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(54) Titre : PROCÉDE ET DISPOSITIF POUR CREER UNE BASE DE DONNEES
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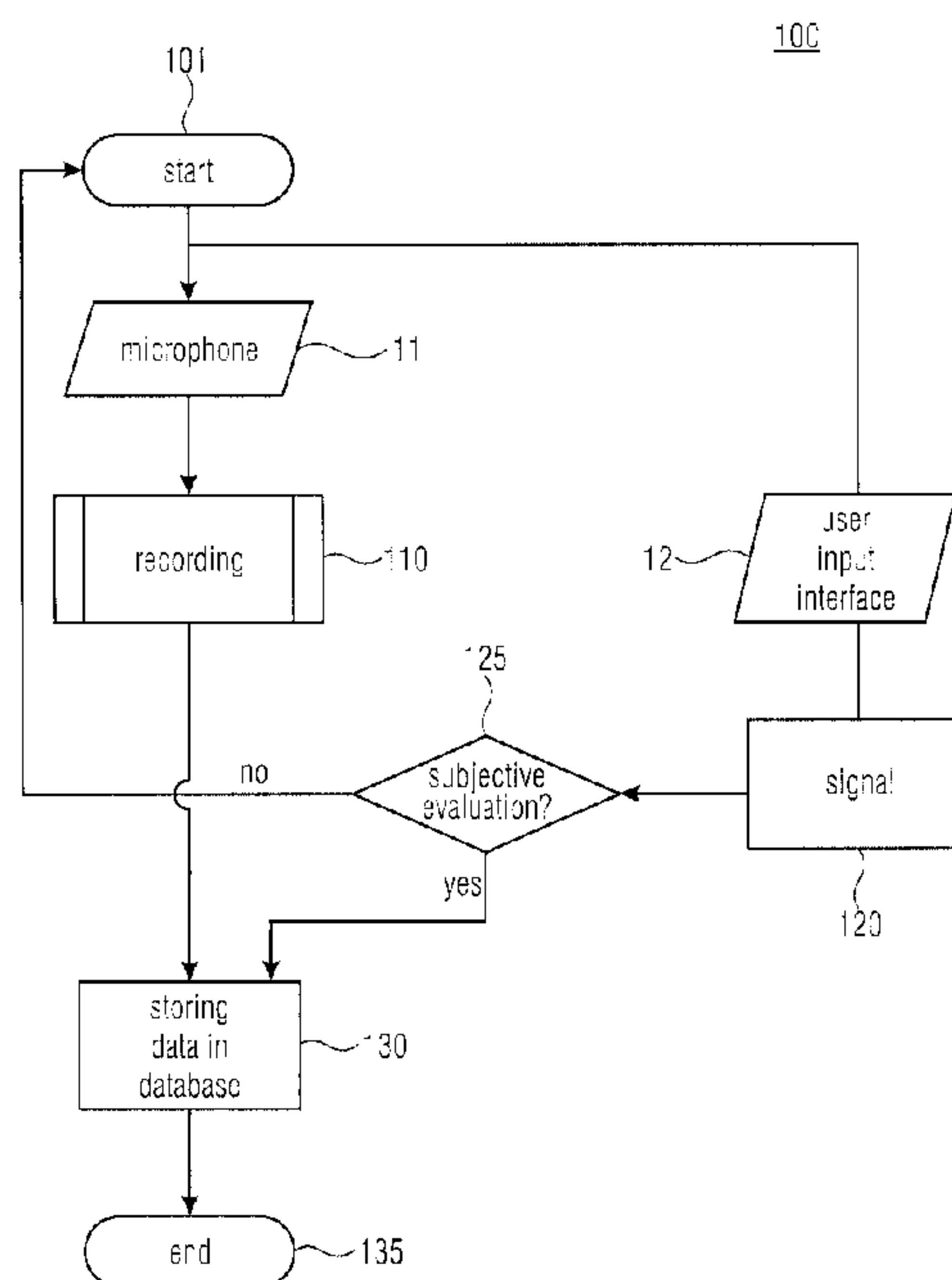


Fig. 1a

(57) **Abrégé/Abstract:**

Exemplary embodiments of the present invention provide a method for creating a database. The method comprises the steps "receiving environmental sounds", which comprise, for example, parasitic noise and "buffered environmental sounds for a rolling time window", such as 30 or 60 seconds, or preferably more than 5 seconds. Alternatively, the method could also comprise the step of "deriving a parameter set for the environmental sounds" and "buffering the parameter set for the rolling time window". The buffered environmental sounds or the buffered parameter set are generally designated as a recording. In addition, the method comprises the step "obtaining a signal", said signal identifying one signal class (e.g. parasitic noise) of a plurality of signal classes (parasitic noise and non-parasitic noise) in the environmental sounds. The third basic step is "storing, as a response to the signal, the buffered recordings" in a memory, such as an internal or external memory. These obtaining and storing steps are repeated in order to construct the database, which has a plurality of buffered recordings for the same signal class.

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(54) Title: METHOD AND DEVICE FOR CREATING A DATABASE

(54) Bezeichnung : VERFAHREN UND VORRICHTUNG ZUM ERZEUGEN EINER DATENBANK

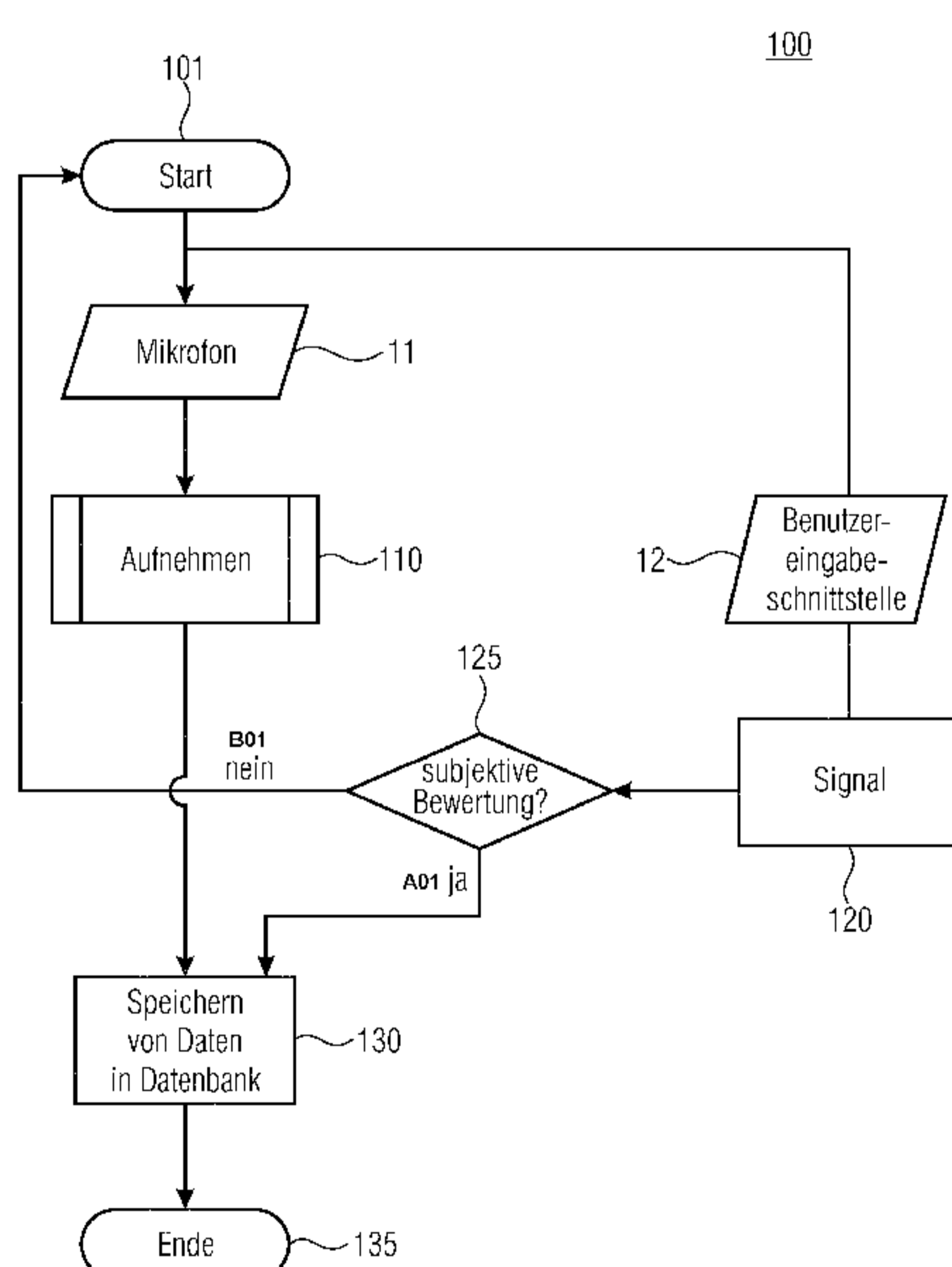


Fig. 1a

101 Start
11 Microphone
110 Recording
12 User entry interface
120 Signal
B01 No
125 Subjective valuation?
A01 Yes
130 Storing data in database
135 End

(57) Abstract: Exemplary embodiments of the present invention provide a method for creating a database. The method comprises the steps "receiving environmental sounds", which comprise, for example, parasitic noise and "buffered environmental sounds for a rolling time window", such as 30 or 60 seconds, or preferably more than 5 seconds. Alternatively, the method could also comprise the step of "deriving a parameter set for the environmental sounds" and "buffering the parameter set for the rolling time window". The buffered environmental sounds or the buffered parameter set are generally designated as a recording. In addition, the method comprises the step "obtaining a signal", said signal identifying one signal class (e.g. parasitic noise) of a plurality of signal classes (parasitic noise and non-parasitic noise) in the environmental sounds. The third basic step is "storing, as a response to the signal, the buffered recordings" in a memory, such as an internal or external memory. These obtaining and storing steps are repeated in order to construct the database, which has a plurality of buffered recordings for the same signal class.

(57) Zusammenfassung: Ausführungsbeispiele der vorliegenden Erfindung schaffen ein Verfahren zum Erzeugen einer Datenbank. Das Verfahren umfasst die Schritte „Empfangen von Umgebungsgeräuschen“, die beispielsweise ein Störgeräusch umfassen, und „zwischenengespeicherte Umgebungsgeräusche für ein mitwanderndes

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Zeitfenster", wie z. B. 30 oder 60 Sekunden oder bevorzugt mehr als 5 Sekunden. Alternativ hierzu wäre es auch denkbar, dass das Verfahren den Schritt des „Ableitens eines Parametersatzes zu den Umgebungsgeräuschen" und des „Zwischenspeicherns des Parametersatzes für das mitwandernde Zeitfenster" umfasst. Die zwischengespeicherten Umgebungsgeräusche oder der zwischengespeicherte Parametersatz werden allgemein als Aufnahme bezeichnet. Des Weiteren umfasst das Verfahren den Schritt des „Erhaltens eines Signals", das eine Signalklasse (z. B. Störgeräusch) einer Mehrzahl von Signalklassen (Störgeräusch und nicht-störendes Geräusch) in den Umgebungsgeräuschen identifiziert. Der dritte Basisschritt ist das „Speichern, als Reaktion auf das Signal, der zwischengespeicherten Aufnahmen" in einen Speicher, wie z. B. einem internen oder einem externen Speicher. Diese Schritte des Erhaltens und Speicherns werden wiederholt, um die Datenbank aufzubauen, die eine Mehrzahl von zwischengespeicherten Aufnahmen für die gleiche Signalklasse aufweist.

Method and Device for Generating a Database

Description

5 Embodiments of the present invention relate to a method and a device and generating a database having buffered recordings of several signal classes.

Noises may, for example, be subdivided into signal classes, like disturbing noises and non-disturbing noises. A subdivision into more disturbing noises and less disturbing
10 noises, for example, would also be conceivable.

Disturbing noises are not always easy to classify. It is important to know that there are different factors which influence whether a noise is perceived as a disturbing noise. A bird, even when its chirping is loud (objective measurable parameter: sound pressure level)
15 and is clearly distinctive from the other environmental noises (objective measurable parameter: dynamics factor), would subjectively not be perceived as a disturbing noise. A considerably quieter plane passing, however, would be perceived as a disturbing noise by many more test persons than the bird just mentioned.

20 The consequence here is that, when examining an environment, like a hotel, wellness area of a hotel or a workplace, relative to disturbing noises in order to allow a prediction of noise evaluation, for example, using current approaches, one has to leave evaluation to the test persons.

