No. 882,039.

T. L. WILLSON. PATENTED MAR. 17, 1908.

FOG SIGNALING APPARATUS.

APPLICATION FILED JUNE 8, 1907.

3 SHEETS—SHEET 1.

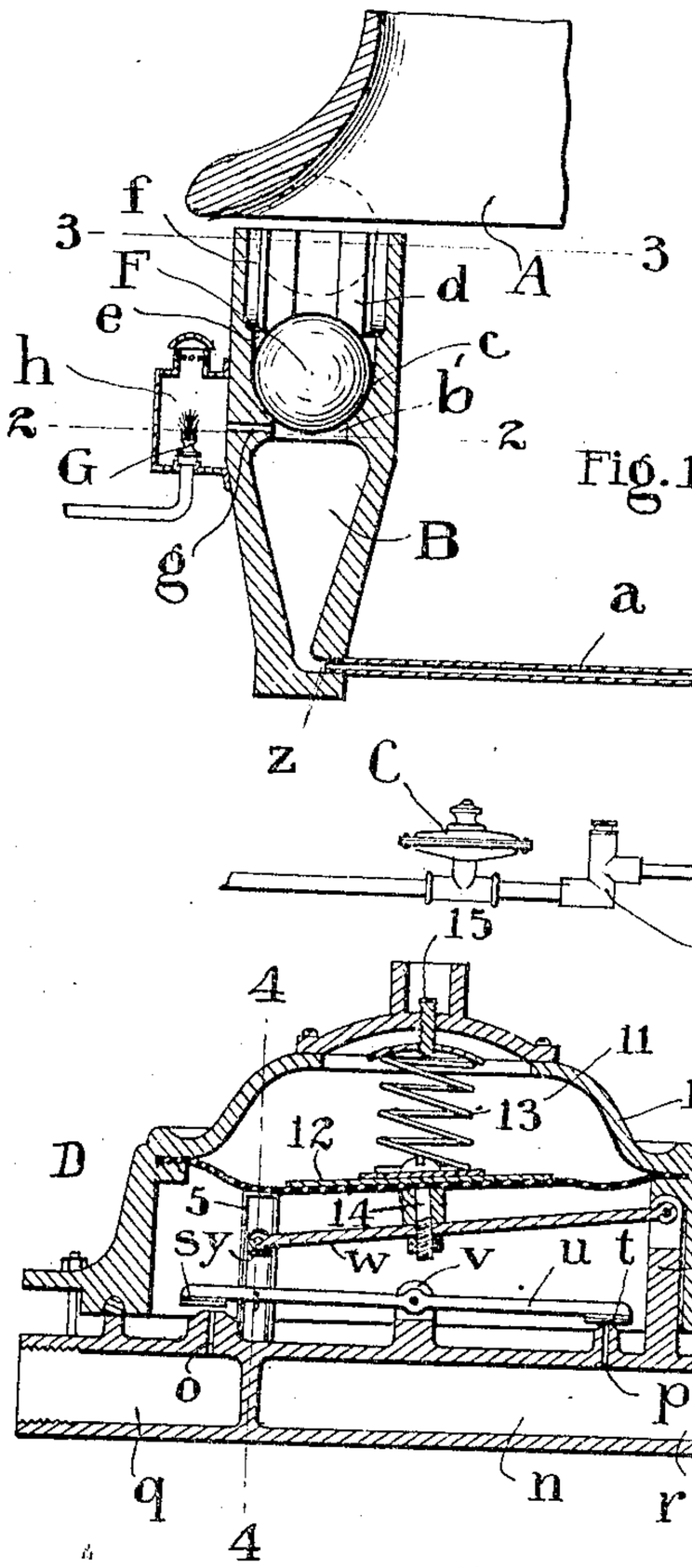


Fig. 1.

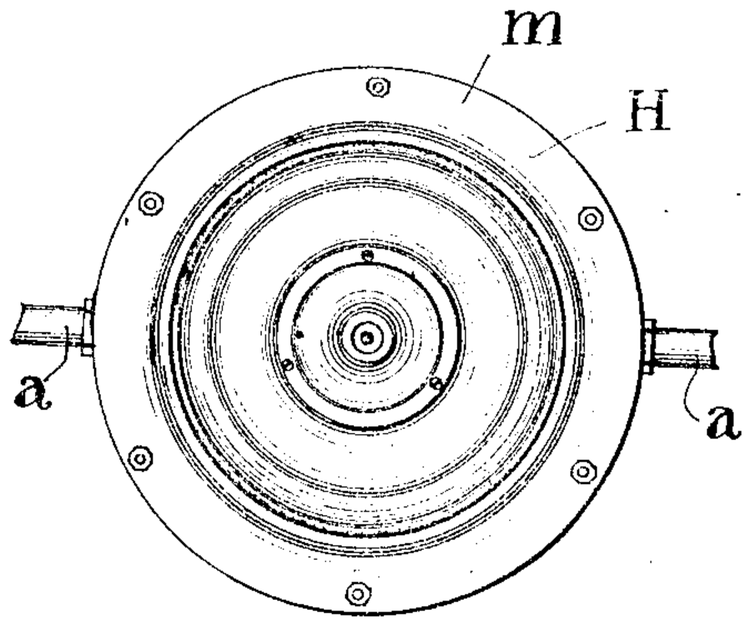


Fig. 7.

