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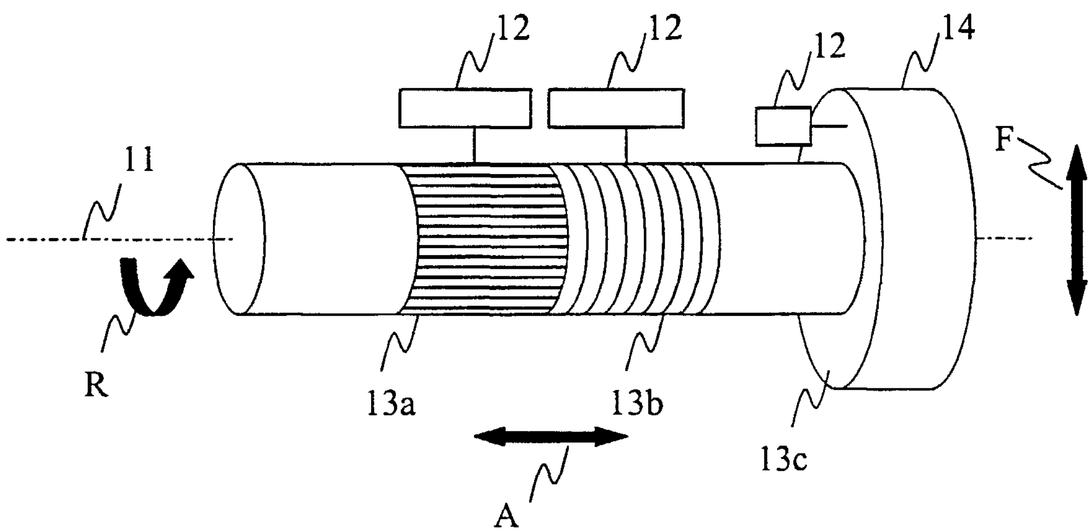

(57) Abstract: A position and movement meter is described, said meter having a carrying body (10) carrying a read pattern comprising at least two types of regions, and at least one read-out means (12) arranged to read the read pattern, the carrying body and the read-out means being movable relative to one another. The read pattern comprises a reflective surface, and the read-off means (12) comprises a source of light and a measurement means, which registers the manner in which light from the source of light is reflected by the various regions. The application also concerns a distance meter comprising such a meter.

WO 01/46644 A1

POSITION AND MOVEMENT METER

Technical Field

The present invention relates to a device for determining positions or movements, said device comprising a carrying body (10) carrying a read pattern comprising at least two types of regions, and at least one read-out means (12) arranged to read the read pattern, the carrying body and the read-out means being movable relative to one another.

Background

Conventional meters of degrees or angles make use of e.g. glass discs having differently coloured fields, said disc being located between a source of light and a sensor. Conventional degree meters of this kind do, however suffer from several drawbacks. Above all, their angle resolution and their accuracy are poor, which in turn limits their possible applications and fields of usage. In addition, prior art angle meters and particularly those showing a somewhat higher degree of resolution, are expensive and complicated to manufacture.

Also in other areas there is a need for more precise and/or cheaper position and movement meters. For example, in many situations the possibility of setting rotational objects, such as discs, shafts, observatories and the like, in a predetermined position is desirable. Also it is often desirable to establish the movements performed by rotational objects, such as shafts, in order to determine wear on bearings, to give off alarms when dangerous situations arise, and so on. Thus, there is a need for less complicated and at the same time efficient position and movement meters.

Object of the Invention

Consequently, it is an object of the present invention to provide a position or movement meter, which completely or at least partly solves the problems found in prior-art technology structures.

This object is achieved by means of a device as defined in the appended claims.

Brief Description of the Drawings

For exemplifying purposes, the invention will be described in the following in more detail with reference to the accompanying drawings, wherein

Fig 1 is a schematic block diagram of a meter of degrees in accordance with a preferred embodiment of the invention;

Fig 2 is a more detailed view of the degree meter of Fig 1;

Fig 3 is a cross-sectional view of the degree meter of Fig 2;

Fig 4 is a schematic view of a meter of distances in accordance with one embodiment of the invention;

Fig 5 is a partly cut view of the distance meter of Fig 4; and

Fig 6 is a schematic representation of a position and determination device intended for a rotational body in accordance with a further embodiment of the invention.

Detailed Description of Preferred Embodiments

The invention concerns a device for measuring angles, and a first embodiment of the angle meter in accordance with the invention is shown in Fig 1. The angle meter comprises a reader part 1 which, senses the current angle and which in response thereto issues an angle-indicating signal, and processing part 2, which transforms the output signal from the reader part into an angle signal, and a user part 3, which uses the signal representative of that angle issued from the processing part. Alternatively, the device could comprise one or several memory means 4 to ensure safer function.

