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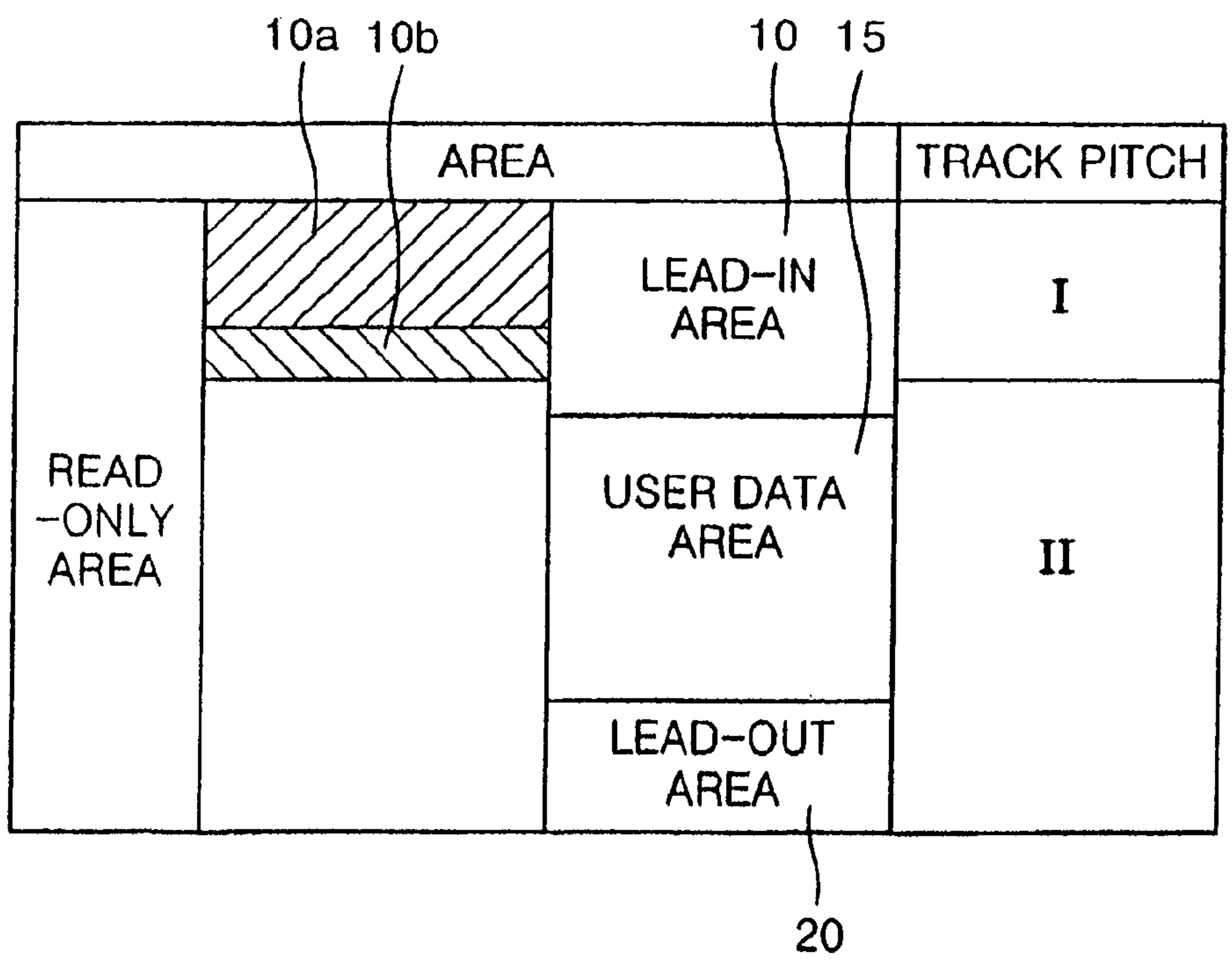
(54) **Titre :** SUPPORT DE STOCKAGE D'INFORMATIONS OPTIQUE
(54) **Title:** OPTICAL INFORMATION STORAGE MEDIUM



(57) **Abrégé/Abstract:**
An optical information storage medium includes a lead-in area, a lead-out area, and a user data area between the lead-in and lead-out areas and in which user data is recorded. Pits are formed in the lead-in area, the user data area, and the lead-out area, and a track pitch in all or a portion of the lead-in area is different from a track pitch in the remaining area of the optical information storage medium

Abstract

An optical information storage medium includes a lead-in area, a lead-out area, and a user data area between the lead-in and lead-out areas and in which user data is recorded. Pits are formed in the lead-in area, the user data area, and the lead-out area, and a track pitch in all or a portion of the lead-in area is different from a track pitch in the remaining area of the optical information storage medium

OPTICAL INFORMATION STORAGE MEDIUM

Technical Field

The present invention relates to an optical information storage medium, and more particularly, to an optical information storage medium in which a track pitch in all or a portion of a lead-in area is different from a track pitch in remaining areas of the optical information storage medium so that the reliability of reproduction of important optical information storage medium-related information can be improved.