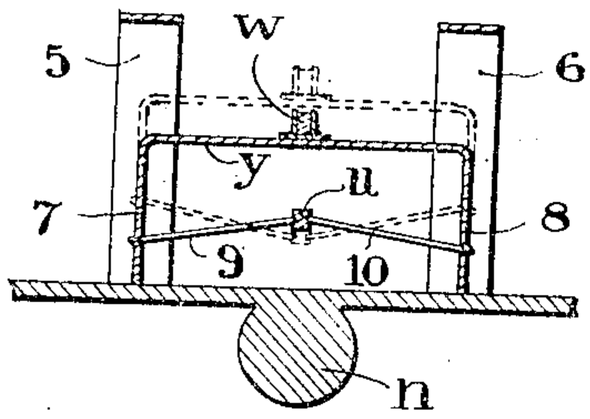


Fig. 6.

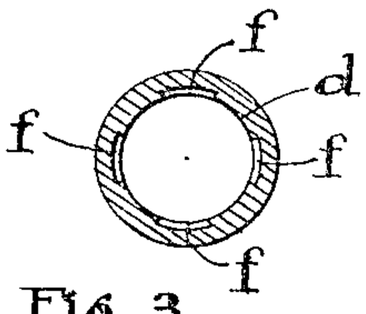


Fig. 3.

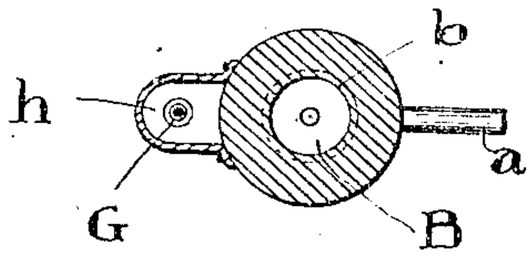


Fig. 2.

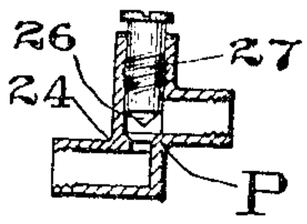


Fig. 4.

WITNESSES

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3 SHEETS—SHEET 2.

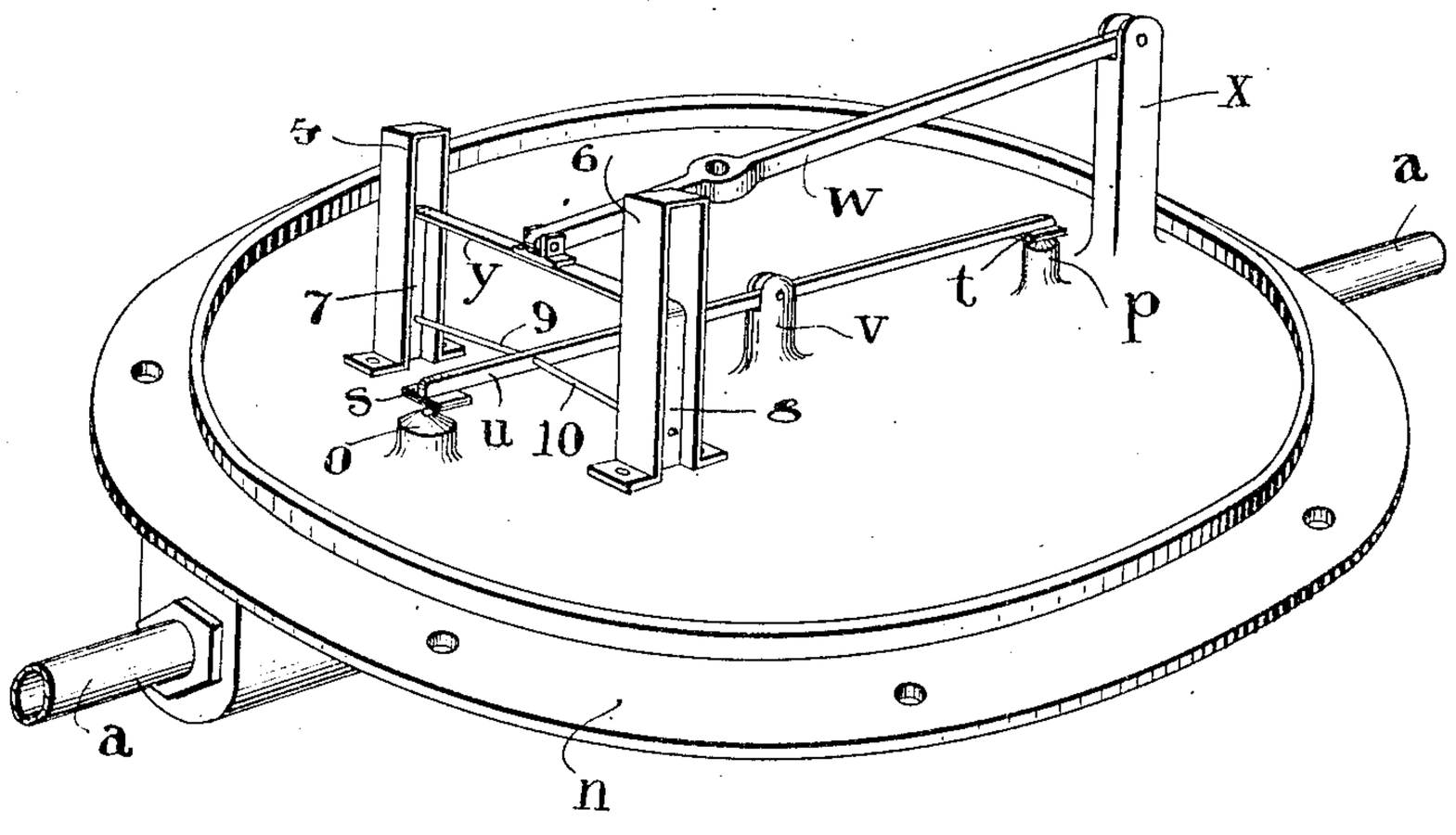


Fig. 8.