25 A purely automatized evaluation relative to the absolute loudness or volume or relative to level increases, for example, serves as a first hint, but is not sufficient for a final evaluation. Thus, there is need for an improved approach.

Main Aspect

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It is the object of the present invention to provide a concept for classifying noises, like subjective disturbing noises.

The object is achieved by the subject matter of the independent claim.

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Embodiments of the present invention provide a method for generating a database. The method comprises the steps of “receiving environmental noises”, which exemplarily comprise a disturbing noise, and “buffered environmental noises for a migrating time window”, like 30 or 60 seconds, or, preferably, more than 5 seconds. Alternatively, it would also be conceivable for the method to comprise the steps of “deriving a set of parameters relative to the environmental noises” and of “buffering the set of parameters for the migrating time window”. The buffered environmental noises or the buffered set of parameters are/is generally referred to as recording. Furthermore, the method comprises the step of “obtaining a signal” which identifies a signal class (like disturbing noise) of a plurality of signal classes (disturbing noise and non-disturbing noise) in the environmental noises. The third basic step is “storing the buffered recordings responsive to the signal” in a memory, like an internal or external memory. These steps of obtaining and storing are repeated in order to set up the database which comprises a plurality of buffered recordings for the same signal class.

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Embodiments of the present invention are based on the finding that, using a device recording continuously and storing relevant locations in the environment, it is possible to set up a database where recordings or characteristics, like an audio fingerprint or psychoacoustic parameters of the recording, are stored so that recognizing such a sound sequence at a later time is possible. The concept here assumes that the step of “recognizing a subjective disturbing noise or a noise of a class” is performed by a human who exemplarily identifies or marks the disturbing noise or signal class using a button or key or different input interface. This signal is used as an indicator for cutting out the sequence or extracting the characteristics from the current continuously running and storing same in a memory for the database to be set up. Thus, it is easily possible to set up a library of disturbing noises or classifiers for unambiguously associating sound-describing parameters, which allows predicting a subjective noise perception afterwards.

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In correspondence with embodiments, the subjective disturbing noise can be described by a parameter, like an audio fingerprint, comprising individual parameters like volume, dynamics, extent, increase in dynamics, frequency spectrum, monotony or a repetitive character, or by psychoacoustic parameters, like sharpness, roughness, tonality, intensity of variation or volume. Thus, in accordance with further embodiments, the method comprises the step of determining an audio fingerprint for the buffered recording or of determining psychoacoustic parameters. Usually, it will be sufficient for the recording or the audio fingerprint to be stored in the database, whereas the psychoacoustic

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parameters represent additional information. It is of advantage with the audio fingerprint that storing the recording takes place in an anonymized manner.

5 In the individual step of obtaining a signal from a user interface, like a button, a further alternative or additional signal which subjectively evaluates the currently identified control noise may be obtained. This subjective evaluation is allocating the audio signals to signal classes (like little disturbing or highly disturbing). This subjective evaluation is then stored in combination with the respective part or parameter.

10 In accordance with further embodiments, a time stamp can be stored in addition to the part or parameter. In accordance with still further embodiments, it would also be conceivable to also store current position information, for example from a GPS receiver. In order not to have the database become too large, it would also be feasible to store the data to be buffered in a data-reduced manner.

15

It is to be pointed out here that, in accordance with an embodiment, the memory or database is contained directly in the respective device executing the method or, in accordance with another embodiment, may be provided externally as well.

20 A further embodiment relates to a corresponding device. Said device comprises a microphone for continuously recording, a buffer for buffering, an interface for receiving the signal, and a further memory for storing the recording (audio file, audio fingerprint or psychoacoustic parameters) in relation to a signal class belonging to the disturbing noise identified. In accordance with further embodiments, this device may comprise an input
25 interface, like a button, using which the presence of a subjective disturbing noise can be confirmed or, generally, a noise can be allocated to a signal class. The input means may also be extended by a way of sorting into one of several signal classes, that is by an evaluation. In accordance with still further embodiments, the device may also comprise a communication interface by means of which the external memory (external database) is
30 connected.

Further developments are defined in the sub-claims.

Further Aspects

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Embodiments of the present invention provide a method for recognizing a noise of signal class (like disturbing noise) of a plurality of signal classes (like disturbing noise and non-disturbing noise). The method includes the steps of “receiving environmental noises” and “establishing whether the environmental noises or a set of parameters derived from the environmental noises fulfill/s a predefined rule which describes the signal class of the plurality of signal classes”. Starting here, the steps of “logging that the predefined rule has been fulfilled”, “recording the environmental noises received for a migrating time window”, “deriving a set of parameters from the environmental noises for the migrating time window and storing the set of parameters” or “emitting an activation signal for another device for recognizing a noise” are performed.

Embodiments of this aspect are based on the finding that, starting from a database as may be determined in by means of the device described above in accordance with the method described above, like by comparing the current noise environment to the noises from the database or parameters obtained from the database or stored in the database, like audio fingerprints, it is possible to recognize the presence of subjectively perceived disturbing noises. This method can be executed in an automated manner and allows a forecast of the evaluation of a noise situation (chirping of a bird vs. air condition) solely using a stored database, without having any subjective evaluation done by humans.

Recognizing a rule match may exemplarily be done by comparing the environmental noises to previously buffered environmental noises or by comparing currently derived parameter datasets (audio fingerprint) to previously determined parameter datasets or by deriving psychoacoustic parameters and comparing to predetermined threshold values for same.

Another embodiment relates to a device for recognizing a noise of a signal class of a plurality of signal classes. The device comprises a microphone for continuously listening to current environmental noises, a processor for comparing the current environmental noises to data stored in a database (recording disturbing noises or parameters describing the disturbing noises), and an interface for outputting information as soon as a disturbing noise has been identified in the current environment. Here, the data, like the recordings determined before, and the audio fingerprints determined before or the threshold values established before for the psychoacoustic parameters can be stored either internally or, in accordance with further embodiments, be read externally using a database, as may, for example, have been determined in accordance with the further aspect.

Starting from these objective disturbing noises recognized or a signal class, the information may be processed further either alone or in combination with an indication of time, an indication of place or a classification of the disturbing noise into one of the classes (a corresponding disturbing group: slightly disturbing, disturbing, highly disturbing). In accordance with a preferred embodiment, these information are output to an external database.

Since in this embodiment only the evaluation of a location or this one position is provided or, in accordance with further embodiments, it is also conceivable to extend this evaluation to several positions, like several positions in space or an outdoor environment, i.e. several neighboring positions (like distributed over a city). Thus, a further embodiment provides a method where the steps of "recording", "comparing" and "outputting" are received for two neighboring positions. When there are information for two neighboring positions, a relation between the recordings for the first and the second position can be determined in order to determine a movement, a spatial extension or a direction of the subjectively perceived disturbing noise, for example.

In accordance with a further embodiment, in analogy to recognizing disturbing noises, it is also conceivable to recognize a different sequence, like a control instruction, using which a corresponding control signal is output. Here, the recording associated to the control signal may either be a speech command or, as described before, an acoustic signal classified as a disturbing noise. The control signal, for example, is output by a device which itself executes the method so that recording is started, for example, or an external device, like another device arranged at a different position which is switched to the recording mode by the control signal.

In accordance with further embodiments, the device outlined above may also comprise a communication interface, for communicating with a database for reading the disturbing noises or parameters determined before, or for outputting the information on the disturbing noises. In accordance with still further embodiments, it is also possible for the device to communicate with another device using this communication interface so that the disturbing noises can be obtained and/or analyzed for two neighboring positions.

An embodiment of a sub-aspect provides a method for analyzing noises of a signal class. The method comprises the step of continuously recording current environmental noises at

a first and a second position. Recording here in turn either means directly recording the environmental noises or deriving same from a set of parameters pertaining to the environmental noises, like an audio fingerprint or psychoacoustic parameters. In addition, for each recording, a comparison to a previously obtained recording of a subjectively
5 perceived disturbing noise or to a parameter describing the disturbing noise is performed in order to identify the disturbing noise for each position (first and second position). A relation between the recordings can be determined from the two recordings (first and second recordings) which comprise the one disturbing noise at different positions, in order to be able to analyze the resulting disturbing noise more precisely, for example relative to
10 its position, extension or movement.

Embodiments of this aspect are based on the finding that it is possible, using the relation of two recordings of one and the same disturbing noise at two different positions, to acquire extended information on the disturbing noise itself. Here, at first the disturbing
15 noises in the respective environment (i.e. at a first position and at a second position) are identified and, when being identified, are related to each other. Advantageously, it is possible here to either obtain information on a movement of the disturbing noise or on an extension of the disturbing noise or on a direction of propagation of the disturbing noise. In addition, it is also possible to differentiate between a local disturbing noise, i.e. only at one
20 position, and a global event, i.e. one occurring at several positions. Recognizing characteristic noise events and their propagation of movement is possible using this method.

In accordance with embodiments, the step of determining a relation between the first and
25 a second recording is done by analyzing a level difference between the first and the second recording. Alternatively or additionally, it would also be possible for a time offset, i.e. a latency or run time offset between the event in two recordings established at the two different positions to be established in the step of determining the relation. Additionally, the two recordings may also be evaluated relative to differences in frequency and Hall
30 effects. Using all these analysis parameters, it is possible to determine a distance between the noise source and the recording position since the sound usually is decreasing with an increasing distance and/or there are frequency shifts such that the upper frequencies are cancelled.

35 In accordance with further embodiments, the method comprises analyzing the audio events or respective sources relative to a distance between a first and a second position,

analyzing relative to a movement of a source of the subjective disturbing noise and/or analyzing relative to a quantity of the source of a subjective disturbing noise. These three analyses are based on evaluating the relation between the first and the second recording, i.e. from comparing the factors mentioned above, for example.

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It is to be mentioned in this aspect that continuously recording preferably is done using a migrating time window. Furthermore, like in the above aspect, it would also be conceivable to read in the noise to be compared externally.

10 It is to be pointed out here that the method may of course be extended to third positions.

In embodiments in accordance with this aspect, recording may be started at a second position when a disturbing signal has been determined at a first position in order to allow temporal analysis of the propagating disturbing signal.

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A further embodiment relates to a system for analyzing signals of a signal class. This system comprises two units having one microphone each for continuously recording current environmental noises. The two units may be positioned at different positions, like neighboring positions. "Recording" here again means both directly recording the environmental noise and deriving same from parameters, like an audio fingerprint. In addition, the system comprises at least one processor which may be integrated either in a first or the second unit and be configured to identify the noise by comparing the first and the second recording of the first and second units to at least one recording obtained before/audio fingerprint of the signal of the signal class or parameters describing the signal of the signal class. In addition, the processor is configured to establish a relation between the first and the second recording.

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In accordance with embodiments, the two units may be connected to each other via a communication interface, like a radio interface.

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In accordance with further embodiments, a computer program for executing one of the methods described above is provided.

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Embodiments of the present invention will be discussed below referring to the appended drawings, in which :

Fig. 1a is a flowchart for illustrating the method in accordance with aspect 1
"setting up a database" in a basic variation;

5 Fig. 1b is a flowchart for illustrating an extended method in accordance with aspect
1;

Figs. 1c to 1f show variations of devices for aspect 1;

10 Fig. 2a is a flowchart for illustrating a method of corresponding basic variations of
aspect 2; "recognizing noises of a signal class";

Fig. 2b is a flowchart of an extended embodiment of aspect 2;

15 Fig. 2c is a schematic block diagram of a device of aspect 2;

Fig. 3a is a flowchart for illustrating the method of a basic variation of aspect 3
"analyzing noises of individual signal classes"; and

20 Fig. 3b is a schematic block diagram of a device of aspect 3.

Before discussing embodiments of the present aspects below in greater detail, it is pointed out that elements and structures of equal effect are provided with equal reference numeral so that a description thereof is mutually applicable or interchangeable.

25 Fig. 1a shows a method 100 for setting up a database comprising the steps of "receiving and recording 110 using a microphone 11 and signal receiving" 120. When the signal 120 has been received (see place of decision 125), the recording of step 110 is stored in a database, which is illustrated using step 130. This step 130 basically represents the end of the basic method 100 (cf. end point 135).

