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GAS-POWERED AND-CONTROLLED FOGHORN

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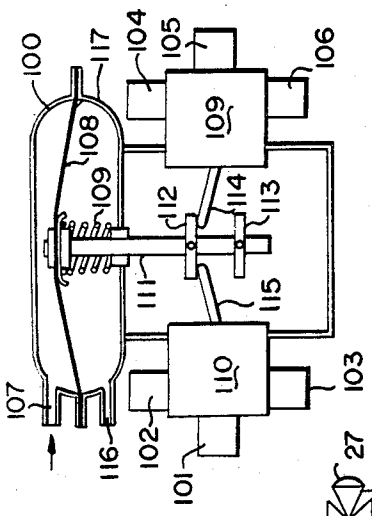


FIG. 2

FIG. 1

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GAS-POWERED AND CONTROLLED FOGHORN

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The present invention relates to fog warning devices and, particularly to gas powered fog-horns which are fail-safe.

With the development of off-shore oil drilling, the presence of great numbers of off-shore drilling rigs has created a considerable hazard to boats navigating those waters. Not only are hazards created by the mere physical presence of the drilling rigs themselves, but to a large extent they are due to the increased water traffic caused by the normal operation of the rigs. That is, a great increase in traffic results from the necessity of providing transportation for the crews who work on the rigs and for the parts and supplies necessary to maintain their operation. These boats, then, that transport the men and supplies are thus added to the already present traffic of fishing boats and other such craft as are customarily found in such coastal waters, as for example, the Gulf of Mexico, an area which presently contains a relatively large number of off-shore drilling rigs and constructions. Thus, there is the necessity for providing navigational warning devices on these constructions, which devices must comply with stringent Coast Guard requirements designed to prevent, or at least minimize collisions therewith. This is especially so with respect to fog warning devices and fog horns, in particular.

Heretofore, it has been common practice on such off-shore constructions to utilize fog-horns for providing the standard two second blast and eighteen second period of silence, where the power for such horns is supplied by a pair of diesel engines and compressors arranged such that one engine and compressor normally drives the horn, and in case of failure, for any reason, the other engine and compressor are automatically connected to the horn in order to supply the required power. In this manner a fail-safe system has been provided.

However, it has been generally found that installation and maintenance costs of such a system are extremely high. In addition, the necessities which are incident to such a system, such as the continuous supplying of appropriate fuel therefor, places an even greater burden on the water traffic in the vicinity thereabout. Thus, the twin diesel and compressor systems heretofore available and presently used represent, at best, an uneconomical method of providing the power and timing means for driving off-shore fog-horns in a fail-safe manner.

Accordingly, it is an object of the present invention to provide a fail-safe fog-horn system which does not require auxiliary power equipment and which can be directly powered by the supply of natural gas which is generally found at the site of such off-shore drilling rigs. The present invention utilizes a gas storage tank which is fed by two gas supply lines, a primary and secondary supply, respectively. The gas output lines from the storage tank provide a gas flow which is capable of driving a gas control system which includes a primary and secondary timer. The gas control system provides two general functions. First, it provides the standard two second blast and eighteen second period of silence; and secondly, it provides a means for switching, or changeover, from the primary timer to the secondary timer in such case where the horn fails to blow for a period longer than one minute. In this manner the present invention provides a fail-safe fog-horn system which is in compliance with the Coast Guard regulations therefor. The system requires only the

source of natural gas, which is generally available at such off-shore drilling rigs, as previously mentioned, and eliminates the need for any diesel power equipment or internal combustion engines which would require the transportation of fuel to such construction sites. The system of the present invention utilizes generally pneumatic components which are commercially available and the cost of the system is only approximately one-fifth of the cost of the twin diesel and compressor system commonly used for such purposes. Furthermore, the system of the present invention provides even greater reliability as compared with the reliability of a system which is supplied by diesel power.

In addition to the provision of primary and secondary timers, the secondary timer acting as a back-stop for the primary timer, the system also provides a primary gas supply as well as a secondary gas supply, which adds an additional safety factor. Therefore, should the primary gas supply system freeze, which might be the most common cause of trouble in the supply, the secondary gas supply would automatically take over. The secondary supply contains means for removing the water vapor in the gas through the use of a dry desiccant dehydrator, which obviates the possibility of the secondary supply freezing. When the primary supply thaws out, it then returns to operation. The secondary supply will then cease and the system will draw only on the primary supply in a manner to be described hereafter.

