Aug. 20, 1935. C. L. FLORISSON 2,012,187

SOUND EMITTING SYSTEM

Original Filed Feb. 27, 1932

Fig: 1

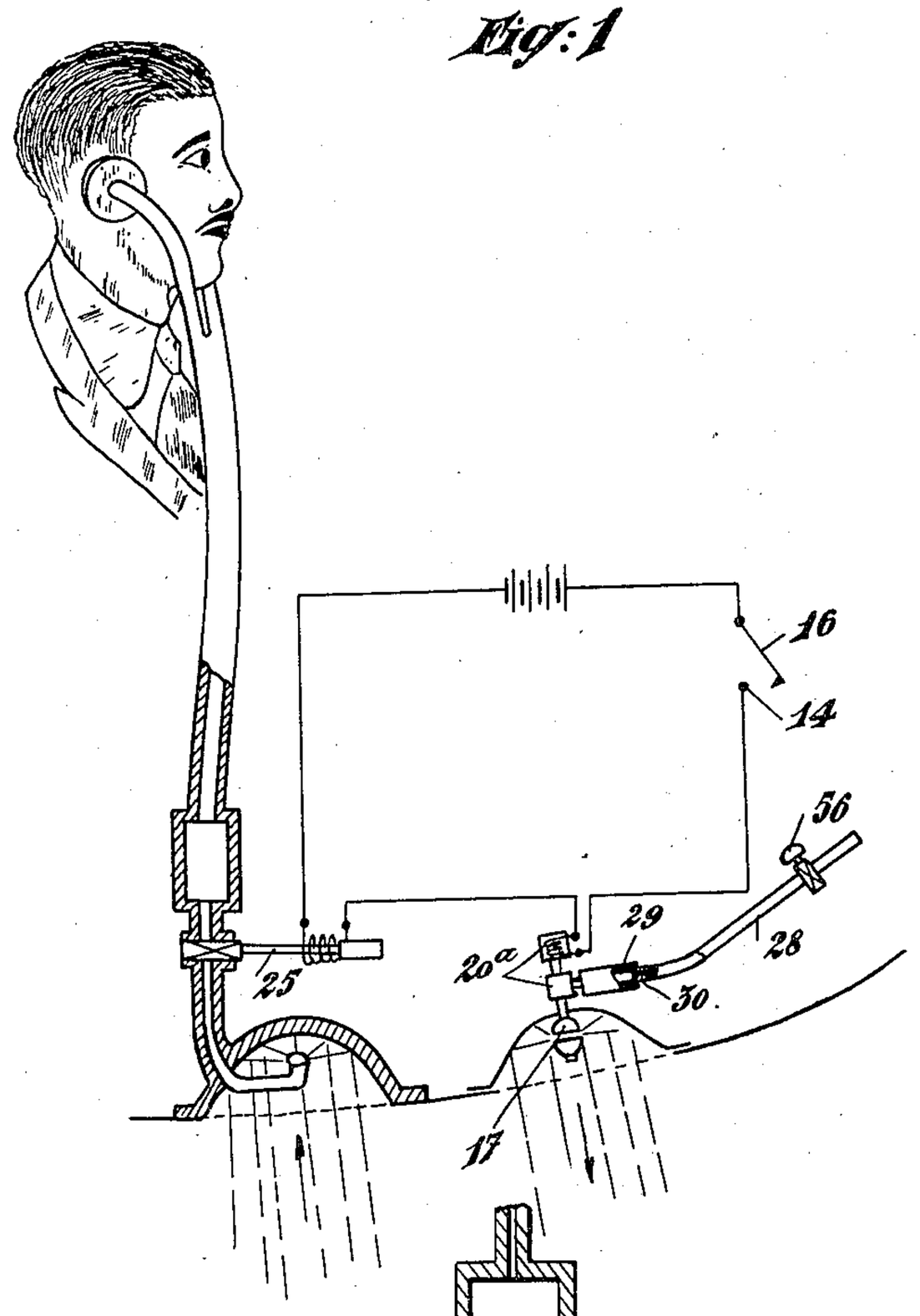
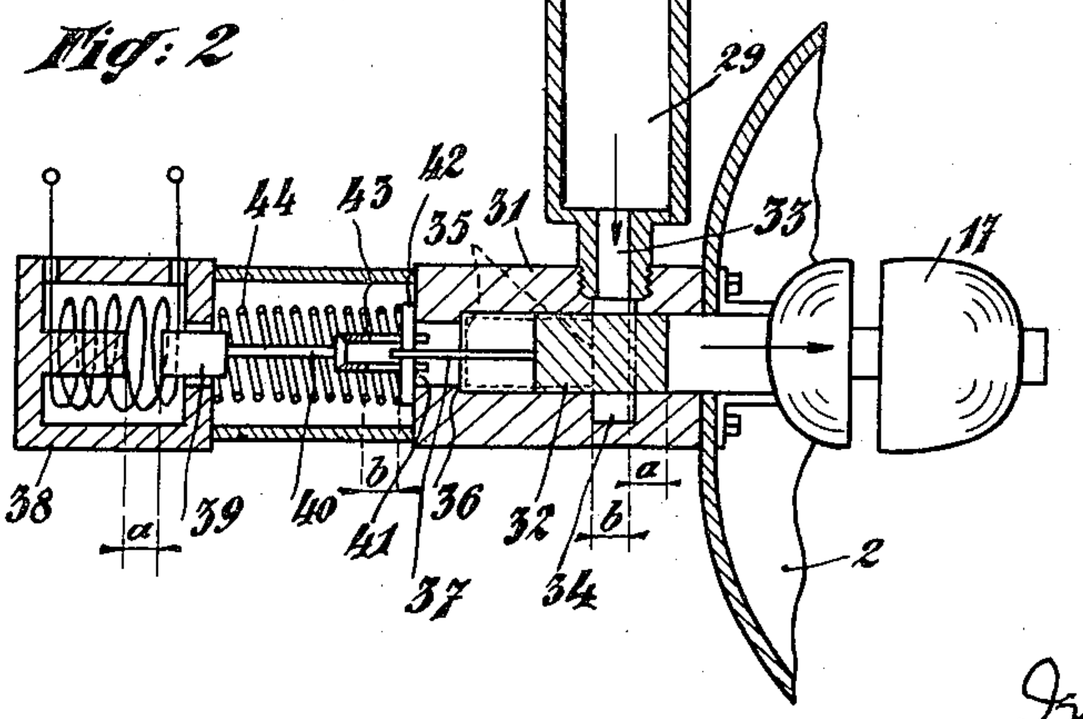