As shown in Figs 2 and 3, the reader part in accordance with the invention comprises a disc 10, which is mounted for rotation about a shaft 11 extending at right angles to the plane of the disc, and at least one read-out means 12, which is located above the plane of the disc to read the disc. In addition, the disc is formed with a reflecting surface and with a read pattern comprising at least two types of fields/regions producing distinguishable reflected signals.

Read patterns

The read pattern comprises at least two types of fields, which provide distinguishable reflected signals.

Preferably, the read pattern is formed by fields located at different levels, i.e. in the form of pits made in the surface, like in the case of conventional compact discs. In this case, the fields also have the appearance of areas enclosed by two radii departing from the axis of rotation of the disc and by two arcs of a circle between the radii. Other configurations of the fields are, however possible within the scope of the invention. By compact discs should be understood in the present description all available types of laser discs.

The fields of the read pattern preferably are arranged in circles extending around the axis of rotation of the discs. In accordance with one embodiment, the fields could be in the shape of helical tracks running outwards, towards the periphery of the disc, and the read-out means is arranged to follow the pitch of the helical track when the disc rotates. Owing to this arrangement, a commercially available standard compact disc could be used. One problem when standard discs are used that have helically configured tracks in the form of apertures laid out in turns extending from the centre of the disc towards the peripheral border thereof is, however that normally, the number of apertures varies from one turn to the next, depending on the distance of the individual turn from the centre of the disc. One consequence hereof is that the reader head cannot assume the same position during the rotation of the disc over any one turn, since if so it would be "derailed". The problem could be solved by using a disc having a pattern in the form of an even circle, i.e. one wherein the distance to the axis of rotation of the disc is constant. As a result the track will not have an end, contrary to the helical track, and will not either change its position relative to the reader head. By using a disc made to particular specifications, it likewise becomes possible to decide the number of apertures per turn, which is a practical solution in order to obtain correct angle meter accuracy.

Another way of solving the problem is to form the disc with conventional helical tracks in the manufacture of the disc but to burn into the disc a feedback feature such that at a predetermined point along the track the reader head is made to jump back, whereby it will always follow the same track. The arrangement also produces an identifiable point of reference in the track, which point may be used as a starting point for calculations. This is a desirable feature in order to make resetting of the angle meter possible in case of error readings of the reader head or similar malfunctions.

A third way is to burn into the disc a "looping" track. This means that when the player reaches the end of the track, the disc contains information, which may be interpreted by the reader head based on the read-out activity and which indicates that the reader head now is to return to a track that it has passed through previously.

The read pattern could also be configured to comprise identifiable information. For example, a pattern could be located internally of the metering track, i.e. such that the read pattern will have a width comprising at least two and preferably several reading fields positioned one radially internally of the other. The pattern extending radially from the centre of the disc could in this case contain digital information, indicating the degrees, and in this manner the degrees may be read directly, without resetting of the disc and calculation. The code preferably is read radially from the centre of the disc, but obviously it is likewise possible to read in the opposite direction.

The pits of the read pattern preferably are located at such levels that the reflection will be either zero or one. This is achieved by arranging for a difference in levels amounting to a fourth of the wavelength of the light issuing from the laser source. However, it is also possible to use several different levels of reflection, which increases the data contents of each bit. This makes possible still more precise measurements and/or the use of fewer radial sections.

The different levels of reflection may be made use of by analysis of the amount of light of a specific wavelength, the different levels being distinguishable from one another. It is however also possible to use two or several different wavelengths of the emitted light, as will be described in more detail in the following.

Yet another way is to use helically configured patterns. For example, the pattern may increase in size around the disc. The degree of reflection could also be varied and indicate the location on the disc. The reflection could be maximum at the beginning of the track, for instance, and minimum at the end.

The size and configuration of the fields could also be made use of to identify one or several positions along the track. An aperture located at the zero point could, for instance have a considerably larger size, making it easy to identify.

It is also possible to arrange two or several read patterns one above the other in such a manner that they may be read selectively and separately. In this manner, the data contents per area unit could be increased drastically.

The read pattern as defined above could be arranged in a circular or helical configuration, i.e. closed or open. As discussed above, the track could be formed on a disc. However, it is likewise possible to form the read pattern in a circular or helical pattern on a cylindrical jacket face, such as externally on a shaft or the like. An open read pattern could also be arranged essentially linearly or be configured differently, provided that the read-out means is able to follow the track. In this case the read pattern could be used to detect displacements in one plane.

Generally speaking, the read pattern could be in the shape of a tape or the like that could be interconnected with the carrying object. Alternatively, the track could be worked directly into the carrying object, such as directly into the disc surface of the disc or directly into the jacket face of a cylindrical body. The read pattern could be produced for instance by punching, moulding or burning by means of a laser.

