L. E. CÔTÉ & W. F. KELLEY.

MEANS FOR PRODUCING SOUND WAVES.

APPLICATION FILED MAR. 19, 1909.

1,080,264.

Patented Dec. 2, 1913.

3 SHEETS—SHEET 1.

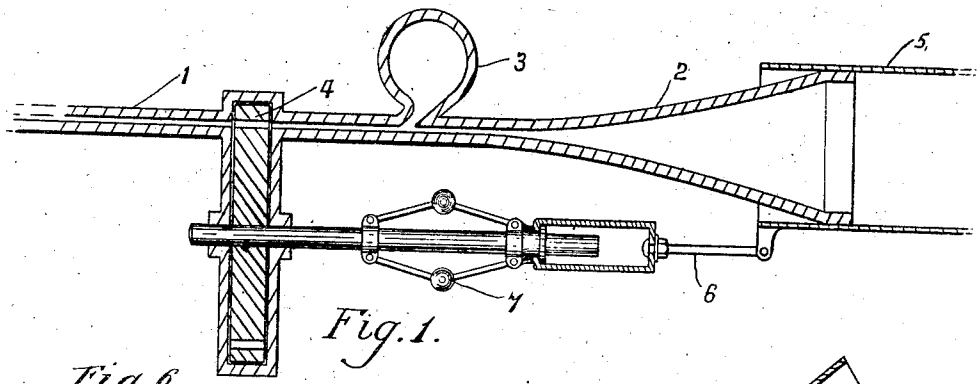
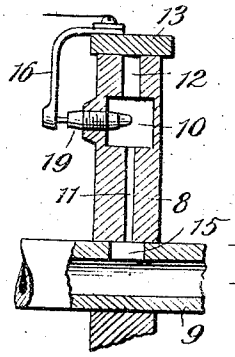


Fig. 1.

Fig. 6.



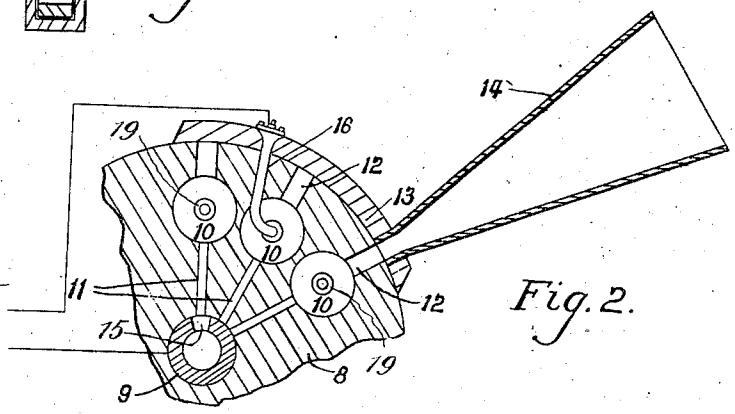


Fig. 2.

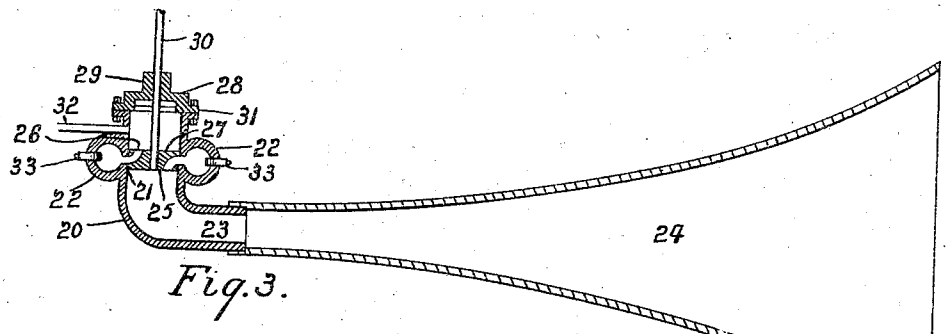


Fig. 3.

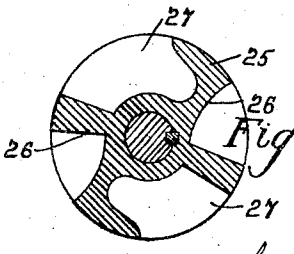


Fig. 4.

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3 SHEETS—SHEET 2.

