

Oct. 20, 1936.

G. F. C. BAUER

2,057,656

POLICE SIGNAL SYSTEM

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2 Sheets-Sheet 1

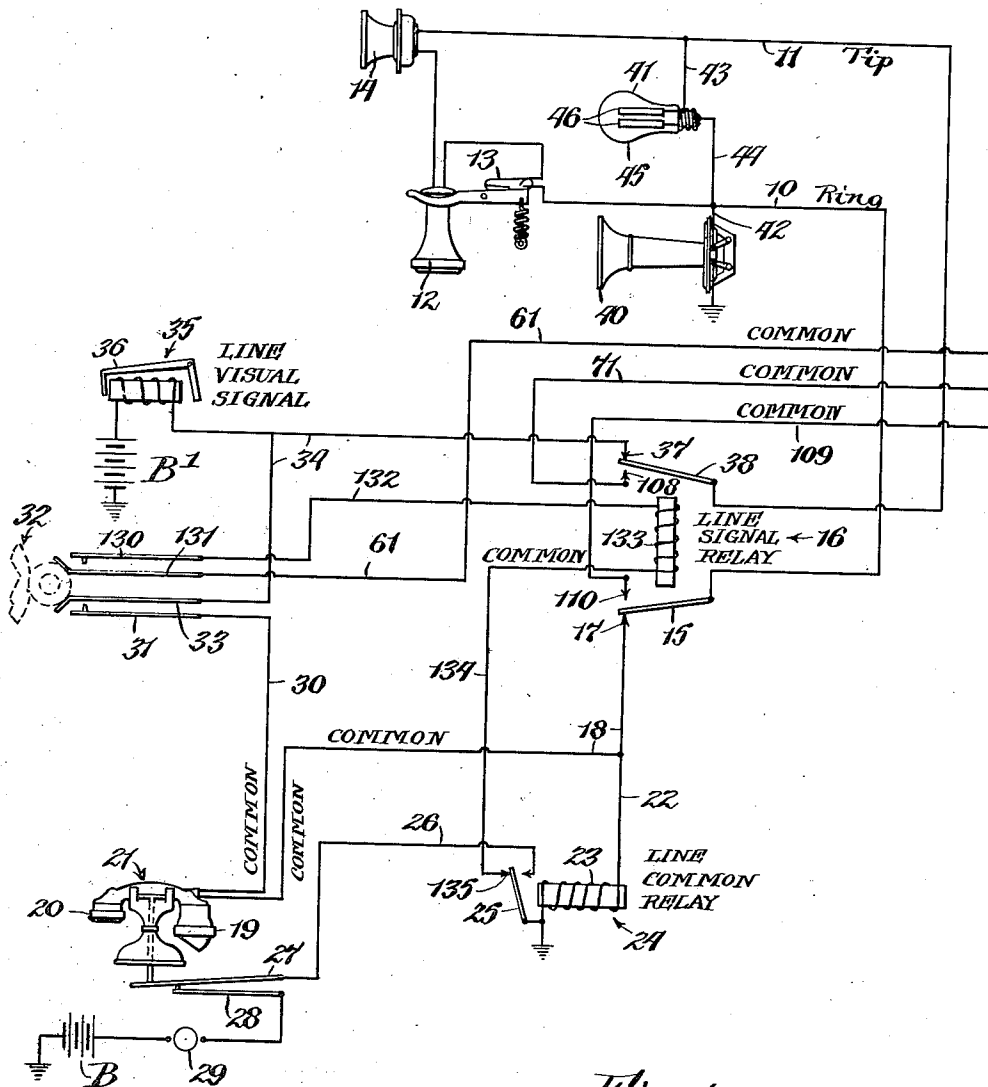


Fig. 1.

