SECTION G — PHYSICS

G01 MEASURING; TESTING

G01S RADIO DIRECTION-FINDING; RADIO NAVIGATION; DETERMINING DISTANCE OR VELOCITY BY USE OF RADIO WAVES; LOCATING OR PRESENCE-DETECTING BY USE OF THE REFLECTION OR RERADIATION OF RADIO WAVES; ANALOGOUS ARRANGEMENTS USING OTHER WAVES

Note(s) [6]

1. In this subclass, the following term is used with the meaning indicated:
   - "transponder" means an arrangement which reacts to an incoming interrogating or detecting wave by emitting a specific answering or identifying wave.
2. Attention is drawn to the Notes following the title of class G01 and to Note (1) following the title of subclass G09B.

Subclass index

1/00 **Beacons or beacon systems transmitting signals having a characteristic or characteristics capable of being detected by non-directional receivers and defining directions, positions, or position lines fixed relatively to the beacon transmitters; Receivers co-operating therewith** (position-fixing by co-ordinating a plurality of determinations of direction or position lines G01S 5/00) **[1, 2, 2006.01]**

1/02 • using radio waves (G01S 19/00 takes precedence) **[1, 2006.01, 2010.01]**

1/04 • • Details **[1, 2006.01]**

1/06 • • • Means for providing multiple indication, e.g. coarse and fine indications **[1, 2006.01]**

1/08 • • Systems for determining direction or position line **[1, 2006.01]**

1/10 • • • using amplitude comparison of signals transmitted sequentially from antennas or antenna systems having differently-oriented overlapping directivity-characteristics, e.g. equi-signal A-N type **[1, 2006.01]**

1/12 • • • • the signals being transmitted sequentially from an antenna or antenna system having the orientation of its directivity characteristic periodically varied, e.g. by means of sequentially effective reflectors **[1, 2006.01]**

1/14 • • • using amplitude comparison of signals transmitted simultaneously from antennas or antenna systems having differently-oriented overlapping directivity-characteristics **[1, 2006.01]**

1/16 • • • • Azimuthal guidance systems, e.g. system for defining aircraft approach path, localiser system **[1, 2006.01]**

1/18 • • • • Elevational guidance systems, e.g. system for defining aircraft glide path **[1, 2006.01]**

1/20 • • • using a comparison of transit time of synchronised signals transmitted from non-directional antennas or antenna systems spaced apart, i.e. path-difference systems **[1, 2006.01]**

1/22 • • • • the synchronised signals being frequency modulations on carrier waves and the transit times being compared by measuring difference of instantaneous frequencies of received carrier waves **[1, 2006.01]**

1/24 • • • • the synchronised signals being pulses or equivalent modulations on carrier waves and the transit times being compared by measuring the difference in arrival time of a significant part of the modulations **[1, 2006.01]**

1/26 • • • • • Systems in which pulses or time-base signals are generated locally at the receiver and brought into predetermined time-relationship with received signals, e.g. pulse duration coincides with time interval between arrival of significant part of modulation of signals received from first and second antennas or antenna systems **[1, 2006.01]**

1/28 • • • • • • wherein the predetermined time-relationship is maintained automatically **[1, 2006.01]**

1/30 • • • • the synchronised signals being continuous waves or intermittent trains of continuous waves, the intermittency not being for the purpose of determining direction or position line and the transit times being compared by measuring the phase difference **[1, 2006.01]**

1/32 • • • • • Systems in which the signals received, with or without amplification, or signals derived therefrom, are compared in phase directly **[1, 2006.01]**

1/34 • • • • • Systems in which first and second synchronised signals are transmitted from both antennas or antenna systems and a beat frequency, obtained by heterodyning the first signals with each other is compared in phase with a beat frequency obtained by heterodyning the second signals with each other **[1, 2006.01]**

1/36 • • • • • Systems in which a beat frequency, obtained by heterodyning the synchronised signals, is compared in phase with a reference signal having a phase substantially independent of direction **[1, 2006.01]**

1/38 • • • using comparison of [1] the phase of the envelope of the change of frequency, due to Doppler effect, of the signal transmitted by an antenna moving, or appearing to move, in a cyclic path with [2] the phase of a reference signal, the frequency of this reference signal being synchronised with that of the cyclic movement, or apparent cyclic movement, of the antenna **[1, 2006.01]**

1/40 • • • • the apparent movement of the antenna being produced by cyclic sequential energisation of fixed antennas **[1, 2006.01]**

1/42 • • • Conical-scan beam beacons transmitting signals which indicate at a mobile receiver any displacement of the receiver from the conical-scan axis, e.g. for "beam-riding" missile control **[1, 5, 2006.01]**

1/44 • • • Rotating or oscillating beam beacons defining directions in the plane of rotation or oscillation **[1, 5, 2006.01]**

1/46 • • • • Broad-beam systems producing at a receiver a substantially continuous sinusoidal envelope signal of the carrier wave of the beam, the phase angle of which is dependent upon the angle between the direction of the receiver from the beacon and a reference direction from the beacon, e.g. cardioid system **[1, 5, 2006.01]**

1/48 • • • • • wherein the phase angle of the direction-dependent envelope signal is a multiple of the direction angle, e.g. for "fine" bearing indication **[1, 5, 2006.01]**

1/50 • • • • • wherein the phase angle of the direction-dependent envelope signal is compared with a non-direction- dependent reference signal **[1, 5, 2006.01]**

1/52 • • • • • wherein the phase angles of a plurality of direction-dependent envelope signals produced by a plurality of beams rotating at different speeds or in different directions are compared **[1, 5, 2006.01]**