Fig: 2



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SOUND EMITTING SYSTEM

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5 Claims. (Cl. 177—8)

This application is a division of my copending application Serial Number 595,640, filed February 27, 1932.

My invention relates to apparatus including a sound emitting device adapted to be operated by a gas under pressure and which is intended to produce a short but strong sound signal, and more especially to air wave echo apparatus such as can be used on aircrafts for determining the altitude.

It can readily be understood that in such apparatus the sound emitting device, such as a whistle, a trumpet provided with a reed or a mouthpiece, or the like, must produce a very strong, but short, signal in order to avoid that the emitted sound wave may interfere with the reflected sound wave, especially when the altitude is low. This necessitates that a small volume of compressed gas should be suddenly fed to the sound emitting device. Such a result is somewhat difficult to obtain due to loss of pressure in the pipes through which the compressed gas is fed to the sound emitting device and to the more or less considerable volume of said pipes.

The object of the present invention is to provide an apparatus of the type above referred to which permits the emission of strong and short sound signals.

To this effect, according to my invention, a chamber of small volume containing the volume of gas required for a single emission is inserted in the pipe through which gas under pressure is fed to the sound emitting device. This chamber is connected, on one side, through a narrow nozzle or tube, with said feed pipe, and, on the other side, through a short conduit of large section, with the sound emitting device, a valve controlling the flow of gas through said conduit.

Other features of the present invention will appear from the folowing detailed description thereof.

A preferred embodiment of the present invention will be hereinafter described with reference to the accompanying drawing, given merely by way of example, and in which:

Fig. 1 is a diagrammatic view of an acoustic sounding apparatus embodying the present invention, and

Fig. 2 is a diagrammatic sectional view of the valve device utilized in said apparatus.

Adverting to Fig. 1, on the tube 28 through which gas under pressure is fed to the sound emitting device 17, there is disposed, immediately before valve 20a, a small chamber 29 the volume of which is so chosen as to correspond with the output of the emitting device and which must contain a reserve of gas necessary for a single short emission. This chamber is fed with compressed gas through pipe 28, with the interposition of a tube of restricted section 30 producing a loss of pressure at that place. On the contrary the conduit leading from chamber 29 to sound emitting device 17 is made short and of large section so as to avoid any loss of pressure at that place and localize the losses of pressure in the emitting device itself, as it is desirable. With such an arrangement, the opening of valve 20a produces the instantaneous discharge of chamber 29 into the sound emitting device and the time for which the emission takes place is only a function of the volume chosen for chamber 29, the pressure of the gas and the sections of the openings of the emitting tube. The inlet of this chamber 29 is of such a small section that the jet of gas that passes therethrough when the emission is ended cannot operate the sound emitting device. But it should however be large enough, once valve 20a is closed, to allow of chamber 29 being filled with gas at the pressure existing in tube 28 in a sufficiently short time for permitting a frequent repetition of the emissions (namely with an interval of time between the emissions of about one second or a few seconds).