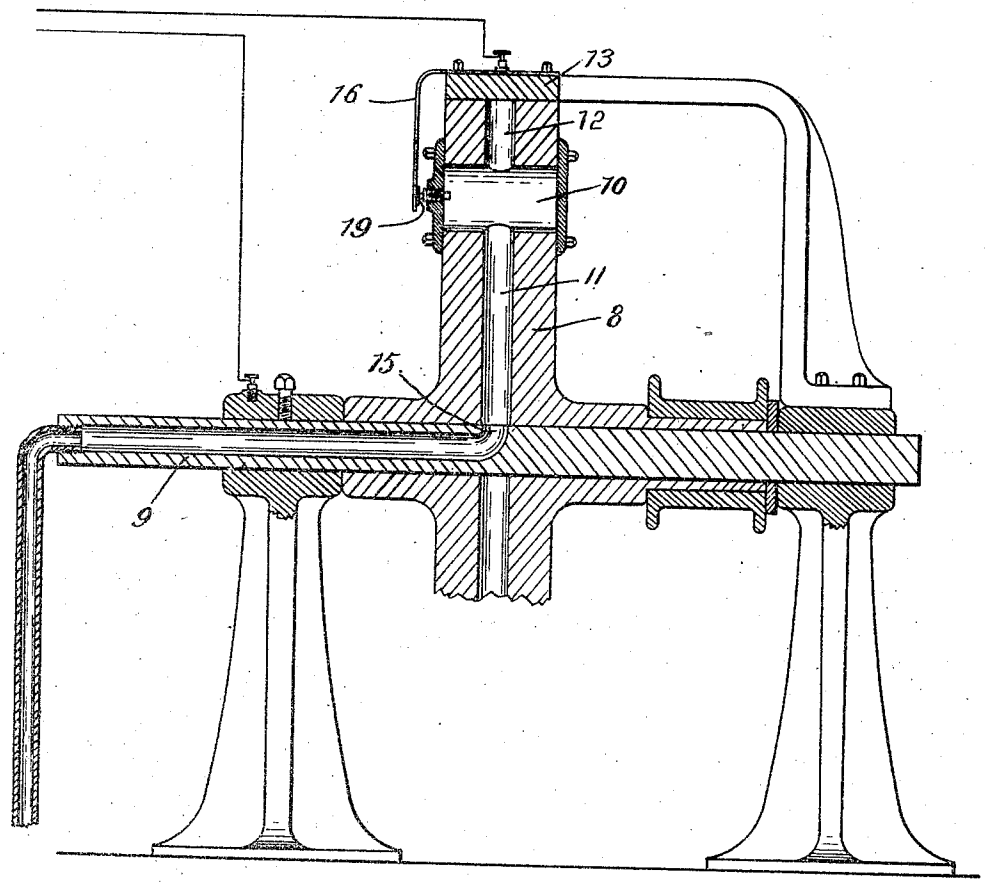

Fig. 5.

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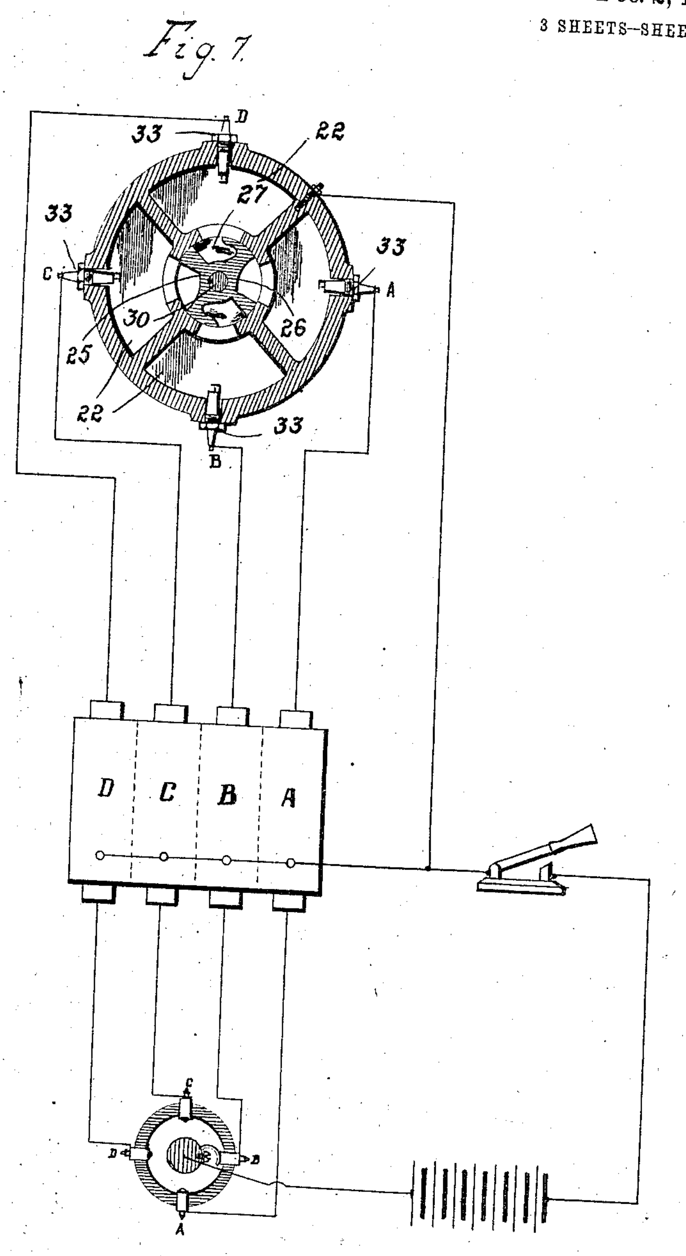
3 SHEETS—SHEET 3.