30 It is to be pointed out as regards the step of "recording 110" that, when recording, usually there may be a sub-step of encoding. Encoding may also be implemented such that a so-called audio fingerprint, i.e. a derivation of characteristic parameters for the recording, is obtained. This audio fingerprint, when compared to a recording, is compressed strongly and thus anonymized, wherein the audio fingerprint still allows recognizing a comparable
35 noise, i.e. a noise of the same class, using the audio fingerprint. Generally, an audio

fingerprint may be described such that it is a representation of an audio signal representing all the essential features of the audio signal so that subsequent classification is possible. An audio fingerprint usually is not sufficient to allow decoding to form the real audio signals and thus protects the privacy. In analogy, or in parallel to encoding, there
5 may be a sub-step of deriving parameters, like psychoacoustic parameters, which describe the recording.

The recording process 110 may also be described to be a ring buffer since the recording will usually be overwritten again and again and, thus, only a predetermined period, like, for
10 example, 120, 60 or 30 seconds, or, generally, more than 5 seconds, is buffered. This ring buffer also offers the advantage that privacy requirements are met. This time window of the environmental noise for the last period is stored or finally stored in a further memory (like a database) when obtaining the signal 120, using step 130, so that it will be available at a later time. In order to set up the database effectively, performing the method 100 is
15 repeated for several signals of one or of different signal classes.

This method 100 serves setting up a database where subjective disturbing noises received (i.e. recorded) by the microphone 11 are identified. Identifying is done using a step performed by the user which exemplarily executes the "signal 120 output" step using
20 a button 12 (or generally a user input interface 12), when the user has recognized a disturbing noise in the environment. Since the microphone 110 listens to the environmental noises and these are buffered in step 110, these disturbing noises are also recorded so that the buffered recording or a part thereof may be stored in a permanent memory for setting up the database (cf. step 130). In case no disturbing noise has been
25 recognized by the user, the method will be repeated, which is illustrated using the arrow from the subjective evaluation (decision element 125) to the starting point 101.

This method is of advantage in that in this way a sufficiently broad database, which comprises a plurality of recordings or parameters, like audio fingerprints, which are
30 associated to subjective perceived disturbing noises can be set up.

It is to be pointed out here that the result of this is a dependence of the point in time of the signal on the time window. Exemplarily, the dependence results from the fact that the beginning of the time window at the time of the signal is at a fixed distance, like 30 or 60
35 seconds, before the time of the signal. In addition, the end of the time window may also be dependent on the time of the signal so that a time of the signal and an end of the time

window coincidence, for example, or there is a temporal distance of 5 seconds (end before the time of the signal). Generally, the dependence is selected such that the recording time window will always precede the time of the signal, wherein the signal may also be within the time window.

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Fig. 1b shows an extended method 100' which also allows setting up a database, however, with extended information. The method 100' generally is based on the method 100 and is limited in its course by start 101 and end 135. Consequently, the method 100' also comprises the basic steps of recording 110', receiving 120' the signal relative to a subjective noise evaluation or, generally, relative to an allocation of the signal received into a signal class (like a disturbing noise) starting from a plurality of signal classes (like non-disturbing noise, slightly disturbing noise and highly disturbing noise), and storing the buffered recording 130, like using a database. In addition, steps 130 and 120' are connected via the point of decision 125.

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In this embodiment, the step of recording 110' is subdivided into two sub-steps, i.e. 110a' and 110b'. Step 110a refers to calculating psychoacoustic parameters, like roughness, sharpness, volume, tonality and/or variation intensity, for example. Step 110b is reduced to determining an audio fingerprint which describes the recording such that the characteristic features can be recognized again later on using the audio fingerprint.

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There may be different input means for performing step 120' of subjective noise evaluation. These are "evaluation using a key or button on the apparatus which executes the method 100'(cf. reference numeral 12a'), associating a subjective noise evaluation using a questionnaire (cf. reference numeral 12b') or evaluation using a smart device (cf. reference numeral 12c'). These three evaluation variations 12a', 12b'and 12c' may be employed either alone or in combination in order to perform the step of subjective noise evaluation 120'. As soon as there is an evaluation (cf. point of decision 125), the psychoacoustic parameters (cf. reference numeral 110a') and/or the audio fingerprint (cf. reference numeral 110b') are stored in the memory, which is illustrated in step 130.

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In accordance with further embodiments, time and/or location information may be added in addition to the pure parameters or the fingerprint or the part of the audio recording. These are also stored in step 130 and originate from another step 132 which correspondingly comprises determining the current location and/or determining the current time.

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When the database has been set up and has a corresponding size (cf. step 130), it can be evaluated, like by correlation or statistical evaluation, as it illustrated in step 132.

5 A typical application case for the methods 100 and 100' described above is that an apparatus is, for example, located in a hotel room and monitors the current environmental noises. When the hotel guest wants to have his peace and quiet in his hotel room, but is prevented from doing so by disturbing noises, he or she can mark these disturbing noises. The result which may be achieved by this is that the room may not be too loud, but that
10 there may be certain noises, like air conditioning, which prevent the guest from going to sleep. Using the apparatus, he or she can perform a subjective evaluation, i.e. classification into signal classes, like "disturbing", "very disturbing" or "highly disturbing". The evaluation characterizes the noise situation evaluated using different parameters. Finally, the audio fingerprints, psychoacoustic parameters or, generally, the recording,
15 associated to one of the signal classes, are stored in the database.

Three variations of apparatuses will be discussed below referring to Figs. 1c, 1d and 1e.

Fig. 1c shows a first apparatus variation, i.e. the device 20, which is connected to the
20 actual signal processing unit (not illustrated) via an interface or radio interface and is basically configured to emit the signal for identifying a disturbing signal or a certain signal class. Here, the device 22 in this embodiment comprises two buttons 24a and 24b for which a subjective evaluation may be performed. These buttons 24a and 24b are associated to different signal classes.

25 The device 20 may exemplarily be a smart device, like a tablet computer, a smartwatch, a smartphone, which comprises the virtual buttons 24a and 24b integrated in an app. This app may exemplarily also include a questionnaire by means of which further information of general quality may be collected from the user, like the hotel guest.

30 When operating the button 24a or 24b, the method of buffering environmental noises or deriving parameters and then actually storing is performed in the actual data collection device. This external device may, for example, be a server having a microphone at a respective place of monitoring.

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Fig. 1d shows another variation in which an internal microphone 26 for receiving the environmental noises is integrated in the device 20' which comprises the buttons 24a and 24b. Additionally or alternatively, an external microphone 26e may be connected to the device 20' via an interface.

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Fig. 1e shows another variation of the device 20'' which does no longer comprise a button as an input means, but only comprises the internal microphone 26 or the optional or alternative external microphone 26e, and using this speech command which may be associated to an environmental noise of a signal class.

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Making reference to the devices 20' and 20'', it is to be noted at this point that several external microphones could also be connected. It would also be conceivable here that, in addition to the normal air-borne sound, structure-borne sound is also recorded (meaning that the respective device comprises a structure-borne sound receiver).

15

Referring to the embodiment of Figs. 1c and 1d, it is to be noted that the different buttons 24a and 24b may also be extended by further buttons. For differentiating the buttons, color coding may be provided: red = disturbing, yellow = indifferent, green = very pleasant environmental noise (the latter exemplarily applies when bird chirping is clearly audible but is perceived as a desirable noise).

20

Referring to Figs. 1c to 1d, it is to be mentioned that the apparatuses 20, 20' and 20'' may additionally be integrated as software applications and, additionally, in apparatuses, like smartphones, tablet computers or smartwatches. These software applications are able to allow the following functions:

25

- extending the detection of a noise quality as mentioned above by questionnaire techniques or different subjective acquisition techniques;
- using sensor systems (microphones, GPS, tilt sensors, bio feedback functions) present in the further apparatuses;
- wireless or, if applicable, mechanical connection to the apparatus developed here for data communication;
- full control of the apparatus developed here using software developed here.

30

Fig. 1f shows the components of a device 20''. The device 20'' comprises a microphone 26, optional calibrating means 26k for calibrating the microphone, and a processing unit 42 and a memory 44.

5 The processing means 42 comprises preprocessing 46 for coding the audio file or for deriving an audio fingerprint, and a unit for determining psychoacoustic parameters 48. Both the metadata of preprocessing 46 and the psychoacoustic parameters of the unit 48 are written to the memory 44. In addition, the audio signal may be stored or stored more exactly in the memory 44 by means of the unit 49, for example controlled by a button.

10

The calibrating means 26k serves for providing all the sensors with a defined value of sensitivity. Here, a measurement or recording, of the switch, the frequency response or compression, for example, is performed beforehand.

15 Starting from the audio sample stored, metadata (audio fingerprint of the psychoacoustic parameter), and the marking by means of one of the input means from Figs. 1c to 1d, the actual data analysis by means of the data analyzer 50, and association to the individual signal classes may then be performed.

20 It is to be pointed out here that the device will typically be a mobile device so that it can typically be supplied with power using a battery or an accumulator. Alternatively, a conventional power supply would also be feasible. In order to store the recordings, the device may also comprise a memory medium, like a portable memory medium (like SD card), or the connection to a server. This connection to a server is done via a wire or glass
25 fiber interface or even a radio interface. On the protocol level, there are different ways of doing this, which will not be discussed here in greater detail.

For an improved evaluability, the device may also comprise means for exact synchronization with other apparatuses, like a time code or a world clock, for example. In
30 addition, it would also be conceivable for the device to be coupled to a position determining unit, like a GPS receiver, or have the same integrated in order to determine which disturbing noises have been determined at which position or been perceived as being disturbing.

35 It is to be pointed out here that, in correspondence with further embodiments, the method 100 or 100' may also comprise pre-calibration (cf. calibrating means 26k). This means

that, in correspondence with embodiments, the method 100 or 100' discussed above comprises a step of calibrating.

5 Relating to aspect 1, it is to be pointed out that, in correspondence with embodiments, it would also be conceivable for all these devices to perform data-reduced recording of the measuring data in order to reduce data. The data reduction may also be of advantage with regard to long-term measurements. Depending on the degree of compression or erroneous-ness, it can be ensured that privacy can be preserved, since the data monitored can always be compressed such that basically only parameters, like psychoacoustic
10 parameters (roughness, sharpness, tonality etc.) or an audio fingerprint are/is recorded. It is to be pointed out again here that the precise decision of whether a recording or an audio fingerprint or only psychoacoustic parameters is influenced essentially by legal frame conditions for data and consumer protection.

15 As has been discussed above, so-called "audio fingerprints" are used, wherein there are different variations of this which will be discussed in greater detail below. A number of methods are known already, using which features or fingerprints can be extracted from an audio signal. US patent N° 5,918,223 discloses a method for contents-based analysis, storage, recovery and segmentation of audio information. An analysis of audio data
20 generates a set of numerical values, which is referred to as a feature vector, which can be used to classify and rank the similarity between individual audio pieces. The volume of a piece, the pitch, the brightness of tones, the bandwidth and the so-called Mel-Frequency Cepstral Coefficients (MFCCs) of an audio piece are used as features for characterizing or classifying audio pieces. The values per block or frame are stored and then subjected
25 to a first derivation relative to time. Statistical quantities, like the mean value or the standard deviation, of each of these features, including the first derivations thereof are calculated from this in order to describe a variation over time. This set of statistical quantities forms the feature vector. The feature vector thus is a fingerprint of the audio piece and can be stored in a database.

30 The expert publication "Multimedia Content Analysis", Yao Wang et al., IEEE Signal Processing Magazine, November 2000, pages 12 to 36, discloses a similar concept for indexing and characterizing multimedia pieces. In order to ensure an efficient association of an audio signal to a certain class, a number of features and classifiers have been
35 developed. Time-range features or frequency-range features are suggested as features for classifying the contents of a multimedia piece. These comprise the volume, the pitch

as a basic frequency of an audio signal shape, spectral features, like the energy contents of a band relative to the total energy contents, cut-off frequencies in the spectral course and others. Apart from short-time features relating to the so-called sizes per block of samples of the audio signals, long-term quantities are suggested which relate to a longer
5 period of the audio piece. Further typical features are formed by forming the time difference of the respective features. The features acquired in blocks are rarely directly passed on as such for classification, since they exhibit too high a data rate. One conventional form of further processing is calculating short-term statistics. Among these are calculating a mean value, variance and temporal correlation coefficients, for example.
10 This reduces the data rate and, on the other hand, results in improved recognizing of an audio signal.

WO 02/065782 describes a method for forming a fingerprint to form a multimedia signal. The method relates to extracting one or several features from an audio signal. The audio
15 signal here is divided into segments and processing as to blocks and frequency bands takes place in each segment. Band-wise calculation of energy, tonality and standard deviation of the power density spectrum are mentioned as examples.