Background Art

Optical discs are generally used as information storage media of optical pickup devices, which record information on and/or reproduce information from the optical discs without contacting the optical discs. Optical discs are classified as either compact discs (CDs) or digital versatile discs (DVDs) according to their information recording capacity. CDs and DVDs further include 650MB CD-Rs, CD-RWs, 4.7GB DVD+RWs, DVD-random access memories (DVD-RAMs), DVD-R, DVD-rewritables (DVD-RWs), and so forth. Read-only discs include 650MB CDs, 4.7GB DVD-ROMs, and the like. Furthermore, high-density digital versatile discs (HD-DVDs) have been developed which have a recording capacity of 20GB or more.

Various methods of increasing the recording capacity of optical discs have been studied. One method of increasing the recording capacity is to reduce a size of an optical spot focused on an optical disc. To reduce the size of the optical spot, the wavelength of a laser light source should be shortened or a numerical aperture (NA) of an objective lens should be increased. Further, the track pitch of the optical disc should be reduced. The track pitch refers to a minimum distance measured from a central line of one track to a central line of an adjacent track.

FIG. 1 illustrates the structure of a conventional DVD-ROM 110. The DVD-ROM 110 includes a user data area 105 in which user data is recorded. A lead-in area 100 is formed inside the user data area 105. A lead-out area 110 which is formed outside the user data area 105. Data is recorded as dots in the lead-in area 100, the user data area 105, and the lead-out area 110. Also, the track pitch is 0.74μm in the lead-in area 100, the user data area 105, and the lead-out area 110.

The track pitch tends to be reduced when increasing the recording capacity. However, since an optical spot focused on a track may reach an adjacent track, the possibility that cross-talk will occur becomes high as the track pitch is reduced. If cross-talk occurs, an abnormal reproduction signal is output. Thus, as the track pitch is reduced, there is an increase in abnormal reproductions of information.

In particular, if information is abnormally reproduced from an area in which is recorded important information in recording and/or reproducing data, this abnormal reproduction may gravely affect a recording and/or reproduction efficiency of a disc. Accordingly, the track pitch is required to be adjusted in accordance with an increase in the recording capacity of a storage medium and the importance of data.

Disclosure of the Invention

The present invention provides an optical information storage medium in which a track pitch in an area in which is recorded important optical information storage medium-related information is different from a track pitch in a user data area in which is recorded user data so that the efficiency and reliability of the reproduction of data can be improved.

Additional aspects and/or advantages of the invention will be set forth in part in the description which follows and, in part, will be obvious from the description, or may be learned by practice of the invention.

According to an aspect of the present invention, an optical information storage medium includes a lead-in area, a lead-out area that is formed outside the lead-in area, and a user data area disposed between the lead-in and lead-out areas and in which user data is recorded where pits are formed in first tracks of the lead-in area, second tracks of remaining area including the user data area, and the lead-out area, and a track pitch of between adjacent first tracks in all or a portion of the lead-in area is different from a track pitch between adjacent second and/or third tracks in the remaining areas of the optical information storage medium.

It is preferable, but not required, that the first track pitch is greater than the second track pitch in the remaining area of the optical information storage medium.

According to an aspect of the invention, the lead-in area includes an area in which optical information storage medium-related information is recorded and an area in which copy protection information is recorded.

It is preferable, but not required, that the first track pitch in at least one of the areas of the lead-in area is greater than the second track pitch in the remaining area of the optical information storage medium.

It is preferable, but not required, that a ratio of tracking error signals detected in the area having the first track pitch to tracking error signals detected in the area having the second track pitch is 1.5 or more.

Brief Description of the Drawings

FIG. 1 illustrates the schematic structure of a conventional DVD-ROM.

FIG. 2 illustrates the schematic structure of an optical information storage medium according to an embodiment of the present invention.

FIG. 3A illustrates a phase tracking error signal (a differential phase detect (DPD) signal) when a track pitch is 0.32μm.

FIG. 3B illustrates a phase tracking error signal (a DPD signal) when a track pitch is 0.35μm.

FIG. 4 is a block diagram of a recording and/or reproducing apparatus according to an embodiment of the present invention.

Best mode for carrying out the Invention

Referring to FIG. 2, an optical information storage medium 1000 according to an embodiment of the present invention includes a user data area 15, a lead-in area 10 which is formed inside the user data area 15, and a lead-out area 20 which is formed outside the user data area 15 and the lead-in area 10. A first track pitch in all or a portion of the lead-in area 10 is different from a second track pitch in remaining areas of the optical information storage medium 1000 including the user data and lead-out areas 15, 20. The reference to the optical storage medium 1000 is shown in FIG. 4.

The lead-in area 10 includes areas in which is recorded important data in reproduction from the optical information storage medium. Examples of the important data include optical information storage medium-related information, which is recorded in area 10a, and copy protection information, which is recorded in area 10b. The optical information storage medium-related information contains information on the type of storage medium (such as whether the medium 1000 is a recordable disc, write-once disc, or a read-only disc), information on the number of recording layers, information on the recording speed, and information on the size of the optical information storage medium 1000 (disc).