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UNITED STATES PATENT OFFICE.

LOUIS EUCLIDE CÔTÉ, OF OTTAWA, ONTARIO, CANADA, AND WALTER FURMAN KELLEY, OF ITHACA, NEW YORK.

MEANS FOR PRODUCING SOUND-WAVES.

1,080,264. Specification of Letters Patent. Patented Dec. 2, 1913.

Application filed March 19, 1909. Serial No. 484,542.

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 of America, respectively, residing at No. 149 Laurier avenue west, in the city of Ottawa, in the Province of Ontario, in the Dominion of Canada, and No. 105 South Cayuga street, in the city of Ithaca, in the State of New York, in the United States of America, respectively, 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 sound 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 exploded 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 sound 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 forms 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.

In the drawings, Figure 1 is a view part diagrammatic and part sectional of an adjustable resonator and a mechanically operated means for creating a series of explosions in synchronism with the occurrence of a phase of the sound wave desired to be produced. Fig. 2 is a view part diagrammatic and part sectional showing a modified form of mechanical means for controlling the explosions of combustible gases emitted to a resonator. Fig. 3 is a view part diagrammatic and part sectional of a further modification of the apparatus. Fig. 4 is a cross sectional view through the distributing valve of the apparatus illustrated in Fig. 3. Fig. 5 is a vertical sectional view of the apparatus as illustrated in Fig. 2. Fig. 6 is a vertical sectional view of the apparatus as shown in Fig. 2. Fig. 7 is a diagrammatic view showing the mechanism by which the spark plugs shown in Fig. 3 are energized periodically.

Like numerals of reference indicate correspondng parts in each figure.

Referring to the drawings, 1 is a supply pipe leading from a suitable supply of combustible gases preferably a gaseous mixture of gasolene and atmospheric air under pressure. The supply pipe 1 is flared at 2 forming a combustion chamber similar in shape to a horn. 3 is an auxiliary gas chamber or

pocket communicating with the supply pipe 1 adjacent to the flared end 2.

4 is a mechanically operated interrupter intercepting the passage through the supply pipe 1 a short distance before the pocket 3. This interrupter may be of varied design, the object being to interrupt the flow of gases passing through the supply pipe 1 at definite frequencies according to the wave train which it is desired to set up and maintain a sound of definite pitch, or the said interrupter 4 may only vary the amount of combustible gas flowing through the supply pipe 1, whereby a small amount of combustible gas is always allowed to pass through the said supply pipe to the flared end 2. As here illustrated the interrupter 4 is a rotating disk intersecting the passage through the supply pipe 1 and having orifices therethrough, which intermittently allow the passage of combustible gas through the pipe 1 as the said disk is rotated by any desired mechanical means.

The above described parts will be sufficient to produce and maintain a sound wave.

The interrupter 4 while rotating will allow a charge of compressed combustible gas to pass to the flared portion of the supply pipe and also to the auxiliary chamber or pocket 3, the said pocket being arranged at a place between the interrupter 4 and the flared end 2, where the travel of gases from the supply pipe is faster than the rate of propagation of flame, and when gas admitted to the flared end of the said pipe is ignited by any suitable means, either a torch, an electric spark or even by a lighted match, an explosion will occur and consume the gas back to a point where the rate of flow of gas through the supply pipe will equal the rate of propagation of the flame, such point being preferably a little distance in advance of the pocket 3—that is, toward the flared end 2. The explosion of the gas in the flared end of the supply pipe will set up a wave train, and repetitions of the explosions will maintain a definite note.