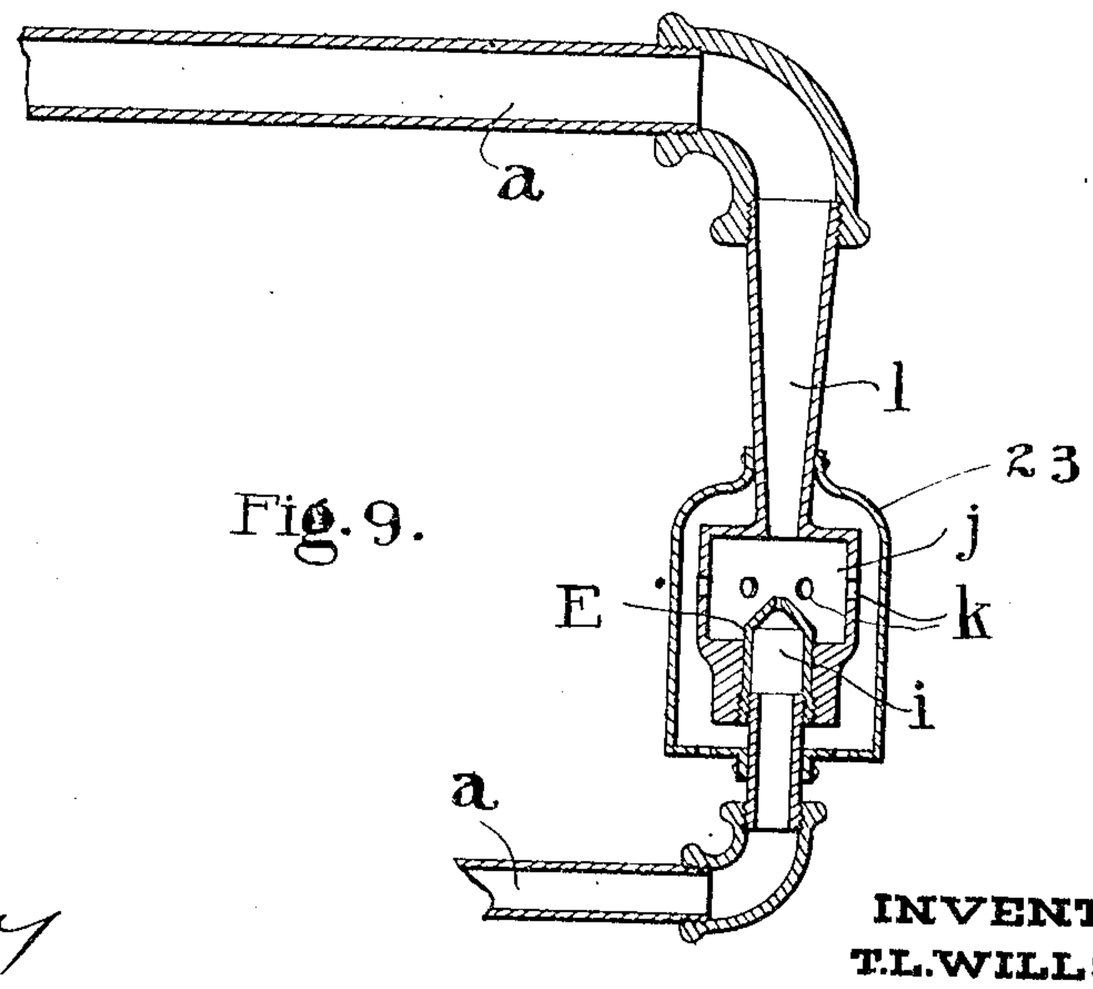


Fig. 9.

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3 SHEETS—SHEET 3.

