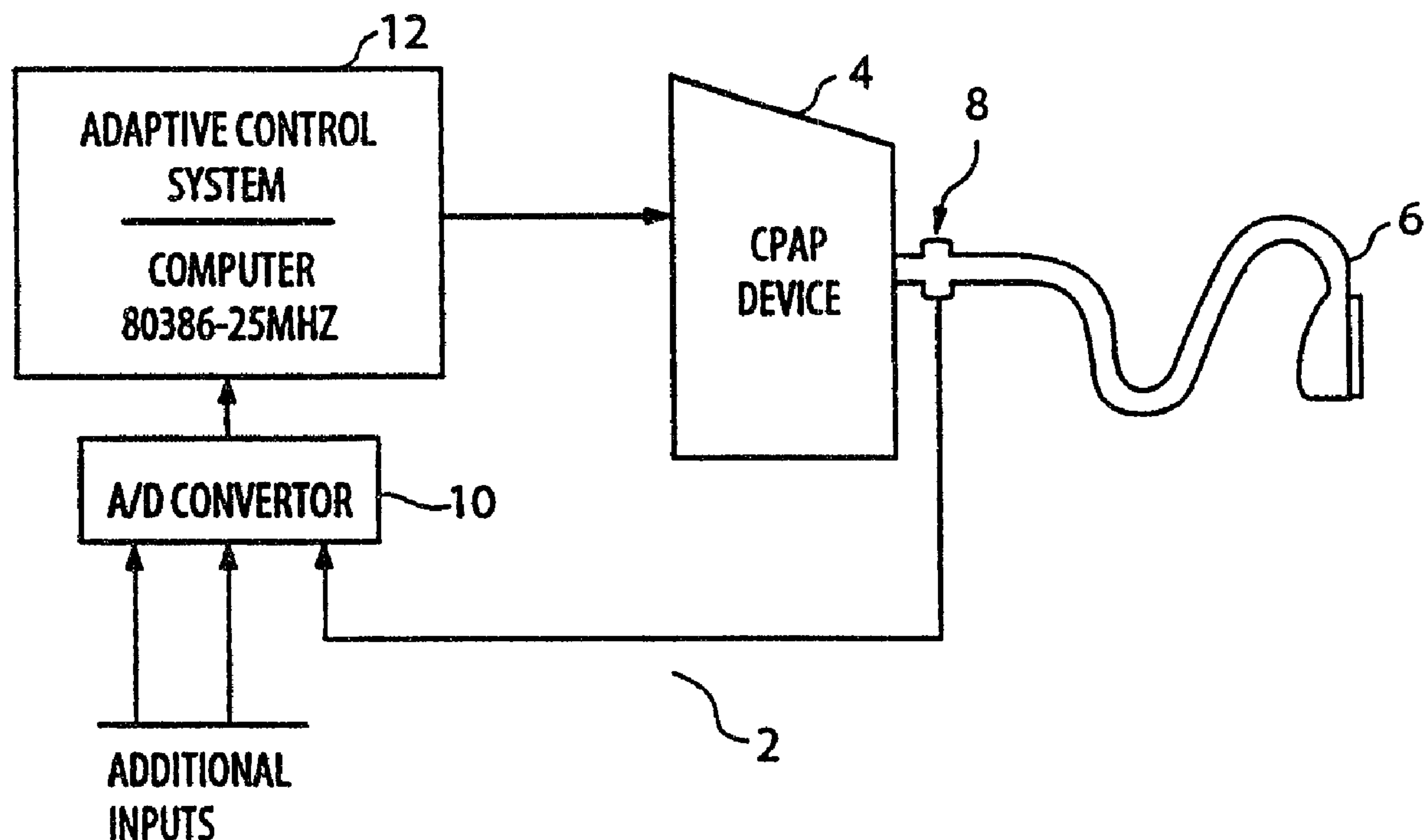




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(54) Titre : SYSTEME AUTOMATIQUE POUR LA VENTILATION SPONTANEE EN PRESSION POSITIVE CONTINUE
(54) Title: AUTO CPAP SYSTEM



(57) Abrégé/Abstract:

The present invention relates to systems and methods for automatically and continuously regulating the level of nasal pressure to an optimal value during OSA treatment. OSA therapy is implemented by a device which automatically re-evaluates an applied pressure and continually searches for a minimum pressure required to adequately distend a patient's pharyngeal airway. For example, this optimal level varies with body position and stage of sleep throughout the night. In addition, this level varies depending upon the patient's body weight and whether or not alcohol or sleeping medicine has been ingested.



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ABSTRACT OF THE DISCLOSURE

The present invention relates to systems and methods for automatically and continuously regulating the level of nasal pressure to an optimal value during OSA treatment. OSA therapy is implemented by a device which automatically re-evaluates an applied pressure and continually searches for a minimum pressure required to adequately distend a patient's pharyngeal airway. For example, this optimal level varies with body position and stage of sleep throughout the night. In addition, this level varies depending upon the patient's body weight and whether or not alcohol or sleeping medicine has been ingested.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. System for providing continuous positive airway pressure in an upper airway system, the system comprising:
 - means for detecting airflow in an upper airway system of a patient;
 - means for generating pressure in said upper airway system in response to a command pressure; and
 - means for adaptively controlling said pressure generating means in response to said detecting means to automatically provide continuous positive airway pressure, said adaptive control means introducing incremental pressure perturbations for setting the command pressure relative to a predetermined critical pressure, wherein the adaptive controlling means further includes means for averaging airflow information over a predetermined period of time and for determining non-respiratory flow using said averaged information, and means for identifying periods of inspiration and expiration using said non-respiratory flow information wherein the critical pressure is the pressure at which a significant obstruction occurs during inspiration and wherein the command pressure corresponds to a minimum effective pressure for eliminating the obstruction during inspiration.

2. System according to claim 1, wherein said adaptive control means identifies said critical pressure as a pressure at which a predetermined upper airway obstruction occurs during said inspiration.
3. System according to claim 2, wherein said adaptive control means extracts features indicative of airflow resistance in said upper airway system to identify said critical pressure and to set said command pressure.
4. System according to claim 3, wherein said extracted features include flatness, roundness and peak flow.
5. Apparatus for adaptively providing continuous positive airway pressure in an upper airway system comprising:
 - means for detecting airflow in the upper airway system in predetermined increments of time during a breath to provide an airflow profile for the breath;
 - means for averaging airflow information over a plurality of breaths;
 - means for partitioning said airflow into respiratory and non-respiratory components using said averaged airflow information;

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means for using non-respiratory airflow information to identify periods of inspiration and expiration and to provide respiratory airflow profile;

means for extracting from the respiratory airflow profile information features comprising peak inspiratory airflow, flatness and/or roundness;

means for introducing a pressure change for a single breath and determining for that breath the peak inspiratory airflow, and flatness and/or roundness;

means for comparing the determined peak inspiratory airflow and the determined flatness and/or roundness for the single breath with the same features extracted from said respiratory airflow profile information of said plurality of breaths; and

means for preventing a patient disturbance from occurring by adjusting pressure in said upper airway system in response to the comparison of said features.