It is preferable, but not required, that a track pitch in at least one of the areas 10a and 10b is the first track pitch which is greater than the second track pitch in the remaining areas except the areas 10a and 10b. It is understood that additional important information in reproduction from the optical information storage medium 1000 may be recorded, and the track pitch in the entire lead-in area 10 may be the first track pitch which is greater than the second track pitch in the remaining areas of the optical information storage medium 1000.

The optical information storage medium according to an embodiment of the present invention is read-only optical information storage medium. The pits are formed everywhere in the lead-in area 10, the user data area 15, and the lead-out area 20. The pits are formed in a substrate in advance when manufacturing the read-only embodiment of the optical information storage medium 1000. If data is recorded as the pits, the pits can be formed in the lead-in area 10 and the user data area 15 without stopping a process of forming the pits. Thus, a process of manufacturing an optical information storage medium can be simplified and the time required for performing the process can be reduced.

One method of performing a tracking operation using the pits is a differential phase detect (DPD) method. For example, the DPD method is used to realize a track servo depending on the phase shift of an optical spot focused on a quarter photodetector. The DPD method is well known, and thus will not be described in detail herein. According to the DPD method, when track pitches on the optical information storage medium are different, an output tracking error signals (such as differential phase tracking error signals) are different. For example, FIG. 3A illustrates a DPD signal when the track pitch is 0.32μm, and FIG. 3B illustrates a DPD signal when the track pitch is 0.35μm. Here, when the same reproduction power is output, the amplitude of a phase tracking error signal (a DPD signal) in the track pitch of 0.32μm was about 1.46V. In contrast, the amplitude of the DPD signal in the track pitch of 0.35μm was about 2.31V. Thus, the amplitude of the DPD signal when the track pitch is larger increased about 1.58 times the amplitude of the DPD signal when the track pitch is smaller. As can be seen in FIGs. 3A and 3B, as the track pitch increased, the amplitude of the DPD signal is increased. As the amplitude of the DPD signal is increased, an error detecting efficiency is improved. Thus, the reproduction efficiency and reliability are improved as the track pitch increased.

According to the result of simulations, it was found that, when the track pitch TP in the area 10a or the area 10b is I and the track pitch TP in the remaining areas of the optical information storage medium is II, it is preferable, but not required, that a ratio of a tracking error signal, particularly, a phase tracking error signal, to each of the track pitches TP is 1.5 or more as expressed by equation 1 set forth below:

$$\frac{Tracking\ Error\ Signal_{TP=I}}{Tracking\ Error\ Signal_{TP=II}} \geq 1.5 \qquad \ldots(1)$$

The optical information storage medium according to embodiments of the present invention can be applied to an optical information storage medium having one or more recording surfaces. In other words, if the optical information storage medium has a plurality of recording surfaces, the track pitch in all or a portion of a lead-in area of each of the plurality of recording surfaces can be greater than the track pitch in the remaining area of each of the plurality of recording surfaces. Accordingly, the track pitch in a portion of the lead-in area in which important information is recorded can be greater than the track pitch in the remaining area of the optical information storage medium so that the reproduction reliability of the important information can be increased.

While not specifically so limited, it is understood that the information storage medium can include the CD-Rs, CD-RWs, DVD-RWs, DVD-RAMs, DVD+RWs, as well as next generation high definition DVDs, such as Blu-ray discs and Advanced Optical Discs (AODs). Further, it is understood the information storage medium need not include lead-in and/or lead-out areas.

FIG. 4 is a block diagram of a recording and/or reproducing apparatus according to an embodiment of the present invention. Referring to FIG. 4, the recording apparatus includes a recording/reading unit 1001, a controller 1002, and a memory 1003. The recording/reading unit 1001 records data on a disc 1000, which is an embodiment of an information storage medium 1000 of the present invention, and reads the data from the disc 1000. The controller 1002 records and reproduces data from tracks having first and second track pitches according to the present invention as set forth above in relation to FIGs. 2 through 3B.

While not required in all aspects, it is understood that the controller 1002 can be computer implementing the method using a computer program encoded on a computer readable medium. The computer can be implemented as a chip having firmware, or can be a general or special purpose computer programmable to perform the method.

In addition, it is understood that, in order to achieve a recording capacity of several dozen gigabytes, the recording/reading unit 1001 could include a low wavelength, high numerical aperture type unit usable to record dozens of gigabytes of data on the disc 1000. Examples of such units include, but are not limited to, those units using light wavelengths of 405 nm and having numerical apertures of 0.85, those units compatible with Blu-ray discs, and/or those units compatible with Advanced Optical Discs (AOD).

While the present invention has been particularly shown and described with reference to exemplary embodiments thereof, it will be understood by those of ordinary skill in the art that various changes in form and details may be made therein without departing from the spirit and scope of the present invention as defined by the following claims and equivalents thereof.

Industrial Applicability

As described above, in an optical information storage medium according to the present invention, the track pitch in an area, such as an optical information storage medium-related information area or a copy protection information area of a lead-in area, in which important information is recorded, is greater than the track pitch in the remaining areas of the optical information storage medium. Thus, reliable reproduction of the important information can be achieved without deteriorating a signal due to cross-talk occurring between adjacent tracks during reproduction of the important information.