The gas control system, in accordance with the present invention, comprises three snap-action pilots which are pressure differential responsive and which control three-way microvalves. The primary timer comprises a first snap-action pilot and valve unit which is so connected and arranged such as to provide timing and cycle control for the horn. The secondary timer is similar to the primary timer and is connected to provide the same timing and cycle functions as the primary timer. The secondary timer, ordinarily, during normal operation remains inactive, serving only as a back-stop unit to the primary timer. The third snap-action pilot and valve unit together with pressure integrating means serve the function of maintaining the primary timer operating during normal horn operation. However, when the horn fails to operate for a predetermined period of time, e.g., a period of one minute, the third snap-action pilot and valve unit automatically switches the gas powered horn system to the secondary timer.

It is thus another object of the present invention to provide a gas powered fog-horn having greater reliability of operation than any system heretofore known.

It is still another object of the present invention to provide a fog-horn system which is more economical, both in initial cost and in maintenance cost, than any system heretofore known.

It is a further object of the present invention to provide a gas powered fog-horn which comprises a dual gas supply line and primary and secondary pneumatic timer systems to achieve an extremely high degree of reliability in the operation of the horn.

The above and still further objects, features and advantages of the present invention will become apparent upon consideration of the following detailed description of one specific embodiment thereof, especially when taken in conjunction with the accompanying drawing, wherein:

FIGURE 1 is a schematic diagram of the system in accordance with the present invention, and

FIGURE 2 is a diagrammatic illustration of the construction of a snap-action pilot and valve unit utilized in the present invention.

Referring now to FIGURE 1 there is illustrated, in schematic form, the entire system in accordance with the present invention. The system can be divided into three

general subsystems; namely, the gas supply system **200**, the horn feed system **300** and the gas control and timing system **400**. The gas supply system **200** comprises generally two gas supply pipes **34** and **37**, a dryer **35** and a volume and liquid fallout storage tank **39**. The primary source of gas is supplied by a primary supply pipe **37** through a ¼-inch needle valve **38** to a ¼-inch pressure regulating valve **36**. The output of valve **36** is connected to the volume and liquid fallout storage tank **39**. A secondary supply of gas is provided by the secondary supply pipe **34** which is connected to the dryer **35** through a ¼-inch needle valve **33**. The output of the dryer **35** is also coupled to the volume and liquid fallout storage tank **39** through a ¼-inch pressure regulating valve **32**. A 150-lb. gauge **31** is connected to the system between the pressure regulator **32** and the tank **39** in order to monitor the pressure at this point.

Two output pipes **55** and **56** connect the gas supply system to the horn feed system by each supplying gas from tank **39** as shown in FIGURE 2 through two ¾-inch, 150 lb. needle valves **28** and **29**. The output of each needle valve is coupled to connections **71** and **72**, respectively, each of which provides a branch to couple the storage tank outputs to ¾-inch quick open diaphragm valves **24** and **27**, and also to pipes **58** and **59** which are both coupled to pipe **57**. Pipe **57** joins the horn feed system **300** to the gas control system **400** and branches at junction **74**, diverting the gas flow to pipes **60** and **61**.

Pipe **61** is connected to dryer **19**, which in turn, is connected to a filter **18** (for example, of the cellulose type) through pipe **62**. The output of filter **18** is connected to pressure regulator **20** (Fisher Governor Company type Series 67 Regulator such as described in Fisher Catalog No. 96–769F) which is connected to the common port **44** of microwave **81**, associated with the changeover snap-action pilot and valve unit **92**. A fifty pound pressure gauge **17** is provided between the pressure regulator **20** and the aforesaid common port **44**. Pipe **95** connects the port **47** of microvalve **81** to the normally open port **45** of the microvalve **84**, associated with the secondary timer **91**. Pipe **96** connects the port **46** of microvalve **81** to the normally open port **50** of microvalve **82**, associated with the primary timer **90**. The common port **49** of the microvalve **82** is connected to an adjustable orifice valve **16**, (such as the Manatrol check, needle and flow control valve illustrated in the Womack Machine Supply Company Designers Manual and Catalog 365E at page 61), the output of which, is connected to the upper diaphragm chamber of the snap-action pilot **12** (for example, of the type illustrated as Model No. 664–CDM–2501–B2 in the March 1963 National Tank Company catalog). The normally closed port **48** is terminated with an adjustable orifice valve **15** (of the same general type as valve **16**). Similarly, the common port **43** of microvalve **84** is connected to an adjustable orifice valve **14** (of the same general type as valve **16**), the output of which, feeds the upper diaphragm chamber of the snap-action pilot **10** (of the same general type as pilot **12**). The normally closed port **42** is terminated with an adjustable orifice valve **13** (of the same general type as valve **16**).

