May 12, 1931. H. O. HOLTE 1,805,092

SIGNALING APPARATUS

Filed June 26, 1926

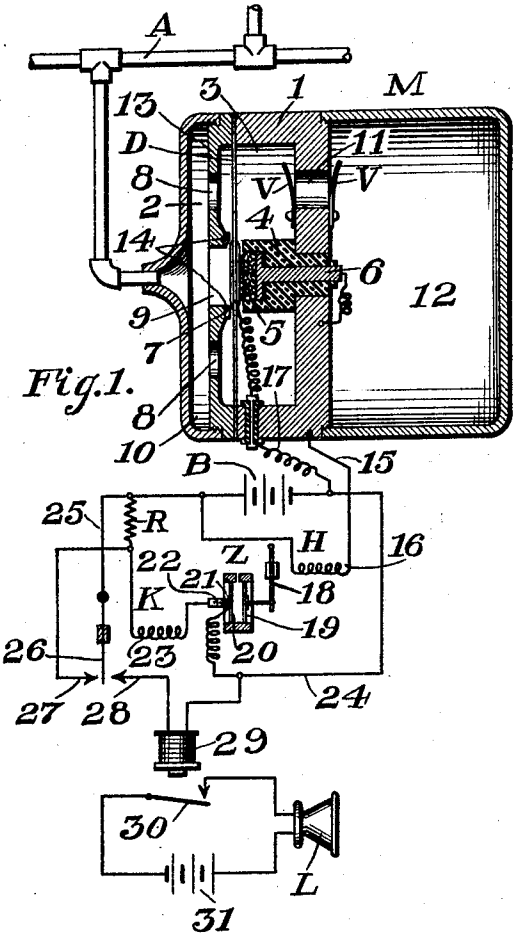


Fig.1.

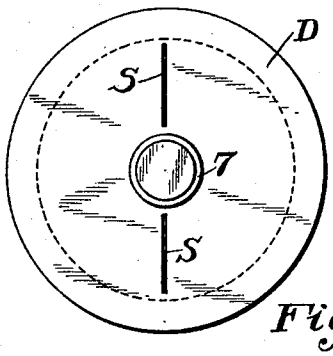


Fig.2.

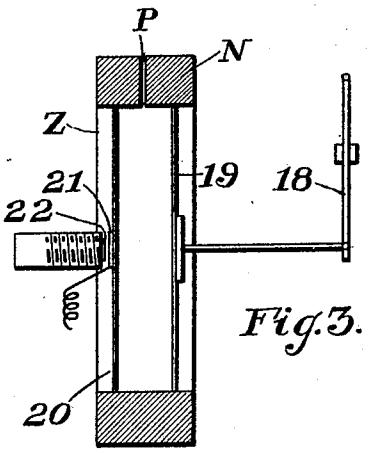


Fig.3.

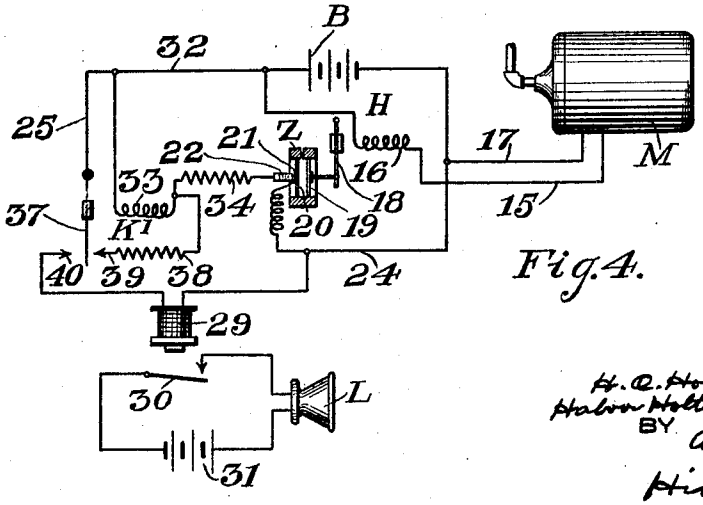


Fig.4.

INVENTOR:
H. O. Holte, deceased,
Halvor Holte, Administrator,
BY
A. L. Vennell
His ATTORNEY

Patented May 12, 1931 1,805,092

UNITED STATES PATENT OFFICE

HAROLD O. HOLTE, DECEASED, LATE OF PITTSBURGH, PENNSYLVANIA, BY HALVOR HOLTE, ADMINISTRATOR, OF CROOKSTON, MINNESOTA, ASSIGNOR TO THE UNION SWITCH & SIGNAL COMPANY, OF SWISSVALE, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA

SIGNALING APPARATUS

Application filed June 26, 1926. Serial No. 117,314.

This invention relates to signaling apparatus, and particularly to apparatus for signaling between two points on a railway train, such, for example, as between the locomotive and the caboose of a freight train, or between the locomotive at the front and a second locomotive at the rear of the train.

