Dec. 15, 1936. L. E. DE NEERGAARD 2,063,890

RADIO SIGNAL SYSTEM

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FIG. 1.

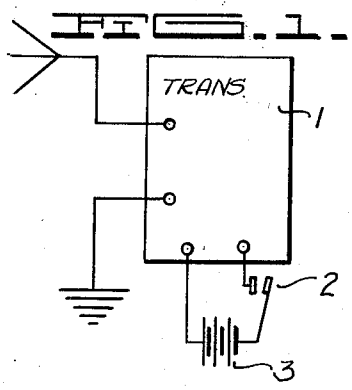


FIG. 2.

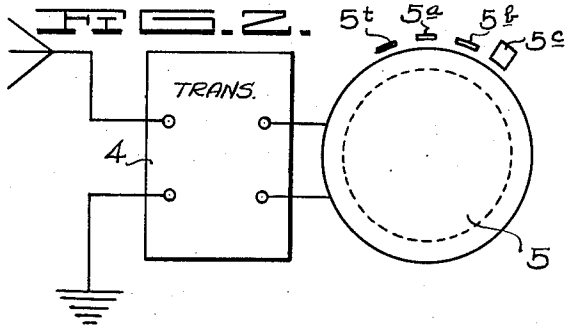


FIG. 3.

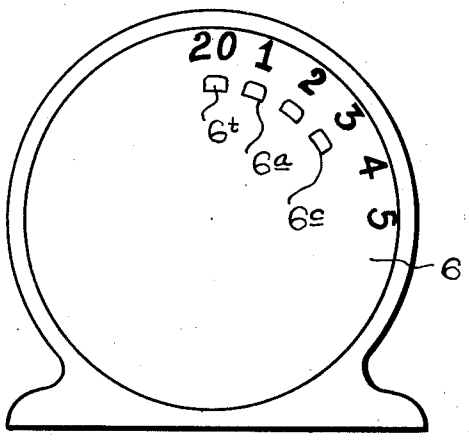


FIG. 4.

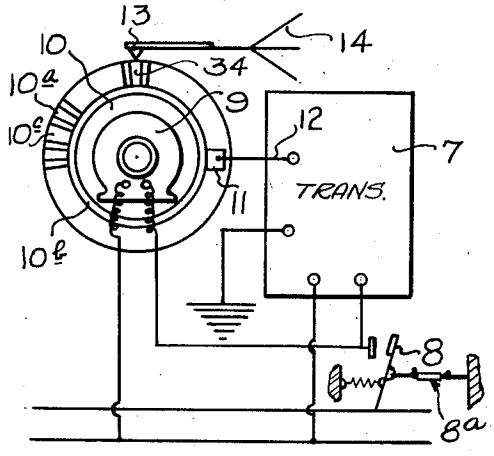


FIG. 5.

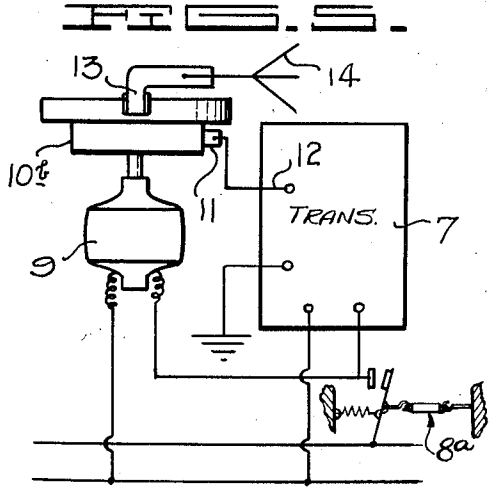
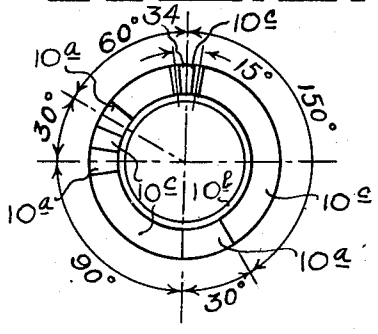


FIG. 6.



