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(54) Noise cancellation for a retail transaction station

(57) A noise cancellation system is provided for a retail transaction station such as a fuel dispenser (100) to substantially reduce ambient noise in the vicinity of the dispenser or station, to enhance and facilitate customer interaction. The noise cancellation system comprises a detector (32) for detecting ambient noise and generating an ambient noise signal, a controller (34) receiving the ambient noise signal and responsively generating a noise cancelling signal, and a transducer (36) receiving the noise cancelling signal and generating a cancelling noise.

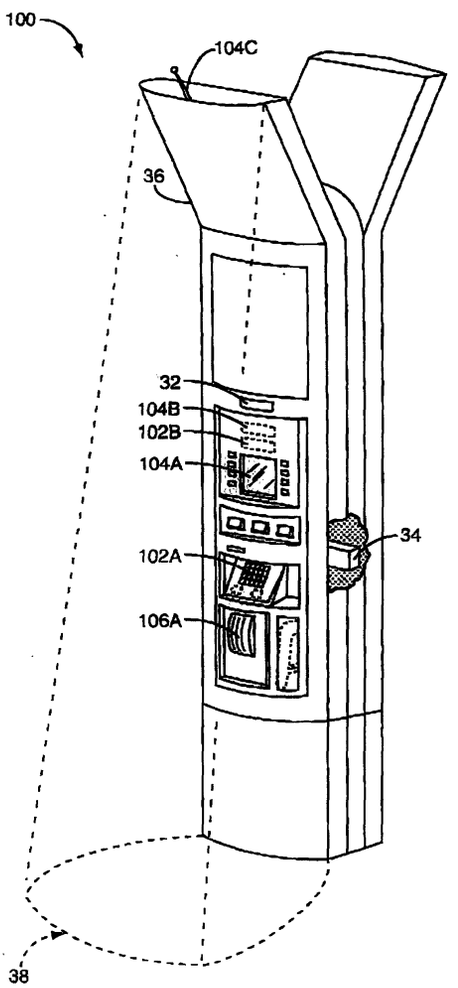

FIG. 1

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Description

[0001] The present invention relates to noise reduction in a retail transaction station and presumably, but not exclusively, to a fuel dispensing environment comprising one or more retail transaction stations in the form of fuel dispensers.

[0002] There is an increasing number of retail transaction stations for the purchase by consumers of a wide variety of goods and/or services. Retail transaction stations as defined by this specification are automated devices through which consumers can conduct a range of transactions, including the direct purchase of consumable goods (such as food for example), the ordering of services, ordering and downloading data in e-commerce transactions, and the like. Typically located outdoors, retail transaction stations are often available for use 24 hours a day, at the convenience of the consumer.

[0003] Retail transaction stations are often combined into "one stop" facilities and the success of these, especially associated with fuel services stations, which by their nature have a "drive-in" facility, has prompted an expansion of this trend, with fuel service stations increasingly offering such convenience products and services as fast food, video rentals, dry cleaning services, and the like. To maximize the convenience to the consumer, many of the interactions required to order and purchase these goods and services are being made at a single point of contact — the fuel dispenser.

[0004] While fuelling an automobile, a consumer can interact with the fuel dispenser, for example, to order lunch at an associated restaurant, or to select a video for rental. These selections can be made through an interactive display built into the fuel dispenser, and purchased at the fuel dispenser by use of a credit card. The consumer's lunch order is transmitted to the restaurant and his video selection transmitted to the video rental store, where personnel would immediately begin preparation of his orders. With fuelling completed the consumer simply takes a receipt issued by the dispenser to a drive-in window of the restaurant or video rental store, where his order has been prepared and is waiting.

[0005] One problem with this business model, however, is that the environment in which the fuel dispenser is located is often not conducive to conducting retail transactions, primarily due to high ambient noise. The constant flow of cars and lorries to adjacent fuelling positions and between the one or more collection windows within the service station contribute to the noisy environment. Additionally, the service station is often located adjacent to a major highway that contributes additional vehicular noise. The service station may also be located near an airport, factory, railroad, or other periodic or continuous source of noise. Even in isolated locations, the fact that the fuel dispensers are often located under a canopy made of non-acoustically absorbing materials results in a generally higher ambient noise level than would be present in a free field environment. Indeed a certain level of noise may be due to the fuel dispensers themselves especially if these comprise fuel pumps, that is to say a dispenser where a pump is actually located in the housing of a dispenser, as opposed to being located in an underground storage tank.

[0006] A high level of ambient noise is distracting to the consumer, and acts as a deterrent to conducting transactions through the fuel dispenser. Additionally, the customer interface at a retail transaction station may include voice recognition as part of its input, and generate audible messages as part of its output. High levels of ambient noise interfere with this mode of interaction. Also, businesses may wish to direct audio/visual advertising to the consumer, to further entice him to conduct retail transactions at the fuel dispenser. High levels of ambient noise degrade the quality of these messages, and may even make them unintelligible.

[0007] Hence, a need exists for a way to significantly reduce or eliminate ambient noise in the vicinity of a retail transaction station.

[0008] According to a first aspect of the present invention there is provided a retail transaction station having an active noise cancellation system for substantially reducing noise existing in an area around said station. Employing the invention enables noise to be cancelled out providing an improved environment more conducive to carrying out a purchase transaction.

[0009] Preferably the noise cancellation system includes a noise detector for detecting noise around said station and producing a noise signal that is representative of the noise; a controller for receiving said noise signal from said detector and generating a noise cancelling signal; and a transducer operatively connected to the controller for receiving said noise cancelling signal and producing a cancelling noise that substantially reduces the noise around said station. The microphone may be located within the area around said station, in which case said controller operates in a feedback mode, or alternatively may be located remotely from said station, wherein said controller operates in a feed forward mode. The station preferably cancels ambient noise but may cancel noise generated within the station itself.

[0010] The invention is particularly applicable to a fuel dispensing environment where the station is a fuel dispenser itself, fuel dispensers normally being located on forecourts subjected to noise from vehicles either within the forecourt itself or on a passing road or motorway.