1/54 • • • • Narrow-beam systems producing at a receiver a pulse-type envelope signal of the carrier wave of the beam, the timing of which is dependent upon the angle between the direction of the receiver from the beacon and a reference direction from the beacon; Overlapping broad beam systems defining a narrow zone and producing at a receiver a pulse-type envelope signal of the carrier wave of the beam, the timing of which is dependent upon the angle between the direction of the receiver from the beacon and a reference direction from the beacon **[1, 5, 2006.01]**

1/56 • • • • • Timing the pulse-type envelope signals derived by reception of beam **[1, 5, 2006.01]**

1/58 • • • • • wherein a characteristic of the beam transmitted or of an auxiliary signal is varied in time synchronously with rotation or oscillation of the beam **[1, 5, 2006.01]**

1/60 • • • • • • Varying frequency of beam signal or of auxiliary signal **[1, 5, 2006.01]**

1/62 • • • • • • Varying phase-relationship between beam and auxiliary signal **[1, 5, 2006.01]**

1/64 • • • • • • Varying pulse timing, e.g. varying interval between pulses radiated in pairs **[1, 5, 2006.01]**

1/66 • • • • • • Superimposing direction-indicating intelligence signals, e.g. speech, Morse **[1, 5, 2006.01]**

1/68 • • Marker, boundary, call-sign, or like beacons transmitting signals not carrying directional information **[1, 2006.01]**

1/70 • using electromagnetic waves other than radio waves **[1, 2006.01]**

1/72 • using ultrasonic, sonic, or infrasonic waves **[1, 2006.01]**

1/74 • • Details **[5, 2006.01]**

1/76 • • Systems for determining direction or position line **[5, 2006.01]**

1/78 • • • using amplitude comparison of signals transmitted from transducers or transducer systems having differently-oriented characteristics **[5, 2006.01]**

1/80 • • • using a comparison of transit time of synchronised signals transmitted from non-directional transducers or transducer systems spaced apart, i.e. path-difference systems **[5, 2006.01]**

1/82 • • • Rotating or oscillating beam beacons defining directions in the plane of rotation or oscillation **[5, 2006.01]**

3/00 Direction-finders for determining the direction from which infrasonic, sonic, ultrasonic, or electromagnetic waves, or particle emission, not having a directional significance, are being received (position-fixing by co-ordinating a plurality of determinations of direction or position lines G01S 5/00) **[1, 2006.01]**

3/02 • using radio waves **[1, 2006.01]**

3/04 • • Details **[1, 2006.01]**

3/06 • • • Means for increasing effective directivity, e.g. by combining signals having differently-oriented directivity characteristics or by sharpening the envelope waveform of the signal derived from a rotating or oscillating beam antenna (comparing amplitude of signals having differently-oriented directivity characteristics to determine direction G01S 3/16, G01S 3/28) **[1, 2006.01]**

3/08 • • • Means for reducing polarisation errors, e.g. by use of Adcock or spaced loop antenna systems **[1, 2006.01]**

3/10 • • • Means for reducing or compensating for quadrantal, site, or like errors **[1, 2006.01]**

3/12 • • • Means for determining sense of direction, e.g. by combining signals from directional antenna or goniometer search coil with those from non-directional antenna (determining direction by amplitude comparison of signals derived by combining directional and non-directional signals G01S 3/24, G01S 3/34) **[1, 2006.01]**

3/14 • • Systems for determining direction or deviation from predetermined direction **[1, 2006.01]**

3/16 • • • using amplitude comparison of signals derived sequentially from receiving antennas or antenna systems having differently-oriented directivity characteristics or from an antenna system having periodically-varied orientation of directivity characteristic **[1, 2006.01]**

3/18 • • • • derived directly from separate directional antennas **[1, 2006.01]**

3/20 • • • • derived by sampling signal received by an antenna system having periodically-varied orientation of directivity characteristic **[1, 2006.01]**

3/22 • • • • derived from different combinations of signals from separate antennas, e.g. comparing sum with difference **[1, 2006.01]**

3/24 • • • • • the separate antennas comprising one directional antenna and one non-directional antenna, e.g. combination of loop and open antennas producing a reversed cardioid directivity characteristic **[1, 2006.01]**

3/26 • • • • • the separate antennas having differently-oriented directivity characteristics **[1, 2006.01]**

3/28 • • • using amplitude comparison of signals derived simultaneously from receiving antennas or antenna systems having differently-oriented directivity characteristics **[1, 2006.01]**

3/30 • • • • derived directly from separate directional systems **[1, 2006.01]**

3/32 • • • • derived from different combinations of signals from separate antennas, e.g. comparing sum with difference **[1, 2006.01]**

3/34 • • • • • the separate antennas comprising one directional antenna and one non-directional antenna, e.g. combination of loop and open antennas producing a reversed cardioid directivity characteristic **[1, 2006.01]**

3/36 • • • • • the separate antennas having differently-oriented directivity characteristics **[1, 2006.01]**

3/38 • • • using adjustment of real or effective orientation of directivity characteristic of an antenna or an antenna system to give a desired condition of signal derived from that antenna or antenna system, e.g. to give a maximum or minimum signal (G01S 3/16, G01S 3/28 take precedence) **[1, 2006.01]**

3/40 • • • • adjusting orientation of a single directivity characteristic to produce maximum or minimum signal, e.g. rotatable loop antenna or equivalent goniometer system **[1, 2006.01]**

3/42 • • • • the desired condition being maintained automatically **[1, 2006.01]**

3/44 • • • • the adjustment being varied periodically or continuously until it is halted automatically when the desired condition is attained **[1, 2006.01]**

3/46 • • • using antennas spaced apart and measuring phase or time difference between signals therefrom, i.e. path-difference systems **[1, 2006.01]**