Valve 20a must open extremely quickly when contact 14—16 is closed, and it is advantageous to utilize electric current of low voltage and intensity. These conditions, which are difficult to obtain with ordinary electrically controlled valves, are on the contrary easily obtained with the arrangement hereinafter described with reference to Fig. 2.

An obturating piston 32 is adapted to slide with an easy fit in a cylinder 31 directly connected with the sound emitting device 17. The compressed air is introduced through orifice 33 connected with a circular groove 34 which completely surrounds the piston. With this arrangement, when the piston is in the position shown in solid lines in the drawing, it cuts off the connection between compressed air inlet 33 and the vibratory emitting device 17, and, which is an important feature, without the pressure of the gas in groove 34 producing any axial reaction on the piston. Such an arrangement makes it possible to control the movements of the piston by means of very small forces which are practically independent of the gas pressure at 34. When the piston is in position 35, shown in dotted lines in the drawing, the compressed gas flows freely from 33 toward 17. It will be noted that the disposition of the

parts is such that, as soon as the port has been slightly uncovered, when the right hand face of the piston has moved forward a distance equal to *a*, a part of the gas pressure is exerted on the right hand face of the piston and suddenly drives the latter toward the left to position **35** where it bears against shoulder **36**. In this way I obtain, with a relatively small force applied to the piston toward the left (which force may eventually be merely capable of starting the displacement of the piston with a small velocity), a complete and quick opening from the time when said opening is started, by utilizing exclusively, from that time on, the compressed gas as the motive agent for driving the piston.

The movement of the piston may be controlled through any device exerting on a rod **37**, at the time chosen for the vibratory sound emission, a force, even relatively small, directed toward the left. I may utilize mechanical controls comprising rods, shafts, or cables, pneumatic controls, hydraulic controls, electric controls, electromagnetic controls and the like. I will now describe, by way of non-limitative example, a controlling device including an electro-magnet.

The electro-magnet may be of any type whatever, either of the ironclad type or not, acting either directly or through a multiplying arrangement, or again through a device adapted to slow down the modification of the magnetic force as a function of the displacement. In Fig. 2 I have shown, by way of example, an ironclad electromagnet **38**. The stroke of movable part **39** may be so chosen as to be equal to the relatively small value *a* above referred to. When current is allowed to flow through the electromagnet, the movable core **39** is drawn toward the left, driving rod **40** together with it. At its right hand end the latter is bifurcated, as shown, and is laterally slotted or formed with a hollow laterally slotted enlarged stem or is similarly arranged, so as to allow of rod **37** sliding loosely therein. This rod **37** is provided with a stop, such as pin **42** for instance, engaging in the elongated slot or slots provided in the right hand end of rod **40**. When the latter is driven toward the left, it causes rod **37** to move together with it, stop **42** abutting against the right hand end of the slot or slots. The operation is as follows: The electromagnet causes its movable part **39**, and therefore piston **32**, to move forward a distance equal to *a*, which initiates the opening of port **33**. When the movable part of the electromagnet is at the end of its stroke toward the left, the sudden completion of the opening of the port is obtained, as above explained, by the action of the compressed gas on the right hand face of the piston. The piston is suddenly driven toward the left until it comes into contact with shoulder **36** (that part of its stroke being *b*, the wholestroke is *a b*). In order to allow such an operation of the parts, rod **40** is provided with a hollow part **43** whose length is very slightly greater than *b*. A spring **44** of suitable strength, bearing on the one hand against a stationary part fixed to the frame of the electromagnet and to cylinder **31**, and on the other hand against the rod **37** of the piston, for instance through pin **42**, serves to push the piston toward the right with a displacement equal to *b* as soon as the pressure at **17** has dropped to a low value (end of the emission of the sound signal). Said spring then drives the whole of the piston and of movable part **39** of the electromagnet, which are now connected together through pin **42**, with a displacement equal to *a* toward the right (closed position) as soon as the current flowing through the electromagnet has been cut off.