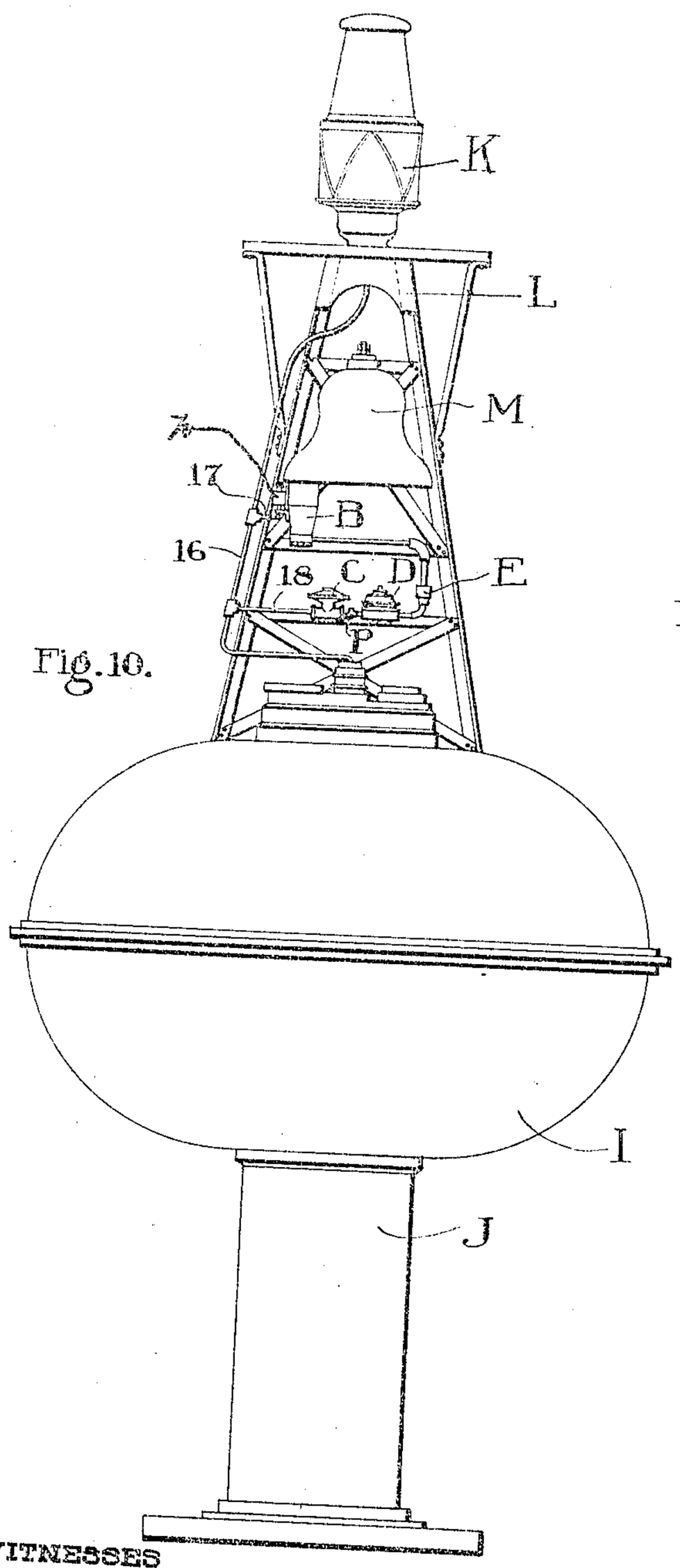


Fig. 10.

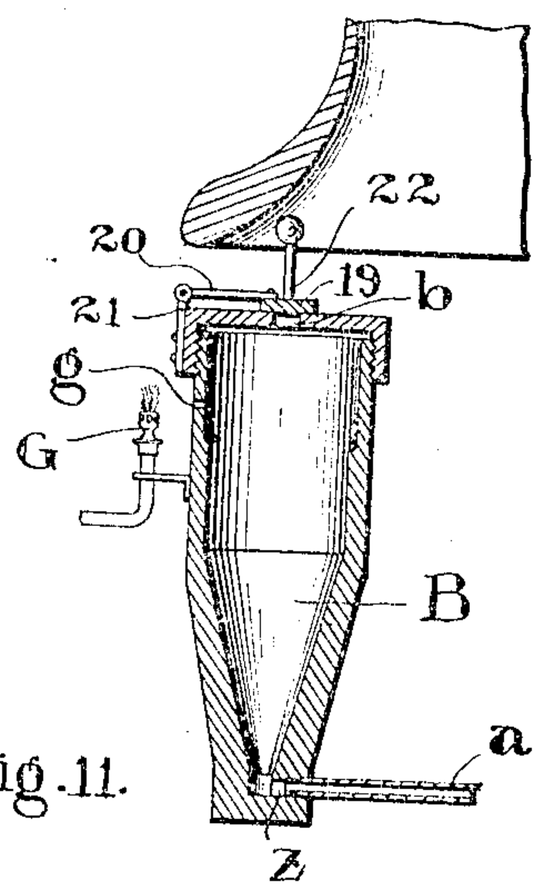


Fig. 11.

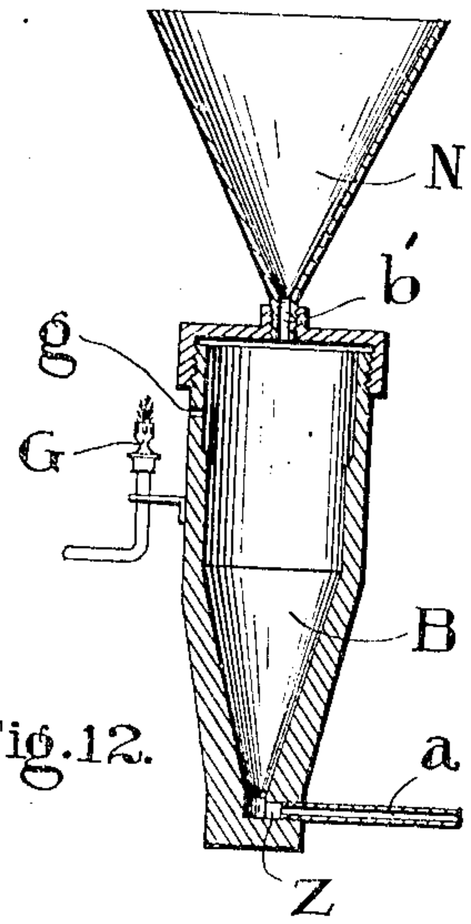


Fig. 12.