[0011] According to a second aspect of the present invention there is provided a service station comprising a plurality of fuel dispensers as referred to above, wherein each of said plurality of fuel dispensers has two fuelling sides; and at least one noise cancellation system associated with at least one fuelling side of each said plurality of fuel dispensers, and operative to substantially reduce ambient noise in the area around at least one side of each said fuel dispenser. This enables noise to be cancelled in an area specific to a user, that is to say, within a region to one side of a fuel dispenser

wherein the user will normally be stood whilst communicating with the dispenser.

[0012] The station may include an input device for ordering goods or services; an output device for communication with customers; a payment device for effectuating payment for the goods or services; and a noise cancellation system for substantially reducing ambient noise in the area around said retail transaction station.

[0013] According to a third aspect of the invention there is provided a method of reducing ambient noise in an area around a fuel dispenser, the method comprising: detecting ambient noise in the area around said fuel dispenser; generating a noise signal that is representative of the ambient noise; processing said noise signal to generate a noise cancelling signal; generating a cancelling noise from said noise cancelling signal, and directing said cancelling noise into the area around said fuel dispenser; whereby the ambient noise in the area around the fuel dispenser is substantially reduced.

[0014] In accordance with a fourth aspect of the invention there is provided a method of reducing ambient noise at a service station having a plurality of co-located fuel dispensers, the method comprising detecting ambient noise in the area around the service station; generating a noise signal that is representative of the ambient noise; processing said noise signal to generate a noise cancelling signal; generating a cancelling noise from said noise cancelling signal; and directing said cancelling noise into the area around said plurality of co-located fuel dispensers; whereby said ambient noise in the area around said plurality of co-located fuel dispensers is substantially reduced.

[0015] Embodiments of the present invention will now be described by way of example only with reference to the accompanying figures of which:

Figure 1 depicts a perspective view of a retail transaction station with a noise cancellation system;

Figure 2 depicts a schematic diagram of a noise cancellation system;

Figure 3 depicts a schematic diagram showing a feedback noise cancellation configuration;

Figure 4 depicts a schematic diagram showing a feed forward noise cancellation configuration;

Figure 5 depicts a perspective view of a fuel dispenser with a noise cancellation system.

Figure 6 depicts a schematic diagram showing multiple fuel dispensers and a noise cancellation system for reducing ambient noise around the fuel dispensers; and

Referring to Figure 1, this depicts a retail transaction station, indicated generally at 100 equipped and operative for interaction with consumers to facilitate the purchase of goods and/or services. For example, goods purchased may comprise information, data, or entertainment in electronic form. Examples include news reports, weather forecasts, and music, video, or other content in electronic format, that the user many order and purchase at the retail transaction station, and that may additionally be downloaded directly into the user's automotive computer, handheld computing device, musical playback device, or the like. Services may include a car wash purchase, placing a telephone call, ordering a rental film. Another example of a retail transaction station is described in PCT Patent Application WO 96/06415, Method and Apparatus for Vending Goods in Conjunction with a Credit Card Accepting Fuel Dispensing Pump," the disclosure of which is incorporated herein in its entirety. In general, any type of goods and/or services may be ordered and purchased through a retail transaction station 100; the above examples are illustrative only, and not limiting.

[0016] The retail transaction station 100 contains an input 102 to establish consumer communication with the retail transaction station 100 for the selection of desired goods and services. Input 102 could comprise a mechanism requiring tactile contact by the consumer, for example a keyboard, keypad, touchscreen, or programmable function keys. Alternatively, the input 102 may be of a form that requires no physical contact, such as a transponder or other wireless communication, a smart card, speech recognition, or a direct link to a secondary device such as a PDA or laptop computer. Retail transaction station 100 may also contain a payment device 106 for allowing the customer to pay for his purchases. This may be done directly, for example with a cash acceptor operative to accept and verify currency and coins. Alternatively, the payment devise 106 may be to identify a credit or cash account number. For example, payment device 106 may comprise a magnetic stripe card reader, a transponder effective to receive an account number wirelessly, or a smart card reader. An illustrative example of a transponder payment device is disclosed in U.S. Patent No. 6,073,840, "Fuel Dispensing and Retail System Providing for Transponder Prepayment," the disclosure of which is incorporated herein in its entirety. Payment device 106 may alternatively comprise an optical reader effective to detect and interpretive visual indicia such as a bar code. An illustrative example of a bar code reader payment device is disclosed in U.S. Patent No. 6,062,473, "Energy Dispensing System Having a Bar Code Scanning Unit," the disclosure of which is incorporated herein in its entirety. Additionally or alternatively, the payment devise 106 may be effective to recognize the consumer, either to thereby associate an account number with the consumer, or as a security measure to validate an account number oth-

erwise received. This may comprise, for example, a camera and associated facial recognition system. As an example of a retail transaction station having a camera incorporated therein, the disclosure of U.S. Patent No. 6,032,126, "Audio and Audio/Video Operator Intercom for a Fuel Dispenser" is incorporated herein in its entirety. Alternatively, a payment devise 106 with customer recognition may include a biometric sensor, for example, a camera effective to detect and interpretive eye iris patterns, a fingerprint detector, or the like.

The retail transaction station 100 additionally includes an output 104 to facilitate communication with the customer. Output 104 may present the customer with instructions, and various menus or other selections of goods and/or services available for purchase.

[0017] Output 104 may comprise a text or graphic output display or, may be audible. Additionally, output 104 may provide for the actual delivery of goods in electronic form. This may be accomplished through communication to a secondary devise, such as a computer in the consumer's automobile, a PDA or laptop computer, a mobile telephone terminal, a musical playback device, or the like. Connection to the secondary device may be through a wired connection, as through a plug provided on the retail transaction station 100, or over a wireless radio or optical connection.

[0018] In the embodiment depicted in Figure 1, the retail transaction station 100 contains a keypad 102a and microphone 102b as input devices. The retail transaction station 100 additionally contains a display 104a, a speaker 104b, and a radio frequency transmitter 104c as output devices. The retail transaction station 100 includes a noise cancellation system which comprises an acoustic detector 32, a controller 34, and a transducer 36, which are shown schematically in Figure 2.