3/48 • • • • the waves arriving at the antennas being continuous or intermittent and the phase difference of signals derived therefrom being measured **[1, 2006.01]**

3/50 • • • • the waves arriving at the antennas being pulse modulated and the time difference of their arrival being measured **[1, 2006.01]**

3/52 • • • using a receiving antenna moving, or appearing to move, in a cyclic path to produce a Doppler variation of frequency of the received signal **[1, 2006.01]**

3/54 • • • • the apparent movement of the antenna being produced by coupling the receiver cyclically and sequentially to each of several fixed spaced antennas **[1, 2006.01]**

3/56 • • • Conical-scan beam systems using signals indicative of the deviation of the direction of reception from the scan axis **[1, 2006.01]**

3/58 • • • Rotating or oscillating beam systems using continuous analysis of received signal for determining direction in the plane of rotation or oscillation or for determining deviation from a predetermined direction in such a plane (G01S 3/16 takes precedence) **[1, 2006.01]**

3/60 • • • • Broad-beam systems producing in the receiver a substantially-sinusoidal envelope signal of the carrier wave of the beam, the phase angle of which is dependent upon the angle between the direction of the transmitter from the receiver and a reference direction from the receiver, e.g. cardioid system **[1, 2006.01]**

3/62 • • • • • wherein the phase angle of the signal is indicated by a cathode-ray tube **[1, 2006.01]**

3/64 • • • • • wherein the phase angle of the signal is determined by phase comparison with a reference alternating signal varying in synchronism with the directivity variation **[1, 2006.01]**

3/66 • • • • Narrow-beam systems producing in the receiver a pulse-type envelope signal of the carrier wave of the beam, the timing of which is dependent upon the angle between the direction of the transmitter from the receiver and a reference direction from the receiver; Overlapping broad-beam systems defining in the receiver a narrow zone and producing a pulse-type envelope signal of the carrier wave of the beam, the timing of which is dependent upon the angle between the direction of the transmitter from the receiver and a reference direction from the receiver **[1, 2006.01]**

3/68 • • • • • wherein the timing of the pulse-type envelope signal is indicated by cathode-ray tube **[1, 2006.01]**

3/70 • • • • • wherein the timing of the pulse-type envelope signal is determined by bringing a locally-generated pulse-type signal into coincidence or other predetermined time-relationship with the envelope signal **[1, 2006.01]**

3/72 • • Diversity systems specially adapted for direction-finding **[1, 2006.01]**

3/74 • • Multi-channel systems specially adapted for direction-finding, i.e. having a single antenna system capable of giving simultaneous indications of the directions of different signals (systems in which the directions of different signals are determined sequentially and displayed simultaneously G01S 3/04, G01S 3/14) **[1, 2006.01]**

3/78 • using electromagnetic waves other than radio waves **[1, 2006.01]**

3/781 • • Details **[5, 2006.01]**

3/782 • • Systems for determining direction or deviation from predetermined direction **[5, 2006.01]**

3/783 • • • using amplitude comparison of signals derived from static detectors or detector systems **[5, 2006.01]**

3/784 • • • • using a mosaic of detectors **[5, 2006.01]**

3/785 • • • using adjustment of orientation of directivity characteristics of a detector or detector system to give a desired condition of signal derived from that detector or detector system **[5, 2006.01]**

3/786 • • • • the desired condition being maintained automatically **[5, 2006.01]**

3/787 • • • using rotating reticles producing a direction-dependent modulation characteristic **[5, 2006.01]**

3/788 • • • • producing a frequency modulation characteristic **[5, 2006.01]**

3/789 • • • using rotating or oscillating beam systems, e.g. using mirrors, prisms **[5, 2006.01]**

3/80 • using ultrasonic, sonic, or infrasonic waves **[1, 2006.01]**

3/801 • • Details **[5, 2006.01]**

3/802 • • Systems for determining direction or deviation from predetermined direction **[5, 2006.01]**

3/803 • • • using amplitude comparison of signals derived from receiving transducers or transducer systems having differently-oriented directivity characteristics **[5, 2006.01]**

3/805 • • • using adjustment of real or effective orientation of directivity characteristics of a transducer or transducer system to give a desired condition of signal derived from that transducer or transducer system, e.g. to give a maximum or minimum signal **[5, 2006.01]**

3/807 • • • • the desired condition being maintained automatically **[5, 2006.01]**

3/808 • • • using transducers spaced apart and measuring phase or time difference between signals therefrom, i.e. path-difference systems **[5, 2006.01]**

3/809 • • • Rotating or oscillating beam systems using continuous analysis of received signal for determining direction in the plane of rotation or oscillation or for determining deviation from a predetermined direction in such a plane **[5, 2006.01]**

3/82 • • with means for adjusting phase or compensating for time-lag errors **[1, 2006.01]**

3/84 • • with indication presented on cathode-ray tubes **[1, 2006.01]**

3/86 • • with means for eliminating undesired waves, e.g. disturbing noises **[1, 2006.01]**

5/00 Position-fixing by co-ordinating two or more direction or position-line determinations; Position-fixing by co-ordinating two or more distance determinations [1, 2, 2006.01]

5/02 • using radio waves (G01S 19/00 takes precedence) **[1, 2006.01, 2010.01]**

5/04 • • Position of source determined by a plurality of spaced direction-finders **[1, 2006.01]**

5/06 • • Position of source determined by co-ordinating a plurality of position lines defined by path-difference measurements (G01S 5/12 takes precedence) **[1, 3, 2006.01]**

5/08 • • Position of single direction-finder fixed by determining direction of a plurality of spaced sources of known location **[1, 2006.01]**