6. System for providing continuous positive airway pressure in an upper airway system, said system comprising:

means for detecting airflow in an upper airway system of a patient;

means for generating pressure in said upper airway system in response to a command pressure;

means for extracting peak inspiratory airflow information and airflow profile information for a plurality of breaths at a first pressure;

means for determining a second peak inspiratory airflow and a second airflow profile for at least one breath at a second pressure;

means for comparing the first and second peak inspiratory airflow and the first and second airflow profile; and

means for preventing a patient disturbance from occurring by adaptively controlling said pressure generating means in response to said comparison means.

7. System according to claim 6, wherein said means for preventing a patient disturbance from occurring by adaptively controlling said pressure generating means in response to said comparison means further includes:

means for averaging airflow information over a predetermined period of time and for determining non-respiratory flow using said averaged information; and

means for identifying periods of inspiration and expiration using said non-respiratory flow information.

8. System according to claim 7, wherein said adaptive control means identifies a critical pressure as a pressure at which a predetermined upper airway obstruction occurs during said inspiration.

9. System according to claim 8, wherein said adaptive control means extracts features indicative of airflow resistance in said upper airway system to identify said critical pressure and to set said command pressure.

10. System according to claim 9, wherein said extracted features include flatness, roundness and peak flow.

11. System according to any one of claims 6 to 10, wherein said adaptive control means further includes:

means for incorporating an additional external input from an oxygen saturation monitor or a snoring monitor.

12. System according to any one of claims 6 to 11, wherein said adaptive control means further includes:

means for incorporating an additional external input from a monitor of pressure, sound, oxygen saturation or body position.

13. System for providing continuous positive airway pressure in an upper airway system, said system comprising:

means for detecting airflow in an upper airway system of a patient;

means for generating pressure in said upper airway system in response to a command pressure;

means for partitioning said airflow into respiratory and non-respiratory components;

means for identifying periods of inspiration and expiration using non-respiratory airflow information;

means for extracting respiratory airflow profile shape for a plurality of breaths at a first pressure;

means for determining a second respiratory airflow profile shape for a single breath at a second pressure;

means for comparing the first and second airflow profile shapes; and

means for preventing a patient disturbance from occurring by adaptively controlling said pressure generating means in response to said comparison means.

14. System according to claim 13, wherein said adaptive control means further includes:

means for averaging airflow information over a predetermined period of time and for determining non-respiratory flow using said averaged information.

