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MEANS FOR PRODUCING SOUND WAVES.

APPLICATION FILED NOV. 21, 1908.

1,068,220. Patented July 22, 1913.

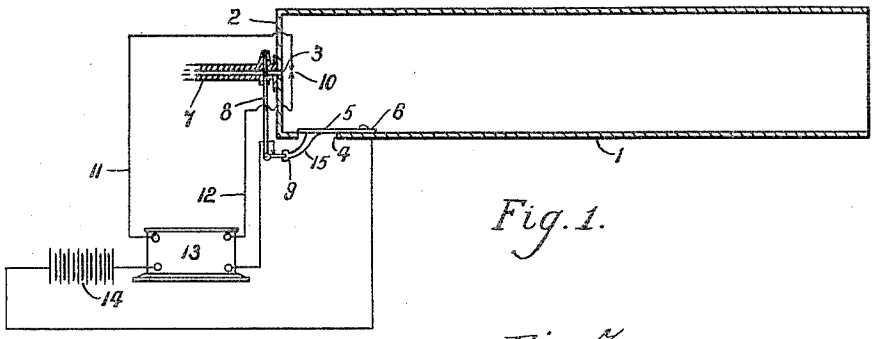
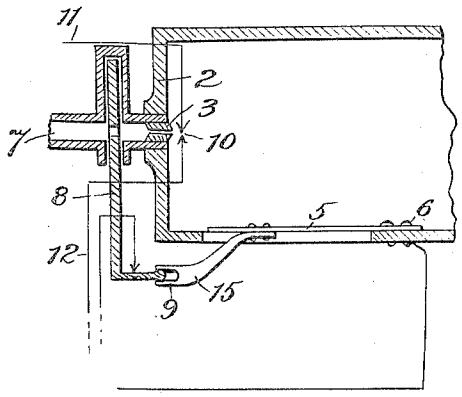


Fig. 1.

Fig. 3.



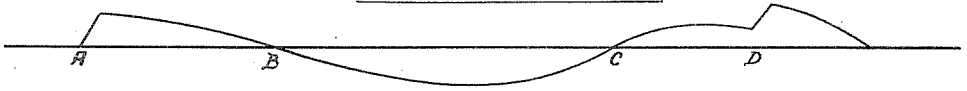


Fig. 2.

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UNITED STATES PATENT OFFICE.

LOUIS EUCLIDE CÔTÉ, OF OTTAWA, ONTARIO, AND WALTER FURMAN KELLEY, OF HALIFAX, NOVA SCOTIA, CANADA.

MEANS FOR PRODUCING SOUND-WAVES.

1,068,220. Specification of Letters Patent. Patented July 22, 1913.

Application filed November 21, 1908. Serial No. 463,887.

To all whom it may concern:

Be it known that we, LOUIS EUCLIDE CÔTÉ and WALTER FURMAN KELLEY, a subject of the King of Great Britain and a citizen of the United States, respectively, residing at No. 149 Laurier avenue west, city of Ottawa, Province of Ontario, Dominion of Canada, and No. 61 Granville street, city of Halifax, in the Province of Nova Scotia, Dominion of Canada, have invented certain new and useful Improvements in Means for Producing Sound-Waves, of which the following is a specification.

The invention relates to a new and useful means for producing sound waves, as described in the present specification, and illustrated in the accompanying drawings that form part of the same.

The invention consists essentially in making a series of explosions in synchronism with the occurrence of a phase of the sound wave desired to be produced.

The objects of the invention are to enable sounds or any combination of sounds of any intensity or pitch to be produced in a simple manner, and particularly to reduce the cost of apparatus now found necessary to produce sounds for fog alarms and other sound signals.

The customary apparatus for producing sound for fog alarms or other sound signals comprises a horn or whistle operated by a continuous supply of compressed air or other gas during the period in which the sound is desired, and in order to supply this compressed air quite an expensive apparatus is required generally comprising an engine, an air compressor, suitable piping, valve mechanism, and in addition thereto, reeds, interrupters or other vibrators. The present invention seeks to eliminate much of this apparatus by using the explosive properties of combustible gases directly in the production of sound without the intervention of other mediums, and the consequent losses in translation of power as in the means now used.

The most successful compressed-air fog alarms are those which have no reeds, but have the flow of air into the horn mechanically interrupted as in the steam or air siren. In the present invention explosions or other motions of compressed gases are made to enter a resonating chamber at intervals of time corresponding to the resonance of the chamber—that is, to the wave frequency occurring in said chamber or a harmonic of said wave frequency. Furthermore successions of explosions of different frequency can be made in the same horn having definite pitch relations and producing melodic or combination signals.

The mechanism used in the production of sounds as described in this application may be varied to a great extent, and the accompanying drawings are shown in diagrammatic form to illustrate the essential requirements, but it must be understood that the different parts of the mechanism may be made in various forms, although their manner of operation will always be substantially as hereinafter described.