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ATTORNEYS

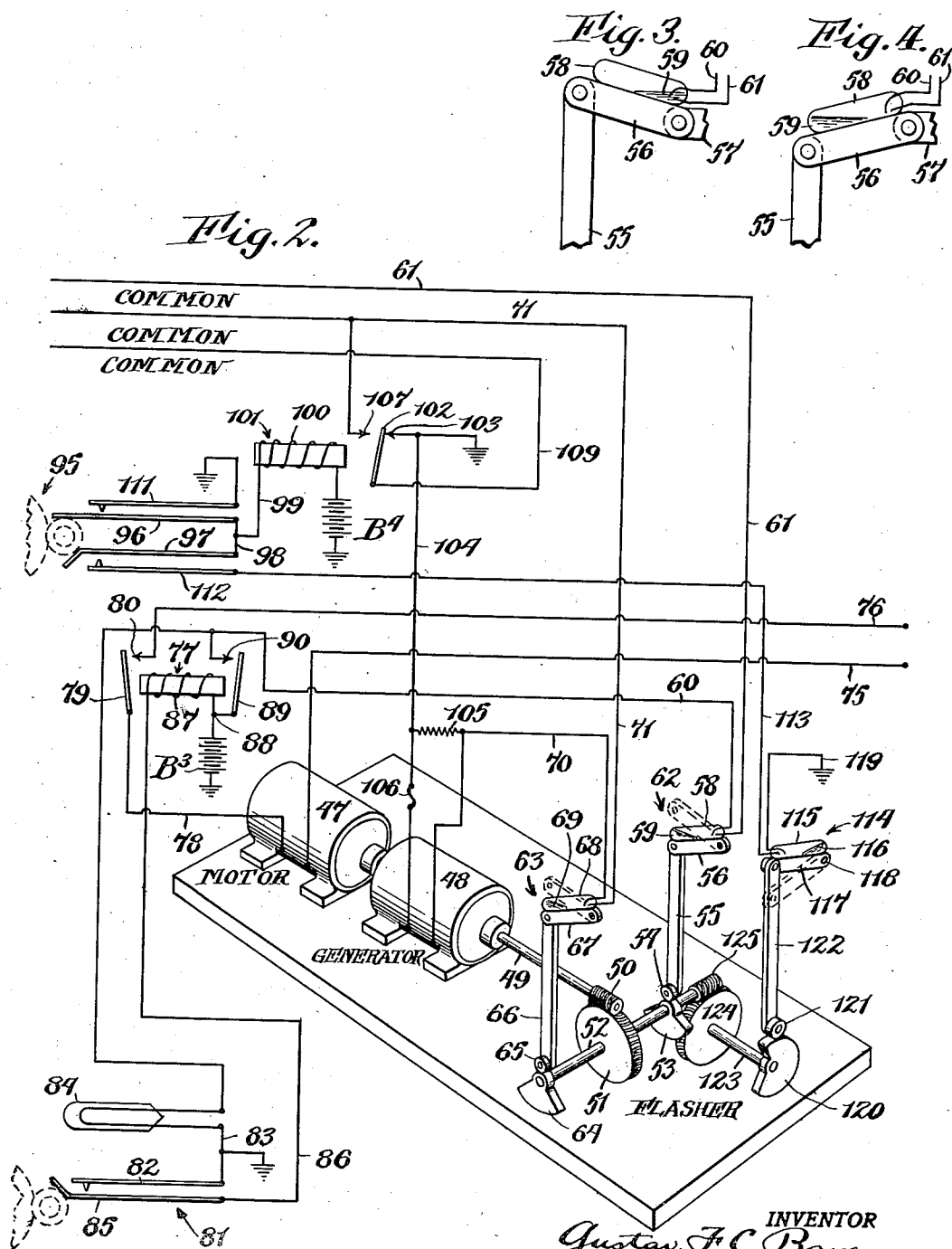
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2 Sheets-Sheet 2



UNITED STATES PATENT OFFICE

2,057,656

POLICE SIGNAL SYSTEM

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Application April 9, 1932, Serial No. 604,232

5 Claims. (Cl. 179—5)

This invention relates to an electrical signaling system and more particularly to a system of this character for use between a central station and a plurality of substations for police purposes.