While the interrupter 4 intercepts the passage of combustible gas from the pipe 1, sufficient compressed gas will have been stored in the pocket 3 to flow toward the flared end 2 and maintain a flame during the interval of interruption of the main supply of gas through the pipe 1, which will only be for an instant, following which another compressed charge will be allowed to pass through the pipe by the interrupter 4 and another forceful outburst of burning gases will occur. It will be thus seen that the flame is constant, and the interrupter 4 is utilized to vary the extent of said flame, and the consequent pressure of gases emitted from the flared end of said pipe thereby maintaining a wave train and producing a note of definite tone according to the speed at which the interrupter 4 is actuated and the pressure of the gas flowing through the supplying pipe 1.

In conjunction with the apparatus for producing and maintaining the wave train, the speed of the interrupter 4 actuates an adjustable resonator 5 by any suitable control device, such as the connecting rod 6 and ball governor 7. This control apparatus is illustrated diagrammatically and the invention must not be confined to the use of the ball governor illustrated, and by means of which the definite resonator 5 is projected or drawn backwardly over the flared end 2 of the supply pipe automatically and in accordance with the speed at which the interrupter 4 is working.

In the means shown in Fig. 2, a rotating disk 8 is suitably mounted on a hollow shaft 9, the said disk having a plurality of chambers 10 arranged therearound. 11 are radial ports leading from the hub of the disk 8 to the chambers 10, and 12 are radial ports leading from the chambers 10 to the outer periphery of said disk. 13 is a shield conforming in shape to the periphery of the disk 8 and supported by a suitable framework, so that it presses snugly against the said disk and covers a plurality of the ports 12. 14 is a resonator mounted in a suitable manner, the inner end of said resonator opening on to the periphery of the disk 8. In the operation of this form of the apparatus the disk 8 is rotated at a predetermined speed according to the natural wave frequency of the resonator 14. As each chamber in said disk comes under the shield 13, a supply of compressed combustible gases flows through the hollow shaft 9 and the port 15 in said shaft into the radial port 11, and on into the chamber 10, and as the said chamber passes still farther under the shield 13, an electric contact finger 16 connected with a suitable induction coil makes contacts with the spark plugs 19 arranged in the side of the disk 8 opposite each of the chambers 10 and having the sparking points thereof projecting into said chambers. By this means the charge of combustible gases is fired in the chamber 10. and retained therein until combustion is complete and the pressure is at a maximum. At this time the disk has rotated far enough to bring the port 12 opposite the outlet to the resonator, and the gases are emitted into the said resonator, and set up a wave train therein. The continuous rotation of the disk with the emission of the exploded gases from the chambers 10 through the ports 12 into the resonator in succession will maintain the intensity of the sound wave within said resonator.

The apparatus illustrated in Fig. 3 is practically the same in operation as the apparatus illustrated in Fig. 2, the essential

difference being in the location of the combustion chambers in the stationary member, the rotating member being a rotary valve having a plurality of peripheral ports and governing the supply of combustible gases to the combustion chambers and the products of combustion of said gases from said chambers to a resonator.

Referring to the Figs. 3 and 4, 20 is a valve casing having the valve face 21 formed on the interior periphery thereof. 22 are pockets formed in the valve casing 20 around the periphery thereof and communicating by suitable ports with the valve face 21. 23 is the outlet in the said valve casing herein illustrated as elbowed and communicating with the reduced end of the resonator 24. 25 is a rotary valve having the inlet ports 26 leading from the top thereof to the circumferential face of said valve and communicating with the ports leading to the pockets 22 as said valve rotates. 27 are outlet ports through the circumferential face of the valve 25 between the ports 26 and opening on the under side of said valve into the outlet end 23 of the casing 20. 28 is a cover secured on the top of the casing 21 and having the journal bearing 29 in vertical central alinement with the valve 25 and through which the valve rod 30 extends, said cover inclosing the gas chamber 31 to which gas is supplied through the pipe 32. 33 are spark plugs electrically connected to a suitable source of electric energy and whereby sparks will be created in the pockets 22 at the required periods of time. In the operation of this form of apparatus a compressed mixture of combustible gases is supplied to the gas chamber 31 in said valve casing through the pipe 32, and as the valve 25 is rotated by any suitable means connected to the valve rod 30, the gas is distributed from the chamber 31 through the ports 26 into the pockets 22, wherein it is exploded immediately after the valve has rotated sufficiently to clear the port 26, and on further rotation of the valve one of the ports 27 releases the exploded gases from the pocket into the outlet end 23 of the valve chamber. In this manner successive charges of exploded gases are forced into the resonator 24, and as hereinbefore explained a wave train is set up in said resonator to produce and maintain a note having a fundamental tone according to the speed at which the valve 25 is rotated. It will be further understood that an adjustable resonator may be used in this application of the invention in a similar manner to that described with reference to Fig. 1, or a stationary resonator may be used, when it will be found that if the speed of the valve 25 emits the exploded charges to said resonator at a near frequency of its fundamental tone, the said resonator will be forced into producing a tone having a near frequency with the fundamental frequency of said resonator, and it must be understood that the valve is not necessarily rotated at the exact speed of the wave vibrations of said resonator.