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# UNITED STATES PATENT OFFICE.

THOMAS LEOPOLD WILLSON, OF OTTAWA, ONTARIO, CANADA.

## FOG SIGNALING APPARATUS.

No. 882,039. Specification of Letters Patent. Patented March 17, 1908.

Application filed June 8, 1907. Serial No. 377,980.

*To all whom it may concern:*

Be it known that I, THOMAS LEOPOLD WILLSON, of the city of Ottawa, in the county of Carleton, Province of Ontario, Canada, have invented certain new and useful Improvements in Fog Signaling Apparatus, of which the following is a specification.

My invention relates to improvements in fog signaling apparatus, and the objects of my invention are to provide a simple and efficient form of fog signaling apparatus for lightships, buoys, submarine bells, or other location on land or sea, which will operate continuously without attention for long periods of time and with a minimum cost for operation.

Fog signaling apparatus, as at present constructed, depends for operation, either on the wave motion communicated to the apparatus through the medium of a buoy, or on a mechanical motor, such as a steam or gas engine, which either operates to produce the signal itself, or controls the admission of the sound-producing medium to the signaling apparatus. Those depending on the wave motion have the disadvantage that they are silent in a calm sea, while those operated or controlled by a mechanical motor are generally costly in construction and require constant attention and repair to keep in operation.

My invention overcomes the defects of both these types of apparatus and provides a continuously and automatically operating signal which may be placed in any location on land or sea and which is directly operated by the periodic explosion of a suitable explosive mixture.

In a preferable form, a bell is rung through the medium of a projectile discharged against it by the force of the explosion. In the alternative form, the bell is replaced by a megaphone, or other sound-intensifying device which accentuates the noise of the explosion.

An embodiment of the invention is illustrated in the accompanying drawings, in which,

Figure 1 is a side view partially in section of the apparatus embodying my invention. Fig. 2 is a sectional view along the line 2—2, Fig. 1. Fig. 3 is a sectional view on the line 3—3, Fig. 1. Fig. 4 is a sectional view of the needle controlling valve. Fig. 5 is a central vertical section through the apparatus used to alternately turn the supply of explosive fluid off and on for predetermined periods of time. Fig. 6 is a sectional detail along the line 4—4, Fig. 5. Fig. 7 is a top view of the apparatus shown in Fig. 5. Fig. 8 is a perspective view of the interior mechanism of the device shown in Fig. 3. Fig. 9 is a sectional detail of the means for mixing air with the explosive fluid. Fig. 10 illustrates my invention as applied to a combined bell and lighting buoy. Fig. 11 is a vertical section showing a modified form of the invention. Fig. 12 is a vertical section illustrating an alternative form of the invention.

In the drawings, like letters and figures of reference indicate corresponding parts in each figure.

Referring to the embodiment illustrated in Figs: 1 to 9, A represents a bell, suitably supported, below which is the explosion chamber B connected by suitable conducting piping *a* with the supply of explosive fluid. Inserted in the conducting pipe *a* are a gas pressure regulator C, a needle controlling valve P, a device D for alternately turning the supply of explosive off and on, and a device E for mixingi air with the explosive fluid. The explosion chamber B is preferably in the form of an inverted cone, having the inlet port *z* at the constricted bottom thereof and the outlet port *b'* in the top of a diameter nearly equal to that of the top of the chamber itself. On the exterior of the top of the explosion chamber, opposite the port *b*, a valve seat *c* is formed in which a striker (shown here as a ball F), or other form of projectile, seats, the said ball being of such weight that it will be raised off its seat by the force of an explosion within the chamber and be discharged against the bell. To guide the ball F when discharged, I provide a tubular extension *d* on the explosion chamber, having an inner diameter substantially equal to that of the ball. Means are provided to enable the products of combustion to escape as soon as the ball has moved a determined distance, the means I have shown being channels formed in the upper part of the tubular extension adapted to permit the escape of the products of combustion, around the ball, as soon as it has passed the lower portion *e*.

Suitable means are provided for igniting the mixture within the chamber, preferably being automatically operated by the passage of gas through the chamber. The means I have invented to accomplish this comprise a

gas burner G disposed near the oulet of a small conducting passage-way *g* which extends through the explosion chamber near the top thereof.

The device E for mixing air with the explosive fluid may be of any desired and well known character, that I have illustrated being shown in Fig. 9 and consisting of a nozzle *i*, through which the explosive fluid discharges into a chamber *j* having apertures *k* therein, through which the air may be drawn in, and a combining tube *l*, above the mixing chamber, in which the air and explosive mixture may thoroughly commingle, prior to their passage through the piping *a* into the explosion chamber B.

When the apparatus is used in locations exposed to the weather, it will be necessary to surround the burner G and device E with suitable protecting casings *h* and 23.