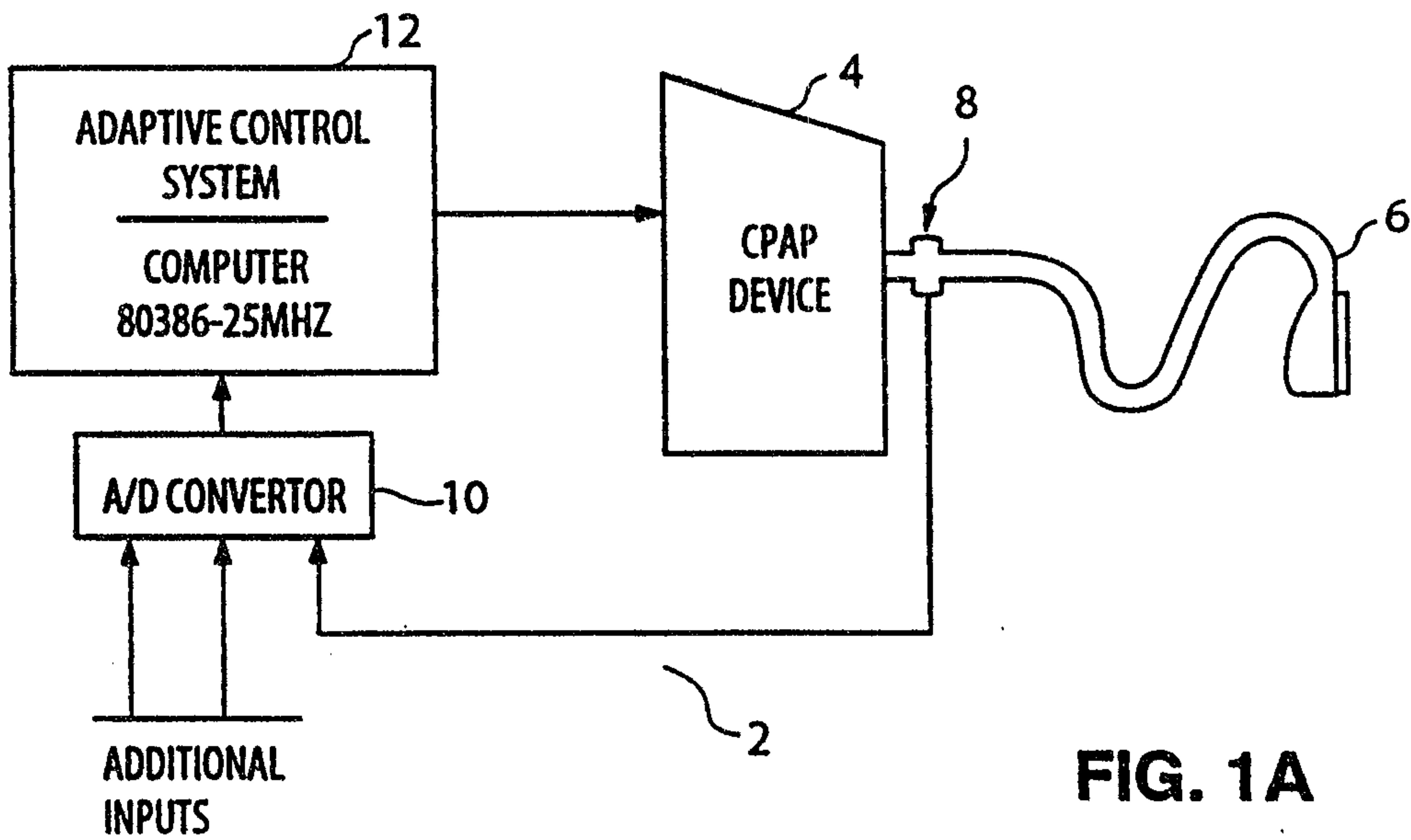


FIG. 1A

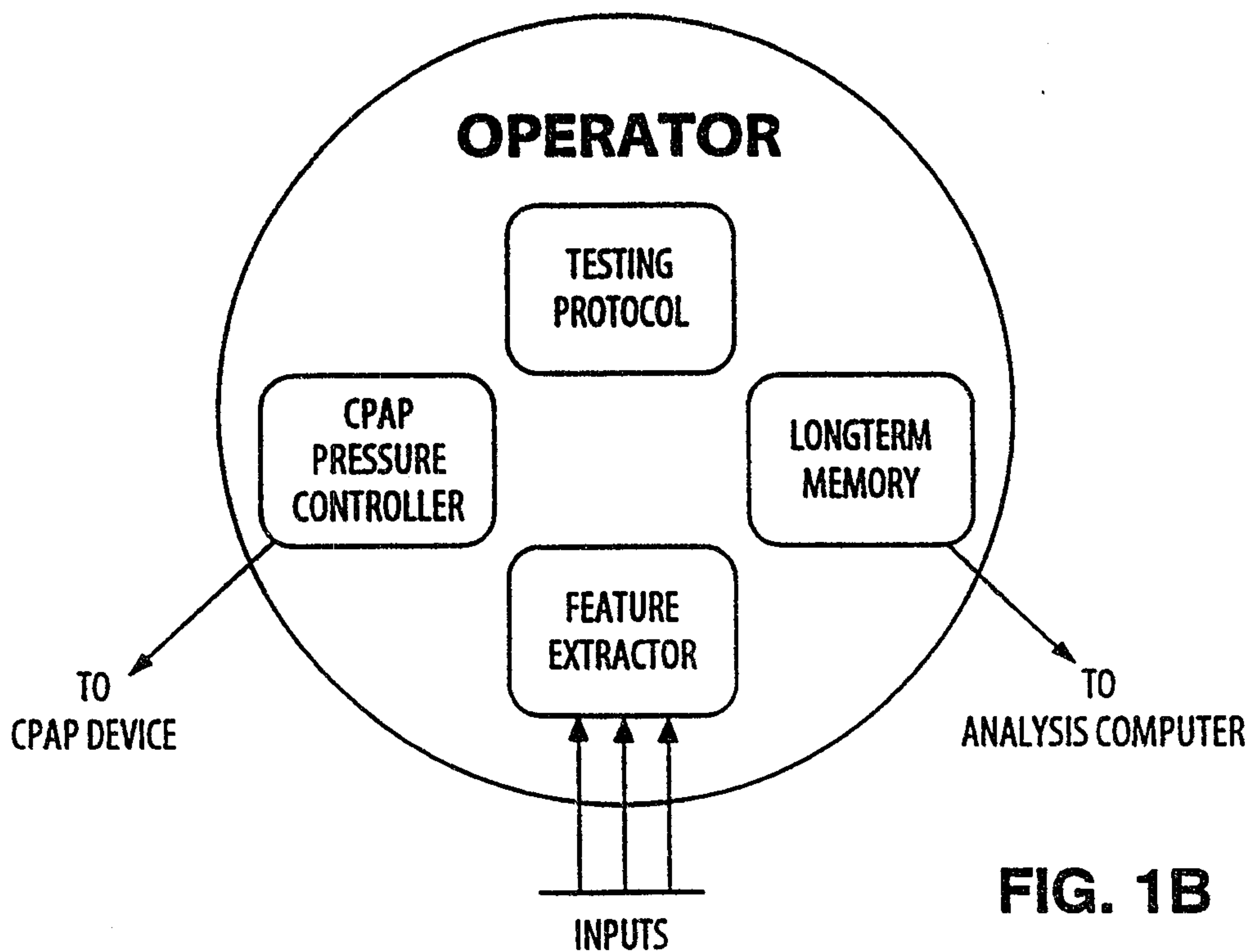


FIG. 1B

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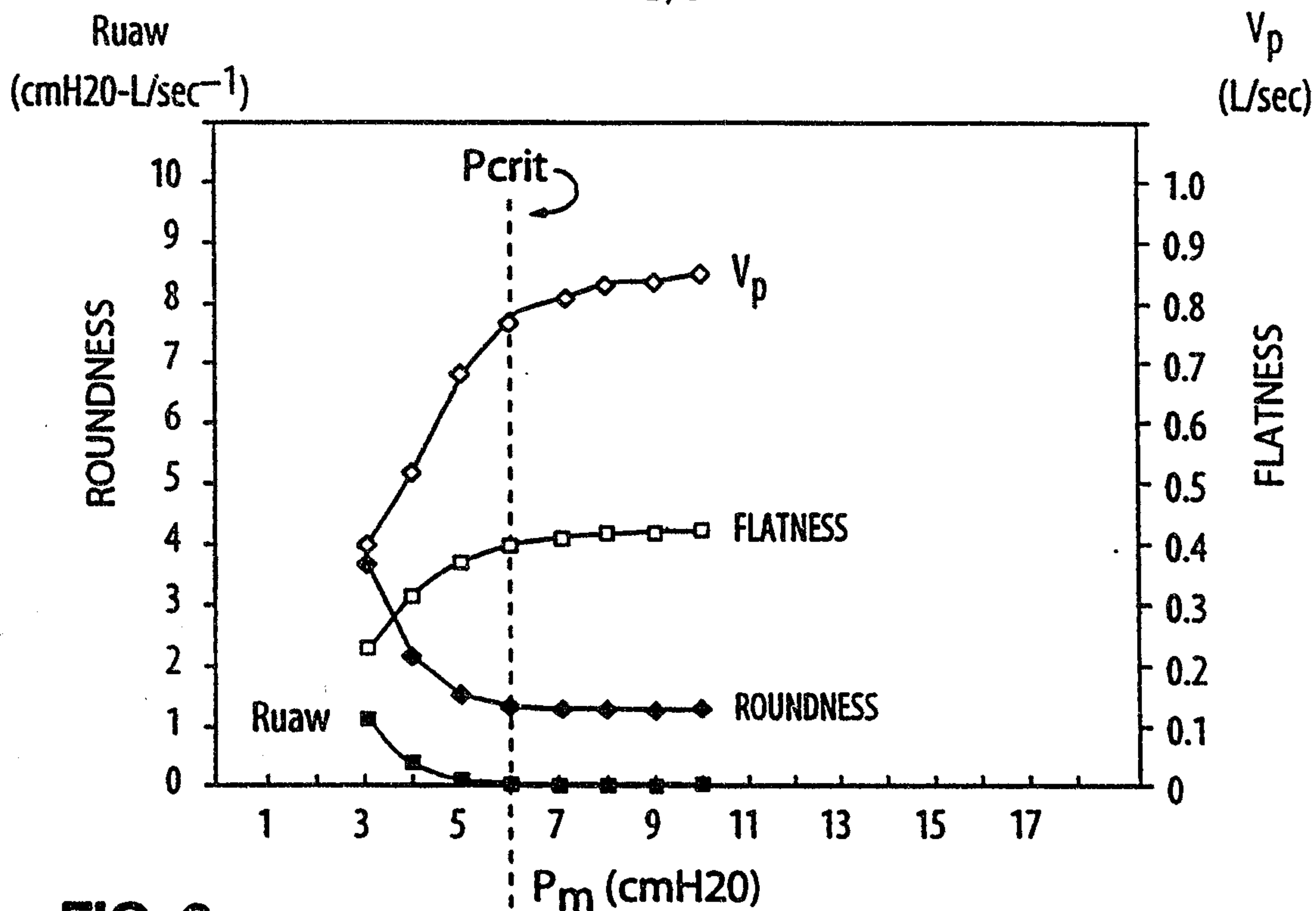