[0019] Detector 32 detects the ambient noise to be cancelled. In general, detector 32 is a transducer operative to transform sound pressure waves in the air into an electrical signal that is representative of the pressure waves. That signal is referred to herein as the ambient noise signal. In the embodiment shown in Figure 1, detector 32 is a microphone disposed in the housing of retail transaction station 100. As is discussed further herein, however, the detector 32 may, in general, be placed in a wide variety of positions and orientations, as may be advantageous for a given application. Additionally, the detector 32 may comprise a unidirectional microphone, detecting sounds only from a particular direction, or it may comprise an omni directional microphone, detecting sounds from all directions, as appropriate.

[0020] Controller 34 receives the ambient noise signal from the detector 32 and generates a noise cancelling signal responsive to the ambient noise signal. The noise cancelling signal is, in general, identical to the ambient noise signal, but with an opposing phase relationship. In other words, the amplitudes of the ambient noise signal and the noise cancelling signal are generally 80 degrees out of phase and thus act to cancel each other out.

[0021] The controller 34 may include a high-speed digital signal processor (DSP) and associated memory and logic. The incoming ambient noise signal is digitised and then analysed by the DSP. Under software control, the DSP generates data representing a noise cancelling signal. This data is converted to an analog electrical signal that is output from the controller 34 as the noise cancelling signal.

[0022] The advantages of using a high-speed DSP in controller 34 are numerous. DSPs operate under software control, and thus may employ different noise cancellation algorithms as may be most advantageous for a given application. Another significant advantage of a DSP is the ability to employ adaptive noise cancellation. In adaptive noise cancellation, data concerning certain recurring or repetitive ambience noises is stored in memory. When the DSP recognises a similar noise pattern in the incoming ambient noise signal, it can retrieve the stored data, significantly reducing the need for computation and increasing response speed and accuracy. Adaptive noise cancellation may be particularly useful in the present invention where, for example, a fuel dispensing service station is located near a recurring and identifiable source of noise, such as an airport or a fire station. However, controller 34 of the present invention is not limited to a DSP, and could for example be implemented with a microprocessor or microcontroller, or could comprise all analog circuits.

[0023] Transducer 36 receives the noise cancelling signal from the controller 34, and transforms that signal into a cancelling noise. The cancelling noise is directed into the zone or area where suppression of ambient noise is desired, depicted in Figure 1 at 38. As used herein the area around a fuel dispenser or retail transaction station refers generally to the area immediately surrounding the dispenser or station, in which a consumer would normally stand when interacting with the dispenser or station. The transducer 36 preferably comprises one or more speakers positioned and directed at zone 38.

[0024] In some applications, the effectiveness of noise cancellation system 30 may be enhanced by adding additional components. In particular, a secondary detector, which in a given application may comprise the detector 32 or may alternatively comprise an additional microphone or vibration sensor, deployed within the noise cancellation zone 38 to monitor the effectiveness of noise cancellation system 30. The secondary detector may generate an error signal that can be fed back into the controller 34, for fine-turning the generation of the noise cancelling signal. For a more complete understanding of noise cancellation technology and methodology, the reader is directed to U.S. Patent No. 6,078,672 issued to Saunders et al., entitled "Adaptive Personal Active Noise System," and containing an extensive discussion of prior art in the field, the disclosure of which is incorporated herein in its entirety.

[0025] As depicted in Figure 1, components of the

noise cancellation system in the retail transaction station 100 may be oriented so as to substantially reduce ambient noise in a particular area or zone 38 around the retail transaction station 100. Alternatively, the components might be oriented so as to reduce ambient noise in all directions around the retail transaction station 100. This may provide the most cost-effective solution in certain applications, as it allows for both sides of retail transaction station 100 to share a common detector 32 and transducer 36, as well as controller 34. However, the use of a separate detector 32 and transducer 36 may be justified by the greater effectiveness of noise cancellation within a narrowly targeted zone 38 on one side of retail transaction station 100 only.

[0026] Figures 3 and 4 illustrate various relationships between the detector 32 and the desired zone 38 of noise cancellation, in relation to a particular source of ambient noise. In both cases the source of the ambient noise is a lorry 40 situated remotely from the retail transaction station 100.

[0027] Figure 3 depicts a feedback noise cancellation configuration, wherein detector 32 is within the zone 38 of desired noise reduction. The controller 34 operates to generate the noise cancelling signal in response to ambient noise detected within zone 38. This is the configuration depicted in Figure 1, and it is the most common noise cancellation system configuration, equally effective at cancelling or reducing all detected noise.

[0028] Figure 4 depicts what is typically referred to as a feed forward noise cancellation configuration. Detector 32 is located a known distance 'd' remotely from transducer 36 in the direction of a known source of ambient noise 40, and outside of noise reduction zone 38. Controller 34 analyses the ambient noise signal and predicts its arrival time at the zone 38, generating the noise cancelling signal so as to cancel the ambient noise at its arrival. In some environments, a feed forward noise cancellation system provides more effective noise cancellation, as controller 34 may take advantage of the travel time of ambient noise across distance 'd' to analyse the ambient noise signal and to generate a noise cancelling signal. A feed forward noise cancellation configuration may be advantageous when the bulk of ambient noise is localised, for example, a service station located next to a highway, a factory, or other noise source. On the other hand, a feed forward system is less effective at cancelling noise from other sources, such as those located near or within zone 38.

A description of another embodiment of the present invention is made with reference to Figure 5, depicting a fuel dispenser, indicated generally at 10. The fuel dispenser 10 includes a fuel dispenser housing 12 that contains various pumps, hydraulics, and other electronics (not shown) necessary to perform the fuel dispenser function of transferring fuel from one or more storage tanks (not shown) into a customer's motor vehicle. The fuel dispenser 10 also includes a pump nozzle 14 connected to a hose 16. The hose 16 is connected in fluid flow relationship with a fuel pump (not shown) in the fuel dispenser housing 12.

