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(54) DEVICE FOR SCANNING A DISC-SHAPED INFORMATION CARRIER WITH CONTROLLED CHANGES IN ANGULAR AND LINEAR VELOCITIES

(75) Inventors: Gheorghe S. Stan, Eindhoven (NL); Johannus L. Bakx, Eindhoven (NL)

(73) Assignee: Koninklijke Philips Electronics N.V., Eindhoven (NL)

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Related U.S. Patent Documents

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(58) Field of Search 360/73.03, 48, 360/135; 369/47.36, 47.4, 43, 44.27, 275.3

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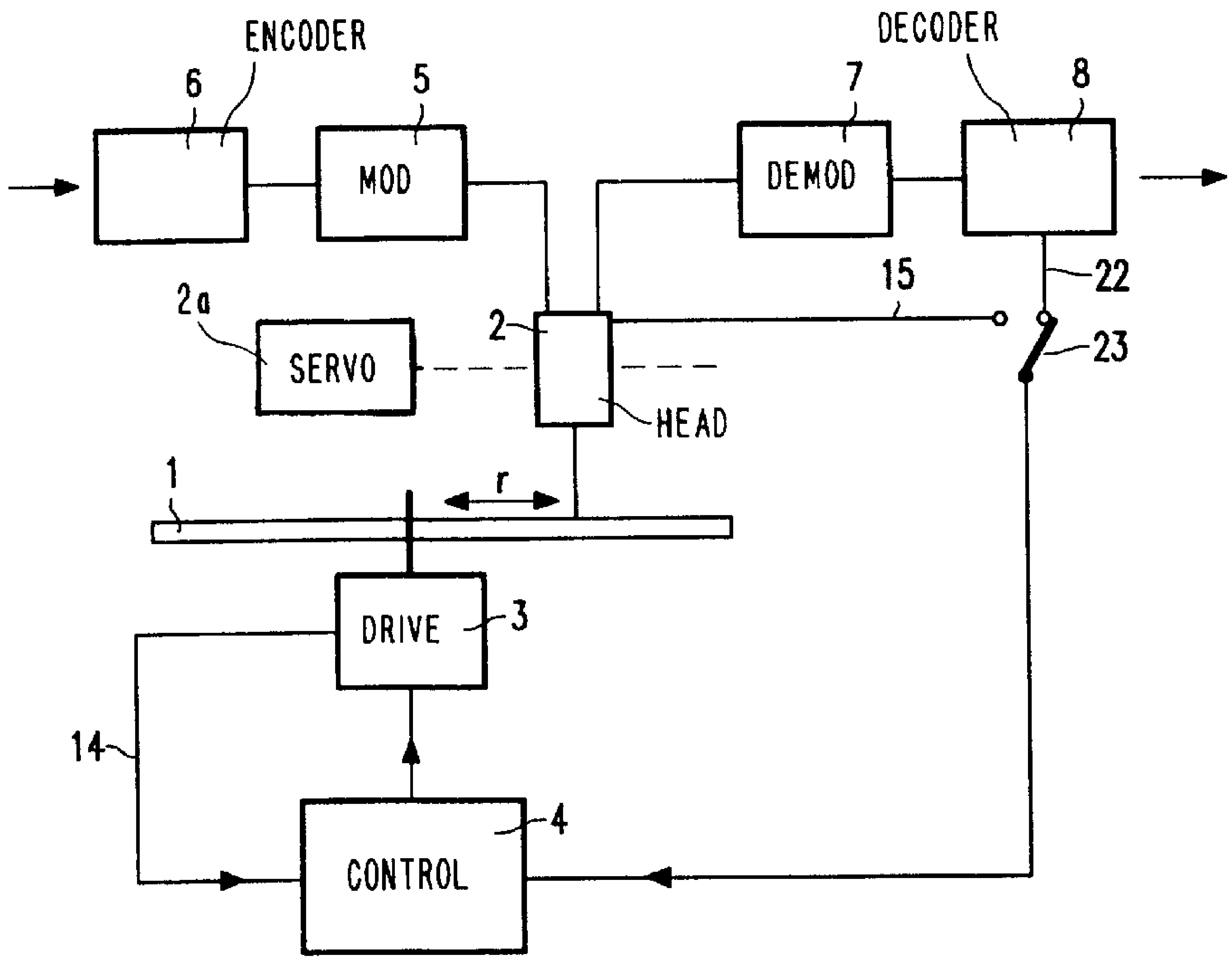
Primary Examiner—Alan T. Faber

(57) ABSTRACT

For scanning a disc-shaped information carrier at a high average information rate with minimum access time, the angular velocity is decreased substantially as the radial distance to the scan location increases, while at the same time the linear velocity of track scanning increases substantially. The track may be divided into zones which are scanned with constant angular velocity. With respect to the inner tracks of at least two adjacent zones, or the innermost and the outermost tracks, the angular velocity decreases less than inversely with increase of radial distance, while the linear velocity increases less than proportionally with increase of radial distance.