What is claimed is:

1. An apparatus for reproducing data with respect to an optical information storage medium, the medium comprising a lead-in area having a first sub-area and a second sub-area, a lead-out area, a user data area formed between the lead-in and lead-out areas and in which user data is recorded, and the first sub-area of the lead-in area has a first track pitch and the second sub-area of the lead-in area has a second track pitch, the apparatus comprising:

a reproducing unit to reproduce a data recorded in the optical information storage medium; and

a controller to control the reproducing unit to reproduce the data from at least one of the first sub-area with the first track pitch and the second sub-area with the second track pitch,

wherein the user data area has a same track pitch as the second track pitch,

wherein the lead-in area, the user data area, and the lead-out area are arranged in sequence, and

wherein the lead-in area is continuous.

2. The apparatus of claim 2, wherein the first track pitch is greater than the second track pitch.

3. The apparatus of claim 3, wherein:

the first sub-area comprises optical information storage medium-related information and the second sub-area comprises copy protection information .

4. The apparatus of any one of claims 1 to 3, wherein a ratio of tracking error signals detected in the first sub-area to tracking error signals detected in the second sub-area is 1.5 or more.

5. The apparatus of any one of claims 1 to 3, wherein a ratio of differential phase tracking error signals detected in the first sub-area to differential phase tracking error signals detected in the second sub-area is 1.5 or more.

6. An optical information storage medium comprising:

a lead-in area having a first sub-area and a second sub-area;

a lead-out area; and

a user data area formed between the lead-in area and lead-out area and in which user data is recorded,

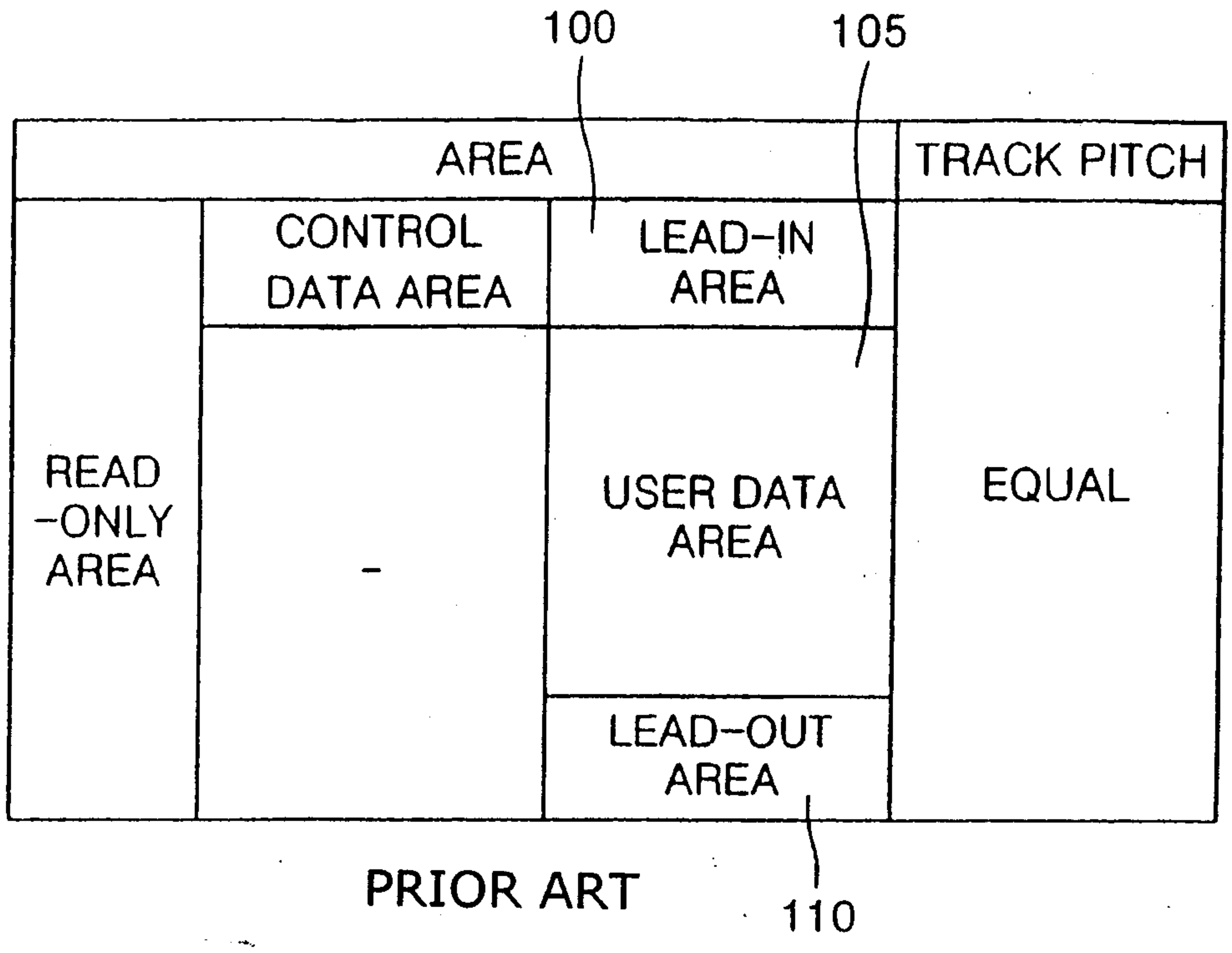
wherein the first sub-area of the lead-in area has a first track pitch and the second sub-area of the lead-in area has a second track pitch,

wherein the user data area has a same track pitch as the second track pitch,

wherein the lead-in area, the user data area, and the lead-out area are arranged in sequence, and

wherein the lead-in area is continuous.