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FIG. 7.

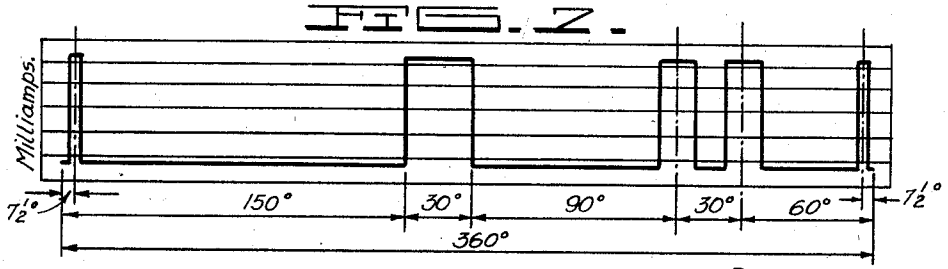


FIG. 8.

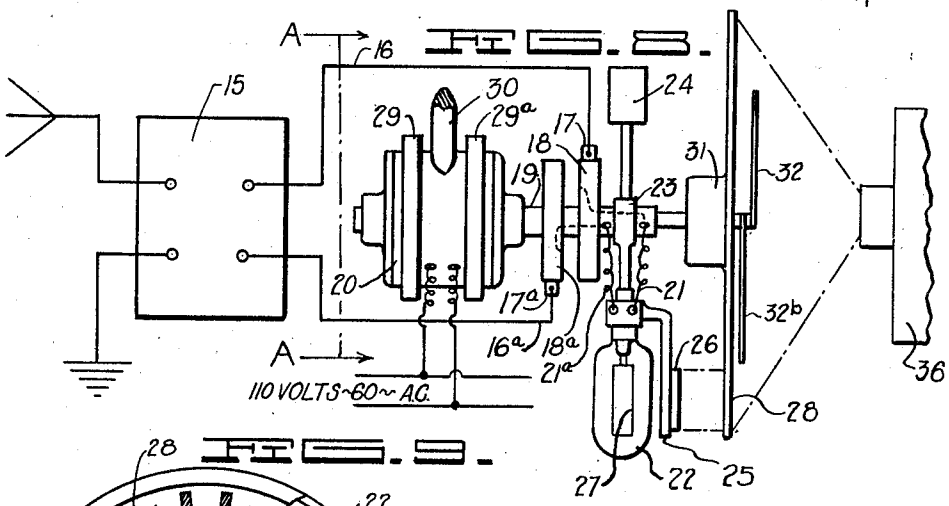


FIG. 9.

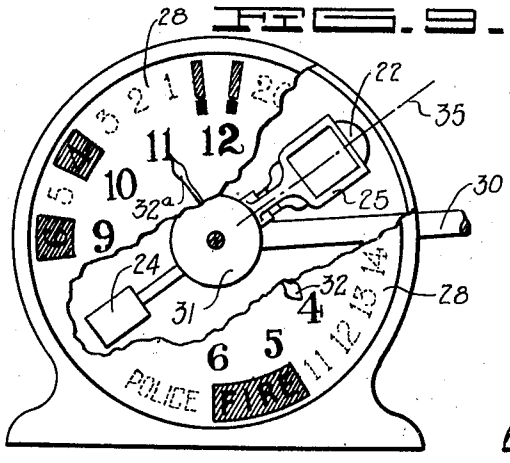
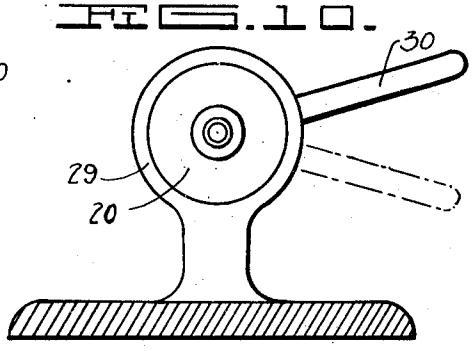


FIG. 10.