193 Claims, 3 Drawing Sheets



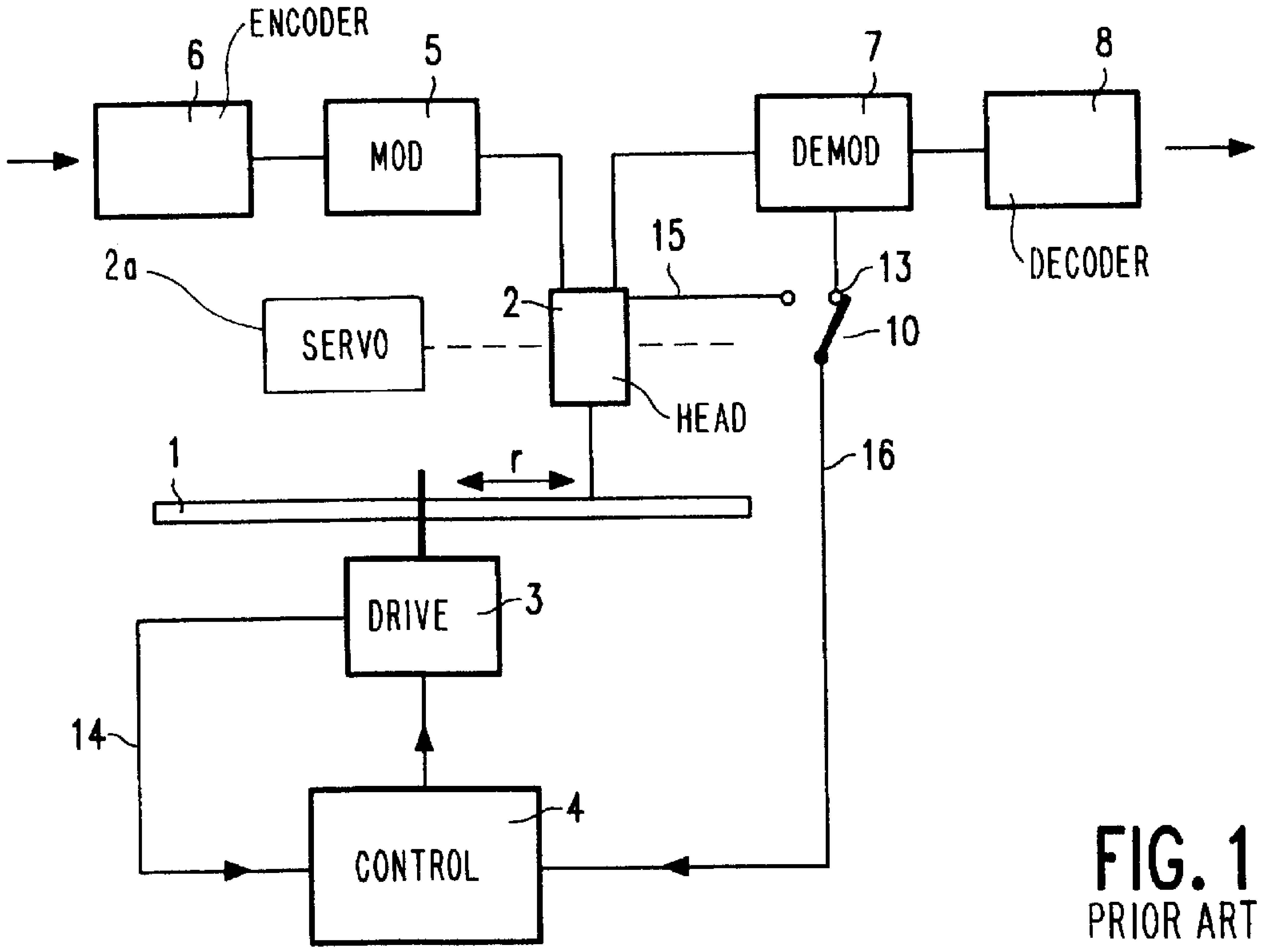


FIG. 1
PRIOR ART

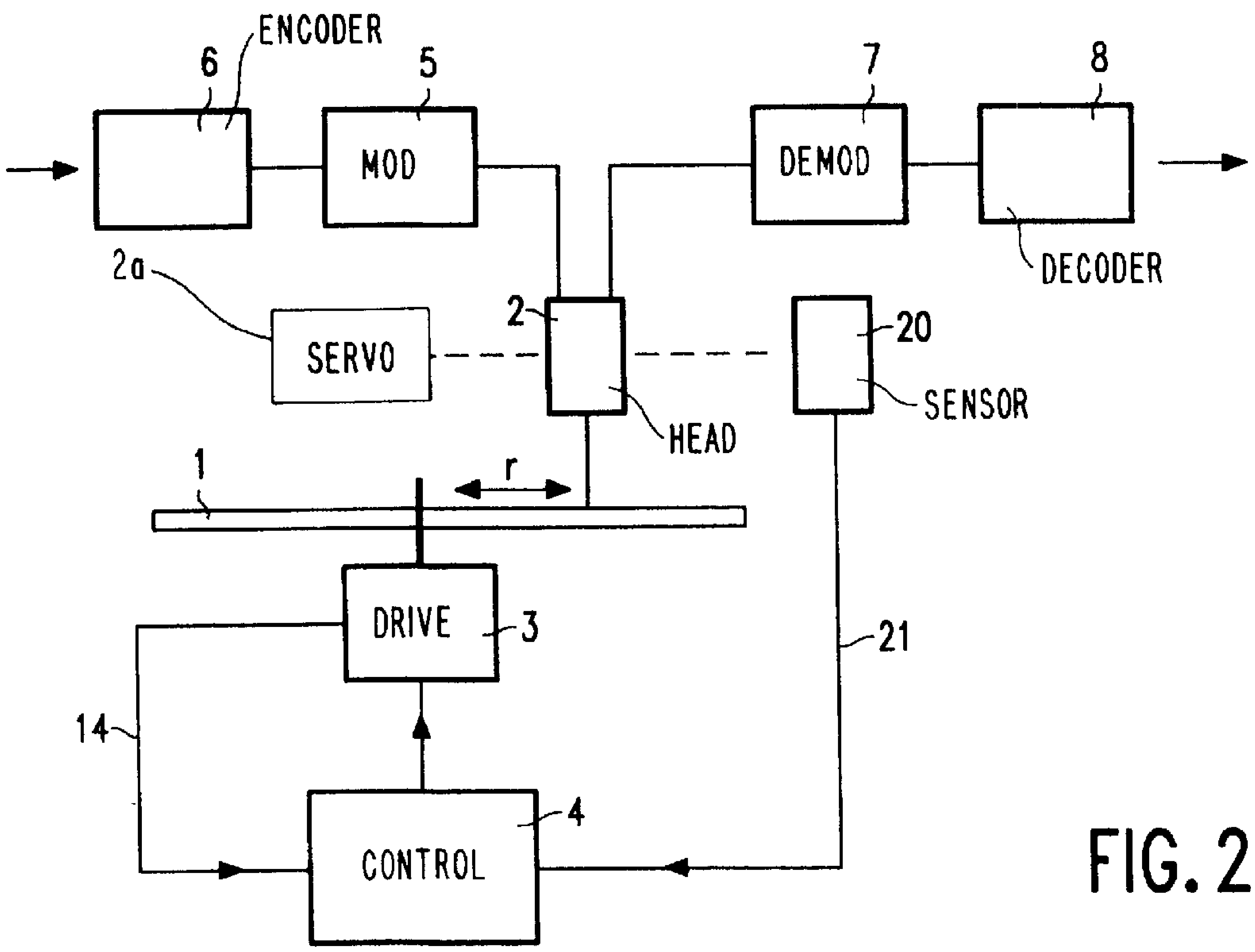


FIG. 2

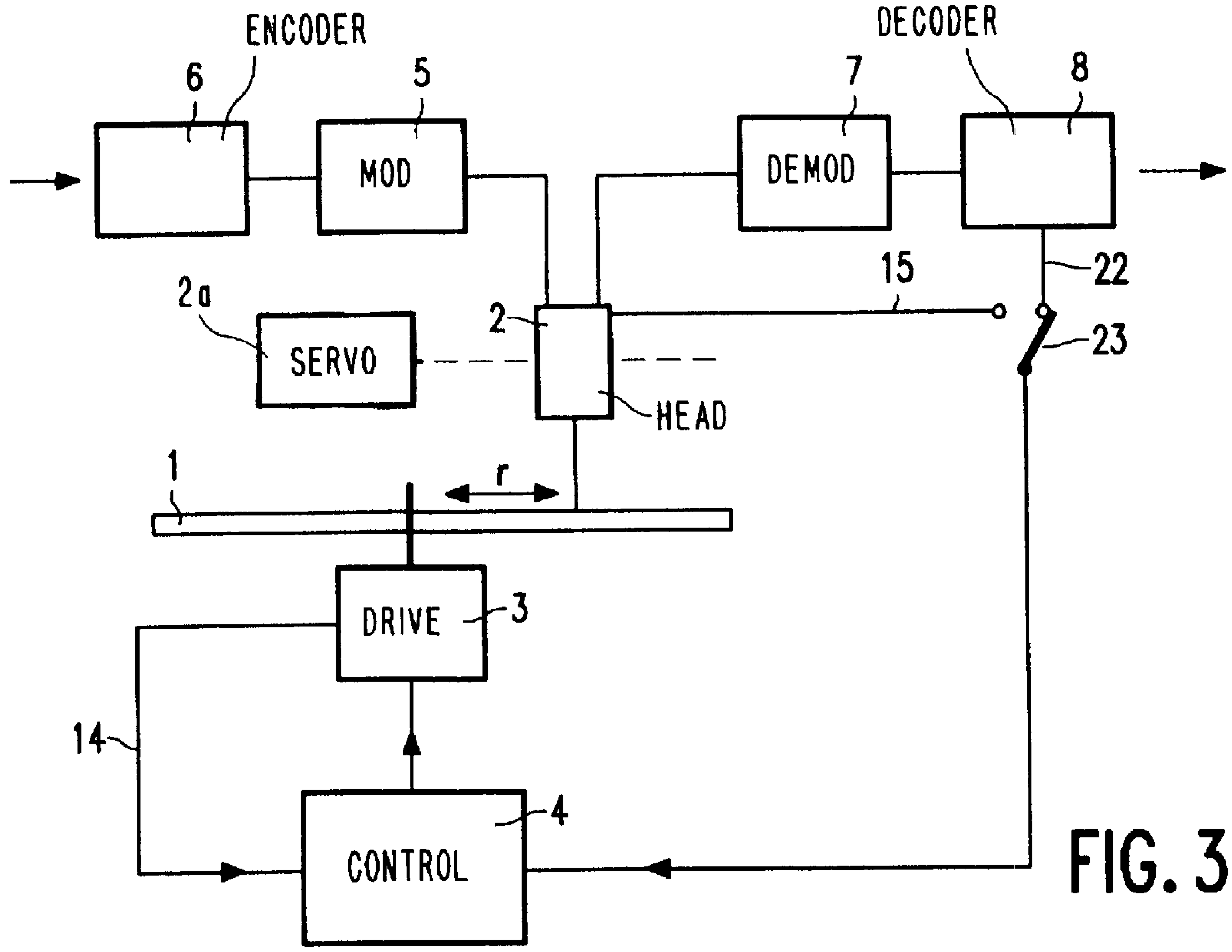


FIG. 3

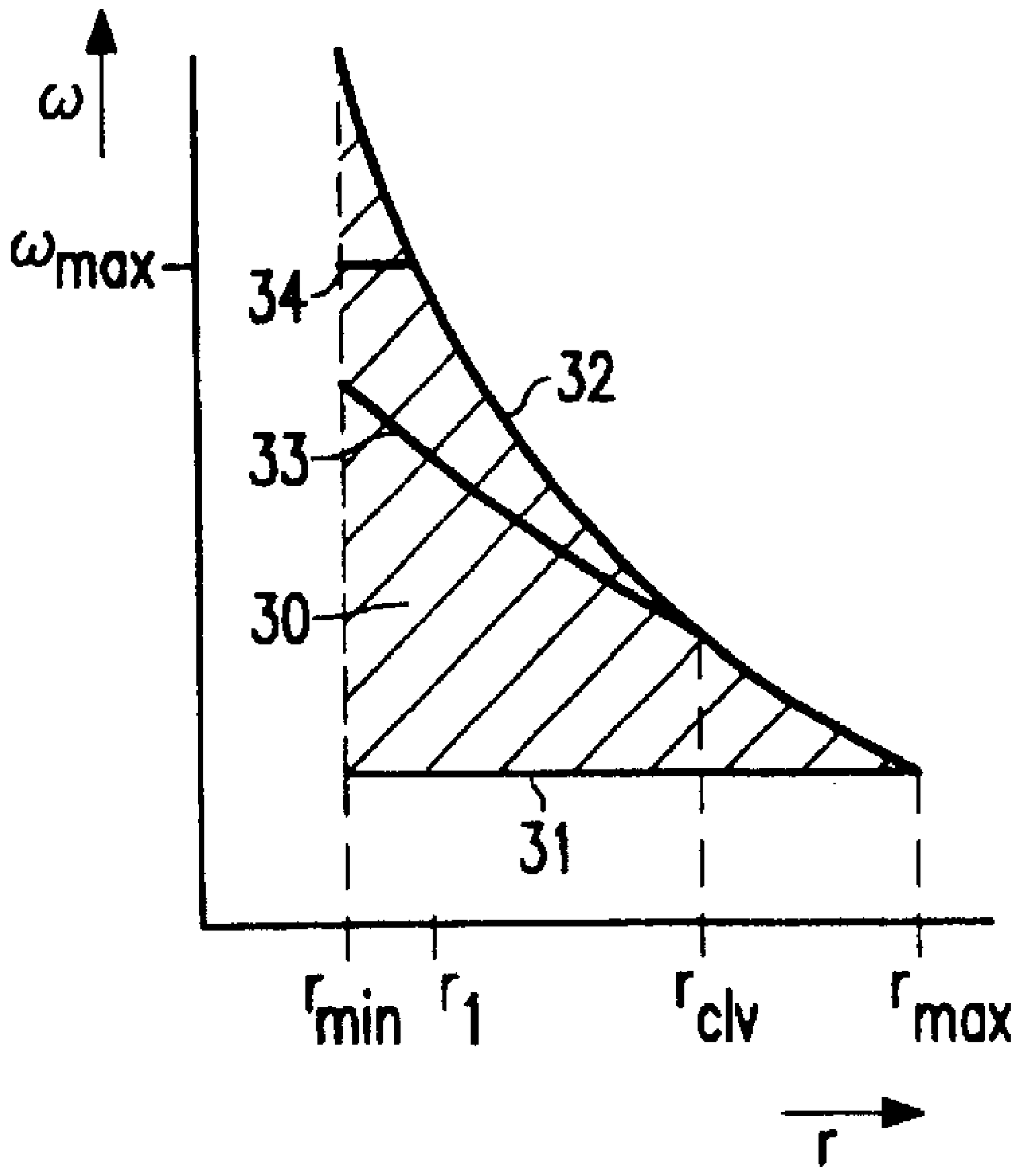


FIG. 4a

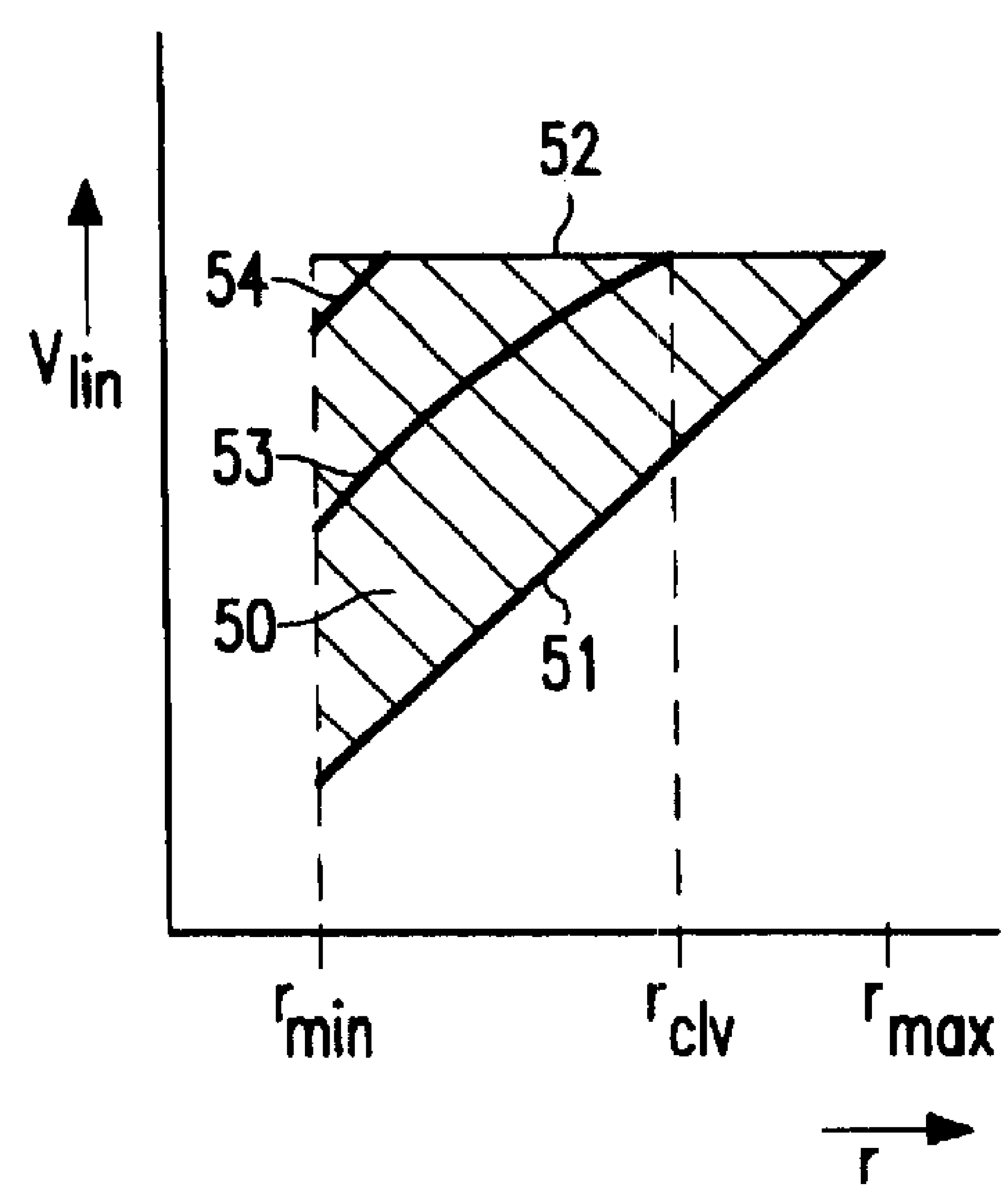


FIG. 4b

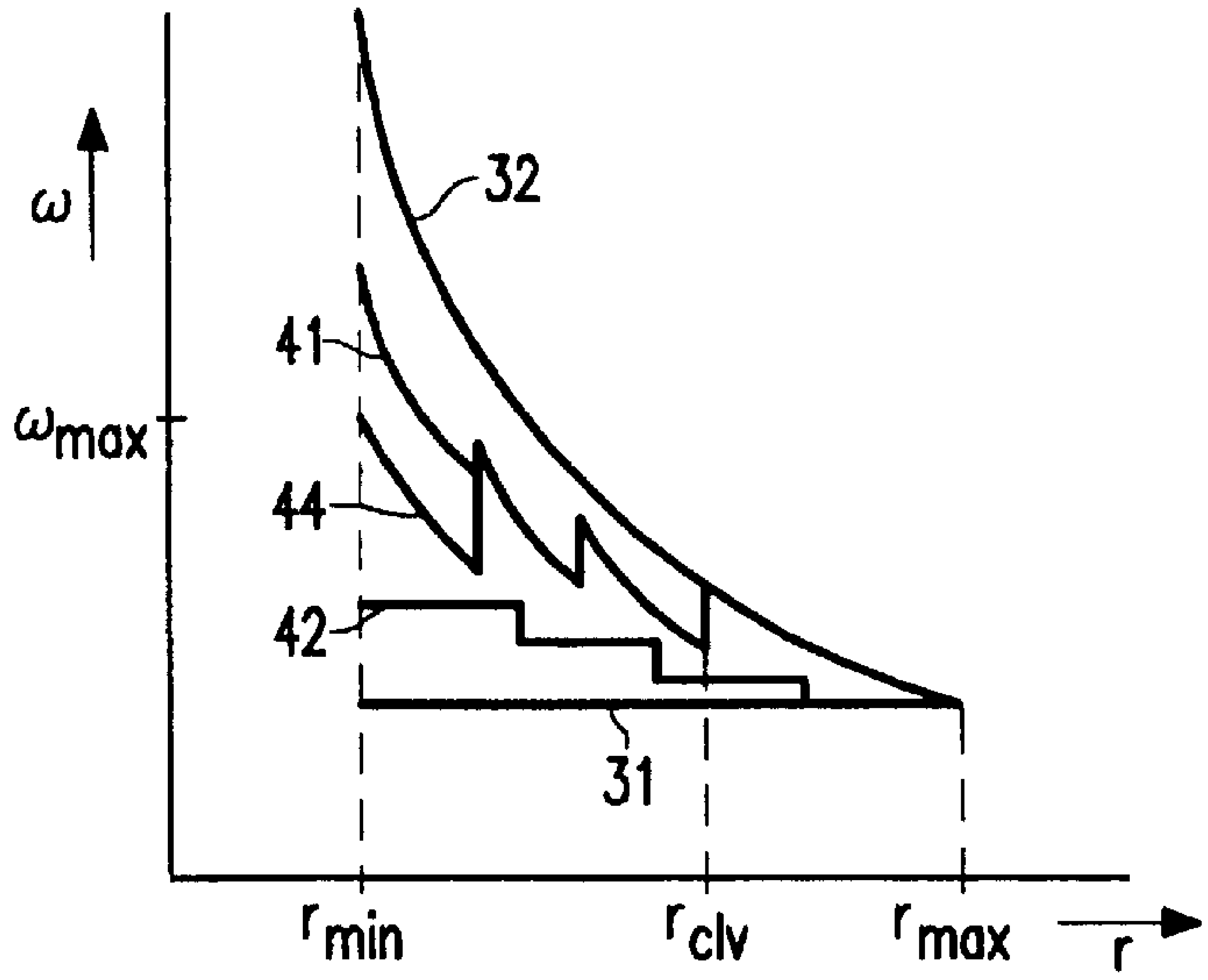

ω
32
41
ω_{max}
44
42
31
r_{min}
r_{clv}
r_{max}
r

FIG. 5

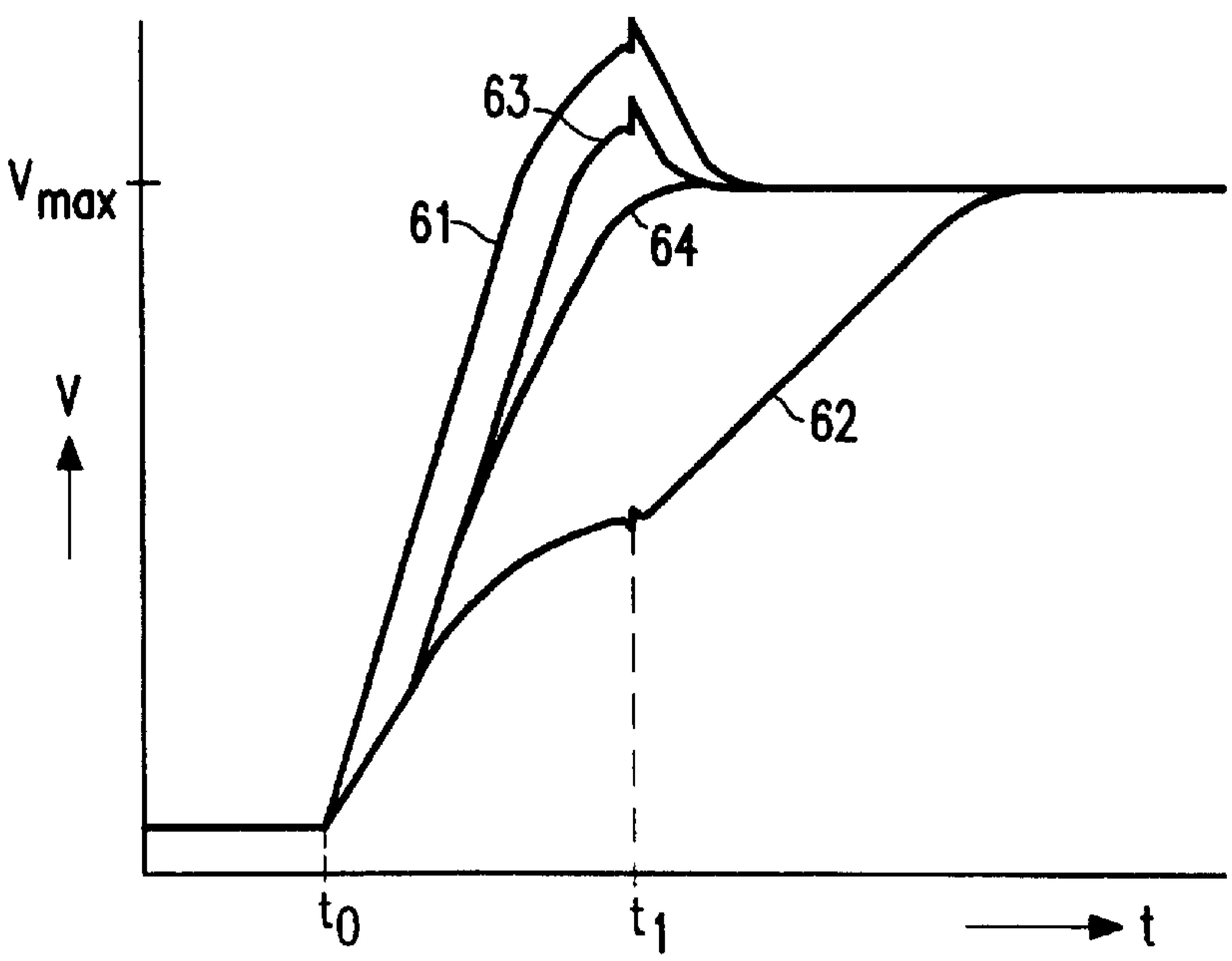

63
V_{max}
61
64
V
62
t_0
t_1
t

FIG. 6

DEVICE FOR SCANNING A DISC-SHAPED INFORMATION CARRIER WITH CONTROLLED CHANGES IN ANGULAR AND LINEAR VELOCITIES

Matter enclosed in heavy brackets [ ] appears in the original patent but forms no part of this reissue specification; matter printed in italics indicates the additions made by reissue.

The invention relates to a device for reading and/or recording information from/in an information track on a disc-shaped information carrier, comprising scanning means for scanning the information track with a linear velocity at a variable distance (r) from a point of rotation of the information carrier, and comprising drive means for causing the information carrier to rotate at an angular velocity, and control means for controlling the drive means.

BACKGROUND OF THE INVENTION

Such a device is known from U.S. Pat. No. 5,161,142. In the known device a so-termed CLV (Constant Linear Velocity) disc, which is a disc-shaped information carrier on which the information track is filled with information having a constant linear density, is scanned with a Constant Angular Velocity (CAV). If information is to be read from another part of the information track, the scanning means are moved as rapidly as possible to this part of the track by a skip across the tracks to a new radial position. In the known device the angular velocity remains unchanged, so that a short access time to information elsewhere on the disc is realised.

A problem of such a device is that the information scanning velocity close to the centre of the disc is considerably lower than near the outer edge. As a result, the average information scanning velocity is much lower than the maximum information scanning velocity. Also the information processing circuit in the device is required to have a large operational range; that is, to process data having widely varying data rates.

SUMMARY OF THE INVENTION

It is an object of the invention to provide, for example, a device that has a high average information scanning velocity, while the access time after a rapid displacement remains short.

This object is achieved by a device as defined in the opening paragraph, characterized in that the control means are arranged to cause the information carrier to be driven in such a way that the angular velocity of the information carrier substantially decreases with an increasing distance (r), and the linear scanning velocity substantially increases.