The pattern in accordance with the invention, and particularly the pattern that is adapted for reading with the aid of several wavelengths, could be used also for other purposes, such as to store information. This solution could be used e.g. to improve the storage capacity of conventional compact discs.

In addition, the pattern in accordance with the invention makes it possible to provide a protective translucent layer of for instance plastics on top of the pattern. This arrangement increases e.g. the dirt-repellent properties.

Angle-Metering Disc

In accordance with one embodiment of the invention, a disc could be used to carry the read pattern. Preferably, the disc could be a commercially available compact disc. By compact disc should be understood in the present document all types of available laser discs.

Examples of commercially available standard compact discs that may be used in conjunction with the present invention are given below.

Type of disc:	No of apertures per turn	Degree Accuracy
CD	92854	1/259
CD-R	216661	1/600
CD-8	61900	1/172
DVD	471238	1/1308

Also other types of compact discs than those mentioned above could also be used in conjunction with the invention. In addition, that above degree accuracy could be improved further by adopting the measures mentioned below.

Since normally the disc need not be exchanged, it may be mounted in a stationary position. This makes the entire device more stable and less impact-sensitive. In addition, it becomes less expensive and more simple to manufacture.

If the disc need to withstand high temperatures, it may be manufactured from glass or some other heat-resistant material. The reflective layer on the disc could also be replaced by other heat-resistant reflective materials.

<u>Read-out unit</u>

The read-out unit 12 comprises a source of light and a measuring means, preferably integrated in the same reader head. The measuring means is a sensor arranged to register the way the light from the source of light is reflected by the various fields on the disc. Preferably, the source of light is a laser and the measuring means preferably is an interferometer. This is particularly suitable in cases when the fields of the disc are reflective fields located at different levels, whereby different degrees of extinction are obtained of the light entering the interferometer, depending on the route travelled by the light.

Preferably, the reader head issues one pulse each time it meets an aperture, the output signal consequently forming a pulse train. By counting the pulses it is possible to gain knowledge on the number of apertures that has passed by. These pulses form the digital data that the processing unit is then to convert into angle data.

By using several reader heads, it becomes possible to obtain more exact measuring results, and this lessens the risk of error readings. By means of two reader heads, for example, two parallel pulses are obtained that may be compared. For each additional reader head, the accuracy is doubled. Likewise it becomes possible to determine whether or not their reading function is correct. The pulses received from the different reader heads may be combined e.g. by means of an OR gate.

The availability of several pulses also makes it possible to see in which direction the disc is rotating. In the measuring process, the different heads will register the points at different times. Consequently, the pulses will be displaced relative to one another. The point registered first shows the direction of rotation of the disc. In addition, it becomes possible to determine the speed and acceleration of the discs by comparing the clock pulses.

Instead of measuring the number of crests, i.e. the not-depressed areas of the disc, it is possible to measure the number of variations that the pulse exhibits This arrangement makes it possible to double the number of obtainable measurement values.

The processing means 2 comprises a processing unit, which is connected to the read-out means 1 and which may be a processor, a micro-chip or the like that interprets the signals from the read-out means to produce the torsion angular position of the disc. Preferably, the processing unit is arranged to continuously supply data on the torsion angular position of the disc.

Preferably, the processing unit 2 comprises a calculator, which counts the number of fields of a particular kind, the number of field changes or the like that pass past the measuring means and that are derived from the output signal from the reader head. Based on the knowledge of the number of fields or the like required to complete the turn, a number that may vary depending on the distance from the disc centre, the unit is able to then determine the position along the turn and consequently also degree differences.

By providing a memory 4 in the device in accordance with the invention, the device may be made more impact-resistant. For example, a signal read some hundredths of a second previously, may be stored in a memory buffer. In case of power failure, the gap may be filled with the aid of the memory buffer. This is true, however, only of angle meters wherein the disc rotates at an essentially constant speed.

In some applications, such as when the angle meter is used to control robots, it may be desirable to be able to start without having to reset the calculator. For instance, during transportation the position of the arm of a robot may be shifted and normally resetting is required under such circumstances. But if the meter measures movements continuously, this problem need not arise. One way of achieving this is to provide a reserve source of energy (not shown), such as a battery, which is activated when the ordinary source of current is disconnected. By keeping the calculator in an ON condition while being powered from the battery, the signal will be let through. Instead of forwarding the signal to the user part it is, however, also in this case possible to store the angle data in a memory circuit. Only in conjunction with mounting of the product at a later occasion does it read the memory to find out the angle position. This is an advantage also in case of power failures, if any, since on the one hand the arrangement facilitates the re-start and on the other, it could be made use of to identify the cause of failure. For example, the memory may retain the 10 latest values.