FIG. 2

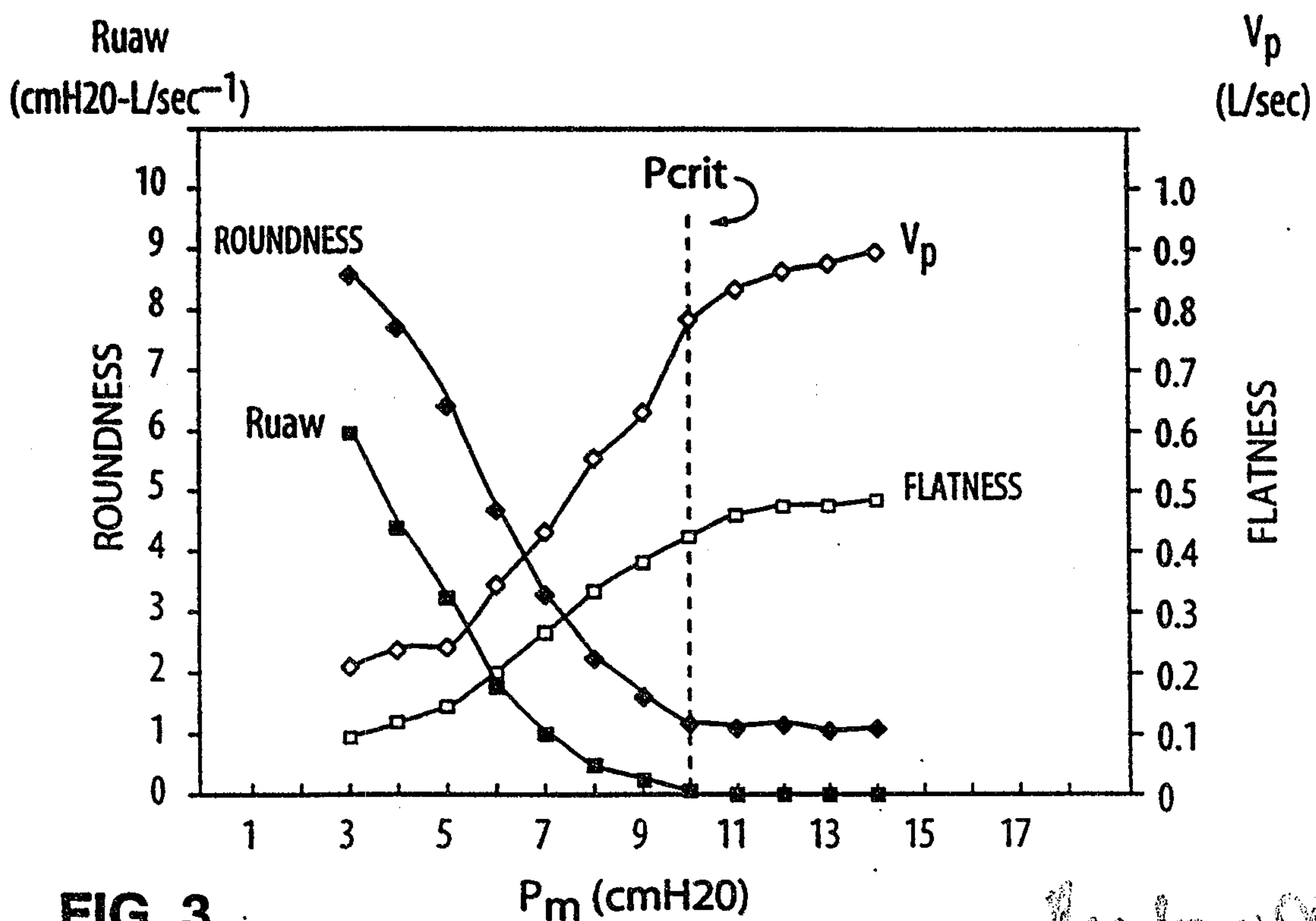


FIG. 3

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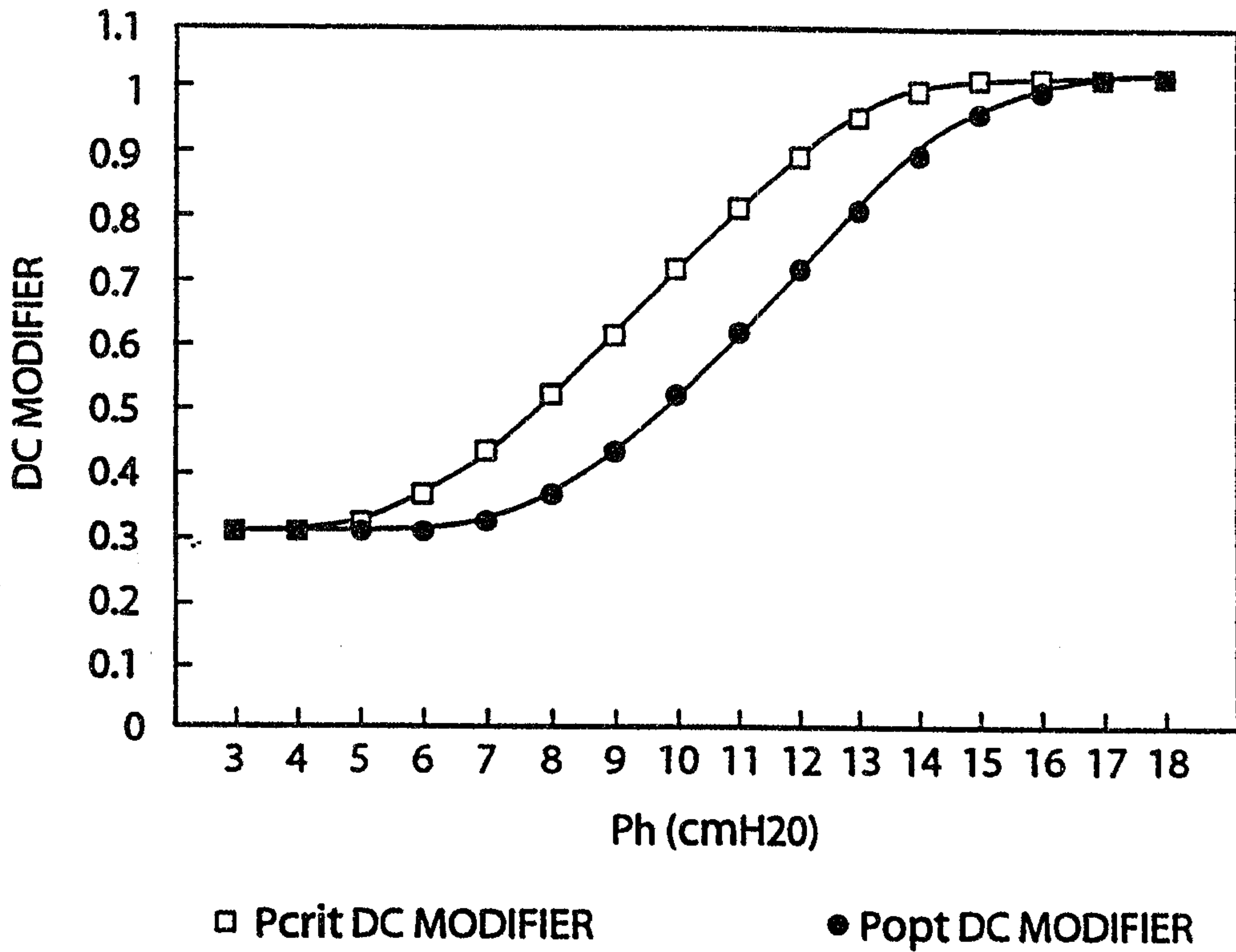