The invention is advantageous in that the difference between the minimum and maximum operational angular velocities is smaller than when recording or reading operations are carried out with a constant linear velocity, so that the adaptation of the angular velocity in the case of a rapid radial displacement remains limited. In a device according to the invention, a relatively low-power motor and motor drive may be used. This not only restricts the weight and size, but also the energy consumption, the heat build-up and mechanical vibrations.

A further embodiment for the device is characterized in that the control means are arranged to set the angular or linear velocity in such a way that a first period of time necessary for the pick-up means to reach another part of the information track by a rapid radial displacement is longer than or equal to a second period of time necessary to adapt

the linear velocity for a rapid radial displacement to a speed at which the information can be processed. This embodiment is advantageous in that, given a specific maximum information processing rate and the physical parameters of the device, the optimum average information rate is obtained with a minimum access time.

A further embodiment for the device is characterized in that the control means are arranged for constant linear velocity scanning during information recording. This embodiment is advantageous in that the recording parameters, such as, for example, the laser power and the shape of the write pulse, need to be determined for only one fixed linear velocity. These parameters continue to be constant during the recording operation.

A further embodiment for the device is characterized in that the control means are arranged for deriving the distance (r) from information in the information track. This embodiment is advantageous in that the distance (r) can be derived from the available signals, for example, addresses, without the necessity of adding another pick-up to the device.

These and other aspect of the invention will be apparent from and elucidated with reference to the embodiments described hereinafter.

BRIEF DESCRIPTION OF THE DRAWING FIGURES

In the drawings:

FIG. **1** is a block diagram of shows a known device for reading and/or recording information,

FIG. **2** is a block diagram of shows a device according to the invention with a pick-up,

FIG. **3** is a block diagram of shows a device according to the invention when address information from the information carrier is used,

FIGS. **4**a and **4**b show the velocity curves for an increasing distance (r),

FIG. **5** shows the velocity curves when r is subdivided into zones, and

FIG. **6** shows the velocity curves for the case of a rapid radial displacement.

In the drawing figures, elements corresponding to elements already described carry like reference characters.

