulating devices G02F 1/00)
 - 5/32 • Holograms used as optical elements (processes or apparatus for producing holograms G03H) [2]
- 6/00 Light guides; Structural details of arrangements comprising light guides and other optical elements, e.g. couplings** [4, 6]
 - 6/02 • Optical fibre with cladding (mechanical structures for providing tensile strength and external protection G02B 6/44) [4, 2006.01]
 - 6/024 • • with polarisation-maintaining properties [2006.01]
 - 6/028 • • with core or cladding having graded refractive index [2006.01]
 - 6/032 • • with non-solid core or cladding [2006.01]
 - 6/036 • • core or cladding comprising multiple layers [2006.01]
 - 6/04 • formed by bundles of fibres (G02B 6/24 takes precedence) [4]
 - 6/06 • • the relative position of the fibres being the same at both ends, e.g. for transporting images [4]
 - 6/08 • • • with fibre bundle in form of plate [4]
 - 6/10 • • of the optical waveguide type (G02B 6/02, G02B 6/24 take precedence; devices or arrangements for the control of light by electric, magnetic, electro-magnetic or acoustic means G02F 1/00; transferring the modulation of modulated light G02F 2/00; optical logic elements G02F 3/00; optical analogue/digital converters G02F 7/00; stores using opto-electronic devices G11C 11/42; electric waveguides H01P; transmission of information by optical means H04B 10/00; multiplex systems H04J 14/00) [4, 2006.01]
 - 6/12 • • of the integrated circuit kind (production or processing of single crystals C30B; electric integrated circuits H01L 27/00) [4]
 - 6/122 • • • Basic optical elements, e.g. light-guiding paths [6]
 - 6/124 • • • • Geodesic lenses or integrated gratings [6]
 - 6/125 • • • • Bends, branchings or intersections [6]
 - 6/126 • • • using polarisation effects [6]
 - 6/13 • • • Integrated optical circuits characterised by the manufacturing method [6]
 - 6/132 • • • • by deposition of thin films [6]
 - 6/134 • • • • by substitution by dopant atoms [6]
 - 6/136 • • • • by etching [6]
 - 6/138 • • • • by using polymerisation [6]
 - 6/14 • • Mode converters [4]
 - 6/24 • Coupling light guides (for electric waveguides H01P 1/00) [4, 5]
 - 6/245 • • Removing protective coverings of light guides before coupling [5]
 - 6/25 • • Preparing the ends of light guides for coupling, e.g. cutting [5]
 - 6/255 • • Splicing of light guides, e.g. by fusion or bonding [5]
 - 6/26 • • Optical coupling means (G02B 6/36, G02B 6/42 take precedence) [4]
 - 6/27 • • • with polarisation selective and adjusting means (polarisation elements in general G02B 5/30; polarisation systems in general G02B 27/28; optical polarisation multiplex systems H04J 14/06) [6]
 - 6/28 • • • having data bus means, i.e. plural waveguides interconnected and providing an inherently bidirectional system by mixing and splitting signals [4]
 - 6/287 • • • • Structuring of light guides to shape optical elements with heat application (G02B 6/255 takes precedence) [6]
 - 6/293 • • • • with wavelength selective means (for optical elements in use, see the relevant subgroups of this subclass; optical wavelength-division multiplexing systems H04J 14/02) [6]
 - 6/30 • • • for use between fibre and thin-film device [4]
 - 6/32 • • • having lens focusing means [4]
 - 6/34 • • • utilising prism or grating [4]
 - 6/35 • • • having switching means (optical switching in general G02B 26/08; by changing the optical properties of the medium G02F 1/00) [6]
 - 6/36 • • Mechanical coupling means (G02B 6/255, G02B 6/42 take precedence) [4, 5]
 - 6/38 • • • having fibre to fibre mating means [4]
 - 6/40 • • • having fibre bundle mating means [4]
 - 6/42 • • Coupling light guides with opto-electronic elements [4]