Microvalve **85**, associated with the secondary timer **10**, utilizes only two ports **51** and **52**, while microvalve **83**, associated with the primary timer **90**, also utilizes only two ports **53** and **54**.

Referring now to microvalve **83**, the common port **54** is connected to a quick-open diaphragm valve **27** (for example National Tank Company Model No. 657–DSG–7501) via pipe **97**, while the common port of microvalve **85** is connected to the quick-open diaphragm valve **24** (of the same general type as valve **27**) via pipe **98**. Both the normally closed ports **51** and **53** are joined to pipe **76** at junction **75** which is connected to junction **74** through a ¼-inch pressure regulator valve **23** (of the same general type as regulator valve **20**). The junction **75** has also provided thereat, a fifty-pound pressure gauge **22**, for measuring the pressure at that point. The upper diaphragm chamber **7** of the changeover snap-action pilot **11** is connected to junction **5** at the mouth of the volume bottle **99**. Also coupled thereto is an adjustable orifice valve **21** (of the same general type as orifice valve **16**), the output of which is connected to junction **8** via a ½-inch pipe **9**. Junction **8** is interposed in the ¾-inch pipe **40**, which directly feeds the horns **41**. Pipe **40** terminates, on the opposite end, at junction **6** which couples two ¾-inch check valves, **25** and **26**, thereto. The input ports of valves **25** and **26** are connected to the output ports of the quick-open diaphragm valves **24** and **27**, respectively.

In the operation of the system, both the primary supply pipe **37** and the secondary supply pipe **34** feed gas to the volume and liquid fallout storage tank **39** until the pressure inside the tank reaches 60 pounds. At this time the secondary supply cuts off and the primary supply continues providing gas until the pressure reaches 70 pounds. The primary supply pressure regulator **36** is set to feed or hold a continuous pressure of 70 pounds on the storage tank **39**. The secondary regulator **32** is set to hold 60 pounds. Since the primary supply regulator pressure is maintained at a higher value than the secondary supply pressure, as long as the primary regulator holds 70 pounds, the secondary does not provide any gas to the storage tank **39**. However, should the primary regulator freeze off or not operate, causing the pressure to drop below 60 pounds, the secondary regulator would maintain a pressure of 60 pounds on the volume tank, which pressure is sufficient for satisfactory system operation. Thus, the utilization of a primary and secondary supply to provide the gas necessary for the operation of the system assures a greater probability of reliable operation.

The greatest cause of potential trouble in the gas supply system, as previously mentioned, is the freezing of the lines of supply. If the primary gas supply freezes and the secondary gas supply begins to operate, there is little possibility that the secondary gas supply will also freeze, since within the secondary supply line is located the dry desiccant dehydrator **35**. When the primary system thaws, it then returns to operation and the dry desiccant dehydrator in the secondary supply line may then be changed or renewed. A dehydrator or dryer, might also be placed in the primary supply, however, this would tend to increase the maintenance required since it would then be necessary to change or renew two desiccants instead of one.

Carried with the gas, which is supplied by the primary and secondary supply pipes, will be a certain amount of liquid which will settle in the storage tank **39** and be forced back into the pipe line through a blow case connection from the volume tank drain, as will be explained in greater detail hereinafter. Both pipes **55** and **56** carry the gas under pressure from the storage tank **39** through needle valves **28** and **29** to the input ports of valves **24** and **27**. However, since the quick-open diaphragm valves **24** and **27** are normally in a closed position, the gas flows through pipes **58** and **59** to junction **73** and then through pipe **57** to junction **74**. There, the gas is diverted to pipes **60** and **61**. The gas flowing through pipe **61** is dehydrated, or dried, in dryer **19** and passed through filter **18** via pipe **62** in order to assure trouble free operation of the snap-action pilots **10**, **11** and **12** and the equipment associated therewith. The elimination of foreign particles and water from the gas flow reduces corrosion and failure of the parts due to the presence of such matter, if any, in the system.