The device D for alternately turning off and on the supply of explosive fluid and which thus serves to prevent firing back, as hereinafter described, may be any of the various types of similar apparatus employed with intermittently burning or flashing gas lights. That which I have illustrated, and which, for the sake of clearness, I will now describe, consists of a casing H formed with an upper part *m* and a base *n*, which is provided with an inlet port *o* and an outlet port *p*, which communicate respectively with conduits *q* and *r*, formed integral with the base and to which is connected the conducting piping *a*.

The passage of the explosive medium, ordinarily gas, through the inlet and outlet ports, is controlled by valve disks *s* and *t*, supported on the extremities of a lever *u* centrally pivoted to a projecting lug *v* on the base. The tilting of this lever *u* is automatically controlled by the passage of the gas into the casing, its regulation being such that when a certain amount of gas has passed into the casing, the inlet port will be automatically closed and the outlet port opened, and then again, when this gas has passed out, the outlet port will be closed and the inlet port opened. The means I show to accomplish this, comprise a lever *w* pivoted to a standard *x* formed integral with the base, the opposite end of the lever having pivoted thereto, a U-shaped dependent spring member *y* having arms 7 and 8, adapted to reciprocate in tracks 5 and 6, which are secured to and upwardly extend from the base. The extremities of the arms 7 and 8 of the spring member are connected to the lever *u* near the end thereof by means of toggle wires 9 and 10, the length of each of which is slightly greater than the distance between the arms and the lever, whereby they will always tend to assume an inclined position, relatively to each other. By this means, when the end of the lever *w* is raised, the lever *u* will not be moved until the points of attachment of the wires 9 and 10 to the arms 7 and 8 have passed above the points of attachment to the lever *u*, when the lever *u* will operate quickly under the action of the toggle wires 9 and 10, actuated by the spring member 7, moving the disk *s* down, and closing the inlet port, its position after this movement, being indicated in dotted lines in Fig. 6.

The movement of the lever *w* is controlled by the amount of gas in the casing, the top of the casing being provided with a dome 11, the bottom of which is closed by a flexible diaphragm 12 pressed toward its lowest position by a suitable spring 13 and connected by a bolt 14, or other connecting means with the lever *w*. The tension of the spring 13 is regulated by a screw 15 extending through the top of the casing, whereby the pressure at which the diaphragm will operate, is controlled.

In operation, the gas passes into the casing, raising the flexible diaphragm 12 and the lever *w*. As soon as the lever *w* has been raised sufficiently to move the extremities of the wires 9 and 10 above the points of attachment to the lever *u*, the spring member will operate to reverse the position of the toggle wires and so depress the end of the lever *u*, closing the inlet port and opening the outlet port. This enables the gas to pass out by its own expansion, and proceed on its way to the explosion chamber. As the gas passes out, the diaphragm 12, under the action of the spring, lowers, lowering the lever *w*, which, lowering the extremities of the toggle wires, will cause the spring member to operate them in a reverse manner to open the inlet port and close the outlet port. This will cause the gas to pass to the air mixing device E in puffs, which will result in alternate puffs of pure air, and mixed air and gas which will pass in succession through the piping *a* into the explosion chamber. Thus any firing back in the piping is prevented by the puffs or plugs of pure air intervening between the puffs or plugs of the explosive mixture of air and gas. The amount of the pressure of the gas fed into the device D is controlled by a needle valve P, or other suitable device. That illustrated comprises a casing 24 having a conical seat 25 therein, against which the conical end 26 of the screw 27 extending through the casing is adapted to fit. The pressure of the gas is controlled by the amount of space between the end of the screw and the seat. The flow of gas is rendered uniform in character by a suitable gas pressure regulator C of any suitable form which, being well known in the art, need not be here described.

In the operation of the device, the burner G is kept burning continuously, and the explosive fluid, which is preferably the same gas as is supplied to the burner G, is passed

through the pressure regulator C and needle valve P and then through the device D, which causes it to pass in puffs through the nozzle *i*, whence it draws the air in through the ports *k* and passest hrough the combining tube *l* and conducting piping *a* into the bottom of the explosion chamber. Here, as the supply is continued, the explosive mixture of gas and air rises gradually to the top of the chamber, where a small portion of it passes out through the passageway *g*, and being ignited by the flame of the burner G, communicates the ignition to the explosive mixture now filling the chamber B. This causes an explosion of the same, which lifts the ball F off its seat and discharges it with great force against the bell A ringing the same.

It will be observed that the force of the explosion is intensified by the construction of the tubular extension *d* which prevents any of the gas escaping until the ball has moved passed the beginning of the channels *f*. After the explosion the passageway *g*, as well as the chamber itself, are cleared by the products of combustion passing out. But the spent gases pass out with the refilling of the chamber, and, as the ball instantly falls back after the explosion and stroke it falls upon the gases which are still in the chamber and passageway for the ball, so that the ball is cushioned by the gases contained in the chamber and passage. The explosion having taken place, back firing of the device E is prevented by the device D, causing alternate puffs of air and explosive mixture to pass through the piping *a*, and before another explosion takes place, the explosion chamber B must be again gradually filled from the bottom, when the action will be again repeated.

It is evident that the periodicity of the explosion is controlled by the speed with which the explosive mixture is forced into the chamber and this will depend on the pressure of the gas itself, and hence, by regulating the needle valve, the periodicity of the explosion may be controlled. The periodicity is also to a certain extent, influenced by the size of the passage-way *g*, as the products of combustion from one explosion, must be cleared out of this, before the next can take place.