In addition, it is possible to make use of more than one wavelength of the emitted light. This may be achieved in one and the same unit, or in several different units. Consequently, different-depth pits in the read pattern are discernible in a simpler and more efficient manner, since different depths provide reverse phases and extinction of the reflected light at different wavelengths. In this manner it becomes possible to provide different fields for specific wavelengths, while at the same time these do not interfere with one another, since except for the specific wavelength they are perceived as noise. The arrangement makes it possible on the one hand to augment the amount of data contained in the read pattern, and on the other to arrange the fields in the track closer to one another, thus making the track more compact, since the arrangement still provides sufficient spacing between the fields to which the respective individual wavelengths have been allocated.

In the case of several wavelengths, it is possible to use several separate reader units, for example one for each wavelength. Also light comprising several wavelengths or a range of wavelengths for illumination of the read pattern may be used. In the detection means, a division of the light according to wavelength may be made, for example by means of a prism, and only the desired wavelengths are used for the detection function. In practical terms, this may be effected for example by means of a multi-interferometer or a CCD could be arranged after the separation of wavelengths. Another possibility is to separate directly in an interferometer or the like the degree of reflection concerning the various wavelengths without first separating the reflected light with respect to wavelength.

It is likewise possible to divide the reading light beam into several separated fields with respect to which the reflection could be analysed separately. In this manner field limits and edges may be identified, since in this case the reflection of the individual fields differs from field to field. This feature could be made use of also to read several track fields simultaneously, in which case the information from the various tracks may be separated subsequently. The arrangement imparts to the reader unit the same performance capacity as that provided by several separate readers but the unit may be made more efficient and more compact.

It is also possible to arrange for the reading function to be effected from two or several superposed read patterns.

In some applications, the read pattern is exposed to severe environmental conditions, such as extreme heat, pollution, vibrations and the like. This may be the case when the angle meter is intended for measuring rotating shafts or the like, as will be described in closer detail further on. In the case of such applications, adaptation of the reader unit is required to make it less sensitive.

The lens arranged to focus the reflected beams towards the detection means (reader head) normally is movably mounted in order to allow focusing corrections during operation of the device. However, the lens and the detection means could instead be fixedly interconnected, which eliminates the problems of vibration-induced error focusing. At the same time, the sensitivity to pollution is reduced, and in addition, this structure can be made more robust and less heat-sensitive.

Should the need for focusing be considerable, for example because of varying spacing between the detection means and the read pattern, other focusing correction means could be provided. For example, two or several detection means (reader heads) may be arranged at different distances from the lens. In this case, correction may be effected by choosing the best-focused detection means. This could be done by guiding the reflected light towards the chosen detection means with the aid of a movable mirror or the like, although preferably all detection means are instead illuminated simultaneously. This may be done by division of the light beam by means of a prism, semi-transparent mirrors or the like, and thereafter the signal issued from the best-focused detection means is chosen. Alternatively, or as a supplement, it is likewise possible to make the detection means more robust by enlarging the area of the detection surface that receives the reflected radiation, which reduces the sensitivity to error focusing.

In addition, it is possible to locate the detection means further away from the read pattern by providing means for transfer of light from the preferred position for respectively emission of light towards the read pattern and reception of reflected light. Such transfer means could be e.g. an optical fibre or the like. In this way, the sensitive equipment may be moved to less exposed locations, thus reducing the problems of pollution, vibrations and heat.

If the speed varies considerably it is possible to use several reader units to scan read patterns having different degrees of resolution. As a result, a higher-resolution reader could be used at low speeds, whereas a reader having a lower degree of resolution are used at higher speeds, when higher-resolution readers have difficulties in coping.

Angle Meter

The read-out means preferably is attached to a stationary part of the device, such as a chassis or a housing 5. In addition, the disc preferably is interconnected with a movable part of the device, such as a laser diode 6 or the like, and the housing 5 and the laser diode 6 may be displaced relative to one another with the aid of a screw means, such as a micro screw 8.

The degree-value data computed by the processing unit 2 are forwarded to a user part 3, such as a data package. The user part could be for instance a display or the like, indicating the degree data. Depending on the application, the degree-value data could also be transferred to some other unit, which makes use of this signal directly for control purposes or the like.

The angle meter in accordance with the invention could also comprise stabilising means 9 or the like to ensure stable and firm movements of the disc 10.

The angle meter in accordance with the invention may be used in a variety of fields, where the number of revolutions need to be counted or angles be measured. As examples of such suitable areas of application may be mentioned in optical distance measurement means, in robot-control means for precision welding purposes, in inductive sensors and other measurement equipment, in observatories, in tachometers, in targeting systems and radar systems. Two basic fields of applications are, however significant, viz.:

1. Degree counters rotating at a constant speed, such as clocks, radars, laser guides; and
2. Degree counters being rotated by an external force, such as tachometers, speedometers, degree meters.