The gas is then fed to the common port of microvalve **81**, associated with the changeover snap-action pilot **11**, the operation of which is more clearly described with reference to FIGURE 2. FIGURE 2 illustrates diagrammatically the general construction of the snap-action pilots **10** and **12**. The construction of the snap-action pilot **11** is similar to **10** and **12**, but is modified in some

respects. Namely, as shown in FIGURE 1, there is only one microvalve assembly instead of the two associated with the snap-action pilots **10** and **12**, and in addition thereto, there are some internal modifications which will be described hereafter.

The three-way microvalves are represented by **109** and **110**. Each has three ports **101**, **102** and **103** associated with the microvalve **110** and **104**, **105** and **106** associated with the microvalve **109**. The microvalves **110** and **109** each have a common port **101** and **105**, respectively, which may be switched to provide a continuous flow to either port **102** or **103** on the one hand, and port **104** or **106** on the other. The switching action of each microvalve is controlled by levers **115** and **114** and the operation of such levers is provided by a reciprocable shaft **111**, having spaced apart collars **112** and **113** fixed at one end thereof. The opposite end of shaft **111** is fixed to a movable diaphragm **108** disposed in the diaphragm chamber **100** and is maintained in a normally upward position by spring **109**. Port **107** is the gas input port to the upper diaphragm chamber, while disposed in port **116** is a bleeder filter which slowly relieves the pressure in the lower diaphragm chamber **117** and permits pressure equalization thereof. In the normal position of the snap-action pilot, where spring **109** maintains diaphragm **108** biased in its upward position, as illustrated in FIGURE 2, ports **103** and **106** are in their normally open position, that is, in this position common ports **101** and **105** are each connected respectively to ports **103** and **106** to provide continuous flow therethrough. Ports **102** and **104** are closed. When the gas pressure that is supplied through port **107** into the upper diaphragm chamber is sufficiently great such as to overcome the bias force of spring **109**, the diaphragm **108** snaps into a downward position causing shaft **111** to move vertically downward and collar **112** to engage levers **114** and **115**. This action snaps each lever to its most downward position resulting in the closing of the normally open ports **103** and **106** and the opening of the normally closed ports **102** and **104** such that in this condition the common ports **101** and **105** are connected to ports **102** and **104**, respectively. When the pressure is relieved in the upper diaphragm chamber **100**, the spring **109** snaps the diaphragm **108** into its upward position moving shaft **111** in an upward vertical direction which causes collar **113** to engage levers **114** and **115** moving them into their most upward position. This action results in the snap-action pilot and valve unit returning to its original condition.

The modifications previously referred to that are required for the snap-action pilot utilized as the changeover pilot **11** are three fold. First, only one three-way microvalve **110** is required. Second, the microvalve ports are arranged such that port **103**, corresponding to port **46** in FIGURE 1, is normally closed when the diaphragm is in its upward position, while port **102**, corresponding to port **47**, is normally open. Third, the collar **112** is omitted, leaving only collar **113** on shaft **111** for reasons which will become clear hereinafter. In addition means are provided to permit manual actuation of the microvalve lever, such means being, for example, merely an opening in the housing.

Referring again to FIGURE 1, with respect to the operation of the system, the gas following the path **61**, **62** passes through the common port **44** of the changeover snap-action pilot **11** to the normally closed port **46**. Thus, initially, the snap-action pilot and microvalve lever may be depressed manually, opening the port **46** to the common port **44**, which permits the gas to flow through the pipe **96** to the normally open port **50** of microvalve **82**. Alternatively, the snap-action pilot diaphragm may be depressed initially by the gas operation of the horn through the secondary timer **91**, since port **47** of microvalve **81** and port **45** of microvalve **84** are both normally open. The gas providing the horn blasts, so initiated, flows through pipe **9** and depresses the pilot **11** diaphragm. Then, the microvalve lever may be manually depressed. (The manual depression of the lever is necessary, of course, since the collar corresponding to **112** in FIGURE 2 is not present.) This also, will permit the gas to flow from the common port **44** to the normally open port **50** of microvalve **82** in the manner aforementioned. The gas then flows to port **49** and through the orifice valve **16** to the upper diaphragm chamber of the primary timer **12**. The orifice valve **16** is adjusted to bleed off the gas flowing therethrough such that it requires a period of 18 seconds to provide sufficient gas pressure in the upper diaphragm chamber to cause the diaphragm to snap into its lower position. This action, as previously described, causes the normally closed port **48** and the normally closed port **53** to be opened to the common ports **49** and **54**, respectively, closing port **50**.