5/10 • • Position of receiver fixed by co-ordinating a plurality of position lines defined by path-difference measurements (G01S 5/12 takes precedence) **[1, 3, 2006.01]**

5/12 • • by co-ordinating position lines of different shape, e.g. hyperbolic, circular, elliptical or radial **[1, 2006.01]**

5/14 • • Determining absolute distances from a plurality of spaced points of known location **[1, 2006.01]**

5/16 • using electromagnetic waves other than radio waves **[1, 2006.01]**

5/18 • using ultrasonic, sonic, or infrasonic waves **[1, 2006.01]**

5/20 • • Position of source determined by a plurality of spaced direction-finders **[5, 2006.01]**

5/22 • • Position of source determined by co-ordinating a plurality of position lines defined by path-difference measurements (G01S 5/28 takes precedence) **[5, 2006.01]**

5/24 • • Position of single direction-finder fixed by determining direction of a plurality of spaced sources of known location **[5, 2006.01]**

5/26 • • Position of receiver fixed by co-ordinating a plurality of position lines defined by path-difference measurements (G01S 5/28 takes precedence) **[5, 2006.01]**

5/28 • • by co-ordinating position lines of different shape, e.g. hyperbolic, circular, elliptical or radial **[5, 2006.01]**

5/30 • • Determining absolute distances from a plurality of spaced points of known location **[5, 2006.01]**

7/00 Details of systems according to groups G01S 13/00, G01S 15/00, G01S 17/00 [1, 2006.01]

7/02 • of systems according to group G01S 13/00 **[1, 2006.01]**

7/03 • • Details of HF subsystems specially adapted therefor, e.g. common to transmitter and receiver **[5, 2006.01]**

7/04 • • Display arrangements **[1, 2006.01]**

7/06 • • • Cathode-ray tube displays **[1, 2006.01]**

7/08 • • • • with vernier indication of distance, e.g. using two cathode-ray tubes **[1, 2006.01]**

7/10 • • • • Providing two-dimensional co-ordinated display of distance and direction **[1, 2006.01]**

7/12 • • • • • Plan-position indicators, i.e. P. P. I. **[1, 2006.01]**

7/14 • • • • • • Sector, off-centre, or expanded- angle display **[1, 2006.01]**

7/16 • • • • • Signals displayed as intensity modulation with rectangular co-ordinates representing distance and bearing, e.g. type B **[1, 2006.01]**

7/18 • • • • • Distance-height displays; Distance-elevation displays, e.g. type RHI, type E **[1, 2006.01]**

7/20 • • • • Stereoscopic displays; Three-dimensional displays; Pseudo-three-dimensional displays **[1, 2006.01]**

7/22 • • • • Producing cursor lines and indicia by electronic means **[1, 2006.01]**

7/24 • • • • the display being orientated or displaced in accordance with movement of object carrying the transmitting and receiving apparatus, e.g. true-motion radar **[1, 2006.01]**

7/26 • • • Displays using electroluminescent panels **[1, 2006.01]**

7/28 • • Details of pulse systems **[1, 2006.01]**

7/282 • • • Transmitters **[5, 2006.01]**

7/285 • • • Receivers **[5, 2006.01]**

7/288 • • • • Coherent receivers **[5, 2006.01]**

7/292 • • • • Extracting wanted echo-signals **[5, 2006.01]**

7/295 • • • • Means for transforming co-ordinates or for evaluating data, e.g. using computers **[5, 2006.01]**

7/298 • • • • • Scan converters **[5, 2006.01]**

7/32 • • • • Shaping echo pulse signals; Deriving non-pulse signals from echo pulse signals **[1, 5, 2006.01]**

7/34 • • • • Gain of receiver varied automatically during pulse-recurrence period, e.g. anti-clutter gain control **[1, 5, 2006.01]**

7/35 • • Details of non-pulse systems **[5, 2006.01]**

7/36 • • Means for anti-jamming **[1, 2006.01]**

7/38 • • Jamming means, e.g. producing false echoes **[2, 2006.01]**

7/40 • • Means for monitoring or calibrating **[1, 2006.01]**

7/41 • • using analysis of echo signal for target characterisation; Target signature; Target cross-section **[6, 2006.01]**

7/42 • • Diversity systems specially adapted for radar **[1, 2006.01]**

7/48 • of systems according to group G01S 17/00 **[1, 2006.01]**

7/481 • • Constructional features, e.g. arrangements of optical elements **[6, 2006.01]**

7/483 • • Details of pulse systems **[6, 2006.01]**

7/484 • • • Transmitters **[6, 2006.01]**

7/486 • • • Receivers **[6, 2006.01, 2020.01]**

7/4861 • • • • Circuits for detection, sampling, integration or read-out **[2020.01]**

7/4863 • • • • • Detector arrays, e.g. charge-transfer gates **[2020.01]**

7/4865 • • • • Time delay measurement, e.g. time-of-flight measurement, time of arrival measurement or determining the exact position of a peak (peak detection in noise, signal conditioning G01S 7/487) **[2020.01]**

7/487 • • • • Extracting wanted echo signals **[6, 2006.01]**

7/489 • • • • Gain of receiver varied automatically during pulse-recurrence period **[6, 2006.01]**

7/491 • • Details of non-pulse systems **[6, 2006.01, 2020.01]**

7/4911 • • • Transmitters **[2020.01]**

7/4912 • • • Receivers **[2020.01]**

7/4913 • • • • Circuits for detection, sampling, integration or read-out **[2020.01]**

7/4914 • • • • • Detector arrays, e.g. charge-transfer gates **[2020.01]**

7/4915 • • • • Time delay measurement, e.g. operational details for pixel components (signal extraction and conditioning G01S 7/493); Phase measurement **[2020.01]**