Two forms of signaling apparatus embodying this invention will be described, and the novel features thereof will then be pointed out in claims.

In the accompanying drawings, Fig. 1 is a view, partly diagrammatic and partly sectional, showing one form of signaling apparatus embodying this invention. Fig. 2 is a plan view of the diaphragm for a microphone shown in Fig. 1. Fig. 3 is a sectional view of a portion of a vibration relay structure shown in Fig. 1. Fig. 4 is a diagrammatic view showing a modified form of signaling apparatus also embodying this invention.

Similar reference characters refer to similar parts in each of the several views.

Referring first to Fig. 1, the apparatus comprises an air signal receiving mechanism in which a brake pipe A is connected to a microphone M in such manner that vibrations in the air in the brake pipe will cause a diaphragm D to vibrate. The vibrations impressed upon the air in the brake pipe may be produced by any suitable mechanism such, for example, as that shown in copending application of Harold O. Holte Serial No. 21,550, filed April 8, 1925, for signaling apparatus.

The microphone M comprises a casing 1 divided into two compartments 2 and 3 by means of the diaphragm D which is thin and flexible. The compartment 3 contains an insulating cup 4 filled with carbon granules 5 which are adapted to vary the electrical resistance between a stationary electrode 6 and an electrode 7 mounted on the diaphragm D. The front wall 13 of the compartment 2 is provided with apertures 8 and 9 which afford communication between compartment 2 and a compartment 10 which is open to the brake pipe A. The wall 13 is provided with stops 14 in proximity to opening 9 to limit the movement of electrode 7, and so to prevent the granules 5 from falling out of cup 4. The back wall of compartment 3 contains a port 11 which communicates with a closed volume 12 of suitable size. It will thus be seen that the diaphragm D is exposed on one side to the air in the brake pipe A, and on the other side to the closed volume 12 through the port 11.

For low signaling frequencies the diaphragm D is preferably made of thin soft rubber provided with slits S (Fig. 2) and it is stretched in such a way as to hold these slits closed. The slits prevent the diaphragm from being ruptured by pressure changes caused by air brake application and release, yet for small pressure changes, such as those due to a weak signal the slits are substantially closed. In order to prevent the diaphragm D from being torn by a sudden and very large pressure change such as would be caused by an emergency brake application, two flap valves V which are mounted at opposite ends of port 11, are provided. A large flow of air will cause one or the other of these valves to close and then leak slowly until the pressures on the two sides of the diaphragm D are equalized.

The electrodes 6 and 7 of microphone M and a battery B, are connected in series with the winding 16 of an untuned or highly damped vibration relay H having an armature 18. The armature 18 operates a contact 21—22 which is connected in series with a tuned vibration relay K having a winding 23, an armature 26, and contacts 27 and 28. The contact 26—28 of relay K controls a relay 29 having its contact 30 in circuit with battery 31 and a signal L.

For the purpose of rendering the operation of contact 21—22 independent of the average microphone current, the relay H is provided with an automatic zero adjuster Z, which is more clearly shown in Fig. 3. An annulus N carries two soft rubber diaphragms 19 and 20. The diaphragm 19 is connected to the armature 18 so that when the armature oscillates the diaphragm 19 will be periodically deflected toward the diaphragm 20 to compress the air enclosed between the diaphragms and close contact 21—22. The volume of air between the two diaphragms is open to the

atmosphere through a port P. The pressure of the air is substantially independent of slow changes in volume, thus whatever the mean position of diaphragm 19 may be, due to different values of direct current in vibration relay H, the mean position of diaphragm 20 will be its normal undeflected position, hence the spacing between contact members 21 and 22 may be very small. The contact member 22 may be adjustable and is shown with adjusting threads for co-operation with a suitable support. The port P in annulus N is made sufficiently small, so that for the desired operating frequency there will not be much leakage through it, hence the deflections of 19 will be communicated to 20 due to the elasticity of the air and thus operate contact 21—22. The use of this adjuster makes it unnecessary to use a transformer, and eliminates the defects caused by the variation of the mean value of microphone current which results from the use of a relay directly in series with the microphone.

In order to make the apparatus substantially immune to interference which would cause foreign vibrations in the brake pipe not intended for signals, the vibration relay K which is tuned and proportioned in such manner that the contacts for operating the signal will only be closed when two impulses properly spaced in time are impressed upon it, is provided. This result is accomplished by placing a resistance R in series with the winding 23 and contact 21—22. The resistance R is of such value that no matter how long contact 21—22 may be closed the current in winding 23 will be insufficient to bring armature 26 into contact with 28. The circuit for winding 23 under this condition is from battery B through resistance R, winding 23, contact 22—21 of adjuster Z and wire 24 to battery B. When contact 21—22 opens, armature 26 is released and on its back swing makes contact at 27. If contact 21—22 closes again while contact is made at 27 a circuit is completed from battery B, through wire 25, armature 26, contact 27, winding 23, contact 22—21, and wire 24 back to battery B, thus shunting out the resistance R. Under these conditions winding 23 will get a larger current impulse which is sufficient to close contact 26—28, and this will energize relay 29 which controls the signal L.