FIG. 4

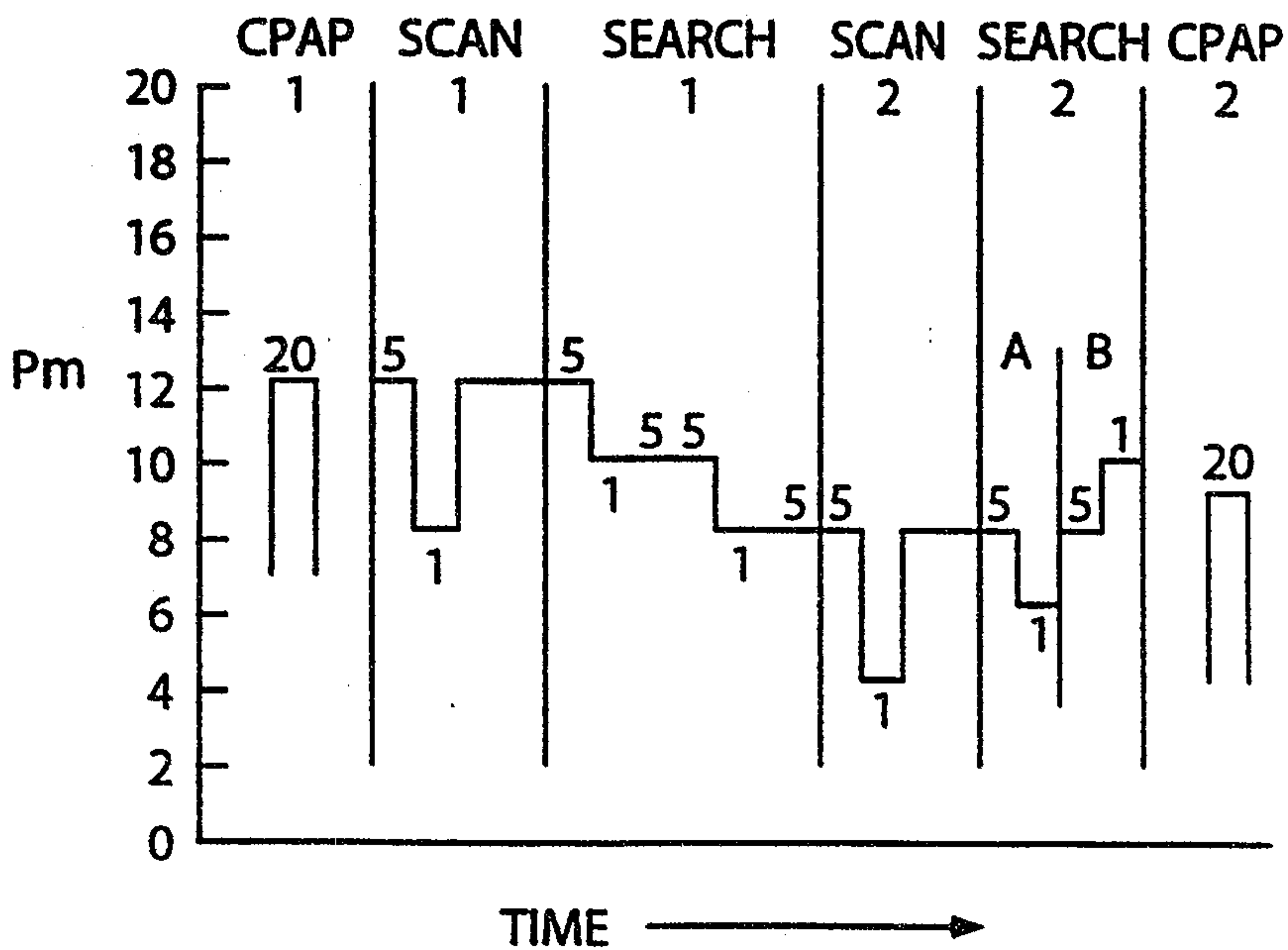


FIG. 5

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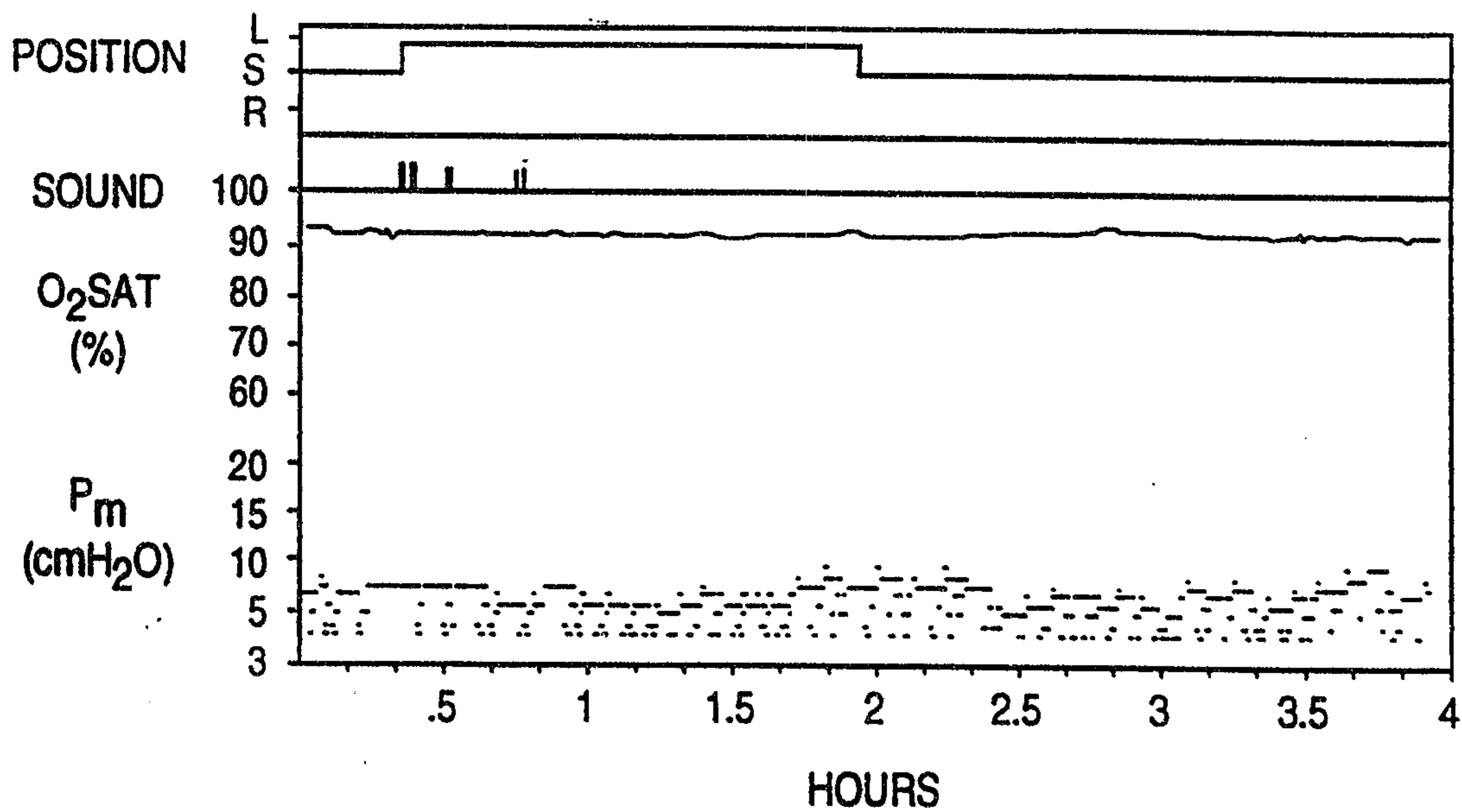