The device in accordance with the invention could also be designed as an absolute-value sensor, and thus be able to produce exact values without having to be reset. This is achieved by means of a reserve source of energy and a memory, as described previously. However, it could also be achieved by providing identifiable information in predetermined positions on the face of the disc, as described above.

Distance Meter

An angle meter in accordance with the invention, as described above, is advantageously used for distance-measurement purposes, for example. The principle behind a distance meter of this kind, shown in Figs 4 and 5, is based on trigonometric relationships, from which, with knowledge of two values, i.e. the angle (v) and a known length of one of the catheters (x), it becomes possible to derive the length (y) of the other catheter and/or the length of the hypotenuse. With increasing length, the accuracy of the angle becomes increasingly important, and consequently very precise angle meters are required for this purpose.

The distance meter preferably comprises two laser diodes 6, 7 spaced a known distance (x) apart. The distance could be for instance one meter. One of the laser diodes 7 is fixedly mounted whereas the other laser diode, as mentioned earlier, is rotary and interconnected with the disc of the angle meter. Rotation of the laser 6 thus results in rotation of the disc mounted underneath. The latter is in turn read by the reader head.

The angle signal is then transformed for instance by means of a stored table of tangential values and is multiplied by the distance x separating the lasers, which gives the value of the distance from the fixed laser 7 and to the point where the beams cross.

The distance meter as defined above may of course be used in distance measurement applications of all kinds. The precision of the angle meter opens up the fields of possible uses for the meter, such as for calculation of areas, obtaining building construction measurements, map interpretation, navigation, and so on.

The use of the distance meter as defined above could be effected in the following manner. The distance meter, set in a zero position, i.e. with the beams being parallel, is directed so as to point at the target, whereby two laser points will appear side by side. By turning the movable laser by means of a micro screw 8 or the like, the spacing between the points will shrink. Finally, they will join and merge into one point. The display 3 of the meter on which display the distance to the target may be shown, is then read. Preferably, the display shows the distance to the beams-meeting point also during the very process of adjustment, when one beam is being rotated.

Summary of Angle Meter and Its Applications

The angle meter as defined above offers a multitude of advantages compared with prior-art meters, viz.:

- The angle meter is simple and accurate and consequently it may be used for a wide range of applications;
- Standard components may be used to a large extent, which makes the meter simple and easy to manufacture;
- The meter is simple to use;
- The meter may be made compact and light, and could for example be designed to be hand-held, requiring no additional support;
- The meter may be made very impact-resistant, particularly when equipped with a memory;
- The meter consumes very little current, and consequently may be battery-operated, for which reason it need never be shut off during normal uses.

Corresponding advantages are of course found also in conjunction with distance meters and other applications, in which the angle meter is used. In addition, a further advantage of the distance meter is that it does not have be located at the place to which the distance is to be measured, nor does a reflecting prism or other similar means have to be set up at that place.

Axial and Radial Movement Meter

In accordance with another embodiment of the invention one or several read patterns and reader units as defined above are used to measure axial and radial movements. This embodiment may be used for example to measure rotation and axial displacement of shafts and bearings, as illustrated in Fig 6, but it may also be used together with other rotating objects, for example to control the rotary motion of observatories and the like turning about an axis of rotation 11.

For the purpose of this application at least one read pattern 13 is arranged for example on the jacket face of the rotating object. The field areas of the track could in this case extend either in an axial direction, 13a, to measure rotational movements R of the rotating object, or in a tangential direction, 13b, to measure movements A in an axial direction. Preferably, fields are arranged in both of these directions. This may be effected by arranging a sequence of several distinguishable tangential read pattern axially, one after the other. The meter can thus be used to indicate the angle of rotation as well as axial displacement, a feature which is of interest for estimation of for instance load on bearings and the like. The tracks could be made distinguishable by arranging identifiable points of reference in the tracks, as discussed above. It is likewise possible to provide in one or both directions calculators that keep track of transitions of fields and based on a starting value calculate the present position. Points of reference or the like may also be used for synchronising purposes and for taking care of any errors that may arise when the read-off activity passes over from one track to another. For this purpose it is likewise possible to provide separate tracks of reference in one or several directions, which tracks handle movements in one of the directions only.

The read pattern could, as already mentioned, be designed to indicate axial displacements only. One such pattern 13b may consist of depressed areas in the form of rings arranged in sequence in an axial direction around the rotary body.

Separate read patterns 13a, 13b with fields that have a larger extension in the direction opposite to the read-off direction could also be used when it is desirable to take measurements in several directions. In this way, the sensibility to vibrations is reduced and so is the problem of error readings. It is, however, possible to use one single pattern only, which is designed to allow positions and movements to be determined in several directions.

The meter in accordance with the invention makes it possible to obtain high precision and accuracy while at the same time the meter is comparatively simple and inexpensive to manufacture.