DESCRIPTION OF THE INVENTION

FIG. **1** shows a device for reading and/or recording information on an optically, magnetooptically or magnetically recordable disc-shaped information carrier **1**, such as, the known CD recordable, or hard disk for computer use. An extensive description of the recordable CD system is found in EP-0326206-A1, corresponding to U.S. Pat. No. 4,901,300, and EP-0325329-A1, corresponding to U.S. Pat. No. 5,187,699. An example of a reading device is the known audio CD or CD-ROM. A description of the reading of a CD is to be found in the book entitled "Principles of optical disc systems" by Bouwhuis et al., ISBN 0-085274-785-3. The information carrier **1** rotates around a point of rotation and is driven by the drive means **3** of a customary type. The drive means **3** are triggered by control means **4** to which a measuring signal indicative of the angular velocity or linear velocity is applied. The control loop thus formed causes the information carrier **1** to rotate at a desired speed. A scanning unit which comprises a read/write head **2** is located at a distance r from the point of rotation of the disc and can be displaced in radial direction by a servotracking system **2**a of a customary type shown schematically.

During recording, information is fed via encoder **6** to modulator **5**, which encoder encodes the information into an information stream with redundancy for error correction. The encoded and modulated information is recorded at a constant information rate determined by a clock signal. The tracking as well as the linear velocity are controlled via the tracking system and the control loop. For example, when a master disc is manufactured, which is subsequently to be used for manufacturing CD-ROMs, the angular velocity can be controlled by deriving a measuring signal **14** from the drive means **3** and allowing the desired angular velocity to decrease inversely proportionally to r. The recordable information carrier may beforehand be provided with patterns, such as in the sampled servosystem, or a wobbled pregroove, so that a control signal **15** is generated in the read/write head **2**. For an extensive description of the manner in which the control signal is generated, reference be made to EP 03262006, or U.S. Pat. No. 4,901,300, which document is deemed incorporated in the description by reference. During recording, the control signal **15** is led to control unit **4** via switch **10**, which unit maintains, in dependence on the control signal, a constant value for the linear velocity at which the information carrier **1** is scanned by the read/write head **2**. In this manner an information carrier **1** is obtained, whose information density seen in the scanning direction is constant.

During reading, a reading signal produced by the read/write head **2** is decoded by a demodulator **7** and decoder **8** into an information signal while the clock signal **13** is being recovered. The frequency of this clock signal is indicative of the linear velocity at which the information pattern is scanned by the read/write head **2**. Switch **10** leads the clock signal **13** to control unit **4** during the reading operation.

In the case of a reading operation according to the so-called CLV system, the rotation is controlled in such a way that a constant linear scanning velocity is obtained, as occurs in the known audio CD player for a CD-DA. For this purpose, the control means **4** are supplied via switch **10** with a linear scanning velocity signal **16**, such as said control signal from the servotracking system during the recording operation, or with the recovered clock signal **13** from demodulator **7** during the reading operation. The information is recorded with a constant density in the information track. As a result, a maximum amount of information can be recorded on the disc. In the CLV system the angular velocity depends on the distance r. Since the angular velocity is to be adapted after a rapid displacement of the read/write head **2** to another part of the information track, the motor control will need some time to reach this velocity. For part of this time, that is, as long as the information rate lies outside the operational area of the information processing circuit (i.e. demodulator **7** and decoder **8**, modulator **5** and encoder **6**, respectively), no information can be processed. A strong motor and a strong motor drive are to be used to obtain a short access time.

During a scanning operation according to the so-called CAV system, the rotation is adjusted in such a way that a constant angular velocity of the information carrier **1** is obtained. For this purpose, the drive means **3** may comprise a sensor which produces a sensing signal **14** which is indicative of the angular velocity. The sensing angle **14** is then applied to the control means **4**. When a recording operation is performed according to the CAV system, the information can be recorded at a constant clock rate, so that the density on the information carrier then decreases with an increasing distance r.

When a recording operation is performed according to the CAV system, a constant information density may be obtained by allowing the information rate of the information to be recorded to increase proportionally to the distance r. However, this poses strict requirements on the operational area of the information processing circuit. In addition, the information transfer rate in the case of a small distance r is much smaller than along the outer edge. As a result, the average information transfer rate is much lower than the maximum information transfer rate. The access time after a rapid displacement only depends on the time necessary for reaching the desired part of the information track. A scanning operation according to the CAV system for reading information carriers which have a constant information density in the scanning direction is known from U.S. Pat. No. 5,161,142.

FIG. **2** shows a first embodiment for a device according to the invention. The angular velocity is set here in dependence on the distance r, so that this velocity decreases less than proportionally to an increasing distance r. A signal **21** indicative of the distance r is generated by a position sensor **20** and applied to the control means **4**. The control means **4** include, for example, a table from which the angular velocity can be determined for a specific value of signal **21**. The angular velocity based upon signal **21** can also be determined in another manner than from a table, for example, from a digital arithmetic unit or from analog signal processing. The determined angular velocity is compared with a sensing signal **14** that indicates the real angular velocity. The driving signal for the drive means **3** is derived in dependence on this comparison.

FIG. **3** shows a second embodiment for a device according to the invention. When an information carrier **1** such as, for example, a CD is used, with address information that indicates the radial position, the distance r can be derived from the information signal **22** coming from the information carrier **1**. The absolute time information in the sub-code of the CD signal, or addresses of data sectors on the information carrier **1**, such as, on a CD-ROM or a hard disk, can be used for this purpose. Such information which is indicative of the distance r can also be derived from other information patterns such as the pregroove on the information carrier during recording. Control signal **15** contains this information. The control means **4** are supplied through switch **23** with signal **22** or signal **15**, from which the angular velocity to be set is determined. The angular velocity is determined and controlled in the way this is done for the first embodiment.

In a third embodiment for the device according to the invention, the linear velocity is set in dependence on the distance r. Control unit **4** is supplied with a signal that is indicative of the real angular velocity i.e. clock signal **13** or signal **15** from switch **10**, as is shown in FIG. **1**. The sensor and the sensing signal **14** are not necessary now, but may be supplied, as required, for controlling the velocity if the read signal is unreliable, for example, during a rapid displacement. With an increasing distance r a larger linear velocity is set, while the linear velocity increases less than proportionally to increasing r. In the control loop the control means **4** compare the set linear velocity with the signal **16** that indicates the real angular velocity. The driving signal for drive means **3** is derived in dependent on this comparison. The distance r can be sensed by position sensor **20** and presented by means of signal **21**, as is shown in FIG. **2**.

A fourth embodiment for a device according to the invention is similar to the third embodiment, with the exception that r is derived now from address information of signal **22** or signal **15**, as shown in FIG. **3**. Position sensor **20** and signal **21** are lacking here.

A fifth embodiment for a device according to the invention is similar to the previous embodiment, except that the angular velocity in the CLV system is controlled while information is being recorded. The recording parameters such as the recording power and the recording pulse may then have fixed settings.

A sixth embodiment for the device according to the invention is similar to the previous embodiment with the exception that the angular velocity in the CAV system is controlled during the information recording. The clock rate is varied inversely proportionally to r, for example, by coupling a signal **21** or **22** indicative of the distance r to a VCO (Voltage-Controlled Oscillator). Then, r may be determined by a sensor **20** or read from a signal **15** or **22** from the information carrier **1**. As a result, there will arise a high, constant information density combined with the constant angular velocity. After a rapid displacement it is then possible to record forthwith, because the angular velocity need not be adapted and there is thus no danger of recording too fast or too slowly, so that information would end up in a wrong area of the information carrier **1**.

FIG. **4**a shows the behaviour of the angular velocity ω with increasing distance r. For the CAV system this is a horizontal line **31** covering the operational area of the read/write head **2** from the minimum distance r_{min} on the inside of the maximum density r_{max} along the outer edge of the information carrier **1**. In the CLV system the angular velocity according to curve **32** has an inversely proportional relation to the distance r. The area **30** between these two extremes **31** and **32** contains the velocity curves as they are found in embodiments for the device according to the invention. A shorter access time is then reached by restricting the differences of angular velocity with respect to the CLV system. Since a smaller difference of speed is to be overcome in the case of a rapid displacement, the device will again be capable of reading or recording information at an earlier instant. For a rapid displacement the maximum information processing rate is taken into account, as is the maximum angular velocity the drive means are capable of realising and at which the servotracking system is still capable of having the read/write head **2** follow the track. After a rapid displacement, the information rate will more rapidly lie in the operational area of the information processing circuit and a shorter access time will be obtained. In the known CLV system the maximum average information rate is obtained. For still obtaining a maximum average information rate with a short access time, the velocity curve **33** closest possible to the CLV curve **32** is selected.

In a first embodiment for the control means **4**, the CLV curve **32** is followed from the outer edge at r_{max} to a specific distance r1. Consequently, the information track having the larger diameters is read and recorded with optimum velocity. From this distance r1 the angular velocity is maintained constant at ω_{max}, as is shown by curve **34**. Mechanical restrictions or restrictions as to high angular velocity servotracking are thus taken into account.

In a second embodiment for the control means **4**, the maximum information processing rate is taken into account and the access time is maintained at a minimum level. In the case of a rapid displacement to the centre, the information carrier **1** will have to be accelerated until the angular velocity corresponds to the new distance r. The information rate will thus be temporarily lower and the (recovered) clock will follow this lower rate. To this end, the system control may temporarily adjust, as required, the modulator **5** or demodulator **7**, respectively. In the case of a rapid displacement from the centre outwards, the information carrier **1** will have to be decelerated. Since the maximum rate of the information processing circuit is limited, the angular velocity must not be too high when the read/write head **2** arrives at the desired part of the information track. A minimum access time prescribes that the time required for decelerating the information carrier is always smaller than or equal to the time necessary for displacing the read/write head **2**. The minimum access time is obtained by selecting the velocity curve in such a way that for each distance r the rapid displacement time is, substantially, at least equal to the deceleration time for each rapid displacement from all other operational distances r. The variation for a specific device is given in curve **33**. Under the conditions of the minimum access time, there will then also arise the maximum average information rate.

The variation of the rapid displacement time for a device will have to be determined to attune the velocity curve thereto. If the rapid displacement time is proportional to the radial displacement, the rapid displacement time can easily be determined. In general, however, the displacement of the read/write head **2** will be effected by first strongly accelerating and then decelerating again. The period of time necessary for adapting the angular velocity will have to be determined from the difference of distance to be covered and the motor parameters. For the CLV curve **32** the difference of angular velocity after a rapid displacement is proportional to the radial displacement added to the distance r. As the rapid displacement takes place over a specific distance closer to the outer edge, so the difference of angular velocity will be smaller and so the necessary deceleration time will be shorter.

For a specific distance r_{clv} it will hold that the rapid displacement time is, substantially, equal to the deceleration time. Without a detrimental effect on the access time, the CLV curve **32** can be followed from distance r_{max} to r_{clv}. In this part of the curve **33** the angular velocity is thus totally determined by the maximum rate of the information processing circuit, whereas in the part from r_{min} to r_{clv}, the curve **33** is determined by the properties of the motor. Depending on the physical properties of the system, the calculated r_{clv} may also be smaller than r_{min} (in that case the curve will decrease to the known CLV curve) or larger than r_{max} (in that case curve **33** lies completely in the area **30**). To be certain that the information can always be processed after a rapid displacement, the point r_{clv} can be selected slightly more towards the outer edge. This creates then a slight margin for physical property tolerance of the device.

In a third embodiment for the control means **4**, a higher average information rate is obtained than in the previous embodiment if a minimum access time is not required in all situations, so that, for example, some extra time is allowed for rate adaptation in the case of a rapid displacement over more than ⅔ of the operational area. The maximum velocity upon arrival is then to fall within the clock recovery capture range in the demodulator **7**, so that the correct linear velocity is sensed. The decoder **8** starts decoding if the linear velocity has come to within the lock range. The curve then shows a variation partly in the area **30** between the CLV curve **32** and the optimum curve **33**.