7/493 • • • Extracting wanted echo signals **[6, 2006.01]**

7/495 • • Counter-measures or counter-counter-measures **[6, 2006.01]**

7/497 • • Means for monitoring or calibrating **[6, 2006.01]**

7/499 • • using polarisation effects **[6, 2006.01]**

7/51 • • Display arrangements **[6, 2006.01]**

7/52 • of systems according to group G01S 15/00 **[1, 2006.01]**

7/521 • • Constructional features **[6, 2006.01]**

7/523 • • Details of pulse systems **[6, 2006.01]**

7/524 • • • Transmitters **[6, 2006.01]**

7/526 • • • Receivers **[6, 2006.01]**

7/527 • • • • Extracting wanted echo signals **[6, 2006.01]**

7/529 • • • • Gain of receiver varied automatically during pulse-recurrence period **[6, 2006.01]**

7/53 • • • • Means for transforming co-ordinates or for evaluating data, e.g. using computers **[6, 2006.01]**

7/531 • • • • • Scan converters **[6, 2006.01]**

7/533 • • • • • Data rate converters **[6, 2006.01]**

7/534 • • Details of non-pulse systems **[6, 2006.01]**

7/536 • • • Extracting wanted echo signals **[6, 2006.01]**

7/537 • • Counter measures or counter-counter-measures, e.g. jamming, anti-jamming **[6, 2006.01]**

7/539 • • using analysis of echo signal for target characterisation; Target signature; Target cross-section **[6, 2006.01]**

7/54 • • with receivers spaced apart **[1, 2006.01]**

7/56 • • Display arrangements **[1, 2006.01]**

7/58 • • • for providing variable ranges **[1, 2006.01]**

7/60 • • • for providing a permanent recording **[1, 2006.01]**

7/62 • • • Cathode-ray tube displays **[1, 2006.01]**

7/64 • • Luminous indications (G01S 7/62 takes precedence) **[1, 5, 2006.01]**

11/00 Systems for determining distance or velocity not using reflection or reradiation (position-fixing by co-ordinating two or more distance determinations G01S 5/00) **[1, 2, 2006.01]**

11/02 • using radio waves (G01S 19/00 takes precedence) **[5, 2006.01, 2010.01]**

11/04 • • using angle measurements **[5, 2006.01]**

11/06 • • using intensity measurements **[5, 2006.01]**

11/08 • • using synchronised clocks **[5, 2006.01]**

11/10 • • using Doppler effect **[5, 2006.01]**

11/12 • using electromagnetic waves other than radio waves **[5, 2006.01]**

11/14 • using ultrasonic, sonic or infrasonic waves **[5, 2006.01]**

11/16 • using difference in transit time between electromagnetic and sonic waves **[5, 2006.01]**

Note(s) [3]

1. Groups G01S 13/00-G01S 17/00cover:
   - systems for detecting the presence of an object, e.g. by reflection or reradiation from the object itself, or from a transponder associated with the object, for determining the distance or relative velocity of an object, for providing a co-ordinated display of the distance and direction of an object or for obtaining an image thereof;
   - systems arranged for mounting on a moving craft or vehicle and using the reflection of waves from an extended surface external to the craft, e.g. the surface of the earth, to determine the velocity and direction of motion of the craft relative to the surface.
2. Groups G01S 13/00-G01S 17/00 do not cover:
   - systems for determining the direction of an object by means not employing reflection or reradiation, which are covered by groups G01S 1/00 or G01S 3/00;
   - systems for determining distance or velocity of an object by means not employing reflection or reradiation, which are covered by group G01S 11/00.

13/00 Systems using the reflection or reradiation of radio waves, e.g. radar systems; Analogous systems using reflection or reradiation of waves whose nature or wavelength is irrelevant or unspecified [3, 2006.01]

13/02 • Systems using reflection of radio waves, e.g. primary radar systems; Analogous systems **[3, 2006.01]**

13/04 • • Systems determining presence of a target (based on relative movement of target G01S 13/56) **[3, 2006.01]**

13/06 • • Systems determining position data of a target **[3, 2006.01]**

13/08 • • • Systems for measuring distance only (indirect measurement G01S 13/46) **[3, 2006.01]**

13/10 • • • • using transmission of interrupted, pulse modulated waves (determination of distance by phase measurement G01S 13/32) **[3, 2006.01]**

13/12 • • • • • wherein the pulse-recurrence frequency is varied to provide a desired time relationship between the transmission of a pulse and the receipt of the echo of a preceding pulse **[3, 2006.01]**

13/14 • • • • • wherein a voltage or current pulse is initiated and terminated in accordance respectively with the pulse transmission and echo reception **[3, 2006.01]**

13/16 • • • • • • using counters **[3, 2006.01]**

13/18 • • • • • wherein range gates are used **[3, 2006.01]**

13/20 • • • • • whereby multiple time-around echos are used or eliminated **[3, 2006.01]**

13/22 • • • • • using irregular pulse repetition frequency **[3, 2006.01]**

13/24 • • • • • using frequency agility of carrier wave **[3, 2006.01]**

13/26 • • • • • wherein the transmitted pulses use a frequency- or phase-modulated carrier wave **[3, 2006.01]**

13/28 • • • • • • with time compression of received pulses **[3, 2006.01]**

13/30 • • • • • using more than one pulse per radar period **[3, 2006.01]**

13/32 • • • • using transmission of continuous waves, whether amplitude-, frequency-, or phase-modulated, or unmodulated **[3, 2006.01]**