[0029] Fuel dispenser 10 also contains a display 18 disposed in the fuel dispenser housing 12. The display 18 indicates to the customer information relating to the fuel purchase transaction, such as the price of various grades (or octane levels) of fuel available, and a continuously updated readout of the volume of fuel dispensed and the total price. Additionally, the fuel dispenser 10 contains a card reader 20 disposed in the fuel dispenser housing 12 for reading data such as a credit card account number from the magnetic stripe of a customer's credit card. A keypad 22 or similar array of buttons are provided for customer input, such as selecting fuel grade, accepting or declining a printed receipt, and the like. A receipt printer 24 is also disposed in the fuel dispenser housing 12 for printing a receipt containing an accounting of the fuel purchase transaction.

[0030] The fuel dispenser 10 of Figure 5 is illustrative only, and the present invention is applicable to other types of fuel dispensers other than that shown in Figure 5. Modern fuel dispensers may contain a broad array of additional mechanisms for accepting payment and for otherwise communicating with the customer. For a more complete understanding of the fuel dispenser and its constituent components, the reader is referred to U.S. Patent No. 5,602,745, "Fuel Dispenser Electronics Design," the disclosure of which is incorporated herein in its entirety.

[0031] Like the retail transaction station 100 of Figure 1, the fuel dispenser 10 is provided with a noise cancellation system 30 that functions much like that described above.

That is, the noise cancellation system 30 associated with the retail transaction station 100 includes a noise detector 32, a controller 34, and a transducer 36, which in combination are operative to substantially reduce the ambient noise within zone 38 around the fuel dispenser 10.

[0032] Figure 6 shows a plurality of fuel dispensers 50, as may be arrayed at a typical service station. Each fuel dispenser 50 is operative to independently dispense fuel at each of two sides. Each fuel dispenser 50 is fitted with a transducer 36 on each side, which projects a cancelling noise to produce a zone 38 of noise reduction adjacent to each side of each fuel dispenser 50. In this embodiment, a single detector 32 is located remotely from the fuel dispensers 50, preferably oriented towards the greatest source of ambient noise, for example, an adjacent highway. Detector 32 generates an ambient noise signal that is sent to site controller 54. Site controller 54 is functionally equivalent to the controller 34 as discussed above, but with a plurality of outputs 56, each of which carries a separate noise cancelling signal from the site controller 54 to a transducer 36 located at each side of fuel dispensers 50.

[0033] Many service stations already employ a site controller operative to control the dispensing actions of

the fuel dispensers 50, remote transaction stations 100, and the like, and to conduct credit card transaction processing. For example, a site controller is disclosed in U.S. Patent No. 6,067,527, "Point of Sale System, Method of Operation Thereof and Programming for Control Thereof," the disclosure of which is incorporated herein in its entirety. The noise cancellation functionality of controller 34 may be advantageously added to existing site controller functions for further cost savings. Alternatively, site controller 54 may comprise an independent unit dedicated to noise cancellation processing.

[0034] The embodiment of the present invention as depicted in Figure 6 present several advantages over individual fuel dispensers 10 having complete noise cancellation systems such as depicted in Figure 5. Significant cost savings may be realised as only a single detector 32 and one site controller 54 are required to provide noise cancellation capability to a plurality of fuel dispensers 50. Hence, detector 32 may be of higher quality, and site controller 54 of greater processing power, than might be feasible with the individualised noise cancellation system of Figure 5.

[0035] The embodiment of Figure 6 is particularly advantageous in environments in which the feed forward noise cancellation configuration depicted in Figure 4 is applicable. By positioning the single site detector 32 between the fuel dispensers 50 and a known source of noise, *e.g.*, a highway, airport, or the like, site controller 54 may be able to more efficiently suppress noise in zones 38 around fuel dispensers 50.

[0036] Several variations of the configuration depicted in Figure 6 are possible. For example, each fuel dispenser 50, or each side of each fuel dispenser 50, may be provided with a controller 34 for generation of the noise cancelling signal, with the ambient noise signal being provided by the single detector 32. Alternatively, further cost savings may be possible over the system as depicted in Figure 6, for example by using a single transducer 36 to provide a noise reduction zone 38 encompassing both sides of each fuel dispenser 50, or alternatively encompassing more than one fuel dispenser 50. In some situations, one or more transducers 36 may be shared by multiple fuel dispensers 50, e.g. by locating the transducers 36 in the canopy of a fuelling forecourt. Thus, the noise reduction zone 38 would encompass multiple fuel dispensers 50.

[0037] Additionally, in the configuration depicted in Figure 6, at least some of the ambient noise present at each fuel dispenser 50 is the result of noise generated by one or more of the other fuel dispensers 50 located nearby. Thus, it may be advantageous in certain situations to position one or more detectors 32 such that they detect and cancel the noise generated by the adjacent or nearby fuel dispensers 50.

[0038] Although the present invention has been described herein with respect to particular features, aspects and embodiments thereof, it will be apparent that numerous variations, modifications, and other embodiments are possible within the scope of the appended claims.

Claims

1. A retail transaction station (100) having a noise cancellation system (32, 34, 36) for substantially reducing noise existing in an area (38) around said station (100).

2. The station of claim 1, wherein said noise cancellation system includes:

   a noise detector (32) for detecting noise around said station (100) and producing a noise signal that is representative of the noise;
   a controller (34) for receiving said noise signal from said detector and generating a noise cancelling signal; and
   a transducer (36) operatively connected to the controller (34) for receiving said noise cancelling signal and producing a cancelling noise that substantially reduces the noise around said station.

3. The station of claim 2, wherein said detector (32) comprises a microphone located within the area around said station and wherein said controller (34) operates in a feedback mode.

4. The station of claim 2, wherein said detector comprises a microphone (32) located remotely from said station and wherein said controller (34) operates in a feed forward mode.

5. The station of claim 2, 3 or 4 wherein said transducer comprises one or more speakers (36) arranged and configured so as to broadcast said cancelling noise in the area around said station (100).

6. The station of any one of claims 2 to 5, wherein said controller (34) comprises a digital signal processor and associated circuits.

7. The station of any one of claims 2 to 6 wherein said controller is programmed to recognise recurring noises in said area around said station and responsively utilise stored data related to said recurring ambient noises to generate said noise cancelling signal.