In a fourth embodiment for the control means **4**, the minimum access time is obtained by a velocity variation mainly found in curve **33** and, as required, in curve **34**. The desired curve may be approximated, for example, by several fixed setting points. The control means **4** then comprise a simple selection mechanism and the sensor and sensing signal **14** may be omitted. The result is then, it is true, a slightly lower average information rate.

For the above embodiments it holds that a simple balancing between average access time and average information rate may be made by suitably selecting a curve in the area **30** between the CLV curve **32** and the CAV curve **31**.

FIG. **4**b shows the variation of the linear scanning velocity v_{lin} plotted against distance r. Curve **51** shows the variation when scanning takes place according to the CAV system, in which the linear velocity thus increases proportionally to the distance r. Curve **52** shows the variation in the case of scanning according to the CLV system, thus with a constant linear velocity. The area **50** includes the possible control curves of a device according to the invention, whereas curves **53** and **54** show the corresponding control curves of curve **33** and **34** in FIG. **4**a.

FIG. **5** shows in curve **41** the variation of the angular velocity ω when the operational area of r is subdivided into zones within which the linear scanning velocity is always constant. In the outermost region this linear velocity is equal to the maximum velocity and curve **41** follows curve **32** of the CLV system. In a simple manner, for example, by means of a table, the control means **4** are capable of deriving from distance r what nominal linear velocity is to be set. The zones may be selected to be equal, or become ever wider, for example, in proportion to an increasing distance r. It is also possible to take into account a maximum angular velocity ω_{max} to be reached by the device, for which a sharper decline of the linear velocity is set in the interior zone, as is shown by curve **44**. Curves **41** and **44** each show that for at least some zones the respective angular velocities at the inner tracks of adjacent zones change less than inversely with respect to the distance r of the inner tracks of those zones. Further, from the innermost track to the outermost track the angular velocity changes less than inversely, and the linear velocity increases less than proportionally, with the increase of distance r. The distance r can be derived, as described above, from a sensing signal from sensor **20**, or from the information signal **22** by analysing the addresses or the sub-code. For each zone the setting point for the nominal linear scanning velocity can be adapted by the control means **4** and be applied to the control loop to activate the drive means **3**.

FIG. **6** shows the variation of the linear velocity v plotted against time t in the case of a large outward displacement at instant t0. In the case of a large rapid displacement it may hold that the time required for adapting the velocity is much shorter than the time necessary for the rapid displacement. The velocity may be set to new values, for example, at the following instants:

a) the new setting is computed from the length of the displacement and is set the moment the displacement commences; the resulting variation is shown in curve **61**,

b) the previous setting is maintained during the rapid displacement and the new distance r will not be determined from signal **21** or **22** and the new value will not be set until after the rapid displacement; the resulting variation is shown in curve **62**,

c) during the rapid displacement the value r is constantly computed and the velocity is constantly adapted; the resulting variation is shown in curve **63**. During the rapid displacement, r can be determined, for example, by sensor **20** or by counting the tracks that are cross. If the linear velocity is controlled, as is done in the third embodiment, the velocity during the rapid displacement will be readjusted too strongly in case a). For that matter, the high linear velocity has already been set in the case of a displacement to the outer edge, whereas read/write head **2** is still located far inward. As a result, the rotation will first be accelerated and the velocity v will exceed the maximum velocity value v_{max}. However, the maximum processing rate should not be exceeded. To avoid this, the velocity may be set according to, for example, case b) or c) and/or v_{max} may be selected slightly lower. In case b) the rotation will be decelerated too much, so that upon arrival at t1 there is still a specific period of time during which acceleration is to take place. In case c) there may be overshoot within a zone. A further optimization of the manner in which the velocity setting during a rapid displacement is effected could be, for example, the use of a damping in the control, so that the velocity is adjusted rapidly, but overshoot just fails to occur, as is the case, for example, in curve **64**. When a sudden displacement towards the centre takes place a complementary effect occurs. Since the velocity is never too high here, method c) can be selected without any objection. Needless to observe that it is alternatively possible to control the desired angular velocity during the rapid displacement, by computing this velocity from the distance r and the linear velocity to be set, and by using a sensor and a signal **14** as has already been discussed with respect to the third embodiment.

In a further embodiment for a device according to the invention, an information carrier **1** is used on which the information density decreases as r increases. For example, the distance r can be divided into zones of constant angular velocity, for example, in accordance with curve **42** in FIG. **5**. With a constant clock rate the density within a zone will then decrease with increasing r; the clock is adjusted per zone, so that, substantially, the density in the inner zone is greater than the density in the outer zone. Also the clock rate may be varied inversely proportionally to r, for example, by coupling a signal **21** or **22** indicative of the distance r to a VCO (Voltage-Controlled Oscillator). This causes a constant density to develop, for example, per zone. During recording, such a coupling can be used over the entire distance r in combination, for example, with a constant angular velocity. r may then be determined by a sensor **20** or from a signal **15** or **22** read from the information carrier **1**. After a rapid displacement, recording is possible forthwith, because the angular velocity need not be adapted, whereas still a high, constant, information density is obtained.

Combinations of variable density, angular velocity and linear velocity make an optimum tuning possible of the average information rate, the access time and the total storage capacity of the information carrier **1**. There should be observed that combinations essentially copying the CAV or CLV variation, for example, by approximating the CLV curve by zones of constant angular velocity, are already known. In that case, however, the angular velocity or linear velocity shows a variation, however, only within a zone different from that of the known CAV or CLV systems, and the angular velocity or lines velocity continues to be constant, substantially.

What is claimed is:

1. A device for scanning an information track on a disc-shaped information carrier, comprising:

scanning means for scanning a location on the information track,

drive means for causing relative rotation between the location and the information carrier, at an angular velocity about a point of rotation, the location thereby having a linear velocity of relative movement along the track,

means for varying a distance (r) between said location and the point of rotation, and control means for controlling the drive means,

characterized in that said control means is arranged to control the drive means so as to cause the relative angular velocity to decrease substantially with increasing distance (r), and to cause the linear velocity to increase substantially with increasing distance (r).

2. A device as claimed in claim **1**, characterized in that said drive means rotates said information carrier about an axis through said point of rotation, said scanning means includes a scanning head, and said means for varying moves said scanning head radially with respect to said axis.

3. A device as claimed in claim **1**, characterized in that said control means are arranged to change said relative rotation such that a first period of time, required to allow said location to be moved to another part of the information track by a rapid variation of said distance, is equal to or longer than a second period of time required to change the relative rotation such that the linear velocity resulting from the changed relative rotation and said rapid variation corresponds to a linear velocity at which the information can be processed.

4. A device as claimed in claim **1**, characterized in that said control means are arranged to change said relative rotation such that for location between a first distance corresponding to the outermost track and a second distance, the linear velocity is substantially equal to a maximum velocity; and for locations between the second distance and a third distance corresponding to the innermost track, the linear velocity is less than the maximum velocity.

5. A device as claimed in claim **4**, characterized in that

said control means are arranged to change said relative rotation such that a first period of time, required to allow said location to be moved to another part of the information track by a rapid variation of said distance, is equal to or longer than a second period of time required to change the relative rotation such that the linear velocity resulting from the changed relative rotation and said rapid variation corresponds to a linear velocity at which the information can be processed, and

the second distance is the smallest distance for which the first and second periods of time are substantially equal.

6. A device as claimed in claim **5**, characterized in that the control means are arranged to set the linear velocity such that the first and second periods of time are substantially equal for locations between the second distance and the third distance.

7. A device as claimed in claim **4**, characterized in that

said control means are arranged to change said relative rotation such that a first period of time, required to allow said location to be moved to another part of the information track by a rapid variation of said distance, is equal to or longer than a second period of time required to change the relative rotation such that the linear velocity resulting from the changed relative rotation and said rapid variation corresponds to a linear velocity at which the information can be processed, and

said control means are arranged to set the linear velocity such that the first and second periods of time are substantially equal for locations between the second distance and the third distance.

8. A device for scanning an information track on a disc-shaped information carrier, where said track includes an innermost track, an outermost track, and a multiplicity of tracks therebetween, comprising:

scanning means for scanning a location on the information track,

drive means for causing relative rotation between the location and the information carrier, at an angular velocity about a point of rotation, the location thereby having a linear velocity of relative movement along the track,

means for varying a distance (r) between said location and the point of rotation, and

control means for controlling the drive means,

characterized in that said control means is arranged to control the drive means so as to cause the relative angular velocity to decrease substantially, but less than inversely with the increase of distance (r), as said location is moved from said increment track to said outermost track; and to cause the linear velocity to increase substantially, but less than proportionally with the increase of distance (r), at said location is moved from said innermost track to said outermost track.

9. A device as claimed in claim **8**, characterized in that said drive means rotates said information carrier about an axis through said point of rotation, said scanning means includes a scanning head, sand said means for varying moves said scanning head radially with respect to said axis.

10. A device as claimed in claim **8**, characterized in that said drive means is a means for rotating said information carrier about said point of rotation, and

the control means sets the angular velocity in dependence on the distance (r).

11. A device as claimed in claim **8**, characterized in that the control means is arranged to cause the drive means to scan with a constant linear velocity while information is being recorded.

12. A device as claimed in claim **8**, characterized in that the control means is arranged to derive the distance (r) from information in the information track.

13. A device as claimed in claim **8**, characterized in that said control means are arranged to change said relative rotation such that a first period of time, required to allow said location to be moved to another part of the information track by a rapid variation of said distance, is equal to or longer than a second period of time required to change the relative rotation such that the linear velocity resulting from the changed relative rotation and said rapid variation corresponds to a linear velocity at which the information can be processed.

14. A device as claimed in claim **8**, characterized in that the control means is arranged to set the linear velocity in dependence on the density (r).

15. A device as claimed in claim **8**, characterized in that an operational area of the distance (r) is subdivided into a number of zones each having an inner track,

said drive means is a means for rotating said information carrier about said point of rotation, and

the control means sets the linear velocity at a constant velocity determined by the zone, such that for at least one zone the angular velocity decreases less than inversely with increase of distance between the inner tracks on the at least one zone and an adjacent zone.

16. A device as claimed in claim **8**, characterized in that said control means are arranged to change said relative rotation such that for locations between a first distance corresponding to the outermost track and a second distance, the linear velocity is substantially equal to a maximum velocity; and for locations between the second distance and a third distance corresponding to the innermost track, the linear velocity is less than the maximum velocity.

17. A device as claimed in claim **16**, characterized in that said control means are arranged to change said relative rotation such that a first period of time, required to allow said location to be moved to another part of the information track by a rapid variation of said distance, is equal to or longer than a second period of time required to change the relative rotation such that the linear velocity resulting from the changed relative rotation and said rapid variation corresponding to a linear velocity at which the information can be processed, and

the second distance is the smallest distance for which the first and second periods of time are substantially equal.

18. A device as claimed in claim **17**, characterized in that the control means are arranged to set the linear velocity such that the first and second periods of time are substantially equal for locations between the second distance and the third distance.

19. A device as claimed in claim **16**, characterized in that the control means are arranged to set the linear velocity such that the first and second periods of time are substantially equal for locations between the second distance and the third distance.

20. A device for scanning a plurality of information tracks recorded on a disc-shaped information carrier, comprising:

a scan head that generates a scanning beam that scans the information tracks;

a scan head drive that moves the scan head in a radial direction relative to the information tracks, to thereby vary a radial distance (r) between the scanning beam and a rotational axis; and,

a carrier drive that imparts rotational movement of the carrier about the rotational axis at an angular velocity that decreases as the radial distance (r) increases, wherein the angular velocity is not inversely proportional to the radial distance (r).

21. The device as set forth in claim 20, wherein a linear velocity of the scanning beam relative to an information track being scanned increases as the radial distance (r) increases, wherein the linear velocity is not proportional to the radial distance (r).

22. The device as set forth in claim 20, wherein the information tracks comprise respective convolutions of a spiral track.

