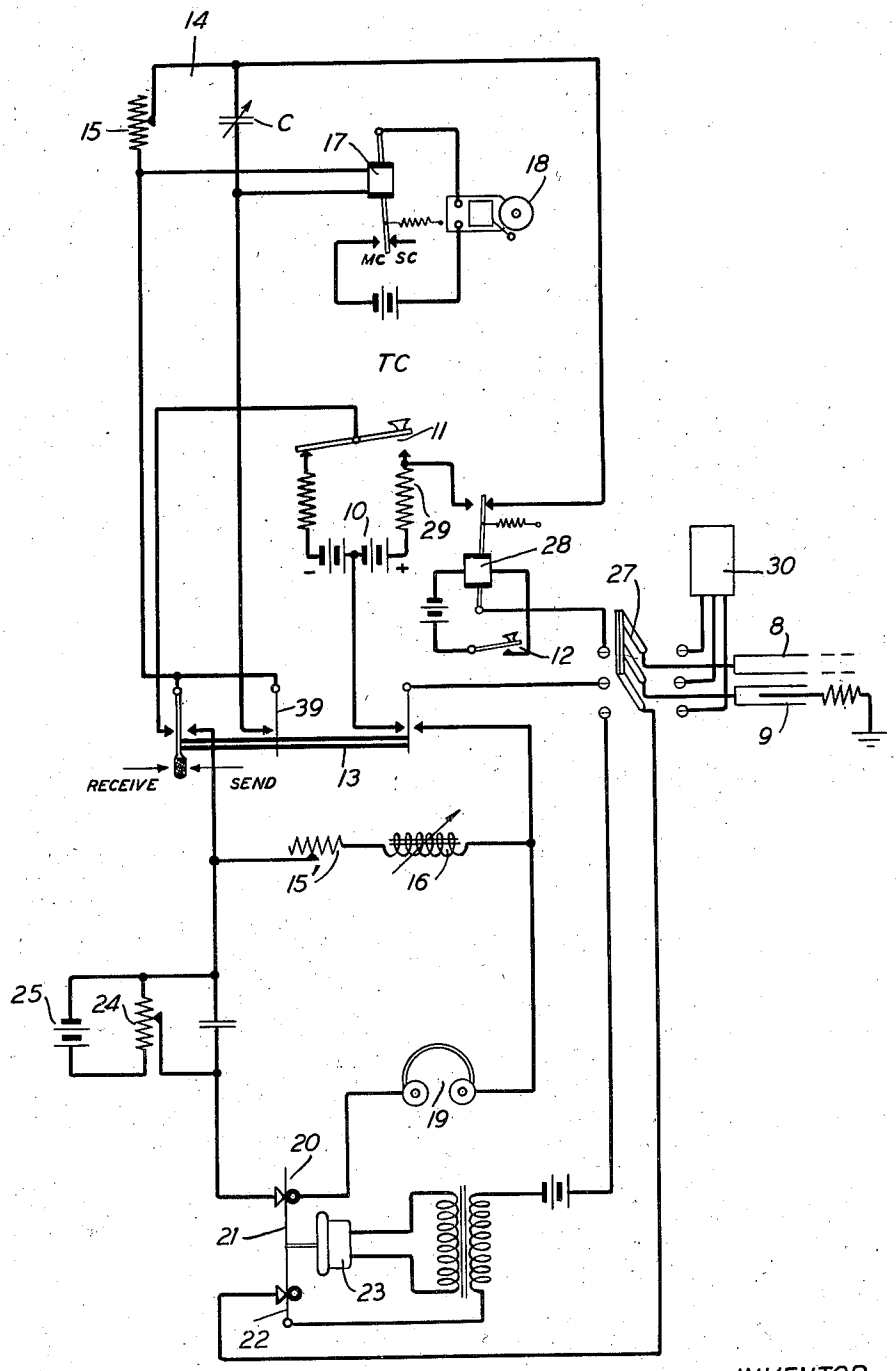
Sept. 22, 1936. A. M. CURTIS 2,054,790

SIGNALING SYSTEM

Filed Oct. 28, 1932



INVENTOR
A. M. CURTIS
BY J. W. Schmied
ATTORNEY

Patented Sept. 22, 1936 2,054,790

UNITED STATES PATENT OFFICE

2,054,790

SIGNALING SYSTEM

Austen M. Curtis, East Orange, N. J., assignor to Bell Telephone Laboratories, Incorporated, New York, N. Y., a corporation of New York