8. The station of any one of claims 2 to 7 wherein said detector comprises a microphone (32) positioned so as to detect noises generated by said station (100) and wherein said transducer comprises one or more speakers (36) positioned so as to substan-

tially reduce said noises generated by said station.

9. The station of any proceeding claim for cancelling ambient noise, wherein said noise detector detects ambient noise.

10. The station of any preceding claim comprising a fuel dispenser (10).

11. The station of any preceding claim including:

an input device (22) for ordering goods or services;
an output device (18) for communication with customers;
a payment device (20) for effectuating payment for the goods or services; and a noise cancellation system (32, 34, 36) for substantially reducing ambient noise in the area (38) around said retail transaction station.

12. The device of claim 11 wherein said input comprises a tactile interface (22).

13. The station of claim 11 or 12 wherein said input device comprises a speech recognition system.

14. The station of claim 11, 12 or 13 wherein said output produces an audible communication.

15. A service station, comprising:

a plurality of fuel dispensers (50) as claimed in claim 10 co-located in the service station, wherein each of said plurality of fuel dispensers has two fuelling sides; and
at least one noise cancellation system (32, 34, 36) associated with at least one fuelling side of each said plurality of fuel dispensers, and operative to substantially reduce ambient noise in the area (38) around at least one side of each said fuel dispenser.

16. The station of claim 15 wherein said noise cancellation system comprises:

a microphone (32) positioned to detect ambient noise common to two or more of the plurality of said fuel dispensers (50) in the service station, which microphone produces a noise signal that is representative of the ambient noise;
a controller associated with each of said plurality of fuel dispensers for receiving said noise signal from said microphone and generating a noise cancelling signal; and
a speaker (36) associated with each of said plurality of fuel dispensers, said speaker operatively connected to said controller for receiving said noise cancelling signal and producing a cancelling noise that substantially reduces the ambient noise in the area around at least one side of each said fuel dispenser.

17. The station of claim 15 or 16 wherein said controller (34) associated with one of said plurality of fuel dispensers is programmed to recognise said noise signal from other said plurality of fuel dispensers (50) in order to produce said cancelling noise.

18. The station of claim 15, wherein said noise cancellation system comprises:

a microphone positioned to detect ambient noise common to two or more of the plurality of said fuel dispensers (50) in the service station, and produce a noise signal that is representative of the ambient noise;
a site controller (54) for receiving said noise signal from said microphone and generating a noise cancelling signal; and
a speaker associated with each of said plurality of fuel dispensers, said speaker operatively connected to said site controller (54) for receiving said noise cancelling signal and producing a cancelling noise that substantially reduces the ambient noise in the area (38) around at least one side of each said fuel dispenser.

19. A method of reducing ambient noise in an area around a fuel dispenser (50), the method comprising: detecting ambient noise in the area around said fuel dispenser; generating a noise signal that is representative of the ambient noise; processing said noise signal to generate a noise cancelling signal; generating a cancelling noise from said noise cancelling signal,; and directing said cancelling noise into the area around said fuel dispenser; whereby the ambient noise in the area around the fuel dispenser is substantially reduced.

20. A method of reducing ambient noise at a service station having a plurality of co-located fuel dispensers (50), the method comprising:

detecting ambient noise in the area around the service station;
generating a noise signal that is representative of the ambient noise;
processing said noise signal to generate a noise cancelling signal;
generating a cancelling noise from said noise cancelling signal; and
directing said cancelling noise into the area around said plurality of co-located fuel dispensers;
whereby said ambient noise in the area around

said plurality of co-located fuel dispensers is substantially reduced.