- 6/43 • • • Arrangements comprising a plurality of opto-electronic elements and associated optical interconnections (light-emissive or light-sensitive semiconductor devices H01L 27/00, H01L 31/00, H01L 33/00; semiconductor lasers monolithically integrated with other components H01S 5/026) [6]
- 6/44 • Mechanical structures for providing tensile strength and external protection for fibres, e.g. optical transmission cables (cables incorporating electric conductors and optical fibres H01B 11/22) [4]
- 6/46 • Processes or apparatus adapted for installing optical fibres or optical cables (installation of cables containing electric conductors and optical fibres H02G) [6]
- 6/48 • • Overhead installation [6]
- 6/50 • • Underground or underwater installation; Installation through tubing, conduits or ducts [6]
- 6/52 • • • using fluid, e.g. air [6]
- 6/54 • • • using mechanical means, e.g. pulling or pushing devices [6]
- 7/00 Mountings, adjusting means, or light-tight connections, for optical elements**
- 7/02 • for lenses
- 7/04 • • with mechanism for focusing or varying magnification [2]
- 7/06 • • • Focusing binocular pairs
- 7/08 • • • adapted to co-operate with a remote control mechanism
- 7/09 • • • adapted for automatic focusing or varying magnification (automatic generation of focusing signals G02B 7/28) [5]
- 7/10 • • • by relative axial movement of several lenses, e.g. of varifocal objective lens
- 7/105 • • • • with movable lens means specially adapted for focusing at close distances [4]
- 7/12 • • Adjusting pupillary distance of binocular pairs
- 7/14 • • adapted to interchange lenses
- 7/16 • • • Rotatable turrets
- 7/18 • for prisms; for mirrors
- 7/182 • • for mirrors (optical devices or arrangements using movable or deformable optical elements for controlling the intensity, colour, phase, polarisation or direction of light G02B 26/00) [5]
- 7/183 • • • specially adapted for very large mirrors, e.g. for astronomy (G02B 7/185, G02B 7/192, G02B 7/198 take precedence) [6]
- 7/185 • • • with means for adjusting the shape of the mirror surface (mirrors with curved faces G02B 5/10) [5]
- 7/188 • • • • Membrane mirrors [5]
- 7/192 • • • with means for minimising internal mirror stresses [5]
- 7/195 • • • • Fluid-cooled mirrors [5]
- 7/198 • • • with means for adjusting the mirror relative to its support [5]
- 7/20 • Light-tight connections for movable optical elements
- 7/22 • • Extensible connections, e.g. bellows
- 7/24 • • Pivoted connections
- 7/28 • Systems for automatic generation of focusing signals (measuring distance per se G01C, G01S; using such signals to control focus of particular apparatus, see the subclasses for the apparatus, e.g. G03B, G03F) [5]
- 7/30 • • using parallactic triangle with a base line [5]
- 7/32 • • • using active means, e.g. light emitter [5]

- 7/34 • • using different areas in a pupil plane [5]
- 7/36 • • using image sharpness techniques [5]
- 7/38 • • • measured at different points on the optical axis [5]
- 7/40 • • using time delay of the reflected waves, e.g. of ultrasonic waves [5]

9/00 Optical objectives characterised both by the number of the components and their arrangements according to their sign, i.e. + or – (G02B 13/00, G02B 15/00 take precedence)

Note(s)

In this group, a component is deemed to be a simple lens or a compound lens or a divided lens equivalent to a simple or to a compound lens.

- 9/02 • having one + component only (simple lenses G02B 3/00)
- 9/04 • having two components only
- 9/06 • • two + components
- 9/08 • • • arranged about a stop
- 9/10 • • one + and one – component
- 9/12 • having three components only
- 9/14 • • arranged + – +
- 9/16 • • • all the components being simple
- 9/18 • • • only one component having a compound lens (G02B 9/30 takes precedence)
- 9/20 • • • • the rear component having the compound
- 9/22 • • • • the middle component having the compound
- 9/24 • • • two of the components having compound lenses (G02B 9/30 takes precedence)
- 9/26 • • • • the front and rear components having compound lenses
- 9/28 • • • • the middle and rear components having compound lenses
- 9/30 • • • the middle component being a – compound meniscus having a + lens
- 9/32 • • • • the + lens being a meniscus
- 9/34 • having four components only
- 9/36 • • arranged + — +

Note(s)

In this group, the first place priority rule is applied.