Application October 28, 1932, Serial No. 640,030

4 Claims. (Cl. 178—69)

This invention relates to signaling systems and more particularly to such systems which include long deep sea telephone and/or telegraph cables.

When an emergency arises at one of the terminals of a long submarine signaling cable which interrupts the regular communication channels, it becomes highly desirable to communicate immediately with the distant end. The system needed for such a purpose must be complete in itself, entirely independent of the regular power supply, and ready at all times to transmit and receive signals with only the cable intact as the means for transmission. In addition to being of value as an emergency device such a system will also be of use as a means of communication between the cable stations at the time that the regular terminal equipment of the cable is being installed and tested.

An object of this invention is to provide a method of and means for communication between the operators at the terminal stations of a submarine signaling cable in the event that, due to some accident, the normal terminal signaling apparatus has ceased to operate.

A further object of the invention is to provide an emergency telegraph system which will be simple to operate and sufficiently reliable for use on long deep sea signaling lines.

In pursuance of these objects the present invention contemplates the transmission from the sending station of a submarine cable of low frequency signaling impulses, the spacing impulses being negative and the marking impulses positive, or vice versa. In order to somewhat preshape these impulses, there is provided a preshaping network which comprises a condenser and a resistance element. At the receiving station of the cable there is provided a receiving shaping system which comprises a shunted receiving condenser in series with the cable, and an adjustable inductive shunt of variable resistance bridged around a detecting circuit. This detecting circuit comprises a pair of head telephones which is connected in series with a transmitter-microphone button, or a tuning fork tone device.

The low frequency signaling impulses are modulated by the vibrating reed of the microphone button to generate a high frequency component which is rendered audible in the telephone receiver.

The invention will now be described in more detail with reference to the accompanying drawing which schematically illustrates a schematic diagram of the circuits and apparatus employed at each end of the signaling line.

The drawing shows a submarine signaling cable 8 and a sea earth cable 9. During normal operation of the signaling system the cable is connected through switch 27 to the regular signaling circuits, indicated at 30. The emergency telegraph circuit comprises a battery 10 with a center tap and an ordinary back and front contact telegraph key 11. An additional key or call button 12 is provided to allow the transmission of a signal which will give an audible alarm at the receiving end of the cable 8. An adjustable sending condenser C is connected between the cable and the key 11 in order to somewhat preshape the transmitted signals. A send-receive switch 13 is arranged so that either the receiving circuit or the transmitting circuit may be connected to the cable. Since the received signal consists of groups of low frequency pulses, the spacing pulses being negative and the marking pulses positive, or vice versa, a receiving shaping system 14 analogous to that used in ordinary low speed cable telegraphy is preferably used. This consists of shunted receiving condenser C in series with the cable and an adjustable inductive shunt 16 with variable resistances 15 and 15'. Polar relay 17 operates on received call signals only; its windings are connected in series with the receiving condenser shunt but play no appreciable part in the shaping of the telegraph signals. In practical experiments it has been found possible to use the same condenser and shunt in both sending and receiving positions without making any changes in the shaping adjustments. The only adjustment necessary in the latter case is in the potentiometer 24.

The emergency receiving circuit comprises a pair of head telephones 19 in series with a transmitter microphone button 20 mounted on a reed 21 which is vibrated by a second button 22 and a telephone receiver element 23 at a frequency of the order of 1000 cycles. As the spacing element of the transmitted signal produces a steady voltage, it is necessary to oppose this voltage by means of a potentiometer 24 and a battery 25 in order that the spacing position of the sending key will correspond to silence in the telephone receiver. When the sending key 11 is depressed, the opposite voltage is applied to the cable and the signal produced by the entire sending battery voltage, attenuated, of course, by the cable, is available at the terminals of the detector as a low frequency direct current pulse. This pulse is modulated by the microphone button and is heard in the receiver as a tone. The potentiometer and battery compensate merely for

the drop of potential produced by the spacing element of the transmitted signal across the inductive shunt and its associated resistance 15.