A device and a method for classifying an audio signal are known from DE 101 34 471 and
20 DE 101 09 648, wherein the fingerprint is acquired by a measure of the tonality of the audio signal. The fingerprint here allows a robust, contents-based classification of audio signals. The documents mentioned here reveal several possibilities of generating a measure of tonality over an audio signal. In this case, transferring a segment of the audio signal to the spectral range is the basis of calculating the tonality. The tonality can then be
25 calculated in parallel for a frequency band or for all frequency bands. However, the disadvantage of such a system is that, with an increasing distortion of the audio signals, the fingerprint is no longer expressive enough and that recognizing the audio signal is no longer possible with satisfying reliability. However, distortions occur in very many cases, in particular when audio signals are transmitted using a system of low transmission quality.
30 At present, this is the case in particular with mobile systems or in the case of strong data compression. Such systems, like mobile phones, are primarily implemented for a bidirectional transmission of voiced signals and frequently only transmit music signals at very low a quality. There are further factors which may have a negative influence on the quality of a signal transmitted, like microphones of low quality, channel disturbances and
35 transcoding effects. For a device for identifying and classifying a signal, the consequence of a deterioration of the signal quality is a strongly deteriorated recognizing performance.

Examinations have revealed that, in particular when using a device or method in accordance with DE 101 34 471 and DE 101 09 648, changes in the system while maintaining the recognizing criterion of tonality (Spectral Flatness Measure) do not result in further significant improvements in the recognizing performance.

5

When assuming that a sufficient database comprising noises, like disturbing noises of different signal classes, has been set up, starting from this, a certain disturbing noise can be searched for in any environment and it can then be logged whether such a disturbing noise has been recognized. This method is illustrated in Fig. 2a.

10

Fig. 2a shows the method 200 comprising step 210 of matching environmental noises received via the microphone 11 (cf. step of receiving 205), to recordings from the database 15. As soon as a match has been found, which is illustrated in the place of decision 215, a signal is output, like for logging or for excluding further action. As long as no match has been found, the method will be repeated, which is illustrated using the day to the start point 201.

15

In correspondence with embodiments, the respective audio fingerprints of the current environmental noises, instead of the recordings, may be compared to audio fingerprints stored before in the database 15. The method here comprises determining the audio fingerprint of the current environmental noise and comparing it to audio fingerprints stored in the database 15.

20

Even when it is assumed in the method 200 that matching environmental noises or audio fingerprints to environmental noises/audio fingerprints stored in the database 15 beforehand takes place for recognizing, expressed generally, the environmental noise may be monitored relative to a rule. In the case of comparing environmental noises/audio fingerprint, the rule would mean a "partial match".

25

Another such rule may, for example, be volume value to simply be exceeded or threshold values relating to psychoacoustic parameters to be exceeded. In accordance with embodiments, deriving psychoacoustic parameters of the current environmental noises takes place, which are compared to predefined respective threshold values by the means of the predefined rule in order to recognize the occurrence of such an event.

30

35

In accordance with an extended embodiment, the method may not only purely recognize such disturbing noises, but classify the noises to voice, motor noise, music, church bells or shots, for example.

5 One potential scenario of application for such a method which exemplarily is executed on a smartphone or a device especially designed for this is for the device to be located in a hotel room and monitor the environmental noises. Here, the environmental noises are evaluated using the data from the database 15, and it is logged how many and which of the noise events probably perceived as being disturbing have taken place over time. This
10 may, for example, be counting disturbing air condition noises in the course of the day. As an alternative to logging, audio recording of this noise or storing the environmental noises buffered beforehand (see above) may be performed. The underlying idea is that the hotel operator is able to forecast and evaluate the noise perception using this method.

15 Fig. 2b shows an extended method 200' which, between the step or point of decision 215 and the end 216, comprises further steps.

These are counting the events by means of step 220 or using a cell variable 221 so that the number of events 222 is obtained as a result. Optionally, audio recording can be
20 started by the event having been recognized, as is illustrated using step 230.

Fig. 2c shows a further implementation of the device 40. It comprises, as a central unit, a processor 41 which performs the actual step of analyzing/matching. In the first place, it uses the internal microphone 26, wherein accessing external microphones 26e1 and 26e2
25 would also be conceivable. The data for matching are stored in the internal memory 44, for example.

Optionally, the processor is configured to determine and match audio fingerprints and/or psychoacoustic parameters so as to obtain a corresponding rule match.

30

In order to allow this functionality, optionally further peripheral units, like the internal clock 55, the battery 56b or, generally, a power supply 56, which may also be realized using that cable 56k, are provided. Optionally, the processor also accesses further sensor elements 57, control units 58, like the recording activation button, or a timer 59. Here, in
35 accordance with further, the processor 41 may also be configured to perform an objective

noise evaluation in order to establish a correlation in combination with the subjective evaluation (recognizing subjective tonal events).

5 In correspondence with embodiments, starting from the subjective evaluation of pleasantness obtained before, the CPU can classify/sort the individual recognized noises of the signal classes in different evaluation matrices, depending on the respective noise class.

10 In accordance with further embodiments, an external data storage 60, like an external hard disk or a server, may also be provided for storing or loading the database. This connection may be a wired connection or a wireless one. In wireless communication, in correspondence with further embodiments, a communication interface 62, like a wireless interface 62w or a wired interface 62k, which realizes external access, is to be provided.

15 In accordance with another aspect, a system is provided which basically consists of two of the devices 40 described before which are combined with each other such that they are mutually activating as soon as a corresponding noise, i.e. signal class, has been received in one of the devices. This system serves for analyzing or evaluating in greater detail noises of the respective noise classes. The method discussed below in Fig. 3 is
20 performed here.

Fig. 3a shows a method 300 comprising the step of noise analysis in correspondence with the method 200 or 200' which is performed at a first position and at a second position. This means that step 210 exists twice (cf. 210a and 210b).

25

The recording or the parameters determined, like the audio fingerprints at the two positions (resulting from steps 210a and 210b), are then compared in another step 220.

30 The two steps 210 at the two neighboring positions may, in accordance with embodiments, be mutually dependent, as is illustrated using the optional step "audio recording on neighboring apparatus 211". Alternatively, another action may be performed at the neighboring apparatus. The reason for this is that, when the first apparatus which executes the method 210a, for example, recognizes a noise and activates the second apparatus which executes the method 210b, the same noise can be recognized at a
35 different position. It is finally to be mentioned here that, starting from the place of decision 215, there is another arrow to the starting point 301 which basically hints to the fact that

the method of noise analysis 210a will be performed until a corresponding match has been found.

5 Since the positions are typically spatially neighboring, it is possible to estimate a propagation of the noise, a speed or a larger noise source in this way.

Exemplarily, when comparing its own analysis to an analysis on a different apparatus at the same time, it can, when one and the same event has been recognized at several apparatuses, be determined whether this is a global event (cf. reference numeral 232 after
10 the field of decision 321), like thunder and lightning, or a local event (cf. reference numeral 324 after the field of decision 321). With a global event 323, usually the level difference between the "near" and the "remote" apparatus is negligibly small (level $\sim 1/r$, change of r small relative to r). With local events 324, the level difference is large (level $\sim 1/r$, change of r great relative to r). A local event may, for example, be a cry for help, an explosion, an
15 open-air concert. With a local event, further analyses, i.e. the analysis 325 relating to further parameters, may follow. Starting from the temporal offset or frequency shifts, a quantity of the local event, propagation or timeline can be determined. Determining the global event 323 or local event 324, like the analysis 325 thereof, basically is the end 329 of the method.

20

One possible scenario of application is for several apparatuses to be distributed over a city center, for example. All the apparatuses are connected to one another via a data connection (like a wired, wireless, Ethernet or LAN connection). A connection using a server would also be possible. All the apparatuses analyze the noise situation
25 (psychoacoustic parameters, audio fingerprint). One of these apparatus recognizes a characteristic event, like a signal class classified in the database beforehand. An audio recording is triggered on the spot. At the same time, the apparatus triggers a behavior, like an action on a neighboring node. By comparing the two nodes, a global and a local event may be differentiated between, as has been discussed above.

30

The method 300 is basically performed by a system comprising two of the devices 40 (Fig. 2c).

35 Since, however, an extra interface is provided for connecting the two devices, little variations may also be possible, as is illustrated in Fig. 3b.

Fig. 3b shows a device 70 comprising, on the input side, a microphone 26 and an optional calibration unit 26k. The audio stream received by the microphone is preprocessed by means of preprocessing 46 in order to derive audio fingerprints (cf. reference numeral 46a) or psychoacoustic parameters (cf. reference numeral 48), for example. In parallel, events or classes may be recognized (cf. reference numeral 50). By means of recognizing events/classes, automatic audio recording can be triggered on the one hand (cf. reference numeral 50a1) or a control instruction, like for activating the further node (cf. reference numeral 50a2 or further device 70'), can be emitted. The means for outputting the control instruction 50a2 may exemplarily activate the memory which then receives and records the data from the means for generating the audio fingerprint 46a or the means for deriving the psychoacoustic parameters 48. The audio signal may also be stored in the memory 44, wherein here, too, recording may be allowed or prevented by a button 49a. In this embodiment, the CPU 41 may also be connected to a timer 59.

Apart from the device 70, a device 70', which basically fulfills the same functions, is provided at another, neighboring location. This device 70' also comprises a memory 44 which, when the device 70' by means of the activating means 50a2 or, starting from a noise recognized and belonging to a class, has stored the audio results for this time period. The recording or the audio fingerprints or the psychoacoustic parameters from the memories 44 of the devices 70 and 70' are analyzed by the data analyzer 72 in a next step, for example relative to the extension. However, it is of advantage here for the data analyzer 72 to be connected with both memories of the further device, wherein it is mentioned here that the data analyzer 72 may be arranged in one of the devices 70 and 70' or externally relative to both of them.

In correspondence with further embodiments, a button, like a button 24a', may be integrated in the device 70 so that the device 70 also performs the functionality of the devices 20, 20' or 20''.

The optional element 50a' allows automatic triggering of recording after having recognized a classification. Alternatively, it would also be conceivable here for the automatic recording to be shaped when no noise has been found in any of the signal classes obtained already.

In other words, the method 303 can describe that the functionality of the method 200, i.e. recognizing and classifying noises, like voice, motor noises, music, kitchen blocks, shots,

is basically covered and this functionality has been extended by the analysis, starting from a number of microphones at different locations.

5 It is also to be pointed out here that an automatic recording of certain classes, like with explosions and shots, for example, hinting to terrorism, would also be possible. Here, it would be useful for all the neighboring nodes 70/70' to be switched directly to recording.

10 Additionally, automatic (for example, temporally limited) recording would also be possible when certain noise threshold values are exceeded over a period of time. The recording may also be extended to neighboring nodes in order to thus perform precise localization of the signal sources by these longer recordings, when merging several nodes (cause study for disturbing sources, separating noise sources).

Potential fields of applications of the three scenarios mentioned above are as follows:

- 15
- tourism, hotels, wellness sector, bicycle paths, hiking paths;
 - work protection (office work, machine shops, cabin workplaces);
 - urban planning (soundscapes, noise mapping);
 - public security (monitoring production facilities).

20 Combinations of methods 100/100', 200/200' and 300 or the functionality of devices 20/20'/20''/20''', 40 and 70/70' would also be conceivable. Examples of this are combinations of device and method for subjectively evaluating and recording in and for a machine evaluation of an apparatus.

25 It is to be pointed out here that elements having been discussed in connection with a different aspect may of course be applied to a second aspect as well. Exemplarily, the teaching relating to audio fingerprints or psychoacoustic parameters is applicable to all three aspects, wherein the teaching is discussed in greater detail only in connection with the first aspect.

30

Although some aspects have been described in the context of a device, it is clear that these aspects also represent a description of the corresponding method, such that a block or element of a device also corresponds to a respective method step or a feature of a method step. Analogously, aspects described in the context of a method step also
 35 represent a description of a corresponding block or item or feature of a corresponding device. Some or all of the method steps may be executed by (or using) a hardware

apparatus, like a microprocessor, a programmable computer or an electronic circuit, for example. In some embodiments, some or several of the most important method steps may be executed by such an apparatus.

5 An inventively encoded signal, like an audio signal or a video signal or a transport stream signal, may be stored on a digital storage medium or may be transmitted on a transmission medium, like a wireless transmission medium or a wired transmission medium, like the Internet.

10 The inventive encoded audio signal may be stored on a digital storage medium, or may be transmitted on a transmission medium, like a wireless transmission medium or a wired transmission medium, like the Internet, for example.