13/34 • • • • • using transmission of continuous, frequency-modulated waves while heterodyning the received signal, or a signal derived therefrom, with a locally-generated signal related to the contemporaneously transmitted signal **[3, 2006.01]**

13/36 • • • • • with phase comparison between the received signal and the contemporaneously transmitted signal **[3, 2006.01]**

13/38 • • • • • • wherein more than one modulation frequency is used **[3, 2006.01]**

13/40 • • • • • • wherein the frequency of transmitted signal is adjusted to give a predetermined phase relationship **[3, 2006.01]**

13/42 • • • Simultaneous measurement of distance and other coordinates (indirect measurement G01S 13/46) **[3, 2006.01]**

13/44 • • • • Monopulse radar, i.e. simultaneous lobing **[3, 2006.01]**

13/46 • • • Indirect determination of position data **[3, 2006.01]**

13/48 • • • • using multiple beams at emission or reception **[3, 2006.01]**

13/50 • • Systems of measurement based on relative movement of target **[3, 2006.01]**

13/52 • • • Discriminating between fixed and moving objects or between objects moving at different speeds **[3, 2006.01]**

13/522 • • • • using transmissions of interrupted pulse modulated waves **[5, 2006.01]**

13/524 • • • • • based upon the phase or frequency shift resulting from movement of objects, with reference to the transmitted signals, e.g. coherent MTi **[5, 2006.01]**

13/526 • • • • • • performing filtering on the whole spectrum without loss of range information, e.g. using delay line cancellers or comb filters **[5, 2006.01]**

13/528 • • • • • • • with elimination of blind speeds **[5, 2006.01]**

13/53 • • • • • • performing filtering on a single spectral line and associated with one or more range gates with a phase detector or a frequency mixer to extract the Doppler information, e.g. pulse Doppler radar **[5, 2006.01]**

13/532 • • • • • • • using a bank of range gates or a memory matrix **[5, 2006.01]**

13/534 • • • • • • based upon amplitude or phase shift resulting from movement of objects, with reference to the surrounding clutter echo signal, e.g. non-coherent MTi, clutter referenced MTi, externally coherent MTi **[5, 2006.01]**

13/536 • • • • using transmission of continuous unmodulated waves, amplitude-, frequency-, or phase-modulated waves **[5, 2006.01]**

13/538 • • • • eliminating objects that have not moved between successive antenna scans, e.g. area MTi **[5, 2006.01]**

13/56 • • • • for presence detection **[3, 2006.01]**

13/58 • • • Velocity or trajectory determination systems; Sense-of-movement determination systems **[3, 2006.01]**

13/60 • • • • wherein the transmitter and receiver are mounted on the moving object, e.g. for determining ground speed, drift angle, ground track (G01S 13/64 takes precedence) **[3, 2006.01]**

13/62 • • • • Sense-of-movement determination **[3, 2006.01]**

13/64 • • • • Velocity measuring systems using range gates **[3, 2006.01]**

13/66 • Radar-tracking systems; Analogous systems **[3, 2006.01]**

13/68 • • for angle tracking only **[3, 2006.01]**

13/70 • • for range tracking only **[3, 2006.01]**

13/72 • • for two-dimensional tracking, e.g. combination of angle and range tracking, track-while-scan radar **[3, 2006.01]**

13/74 • Systems using reradiation of radio waves, e.g. secondary radar systems; Analogous systems **[3, 6, 2006.01]**

13/75 • • using transponders powered from received waves, e.g. using passive transponders **[6, 2006.01]**

13/76 • • wherein pulse-type signals are transmitted **[3, 2006.01]**

13/78 • • • discriminating between different kinds of targets, e.g. IFF-radar, i.e. identification of friend or foe (G01S 13/75, G01S 13/79 takes precedence) **[3, 2006.01]**

13/79 • • Systems using random coded signals or random pulse repetition frequencies **[6, 2006.01]**

13/82 • • wherein continuous-type signals are transmitted **[3, 2006.01]**

13/84 • • • for distance determination by phase measurement **[3, 2006.01]**

13/86 • Combinations of radar systems with non-radar systems, e.g. sonar, direction finder **[3, 2006.01]**

13/87 • Combinations of radar systems, e.g. primary radar and secondary radar **[3, 2006.01]**

13/88 • Radar or analogous systems, specially adapted for specific applications (electromagnetic prospecting or detecting of objects, e.g. near-field detection, G01V 3/00) **[3, 6, 2006.01]**

13/89 • • for mapping or imaging **[3, 2006.01]**

13/90 • • • using synthetic aperture techniques **[3, 6, 2006.01]**

13/91 • • for traffic control (G01S 13/93 takes precedence) **[3, 2006.01]**

13/92 • • • for velocity measurement **[3, 2006.01]**

13/93 • • for anti-collision purposes **[3, 2006.01, 2020.01]**

13/931 • • • of land vehicles **[2020.01]**

13/933 • • • of aircraft or spacecraft **[2020.01]**

13/934 • • • • on airport surfaces, e.g. while taxiing **[2020.01]**

13/935 • • • • for terrain-avoidance **[2020.01]**

13/937 • • • of marine craft **[2020.01]**

13/95 • • for meteorological use **[3, 2006.01]**

15/00 Systems using the reflection or reradiation of acoustic waves, e.g. sonar systems [3, 2006.01, 2020.01]

15/02 • using reflection of acoustic waves (G01S 15/66 takes precedence) **[3, 2006.01]**

15/04 • • Systems determining presence of a target **[3, 2006.01]**

15/06 • • Systems determining position data of a target **[3, 2006.01]**

15/08 • • • Systems for measuring distance only (indirect measurement G01S 15/46) **[3, 2006.01]**