The operation of the emergency system is as follows:

In normal operation, the regular receiving apparatus at both terminals are connected to the cable. Also, the polar relay 17 whose windings are included in the receiving condenser shunt, is connected so that the spacing signal normally holds its armature against the spacing contact SC as shown. (As there appear in this part of the circuit only the very low frequency components of the signal, the normally transmitted marking signal will not operate this relay.) When an emergency arises at one of the terminal stations which precludes the use of the regular telephone or telegraph channels the operator located at this station actuates switch 27 which disconnects the cable 8 from the normal circuit and connects it to the emergency circuit, and sets his send-receive key in the sending position. He then pushes the call alarm button 12. The call alarm button 12 operates relay 28 which automatically disconnects the shaping networks and places the full transmitting battery on the cable through the protective resistance 29. If the operator at the far end has not become aware of trouble due to a cessation of traffic, this direct current pulse will cause the meters in his receiving circuits to deflect violently due to blocking of the receiving amplifiers. He then connects his emergency set to the cable and answers the distant operator. After the first communication has been completed, each operator leaves his emergency set in the receiving position. When in this position, the call alarm bell 18 rings when the call button 12 is depressed, the marking half of the transmitting battery 10 is applied directly to the cable, by-passing the sending shaping network. Under these conditions, the low frequency signal received in winding of relay 17 is sufficient to throw the armature of relay 17 to its marking contact MC and to ring the alarm bell 18 which is connected to the marking contact. In order to avoid operation of the calling device at the transmitting end of the cable when the same condenser is used as sending and receiving condenser, additional contact 39 attached to the send-receive switch may be utilized to short-circuit the windings of the relay when the switch is turned to the sending position.

It is understood that the scope of the invention is not limited to the use of a reed and a microphone button for modulating the incoming low frequency impulses, but that other suitable instrumentalities (a tuning fork tone device, for instance) may be used as equivalents without thereby departing from the spirit of the present invention.

What is claimed is:

1. A signaling system comprising a deep sea signaling cable, a source of current for transmitting impulses of low frequency over said cable, vibrating means at the receiving end of said cable, and modulating means connected to the receiving end of said cable and to said vibrating means for modulating the low frequency signal impulses to produce a high frequency component, and means for rendering audible said high frequency component.

2. A signaling system including a long submarine signaling cable, means for transmitting marking and spacing impulses over said cable, modulating means connected to the receiving end of said cable to produce a high frequency current modulated in accordance with said impulses, and an adjustable resistance element and battery connected to said modulating means to compensate for the voltage produced by said spacing impulses.

3. In a submarine cable communication system, an emergency signaling system comprising calling apparatus for transmitting and responding solely to long calling impulses connected to said cable, a telegraph impulse transmitter, a shaping network connected thereto and connected to said cable, a telegraph signal receiving device connected to said cable and shaping network having a modulator connected thereto, and a mechanical vibrator connected to said modulator, and means for disconnecting said emergency signaling system from said submarine cable communicating system.

4. In an emergency signaling system for a submarine communication system comprising switching means for connecting said emergency system to said communication system, a telegraph impulse transmitter connected to said switching means, for transmitting marking and spacing impulses, a receiving circuit connected to said switching means for receiving marking and spacing impulses having an audible signal indicating device and a mechanically driven modulator connected in said receiving system, a mechanical oscillator mechanically connected to said modulator, and a battery and variable resistance connected to said receiving circuit to compensate for the voltage produced by the received spacing impulses, means for transmitting a call signal over said communication system, and means connected to said emergency signaling system for receiving and making audible said call signal.

AUSTEN M. CURTIS.