Depending on certain implementation requirements, embodiments of the invention can be
15 implemented in hardware or in software. The implementation can be performed using a digital storage medium, for example a floppy disk, a DVD, Blu-Ray disc, CD, ROM, PROM, EPROM, EEPROM or a FLASH memory, a hard drive or another magnetic or optical memory having electronically readable control signals stored thereon, which cooperate or are capable of cooperating with a programmable computer system such that
20 the respective method is performed. Therefore, the digital storage medium may be computer-readable.

Some embodiments according to the invention include a data carrier comprising electronically readable control signals, which are capable of cooperating with a
25 programmable computer system such that one of the methods described herein is performed.

Generally, embodiments of the present invention can be implemented as a computer program product with a program code, the program code being operative for performing
30 one of the methods when the computer program product runs on a computer.

The program code may, for example, be stored on a machine-readable carrier.

Other embodiments comprise the computer program for performing one of the methods
35 described herein, wherein the computer program is stored on a machine-readable carrier.

In other words, an embodiment of the inventive method is, therefore, a computer program comprising program code for performing one of the methods described herein, when the computer program runs on a computer.

- 5 A further embodiment of the inventive methods is, therefore, a data carrier (or a digital storage medium or a computer-readable medium) comprising, recorded thereon, the computer program for performing one of the methods described herein.

10 A further embodiment of the inventive method is, therefore, a data stream or a sequence of signals representing the computer program for performing one of the methods described herein. The data stream or the sequence of signals may, for example, be configured to be transferred via a data communication connection, for example via the Internet.

- 15 A further embodiment comprises processing means, like a computer, or a programmable logic device, configured to or adapted to perform one of the methods described herein.

A further embodiment comprises a computer having installed thereon the computer program for performing one of the methods described herein.

20

A further embodiment according to the invention comprises a device or a system configured to transfer a computer program for performing at least one of the methods described herein to a receiver. The transmission can be performed electronically or optically. The receiver may, for example, be a computer, a mobile device, a memory device or the like. The device or system may, for example, comprise a file server for transferring the computer program to the receiver.

25

In some embodiments, a programmable logic device (for example a field-programmable gate array, FPGA) may be used to perform some or all of the functionalities of the methods described herein. In some embodiments, a field programmable gate array may cooperate with a microprocessor in order to perform one of the methods described herein. Generally, in some embodiment, the methods are performed by any hardware device. This can be universally applicable hardware, such as a computer processor (CPU), or hardware specific for the method, such as ASIC.

30

35

The above described embodiments are merely illustrative for the principles of the present invention. It is understood that modifications and variations of the arrangements and the details described herein will be apparent to others skilled in the art. It is the intent, therefore, that the invention is limited only by the scope of the appended patent claims
5 and not by the specific details presented by way of description and explanation of the embodiments herein.

Claims

1. A method (100, 100') for generating a database (15), comprising the steps of:
 - 5 receiving (110, 110') environmental noises and buffering the environmental noises for a migrating time window or deriving a set of parameters from the environmental noises and buffering the set of parameters for the migrating time window in order to obtain a buffered recording;
 - 10 obtaining (120) a signal which identifies a signal class of a plurality of signal classes in the environmental noise;
 - storing (130) the buffered recording in a memory responsive to the signal; and
 - 15 repeating the steps of obtaining (120) and storing (130) in order to obtain the database (15) which comprises a plurality of buffered recordings for the same signal class.
2. The method (100, 100') in accordance with claim 1, wherein there is a temporal
20 dependence between the signal and the migrating time window of the buffered recording.
3. The method (100, 100') in accordance with claim 2, wherein the temporal
25 dependence is that the beginning of the migrating time window is before the time of the signal; or
the end of the migrating window is at or before the time of the signal.
4. The method (100, 100') in accordance with any of the preceding claims, wherein
30 the signal is received by user input means (24a, 24b), a button (24a, 24b) or a smart device.
5. The method (100, 100') in accordance with any of the preceding claims, wherein
35 the signal is received by a detector, for determining the volume, a processor for identifying a control signal in the environmental noise, or a device for generating a database (15) at a neighboring position.

6. The method (100, 100') in accordance with any of the preceding claims, wherein deriving a set of parameters comprises determining an audio fingerprint for the buffered environmental noises.
- 5
7. The method (100, 100') in accordance with any of the preceding claims, wherein deriving a set of parameters comprises determining psychoacoustic parameters of the buffered recording.
- 10
8. The method (100, 100') in accordance with claim 7, wherein the psychoacoustic parameters comprise volume, sharpness, tonality, roughness and/or an intensity of variation.
- 15
9. The method (100, 100') in accordance with any of the preceding claims, comprising obtaining a further signal which identifies a further signal class of a plurality of signal classes in the environmental noise, wherein storing is performed responsive to the further signal so that an association of the buffered recording to the class or the further signal class is maintained.
- 20
10. The method (100, 100') in accordance with any of the preceding claims, wherein, when storing (130), a time stamp of when the signal is obtained is also stored together with the buffered recording.
- 25
11. The method (100, 100') in accordance with any of the preceding claims, wherein the method (100, 100') comprises the step of determining the current location when obtaining the signal and the location determined is stored stored together with the buffered recording.
- 30
12. The method (100, 100') in accordance with any of the preceding claims, wherein the buffered recording is stored in a data-reduced manner.
13. The method (100, 100') in accordance with any of the preceding claims, wherein the memory (44) is arranged externally.
- 35
14. A computer program having a program code for performing the method (100, 100') in accordance with any of claims 1 to 13 when the program runs on a computer.

15. A device (20, 20', 20'', 20''') for generating a database (15), comprising:
- 5 a microphone (11) for receiving environmental noises;
- a buffer for buffering the environmental noises for a migrating time window or deriving a set of parameters from the environmental noises and for buffering the set of parameters for the migrating time window in order to obtain a buffered recording;
- 10 an interface for obtaining a signal which identifies a signal class of a plurality of signal classes in the environmental noise; and
- a memory (44) for storing the buffered recording response to the signal;
- 15 wherein the device (20, 20', 20'', 20''') is configured to repeat obtaining and storing in order to obtain the database (15) which comprises a plurality of buffered recordings for the same signal class.
- 20 16. The device (20, 20', 20'', 20''') in accordance with claim 15, wherein the device (20, 20', 20'', 20''') comprises input means, a button or a smart device connected to the input interface; or
- wherein the input interface is connected to a detector for determining the volume, a processor for identifying a control signal in the environmental noise, or a further device (20, 20', 20'', 20''') for generating a database (15) at a neighboring position.
- 25
17. The device (20, 20', 20'', 20''') in accordance with claim 15 or 16, wherein the device (20, 20', 20'', 20''') comprises position determining means using which a current position can be determined so that the current position can be stored in connection with the part or parameters of the buffered recording to be stored.
- 30
18. The device (20, 20', 20'', 20''') in accordance with any of claims 15 to 17, wherein the buffer is a ring memory.
- 35

19. The device (20, 20', 20'', 20''') in accordance with any of claims 15 to 18, wherein the device (20, 20', 20'', 20''') comprises a communication interface using which the external memory (44) can be connected.
- 5 20. A usage of a database (15) generated by means of a method in accordance with any of claims 1 to 13.