FIG. 6A

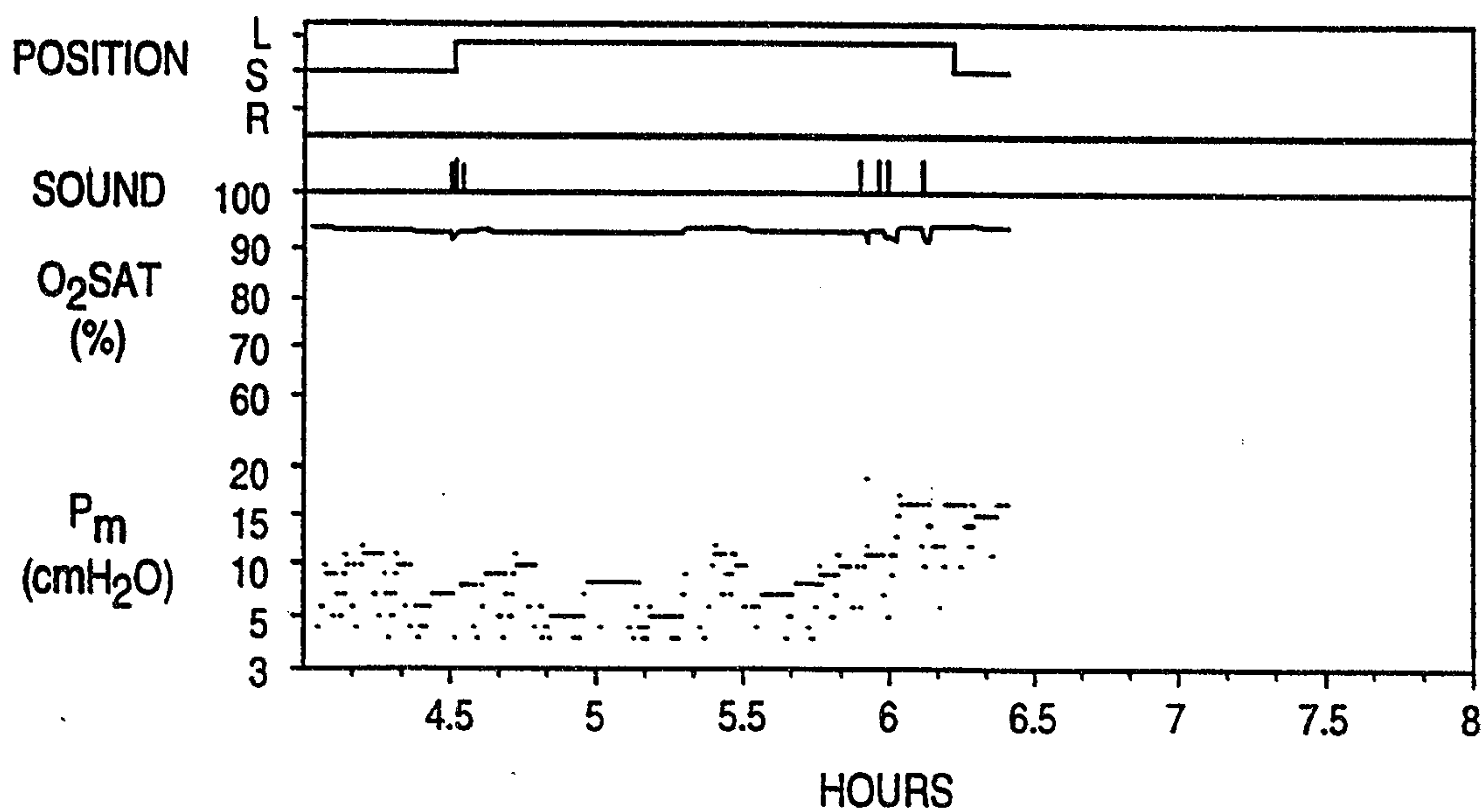


FIG. 6B

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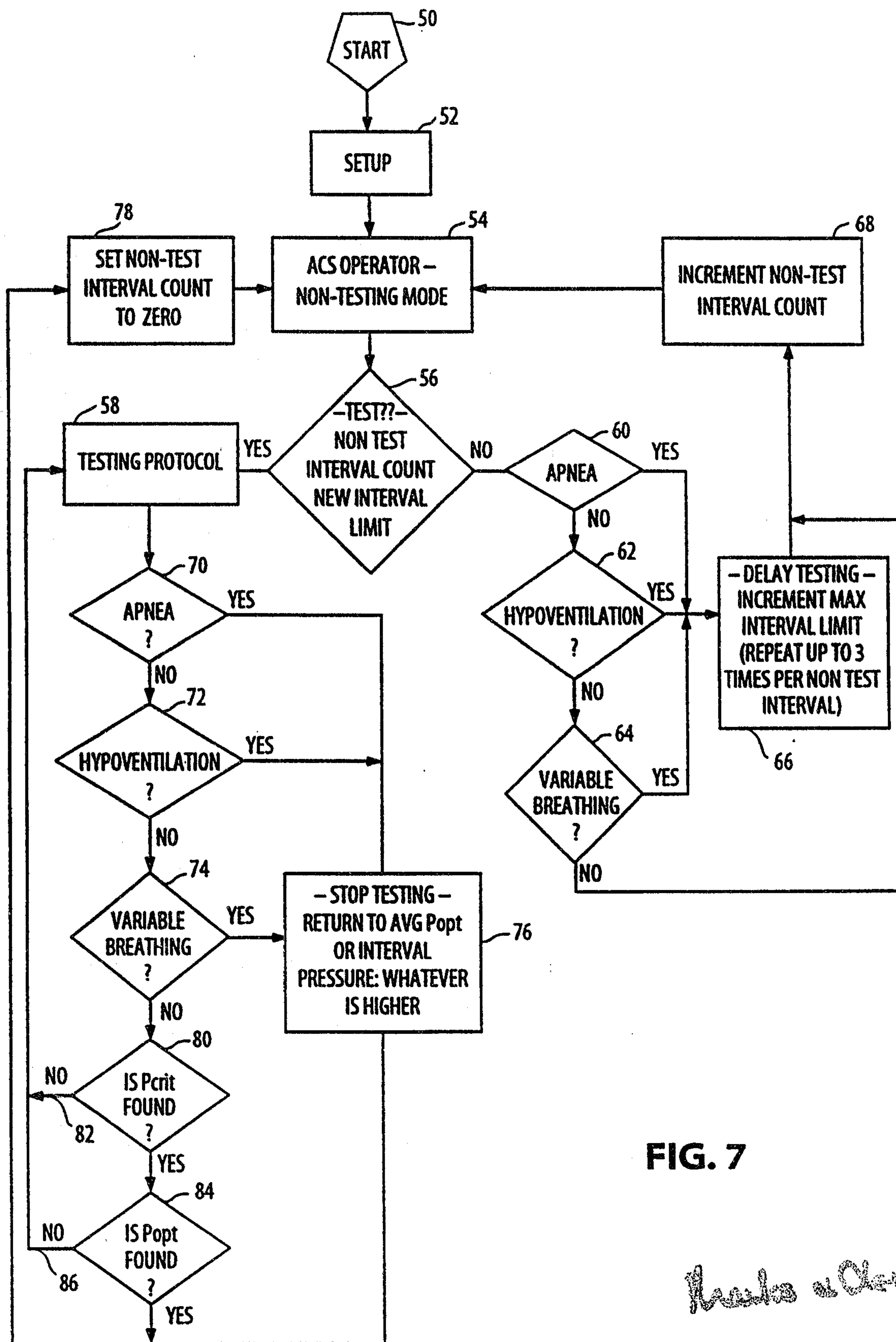