5 This invention is primarily an improvement on the system shown and described in Patent No. 1,920,236, dated August 1, 1933, for a police signal system and it is the principal object to obtain all of the advantages of said prior system, such as the use of standard commercial telephone
10 cables and simplicity of equipment, and in addition obtain the further advantages hereinafter set forth. It will be understood, however, that these improvements can be embodied in systems
15 differing from that shown in said patent.

In their broadest aspect, these police signal systems comprise a central station connected to a plurality of police boxes by telephone circuits and an audible and a visual signal at each box
20 which can be set up for operation from the central station to call the policeman to the nearest box for the purpose of giving him orders. These signals are periodically operated so as to flash the visual signal and provide periodic blasts of the audible signal through a flasher at the cen-
25 tral station.

One of the principal objects of the present invention is to provide for the full automatic operation, alternately, of these visual and audi-
30 ble signals, if desired. The audible signals are disagreeable in sound. Any continued operation is extremely objectionable to the residents near the boxes. It has heretofore been the practice to provide at the central station a manually
35 operable key for each circuit which in a holding position operates the visual signal at the corresponding box but can be moved to a non-holding position to operate the audible signal or howler at the box for a few blasts. The present inven-
40 tion proposes to retain this selective operation and at the same time permit the central station operator to set up any number of the box circuits for an automatic operation in which, say, twenty-five flashes of the visual signal will be followed
45 by five blasts of the audible signal and so on. This automatic operation of the audible signals after a long interval of visual signal flashing, not only relieves the central station operator from determining when and how long the audible sig-
50 nals should be operated but also tends to hurry the policeman to the nearest box. The police-
man knows that after a predetermined number of visual flashes, the audible signals will be set in operation and since any complaints from the
55 neighbors through excessive operation of the au-

dible signals will be directly traceable to his slowness in answering calls, he will naturally hurry to the nearest box to avoid repetition of the audible signal.

Another object of the present invention is to
5 incorporate a fixed resistance across the output circuit of the signal current generator so that under no condition can this generator operate without some load in its output circuit. Since
10 this generator is used to operate any number of signals from one up to the total number, it is apparent that a variable load is placed upon the generator which under operating conditions may
15 vary the voltage more or less in proportion to this load, and since the generator output circuit includes a flasher, such voltage surges due to the varying load might be excessive. Such unde-
20 desirable excessive voltage surges are avoided in the present system by placing a resistance across the generator output circuit which is sufficiently
25 large so that even when no signal load exists this fixed resistance will have the effect of stabilizing the generator voltage and prevent too great a change in the signal output voltage under all conditions of load.

Another object is to avoid destructive surges through the substation line circuits through their use as a carrier of the signal energy. In the circuit shown in my said co-pending application visual signal energy was supplied over the tip
30 and ring sides of the set up circuits, the visual signal at each box being bridged across the tip and ring sides of the circuit. When it was desired to operate the audible signal at any box, the generator output circuit was changed so that
35 energy was supplied over the ring side only, the audible signal being connected to the ring side, and the generator and audible signal being grounded. In this combination the tip side of
40 each line had practically an open circuit condition when its audible signal was operated and was free to act as a condenser. While in said previous system the ionized gas visual signal operated to drain any voltages so created which
45 exceeded its ionization voltage, the present system provides a circuit which makes this draining action of the visual signal unnecessary. This is achieved by impressing the same potential on the tip as on the ring side of each line circuit dur-
50 ing audible signal operation, thereby preventing any capacity effects from developing in the line circuits through their use as a carrier for the generator energy because during such intervals the potential existing on the tip side of the line
55

is the same as that existing on the rings and therefore no capacity reaction can occur.

Still further objects are to provide switchboard or central station equipment which can be made extremely compact, which is reliable and efficient in operation and will not readily get out of order and in which there is a minimum chance of confusion in the operation of the switchboard.

In the accompanying drawings:

Figure 1 is a diagrammatic representation of a substation and showing the central station telephone equipment associated therewith and also a part of the signaling current circuit.

Figure 2 is a continuation of Fig. 1 and showing the central station signaling equipment.

Figures 3 and 4 are side elevations of the mercury contact switches shown in Fig. 2.