15/10 • • • • using transmission of interrupted, pulse-modulated waves (determination of distance by phase measurement G01S 15/32) **[3, 2006.01]**

15/12 • • • • • wherein the pulse-recurrence frequency is varied to provide a desired time relationship between the transmission of a pulse and the receipt of the echo of a preceding pulse **[3, 2006.01]**

15/14 • • • • • wherein a voltage or current pulse is initiated and terminated in accordance respectively with the pulse transmission and echo reception **[3, 2006.01]**

15/18 • • • • • wherein range gates are used **[3, 2006.01]**

15/32 • • • • using transmission of continuous waves, whether amplitude-, frequency-, or phase-modulated, or unmodulated **[3, 2006.01]**

15/34 • • • • • using transmission of continuous, frequency-modulated waves while heterodyning the received signal, or a signal derived therefrom, with a locally-generated signal related to the contemporaneously transmitted signal **[3, 2006.01]**

15/36 • • • • • with phase comparison between the received signal and the contemporaneously transmitted signal **[3, 2006.01]**

15/42 • • • Simultaneous measurement of distance and other coordinates (indirect measurement G01S 15/46) **[3, 2006.01]**

15/46 • • • Indirect determination of position data **[3, 2006.01]**

15/50 • • Systems of measurement based on relative movement of target **[3, 2006.01]**

15/52 • • • Discriminating between fixed and moving objects or between objects moving at different speeds **[3, 2006.01]**

15/58 • • • Velocity or trajectory determination systems; Sense-of-movement determination systems **[3, 2006.01]**

15/60 • • • • wherein the transmitter and receiver are mounted on the moving object, e.g. for determining ground speed, drift angle, ground track **[3, 2006.01]**

15/62 • • • • Sense-of-movement determination **[3, 2006.01]**
15/66 • Sonar tracking systems **[3, 2006.01]**
15/74 • Systems using reradiation of acoustic waves, e.g. IFF, i.e. identification of friend or foe **[3, 2006.01]**
15/86 • Combinations of sonar systems with lidar systems; Combinations of sonar systems with systems not using wave reflection **[2020.01]**
15/87 • Combinations of sonar systems **[3, 2006.01]**
15/88 • Sonar systems specially adapted for specific applications (seismic or acoustic prospecting or detecting G01V 1/00) **[3, 6, 2006.01]**
15/89 • • for mapping or imaging **[3, 2006.01]**
15/93 • • for anti-collision purposes **[3, 2006.01, 2020.01]**
15/931 • • • of land vehicles **[2020.01]**
15/96 • • for locating fish **[3, 2006.01]**

17/00 Systems using the reflection or reradiation of electromagnetic waves other than radio waves, e.g. lidar systems [3, 2006.01, 2020.01]

17/02 • Systems using the reflection of electromagnetic waves other than radio waves (G01S 17/66 takes precedence) **[3, 2006.01, 2020.01]**
17/04 • • Systems determining the presence of a target **[2020.01]**
17/06 • • Systems determining position data of a target **[3, 2006.01]**
17/08 • • • for measuring distance only (indirect measurement G01S 17/46; active triangulation systems G01S 17/48) **[3, 2006.01]**
17/10 • • • • using transmission of interrupted, pulse-modulated waves (determination of distance by phase measurements G01S 17/32) **[3, 2006.01, 2020.01]**
17/14 • • • • • wherein a voltage or current pulse is initiated and terminated in accordance with the pulse transmission and echo reception respectively, e.g. using counters **[2020.01]**
17/18 • • • • • wherein range gates are used **[2020.01]**
17/26 • • • • • wherein the transmitted pulses use a frequency-modulated or phase-modulated carrier wave, e.g. for pulse compression of received signals **[2020.01]**
17/32 • • • • using transmission of continuous waves, whether amplitude-, frequency-, or phase-modulated, or unmodulated **[3, 2006.01, 2020.01]**
17/34 • • • • • using transmission of continuous, frequency-modulated waves while heterodyning the received signal, or a signal derived therefrom, with a locally-generated signal related to the contemporaneously transmitted signal **[2020.01]**
17/36 • • • • • with phase comparison between the received signal and the contemporaneously transmitted signal **[3, 2006.01]**
17/42 • • • Simultaneous measurement of distance and other coordinates (indirect measurement G01S 17/46) **[3, 2006.01]**
17/46 • • • Indirect determination of position data **[3, 2006.01]**
17/48 • • • • Active triangulation systems, i.e. using the transmission and reflection of electromagnetic waves other than radio waves **[2006.01]**
17/50 • • Systems of measurement based on relative movement of target **[3, 2006.01]**
17/58 • • • Velocity or trajectory determination systems; Sense-of-movement determination systems **[3, 2006.01]**
17/66 • Tracking systems using electromagnetic waves other than radio waves **[3, 2006.01]**
17/74 • Systems using reradiation of electromagnetic waves other than radio waves, e.g. IFF, i.e. identification of friend or foe **[3, 2006.01]**
17/86 • Combinations of lidar systems with systems other than lidar, radar or sonar, e.g. with direction finders **[2020.01]**
17/87 • Combinations of systems using electromagnetic waves other than radio waves **[3, 2006.01, 2020.01]**
17/875 • • for determining attitude **[2020.01]**
17/88 • Lidar systems, specially adapted for specific applications **[3, 2006.01]**
17/89 • • for mapping or imaging **[6, 2006.01, 2020.01]**
17/894 • • • 3D imaging with simultaneous measurement of time-of-flight at a 2D array of receiver pixels, e.g. time-of-flight cameras or flash lidar **[2020.01]**
17/90 • • • using synthetic aperture techniques **[2020.01]**
17/93 • • for anti-collision purposes **[6, 2006.01, 2020.01]**
17/931 • • • of land vehicles **[2020.01]**
17/933 • • • of aircraft or spacecraft **[2020.01]**
17/95 • • for meteorological use **[6, 2006.01]**