FIG. 7

Heads or Tails

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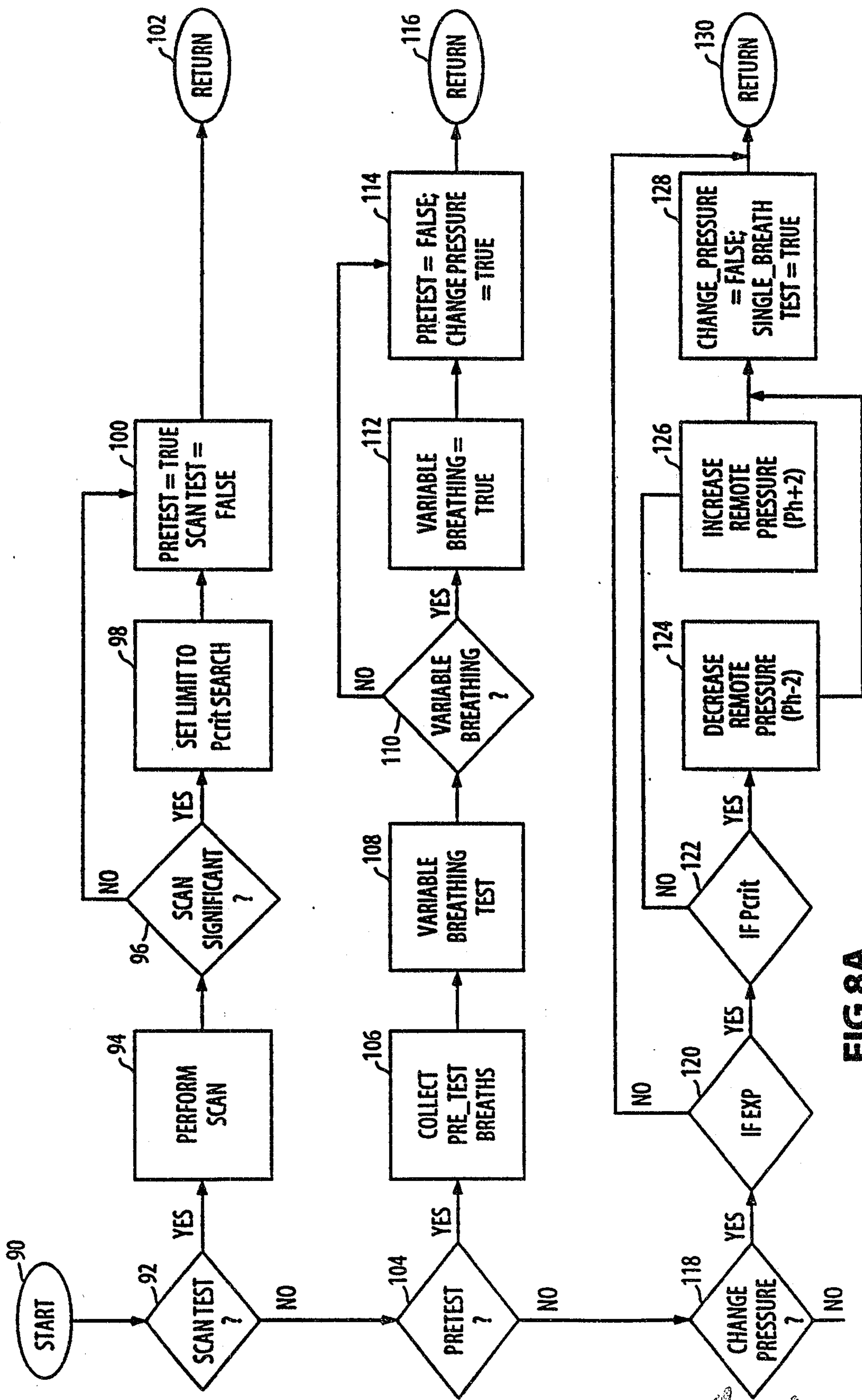