Telephone circuit

The central station equipment is connected to each of the several police boxes or substation circuits by the usual telephone lines each comprising a ring side 10 and a tip side 11. At each police box a telephone receiver 12, hook switch 13 and transmitter 14 are in series with the ring and tip sides of the line circuit. These elements are arranged in the usual manner so that when the receiver 12 is removed from the hook, the hook switch 13 closes and an electrical circuit is established between the tip side of the line circuit, transmitter 14, receiver 12 and ring side 10 of the line circuit. Instead, however, of employing the usual mechanical hook switch, the hook switch 13 is preferably of the enclosed mercury contact type in which the contacts of the circuit are passed through the sides of a sealed glass tube containing a globule of mercury which rolls to connect the two contacts when the receiver is taken off the hook. Such a switch is less susceptible of getting out of order and has been found entirely satisfactory in installations made according to the invention.

At the central station the ring side 10 of each line is connected with one armature 15 of the corresponding line signal relay 16. This armature 15 in the normal or deenergized condition of the line signal relay 16 is in engagement with a contact 17. This contact 17 is common to all of the line signal relays 16 and is connected by a common line 18 with the transmitter and receiver 19 and 20 of the switchboard operator's telephone set 21. This contact 17 is also connected by a common wire 22 with the windings 23 of a line common relay 24. The opposite end of the windings 23 of this line common relay is grounded and is also connected with an armature 25 which in the energized condition of the line common relay 24 is held in engagement with a wire 26 which connects with one spring 27 of the cradle switch of the switchboard operator's telephone set.

The switchboard operator's set is shown as being of the Continental type and the operation of the cradle switch has been represented diagrammatically by continuing the operating plunger of the cradle switch downwardly to engage the spring 27. When the transmitter and receiver of the telephone set 21 are placed upon the cradle, the spring contact 27 of the cradle switch is held in engagement with a spring contact 28, this spring contact 28 being connected to a buzzer 29 and the opposite terminal of this buzzer being connected to a grounded battery B.

The other wire 30 leading to the transmitter and receiver of the switchboard operator's tele-

phone set connects with the lower ring contact 31 of the line key 32. Each of these line keys 32 is so arranged that upon throwing the key up the tip spring contact 33 is thrown into engagement with the ring spring contact 31 and a circuit is established therebetween. The tip spring contact 33 is connected by a wire 34 with the windings of a line visual 35. One of these line visuals is associated with each line and each comprises the usual electro-magnet which, when energized, draws a visual target 36 into the view of the switchboard operator through a small window (not shown) so that the operator can identify the particular line calling in. The opposite ends of the line visuals 35 are connected to a grounded battery B¹. The wire 34 also connects with a contact 37 which, in the normal or deenergized condition of the line signal relays 16 is engaged by an armature 38. This armature 38 connects directly with the tip side 11 of the line.

Operation of the telephone circuit

When the policeman at the box wishes to talk with the switchboard operator he lifts the receiver 12 at the box. This establishes a circuit from battery B¹ through the corresponding line visual 35, wire 34, contact 37, armature 38, tip side 11 of the line, transmitter 14, receiver 12, hook switch 13, ring side 10 of the line, armature 15, contact 17, wire 22 and through the line common relay 24 to ground. The energization of the line visual 35 draws the target 36 into view so that the switchboard operator can identify the particular line calling, and the energization of the line common relay 24 draws up its armature 25 so that it contacts with the wire 26. As soon as this contact is made a circuit is established from battery B through buzzer 29, springs 28 and 27 of the cradle switch of the switchboard operator's telephone set 21, wire 26 and armature 25 to ground. This, of course, operates the buzzer 29 and calls the attention of the operator to the fact that a call is being made from some one of the police boxes.