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UNITED STATES PATENT OFFICE

2,063,890

RADIO SIGNAL SYSTEM

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Application July 22, 1933, Serial No. 681,738

2 Claims. (Cl. 250—2)

This invention relates to electrically controlled protective systems for signaling to a central station, the location of premises in the event a fire or robbery is taking place on said premises. This invention specifically relates to protective signaling systems where the transmission and reception of radiant energy is utilized as the signaling means.

A primary object of this invention is to afford means whereby the metallic conductors linking outside points to the central receiving station may be eliminated thus effecting a very material saving in capital outlay.

A second object of this invention is to furnish means whereby, due to the entire elimination of physical conductors between the outside points being protected and the central receiving station, the likelihood of malicious tampering with the system is very greatly reduced.

A further object of this invention is the provision of protective signaling means which will instantaneously signal to the central receiving station the exact location of a building or premises in the event a fire or burglary is taking place at said building or premises.

A further object of this invention is the provision of means at the central receiving station which will automatically translate signals giving an alarm into a visual indication of the location of said point sending out the alarm.

Another salient object of this invention is the provision of means at the central receiving station for making a permanent visual record of the exact time an alarm signal is received along with the location of the point emitting the signal.

A still further object of this invention is the provision of radiant energy signaling means making use of an unmodulated carrier and thus effecting a very real saving in the cost and complexity of the receiving and transmitting units.

This invention resides also in the methods and apparatus hereinafter described and claimed, the foregoing and further characteristics of this invention being determinable from the following description.

For an understanding of the methods and description of some of the forms the invention may take, reference is to be made to the accompanying drawings, in which:

Figure 1 is a schematic view of a transmitter of radiant energy of that form of the invention employing low frequency modulation of the carrier wave.

Figure 2 is a schematic view of a receiver and visual indicator adapted to be controlled by the received emissions radiated by the transmitter illustrated by Figure 1.

Figure 3 is a view of the dial used in conjunction with the visual indicator illustrated in Figure 2.

Figure 4 is a schematic view of a transmitter of radiant energy of that form of my invention employing interruptions of the carrier wave for signaling.

Figure 5 is another schematic view, taken in a different plane, of the transmitter shown in Figure 4.

Figure 6 is a more detailed illustration of the interrupter disc used in the transmitter illustrated by Figures 4 and 5.

Figure 7 illustrates the change in plate current of a receiver tuned to resonance with the transmitter illustrated by Figures 4 and 5.

Figure 8 is a schematic view of a receiver of radiant energy of that form of my invention employing interruption of the carrier wave for signaling purposes.

Figure 9 is a view of the visual indicating means used in conjunction with the receiver illustrated in Figure 8.

Figure 10 is a more detailed view of the synchronization means used to bring the visual indicating means illustrated in Figures 8 and 9 in step with the rotation of the interrupter plate illustrated by Figure 6 and utilized in the transmitter illustrated by Figures 4 and 5.

Referring to Figure 1, 1 is a transmitter of radiant energy emitting a signal at a wave length of 5 meters and in this particular case modulated at 1000 cycles.

Means for modulating a carrier wave at some constant audio frequency being so well known to those skilled in this art, it is not considered necessary to show this in any detail. Suffice it to say that either an electrical circuit utilizing proper values of capacitance and resistance or an electro-magnetically driven tuning fork may be used to effect the modulation of the 5 meter wave at any desired preselected audio frequency.

Upon the closing of relay 2 in circuit with the transmitter's power supply 3, transmitter 1 immediately starts transmitting and continues to do so until relay 2 is manually opened.