23. The device as set forth in claim 20, wherein the disc-shaped information carrier comprises an optical disc.

24. The device as set forth in claim 20, wherein the disc-shaped information carrier comprises a magneto-optical disc.

25. The device as set forth in claim 20, wherein the scanning beam comprises a laser beam.

26. The device as set forth in claim 20, wherein the scan head comprises a read/write head.

27. The device as set forth in claim 20, wherein the scan head comprises an optical head.

28. A device for scanning a plurality of information tracks recorded on a disc-shaped information carrier, comprising:

a scan head that generates a scanning beam that scans the information tracks;

a carrier drive that imparts rotational movement of the carrier about a rotational axis at an angular velocity that decreases as a radial distance (r) between the scanning beam and the rotational axis increases, wherein the angular velocity is not inversely proportional to the radial distance (r); and,

a scan head drive that moves the scan head in a radial direction relative to the information tracks, to thereby vary the radial distance (r) between the scanning beam and the rotational axis, wherein a linear velocity of the scanning beam relative to an information track being scanned increases as the radial distance (r) increases, and wherein further, the linear velocity is not proportional to the radial distance (r).

29. The device as set forth in claim 28, wherein the information tracks comprise respective convolutions of a spiral track.

30. The device as set forth in claim 28, wherein the disc-shaped information carrier comprises an optical disc.

31. The device as set forth in claim 28, wherein the disc-shaped information carrier comprises a magneto-optical disc.

32. The device as set forth in claim 28, wherein the scanning beam comprises a laser beam.

33. The device as set forth in claim 28, wherein the scan head comprises a read/write head.

34. The device as set forth in claim 28, wherein the scan head comprises an optical head.

35. A device for scanning a plurality of information tracks recorded on a disc-shaped information carrier, comprising:

a scan head that generates a scanning beam that scans the information tracks;

a carrier drive that imparts rotational movement of the carrier about a rotational axis; and,

a scan head drive that moves the scan head in a radial direction relative to the information tracks, so thereby vary a radial distance (r) between the scanning beam and the rotational axis, wherein a linear velocity of the scanning beam relative to an information track being scanned increases as the radial distance (r) increases, and wherein further, the linear velocity is not proportional to the radial distance (r).

36. The device as set forth in claim 35, wherein the information tracks comprise respective convolutions of a spiral track.

37. The device as set forth in claim 35, wherein the disc-shaped information carrier comprises an optical disc.

38. The device as set forth in claim 35, wherein the disc-shaped information carrier comprises a magneto-optical disc.

39. The device as set forth in claim 35, wherein the scanning beam comprises a laser beam.

40. The device as set forth in claim 35, wherein the scan head comprises a read/write head.

41. The device as set forth in claim 35, wherein the scan head comprises an optical head.

42. A device for scanning a plurality of information tracks recorded on a disc-shaped information carrier, comprising:

a scan head that generates a scanning beam that scans the information tracks;

a drive system that imparts relative radial movement between the scanning beam and the carrier, to thereby vary a radial distance (r) between the scanning beam and a central axis of the carrier; and,

a servo controller that controls the drive system to increase a linear velocity of the scanning beam relative to an information track being scanned as the radial distance (r) increases, wherein the linear velocity is not proportional to the radial distance (r).

43. The device as set forth in claim 42, wherein the information tracks comprise respective convolutions of a spiral track.

44. The device as set forth in claim 42, wherein the disc-shaped information carrier comprises an optical disc.

45. The device as set forth in claim 42, wherein the disc-shaped information carrier comprises a magneto-optical disc.

46. The device as set forth in claim 42, wherein the scanning beam comprises a laser beam.

47. The device as set forth in claim 42, wherein the scan head comprises a read/write head.

48. The device as set forth in claim 42, wherein the scan head comprises an optical head.

49. A device for scanning a multiplicity of information tracks recorded on a disc-shaped information carrier having a plurality of CAV zones each comprised of a plurality of information tracks spanning a radial portion of a surface of the carrier, the device comprising:

a scan head that generates a scanning beam that scans the information tracks;

a carrier drive that imparts rotational movement of the carrier about a rotational axis, at an angular velocity;

a scan head drive that moves the scan head in a radial direction relative to the information tracks, to thereby vary a radial distance (r) between the scanning beam and the rotational axis; and,

a servo controller that controls the carrier drive in such a manner as to cause the angular velocity to decrease in successive CAV zones located successively further from the rotational axis, and that control the carrier drive to maintain a substantially constant angular velocity within each CAV zone, wherein an average angular velocity decreases as the radial distance (r) increases, and wherein further, the average angular velocity is not inversely proportional to the radial distance (r).

50. The device as set forth in claim 49, wherein a linear velocity of the scanning beam relative to an information track being scanned increases as the radial distance (r) increases, wherein the linear velocity is not proportional to the radial distance (r).

51. The device as set forth in claim 49, wherein an information density decreases in successive CAV zones located at a successively greater distance from the rotational axis, but the information density within each CAV zone is substantially constant.

52. The device as set forth in claim 49, wherein the radial portion spanned by successive CAV zones located at a successively greater distance from the rotational axis increases.

53. The device as set forth in claim 50, wherein the radial portion spanned by successive CAV zones located at a successively greater distance from the rotational axis increases.

54. The device as set forth in claim 49, wherein the information tracks comprise respective convolutions of a spiral track.

55. The device as set forth in claim 49, wherein the disc-shaped information carrier comprises an optical disc.

56. The device as set forth in claim 49, wherein the disc-shaped information carrier comprises a magneto-optical disc.

57. The device as set forth in claim 49, wherein the scanning beam comprises a laser beam.

58. The device as set forth in claim 49, wherein the scan head comprises a read/write head.

59. The device as set forth in claim 49, wherein the scan head comprises an optical head.

60. A device for scanning a multiplicity of information tracks recorded on a disc-shaped information carrier in a plurality of CLV zones each comprised of a plurality of information tracks spanning a radial portion of a surface of the carrier, the device comprising:

a scan head that generates a scanning beam that scans the information tracks;

a drive system that imparts relative linear movement between the scanning beam and an information track being scanned, at a linear velocity; and,

a servo controller that controls the drive system to increase the linear velocity in successive CLV zones located successively further from a central axis of the carrier, and that controls the drive system to maintain a substantially constant linear velocity within each CLV zone, wherein an average linear velocity of the scanning beam relative to an information track being scanned increases as a radial distance (r) between the scanning beam and the central axis increases, and wherein further, the average linear velocity is not proportional to the radial distance (r).

61. The device as set forth in claim 60, wherein an information density decreases in successive CLV zones located at a successively greater radial distance from the central axis, but the information density within each CLV zone is substantially constant.

62. The device as set forth in claim 60, wherein the radial span spanned by successive CLV zones located at a successively greater distance from the central axis increases.

63. The device as set forth in claim 61, wherein the radial span spanned by successive CLV zones located at a successively greater distance from the central axis increases.

64. The device as set forth in claim 60, wherein the information tracks comprise respective convolutions of a spiral track.

65. The device as set forth in claim 60, wherein the disc-shaped information carrier comprises an optical disc.

66. The device as set forth in claim 60, wherein the disc-shaped information carrier comprises a magneto-optical disc.

67. The device as set forth in claim 60, wherein the scanning beam comprises a laser beam.

68. The device as set forth in claim 60, wherein the scan head comprises a read/write head.

69. The device as set forth in claim 60, wherein the scan head comprises an optical head.

70. A method comprising recording information in a plurality of recording zones on a disc-shaped information carrier, each recording zone being comprised of a plurality of information tracks spanning a radial distance, wherein an information density decreases in successive recording zones located at a successively greater radial distance from a center of the carrier, but the information density within each zone is substantially constant.

71. The method as set forth in claim 70, wherein the radial distance spanned by successive zones located at a successively greater radial distance from the center of the carrier increases.

72. The method as set forth in claim 70, wherein the information tracks comprise respective convolutions of a spiral track.

73. The method as set forth in claim 70, wherein the disc-shaped information carrier comprises an optical disc.

74. The method as set forth in claim 70, wherein the disc-shaped information carrier comprises a magneto-optical disc.

75. The method as set forth in claim 70, wherein the scanning beam comprises a laser beam.

76. The method as set forth in claim 70, wherein the scan head comprises a read/write head.

77. The method as set forth in claim 70, wherein the scan head comprises an optical head.

78. A device for scanning a plurality of information tracks recorded on a disc-shaped information carrier, comprising:

a scan head that generates a scanning beam that scans the information tracks;

a scan head drive that moves the scan head in a radial direction relative to the information tracks, to thereby vary a radial distance (r) between the scanning beam and a rotational axis;

a carrier drive that imparts rotational movement of the carrier about the rotational axis, at an angular velocity; and,

a servo controller that controls the carrier drive in such a manner as to cause the angular velocity to decrease as the radial distance (r) increases, wherein the angular velocity is not inversely proportional to the radial distance (r).

79. The device as set forth in claim 78, wherein a linear velocity of the scanning beam relative to an information track being scanned increases as the radial distance (r) increases, and wherein further, the linear velocity is not proportional to the radial distance (r).

80. The device as set forth in claim 78, wherein the information tracks comprise respective convolutions of a spiral track.

81. The device as set forth in claim 78, wherein the disc-shaped information carrier comprises an optical disc.

82. The device as set forth in claim 78, wherein the disc-shaped information carrier comprises a magneto-optical disc.

83. The device as set forth in claim 78, wherein the scanning beam comprises a laser beam.

84. The device as set forth in claim 78, wherein the scan head comprises a read/write head.

85. The device as set forth in claim 78, wherein the scan head comprises an optical head.

86. A device for scanning a plurality of information tracks recorded on a disc-shaped information carrier, comprising:

a scan head that generates a scanning beam that scans the information tracks;

a carrier drive that imparts rotational movement of the carrier about a rotational axis, at an angular velocity;

a scan head drive that moves the scan head in a radial direction relative to the information tracks, to thereby vary a radial distance (r) between the scanning beam and the rotational axis;

a first servo controller that controls the carrier drive in such a manner as to cause the angular velocity to decrease as the radial distance (r) increases, wherein the angular velocity is not inversely proportional to the radial distance (r); and,

a second servo controller that controls the scan head drive in such a manner as to cause a linear velocity of the scanning beam to increase as the radial distance (r) increases, wherein the linear velocity is not proportional to the radial distance (r).

87. The device as set forth in claim 86, wherein the information tracks comprise respective convolutions of a spiral track.

88. The device as set forth in claim 86, wherein the disc-shaped information carrier comprises an optical disc.

89. The device as set forth in claim 86, wherein the disc-shaped information carrier comprises a magneto-optical disc.

90. The device as set forth in claim 86, wherein the scanning beam comprises a laser beam.

91. The device as set forth in claim 86, wherein the scan head comprises a read/write head.

92. The device as set forth in claim 86, wherein the scan head comprises an optical head.

93. A device for scanning a plurality of information tracks recorded on a disc-shaped information carrier, comprising:

a scan head that generates a scanning beam that scans the information tracks;

a carrier drive that imparts rotational movement of the carrier about a rotational axis;

a scan head drive that moves the scan head in a radial direction relative to the information tracks, to thereby vary the distance (r) between the scanning beam and a rotational axis; and,

a servo controller that controls the scan head drive and the carrier device in such a manner as to cause a linear velocity of the scanning beam relative to an information track being scanned to increase as the radial distance (r) increases, wherein the linear velocity is not proportional to the radial distance (r).

94. The device as set forth in claim 93, wherein the information tracks comprise respective convolutions of a spiral track.

95. The device as set forth in claim 93, wherein the disc-shaped information carrier comprises an optical disc.

96. The device as set forth in claim 93, wherein the disc-shaped information carrier comprises a magneto-optical disc.

97. The device as set forth in claim 93, wherein the scanning beam comprises a laser beam.

98. The device as set forth in claim 93, wherein the scan head comprises a read/write head.

99. The device as set forth in claim 93, wherein the scan head comprises an optical head.

100. A method for scanning a plurality of information tracks recorded on a disc-shaped information carrier, comprising:

scanning the information tracks with a scanning beam;

moving the scanning beam in a radial direction relative to the information tracks, to thereby vary a radial distance (r) between the scanning beam and a rotational axis; and,

rotating the carrier about the rotational axis at an angular velocity that decreases as the radial distance (r) increases, wherein the angular velocity is not inversely proportional to the radial distance (r).