- 9/38 • • • both – components being meniscus
- 9/40 • • • • one – component being compound
- 9/42 • • • • two – components being compound
- 9/44 • • • both – components being biconcave
- 9/46 • • • • one – component being compound
- 9/48 • • • • two – components being compound
- 9/50 • • • both + components being meniscus
- 9/52 • • • the rear + component being compound
- 9/54 • • • the front + component being compound
- 9/56 • • • all components being simple lenses
- 9/58 • • arranged – + + –
- 9/60 • having five components only
- 9/62 • having six components only
- 9/64 • having more than six components

11/00 Optical objectives characterised by the total number of simple and compound lenses forming the objective and their arrangement (G02B 9/00 takes precedence; having only one simple lens G02B 3/00)

Note(s)

In groups G02B 11/02-G02B 11/34, lenses in broken contact are counted separately. Simple lenses are denoted by L, compound lenses by C, and the front lens is mentioned first.

- 11/02 • having two lenses only
 - 11/04 • • arranged C C
 - 11/06 • having three lenses only
 - 11/08 • • arranged L L L
 - 11/10 • • arranged L C L
 - 11/12 • • arranged L L C
 - 11/14 • • arranged C L C
 - 11/16 • • arranged C C L
 - 11/18 • • arranged C C C
 - 11/20 • having four lenses only
 - 11/22 • • arranged L L L L
 - 11/24 • • arranged C L L C
 - 11/26 • • arranged L C C L
 - 11/28 • • arranged C C C C
 - 11/30 • having five lenses only
 - 11/32 • having six lenses only
 - 11/34 • having more than six lenses
- 13/00 Optical objectives specially designed for the purposes specified below** (with variable magnification G02B 15/00)
- 13/02 • Telephoto objectives, i.e. systems of the type + – in which the distance from the front vertex to the image plane is less than the equivalent focal length
 - 13/04 • Reversed telephoto objectives
 - 13/06 • Panoramic objectives; So-called "sky lenses"
 - 13/08 • Anamorphic objectives
 - 13/10 • • involving prisms (G02B 13/12 takes precedence)
 - 13/12 • • with variable magnification
 - 13/14 • for use with infra-red or ultra-violet radiation (G02B 13/16 takes precedence)
 - 13/16 • for use in conjunction with image converters or intensifiers
 - 13/18 • with lenses having one or more non-spherical faces, e.g. for reducing geometrical aberration
 - 13/20 • Soft-focus objectives (diffusing elements in general G02B 5/02)
 - 13/22 • Telecentric objectives or lens systems
 - 13/24 • for reproducing or copying at short object distances
 - 13/26 • • for reproducing with unit magnification [3]
- 15/00 Optical objectives with means for varying the magnification** (anamorphic objectives G02B 13/08)
- 15/02 • by changing, adding, or subtracting a part of the objective, e.g. convertible objective
 - 15/04 • • by changing a part
 - 15/06 • • • by changing the front part
 - 15/08 • • • by changing the rear part
 - 15/10 • • by adding a part, e.g. close-up attachment
 - 15/12 • • • by adding telescopic attachments (G02B 15/14 takes precedence)
 - 15/14 • by axial movement of one or more lenses or groups of lenses relative to the image plane for continuously varying the equivalent focal length of the objective [4]
 - 15/15 • • compensation by means of only one movement or by means of only linearly related movements, e.g. optical compensation [4]

