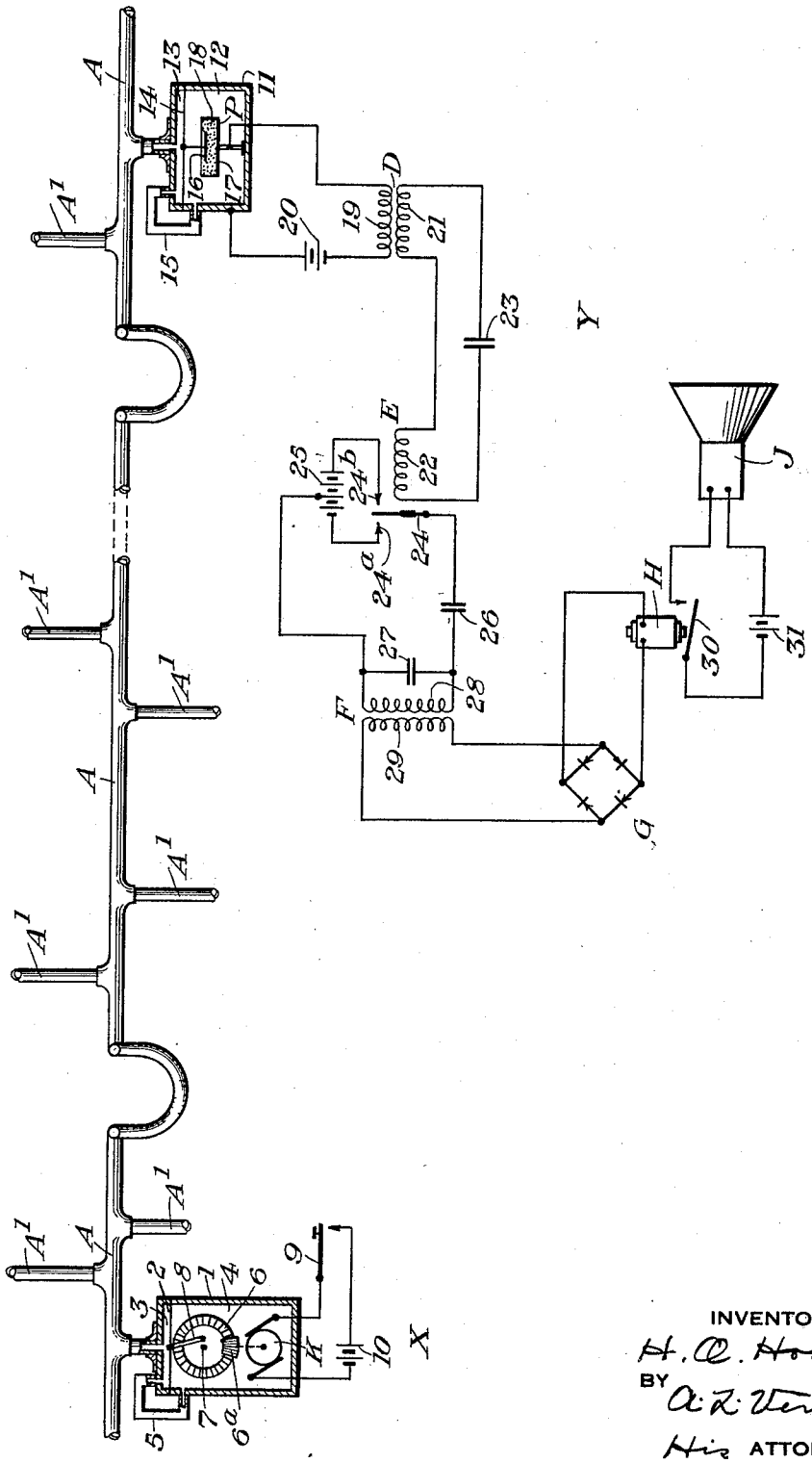
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SIGNALING APPARATUS

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SIGNALING APPARATUS

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My 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 first locomotive and a second locomotive at the rear of the train.

I will describe one form and arrangement of signaling apparatus embodying my invention, and will then point out the novel features thereof in claims.

The accompanying drawing is a view, partly diagrammatic, showing one form and arrangement of signaling apparatus embodying my invention.

Referring to this drawing the apparatus comprises a transmitting mechanism designated as a whole by the reference character X, and a receiving mechanism designated as a whole by the reference character Y, both associated with the usual train brake pipe A extending throughout the length of the train and containing air under pressure. The brake pipe A is provided, as usual, with branch pipes A', leading to the brake mechanism, etc., on each car.

The transmitting mechanism X comprises a chamber 1 connected with the brake pipe A and divided into an upper compartment 3 and a lower compartment 4 by means of a diaphragm or piston 2. The lower compartment 4 contains apparatus for vibrating the diaphragm 2 which apparatus as here shown comprises a circular plate 6 rotatable about its center 7 and provided at its periphery with gear teeth meshing with a bevel pinion 6^a. The pinion 6^a is rotated by a motor K which is supplied with current from a suitable source of energy such as a battery 10 through a circuit controller 9 which may be controlled in any desired manner. A link 8 has its upper end fastened to diaphragm 2, and the lower end of this link is constrained to move in a circular path by fastening this end to a point on the plate 6 eccentric with respect to the center 7. It will be clear that when circuit controller 9 is closed motor K will drive plate 6 and hence will vibrate diaphragm 2. Since the upper surface of diaphragm 2 is exposed to the air in the brake pipe the vibrations of the diaphragm are transmitted through the air in the brake pipe to the receiving apparatus Y in the form of pulsations, the frequency of which depends upon the speed of motor K.