Thus, during this period of time two actions occur. First, the gas flow from pipe **57**, at junction **74**, flows through pipe **60** to port **53**, to the common port **54** of microvalve **83**, and through pipe **97** to the quick-open diaphragm valve **27**. This pressure is sufficient to open valve **27**, permitting the gas from the volume storage tank **39** to pass through pipe **56** and check valve **26** to junction **6** and up pipe **40** and to the horns **41**. Second, when the common port **49** of the microvalve **82** is connected to the port **48**, the gas pressure which has accumulated in the upper diaphragm chamber is permitted relief through the adjustable orifice valve **16** and the valve **15**, such valves combined, being adjusted for sufficient gas discharge bleed in the required time of two seconds. At this time, since the pressure in the upper diaphragm chamber is no longer sufficient to retain the diaphragm in its lower position, the spring contained therein, forces the diaphragm to its normal position, lifting the control shaft and closing valve ports **48** and **53**. The closing of port **53** cuts off the horn blast. Thus, the cycle is repeated with gas flowing through the normally open port **50**, to port **49**, through the orifice valve **16**, and into the upper diaphragm chamber for a period of eighteen seconds, at which time the pressure in the upper diaphragm chamber has attained a predetermined value sufficient to snap the diaphragm into its lower position. The normally open port **50** is closed, ports **48** and **53** are opened, permitting another two second blast on the horn, the gas being discharged from the upper chamber through orifice valves **15** and **16**.

During these repetitive twenty-second cycles, i.e., two seconds of blast and eighteen seconds of silence, the diaphragm of the snap-action pilt **11** must be maintained in its downward position, permitting gas to flow from junction **44** to the normally closed port **46**. During the two second blasts from the horns **41**, gas flows from junction **8** through ¼ inch pipe **9** to the orifice valve **21**, and then to the upper diaphragm chamber **7**. During this process the volume bottle **99** will fill to a certain given pressure as the gas passes and divides at junction **5**. Thus, during the eighteen second period of the cycle when no gas flows through pipe **40**, the pressure developed in volume bottle **99** will cause the upper diaphragm chamber to retain a pressure therein greater than the minimum required to maintain the diaphragm in its downward position for a period of one minute, after which the diaphragm will snap to its normally upward position. The one minue time period is set by adjustment of the orifice valve **21**, and the orifice valve and volume bottle integrate the gas pressure to the chamber **7**. Should the horn fail to blow for a period longer than one minute, the continuous bleeding of valve **21** causes the pressure on the diaphragm of pilot **11** to decrease below that which results in the diaphragm snapping to its normally upward position. This, in turn, causes the shaft corresponding to **111** in FIGURE 2 to move upward, following the motion of the diaphragm. As shaft **111** moves to its uppermost position, the collar corresponding to **113** engages the microwave switch lever causing the common port **44** to switch from the port **46** to the normally open port **47**.