- 15/16 • • with interdependent non-linearly related movements between one lens or lens group, and another lens or lens group (G02B 15/22 takes precedence) [4]
- 15/163 • • • having a first movable lens or lens group and a second movable lens or lens group, both in front of a fixed lens or lens group (G02B 15/177 takes precedence) [4]
- 15/167 • • • having an additional fixed front lens or group of lenses [4]
- 15/17 • • • • arranged + — [4]
- 15/173 • • • • arranged + – + [4]
- 15/177 • • • having a negative front lens or group of lenses [4]
- 15/20 • • • having an additional movable lens or lens group for varying the objective focal length [4]
- 15/22 • • with movable lens means specially adapted for focusing at close distances [4]
- 15/24 • • • having a front fixed lens or lens group and two movable lenses or lens groups in front of a fixed lens or lens group [4]
- 15/26 • • • arranged + — [4]
- 15/28 • • • arranged + – + [4]

17/00 Systems with reflecting surfaces, with or without refracting elements (microscopes G02B 21/00; telescopes, periscopes G02B 23/00; beam shaping not otherwise provided for G02B 27/09; for beam splitting or combining G02B 27/10; for optical projection G02B 27/18) [6]

- 17/02 • Catoptric systems, e.g. image erecting and reversing system
- 17/04 • • using prisms only
- 17/06 • • using mirrors only
- 17/08 • Catadioptric systems

19/00 Condensers (for microscopes G02B 21/08)

- 21/00 Microscopes** (eyepieces G02B 25/00; polarising systems G02B 27/28; measuring microscopes G01B 9/04; microtomes G01N 1/06; scanning-probe techniques or apparatus G01Q) [1, 7]
- 21/02 • Objectives
 - 21/04 • • involving mirrors
 - 21/06 • Means for illuminating specimen
 - 21/08 • • Condensers
 - 21/10 • • • affording dark-field illumination (G02B 21/14 takes precedence)
 - 21/12 • • • affording bright-field illumination (G02B 21/14 takes precedence)
 - 21/14 • • • affording illumination for phase-contrast observation
 - 21/16 • adapted for ultra-violet illumination
 - 21/18 • Arrangements with more than one light-path, e.g. for comparing two specimens
 - 21/20 • • Binocular arrangements
 - 21/22 • • • Stereoscopic arrangements
 - 21/24 • Base structure
 - 21/26 • • Stages; Adjusting means therefor
 - 21/28 • • with cooling device
 - 21/30 • • with heating device
 - 21/32 • Micromanipulators structurally combined with microscopes
 - 21/33 • Immersion oils [6]