The receiver 4, shown in Figure 2, is of orthodox design and is permanently tuned to resonance with the emissions being radiated by transmitter 1 in Figure 1, namely, 6000 kilocycles. After detection, the signal is amplified sufficiently so that

the output of receiver 4 is enough to actuate the reed type frequency meter 5.

The reed type frequency meter consists of a central electro-magnet armature. The output of receiver 4 is fed to the windings of the armature and produces a pulsating flux in said armature, the frequency of the flux pulsations being of course controlled by the demodulated output of the receiver 4. Grouped about the central armature are a series of reeds 5*a*, 5*b*, 5*c* etc. Each reed is mechanically tuned to a specific single audio frequency. Thus reed 5*a* would be tuned to 900 cycles, reed 5*b* to 950 cycles, 5*c* to 1000 cycles etc.

The free ends of the reeds would be bent and painted white and would be placed before a black background. Thus, if the output of the receiver 4 were 1000 cycles, reed 5*c* (being mechanically tuned to 1000 cycles) would immediately start vibrating in resonance with the pulsating field set up in the central armature. The free end of reed 5*c* would vibrate with such amplitude that an operator would see the white end of the reed as a white rectangle against a black background. The height of this rectangle would of course be controlled by the amplitude of the vibrations and its height would of course be greatly in excess of the rectangular tip of the reed when quiescent.

Figure 3 illustrates a dial 6 which would be placed in front of the frequency meter 5 in Figure 2. In the dial face, symmetrically disposed are twenty small windows 6*a* to 6*t* through which an operator can view the reeds 5*a* to 5*t*. Immediately adjacent each window is an individual numeral identifying the transmitter causing the reed at that particular window to vibrate.

Thus it will be seen that the reed indicator with its attendant dial is capable of notifying an operator the exact location of twenty transmitters all tuned to the same wave length when each individual transmitter is modulated at one of the frequencies of the reeds.

Detailed illustrations of the frequency reed indicator are not shown as this type indicator has been very well known in the art for the past twenty five or more years and has, with a few minor changes, been recently utilized as a visual indicator for an aerial navigation system developed by the United States Department of Commerce.

Figures 4 and 5 illustrate a transmitter utilizing an unmodulated carried wave for signaling. The individual identifying characteristic of the transmitting station is accomplished by a peculiar breaking up of the wave train and may be likened to C—W telegraph.

The transmitter 7, shown in Figure 4, consists of an oscillating circuit oscillating for example, at 6000 kilocycles. Its output is not modulated. Upon the closing of relay 8, current (from an alternating current source such as a central generating station) flows to the transmitter 7 after necessary rectification and transformation. This alternating current from the central generating station is almost always at a frequency of 60 cycles. The closing of relay 8 also allows this alternating current to flow to the small, synchronous motor 9. This motor is two pole and therefore would be rotated at 3600 R. P. M. when energized with the 60 cycle alternating current.

Integral with the armature of motor 9 is interrupter disc 10. Disc 10 has a series of segmental conductors 10*a* peripherally disposed about the circumference of disc 10 and in electrical contact with shoulder 10*b* of interrupter disc 10. The segmental conductors or inserts 10*a* are separated from one another by the nonconducting segments 10*c* which may be of fiber or bakelite.

The output of the transmitter 7 is fed to the brush 11 through the lead 12. The brush 11 abuts against the shoulder 10*b* of the interrupter disc 10. The radio frequency current output of the transmitter 7 flows from the shoulder 10*b* to the radiating antenna 14 through the brush 13 when one of the segmental conductors 10*a* registers with brush 13.

A study of Figure 6, which illustrates the interrupter disc 10 more in detail, will show that the radio frequency current will be radiated and interrupted five times per each exact revolution of the interrupter disc 10. The duration of each continuous emission can be controlled, of course, by the angular dimensions of the segmental conductors 10*a*. The number of impulses per revolution of the interrupter disc 10 as well as their relative tuning to one another can further be controlled by the number and placement of the segmental conductors 10*a*. Thus it will be seen that many thousand separate preselected combinations may be obtained by the number, angular dimensions and angular arrangement of the segmental conductors 10*a* about the periphery of the interrupter disc 10.