The above description clearly shows that, through the combination of valve **20a**, built according to the principle illustrated in Fig. 2 and of a chamber **29** provided with the narrow nozzle or tube **30**, the short vibratory sound emission can be started by causing, at a determined moment, an electric current, which may be of relatively low intensity and voltage, to pass, for a very short time, through electromagnet **38**, said electromagnet being intended merely to displace the piston so as to partly uncover port **33**, the complete opening being then suddenly produced through the action of the gas pressure. The stopping of the emission is automatically produced when chamber **29** is emptied and the gas pressure on the right hand face of the piston has become lower than the compressive force exerted by spring **44**. Said spring then pushes piston **32** toward the right and thus cuts off the reduced jet of gas issuing through **33** and stops the vibratory emission (contact **14—16** is so adjusted that the current is switched off before the end of the sound emission, that is to say before chamber **29** is emptied).

Any known means may be provided for adjusting the force exerted by spring **44** on piston **32** so as to permit of the sound emission being cut off when the pressure in chamber **29** has dropped to a certain value, in order to permit of shortening the duration of the emission for soundings at very short distance.

While I have described what I deem to be a practical and efficient embodiment of my invention, it should be well understood that I do not wish to be limited thereto as there might be changes made in the arrangement, disposition and form of the parts without departing from the principle of my invention as comprehended within the scope of the appended claims.

What I claim is:

1. An apparatus of the type described, which comprises in combination, a sound emitting device of the wind instrument type operative by a gas under pressure, means for feeding gas under pressure to said sound emitting device, a chamber of small volume adapted to contain the quantity of gas required for a short emission of said device, a narrow passage between said means and said chamber, a short conduit of large section for forming a passage between said chamber and said sound emitting device, and valve means for quickly fully opening the passage between said chamber and said sound emitting device.

2. An apparatus of the type described, which comprises in combination, a sound emitting device of the wind instrument type operative by a gas under pressure, means for feeding gas under pressure to said sound emitting device, a chamber of small volume adapted to contain the quantity of gas required for a short emission of said device, a narrow passage between said means and said chamber, a short conduit of large section for connecting said chamber with said sound emitting device, a piston valve movable across said conduit for controlling the connection between said conduit and said sound emitting device, said piston valve having one of its ends constantly connected with said sound emitting device, and control means for bringing said piston valve into a partly open position, whereby said end of the piston valve is subjected to the action of said gas under pressure which quickly fully opens it.

3. An apparatus of the type described, which

comprises in combination, a sound emitting device of the wind instrument type operative by a gas under pressure, means for feeding gas under pressure to said sound emitting device, a chamber of small volume adapted to contain the quantity of gas required for a short emission of said device, a nozzle of restricted section connecting said means and said chamber, a short conduit of large section connected with the outlet end of said chamber, a cylinder directly connected with said sound emitting device and provided with an aperture in its wall opening into said conduit, a piston adapted to slide in said cylinder, control means for starting the sliding displacement of said piston as far as the position thereof for which said aperture is partly uncovered by said piston, so that the full displacement of said piston is subsequently ensured by the gas pressure, and elastic means for urging said piston toward its initial position.

4. An apparatus of the type described, which comprises in combination, a sound emitting device of the wind instrument type operative by a gas under pressure, means for feeding said gas under pressure to said sound emitting device, a chamber of small volume adapted to contain the quantity of gas required for a short emission of said device, a nozzle of restricted section connecting said means with said chamber, a short conduit of large section directly connected with the outlet end of said chamber, a cylinder directly connected with said sound emitting device and provided with an aperture in its lateral wall opening directly into said conduit, a piston adapted to slide in said cylinder, an electromagnet including a winding fixed with respect to said cylinder and a core movable in said winding parallel to the axis of said cylinder, means for connecting said piston with said core with a certain axial play, elastic means for urging said piston toward its position with respect to said cylinder in which it covers said aperture in the cylinder wall, and means for energizing said electromagnet, whereby the energizing of the electro-magnet causes the core thereof and therefore the piston to move against the action of said spring, thus partly uncovering said aperture, the complete and rapid opening then taking place under the effect of the gas pressure in said chamber, while the closing displacement of the piston is effected by said spring, as soon as the strength thereof is greater than the force exerted by the remaining gas pressure on the piston.

5. An apparatus of the type described, which comprises, in combination, a whistle operative by a gas under pressure, means for feeding gas under pressure to said whistle, a chamber of small volume adapted to contain the quantity of gas required for a short blast of said whistle, a narrow passage between said means and said chamber, a short conduit of large section for connecting said chamber with said whistle, and means for controlling the flow of gas under pressure from said chamber to said whistle.

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