The switchboard operator then throws up the line key 32 associated with the particular circuit making the call, as identified by the line visual 35 and thereby moves its spring contacts 31 and 33 into contact with one another. At the same time the switchboard operator lifts his telephone set 21 from its cradle so that the cradle switch contacts 27 and 28 are moved out of engagement with one another. The opening of the cradle switch of the switchboard operator's telephone set causes the buzzer 29 to become inoperative since the grounded end of its circuit is broken and the throwing up of the switch key 32 establishes a talking circuit over the line, this talking circuit being fed by the battery B¹. This talking circuit is a split circuit, electrical energy being fed from battery B¹ line visual 35, wire 34, contact 37, armature 38, tip side 11 of line, transmitter 14 and receiver 12, hook switch 13, ring side of line, armature 15 of line signal relay 16, contact 17, wire 22 and windings 23 of line common relay 24 to ground and also from battery B¹, through line visual signal 35, wire 34, spring contacts 33 and 31 of line key 32, wire 30, transmitter and receiver 19 and 20 of switchboard operator's telephone set 21, wires 18 and 22 and through the windings of line common relay 24 to ground. It is therefore apparent that a conversation can be carried on over the telephone circuit as described.

It will be noted that the means for supplying talking battery to the operator's set is not the conventional method used in telephone practice. The circuit arrangement is such that the operator's telephone set derives its talking battery from the circuit to which it is connected by means of the line key 32. With the present system the key 32 is also employed to control the sending of signaling energy over the corresponding line as well as to set up the talking circuit between the operator and the corresponding substation.

When the conversation is finished both parties hang up, the apparatus being thereby restored to the normal inoperative condition which it had before the patrolman put in his call. When the patrolman hangs up, if the switchboard operator fails to throw the key 32 back to normal, the buzzer 29 will begin to function as soon as the operator replaces his telephone set on its cradle switch because the relay 24 is still energized by battery flowing through the operator's talking set over a circuit still closed through the springs 31 and 33 of the line key 32. This, then, provides an alarm circuit notifying the operator that he has failed to restore the key 32 to its normal inoperative position.

The signaling circuit

Associated with each box is arranged an audible signal comprising an electric horn 40 and a visual signal 41, these two signals being so arranged as to be visible and audible at a distance from the box, their purpose being to call the patrolman to the box in order to give him instructions. The horn or howler 40 is of the electro-magnetic alternating current type and consequently its pitch is determined by the frequency of the alternating current operating it. To insure the desired frequency the current is supplied, as hereinafter described, from a motor-generator unit which supplies the current at 150 cycles, thereby providing a frequency of 300 sound vibrations per second. Electrical frequency, when directly converted into sound energy, has the effect of creating a sound pitch of double the frequency of the electrical energy due to the fact that the negative electrical impulse creates one sound impulse and the positive electrical impulse creates another sound impulse and since one cycle consists of one negative and one positive impulse, one cycle in the frequency of the electrical energy creates two sound impulses of the same character. The horn 40 is connected by a wire 42 to the ring side 10 of the line and its other terminal is grounded.

The visual signal 41 is connected across the line by wires 43 and 44. This is possible in the present system since the signal 41 is not a filament lamp but is an ionized gas type lamp. In my co-pending application, Serial No. 525,471, filed March 26, 1931, I have described a type of lamp or visual target which is particularly suited for the present purpose and in general this target consists of a lamp having the conventional Edison base and carrying a clear glass globe 45 which is hermetically sealed to the base and is filled with a gas to obtain the desired color. Neon gas is the best suited for the present use since it gives a color approaching the red heretofore used as visual signals in systems of this character and forms a distinctive target. Within the globe 45 are arranged a pair of spaced electrodes 46 each of which is connected to one of the wires 43 and 44. When a current of high enough voltage is impressed upon the electrodes

46 the lamp is illuminated to give a distinctive colored light which is easily discernible both at day and by night. The starting voltage of this lamp is, however, higher than the normal voltages of the talking currents and hence when such a lamp is placed across a circuit having a lower voltage than is necessary to ionize the lamp, in other words, its starting voltage, the lamp has the characteristics of a capacity across the circuit. Inasmuch as the size of the two electrodes is relatively small and the spacing between them is relatively large, the capacity effect will be exceedingly low on talking frequencies and the losses to said talking frequencies through the shunt circuit formed by the lamp are negligible. Furthermore, at no time would there be any battery leakage through the lamp. Therefore, it is not necessary to incorporate a condenser in series with the lamp across the talking circuit for the purpose of blocking the battery current. This, then, makes an ideal signaling and talking circuit because the lamp itself can work at its highest efficiency on the signal current used, creates no loss to the talking frequencies of the telephone circuit and acts as a condenser, blocking off the flow of battery current from one side of the line circuit to the other.