Thus, in this manner, the gas supply then flows through pipe **95**, through the normally open port **45** in microvalve **84**, to the common port **43** and through the adjustable orifice valve **14** to the upper diaphragm chamber of the pilot **10**. The operation of the secondary timer **91** is similar to the operation of the timer **90** such that for a period of eighteen seconds, until the pressure is sufficient in the upper diaphragm chamber of pilot **10** to cause the diaphragm to snap into its downward position, the port **45** is open and ports **42** and **51** are closed. After the eighteen second interval, set by adjustment of orifice valve **14**, the port **45** is closed and the port **42** is opened to the common port **43**, allowing the gas pressure in the diaphragm chamber to be relieved through both orifice valves **14** and **13**, which relief takes place in two seconds. During this period of two seconds the common port **52** of the microvalve **85** is connected to provide a flow path to the normally closed port **51**. Further, during this required two second interval, the gas flowing from pipe **76** through ports **51** and **52**, and through pipe **98** to the quick-open diaphragm valve **24** causes the valve **24** to open. This action permits the gas flow from pipe **55** to pass through unidirectional check-valve **25** to pipe **40** and causes a two second blast of horns **41**. The gas flow is blocked from interfering with the operation of the valve **27** by the presence of check-valve **26**. During this period of operation, the gas flow from junction **8**, pipe **9**, and through orifice valve **21**, over volume bottle **99** and to the upper diaphragm changeover pilot **11** continues as with the operation of the primary timer **90**. Since the construction of pilot **11** is modified as compared with the construction of pilots **10** and **12**, by the omission of collar **112** as shown in FIGURE 2, when the pressure in the upper diaphragm chamber **7** of snapper **11** reaches, again, a sufficient value to cause the diaphragm to snap to its lower position, the microvalve **81** remains unchanged since with the omission of collar **112** there is no mechanism for engaging and depressing the lever of the microvalve. Thus, the timer **91** will continue to operate indefinitely until the system is reset externally by actuating the lever of microvalve **81** to its downward position. This may be accomplished by merely actuating the lever by hand through an opening in the housing provided therefor, or alternatively, may be accomplished by remote means such as an electric solenoid or a hydraulic or pneumatic piston arrangement. This, of course, causes the port **47** to close and the port **46** to open, bringing the system, once again, to its initial operating condition utilizing the primary timer **90**. As is now apparent, the omission of collar **112** in the pilot **11** is necessary in order to prevent the system from oscillating between the primary and secondary timers when a fault occurs in the former. It is understood, of course, that other means might be utilized to prevent such system oscillation as will be apparent to workers in the art.

During the operation of the system and the primary and secondary supply, a certain amount of liquid is mixed with the gas and carried within the storage tank **39**. Such liquid settles, or falls out, to the bottom of the tank and is put back into the pipeline through a blowcase connection (not shown) from the volume tank drain located near the bottom of the tank. Thus, the blowcase accumulates the liquid at a pressure of about 70 pounds and when it is full, all valves are closed, and the pressure is increased to equal the line pressure. The liquids are then gravitated back into the line in a manner known in the art.

A system has thus been disclosed and described for operating a gas powered fog-horn which is fail-safe and economical and which comprises novel features providing an extremely high degree of reliability.

While we have described and illustrated one specific embodiment of our invention, it will be clear that variation of the details of construction which are specifically illustrated and described may be resorted to without departing from the true spirit and scope of the invention as defined in the appended claims.

We claim:

1. An acoustical signal device comprising a source of gas under pressure; a gas actuated acoustic transducer; a pair of gas flow paths each interconnecting said source and said transducer; primary and secondary selectively actuable timer means, each for cyclically passing and blocking flow of pressurized gas between said source and said transducer by a respective one of said pair of gas flow paths; switching means having at least first and second operative states, for rendering said primary timer means actuated and said secondary timer means unactuated in said first operative state and for rendering said primary timer means unactuated and said secondary timer means actuated in said second operative state; and control means responsive to failure of said transducer to be actuated for a predetermined period of time for actuating said switching means to said second operative state.

2. The signal device according to claim **1** wherein said actuable switching means includes a pressure differential responsive means and a switchable valve means, and wherein said control means comprises a pressure integrating means; and wherein is further provided means for connecting said switchable valve means such that it selectively interconnects said source with said primary and said secondary timer means in response to actuation by said pressurized differential responsive means; means for connecting said pressure differential responsive means to be actuated by the output of said pressure integrating means; means for connecting said pressure integrating means to said gas flow paths whereby said pressure differential responsive means maintains said switchable valve means in one selected position corresponding to said first operative state of said actuable switching means during the presence of a given pressure in either of said gas flow paths and actuates said switchable valve means to another position corresponding to said second operative state of said actuable switching means in the absence of a given pressure in either of said gas flow paths during said predetermined period of time.

3. The signal device according to claim **1** wherein said source of gas under pressure comprises a storage means and a first and second supply means coupled thereto.

4. The signal device according to claim **3** wherein one of said supply means includes means for dehydrating the gas flowing therethrough.

5. The signal device according to claim **3** wherein said first supply means normally feeds said gas under pressure to said storage means; said source further comprising means for preventing said second supply means from feeding said storage means whenever the pressure in said storage means is greater than a given value and permitting said second supply means to feed said storage means whenever said pressure is lower than said given value.

6. The signal device of claim **2** wherein said pressure integrating means includes an orifice valve having an input port and an output port in series with both said gas flow paths and a volume bottle coupled to said output port.