Figure 8 shows a radio receiver and its attendant visual indicator capable of receiving and translating the signals, from a transmitter of the type just described, into a visual indication of the specific transmitter from which signals are at that specific instant being received.

Receiver 15, Figure 8, is permanently tuned to a frequency of 6000 k. c. This is the frequency of the signals received from the transmitter 7, Figures 4 and 5. The plate current, after detection, would rise and fall due to the received signal, as shown in Figure 7. Thus an oscillographic record study of the output of the receiver 15 would show a wave form substantially identical to Figure 7 and recurring sixty times per second if the carrier wave was broken up by an interrupter disc similar to the one shown in Figure 6.

The output of the receiver 15, Figure 8, is fed, after sufficient amplification through conductors 16 and 16*a* to brushes 17 and 17*a* which abut against step rings 18 and 18*a*, mounted integrally on the armature shaft 19 of the motor 20. The motor 20 is a two pole synchronous, alternating current, fractional horse-power size motor and operates on the same central power station line as motor 9, Figures 4 and 5. Thus, both motors are rotating in synchronism with one another.

Slip rings 18 and 18*a* are electrically insulated from one another. Conductors 21 and 21*a* are in electrical connection with step rings 18 and 18*a* respectively and lead current to the anode and the cathode of the neon lamp 22, which is supported on the bracket 23 which rotates integrally with armature shaft 19 of the motor 20. Counterbalancing the mass of the neon lamp 22 and bracket 23 is a counterweight 24.

The bracket 23 carries a lens support 25 which supports the cylindrical lens 26 in front of the illuminated plate 27 of the neon lamp 22. The cylindrical lens 26 is so positioned that its focal point coincides with the under surface of the dial 28. Dial 28 is translucent and has figures painted or otherwise affixed to its reverse side.

Motor 20 is mounted in the collars 29 and 29a which clamp the stator or outer frame of the motor 20 but which allow the slight rotation of the outer frame, when adjustment is necessary by raising or lowering the synchronizing lever 30. Figure 10 is a section taken at A—A on Figure 8 and shows the collar 29 and the synchronizing lever 30.

Mounted on the reverse surface of the dial 28 and driven by the armature shaft 19 of the motor 20 is a clock 31 whose hands 32 and 32b appear before the obverse side of the dial 28.

The operation of the complete transmitting, receiving and visual indicating units is as follows: The transmitter 7, Figures 4 and 5, complete with its interrupter unit, is installed at or in a building to be protected by the system. Due to a fire breaking out on the premises, relay 8, Figures 4 and 5, is closed by means of a fusible link 8a or its equivalent. The oscillating unit immediately starts generating a carrier wave at a frequency of 6000 kilocycles. Simultaneously, the interrupter plate interrupts the carrier wave to produce the received demodulated wave form shown in Figure 7. The transmitter 7, Figures 4 and 5, continues to transmit until the relay 8 is manually opened. The broken up groups of signals are received by the receiver 15, Figure 8. These are demodulated and amplified. The output of the receiver 15 is then delivered to the anode and cathode of the neon lamp, causing it to light with any desired brilliance when the plate current increases due to the reception of one of the trains of radio frequency current comprising part of the signal being transmitted.

The interrupter disc 10, Figures 4 and 5, rotates clockwise while the neon lamp 22 rotates counter-clockwise when facing the dial 28, Figure 9. The neon lamp 22 will thus illuminate five patches of the dial 28 in perfect reproduction of the five conducting segments 10a. Figures 4 and 5. The dial 28 is translucent and has a series of numerals painted on its reverse side from 1 to say 20, to identify any radially disposed areas which may be illuminated. Thus, the radially disposed zones 4 and 6, Figure 9, are illuminated to notify the operator that transmitter 4—6 is signaling. The radially disposed area 56 is also illuminated to inform the operator that a fire is the cause for the alarm.