The source of alternating current for the operation of the visual and audible signals at the police boxes comprises a motor 47 directly connected with a generator 48, and the generator shaft 49 through a worm 50 and worm gear 51 drives the shaft 52 of a flasher. This flasher shaft 52 carries a relatively large cam 53 which engages and periodically lifts a roller 54 on the lower end of a bar 55. This bar 55 is pivotally connected to one end of an arm 56, the other end of which is pivotally connected to a stationary support 57, as best shown in Figs. 3 and 4. Secured to the upper side of the arm 56 is a hermetically sealed glass tube 58 which contains a globule 59 of mercury. At the end of the tube 58 adjacent the stationary support 57 two leads enter the tube, one of these leads forming the terminal for a wire 60 and the other forming the terminal for a wire 61. This mercury contact switch, indicated generally at 62, is adapted to periodically open and close a battery circuit for setting up the signaling circuit to conduct signaling energy through the line circuits.

At the opposite end of the flasher shaft 52 a similar mercury contact switch, indicated generally at 63, is arranged, this switch being adapted to periodically send out signaling energy over the circuits set up by the battery switch 62. This switch 63 is operated by a cam 64 which is similar to the cam 53 except that it is of smaller extent and is so disposed that it closes its circuit after the cam 53 has closed its circuit and opens its circuit before the cam 53 has opened its circuit. This smaller cam 64 is arranged to raise a roller 65 at the lower end of a bar 66, this bar being pivotally connected to one end of an arm 67 which arm is supported in the same manner as the arm 56. This arm carries the mercury contact switch 63 which comprises a hermetically sealed glass tube 68 containing a globule of mercury 69 and when the arm 67 is raised this globule of mercury 69 rolls into contact with the ends of two wires 70 and 71 and closes the circuit therebetween.

One terminal of the motor 47 is connected to one commercial power line 75 usually supplying sixty cycle current at 110 volts and the other motor terminal is connected to the other commercial power line 76 through a relay indicated gen-

erally at 77, this connection comprising a wire 78 connecting the motor terminal with an armature 79, this armature being drawn into engagement with the contact 80 of the commercial power line 76 when the relay 77 is energized. The relay 77 is energized through a power key indicated generally at 81, this power key having one of its springs 82 connected through a signal switchboard lamp 84 with the wire 60. The other spring contact 85 of the power switch 81 is connected by a wire 86 with the windings 87 of the relay 77 and the other end of the windings 87 are connected by a wire 88 with a grounded battery B³.

The wire 88 is also connected to another armature 89 of the relay 77, this armature 89 being drawn into engagement with a contact 90 of the wire 60 when the relay 77 is energized.

The selection of signal operation is provided by the master signal key 95 which is common to all line circuits. This signal key 95 has three positions; a central or neutral position for continuous operation of the visual signals; a depressed non-locking, self-restoring position for continuous operation of the audible signals; and a raised locking position for automatic operation of the signals in which the visual signals are operated a predetermined number of times followed by a shorter period of operation of the audible and then repeating the cycle, without any attention on the part of the operator.

This signal key has two central springs 96 and 97 which are connected by a wire 98. The upper spring 96 is formed so that it does not lock the key when the key is thrown down but restores it to normal when released, but the lower spring 97 is formed in such manner that when the key is thrown up it locks the key in its elevated position until manually restored to normal. The two spring contacts 96 and 97 are connected by a wire 99 with the windings 100 of a relay 101. The other end of the windings of this relay 101 is connected to a grounded battery B⁴. The armature 102 of this relay, in the deenergized condition of the relay 101, engages a contact 103 of the grounded terminal wire 104 of the generator 48, the other terminal of the generator 48 being connected to the wire 70. Across the generator output wires 70 and 104 a fixed resistance 105 is placed, this resistance being sufficiently large to insure, at all times, such load upon the generator as will prevent undue voltage surges through the equipment as hereinafter described. A fuse 106 is arranged in the line 104 between the generator 48 and the resistance 105.