FIG. 1



PRIOR ART

FIG. 2

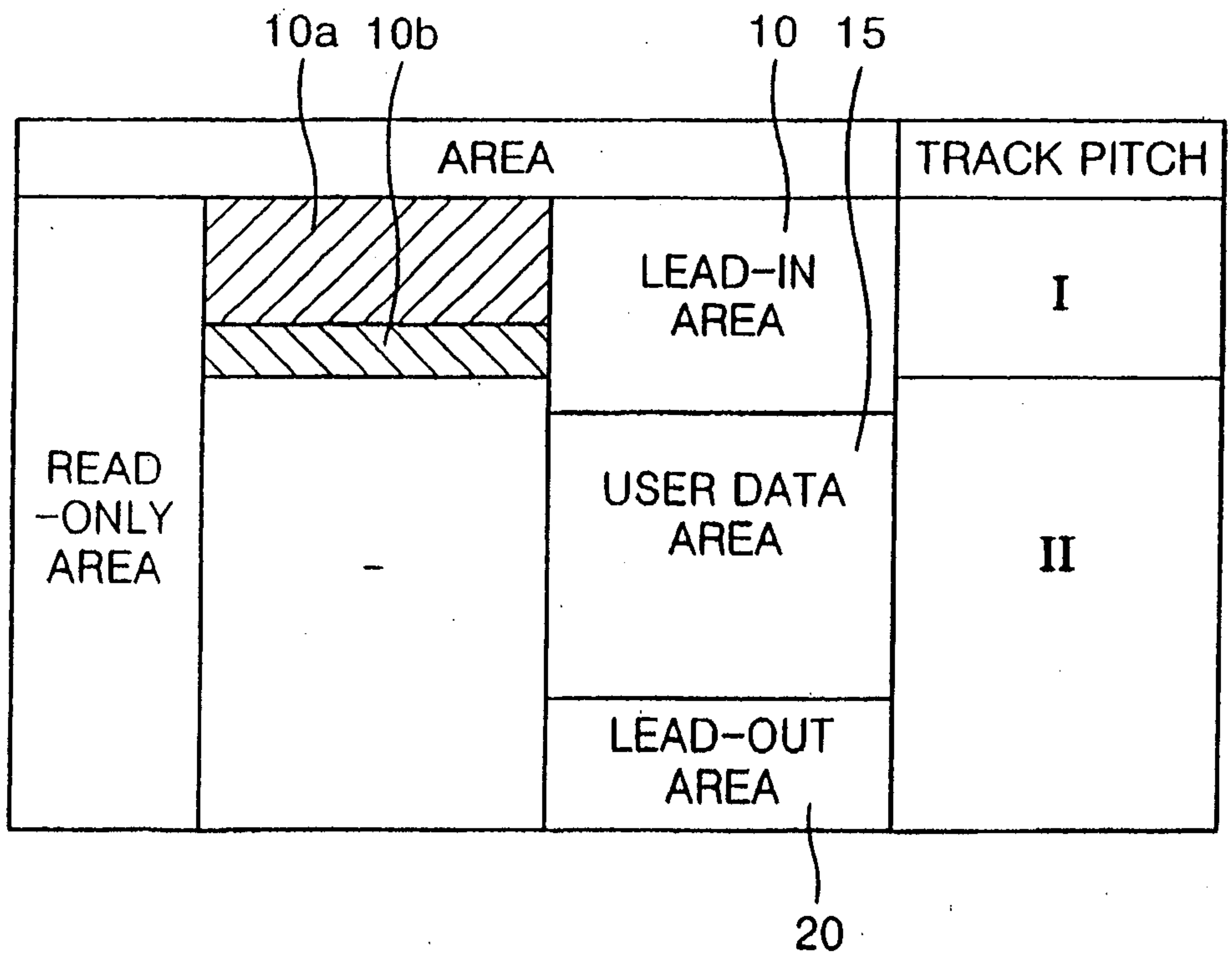