7. A system for providing a cyclical alarm signal comprising:

a source of pressurized gas;

transducer means having a gas inlet port and responsive to application of pressurized gas to said gas inlet port for generating an alarm signal;

first and second gas flow paths, each for conducting pressurized gas from said source to said gas inlet port;

first switching means disposed in said first flow path and having two discrete states wherein upon application of a first control signal to said first switching means the latter assumes a first state in which it permits flow of pressurized gas from said source to said gas inlet port via said first flow path and wherein in the absence of said first control signal at said first

switching means the latter assumes a second state in which it blocks flow of pressurized gas from said source to said gas inlet port via said first flow path;

a second switching means disposed in said second flow path and having two discrete states wherein upon application of a second control signal to said second switching means the latter assumes a first state in which it permits flow of pressurized gas from said source to said gas inlet port via said second flow path and wherein in the absence of said second control signal at said second switching means the latter assumes a second state in which it blocks flow of pressurized gas from said source to said gas inlet port via said second flow path;

first selectively actuable timer means for cyclically applying said first control signal to said first switching means at a specified frequency whenever said first timer means is actuated;

second selectively actuable timer means for cyclically applying said second control signal to said second switching means at said specified frequency whenever said second timer means is actuated;

timer selector means having a first operational mode for maintaining said first timer means actuated and said second timer means unactuated and having a second operational mode for maintaining said second timer means actuated and said first timer means unactuated, said timer selector means including: pre-set means for placing said timer selector means in said first operational mode at the start of a system operational sequence, sensing means for sensing the frequency of application of pressurized gas to said gas inlet port, and controller means responsive to a predetermined decrease of the frequency of the application of said pressurized gas to said gas inlet port for placing said timer selector means in said second operational mode.

8. The system according to claim **7** wherein said source of pressurized gas includes:

a gas storage tank;

a first gas supply pipe for supplying pressurized gas to said storage tank;

a second gas supply pipe for supplying pressurized gas to said storage tank;

first pressure regulator means for cutting off the supply of pressurized gas to said storage tank from said first supply pipe whenever the gas pressure in said storage tank exceeds a first predetermined pressure;

second pressure regulator means for cutting off the supply of pressurized gas to said storage tank from said second supply pipe whenever the pressure in said storage tank exceeds a second predetermined pressure, wherein said second predetermined pressure is less than said first predetermined pressure; and

output port means for supplying pressurized gas from said tank to said first and second flow paths.

9. The system according to claim **8** further comprising means for dehydrating the gas flowing into said storage tank from said second supply pipe.

10. The system according to claim **8** wherein said output port means comprises first and second individual output ports formed in said storage tank and connected to respective ones of said first and second flow paths.

11. The system according to claim **7**:

wherein said sensing means in said timer selector means comprises integrator means for providing a gas pressure signal as a function of the frequency of application of pressurized gas to said gas inlet port at said transducer;

wherein said controller means comprises: a pressure responsive actuator responsive to said gas pressure signal for maintaining a first position corresponding to said first operational mode when said gas pressure signal remains above a predetermined pressure and for maintaining a second position corresponding to said second operational mode when said gas pressure signal falls below said predetermined pressure, said predetermined pressure corresponding to that which is provided by said integrator means when the frequency of application of gas pressure to said gas inlet port experiences said predetermined decrease; and valve means actuable by said pressure-responsive actuator for applying a gas pressure actuating signal to said first timer means when said pressure-responsive actuator is in its first position and for applying said gas pressure actuating signal to said second timer means when said pressure-responsive actuator is in its second position.

12. The system according to claim **11** wherein said first and second timer means each comprise:

an inlet port for receiving said gas pressure actuating signal from said timer selector means;

a pressure responsive member having a first position assumed in response to application of said gas pressure actuating signal thereto and a second position assumed in the absence of application of said gas pressure actuating signal thereto;

a flow path between said inlet and said pressure-responsive member for said gas pressure actuating signal, said flow path including delay means for providing a first predetermined time delay between the time of application of said gas pressure actuating signal to said inlet port and to said pressure-responsive member;

valve means actuable by said pressure-responsive member and having a first condition corresponding to the first position of said pressure-responsive member in which pressure applied to said pressure-responsive member is exhausted to ambient pressure through further delay means.

References Cited

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