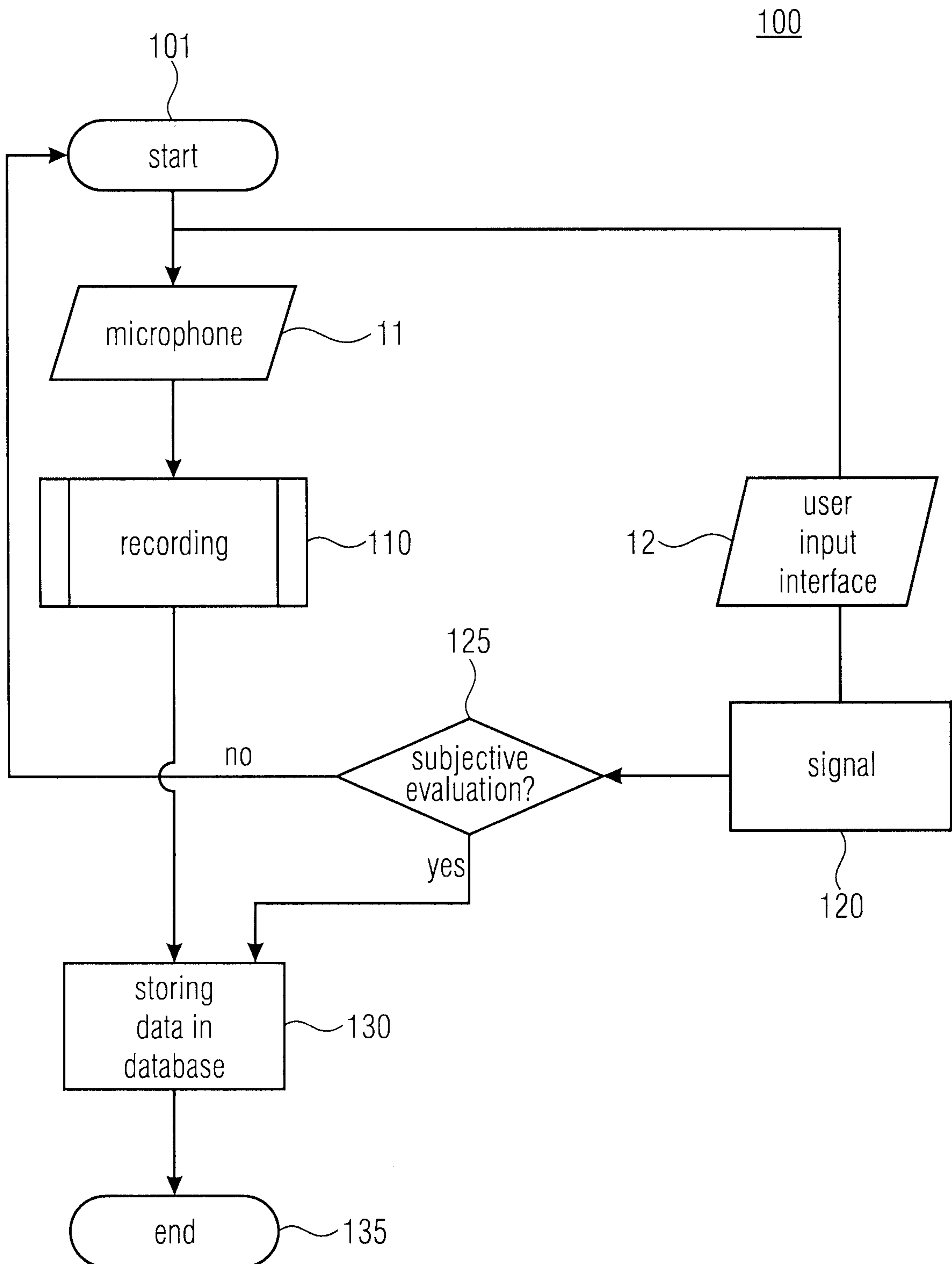


Fig. 1a

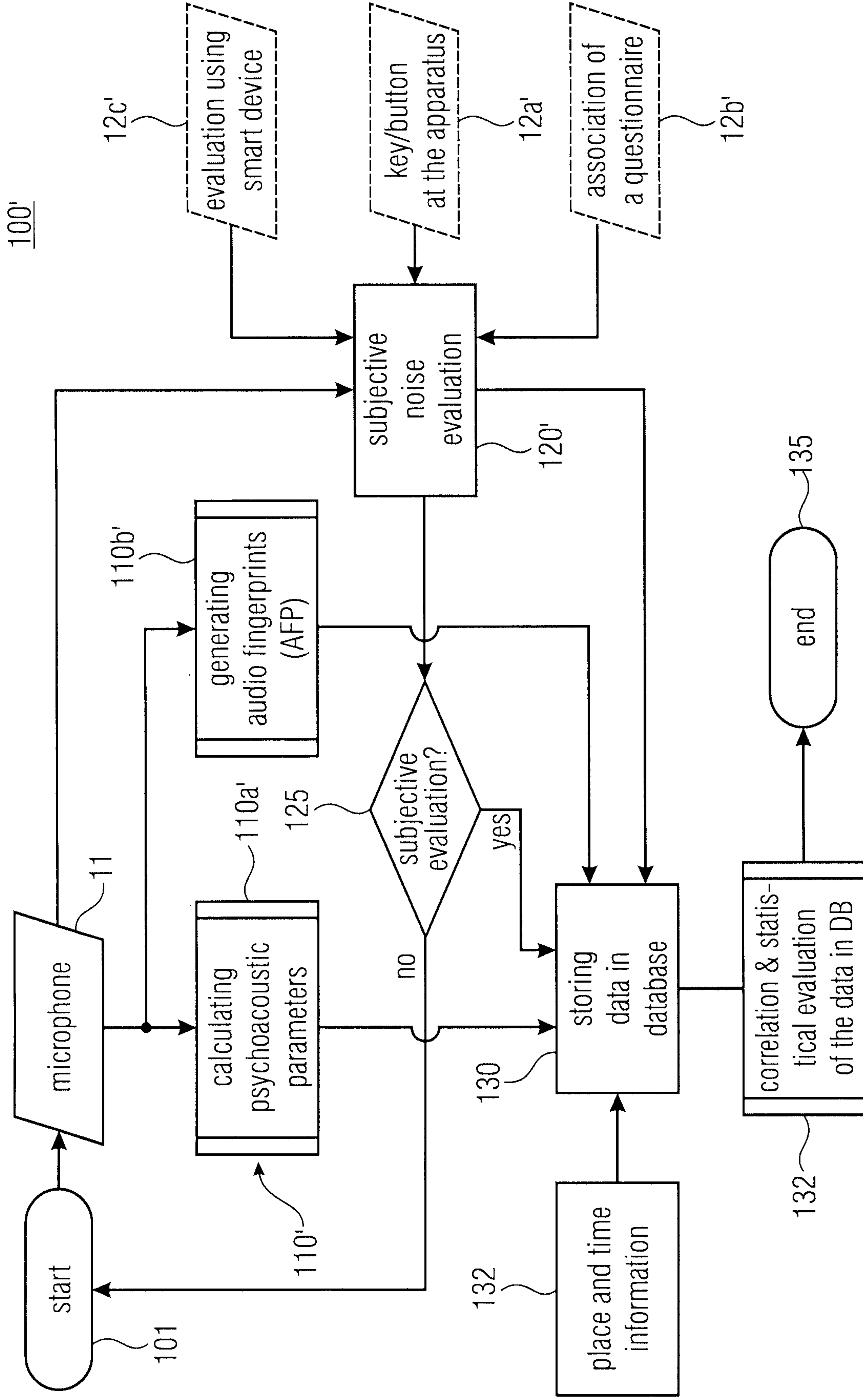


Fig. 1b

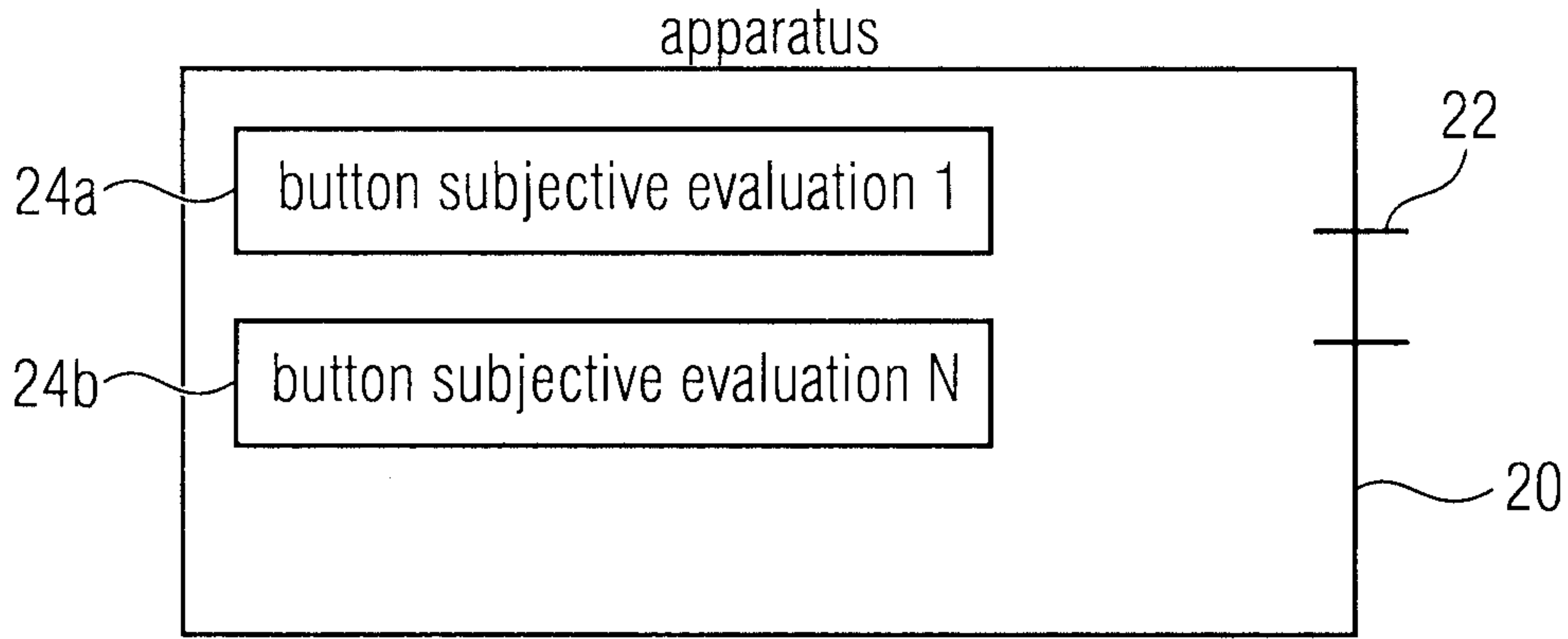


Fig. 1c

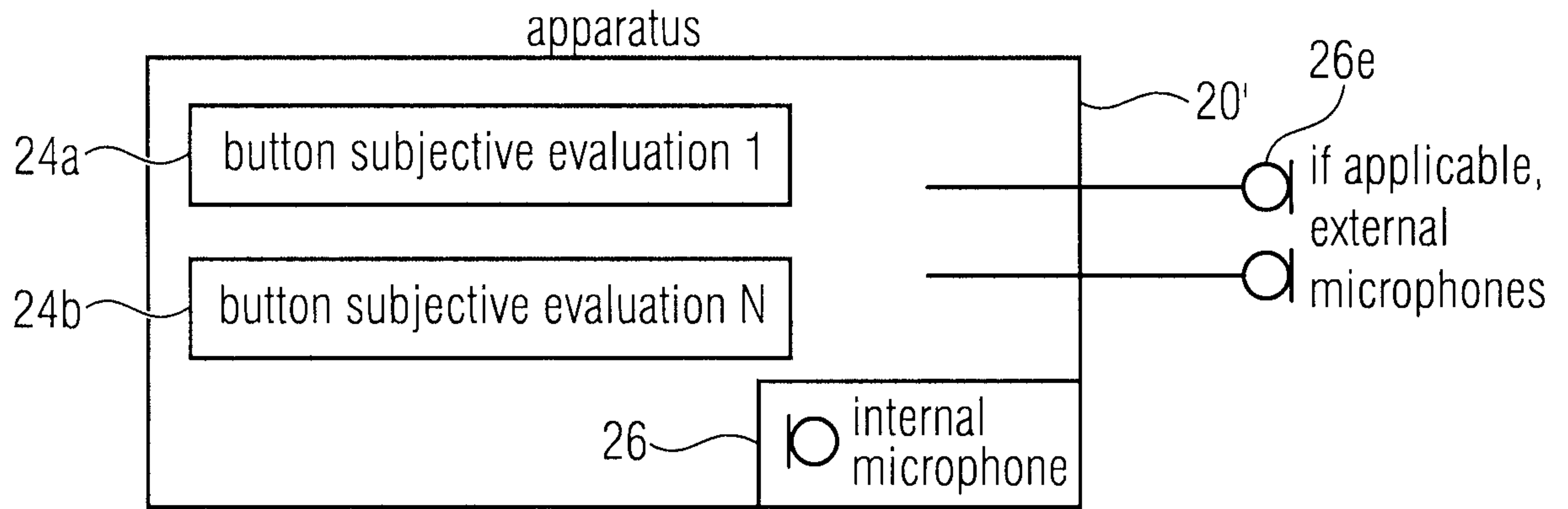


Fig. 1d

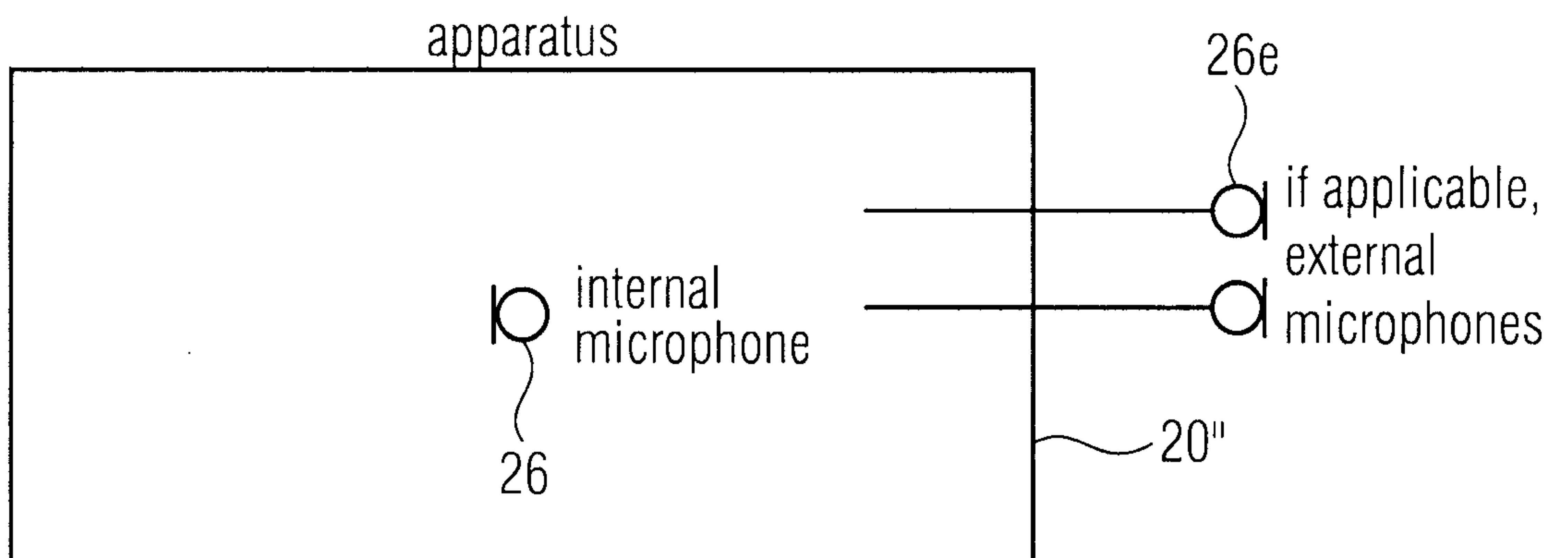


Fig. 1e