19/00 Satellite radio beacon positioning systems; Determining position, velocity or attitude using signals transmitted by such systems [2010.01]

19/01 • Satellite radio beacon positioning systems transmitting time-stamped messages, e.g. GPS [Global Positioning System], GLONASS [Global Orbiting Navigation Satellite System] or GALILEO **[2010.01]**
19/02 • • Details of the space or ground control segments **[2010.01]**
19/03 • • Cooperating elements; Interaction or communication between different cooperating elements or between cooperating elements and receivers **[2010.01]**

Note(s) [2010.01]

The term "cooperating elements" designates additional elements or subsystems, including receivers of other users, which interact or communicate with the receiver or the satellite positioning system.

19/04 • • • providing carrier phase data **[2010.01]**
19/05 • • • providing aiding data **[2010.01]**
19/06 • • • • employing an initial estimate of the location of the receiver as aiding data or in generating aiding data **[2010.01]**
19/07 • • • providing data for correcting measured positioning data, e.g. DGPS [differential GPS] or ionosphere corrections **[2010.01]**
19/08 • • • providing integrity information, e.g. health of satellites or quality of ephemeris data **[2010.01]**
19/09 • • • providing processing capability normally carried out by the receiver **[2010.01]**
19/10 • • • providing dedicated supplementary positioning signals **[2010.01]**
19/11 • • • • wherein the cooperating elements are pseudolites or satellite radio beacon positioning system signal repeaters **[2010.01]**

19/12 • • • • wherein the cooperating elements are telecommunication base stations **[2010.01]**
19/13 • • Receivers **[2010.01]**
19/14 • • • specially adapted for specific applications **[2010.01]**
19/15 • • • • Aircraft landing systems **[2010.01]**
19/16 • • • • Anti-theft; Abduction **[2010.01]**
19/17 • • • • Emergency applications **[2010.01]**
19/18 • • • • Military applications **[2010.01]**
19/19 • • • • Sporting applications **[2010.01]**
19/20 • • • Integrity monitoring, fault detection or fault isolation of space segment **[2010.01]**
19/21 • • • Interference related issues **[2010.01]**
19/22 • • • Multipath-related issues **[2010.01]**
19/23 • • • Testing, monitoring, correcting or calibrating of a receiver element **[2010.01]**
19/24 • • • Acquisition or tracking of signals transmitted by the system **[2010.01]**
19/25 • • • • involving aiding data received from a cooperating element, e.g. assisted GPS **[2010.01]**
19/26 • • • • involving a sensor measurement for aiding acquisition or tracking **[2010.01]**
19/27 • • • • creating, predicting or correcting ephemeris or almanac data within the receiver **[2010.01]**
19/28 • • • • Satellite selection **[2010.01]**
19/29 • • • • carrier related **[2010.01]**
19/30 • • • • code related **[2010.01]**
19/31 • • • Acquisition or tracking of other signals for positioning **[2010.01]**
19/32 • • • Multimode operation in a single same satellite system, e.g. GPS L1/L2 **[2010.01]**
19/33 • • • Multimode operation in different systems which transmit time stamped messages, e.g. GPS/GLONASS **[2010.01]**
19/34 • • • Power consumption **[2010.01]**
19/35 • • • Constructional details or hardware or software details of the signal processing chain **[2010.01]**
19/36 • • • • relating to the receiver frond end **[2010.01]**
19/37 • • • • Hardware or software details of the signal processing chain **[2010.01]**
19/38 • Determining a navigation solution using signals transmitted by a satellite radio beacon positioning system **[2010.01]**
19/39 • • the satellite radio beacon positioning system transmitting time-stamped messages, e.g. GPS [Global Positioning System], GLONASS [Global Orbiting Navigation Satellite System] or GALILEO **[2010.01]**
19/40 • • • Correcting position, velocity or attitude **[2010.01]**
19/41 • • • • Differential correction, e.g. DGPS [differential GPS] **[2010.01]**
19/42 • • • Determining position **[2010.01]**
19/43 • • • • using carrier phase measurements, e.g. kinematic positioning; using long or short baseline interferometry **[2010.01]**
19/44 • • • • • Carrier phase ambiguity resolution; Floating ambiguity; LAMBDA [Least-squares AMBiguity Decorrelation Adjustment] method **[2010.01]**
19/45 • • • • by combining measurements of signals from the satellite radio beacon positioning system with a supplementary measurement **[2010.01]**
19/46 • • • • • the supplementary measurement being of a radio-wave signal type **[2010.01]**
19/47 • • • • • the supplementary measurement being an inertial measurement, e.g. tightly coupled inertial **[2010.01]**
19/48 • • • • by combining or switching between position solutions derived from the satellite radio beacon positioning system and position solutions derived from a further system **[2010.01]**
19/49 • • • • • whereby the further system is an inertial position system, e.g. loosely-coupled **[2010.01]**
19/50 • • • • whereby the position solution is constrained to lie upon a particular curve or surface, e.g. for locomotives on railway tracks **[2010.01]**
19/51 • • • • Relative positioning **[2010.01]**
19/52 • • • Determining velocity **[2010.01]**
19/53 • • • Determining attitude **[2010.01]**
19/54 • • • • using carrier phase measurements; using long or short baseline interferometry **[2010.01]**
19/55 • • • • • Carrier phase ambiguity resolution; Floating ambiguity; LAMBDA [Least-squares AMBiguity Decorrelation Adjustment] method **[2010.01]**