It is likewise possible to use a disc or a similar radially projecting part 14 on the shaft or the cylindrical body, having a face that is not parallel to the axial direction and that preferably comprises a plane extending at right angles to the axial direction, in order to carry the read pattern 13c, like in the meter described previously. Preferably, the track in this case comprises concentric rings. In this manner displacements F in the radial direction may be detected, which is useful in order to detect bearing play.

One of several of the patterns described above thus may be used simultaneously, and one or several read-off means 12 may be provided to read these patterns.

Summary

The invention has been described above by means of one embodiment. The expert in the field readily understands that several alternative embodiments of the invention are possible. For example, the different distinguishable fields of the read pattern may be designed in other ways than as pits, other types of compact discs than those enumerated herein could be used, other ways of obtaining identifiable points of reference are possible, the angle meter could be used in other fields of application, and so on. The invention could be used to identify predetermined positions of rotary or movable objects. In addition, by light used for read-off should be understood herein all kinds of electromagnetic radiation that may be used in this context. Such and other obvious modifications should be regarded as embraced by the invention as the latter is defined in the appended claims.

CLAIMS

1. A position and movement meter having a carrying body (10) carrying a read pattern comprising at least two types of regions, and at least one read-out means (12) arranged to read the read pattern, the carrying body and the read-out means being movable relative to one another, c h a r a c t e r i s e d in that the read pattern comprises a reflective surface, and in that the read-off means (12) comprises a source of light and a measurement means, which registers the manner in which light from the source of light is reflected by the various regions.

2. A meter as claimed in claim 1 for measuring angles, wherein the carrying body comprises a disc (10), which is arranged to rotate about an axis extending perpendicularly to the plane of the disc.

3. A meter as claimed in claim 2, c h a r a c t e r i s e d in that said source of light is a laser and in that said measurement means is an interferometer, and in that the regions of the disc are formed by recessions made in the surface.

4. A meter as claimed in claim 2 or 3, c h a r a c t e r i s e d in that the regions of the disc have the appearance of areas enclosed by two radii departing from the axis of rotation of the disc and by two arcs of a circle defined between said radii.

5. A meter as claimed in any one of claims 2-4, c h a r a c t e r i s e d in that the regions of the disc extend/run/ in a helical track outwards, towards the periphery of the disc, and in that the read-out means follows the pitch of said helical track upon rotation of the movable parts.

6. A meter as claimed in claim 5, c h a r a c t e r i s e d in that the helical track is designed with a

feedback function, whereby the read-off means is made to return to a previously passed-by position along the track.

7. A meter as claimed in any one of claims 2-6, c h a r a c t e r i s e d in that the disc (10) is a compact disc and preferably a commercially available standard disc.

8. A meter as claimed in any one of claims 2-7, c h a r a c t e r i s e d in that it further comprises a processing unit (2), such as a processor, which is connected to the read-off means (12) and which interprets the signals of the read-off means to provide the angle of rotation of the disc.

9. A meter as claimed in claim 8, c h a r a c t e r i s e d in that the processor is arranged continuously to provide the angle of rotation of the disc.

10. A meter as claimed in any one of claims 2-9, c h a r a c t e r i s e d in that the read-off means is attached to a stationary part (5) of the meter, and in that the disc is connected with a movable part (11) of the meter.

11. A meter as claimed in claim 10, wherein the movable part (11) is turned relative to the stationary part (5) by a variable force supplied externally.

12. A meter as claimed in claim 11, wherein the external force is supplied by means of a screw device (8).

13. A meter as claimed in claim 10, wherein the movable part (11) is turned relative to the stationary part (5) at an essentially constant velocity of rotation.

14. A meter as claimed in any one of claims 2-13, wherein the disc regions are designed in such a

manner that at least one angular position of the disc is identifiable.

15. A distance meter comprising a angle meter in accordance with any one of claims 2-14.

16. A meter as claimed in claim 15 when dependent on claim 10, wherein the distance meter comprises a first source of light (7), and preferably a laser, which is fixedly mounted on the stationary part (5), and a second source of light (6), and preferably a laser, which is fixedly mounted on the movable part (11).

17. A position and movement meter as claimed in claim 1, wherein the carrying body (10) is arranged to rotate about an axis of rotation.

18. A meter as claimed in claim 17, wherein the read pattern (13a;13b) is arranged on a surface, which is not perpendicular to the axis of rotation, and preferably extends in parallel with the axis of rotation.

19. A meter as claimed in claim 18, wherein the read pattern (13b) is designed to allow determination of axial movements of the rotary carrying body.

10. A meter as claimed in any one of claims 17-19, wherein the read pattern (13a) is designed to allow determination of the rotational movement of the rotary carrying body.

21. A meter as claimed in any one of claims 17-19, wherein the carrying body comprises a part (14), which projects from the axis of rotation and which carries a read pattern (13c).