When the relay 101 is energized its armature 102 is drawn into engagement with a contact 107 connected with the wire 71. One end of this wire 71, as previously explained, connects with the secondary mercury contact switch 63 and the other end of this wire 71 terminates in a contact 108, this contact 108 being common to all of the line signal relays 16 and being engaged by the armatures 38 of any of the line signal relays 16 which are energized.

The armature 102 of the relay 101 is permanently connected to a wire 109, this wire terminating in a contact 110, this contact 110 being common to all of the line signal relays 16 and being engaged by the armatures 15 of any of the line signal relays which are energized.

The upper spring 111 of the key 95, which is engaged by the spring 96 upon throwing the key 95 down is grounded and the lower spring 112 of this key, which engages the holding spring 97 when the key 95 is thrown up, is connected by a

wire 113 with a mercury contact switch indicated at 114. This mercury contact switch 114 is similar to the mercury contact switches 62 and 63 and comprises an hermetically sealed glass tube 115 which contains a globule of mercury 116. This tube 115 is mounted on a swinging arm 117 having a stationary pivot 118 and when this arm 117 is in its depressed position the globule of mercury rolls into contact with the leads of the wire 113 and a grounded wire 119, thereby grounding the wire 113. The arm 117 is elevated by a cam 120 which engages and lifts a roller 121, this roller being mounted at the lower end of a bar 122, the upper end of which bar is connected to the free end of the arm 117. The cam 120 has a relatively large salient face and a relatively small receding face and this cam is mounted on a shaft 123 to which is also fixed a worm wheel 124. This worm wheel 124 is driven by a worm 125 on the flasher cam shaft 52. The ratio between the rotation of the flasher cams 53 and 64 and the cam 120 can be selected as desired but preferably is about 30 to 1.

The individual line circuits are set up for signaling by throwing the key 32 down. This movement of the key 32 connects the upper spring contacts 130 and 131. The lower spring contact 131 is connected to the wire 61, this wire 61 being common to all of the keys 32 and the upper spring 130 is connected by a wire 132 with the windings 133 of the corresponding line signal relay 16. The other end of the windings 133 of each of the line signal relays 16 is connected by a common wire 134 to a contact 135, this contact being engaged by the armature 25 of the line common relay 24 when the line common relay 24 is deenergized.

Operation of the signal circuit

When the switchboard operator wishes to call a patrolman to a nearby box to give him instructions, the operator throws the power key 81 down and also throws down the line keys 32 on such lines as he desires to use. This establishes contact between the corresponding spring contacts 82 and 85 and 130 and 131. The closing of the contacts 82 and 85 of the power key 81 establishes a circuit from battery B³ through the windings 87 of the relay 77, wire 86, spring contacts 85 and 82 to ground. This energizes the relay 77 and draws up its armature 79 so as to supply commercial power to the motor 47 from commercial power line 76, contact 80, armature 79, wire 78, motor 47 and commercial power line 75. The energization of the motor starts the rotation of the generator shaft 49 which, through the worm and worm gear 50 and 51, drives the flasher cam shaft 52. The rotation of the cam shaft 52 rotates the primary rotary flasher cam 53 which periodically raises and lowers the bar 55 so as to close and open the mercury contact switch 62. This primary flasher switch 62 operates to set up periodically the signaling circuit for sending signaling impulses over the particular line circuits selected and in so setting up the line circuits over which the signal impulses are to be sent the current from battery B³ passes through the armature 89 of energized relay 77, contact 90, wire 60, closed mercury contact switch 62, wire 61, closed spring contacts 130 and 131 of the set-up line 70 keys 32, wire 132, windings 133 of the corresponding line signal relays 16, wire 134 and contact 135 and armature 25 to ground. The energization of the selected line signal relays 16 draws up their armatures 15 and 38, thereby disconnect-

ing the entire talking circuit and setting up the signaling circuit.