FIG 8A

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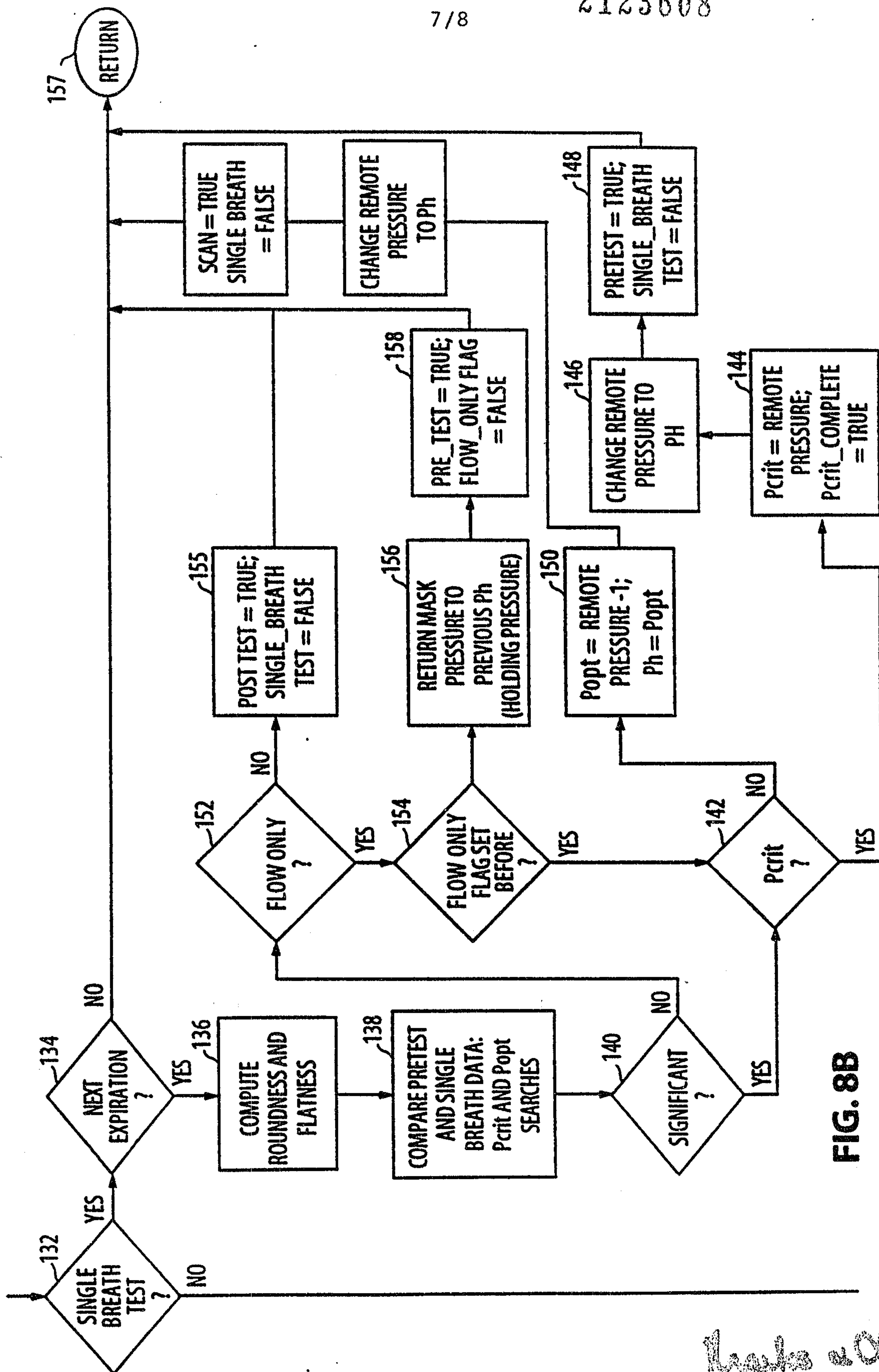


FIG. 8B

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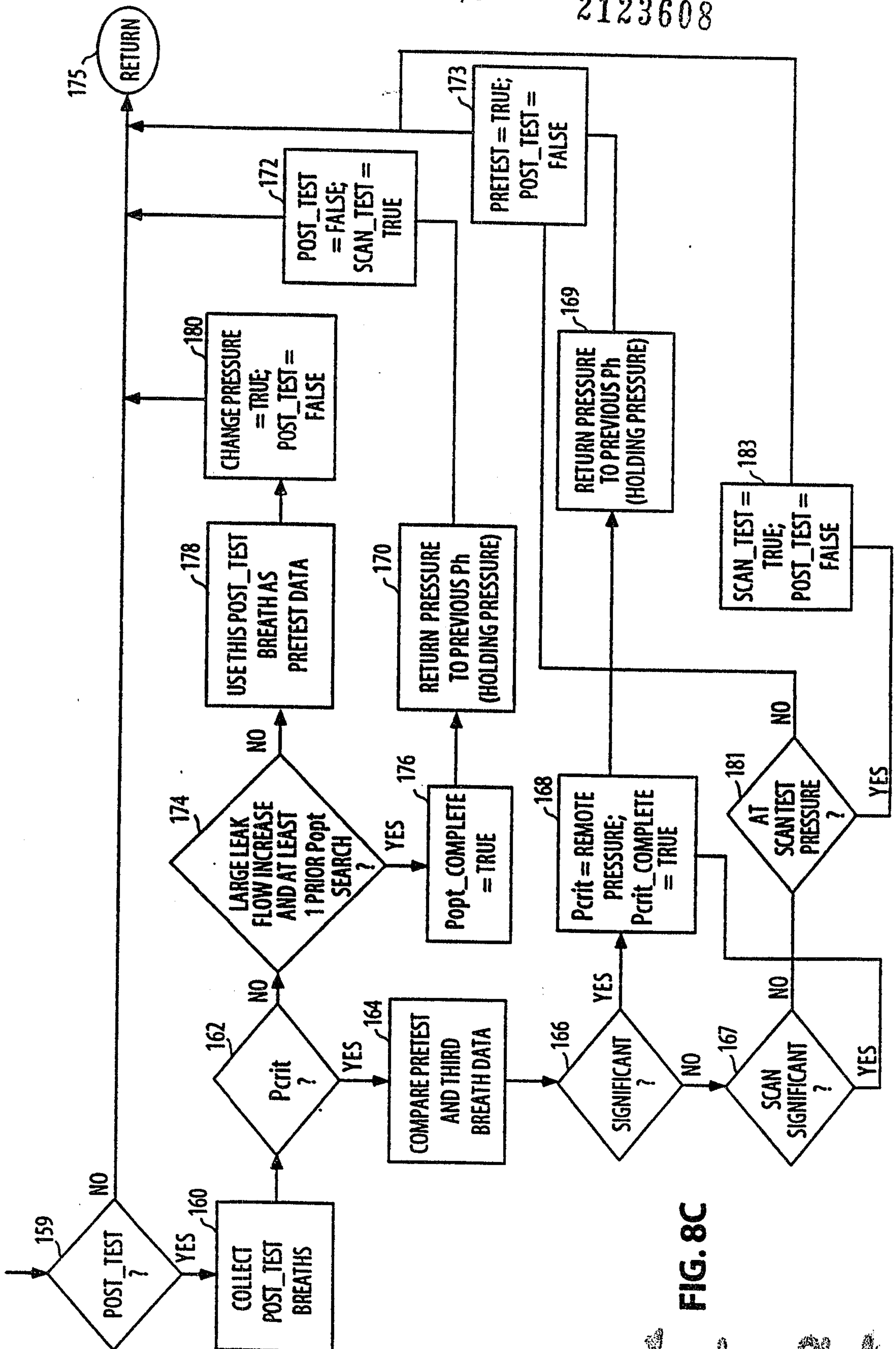


FIG. 8C

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