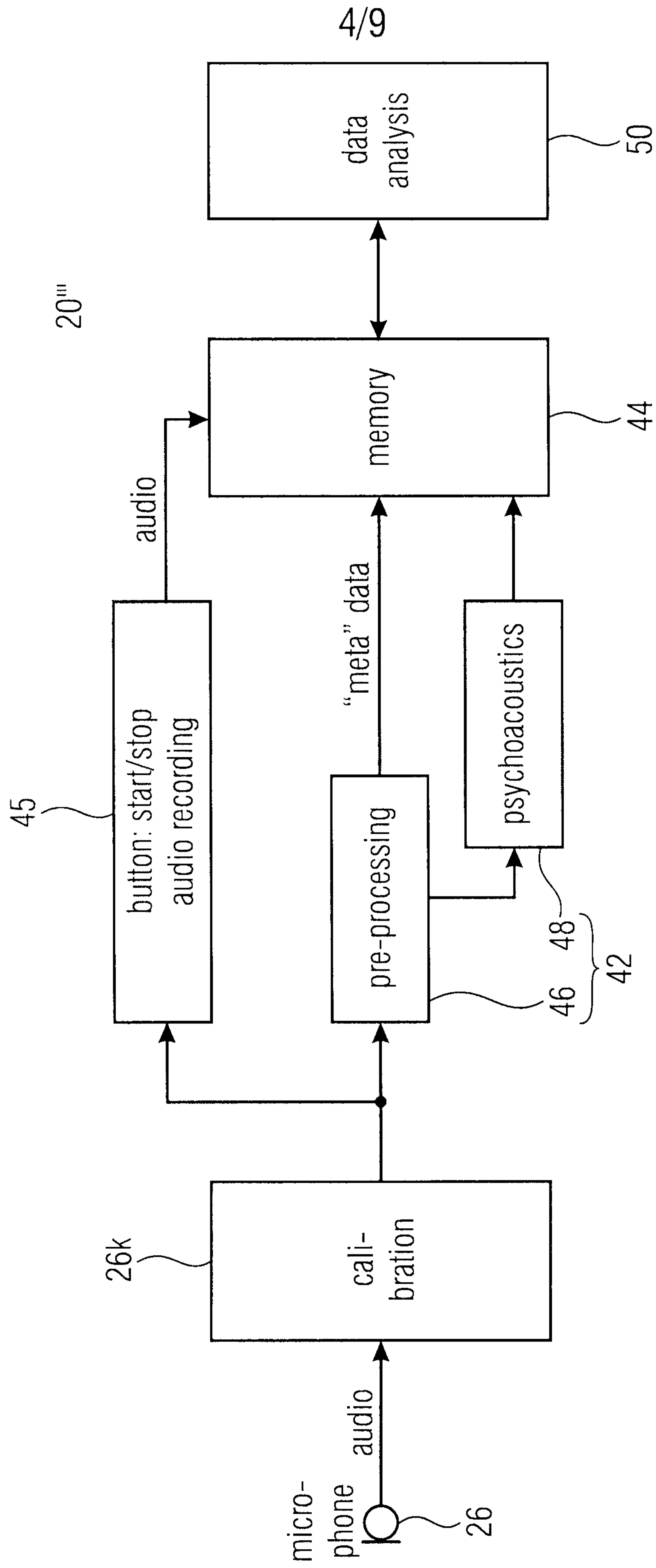


Fig. 1f

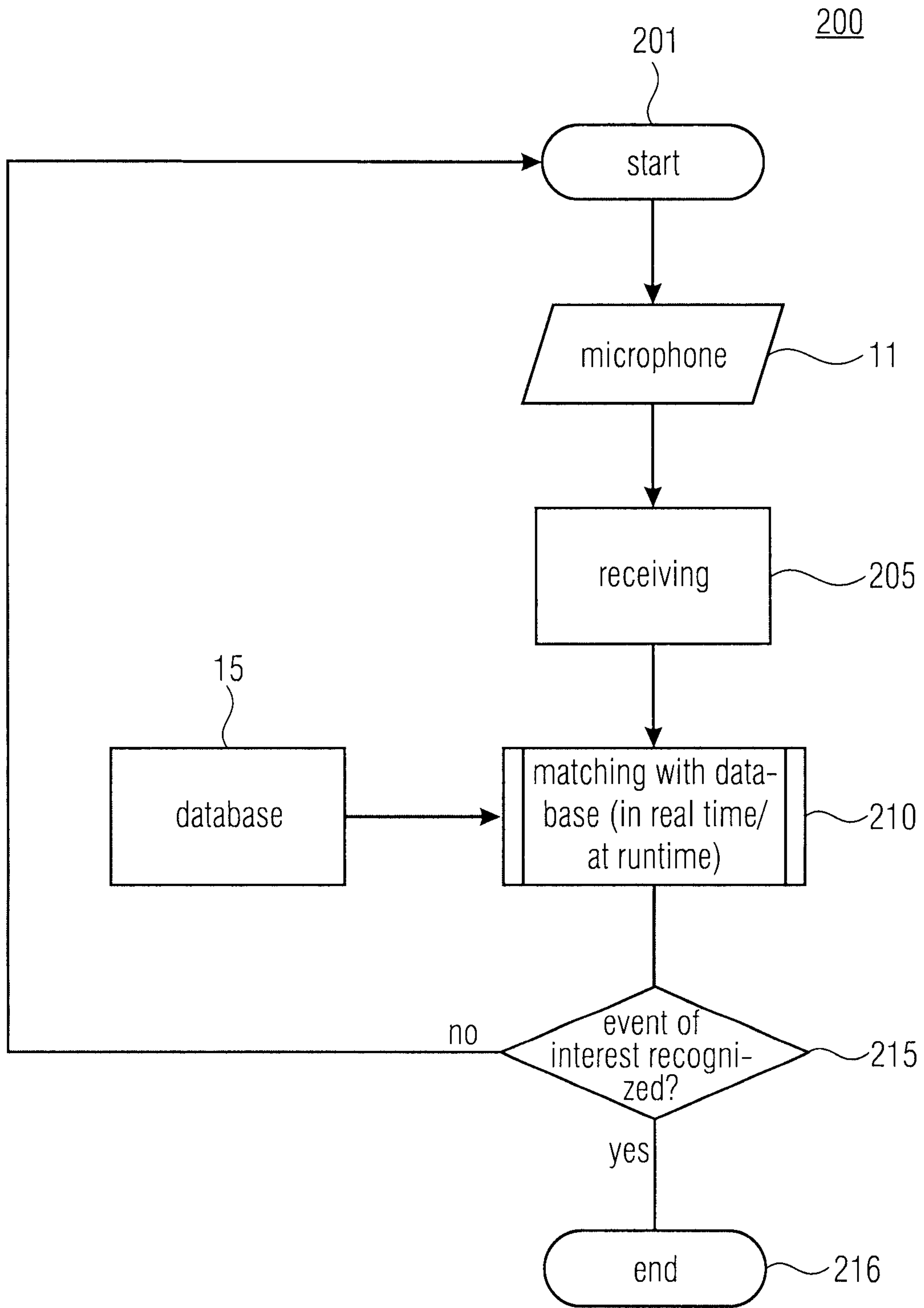


Fig. 2a

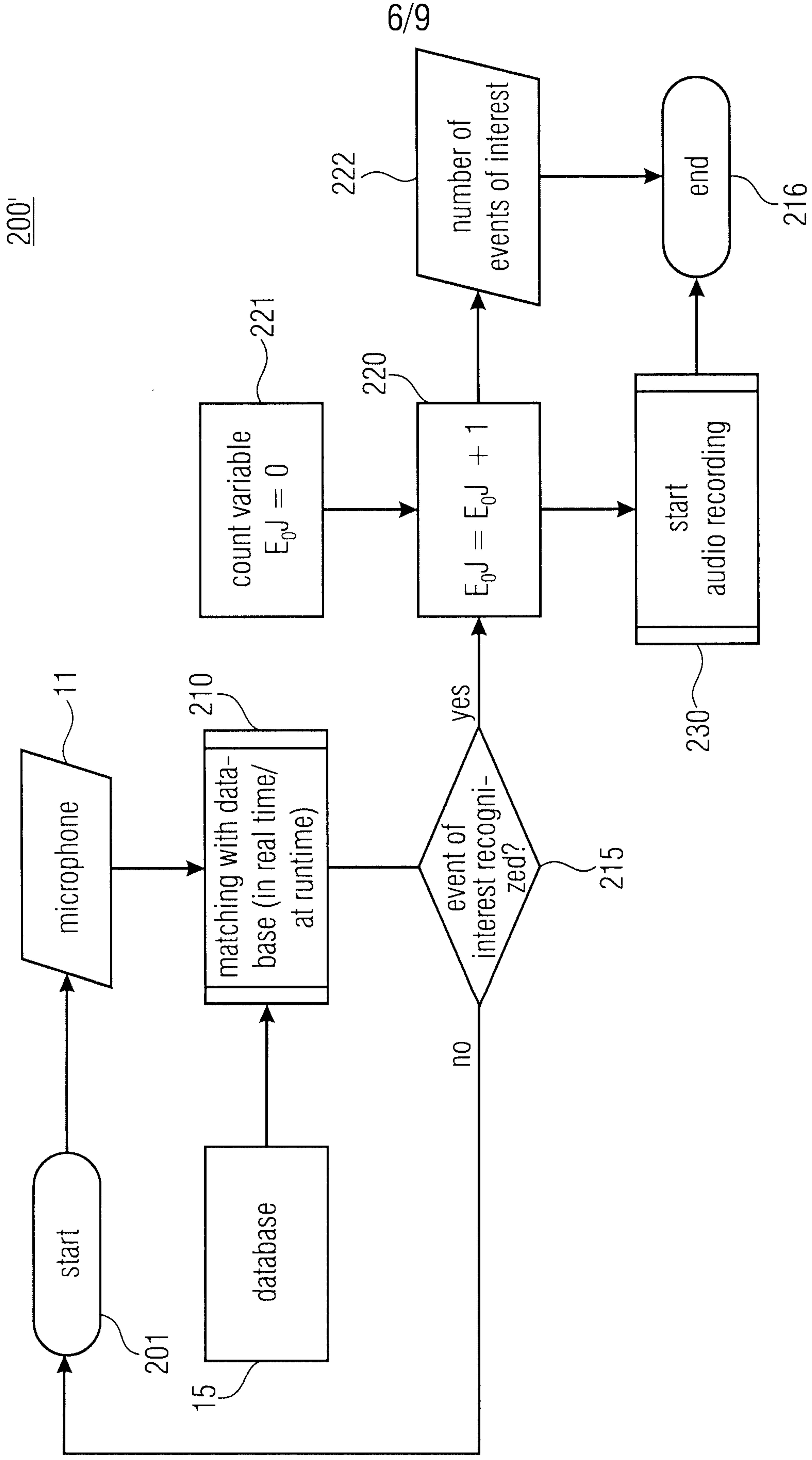


Fig. 2b

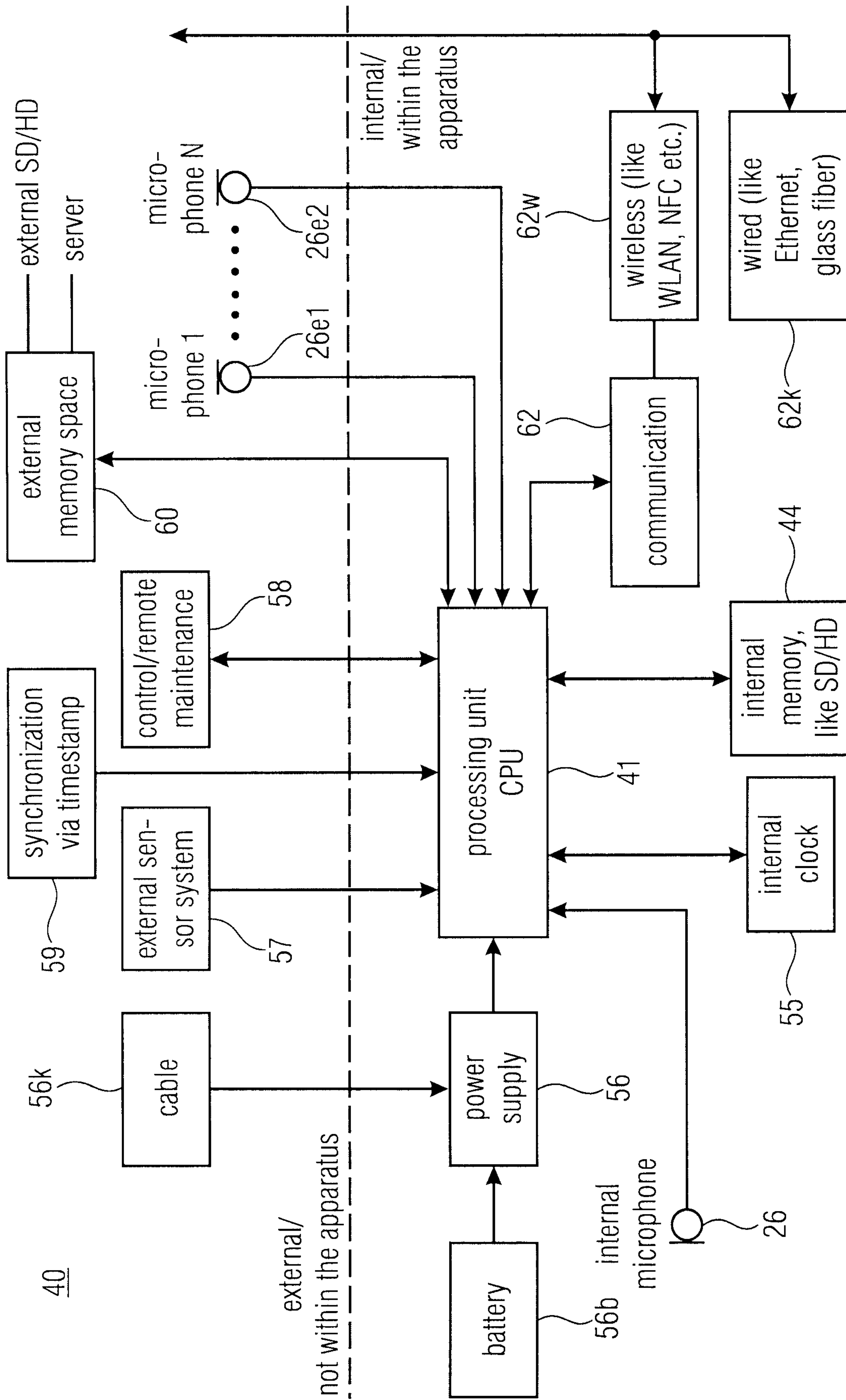


Fig. 2c

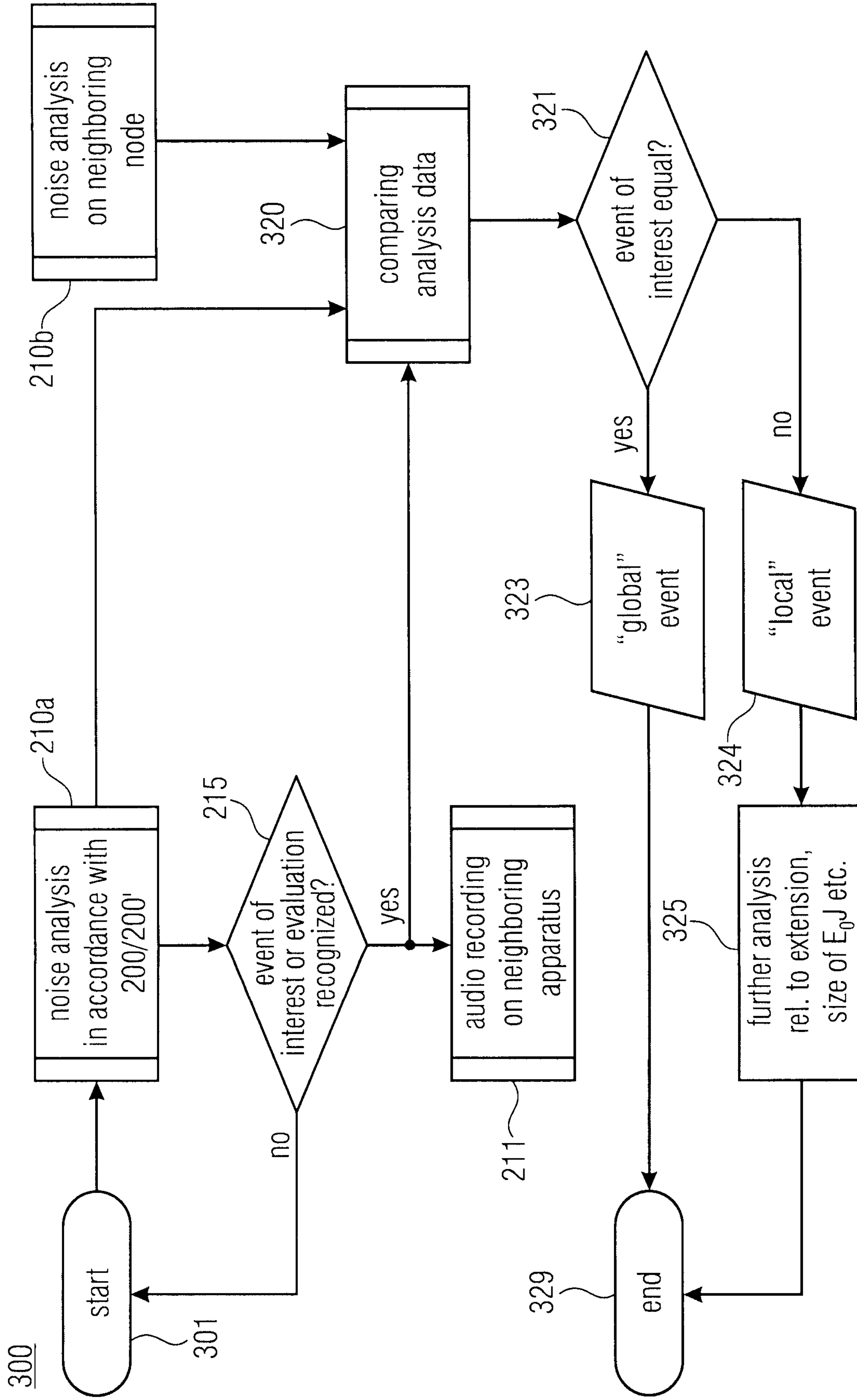


Fig. 3a