FIG. 3A

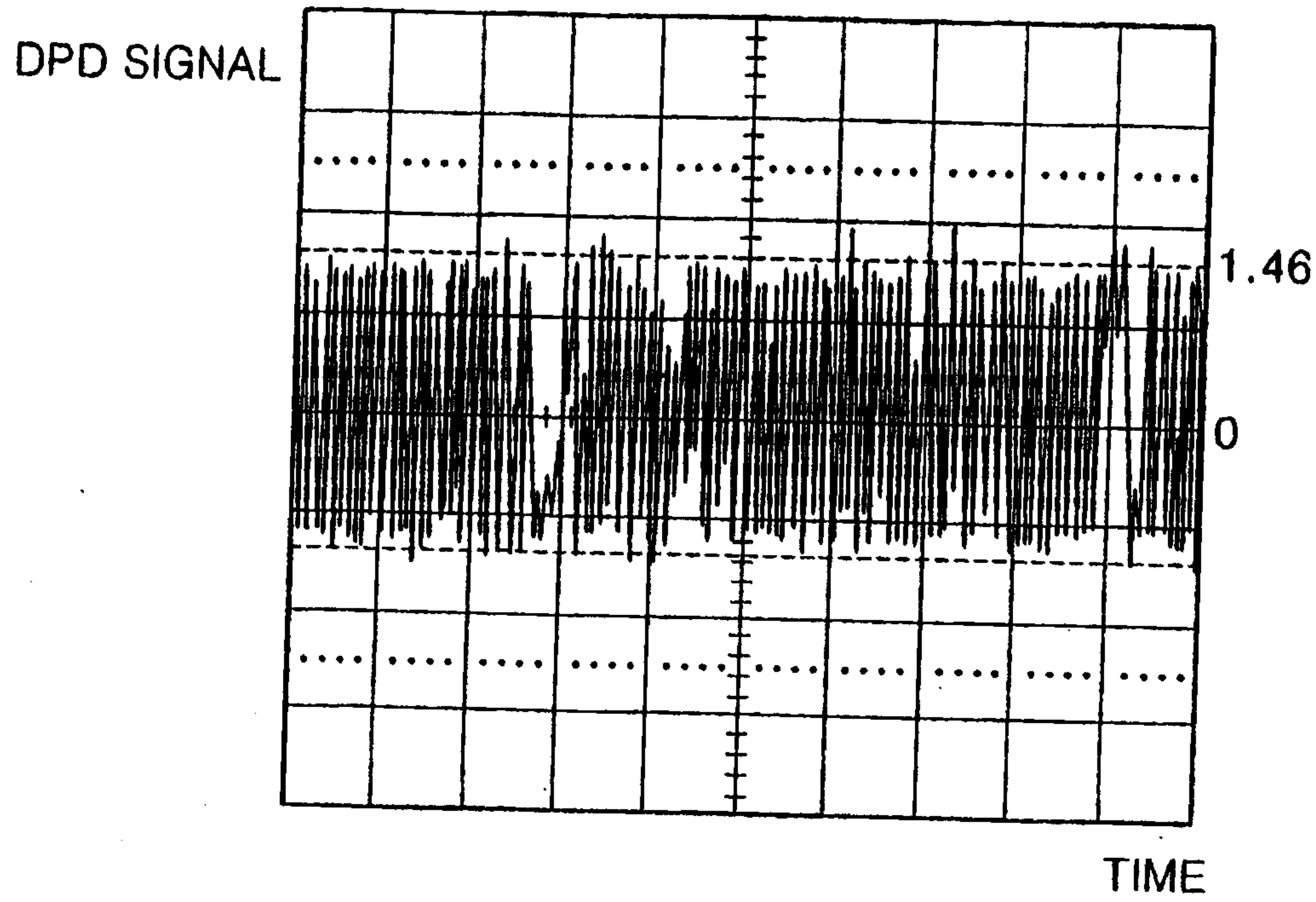


FIG. 3B

