April 23, 1929. E. WILCKENS 1,709,890

SIGNAL BUOY

Filed May 26, 1928

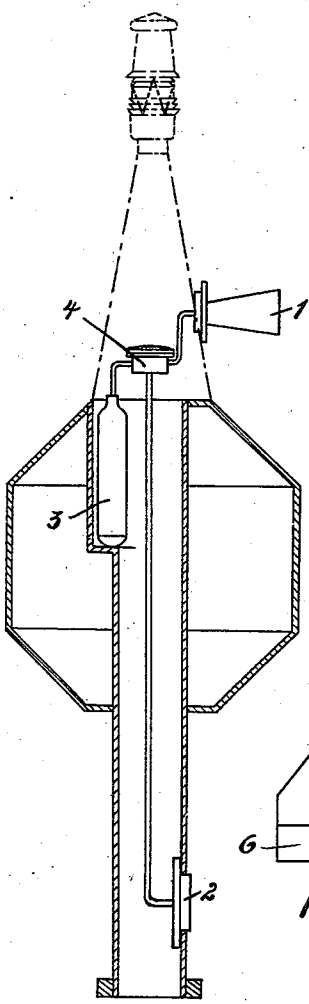


Fig. 1

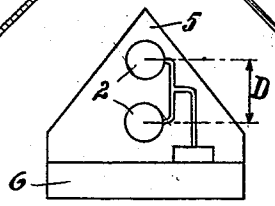


Fig. 3

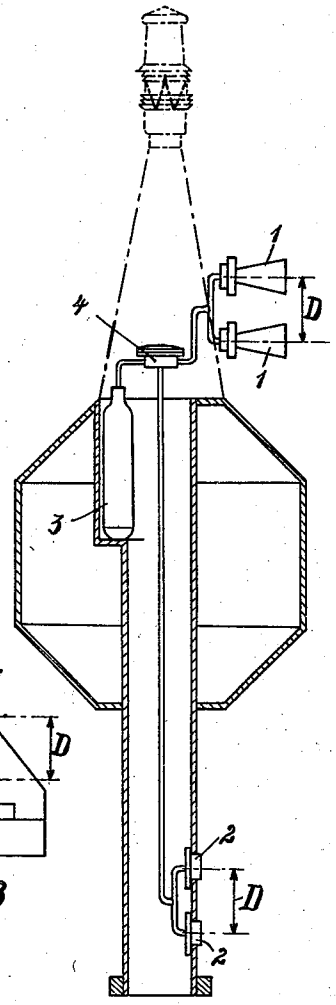


Fig. 2

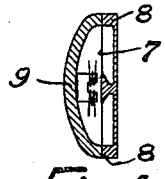


Fig. 4

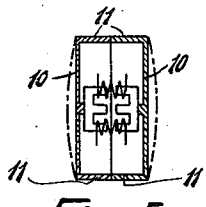


Fig. 5

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UNITED STATES PATENT OFFICE.

ERNST WILCKENS, OF BERLIN, GERMANY.

SIGNAL BUOY.

Application filed May 26, 1928, Serial No. 280,945, and in Germany June 14, 1927.

This invention relates to buoys or similar signalling stations fitted with acoustical signalling apparatus.

For the purpose of facilitating navigation in the case of fog or on other occasions when visibility is poor, important points are made recognizable by means of optical and acoustical signals. Whilst optical signals have been perfected to such an extent that the same will operate automatically in perfectly reliable manner for some considerable time, so that economy may be effected as far as attendant personnel is concerned, this has not been achieved up to now in reliable and practical manner in the case of acoustical signalling means. It is accordingly necessary at important points to provide manned light ships or land stations. In order to cut down the heavy expenses thus incurred, attempts have variously been made to mount submarine bells on buoys, and to maintain these in operation by means of gas stored within the buoy. Experience has shown that this type of sound-transmitting apparatus is extremely liable to get in disorder after a short time, as the amount of gas consumed is too great, and the mechanical construction of senders of this type repeatedly gives rise to disturbances.

In the case of sending apparatus not operated by gas, but by the action of the sea, the occurence of mechanical disturbances is also very frequent. In particular buoys of the latter type disclose the great disadvantage that in the case of fog or when visibility is poor signals are not emitted at all, as in this very weather there is practically no wind whatsoever, so that the buoys are then almost immovable in the water.

On the other hand the mariner must necessarily rely on these signals, as otherwise the same rathermore tend to constitute a source of danger than a means for increasing the safety of navigation.

Now it is the object of the invention to provide automatic overwater or submarine signals acting in perfectly reliable manner, whereby it is avoided to employ signalling or sending apparatus which have been developed and constructed for other purposes, and signalling apparatus are employed which are specifically intended for the requirements of unmanned stations.

The signalling or sending apparatus according to the invention do not possess any parts liable to wear, and require for the same strength of sound less primary energy than the senders hitherto known. By the provision and simultaneous use of two or more senders a more favorable utilization of the field of sound generated is attained.

For the above reasons continuously excited diaphragm senders of the type known per se are employed in place of the usual senders manipulated by the application of blows. These diaphragm senders in comparison with the other type possess a greater degree of efficiency, and therefore require less primary energy for generating the same strength of sound.

When using a plurality of senders the arrangement is such that the distance between the same is in a certain proportion to the length of sound wave, so that for example when using two senders the same are situated at a distance apart which is equal or approximately equal to half a wave length. In this manner a field of sound is generated, which corresponds not only to a doubled strength of sound, but to four times the strength of sound of one sender. It will be obvious, therefore, that when using grouped senders, independently of the efficiency, merely a quarter of the primary energy is required for generating the same strength of sound. This if of considerable importance in view of the long period of operation of unmanned stations.