22. A meter as claimed in claim 21, wherein the read pattern (13c) provided on the projecting part is designed to allow determination of displacements of the axis of rotation of the rotary carrying body.

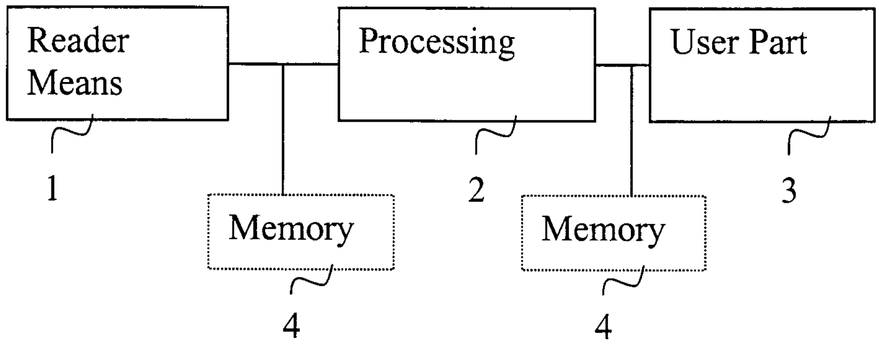
Reader Means
Processing
User Part
1
2
3
Memory
Memory
4
4

