E. C. WOOD & H. G. MARDEN.
SYSTEM FOR OPERATING PNEUMATIC BELLS.
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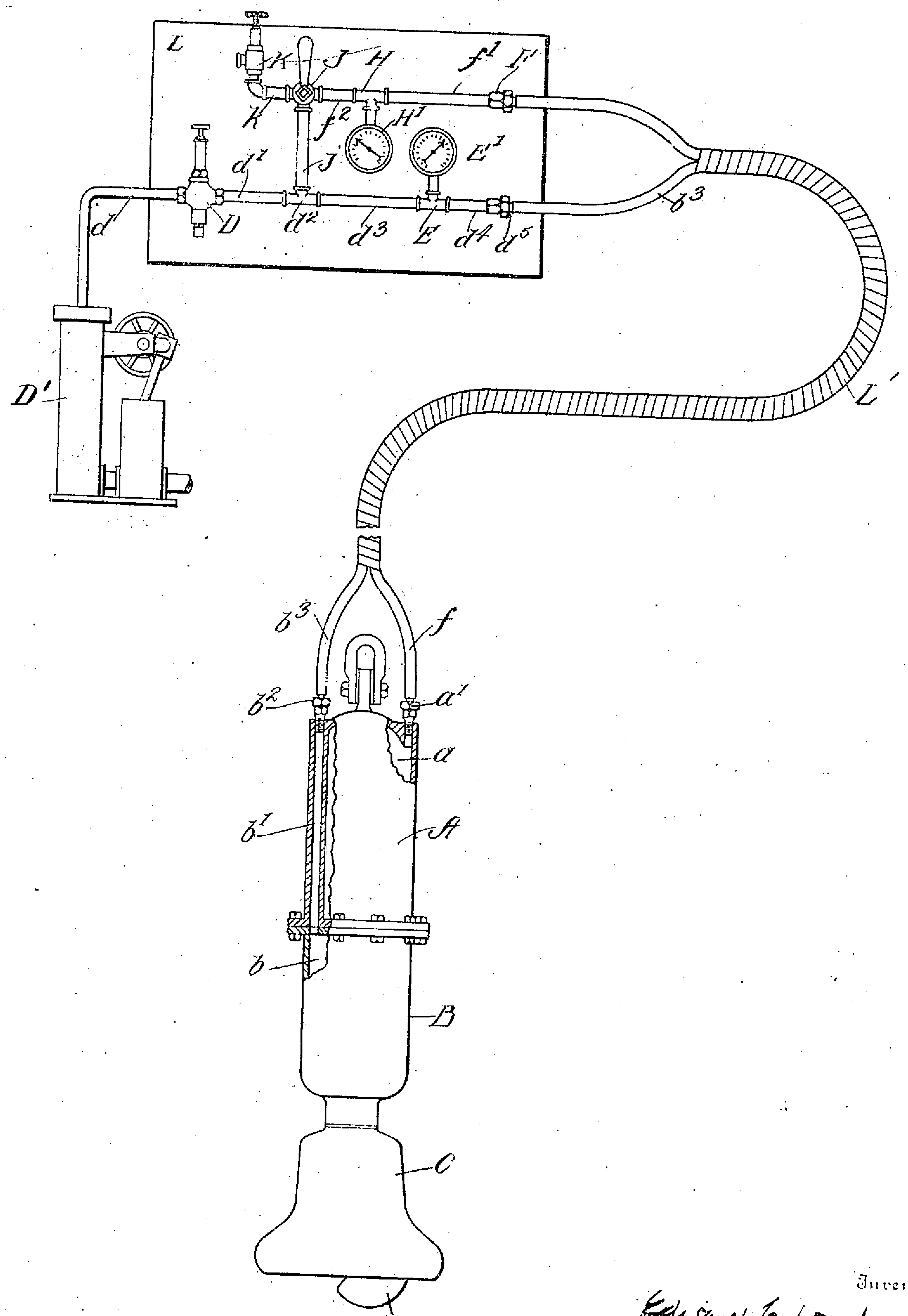
Patented June 20, 1911.



Witnesses
R.E. Brewer.
J.M. Dolan

Inventors
Edward C. Wood
Harry G. Marden
By Charles Raymond Cooke
their Attorneys

UNITED STATES PATENT OFFICE.

EDWARD C. WOOD, OF SOMERVILLE, AND HARRY G. MARDEN, OF BRAINTREE, MASSACHUSETTS, ASSIGNORS TO SUBMARINE SIGNAL COMPANY, OF WATERVILLE, MAINE, A CORPORATION OF MAINE.