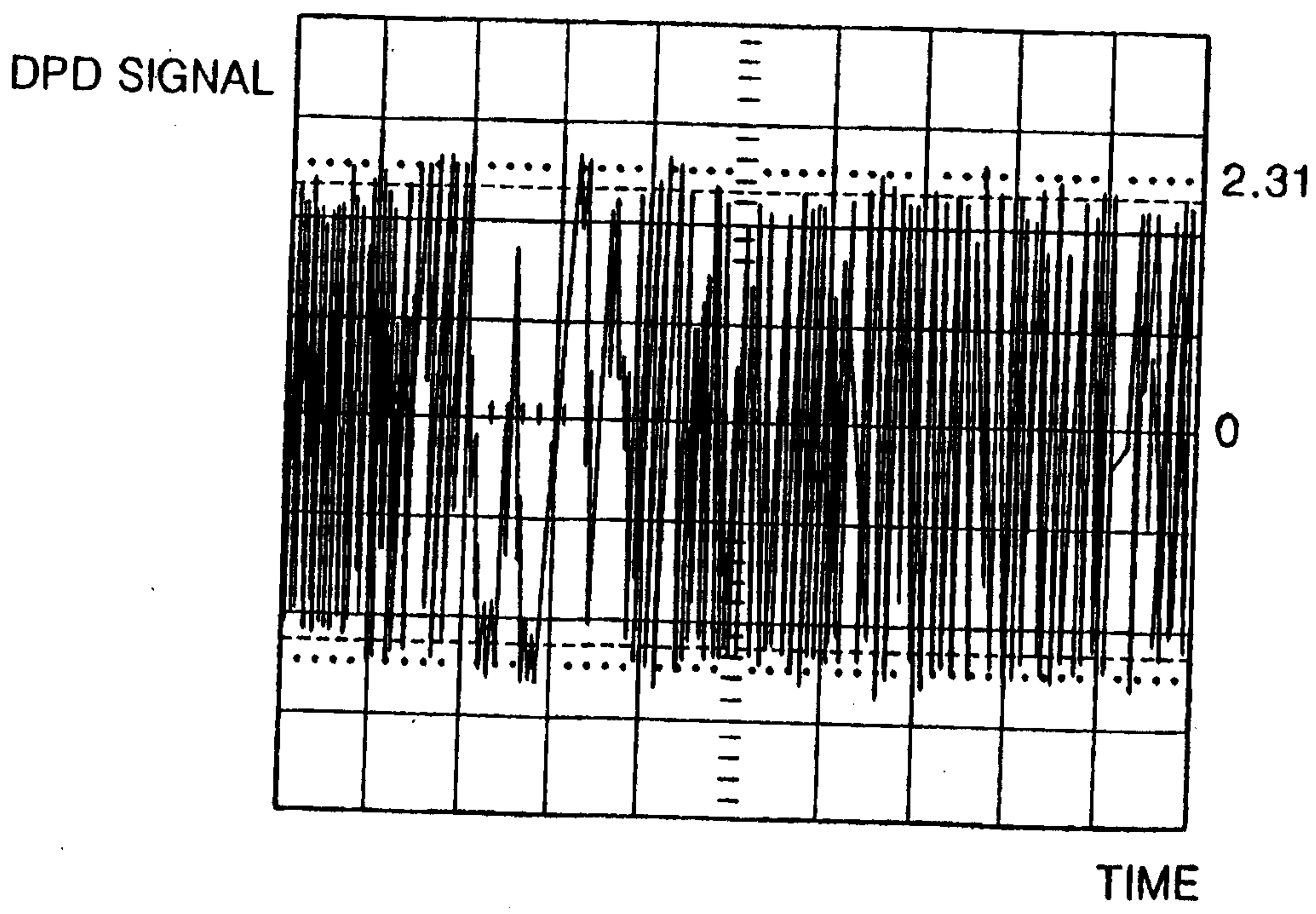
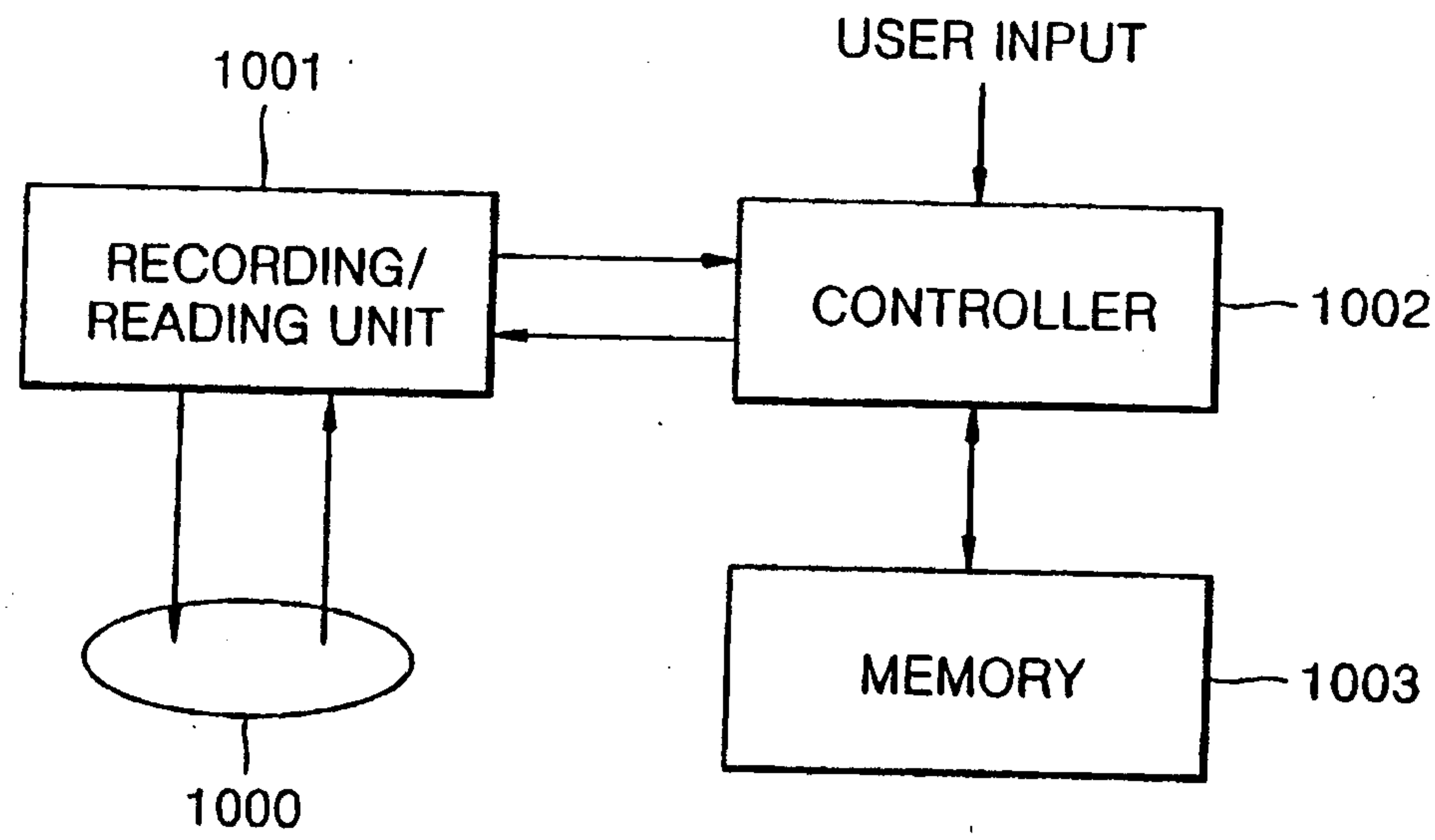