Fig 1

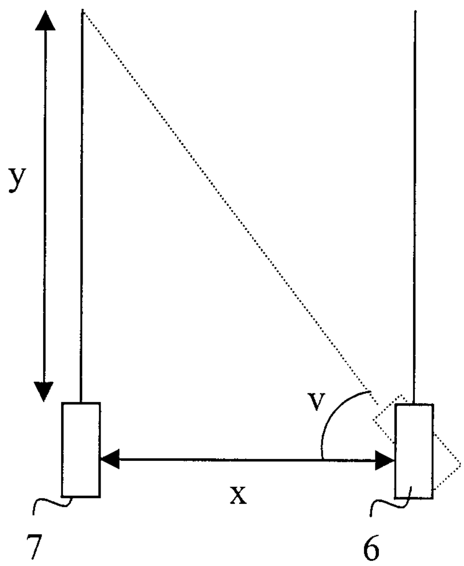
y
v
x
7
6

Fig 4

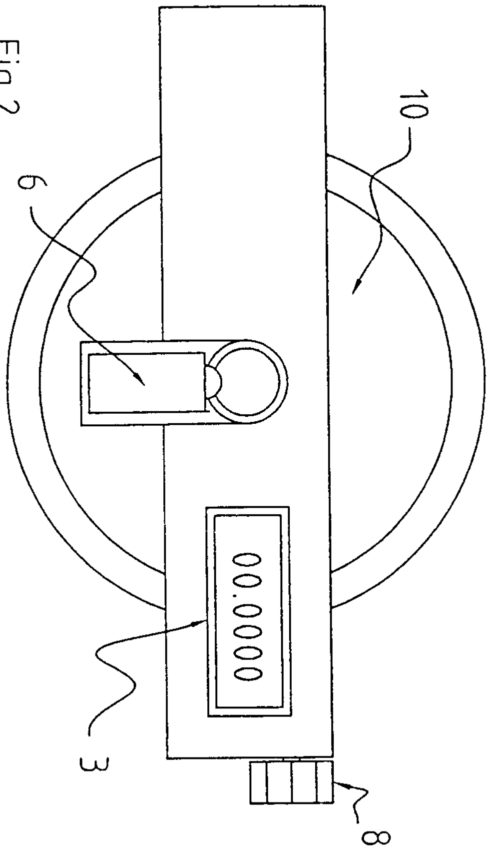

Fig.2

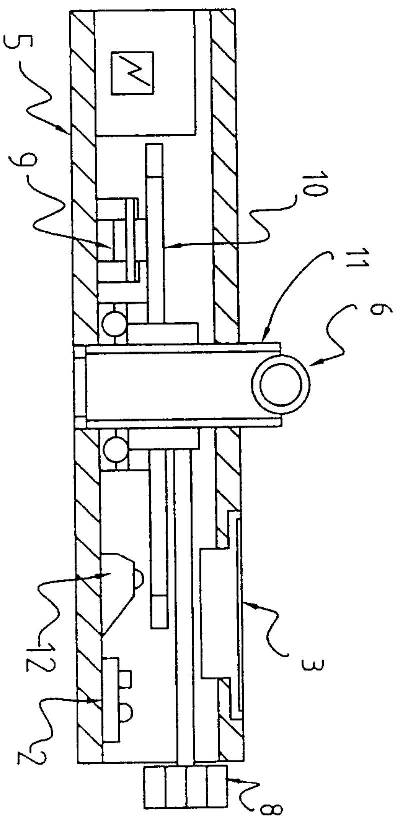

Fig.3

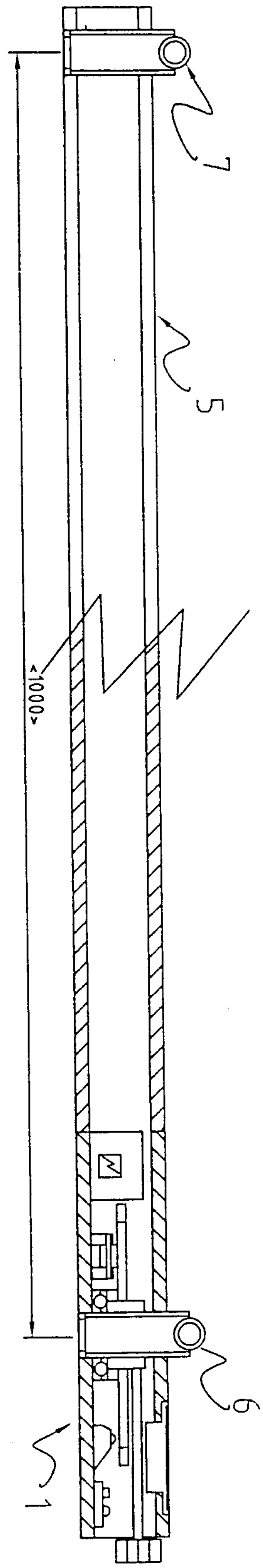

Fig.5

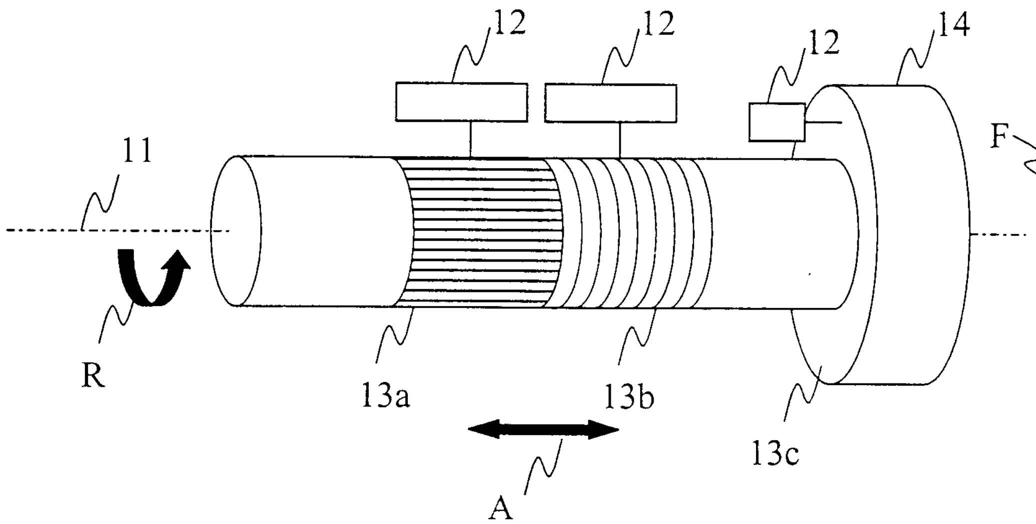

Fig. 6

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 00/02618

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: G01B 11/26, G01D 5/347, G01C 3/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: G01B, G01D, G01C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0577104 A1 (ROCKWELL INTERNATIONAL CORPORATION), 5 January 1994 (05.01.94), column 2, line 13 - column 5, line 48; column 8, line 10 - line 15; column 10, line 28 - line 48, column 12, line 7 - line 16	1-4,7-11, 13-14
Y		15
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X	US 5107107 A (E.P. OSBORNE), 21 April 1992 (21.04.92), column 3, line 3 - column 4, line 48	1-11,13-14
Y		15
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X	US 4987299 A (H. KOBAYASHI ET AL), 22 January 1991 (22.01.91), column 1, line 43 - column 3, line 40	1,17,18,20
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[X] Further documents are listed in the continuation of Box C. [X] See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
4 April 2001	06-04-2001
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86	Authorized officer Anette Eriksson / MRo Telephone No. +46 8 782 25 00

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 00/02618

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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X	US 4639595 A (M. OKITA ET AL), 27 January 1987 (27.01.87), column 1, line 60 - column 2, line 15 --	1,17-18, 20-21
X	DE 4233756 A1 (ROBERT BOSCH GMBH), 14 April 1994 (14.04.94), the whole document --	1,2,3,5,8-9, 15,17-18,20
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A	US 5748111 A (K.C. BATES), 5 May 1998 (05.05.98), the whole document -- --------	1,17-20

INTERNATIONAL SEARCH REPORT

Information on patent family members

25/02/01

International application No.

PCT/SE 00/02618

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