Referring to the application of the device to gas buoys, as illustrated in Fig. 10, I is the float chamber of the buoy, which supports the gas generator tube J, from the top of which the conducting pipe 16 leads to the lamp K, supported in a suitable frame L. A suitable bell M is also supported on the frame, below which the explosion chamber B is arranged, together with the remaining parts of my apparatus as hereinbefore described. Branch conducting pipes 17 and 18 lead from the conducting pipe 16 to supply the gas burner G and the explosion chamber respectively.

In the modified form illustrated in Fig. 11, the port *b* in the top of the explosion chamber is closed by a plate 19 connected to the lever 20 pivoted to the projection 21 on the side of the explosion chamber. In this modification the striker is in the form of an arm 22 which extends from the plate 19 and thus, when an explosion occurs within the chamber, the plate will be raised, swinging on the pivoted arm 20 and causing the striker 22 to hit the bell. In the alternative form illustrated in Fig. 12, the port *b'* has connected thereto, a megaphone N or other sound intensifying device, whereby the noise of the explosion will be intensified to give a warning signal. The explosions are as usual, produced in this case by the passing of the gaseous mixture through the port *g* of the burner G.

The operation of the preferable form of bell striking means illustrated, will produce a very loud and clear ringing of the bell, the ball on striking the bell rebounding very quickly owing to its own weight and the force of its impact, thus eliminating any deadening sound on the bell such as is difficult to avoid in the ordinary bell clapper. The products of combustion passing freely out, clear the chamber and outlet passageways therein.

It will be observed that my mode of operation differs entirely from that hitherto employed, in which the explosive mixture was compressed in a chamber and then exploded, since the mixture is not compressed but flows freely through the chamber at substantially atmospheric pressure.

While an embodiment of the invention has been described herein with great particularity of detail, yet it will be readily understood that in carrying out the construction of the same, changes within the scope of the appended claims, may be made, without departing from the spirit of the invention.

What I claim as my invention is:—

1. A signaling apparatus including a striker, a sounding device operated thereby and an explosion device directly operating the striker.

2. A signaling device including a vibratory sound producing means, an explosion device operating intermittently at atmospheric pressure, and means for directly applying the force of the explosions to vibrate the sound producing means.

3. A signaling apparatus including a striker, a sounding device operated thereby, means for producing explosions of gas at atmospheric pressure, and means for applying the force of the explosions to operate the striker.

4. A signaling apparatus, including a bell,

a projectile means for creating an explosion, means for applying the force of the explosion to direct the projectile against the bell.

5. A signaling apparatus including in combination, means for producing an explosive mixture, means for igniting said mixture at substantially atmospheric pressure to produce an explosion and signaling means operated by the explosion.

6. A signaling apparatus including in combination, an explosion chamber having permanent communication with the open air, means for introducing an explosive mixture into the chamber, means for igniting the mixture in the chamber, and signaling means operated by an explosion within the chamber.

7. A signaling apparatus including in combination an explosion chamber having a permanently open port, means for introducing an explosive mixture at substantially atmospheric pressure into the chamber, a gas burner exterior to the chamber adjacent to the port therein, adapted to ignite the mixture through the port and signaling means operated by an explosion within the chamber.

8. The combination with a gas containing buoy, of a sounding device, a striker therefor, and an explosion device directly operating the striker and adapted to be operated by the gas carried by the buoy.

9. The combination with a buoy, and gas generating means thereon, of means for periodically producing explosions of a portion of said gas, and signaling means operated by the force of the explosions.

10. The combination with a bell, of a projectile and an exploding apparatus automatically operating to positively and periodically impel the projectile against the bell.

11. The combination with a bell, of a projectile, an exploding apparatus automatically operating to positively and periodically impel the same against the bell, and means for varying the periodicity of the discharge.

12. A signaling apparatus, including in combination, a bell, an explosion chamber, means for intermittently producing an explosion therein, and bell ringing means operated by the force of the explosion.

13. A signaling apparatus, including in combination, a bell, an explosion chamber, means for intermittently producing an explosion therein, means for directing the products of the explosion towards the bell, and means operated by the outward passage of said products for ringing the bell.

14. A signaling apparatus including in combination, a bell, an explosion chamber having an outlet port therein, a gravity seated ball closing the outlet port but adapted to be impelled by an explosion within the chamber, means for directing the ball against the bell, and means for intermittently producing an explosion within the chamber.

15. A signaling apparatus including in combination, a bell, an explosion chamber having an outlet port therein, a gravity seated ball closing the outlet port, but adapted to be impelled by an explosion within the chamber, a tubular extension on the explosion chamber adapted to direct the ball against the bell and means for intermittently creating explosions within the chamber.

16. A signaling apparatus including in combination, a bell, an explosion chamber having an outlet port therein, a gravity seated ball closing the outlet port but adapted to be impelled by an explosion therein, a tubular extension on the chamber adapted to direct the ball against the bell, the inner diameter of the tubular extension being substantially equal to that of the ball and means on the upper part of the extension for permitting the escape of the products of the explosion after the ball has traveled a determined distance, and means for intermittently creating an explosion within the chamber.

17. A signaling apparatus including in combination, a bell, an explosion chamber, having an outlet port therein, a valve seat formed on the outer side of the outlet port, a ball in the valve seat adapted to be impelled by an explosion within the chamber, means for directing the ball against the bell, and means for intermittently creating an explosion within the chamber.