What we claim as our invention is:

1. In means for maintaining a train of sound waves, a resonator, means for supplying combustible gases to said resonator, means for interrupting the supply of said gases, and means for igniting said gases at intervals corresponding to the frequency of the sound waves produced.

2. In means for maintaining a train of sound waves, a resonator, means for supplying combustible gases to said resonator, means for igniting said combustible gases in said resonator, and means for interrupting the supply of gases to said resonator at intervals corresponding to the frequency of the sound waves produced.

3. In means for maintaining a train of sound waves, a resonator, a combustion chamber communicating with said resonator, means for supplying combustible gases to said combustion chamber, means for igniting said combustible gases in said combustion chamber, and means for interrupting the supply of gases to said combustion chamber at frequencies in harmonic relation with the frequencies of the sound waves produced.

4. In means for maintaining a train of sound waves, a resonator, a combustion chamber communicating with said resonator, means for supplying combustible gases to said combustion chamber, means for igniting said combustible gases in said combustion chamber at intervals in accord with the frequency of the sound waves produced, and means for interrupting the supply of gases to said combustion chamber.

5. In means for maintaining a train of sound waves, a combustion chamber, means for supplying combustible gases to said chamber, means for interrupting the supply of said gases, and means for igniting said gases periodically at frequencies in harmonic relation with the frequencies of the sound waves produced.

6. In means for maintaining a train of sound waves, a combustion chamber, means for supplying combustible gases to said chamber, means for igniting said combustible gases in said chamber, and means for interrupting the supply of gases to said chamber periodically at frequencies in harmonic relation with the frequencies of the sound waves produced.

7. In means for maintaining a train of sound waves, a resonator, a combustion chamber communicating with said resonator, means for supplying combustible gases to said combustion chamber, and means for igniting said combustible gases in said com-

bustion chamber at intervals corresponding to the frequency of the sound waves produced.

8. In means for maintaining a train of sound waves, a resonator, and means for supplying products of ignited gases to said resonator at intervals in harmony with the natural sound frequency of said resonator.

9. In means for maintaining a train of sound waves, a resonator, and means for causing a series of explosions in said resonator periodically in synchronism with recurrence of the same phase of the sound waves produced.

10. In means for maintaining a train of sound waves, a resonator, a combustion chamber, means for supplying said combustion chamber with explosive gases, means for exploding said gases at frequencies in harmonic relation with the frequencies of the sound vibrations produced, and means for exhausting the products of combustion from said combustion chamber to said resonator.

11. In means for maintaining a train of sound waves, a resonator, a combustion chamber, means for supplying said combustion chamber with explosive gases periodically at frequencies in harmonic relation with the frequency of the sound waves produced, means for exploding said gases, and means for exhausting the products of combustion from said combustion chamber to said resonator in synchronism with recurrences of the same phase of the sound waves produced.

12. In means for maintaining a train of sound waves, a resonator, a valve chamber communicating with said resonator, means for supplying combustible gases to said valve chamber, means for exploding said gases periodically at frequencies in harmonic relation with the frequency of the sound waves produced, and a valve rotating in said valve chamber and admitting the products of combustion of said gases into said resonator.

13. In means for maintaining a train of sound waves, a resonator, a valve chamber having an outlet opening into said resonator, a plurality of combustion chambers communicating with said valve chamber, means for supplying said valve chamber with combustible gas, a valve rotatably arranged in said valve chamber having inlet and outlet ports communicating with said combustion chambers, and ignition means in said combustion chambers.

14. In means for maintaining a train of sound waves, a resonator, a valve chamber having an outlet opening communicating with said resonator, a plurality of combustion chambers communicating with said valve chamber, means for supplying said valve chamber with combustible gas, and a valve rotatably arranged in said valve chamber and adapted to direct said combustible gas into said combustion chambers and the products of combustion from said chambers to said outlet opening.

15. In means for maintaining a train of sound waves, a supply of combustible gases, means for exploding said combustible gases, and means for releasing said exploded gases at intervals in accord with the frequency of the sound waves desired to be produced.

Signed at the city of Ottawa, in the Province of Ontario, in the Dominion of Canada, this 27th day of February, 1906.

LOUIS EUCLIDE CÔTÉ.
WALTER FURMAN KELLEY.

Witnesses:
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