101. The method as set forth in claim 100, further comprising increasing a linear velocity of the scanning beam relative to an information track being scanned as the radial distance (r) increases, wherein the linear velocity is not proportional to the radial distance (r).

102. The method as set forth in claim 100, wherein the information tracks comprise respective convolutions of a spiral track.

103. The method as set forth in claim 100, wherein the disc-shaped information carrier comprises an optical disc.

104. The method as set forth in claim 100, wherein the disc-shaped information carrier comprises a magneto-optical disc.

105. The method as set forth in claim 100, wherein the scanning beam comprises a laser beam.

106. A method for scanning a plurality of information tracks recorded on a disc-shaped information carrier, comprising:

scanning the information tracks with a scanning beam;

rotating the carrier about a rotational axis at an angular velocity that decreases as a radial distance (r) between the scanning beam and the rotational axis increases, but at a rate that is not inversely proportional to the radial distance (r), wherein the angular velocity is not inversely proportional to the radial distance (r); and, *moving the scanning beam in a radial direction relative to the information tracks, to thereby vary the radial distance (r) between the scanning beam and the rotational axis, wherein a linear velocity of the scanning beam relative to an information track being scanned increases as the radial distance (r) increases, and wherein further, the linear velocity is not proportional to the radial distance (r).*

107. The method as set forth in claim 106, further comprising increasing a linear velocity of the scanning beam relative to an information track being scanned as the radial distance (r) increases, but at a rate that is not proportion to the radial distance (r), wherein the linear velocity is not proportional to the radial distance (r).

108. The method as set forth in claim 106, wherein the information tracks comprise respective convolutions of a spiral track.

109. The method as set forth in claim 106, wherein the disc-shaped information carrier comprises an optical disc.

110. The method as set forth in claim 106, wherein the disc-shaped information carrier comprises a magneto-optical disc.

111. The method as set forth in claim 106, wherein the scanning beam comprises a laser beam.

112. A method for scanning a plurality of information tracks recorded on a disc-shaped information carrier, comprising:

scanning the information tracks with a scanning beam;

rotating the carrier about a rotational axis; and,

moving the scanning beam in a radial direction relative to the information tracks, to thereby vary a radial distance (r) between the scanning beam and the rotational axis, wherein a linear velocity of the scanning beam relative to an information track being scanned increases as the radial distance (r) increases, and wherein further, the linear velocity is not proportional to the radial distance (r).

113. The method as set forth in claim 112, wherein the information tracks comprise respective convolutions of a spiral track.

114. The method as set forth in claim 112, wherein the disc-shaped information carrier comprises an optical disc.

115. The method as set forth in claim 112, wherein the disc-shaped information carrier comprises a magneto-optical disc.

116. The method as set forth in claim 112, wherein the scanning beam comprises a laser beam.

117. A method for scanning a plurality of information tracks recorded on a disc-shaped information carrier, comprising:

scanning the information tracks with a scanning beam;

imparting relative radial movement between the scanning beam and the carrier, to thereby vary a radial distance (r) between the scanning beam and a central axis of the carrier; and,

controlling the imparting in such a manner as to increase a linear velocity of the scanning beam relative to an information track being scanned as the radial distance (r) increases, wherein the linear velocity is not proportional to the radial distance (r).

118. The method as set forth in claim 117, wherein an information density of the carrier varies as a function of the radial distance (r).

119. The method as set forth in claim 117, wherein the information tracks comprise respective convolutions of a spiral track.

120. The method as set forth in claim 117, wherein the disc-shaped information carrier comprises an optical disc.

121. The method as set forth in claim 117, wherein the disc-shaped information carrier comprises a magneto-optical disc.

122. The method as set forth in claim 117, wherein the scanning beam comprises a laser beam.

123. A method for scanning a multiplicity of information tracks recorded on a disc-shaped information carrier having a plurality of CAV zones each comprised of a plurality of information tracks spanning a radial portion of a surface of the carrier, the method comprising:

scanning the information tracks with a scanning beam;

rotating the carrier about a rotational axis, at an angular velocity;

moving the scanning beam in a radial direction relative to the information tracks, to thereby vary a radial distance (r) between the scanning beam and the rotational axis; and,

controlling the rotating in such a manner as to cause the angular velocity to decrease in successive CAV zones located successively further from the rotational axis, while maintaining a substantially constant angular velocity within each CAV zone, wherein an average angular velocity increases as the radial distance (r) increases, and wherein further, the average angular velocity is not inversely proportional to the radial distance (r).

124. The method as set forth in claim 123, further comprising increasing a linear velocity of the scanning beam relative to an information track being scanned as the radial distance (r) increases, but at a rate that is not proportional to the radial distance (r), wherein the linear velocity is not proportional to the radial distance (r).

125. The method as set forth in claim 123, wherein an information density decreases in successive CAV zones located at a successively greater distance from the rotational axis, but the information density within each CAV zone is substantially constant.

126. The method as set forth in claim 123, wherein the radial portion spanned by successive CAV zones located at a successively greater distance from the rotational axis increases.

127. The method as set forth in claim 125, wherein the radial portion spanned by successive CAV zones located at a successively greater distance from the rotational axis increases.

128. The method as set forth in claim 123, wherein the information tracks comprise respective convolutions of a spiral track.

129. The method as set forth in claim 123, wherein the disc-shaped information carrier comprises an optical disc.

130. The method as set forth in claim 123, wherein the disc-shaped information carrier comprises a magneto-optical disc.

131. The method as set forth in claim 123, wherein the scanning beam comprises a laser beam.

132. A method for scanning a multiplicity of information tracks recorded on a disc-shaped information carrier in a plurality of CLV zones each comprised of a plurality of information tracks spanning a radial portion of a surface of the carrier, the method comprising:

scanning the information tracks with a scanning beam;

imparting relative linear movement between the scanning beam and an information track being scanned, at a linear velocity; and, *controlling the imparting in such a manner as to increase the linear velocity in successive CLV zones located successively further from a central axis of the carrier, while maintaining a substantially constant linear velocity within each CLV zone, wherein the controlling is performed in such a manner as to cause an average linear velocity of the scanning beam relative to an information track being scanned to increase as the radial distance (r) increases, and wherein further, the average linear velocity is not proportional to the radial distance (r).*

133. The method as set forth in claim 132, wherein an information density decreases in successive CLV zones located at a successively greater radial distance from the central axis, but the information density within each CLV zone is substantially constant.

134. The method as set forth in claim 132, wherein the radial portion spanned by successive CLV zones located at a successively greater distance from the central axis increases.

135. The method as set forth in claim 133, wherein the radial portion spanned by successive CLV zones located at a successively greater distance from the central axis increases.

136. The method as set forth in claim 133, wherein the information tracks comprise respective convolutions of a spiral track.

137. The method as set forth in claim 133, wherein the disc-shaped information carrier comprises an optical disc.

138. The method as set forth in claim 133, wherein the disc-shaped information carrier comprises a magneto-optical disc.

139. The method as set forth in claim 133, wherein the scanning beam comprises a laser beam.

140. A device for recording information on a disc-shaped information carrier, comprising:

means for recording information in a plurality of recording zones on the carrier, each recording zone being compared of a plurality of information tracks spanning a radial distance; and,

means for controlling the means for recording in such a manner as to decrease an information density in successive recording zones located at a successively greater radial distance from a center of the carrier, while maintaining the information density within each zone substantially constant.

141. The device as set forth in claim 140, wherein the radial distance spanned by successive zones located at a successively greater radial distance from the center of the carrier increases.

142. The device as set forth in claim 140, wherein the information tracks comprise respective convolutions of a spiral track.

143. The device as set forth in claim 140, wherein the disc-shaped information carrier comprises an optical disc.

144. The device as set forth in claim 140, wherein the disc-shaped information carrier comprises a magneto-optical disc.

145. A method for scanning a plurality of information tracks recorded on a disc-shaped information carrier, comprising:

scanning the information tracks with a scanning beam;

rotating the carrier about a rotational axis, at an angular velocity;

moving the scanning beam in a radial direction relative to the information tracks, to thereby vary a radial distance (r) between the scanning beam and the rotational axis; and,

controlling the rotating in such a manner as to cause the angular velocity to decrease as the radial distance (r) increases, wherein the angular velocity is not inversely proportional to the radial distance (r).

146. The method as set forth in claim 145, further comprising increasing a linear velocity of the scanning beam relative to an information track being scanned as the radial distance (r) increases, wherein the linear velocity is not proportional to the radial distance (r).

147. The method as set forth in claim 145, wherein the information tracks comprise respective convolutions of a spiral track.

148. The method as set forth in claim 145, wherein the disc-shaped information carrier comprises an optical disc.

149. The method as set forth in claim 145, wherein the disc-shaped information carrier comprises a magneto-optical disc.

150. The method as set forth in claim 145, wherein the scanning beam comprises a laser beam.

151. A method for scanning a plurality of information tracks recorded on a disc-shaped information carrier, comprising:

scanning the information tracks with a scanning beam;

rotating the carrier about a rotational axis, at an angular velocity;

moving the scanning beam in a radial direction relative to the information tracks, to thereby vary a radial distance (r) between the scanning beam and the rotational axis;

controlling the rotating in such a manner as to cause the angular velocity to decrease as the radial distance (r) increases, wherein the angular velocity is not inversely proportional to the radial distance (r); and,

controlling the moving in such a manner as to cause a linear velocity of the scanning beam relative to an information track being scanned to increase as the radial distance (r) increases, wherein the linear velocity is not proportional to the radial distance (r).

152. The method as set forth in claim 151, wherein the information tracks comprise respective convolutions of a spiral track.

153. The method as set forth in claim 151, wherein the disc-shaped information carrier comprises an optical disc.

154. The method as set forth in claim 151, wherein the disc-shaped information carrier comprises a magneto-optical disc.

155. The method as set forth in claim 151, wherein the scanning beam comprises a laser beam.

156. A method for scanning a plurality of information tracks recorded on a disc-shaped information carrier, comprising:

scanning the information tracks with a scanning beam;

rotating the carrier about a rotational axis;

moving the scanning beam in a radial direction relative to the information tracks, to thereby vary the distance (r) between the scanning beam and the rotational axis; and

controlling the rotating and moving in such a manner as to cause a linear velocity of the scanning beam relative to an information track being scanned to increase as the radial distance (r) increases, wherein the linear velocity is not proportional to the radial distance (r).

157. The method as set forth in claim 156, wherein the information tracks comprise respective convolutions of a spiral track.

158. The method as set forth in claim 156, wherein the disc-shaped information carrier comprises an optical disc.

159. The method as set forth in claim 156, wherein the disc-shaped information carrier comprises a magneto-optical disc.

160. The method as set forth in claim 156, wherein the scanning beam comprises a laser beam.

161. A device for scanning a plurality of information tracks recorded on a disc-shaped information carrier, comprising:

means for scanning the information tracks with a scanning beam;

means for moving the scanning beam in a radial direction relative to the information tracks, to thereby vary a radial distance (r) between the scanning beam and a rotational axis; and,

means for rotating the carrier about the rotational axis at an angular velocity that decreases as the radial distance (r) increases, wherein the angular velocity is not inversely proportional to the radial distance (r).

162. The device as set forth in claim 161, further comprising means for increasing a linear velocity of the scanning beam relative to an information track being scanned as the radial distance (r) increases, but at a rate that is not proportional to the radial distance (r), wherein the linear velocity is not proportional to the radial distance (r).