21/34	• Microscope slides, e.g. mounting specimens on microscope slides (preparing specimens for investigation G01N 1/28; means for supporting the objects or the materials to be analysed in electron microscopes H01J 37/20)	26/10	• • Scanning systems (for special applications, <u>see</u> the relevant places, e.g. G03B 27/32, G03F 3/08, G03G 15/04, G09G 3/00, H04N) [4]
21/36	• arranged for photographic purposes or projection purposes (G02B 21/18 takes precedence)	26/12	• • • using multifaceted mirrors [6]
23/00	Telescopes, e.g. binoculars (measuring telescopes G01B 9/06); Periscopes; Instruments for viewing the inside of hollow bodies (diagnostic instruments A61B); Viewfinders (objectives G02B 9/00, G02B 11/00, G02B 15/00, G02B 17/00; eyepieces G02B 25/00); Optical aiming or sighting devices (non-optical aspects of weapon aiming or sighting devices F41G) [4]	27/00	Other optical systems; Other optical apparatus (means for bringing-about special optical effects in shop-windows, showcases A47F, e.g. A47F 11/06; optical toys A63H 33/22; designs or pictures characterised by special light effects B44F 1/00)
23/02	• involving prisms or mirrors (G02B 23/14 takes precedence)	27/01	• Head-up displays [6]
23/04	• • for the purpose of beam splitting or combining, e.g. fitted with eyepieces for more than one observer (G02B 23/10 takes precedence)	27/02	• Viewing or reading apparatus (stereoscopic systems G02B 27/22; of the projection type G03B; slide-changing apparatus G03B)
23/06	• • having a focusing action, e.g. parabolic mirror	27/04	• • having collapsible parts
23/08	• • Periscopes	27/06	• • with moving-picture effect
23/10	• • reflecting into the field of view additional indications, e.g. from collimator (collimators in general G02B 27/30; graticules G02B 27/34)	27/08	• • Kaleidoscopes
23/12	• with means for image conversion or intensification (objectives for image conversion or intensification G02B 13/16; electrical image converters with optical input and optical output H01J 31/50)	27/09	• Beam shaping, e.g. changing the cross-sectioned area, not otherwise provided for [6]
23/14	• Viewfinders (for photographic apparatus G03B 13/02)	27/10	• Beam splitting or combining systems (mixing and splitting light signals using optical waveguides G02B 6/28; polarising systems G02B 27/28) [4]
23/16	• Housings; Caps; Mountings; Supports, e.g. with counterweight (cases or receptacles A45C)	27/12	• • operating by refraction only
23/18	• • for binocular arrangements	27/14	• • operating by reflection only
23/20	• • Collapsible housings (G02B 23/18 takes precedence)	27/16	• • used as aids for focusing
23/22	• • Underwater equipments, e.g. for submarine periscope	27/18	• for optical projection, e.g. combination of mirror and condenser and objective
23/24	• Instruments for viewing the inside of hollow bodies, e.g. fibrescopes [4]	27/20	• • for imaging minute objects, e.g. light-pointer
23/26	• • using light guides [4]	27/22	• for producing stereoscopic or other three-dimensional effects (in microscopes G02B 21/22; viewing apparatus G02B 27/02)
25/00	Eyepieces; Magnifying glasses (simple lenses G02B 3/00)	27/24	• • involving reflecting prisms and mirrors only
25/02	• with means for illuminating object viewed	27/26	• • involving polarising means
25/04	• affording a wide-angle view, e.g. through a spy-hole	27/28	• for polarising (used in stereoscopes G02B 27/26)
26/00	Optical devices or arrangements using movable or deformable optical elements for controlling the intensity, colour, phase, polarisation or direction of light, e.g. switching, gating, modulating (mechanically operable parts of lighting devices for the control of light order F21V; specially adapted for measuring characteristics of light G01J; devices or arrangements, the optical operation of which is modified by changing the optical properties of the medium of the devices or arrangements G02F 1/00; control of light in general G05D 25/00; control of light sources H01S 3/10, H05B 37/00-H05B 43/00) [4]	27/30	• Collimators
26/02	• for controlling the intensity of light [4]	27/32	• Fiducial marks or measuring scales within the optical system
26/04	• • by periodically varying the intensity of light, e.g. using choppers [4]	27/34	• • illuminated
26/06	• for controlling the phase of light (G02B 26/08 takes precedence) [4]	27/36	• • adjustable
26/08	• for controlling the direction of light (in light guides G02B 6/35) [4]	27/40	• Optical focusing aids (beam splitting or combining systems G02B 27/10)
		27/42	• Diffraction optics (G02B 27/60 takes precedence) [3]
		27/44	• • Grating systems; Zone plate systems (G02B 27/46 takes precedence; spectrometry G01J) [3]
		27/46	• • Systems using spatial filters (character recognition G06K 9/00) [3]
			Note(s)
			In this group, the filter may be in any plane, e.g. the image or the Fourier transfer plane.
		27/48	• Laser speckle optics (speckle suppression in holography G03H 1/32) [3]
		27/50	• Optics for phase object visualisation (in microscopes G02B 21/14) [3]
		27/52	• • Phase contrast optics [3]
		27/54	• • Schlieren-optical systems [3]
		27/56	• Optics using evanescent waves, i.e. inhomogeneous waves [3]
		27/58	• Optics for apodization or superresolution; Optical synthetic aperture systems [3]
		27/60	• Systems using moire fringes (means for converting the output of a sensing member using diffraction gratings G01D 5/38) [3]
		27/62	• Optical apparatus specially adapted for adjusting optical elements during the assembly of optical systems (adjusting means being part of the system to be assembled G02B 7/00) [3]

G02B

- 27/64 • Imaging systems using optical elements for stabilisation of the lateral and angular position of the image (focusing systems G02B 7/04; adjustment of

optical system relative to image or object surface
G03B 5/00) [3]