In the present means, we have shown in the drawings a form of mechanism in which the sounds can be produced, although the scope of our invention is hardly limited to any particular form of machine as long as the main features are adhered to.

Figure 1 is a view part diagrammatic and part sectional of a definite resonator and means for supplying combustible gases thereto, and igniting the same at definite frequencies. Fig. 2 is a diagrammatic view of a wave train illustrating the intervals at which ignition occurs during the maintenance of a sound of definite pitch. Fig. 3 is an enlarged sectional perspective detail view of the slide valve controlling the admission of gas to the resonator.

Like numerals of reference indicate corresponding parts in each figure.

Referring to the drawings, 1 is a resonating chamber which may be of any suitable proportions or form, although here shown as tubular and having the closed end 2.

3 is a central orifice in the closed end 2 of the resonating chamber 1, and 4 is a slot preferably arranged in the side wall of the resonating chamber 1 in proximity to the closed end 2.

5 is a vibratory tongue secured to the side

wall of the resonating chamber 1 at 6, and extending over the slot 4, so that on any pressure occurring within the resonating chamber 1 the spring tongue 5 will move outwardly through the slot 4.

7 is a pipe leading from the opening 3 in the closed end of the resonating chamber 1 and communicating with a suitable supply of combustible gases, such as vaporized gasolene and atmospheric air.

8 is a slide valve arranged across the pipe 7 in proximity to the opening 3 and intercepting the passage of combustible gases through said pipe. The slide valve 8 is connected by a suitable connecting-piece 9 to the vibratory end of the tongue 5, and it will be readily seen that the said valve will be moved across the opening through said pipe at each vibration of the tongue 5.

Although the slide valve 8 is described as governing the supply of combustible gases to the resonating chamber or tube, it may not be necessary in actual use, as the varying pressure within the tube may of itself regulate the supply of gases flowing through the pipe 7.

10 are the discharge terminals of an induction coil arranged in any suitable manner within the resonating chamber 1 toward the closed end 2 and connected by wires 11 and 12 to the induction coil 13, said coil being energized in the usual manner by the battery 14, the current from said battery being interrupted by the make-and-break contact 15 having one member thereof secured to the vibratory tongue 5.

The electric wiring and the arrangement of the sparking device is similar to that used in connection with any internal combustion engine using jump-spark ignition, and is shown in diagrammatic form.

In the operation of the sound producing apparatus, the slide valve 8 is so arranged that the passage through the pipe 7 is normally open—that is, when the tongue 5 is not pressed outwardly. Combustible gases may thus pass through the pipe 7 into the resonating chamber 1 at the closed end through the opening 3, and when the said gases gather in a sufficient quantity within the resonator to make an explosive mixture, the initial spark between the points 10 is caused by some outside agency, and will igniate the mixture and an explosion will occur. This explosion will have its greatest force at the closed end of the resonating chamber, and press the vibratory tongue 5 outwardly, thereby breaking the contact 15 and shutting off the supply of combustible gases through the pipe 7. The explosion of the gases will create the high pressure portion of a sound wave, and thereby set up a stationary train of sound waves at the natural frequency of the resonating chamber, the products of combustion gradually escaping from the open end of the chamber. Following the high pressure portion of the sound wave the pressure at the closed end of the tube gradually diminishes permitting the vibratory tongue 5 to return to its normal position, and move the slide valve 8, which will admit a fresh supply of combustible gases to the tube 1. As is well known in acoustics the sound wave again returns toward its maximum pressure at the closed end of the tube. The tongue 5 is again pressed outwardly and the supply of combustible gases stopped by the valve 8. At the same time the fresh supply of combustible gases in the tube is compressed and finally the electric contact is broken and the charge ignited, thereby adding another impulse to the wave train at its proper phase relation.

The timing of the admission of the combustible gases, the compression and the explosion thereof in relation to the sound wave in the tube 1 is clearly illustrated in Fig. 2 by a wave pressure curve, wherein A is the time at which the explosion occurs and at which the wave is set up and the wave pressure starts. B is the time the pressure is reduced sufficiently to admit a fresh supply of combustible gases. C is the time the supply is shut off and compression starts and prepares the fresh supply of combustible gases for ignition. D is the time ignition occurs and gives the added impulse to the wave train at its proper phase relation. It will thus be seen that an explosion occurs at each high pressure phase of the wave, and a continuous wave train of great intensity is maintained until the supply of combustible gases and the sparking is definitely stopped by some outside agency.

Although in the drawings only one figure is shown to illustrate a mechanical contrivance which will operate to produce sound waves, it must be understood, this figure being purely diagrammatic, that many modified arrangements of the elements therein illustrated may be made without departing from the spirit of the invention which, as mentioned in the preamble to this specification, requires construction of parts, whereby a vibratory motion of the products of combustible gases within the resonator is obtained.