163. A device for scanning a plurality of information tracks recorded on a disc-shaped information carrier, comprising:

means for scanning the information tracks with a scanning beam;

means for rotating the carrier about a rotational axis at an angular velocity that decreases as a radial distance (r) between the scanning beam and the rotational axis increases, but at a rate that i snot inversely proportional to the radial distance (r), wherein the angular velocity is not inversely proportional to the radial distance (r); and,

means for moving the scanning beam in a radial direction relative to the information tracks, to thereby vary the radial distance (r) between the scanning beam and the rotational axis, wherein a linear velocity of the scanning beam relative to an information track being scanned increases as the radial distance (r) increases, wherein the linear velocity is not proportional to the radial distance (r).

164. A device for scanning a plurality of information tracks recorded on a disc-shaped information carrier, comprising:

means for scanning the information tracks with a scanning beam;

means for rotating the carrier about a rotational axis; and,

means for moving the scanning beam in a radial direction relative to the information tracks, to thereby vary a radial distance (r) between the scanning beam and the rotational axis, wherein a linear velocity of the scanning beam relative to an information track being scanned increases as the radial distance (r) increases, wherein the linear velocity is not proportional to the radial distance (r).

165. A device for scanning a plurality of information tracks recorded on a disc-shaped information carrier, comprising:

means for scanning the information tracks with a scanning beam;

means for imparting relative radial movement between the scanning beam and the carrier, to thereby vary a radial distance (r) between the scanning beam and a central axis of the carrier; and,

means for controlling the means for imparting in such a manner as to increase a linear velocity of the scanning beam relative to an information track being scanned as the radial distance (r) increases, wherein the linear velocity is not proportional to the radial distance (r).

166. The device as set forth in claim 165, wherein an information density of the carrier varies as a function of the radial distance (r).

167. A device for scanning a multiplicity of information tracks recorded on a disc-shaped information carrier having a plurality of CAV zones each comprised of a plurality of information tracks spanning a radial portion of a surface of the carrier, the device comprising:

means for scanning the information tracks with a scanning beam;

means for rotating the carrier about a rotational axis, at an angular velocity;

means for moving the scanning beam in a radial direction relative to the information tracks, to thereby vary a radial distance (r) between the scanning beam and the rotational axis; and,

means for controlling the means for rotating in such a manner as to cause the angular velocity to decrease in successive CAV zones located successively further from the rotational axis, while maintaining a substantially constant angular velocity within each CAV zone, wherein an average angular velocity increases as the radial distance (r) increases, and wherein further, the average angular velocity is not inversely proportional to the radial distance (r).

168. The device as set forth in claim 167, further comprising means for increasing a linear velocity of the scanning beam relative to an information track being scanned as the radial distance (r) increases, wherein the linear velocity is not proportional to the radial distance(*r*).

169. The device as set forth in claim 167, wherein an information density decreases in successive CAV zones located at a successively greater distance from the rotational axis, but the information density within each CAV zone is substantially constant.

170. The device as set forth in claim 167, wherein the radial portion spanned by successive CAV zones located at a successively greater distance from the rotational axis increases.

171. The device as set forth in claim 169, wherein the radial portion spanned by successive CAV zones located at a successively greater distance from the rotational axis increases.

172. A device for scanning a multiplicity of information tracks recorded on a disc-shaped information carrier in a plurality of CLV zones each comprised of a plurality of information tracks spanning a radial portion of a surface of the carrier, the device comprising:

means for scanning the information tracks with a scanning beam;

means for imparting relative linear movement between the scanning beam and an information track being scanned, at a linear velocity; and,

means for controlling the means for imparting in such a manner as to increase the linear velocity in successive CLV zones located successively further from a central axis of the carrier, while maintaining a substantially constant linear velocity within each CLV zone, wherein the means for controlling causes an average linear *velocity of the scanning beam relative to an information track being scanned to increase as the radial distance (r) increases, and wherein further, the average linear velocity is not proportional to the radial distance (r).*

173. The device as set forth in claim 172, wherein an information density decreases in successive CLV zones located at a successively greater radial distance from the central axis, but the information density within each CLV zone is substantially constant.

174. The device as set forth in claim 172, wherein the radial portion spanned by successive CLV zones located at a successively greater distance from the central axis increases.

175. The device as set forth in claim 173, wherein the radial portion spanned by successive CLV zones located at a successively greater distance from the central axis increases.

176. A device for scanning a multiplicity of information tracks recorded on a disc-shaped information carrier in a plurality of CLV zones each comprised of a plurality of information tracks spanning a radial portion of a surface of the carrier, the device comprising:

scanning means for generating a scanning beam for scanning the information tracks;

rotating means for rotating the carrier about a rotational axis, at an angular velocity;

moving means for moving the scanning beam in a radial direction relative to the information tracks, to thereby vary a radial distance (r) between the scanning beam and the rotational axis; and,

control means for controlling the rotating means and the moving means in such a manner as to substantially increase a linear velocity of the scanning beam relative to an information track being scanned as the scanning beam is moved from an innermost track towards an outermost track, the control means being arranged to set the linear velocity at a substantially constant linear velocity determined by the CLV zone of the information track being scanned,

wherein the control means causes the angular velocity of the scanning beam relative to an information track being scanned to change as the radial distance (r) increases.

177. The device as set forth in claim 176, wherein the angular velocity within each CLV zone is limited to a maximum angular velocity for that CLV zone, and wherein further, the angular velocity of an outermost track of a given one of the CLV zones is substantially equal to the angular velocity of an information track of an adjacent one of the CLV ones.

178. The device as set forth in claim 176, wherein the angular velocity within each CLV zone increases from an initial angular velocity at an innermost track of that CLV zone to a maximum angular velocity at an outermost track of that CLV zone.

179. The device as set forth in claim 178, wherein the maximum angular velocity of one of the CLV zones is substantially equal to the initial angular velocity of an adjacent one of the CLV zones.

180. A device for scanning a multiplicity of information tracks recorded on a disc-shaped information carrier in a plurality of CLV zones each comprised of a plurality of information tracks spanning a radial portion of a surface of the carrier, the device comprising:

scanning means for generating a scanning beam for scanning the information tracks;

rotating means for rotating the carrier about a rotational axis, at an angular velocity;

moving means for moving the scanning beam in a radial direction relative to the information tracks, to thereby vary a radial distance (r) between the scanning beam and the rotational axis; and,

control means for controlling the rotating means and the moving means in such a manner as to substantially increase a linear velocity of the scanning beam relative to an information track being scanned as the scanning beam is moved from an innermost track towards an outermost track, the control means being arranged to set the linear velocity at a substantially constant linear velocity determined by the CLV zone of the information track being scanned,

wherein the radial portion spanned by an outermost one of the CLV zones is greater than the radial portion spanned by an innermost one of the CLV zone; and,

wherein the angular velocity decreases substantially at least within the outermost one of the CLV zones.

181. The device as set forth in claim 180, wherein the radial portion spanned by the CLV zones increases with increasing distance (r).

182. A device for scanning a multiplicity of information tracks recorded on a disc-shaped information carrier in a plurality of CLV zones each comprised of a plurality of information tracks spanning a radial portion of a surface of the carrier, the device comprising:

a scan head that generates a scanning beam that scans the information tracks;

a carrier drive that rotates the carrier about a rotational axis, at an angular velocity;

a scan head drive that moves the scan head in a radial direction relative to the information tracks, to thereby vary a radial distance (r) between the scanning beam and the rotational axis; and,

a servo controller that controls the carrier drive and the scan head drive in such a manner as to substantially increase a linear velocity of the scanning beam relative to an information track being scanned as the scanning beam is moved from an innermost track towards an outermost track, the servo controller being arranged to set the linear velocity at a substantially constant linear velocity determined by the CLV zone of the information track being scanned, wherein the servo controller causes the angular velocity of the scanning beam relative to an information track being scanned to change substantially as the radial distance (r) increases.

183. The device as set forth in claim 182, wherein the angular velocity within each CLV zone is limited to a maximum angular velocity for that CLV zone, and wherein further, the angular velocity of an outermost track of a given one of the CLV zones is substantially equal to the angular velocity of an innermost track of an adjacent one of the CLV ones.

184. The device as set forth in claim 182, wherein the angular velocity within each CLV zone increases from an initial angular velocity at an innermost track of that CLV zone to a maximum angular velocity at an outermost track of that CLV zone.

185. The device as set forth in claim 183, wherein the maximum angular velocity of one of the CLV zones is substantially equal to the initial angular velocity of an adjacent one of the CLV zones.

186. A device for scanning a multiplicity of information tracks recorded on a disc-shaped information carrier in a *plurality of CLV zones each comprised of a plurality of information tracks spanning a radial portion of a surface of the carrier, the device comprising:*

a scan head that generates a scanning beam that scans the information tracks;

a carrier drive that rotates the carrier about a rotational axis, at an angular velocity;

a scan head drive that moves the scan head in a radial direction relative to the information tracks, to thereby vary a radial distance (r) between the scanning beam and the rotational axis; and,

a servo controller that controls the carrier drive and the scan head drive in such a manner as to substantially increase the linear velocity of the scanning beam relative to an information track being scanned as the scanning beam is moved from an innermost track towards an outermost track, the servo controller being arranged to set the linear velocity at a substantially constant linear velocity determined by the CLV zone of the information track being scanned,

wherein the radial portion spanned by an outermost one of the CLV zones is greater than the radial portion spanned by an innermost one of the CLV zones; and,

wherein the angular velocity decreases substantially at least within the outermost one of the CLV zones.

187. The device as set forth in claim 186, wherein the radial portion spanned by the CLV zones increases with increasing distance (r).

188. A method for scanning a multiplicity of information tracks recorded on a disc-shaped information carrier in a plurality of CLV zones each comprised of a plurality of information tracks spanning a radial portion of a surface of the carrier, the method comprising:

generating a scanning beam for scanning the information tracks;

rotating the carrier about a rotational axis, at an angular velocity;

moving the scanning beam in a radial direction relative to the information tracks, to thereby vary a radial distance (r) between the scanning beam and the rotational axis; and,

controlling the rotating and the moving to substantially increase a linear velocity of the scanning beam relative to an information track being scanned as the scanning beam is moved from an innermost track towards an outermost track; to set the linear velocity at a substantially constant linear velocity determined by the CLV zone of the information track being scanned; and, to cause the angular velocity of the scanning beam relative to an information track being scanned to change substantially as the radial distance (r) increases.

189. The method as set forth in claim 188, wherein the angular velocity within each CLV zone is limited to a maximum angular velocity for that CLV zone, and wherein further, the angular velocity of an outermost track of a given one of the CLV zones is substantially equal to the angular velocity of an innermost track of an adjacent one of the CLV ones.

190. The method as set forth in claim 188, wherein the angular velocity within each CLV zone increases from an initial angular velocity at an innermost track of that CLV zone to a maximum angular velocity at an outermost track of that CLV zone.

191. The method as set forth in claim 188, wherein the maximum angular velocity of one of the CLV zones is substantially equal to the initial angular velocity of an adjacent one of the CLV zones.

192. A method for scanning a multiplicity of information tracks recorded on a disc-shaped information carrier in a plurality of CLV zones each comprised of a plurality of information tracks spanning a radial portion of a surface of the carrier, the method comprising:

generating a scanning beam for scanning the information tracks;

rotating the carrier about a rotational axis, at an angular velocity;

moving the scanning beam in a radial direction relative to the information tracks, to thereby vary a radial distance (r) between the scanning beam and the rotational axis; and,

controlling the rotating and the moving to substantially increase a linear velocity of the scanning beam relative to an information track being scanned as the scanning beam is moved from an innermost track towards an outermost track, and to set the linear velocity at a substantially constant linear velocity determined by the CLV zone of the information track being scanned,

wherein the radial portion spanned by an outermost one of the CLV zones is greater than the radial portion spanned by an innermost one of the CLV zones; and,

wherein the angular velocity decreases substantially at least within the outermost one of the CLV zones.

193. The method as set forth in claim 192, wherein the radial portion spanned by the CLV zones increases with increasing distance (r).

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