SYSTEM FOR OPERATING PNEUMATIC BELLS.

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Application filed July 17, 1905. Serial No. 269,999.

To all whom it may concern:

Be it known that we, EDWARD C. WOOD, of Somerville, in the county of Middlesex and State of Massachusetts, and HARRY G. MARDEN, of Braintree, in the county of Norfolk and State of Massachusetts, both citizens of the United States, have invented a new and useful Improvement in Systems for Operating Pneumatic Bells, of which the following is a specification.

We have heretofore, namely,—on the 31st day of May 1905, filed an application for Letters Patent of the United States, Serial No. 263,165, for an improvement in apparatus for submarine signaling. That improvement in its preferred form comprises a bell attached to a water tight casing which contains mechanism for operating the hammer or striker which mechanism is operated by compressed air introduced into a reservoir within the casing in which the pressure is maintained at say 45 pounds. When submerged the pressure on the exhaust side of the apparatus is preferably maintained at at least one atmosphere depending upon the depth to which the apparatus is sunk, the air pressure within the casing thus being sufficient to keep out the water should the apparatus show any tendency to leak. This may be accomplished by a back pressure valve which allows the escape of a portion only of the exhaust being set to maintain the pressure in the exhaust chamber of the valve at a predetermined amount. As the operation of the apparatus depends upon the difference in pressure between the compressed air reservoir and the exhaust reservoir if these pressures are equalized the apparatus will stop signaling and at the same time any leakage in the apparatus will be indicated by the fact that the pressures will not be maintained without constant pumping.

The present invention relates to apparatus designed primarily for use in connection with the compressed air motor for operating the pneumatic bell or signaling device above described, but it will be obvious that the apparatus will be equally useful in connection with such a submerged pneumatic motor irrespective of the work done or the device actuated by said motor.

The invention will be understood by reference to the drawings in which an embodiment of it is shown diagrammatically. As its parts are all of a type procurable in the market and well known to those skilled in the art (with the exception of the pneumatic bell itself which is described in our said application) we shall give no detailed description of them.

A, B, is the casing of our said pneumatic bell, C being the bell itself, and *c* the tongue. The casing A embodies compressed air and exhaust reservoirs in communication through a bell-operating compressed air motor. This mechanism will not be further described except by reference to our previous application, and to say, that generally speaking the lower portion B of the casing contains a compressed air reservoir *b* which is connected through the passage b^1 and a coupling b^2 with a feed hose or pipe b^3 connecting it with the air pump D^1 as will be below described. The upper portion A of the casing contains the exhaust reservoir *a* which is connected in like manner by the coupling a^1 with the exhaust hose or pipe *f*. To illustrate the general arrangement of parts a motor of the type described in said application is indicated diagrammatically at A^1.

A^2 is the tube by which air is taken from the pressure reservoir the valve A^3 allows it and is delivered into the motor from which it is afterward exhausted into the chamber *a* through an opening in the bottom of the motor as described in our above named application.

The system at the station is as follows: The pipe *d* connects with the reservoir of an air pump, D^1, and D is a relief valve of any ordinary kind such as is found in the market capable of reducing the pressure of the air pump reservoir to a predetermined amount, say 45 pounds. It is desirable that the reservoir of the compressed air pump at all times contain adequate pressure, considerably in excess of the pressure needed to operate the bell, which under ordinary conditions may be assumed to be 45 pounds. The relief valve D is connected by the pipe d^1 with a T-coupling d^2 which is connected by pipe d^3 with a second T-coupling E, on which is mounted the pressure gage E^1 adapted to indicate the pressure in the main line. By means of suitable pipe d^4 and coupling d^5 this direct line from the air pump

is connected with the feed hose b^3 leading to the coupling b^2 on the casing.