Although it has been mentioned that the explosions occur at intervals corresponding to the wave vibrations of the resonator, it must be understood that the impulse to the wave train may be given at one of its harmonics—that is, at every second or third nodal point in the wave set up within the resonator. Furthermore the explosion may be emitted into the resonating chamber at intervals corresponding to wave frequencies

other than those of the fundamental note of the wave chamber and will produce corresponding sounds. It is also possible by known methods to govern the rate of the emissions into the resonating chamber by the action of the pressures of the wave train set up.

This specification must not be understood to confine the application of the invention to emitting the exploded gases directly into the resonating chamber, as the energy of the explosions may be used to set up wave trains in other chambers by its action on the walls thereof or a portion of the wall. The explosions need not be emitted at the exact frequency of the natural wave train of the resonating chamber, but if emitted at a near frequency will force the contents of the resonating chamber to vibrate at the frequency of the emissions.

What we claim as our invention is:

1. In means for producing sound waves, a resonating chamber, and means operated at intervals synchronous with the frequency of the sound waves produced for moving the contents of the chamber by successive explosions of a combustible material.

2. In means for producing sound waves, a resonating chamber, and means actuated at the frequency of the sound waves produced for causing explosions of a combustible material at definite intervals corresponding to the wave frequency of said chamber.

3. In means for producing sound waves, a resonating chamber, means for supplying combustible gases to said chamber, and means governed by the varying pressure of the contents within said chamber for exploding said combustible gases.

4. In means for producing sound waves of a definite pitch, a resonating chamber, means for supplying combustible gases to said chamber, means for exploding said combustible gases at a definite place in said chamber, and means for causing successive explosions of said gases to maintain a sound of definite pitch within said chamber.

5. In a means for producing sound waves, a resonating chamber, a pipe leading from a suitable supply of combustible gases and communicating with said resonating chamber, means for admitting combustible gases from said pipe to said chamber at predetermined intervals, and means for igniting said combustible gases at intervals in harmony with the sound wave produced.

6. In means for producing sound waves, a tubular resonating chamber having one end thereof closed and an orifice through said closed end, a pipe leading from a suitable supply of combustible gases to the orifice in the closed end of said resonating chamber, electrical means arranged within said chamber adjacent to said orifice for causing a spark, and means associated with said chamber for interrupting the electrical connections at intervals corresponding to the wave frequency of said chamber.

7. In a means for producing sound waves, a tube closed at one end, a pipe leading from a suitable supply of combustible gases and to the interor of said tube, a valve interrupting the flow of combustible gases through said pipe, a spring tongue arranged within said tube toward the closed end thereof and operating said valve on a difference in the pressure of gases within said tube and electrical means associated with said spring tongue for generating a spark within said tube adjacent to the closed end thereof at intervals corresponding to the wave frequency of said tube.

8. In means for producing sound waves, a tube closed at one end, and having an orifice in said closed end, a pipe leading from a suitable supply of combustible gases and to said orifice in the closed end of said tube, a slide valve interrupting the flow of combustible gases through the said pipe, a spring tongue arranged within said tube toward the closed end thereof, and operating said slide valve on a difference in the pressure of gases within said tube, and electrical means associated with said spring tongue for generating a spark within said tube adjacent to the closed end thereof at intervals corresponding to any recurrence of the same phase of the sound waves set up in said tube.

9. In a means for producing sound waves, a tube closed at one end, a pipe leading from a suitable supply of combustible gases and to the interior of said tube at the closed end thereof, a slide valve interrupting the passage through said pipe, a spring suitably connected to said slide valve, an induction coil, electric discharge terminals arranged within said tube toward the closed end thereof and suitably connected to said induction coil, a battery, and means associated with said spring for electrically completing circuits comprising said battery, said induction coil and said discharge terminals at intervals corresponding to the wave frequency occurring within said tube.

10. In means for producing sound waves, a resonator, means for admitting combustible gases to said resonator, means for exploding said gases in said resonator, and means vibrating in harmony with the sound wave desired to be produced for controlling said exploding means.

11. In means for producing sound waves, a resonator, means for admitting combustible gases to said resonator, means for exploding said gases in said resonator, and means vibrating in harmony with the sound

waves desired to be produced for controlling the supply of combustible gases to said resonator.

12. In means for producing sound waves, means for supplying combustible gases at a definite point and means actuated at intervals synchronous with the frequency of the sound waves produced for exploding said combustible gases.

Signed at the city of Ottawa, county of Carleton, Province of Ontario, Canada, this 29th day of October 1908.

LOUIS EUCLIDE CÔTÉ.
WALTER FURMAN KELLEY.

Witnesses:
LLOYD BLACKMORE,
RENÉ PIGEON.