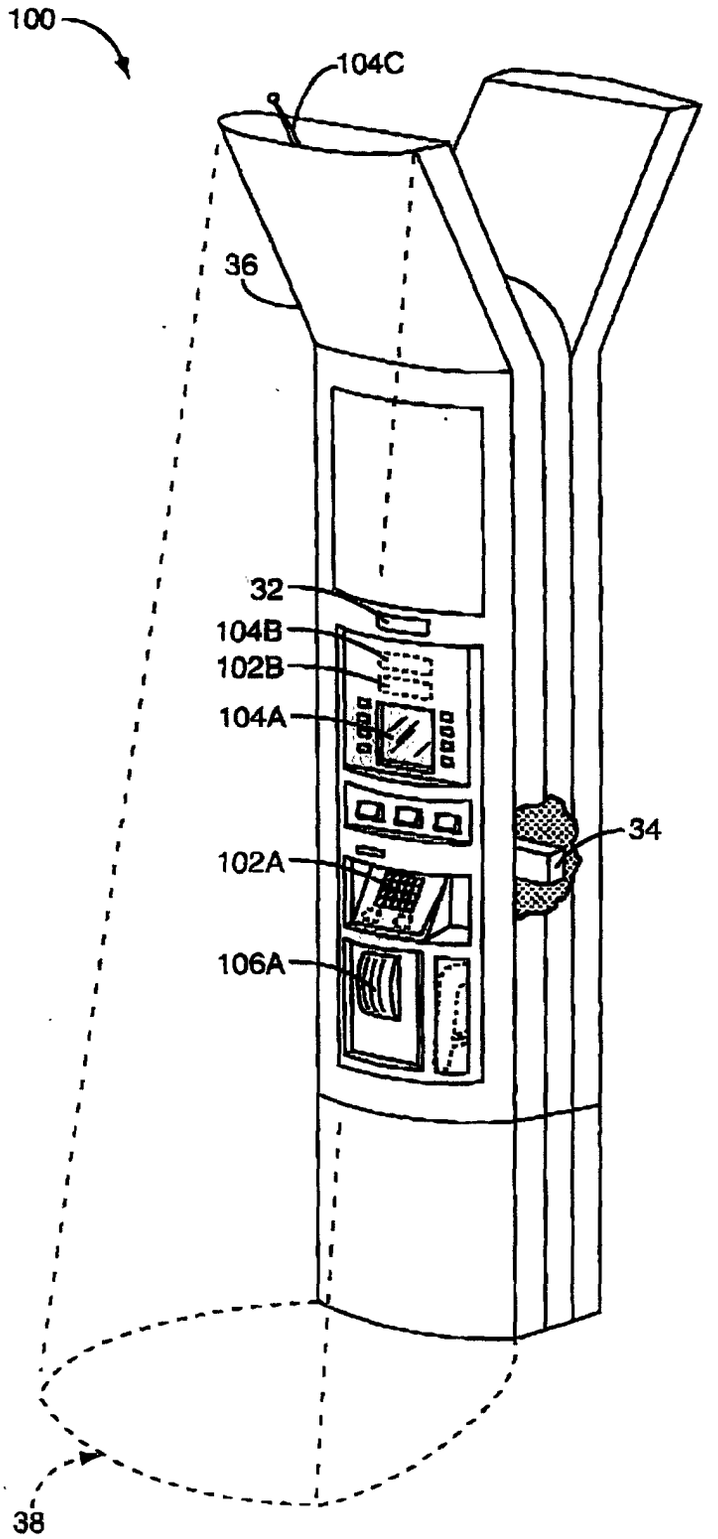

FIG. 1

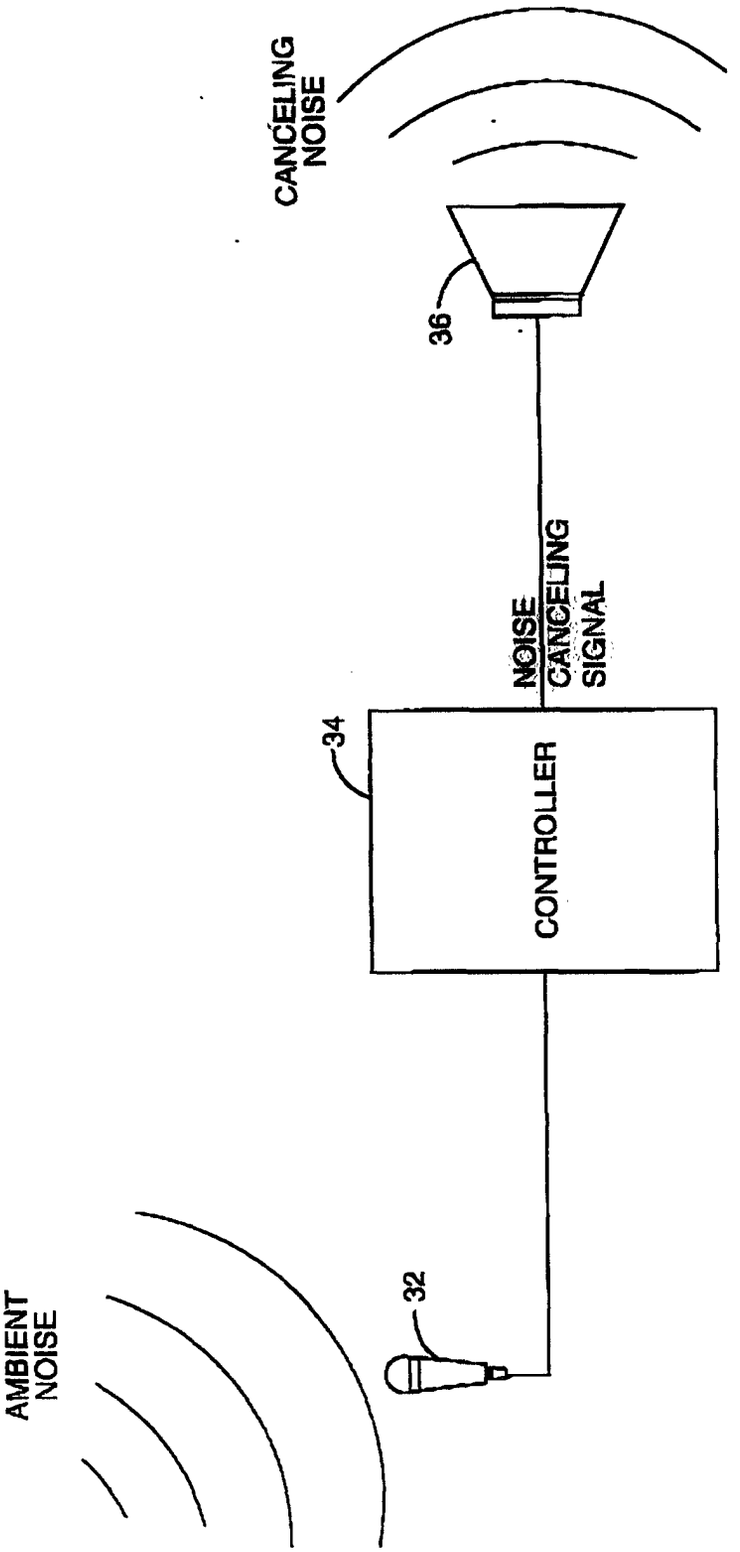
CANCELING NOISE
36
NOISE CANCELING SIGNAL