A restricted passage 5 connects compartment 3 with compartment 4, to permit equalization of the air pressure on both sides of the diaphragm 2 when the brake pipe pressure is varied in manipulating the brakes.

The receiving mechanism Y comprises a chamber 11 divided into an upper compartment 13 and a lower compartment 12 by a diaphragm 14. These two compartments 13 and 12 are connected by a restricted equalizing passage 15 for the same purpose as passage 5 in transmitting mechanism X.

Since the upper surface of diaphragm 14 is exposed to the air in the brake pipe, the pulsations impressed upon the brake pipe air cause this diaphragm to vibrate at the same frequency as the pulsations.

The compartment 12 contains a microphone P comprising, as usual, a cup 17 rigidly attached to the wall of chamber 11, but insulated therefrom, and containing the usual carbon granules 18, and a button 16 attached to the diaphragm 14. A transformer D has a primary winding 19 connected in series with a battery 20 and the microphone P. The secondary 21 of transformer D is connected with the winding 22 of a vibration relay E comprising a reed 24 vibrated by current in winding 22 and tuned to mechanical resonance at the frequency of the pulsations in brake pipe A. This reed co-acts with two fixed contacts 24^a and 24^b, which are connected with the left hand and right hand terminals respectively of a battery 25. A transformer F has its primary winding 28 tuned to approximate resonance at the frequency of the pulsations in the brake pipe by means of a condenser 27. The lower terminal of primary 28 is connected with reed 24, and the upper terminal of this primary is connected with the mid point of battery 25. A slow pick-up relay H is connected, through a rectifier G, with secondary 29 of transformer F.

The relay H controls any suitable form of

signal J, such as an electric horn, so that when the relay H is energized current is supplied to signal J from battery 31 over front contact 30 of relay H.

The operation of the apparatus is as follows:

When circuit controller 9 is closed, motor K is operated to impress pulsations of a given frequency upon the air in pipe A. These pulsations are transmitted to the receiving apparatus at Y where diaphragm 14 is vibrated at the same given frequency. Microphone P then operates to vary the resistance of the circuit through battery 20 and a pulsating direct current is thus supplied to the primary 19 of transformer D. As a result an alternating current of the same frequency as the pulsations in pipe A is induced in secondary 21 of transformer D and operates relay E. The circuit including winding 22 is tuned to resonance at the frequency of the pulsations in pipe A by means of a condenser 23. The current in winding 22 of relay E causes reed 24 to vibrate and make contact alternately with contacts 24^a and 24^b, thus supplying primary 28 of transformer F with a periodically reversing direct current the periodicity of which is the same as that of the pulsations in pipe A. The alternating current supplied by secondary 29 of transformer F is then changed, by rectifier G, into a direct current which energizes relay H and, closing front contact 30, operates signal J. Signal J is therefore operated as long as circuit controller 9 is closed.

It should be pointed out that since relay H has slow pick-up characteristics, a single surge of energy will not close contact 30, but that continuous energy must be supplied to actuate signal J.

I have found that if the pulsations impressed upon the air in the brake pipe have a wave length such that the effective resonant length of any of the branch pipes A′ is approximately one quarter, three quarters, or five quarters of one wave length, the branch will absorb a large amount of the energy of the pulsations and the attenuation along the brake pipe will be excessive. It is therefore desirable to choose a frequency for the pulsations such that the effects of this absorption phenomenon will be reduced to a minimum.

It is known also that the attenuation in a long straight pipe increases about as the square root of the frequency. It is therefore undesirable to use higher frequencies. Consequently, I prefer to accomplish the signaling by means of pulsations having a frequency so low that the effective length of the branch pipe having the greatest effective length is less than one fourth of one wave length. By effective length of a branch pipe I mean the total resonant length of the pipe including any cylinders, valves, or other devices which may be in communication with the pipe. In ordinary use, with triple valves in lap or service positions, the effective lengths of these branch pipes, vary from two to seven feet, and so I choose pulsations of a wave length greater than four times seven, or 28 feet. Since the velocity of transmission of these pulsations through the air in the brake pipe is approximately 11,000 feet per second, the frequency of pulsations which can be used without excessive attenuation must be less than 11,000 divided by 28, that is, less than 40 pulsations per second.

With frequencies of this order successful communication can be established between widely spaced points on a train with a minimum of expended power.

One advantage of my invention is that since the secondary circuit of transformer D and the primary circuit of transformer F, as well as the reed 24 of relay E, are all tuned to resonance at the frequency of the pulsations used, danger of interference from stray power sources or mechanical vibration is reduced to a minimum.

It should also be particularly noticed that since the reed 24 is tuned and controls a local source of energy, the current supplied to relay H will be substantially constant irrespective of the amplitude of the pulsations in the brake pipe air.

Although I have herein shown and described only one form and arrangement of signaling apparatus embodying my 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 my invention.

Having thus described my invention, what I claim is:

1. Apparatus for signaling between two points on a train comprising, in combination with the brake pipe having the usual branches, means for imposing upon the air in such brake pipe pulsations of a wave length more than four times the longest effective length of a branch pipe.

2. Apparatus for signaling between two points on a train comprising in combination with the brake pipe having the usual branches, means for impressing upon the air in said brake pipe pulsations of such frequency that the effective length of the branch pipe having the greatest effective length is less than one fourth of the wave length of said pulsations, and a signal controlled by said pulsations.

In testimony whereof I affix my signature.

HAROLD O. HOLTE.