The exhaust connections comprise the pipe f leading from the coupling a^1 back to a coupling F which is connected by the pipe f^1 with a second coupling H carrying a pressure gage H^1. A pipe f^2 connects the coupling H with a three-way valve J which in addition to the passage through the pipe f^2 controls a pipe j leading to the coupling d^2, in the main line and also a pipe k leading to a back pressure valve K. This back pressure valve is set to retain within the casing whatever pressure is considered desirable, for example,—one atmosphere, 15 pounds. The three-way cock J may be so turned as merely to connect the back pressure valve K with the exhaust pipe f and so allow the escape of the exhaust at 15 pounds. In that case the pressure in the reservoir b is maintained at 45 pounds or at whatever other pressure the relief valve is set, and the bell operates owing to the difference between the two pressures, the exhaust from the apparatus passing back through the pipe f and through the three-way valve J to the back pressure valve K from which it exhausts in such a manner as not to reduce the pressure in the casing below the desired point. When it is desired to stop the bell from signaling, the three-way valve J is turned into such position as to connect the pipe j with the exhaust system. Under these circumstances there will be no exhaust but the air entering through the valve D will divide and produce counterbalancing pressures in the reservoir a and the reservoir b so that the apparatus will not work. The gages show the pressures on both sides of the casing and hence serve as an indication that the apparatus is in operative or in inoperative condition and also if they show that the pressure is not being maintained it will be understood that the casings leak. We have shown this apparatus attached to a base L which is located at the station at which is the air pump D^1 and the feed hose b^3 and the exhaust hose f may be connected together in one structure L^1. Such a station may be on shore or on board a lightship from which the bell is suspended. In either case the connection of the station with the bell will be by means of a hose of any necessary length. Such a bell for example may be suspended from a buoy some distance off shore and connected by hose with a convenient station on shore from which it is operated.

The apparatus has been found extremely useful because it affords a simple way, viz:—by simply turning the three-way valve, first of operating the bell to make it ring its peculiar signal, and second, of maintaining it when out of use in operative condition, *i. e.*, from any water which might leak into it. The gages at all times indicate its condition, one gage showing at 45 pounds, and the other gage at 15 pounds, when the apparatus is operating, and both showing at 45 pounds when the apparatus is not operating, and any unsteadiness in the gage readings showing a leakage.

While the form of our system shown in the drawings is the best now known to us, of course it is possible that other arrangements of these parts may be made within the scope of the appended claims by which the desired result, or some of them, can be accomplished.

We have not shown or described any air pump in detail as air pumps are well known and there are many which will answer the requirement of our invention, namely,—that the air pump shall be capable of maintaining at least sufficient pressure in the compressed air reservoir.

What we claim as our invention is:

1. In an apparatus of the character described, in combination; a pressure system comprising an air pump, a compressed air reservoir, means connecting said air pump and said compressed air reservoir, and a relief valve to control the pressure in said compressed air reservoir; an exhaust system comprising an exhaust reservoir, a back pressure valve, and means connecting said exhaust reservoir with said back pressure valve; an air motor connected with both said pressure and exhaust systems and adapted to be operated by the difference in pressure therein; and means for equalizing the pressures in said systems to render said motor inoperative and for maintaining a predetermined pressure on said motor, substantially as set forth.

2. In an apparatus of the character described, in combination; a pressure system comprising an air pump, a compressed air reservoir, and a relief valve to control the pressure in said compressed air reservoir; an exhaust system comprising an exhaust reservoir, a back pressure valve, and means connecting said exhaust reservoir with said back pressure valve; an air motor connected with both said pressure and exhaust systems and adapted to be operated by the difference in pressure therein; and means for equalizing the pressures in said systems to render said motor inoperative and for maintaining a predetermined pressure on said motor, said means comprising a pipe connecting said pressure and exhaust systems at points intermediate said relief valve and motor and said back pressure valve and motor, respectively, and a cock to control the passage through said pipe, substantially as set forth.

3. In an apparatus of the character described, in combination; a pressure system comprising an air pump, a compressed air reservoir, means connecting said air pump and said compressed air reservoir, and a

relief valve to control the pressure in said compressed air reservoir; an exhaust system comprising an exhaust reservoir, a back pressure valve, and means connecting said exhaust reservoir with said back pressure valve; an air motor connected with both said pressure and exhaust systems and adapted to be operated by the difference in pressure therein; and means for equalizing the pressures in said systems to render said motor inoperative and for maintaining a predetermined pressure on said motor, said means comprising a three-way cock in the connection between said exhaust reservoir and back pressure valve and means connecting said three-way cock with the connection between said air pump and compressed air reservoir, substantially as set forth.

4. In an apparatus of the character described, in combination; a pressure system comprising an air pump, a submerged compressed air reservoir, means connecting said air pump and said compressed air reservoir, and a relief valve to control the pressure in said compressed air reservoir; an exhaust system comprising a submerged exhaust reservoir, a back pressure valve, and means connecting said exhaust reservoir with said back pressure valve; a submerged air motor connected with said compressed air and exhaust reservoirs respectively; and means for equalizing the pressures in said systems to render said motor inoperative and for maintaining a predetermined pressure in both said reservoirs, whereby the hydrostatic pressure on the submerged portions of said apparatus is opposed and leakage prevented, substantially as set forth.

EDWARD C. WOOD.
HARRY G. MARDEN.

In presence of—
JOHN E. R. HAYES,
R. E. BREWER.