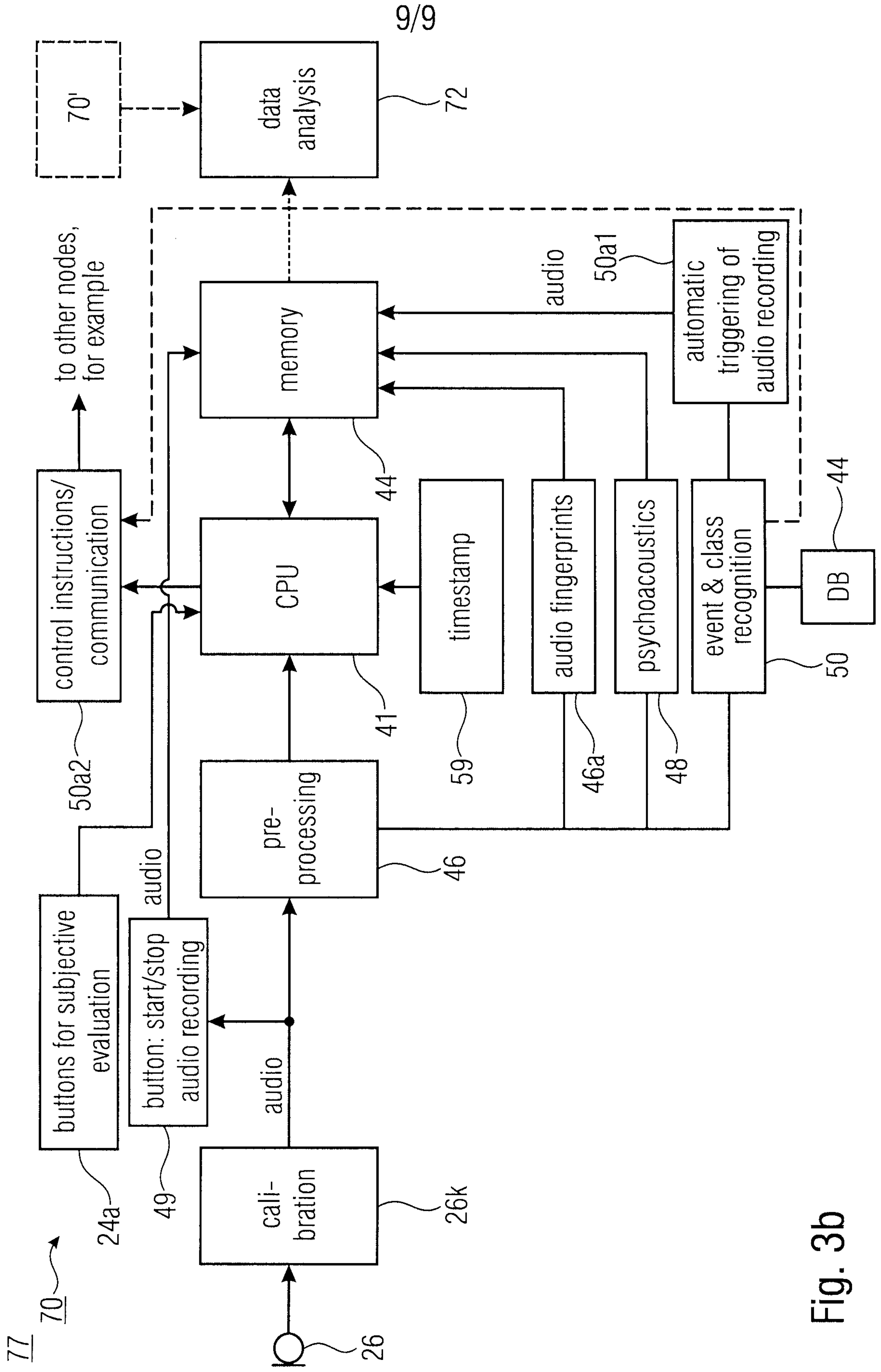


Fig. 3b

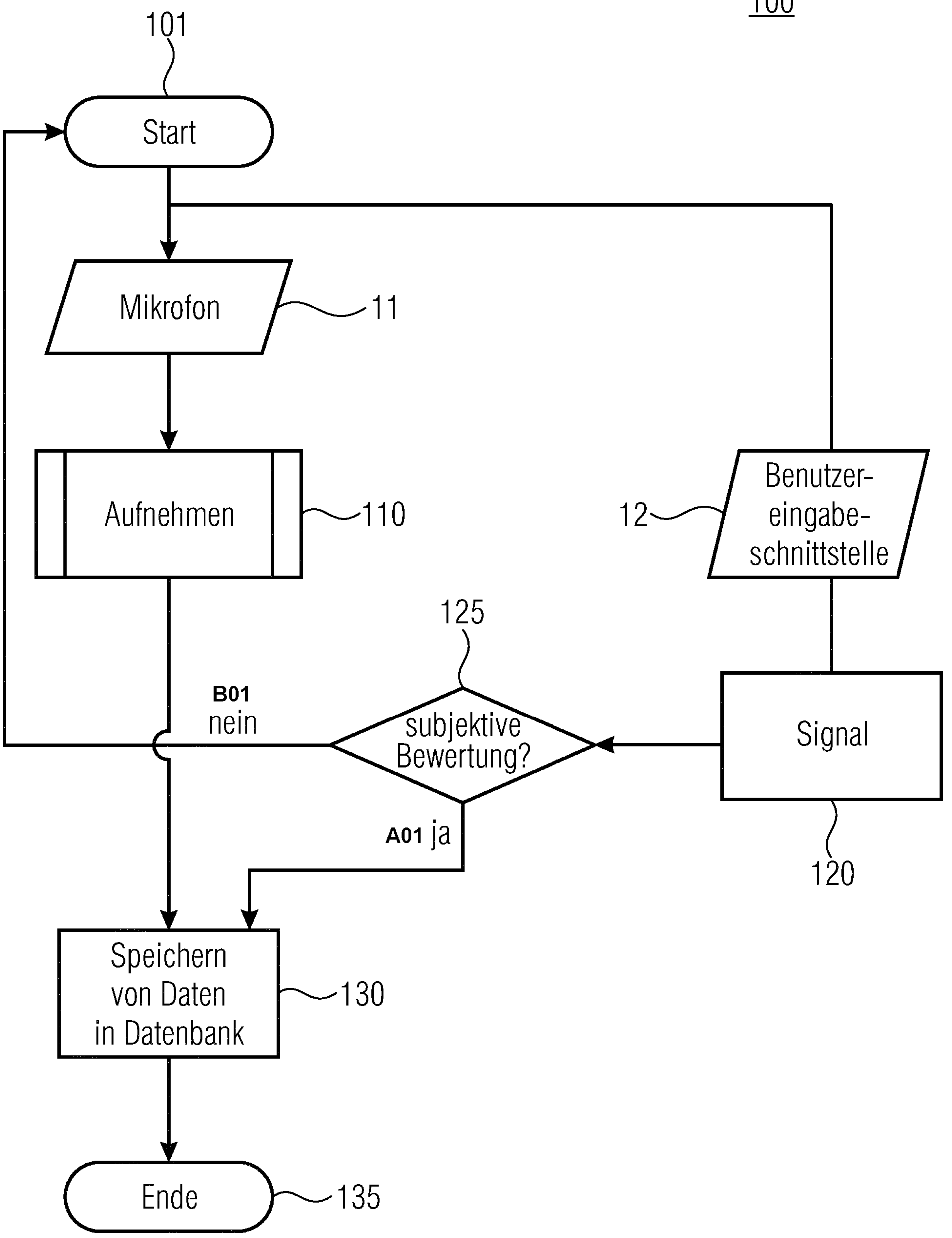


Fig. 1a

- 101 Start
- 11 Microphone
- 110 Recording
- 12 User entry interface
- 120 Signal
- B01 No
- 125 Subjective valuation?
- A01 Yes
- 130 Storing data in database
- 135 End