From the employment of a plurality of senders in the arrangement described, the recognition is furthermore to be deduced that if weight and also the sending apparatus require to be particularly small, high sending frequencies require to be selected, as with increasing frequency the wave length and together therewith the distance between the senders becomes smaller. For this reason frequencies of not less than approximately 200 will be employed in the case of overwater senders, or approximately 900 in the case of submarine senders.

In order to attain a maximum in the utilization of the weight and the size of construction the overwater or submarine sender required for such stations will, on the basis of theoretical considerations, be preferably so constructed that the rear wall of the casing of

the sender constitutes a radiating, i. e., energy emitting diaphragm. This arrangement enables, for example with the same diameter of diaphragm, a doubled strength of sound and in addition a smaller total weight to be attained. Apart from the fact that a saving of weight is effected by avoiding the thick casing wall, the edge mass of the diaphragm may with this arrangement be made very small, as with equiphase excitation of the diaphragm the latter, due to the opposite action of the two, remains stationary. In the case of senders having only one diaphragm the edge mass of the diaphragm, for obtaining the same effect, must in the known manner constitute a plurality of the central vibratory mass. It will thus be seen that in the normal construction the edge mass represents a considerable part of the weight of the sender.

The invention will now be described more fully with reference to the accompanying drawing, in which the same reference characters have been employed throughout for denoting the same parts.

Fig. 1 shows in diagrammatical form a form of embodiment of a buoy according to the present invention;

Fig. 2 is a modification;

Fig. 3 shows diagrammatically an apparatus employed in lieu of a buoy and resting on the bed of the same; and,

Fig. 4 shows diagrammatically in section a sender of the diaphragm type;

Fig. 5 is a modification of Fig. 4.

Fig. 1 shows a buoy, which is furnished with an overwater acoustical signalling apparatus 1 of the diaphragm type, and a submarine acoustical signalling apparatus 2, also of the diaphragm type. These apparatus or senders are operated by means of gas, which is stored in a reservoir 3. The gas proceeds from the reservoir 3 to a control apparatus 4, which is actuated automatically by the pressure of the gas, and which supplies gas to the sender at certain intervals of time, causing the same to operate.

Fig. 2 shows a buoy, in which in place of one overwater or submarine signalling apparatus two of each are employed for the purpose of amplifying the sound. In this arrangement the distance "p" is equal or approximately equal to half the length of a sound wave. In order that the submarine sender 2 may be readily accessible for overhauling purposes on the occasions when the buoy is recharged with gas, the arrangement is such that the senders are capable of being hoisted out of the top of the buoy when the latter is in the water.

Fig. 3 shows a form of embodiment, in which in place of a buoy a frame is employed resting on the bed of the sea. The base plate 2 of this frame simultaneously acts as energy reservoir, and the submarine senders 2 are arranged exactly as in the case of a buoy. This embodiment is more particularly intended for use in such cases when buoys might constitute an obstruction to shipping, or when, owing to natural conditions, for example in localities abounding in ice, it is a difficult matter to retain buoys for any appreciable length of time at one and the same point.

Fig. 4 shows a normal sender of the diaphragm type in principle. This sender may be operated either electrically or pneumatically. The diaphragm 7 is firmly connected with the casing 9 by means of the edge mass 8. Only when the mass 8 is large does the diaphragm adhere to the law governing diaphragms which are firmly held on all sides, and vibrate in the same manner.

In Fig. 5 the rear wall of the casing is replaced by the diaphragm 10. The dotted line shows the position of the two diaphragms upon equiphase excitation. It will be readily recognizable that in the case of such an arrangement the edge mass 11, due to the oppositely acting forces, remains stationary. The effect of the firmly held diaphragm is accordingly attained in this case without the employment of large masses.

It is of course understood that I do not restrict myself to the exact forms of embodiment shown, but that various other forms may be devised without departing from the spirit of the invention.

What I claim as new and desire to secure by Letters Patent is:

1. In a buoy having a floating body and a hollow tail member disposed on the lower part of the body, an acoustical signalling device comprising a plurality of submarine acoustical signals in said tail member, a plurality of overwater acoustical signals disposed on the upper part of said floating body, a gas reservoir in said body connected to said signal devices, and control means for regulating the gas supply to said signals.

2. In a buoy having a floating body and a tail member extending through the body and projecting downwardly therefrom, a plurality of submarine diaphragm acoustical signals spacedly disposed in the walls of the lower part of said member, a plurality of overwater diaphragm acoustical signals spacedly disposed above said floating body, a gas reservoir in said body connected to said signals, and control means regulating the gas supply to said signals.

3. In a buoy having a floating body and hollow tail members extending through the body and projecting downwardly therefrom, a plurality of acoustical signal devices rearwardly disposed in said tail member at a distance apart substantially equal to one half the length of a sound wave, a gas reservoir in the floating body connected to said signal devices, a plurality of signals spacedly disposed on the upper part of said body, a gas

reservoir in said body connected to said signals and control means for regulating the gas supply to said signals.

4. In a buoy having a floating body and a hollow tail member extending through the body and projecting downwardly therefrom, a removable acoustical signal in the wall of of said tail member, a signal disposed on the upper part of said body, a gas reservoir connected to said signal, and control means for regulating the gas supply to said signals.

In testimony whereof I have affixed my signature.

ERNST WILCKENS.