Due to the characteristics of a brake pipe as a transmission medium it is necessary to use a comparatively low frequency for transmitting signals through a long train. In order to make the signal L operate continuously over the time of a group of cycles the relay 29 may be slow releasing so that it will hold over from one cycle to the next. The contact 27—28 may operate the signal L directly, but in that case the indication will be of the same frequency as the air vibrations and the listener must judge whether it is due to the transmission of signals through the brake pipe or to some interference which has penetrated the system of relays.

The operation of the apparatus is as follows:

When a train of waves, due to signaling pulsations impressed upon the air in brake pipe A, strikes the diaphragm D causing it to vibrate with the same frequency as that of the impressed waves, the resistance of the circuit through battery B and winding 16 of relay H is varied and a pulsating direct current is therefore supplied to relay H. Armature 18 is set into vibration causing contact 21—22 to be opened and closed at a rate depending upon the frequency of the signaling waves. Relay K is tuned to respond to current of the frequency supplied by the transmitter, hence on the first back swing of armature 26, contact 26—27 will be closed to shunt out resistance R. Contact 21—22 will close while contact 26—27 is closed so that sufficient current will flow to winding 23 to close contact 26—28 and energize relay 29. Contact 30 will close and signal L will be supplied with current from battery 31. After energization of relay 29, contact 26—28 will open again due to opening of contact 21—22, but due to the slow acting characteristics of relay 29 it will hold over from one pulsation to the next as long as pulsations of signaling frequency are supplied to relay H, so that contact 30 will not be released during the time between the periodic opening and closing of contact 26—28. If a train of waves of a frequency different from the signaling frequency chosen, should impinge upon diaphragm D the contact 26—28 of relay K could only be closed if two interfering impulses properly spaced in time according to the tuning of relay K should occur, hence the system will be substantially free from interference due to foreign vibrations.

In Fig. 4 is shown a modified form of receiving apparatus in which all of the parts with the exception of the tuned vibration relay K^1 are the same as those illustrated in Fig. 1.

The relay K^1 comprises a winding 33, an armature 37 co-acting with contacts 39 and 40, and two resistances 34 and 38. Contact 37—39 is normally closed when contact 21—22 is closed, the current flowing from battery B through wire 32, and then dividing between two branch circuits, one passing through winding 33 and the other including wire 25, contact 37—39, and resistance 38. The current from the two branch circuits passes through resistance 34, contact 22—21 and wire 24 back to battery B. The proportioning of parts is such that when contact 22—21 opens, the backward swing of armature 37 will not close contact 37—40, but if contact 22—21 closes while contact 37—39 is open the current from battery B will pass directly

through wire 32 and winding 33, the branch circuit through resistance 38 being open at contact 37—39. Under these conditions the current supplied to the winding 33 will give the armature 37 a larger impulse so that on its backward swing it will close contact 37—40 to pick up the relay 29 and operate signal L. When contact 37—40 is closed, current flows from battery B through wires 32 and 25, contact 37—40, relay 29, and wire 24 back to battery B. It will thus be seen that contact 37—40 can only be closed when two interfering impulses properly spaced in time are supplied to relay K^1. The relay 29 is arranged to hold over from one impulse to the next in the manner described with reference to Fig. 1.

Although there is shown and described but two forms of signaling apparatus embodying this invention it is understood that various changes and modifications may be made therein within the scope of the appended claims without departing from the spirit and scope of the invention.

Having thus described the invention what is claimed is:

1. A fluid pressure responsive device comprising a chamber having an opening communicating with a fluid pressure system, a thin diaphragm stretched across said chamber and provided with slits which are normally closed but which open in response to severe pressure changes in said system, and a microphone having two coacting members one of which is attached to said chamber and the other to said diaphragm.

2. A fluid pressure responsive device comprising a chamber having two openings one of which communicates with a fluid pressure system, a closed reservoir communicating with the other opening, a flap valve at each end of said second opening, a diaphragm stretched across said chamber between said two openings, and a microphone having two coacting members one of which is attached to said chamber and the other to said diaphragm.

3. A fluid pressure responsive device comprising a chamber having two openings one of which communicates with a fluid pressure system, a closed reservoir communicating with the other opening, a flap valve at each end of said second opening, a thin diaphragm stretched across said chamber between said two openings and provided with slits which are normally closed but which open in response to severe pressure changes in said system, and a microphone having two coacting members one of which is attached to said chamber and the other to said diaphragm.

In testimony whereof I affix my signature.

HALVOR HOLTE,
Administrator of Harold O. Holte, deceased.