18. A signaling apparatus including in combination, a bell, an explosion chamber having an outlet port therein, a gravity seated projectile normally closing the outlet port but adapted to be impelled by an explosion within the chamber, and means for preventing the escape of the products of the explosion until the projectile has moved a predetermined distance, and means for creating an explosion within the chamber.

19. A signaling apparatus including in combination, an explosion chamber, means for introducing an explosive mixture near the bottom thereof, and igniting means at the upper part of the chamber adapted to explode the mixture when it rises to the said upper part and signaling means operated by an explosion within the chamber.

20. A signaling apparatus including in combination, an explosion chamber, a supply pipe entering the same near the bottom thereof, means for mixing air with the explosive fluid during passage through the pipe, igniting means on the upper part of the chamber adapted to explode the mixture when it rises thereto, and means for preventing firing back after an explosion and signaling means operated by an explosion within the chamber.

21. A signaling apparatus including in combination, an explosion chamber, piping leading thereto, means for alternately pass-

ing through the piping, puffs of air and mixed air and gas, and igniting means at the upper part of the chamber adapted to explode the mixture when it rises thereto and signaling means operated by an explosion within the chamber.

22. A signaling apparatus including in combination, an explosion chamber, a gas supply pipe therefor, means in said pipe for mixing air with the gas during passage therethrough, means for automatically turning the gas off and on for predetermined periods of time, igniting means disposed exterior to the chamber and means placing the same in communication with the interior of the chamber, signaling means operated by an explosion within the chamber.

23. A signaling apparatus including in combination, a chamber having an opening therein, means for passing an explosive mixture into the chamber, igniting means coacting with the chamber for periodically exploding the mixture while in the chamber, closing means for the opening in the chamber adapted to be moved outwardly by an explosion within the chamber and a sounding device operated by the outward movement of the closing means.

24. A signaling apparatus including in combination, an explosion chamber having an opening therein, outwardly movable closing means for the said opening, normally gravity held in closed position but adapted to be moved outwardly by an explosion within the chamber, means for creating an explosion within the chamber and a sounding device operated by the closing means in its outward movement.

25. A signaling apparatus including in combination, an explosion chamber having an opening therein, means for creating an explosion in the chamber, closing means for the opening, adapted to be moved outwardly by an explosion within the chamber, and a bell adapted to be rung by the closing means in its outward movement.

26. A signaling apparatus including in combination, an explosion chamber, means for introducing an explosive mixture thereinto and igniting means external to the chamber, the said chamber having a conducting passageway permanently open and adapted to afford communication between the mixture within the chamber and the igniting means and signaling means operated by an explosion within the chamber.

27. A signaling apparatus including in combination, an explosion chamber having a permanently open inlet port at the bottom and an outlet port at the top, means for introducing an explosive mixture through the inlet port, and igniting means external to the chamber, the said chamber having a conducting passage-way at the top thereof, adapted to afford communication between the mixture within the chamber and the igniting means, and signaling means operated by an explosion through the outlet port.

28. A signaling apparatus comprising a gradually enlarging explosion chamber, an inlet port near the smaller end thereof, an outlet port at the larger end, closing means at the outlet port adapted to be displaced by an explosion within the chamber, means for introducing a mixture within the chamber, means for exploding the mixture, and signaling means operated by the displacement of the closing means.

29. A signaling apparatus comprising an explosion chamber having the interior thereof substantially in the form of an inverted cone, with an inlet port at the bottom and an outlet port at the top of nearly equal diameter with the large diameter of the cone, closing means for the outlet port adapted to be displaced by an explosion within the chamber, means for exploding the mixture and signaling means operated by the displacement of the closing means.

30. In combination with an explosion device, and signal operated thereby, of means for supplying to the explosion device combustible and non-combustible fluids in alternate succession.

31. In combination with an explosion device and signal operated thereby, of a feed conduit for the explosion device and means for alternately providing in said conduit combustible and non-combustible fluids.

32. In combination with an explosion device and signal operated thereby, of a feed conduit for the explosion device, means for passing a combustible fluid intermittently through said conduit and means for drawing air into said conduit by the passage of said fluid.

33. The combination with an explosion chamber of determined form having igniting means near one end thereof, and an inlet port near the other end thereof, with a clear passage between, of means for gradually feeding an explosive mixture by its own expansion through the inlet port to the igniting means, and signaling means directly operated by the force of the explosion.

34. The combination of the explosion device and projectile discharged thereby, and of sounding means operated by the projectile when discharged by said explosion device, said explosion device being provided with means for holding the gases to cushion the projectile on its return.

35. In a signaling apparatus and in combination, an explosion chamber, means for supplying by its own expansion an explosive fluid thereto, means for igniting said fluid when the chamber is substantially filled, and signaling means actuated by an explosion of the fluid.

36. A signaling apparatus including in

combination, a vibratory sound producing means, a projectile and automatically actuating means for periodically and positively impelling the projectile against the sound producing means.

37. The combination with a sounding device, of an explosive device adapted to intermittently discharge the products of combustion, and a striker for the sounding device operated by the discharge of said products.

Signed at the City of Ottawa, in the Province of Ontario, this 4th day of June, 1907.

THOMAS LEOPOLD WILLSON.

Witnesses:
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MARY C. LYON.