34
CONTROLLER
32
AMBIENT NOISE

FIG. 2

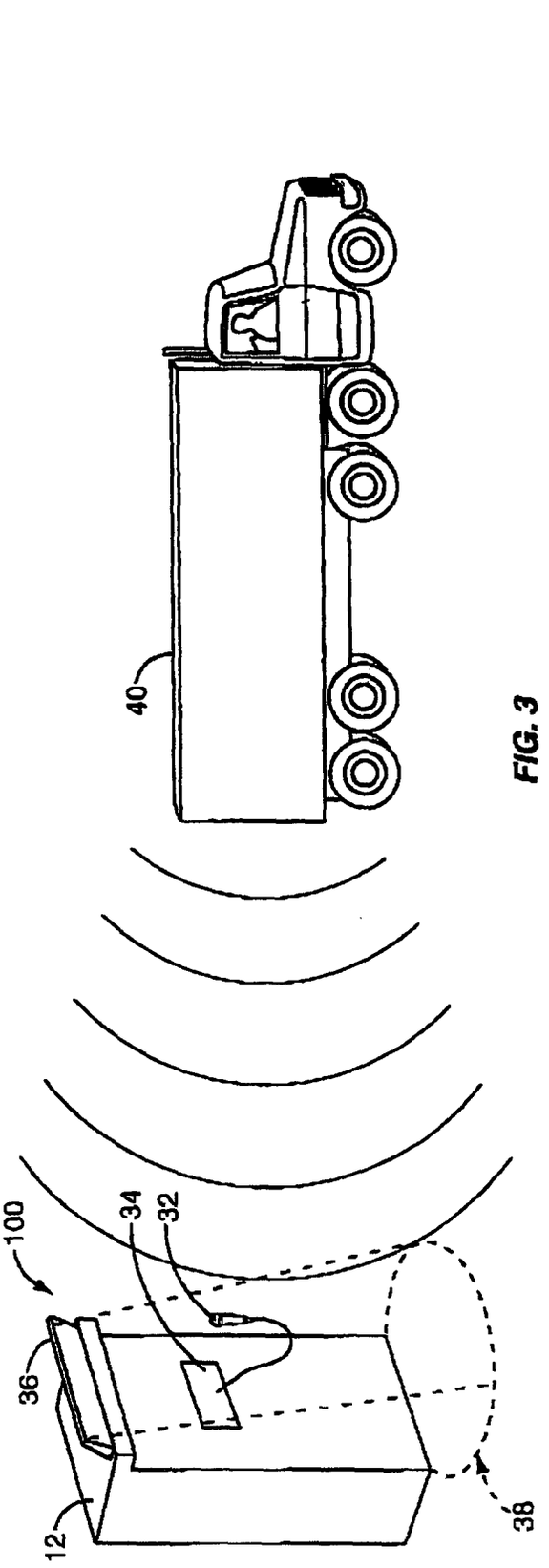

FIG. 3

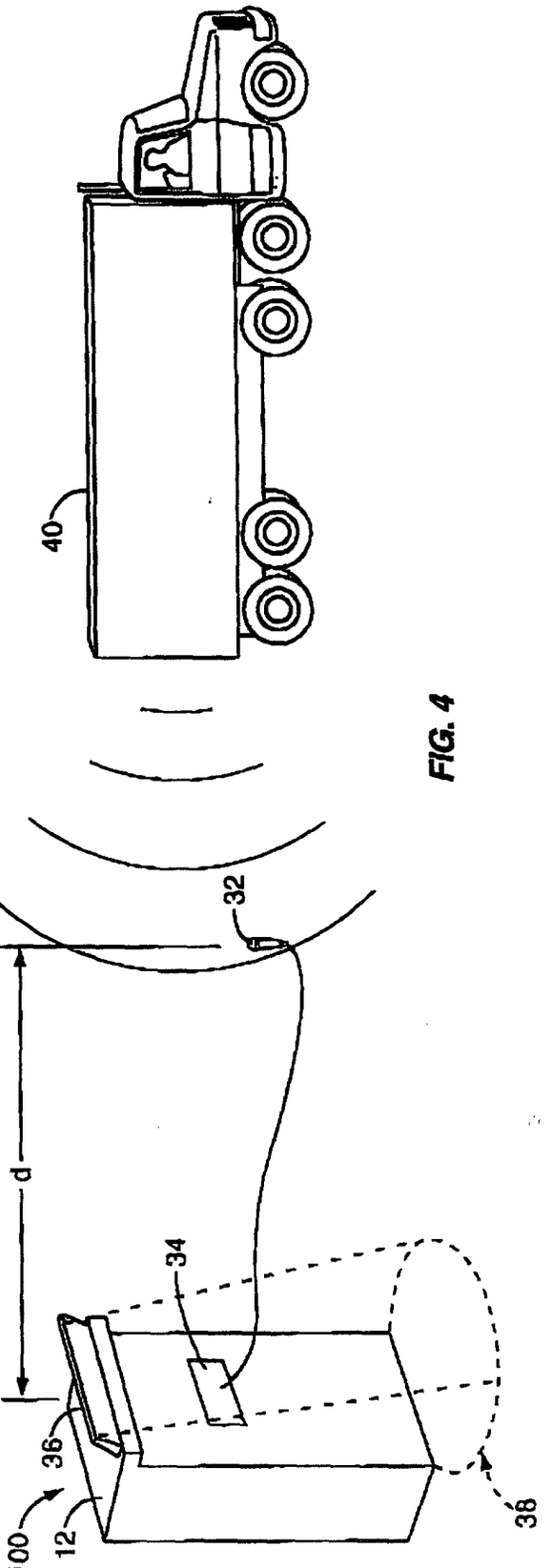