FIG. 4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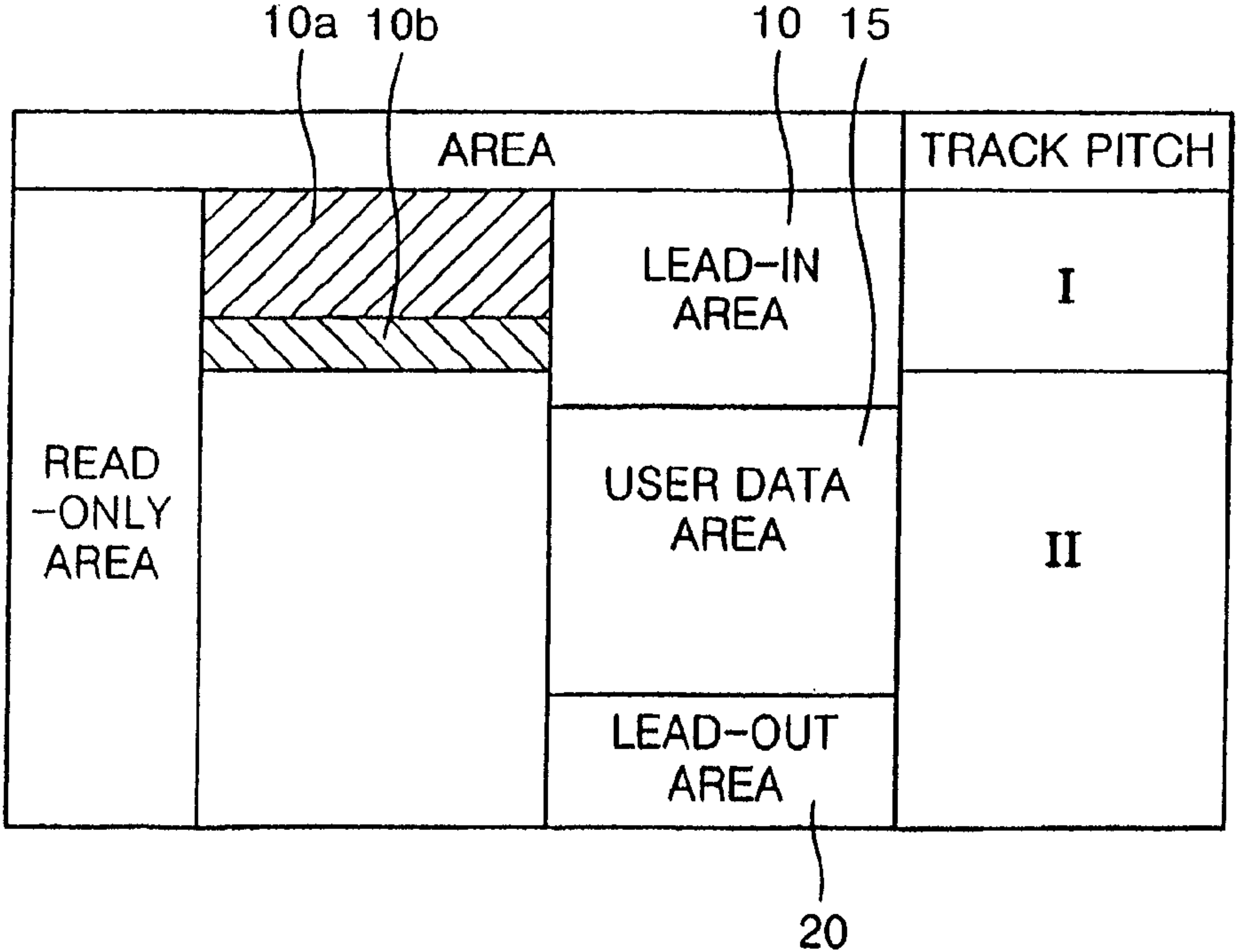
READING UNIT
USER INPUT
CONTROLLER
1002
MEMORY
1003
1000


10a
10b
10
15
AREA
TRACK PITCH
READ
-ONLY
AREA
LEAD-IN
AREA
I
USER DATA
AREA
II
LEAD-OUT
AREA
20