The motor 9, Figures 4 and 5, and motor 20, Figure 8, as mentioned before, receive their energy from the same identical source, namely, from the same central generating station and both being synchronous, rotate in synchronism. However, a small difference in the phase relationship of the alternating current received at the transmitter and receiver may take place. Due to large motors or other drains being put on and off the line, means for bringing the motor 9, Figures 4 and 5, of the transmitter and the motor 20, Figure 8, of the receiver into synchronization must therefore be furnished. This is accomplished by the raising or lowering of the lever 30, Figures 8 and 9, which brings the axis 35 of the neon tube 22 into an exact vertical position at the precise instant the non-conducting segment 34 is in its exact vertical position. There is, of course, nothing novel or new in this method of bringing two rotating elements into synchronization, as the method is utilized very commonly in television and facsimile transmission and reception.

The camera 36, Figure 8, may be used where a permanent record is desired of the call number of the transmitter sending the alarm along with the exact time of the alarm. The shutter of the camera may be automatically actuated by any suitable electro-magnetically controlled unit upon receipt of any signal or by means of a photo-electric cell controlling the camera shutter when the neon tube 22 is illuminated.

While throughout the figures illustrating this invention, simple relays have been shown to control the sending of signals from the transmitters in case an alarm must be sent to the central receiving station, it will be understood that many various types of relay devices may be used to control the transmitters. For instance, a thermostatically controlled relay may be used to cause the transmitter to signal an alarm in case of fire. A photo-electric cell may be used to control the transmitter for a burglar alarm or many other types of relays may be used dependent upon the circumstances under which they must cause the transmitter to send out the alarm.

The method of breaking up the carrier wave into a series of impulses for signaling, used by the equipment illustrated in Figures 4 to 10 inclusive is greatly preferable to the method of audio-modulation of the carrier wave used by the apparatus illustrated in Figures 1 to 3 inclusive. First, the cost and complexity of the equipment is vastly less. It would be greatly less sensitive to static as the receiver 15, Figure 8, could be designed to pass only the carrier wave with very sharp cut off on either side, making the use of the side bands unnecessary.

Manifestly, the construction and arrangement of the invention described in the foregoing is capable of considerable modification and alteration without departing from the spirit or intent of the invention and I reserve the right to make such changes as fall within the meaning and scope of the following claims.

What is claimed is:

1. A radio signaling system for signaling an alarm from an exterior point to a central receiving station comprising a source of alternating current, a synchronous motor at said exterior point, a relay operative to connect said motor to said current source, commutating means driven by said motor, a source of radiant energy at said exterior point and arranged to become operative upon the closing of said relay, said commutating means being effective for controlling the radiation and suppression of the radiant energy, a synchronous motor at said central receiving station and connected to said current source, a receiver of radiant energy at said central station, rotatable light means at said central station and driven by said second synchronous motor, and means operative to illuminate said light means during the time intervals of reception of radiant energy from said exterior source.

2. A radio signaling system for signaling an alarm from an exterior point to a central receiving station including in combination, a source of alternating current, a synchronous motor at said exterior point, a relay operative to connect said motor to said current source, commutating means driven by said motor, a source of radiant energy at said exterior point and arranged to become operative upon the closing of said relay, said commutating means being effective for controlling the radiation and suppression of the radiant energy at predetermined intervals, a synchronous motor at said central receiving station and connected to said current source, a receiver of radi-

ant energy at said central station, light means rotatably mounted and connected to the shaft of the said second synchronous motor, means to illuminate said light means during the intervals of reception of radiant energy from said exterior source, an indicating dial having identifying characters thereon, each of said characters being arranged to be illuminated by said light means at preselected intervals of reception of said radiant energy.

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