FIG. 4

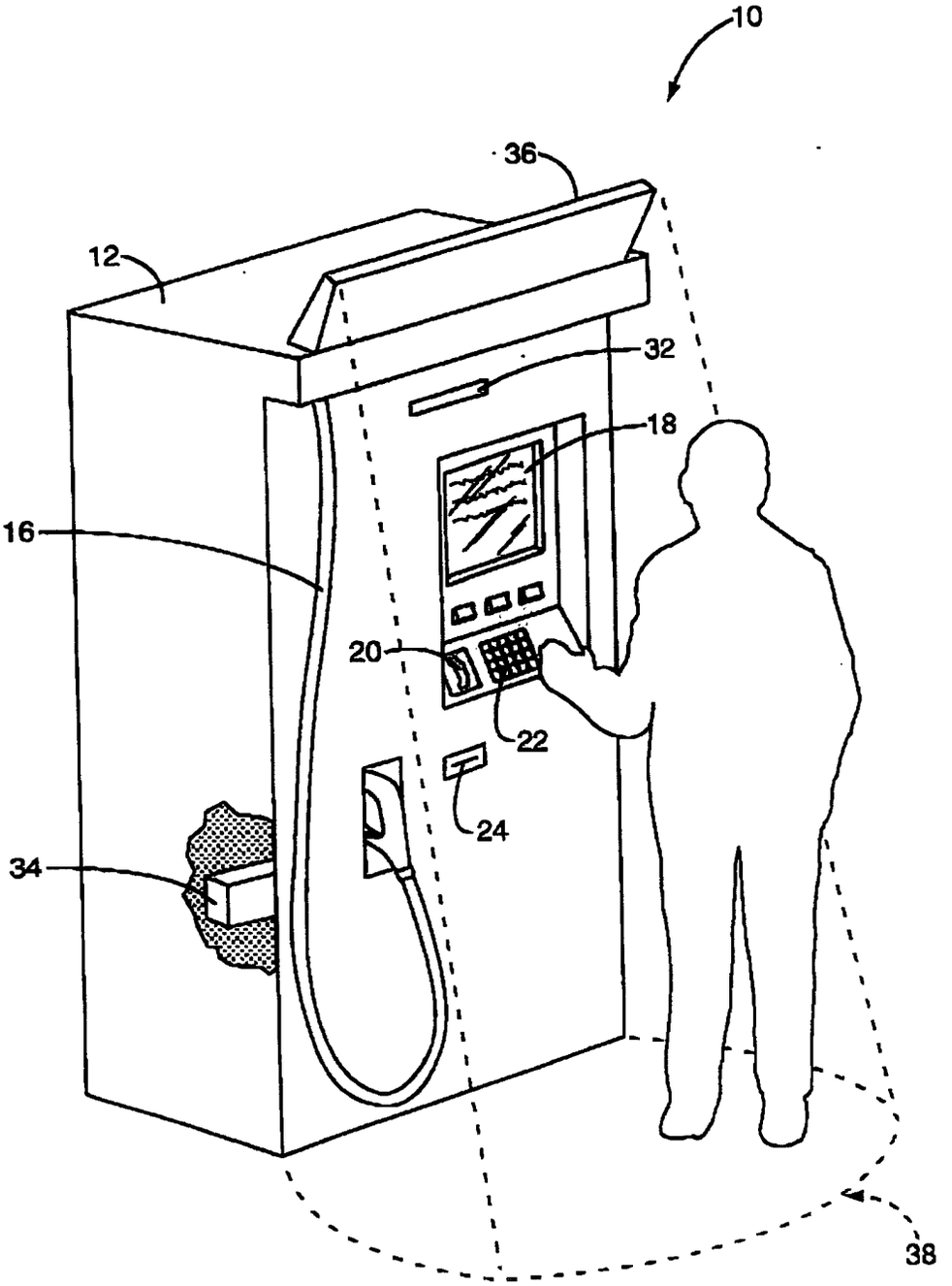

FIG. 5

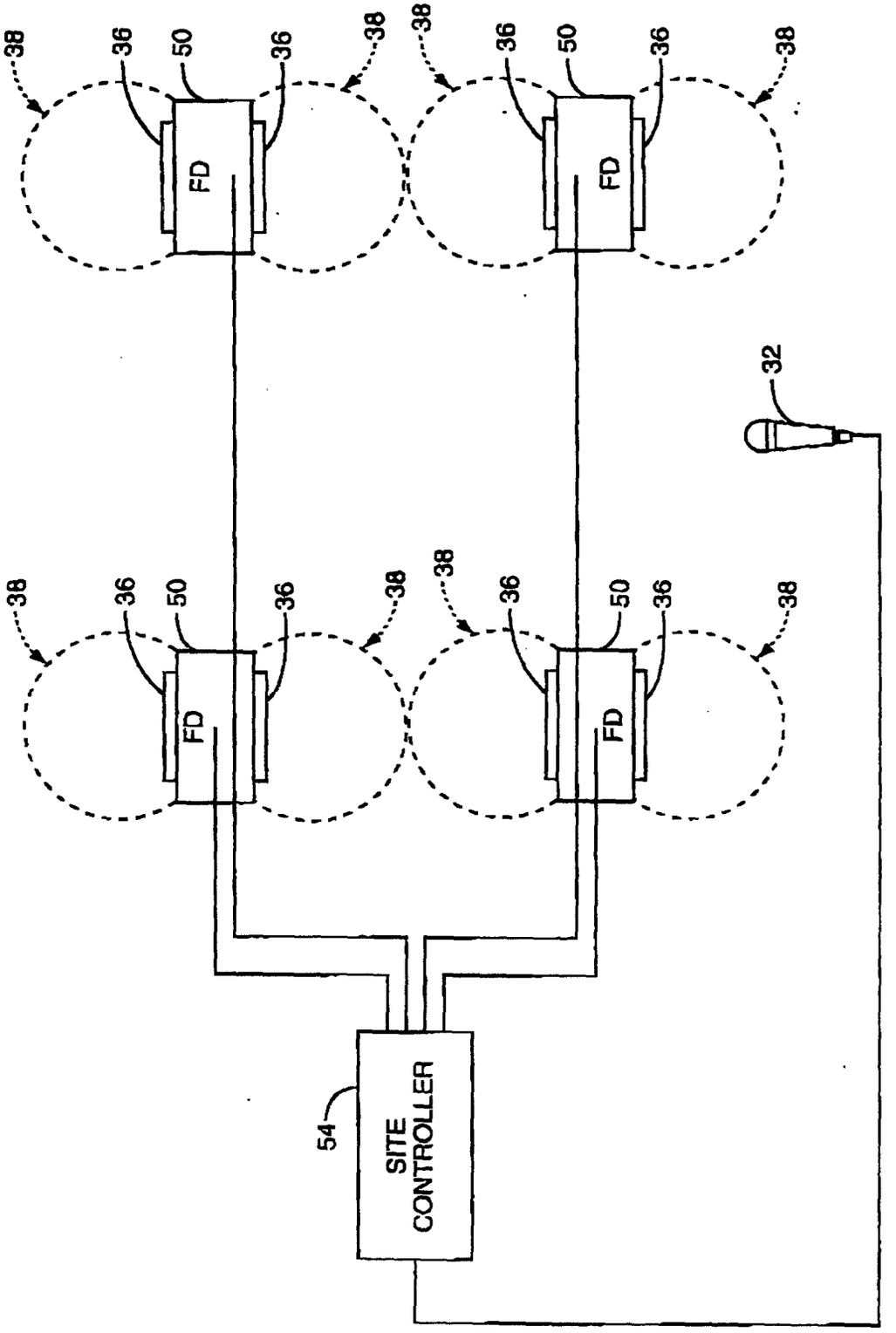

FIG. 6