The rotation of the flasher cam shaft 52 also rotates the secondary rotary flasher cam 64. When this occurs signal current of 110 volts flows intermittently from the generator 48, wire 70, opening and closing secondary flasher switch 63, wire 71, contact 108, armatures 38 of the energized line signal relays 16, tip sides 11 of the set-up lines, wires 43, ionized gas lamps 41, wires 44, ring sides 10 of the selected lines, armatures 15 of the energized line signal relays 16, common contact 110, wire 109, armature 102 of deenergized relay 101 and contact 103 of wire 104 to ground.

The primary flasher cam 53 is larger than the secondary flasher cam 64 so that it closes its mercury switch 62 before the switch 63 and opens its switch 62 after the switch 63 opens. Each time the flasher cam shaft 52 rotates therefore it sets up the signaling circuit through the primary flasher cam 53 which draws up the armatures 15 and 38 of the selected line signal relays 16, and subsequently sends out a signaling impulse over the set-up circuits through the secondary flasher switch 63 and the visual signals 41. The visual signals 41 of the set-up circuits, therefore, flash on and off periodically until the patrolman answers the call. Since no signaling energy is sent over the lines until after they are set up and since this signaling energy is cut off before the set-up circuits are broken, it is apparent that arcing of the relays in breaking the relatively high voltage signaling current is avoided on the contacts of relay 16.

The visual signal 41 at the box is not always within the view of the patrolman and it is therefore necessary to give a few blasts on the horn or howler 41 to call his attention, audibly, to the fact that he is wanted at the box. This cannot, however, be continued as the periodic blast of the horn or howler is extremely annoying to the residents near the box if its operation is continued for any substantial period of time. To give a few blasts on the horn the switchboard operator throws the key 95 down to its non-locking position for a short time and then releases it to its normal position shown. In so doing he closes the spring contacts 97 and 111 and establishes a circuit from battery B⁴ through windings 100 of the relay 101, wire 99, and through spring contacts 96 and 111 to ground. The energization of the relay 101 draws its armature 102 away from the contact 103 and into engagement with the contact 107. This therefore establishes a circuit from generator 48 through wire 70, secondary flasher switch 63 (which is periodically opening and closing) wire 71, contact 107, armature 102 of energized relay 101, wire 109, common contact 110, armatures 15 of the energized line signal relays 16 of the set-up circuits, ring sides 10 of the set-up lines and horns 40 of the set-up lines to ground. When the desired number of blasts have been given the switchboard operator releases the key 95 to its normal position shown and the periodic operation of the visual signal 41 is resumed until the policeman answers the call.

It will be particularly noted that while signal energy for operating the horns 40 is being sent over the ring sides of the set-up lines to ground, the tip side 11 of the line is also charged with an equal potential. Thus while current is passing from the wire 71 through the contact 107 and armature 102 of the energized relay 101, this wire 71 is, of course, charged and through the

common contact 108, armatures 38 of the set-up line signal relays 16, the tip sides 11 of the set-up line circuits are also, of course, charged to the same potential as is being impressed on the ring sides of the same circuits, and furthermore prevents any noise on adjacent circuits. This avoids any condenser action between the tip and ring sides of the set-up lines and avoids any destructive surges. In the circuit arrangement shown in my Patent No. 1,920,236, dated August 1, 1933, when it was desired to operate the audible signals the generator output circuit was supplied over the ring side of the set-up lines to the substations and the other side of the generator was grounded at the central station. Each of the audible signals at the substations was connected between the ring side of its line circuit to ground. In this previous system the tip sides of the set-up lines, being insulated from the ring sides and practically having an open circuit condition during the periods when the audible signals were operated, were free to act as one side of a condenser. Thus, in the previous circuit, when signal energy was sent from ground over the ring side of the line to operate the grounded horn the inoperative tip side of the line was not charged, but since the ring and tip sides of the line were in the same cable, an opposite potential was induced in the inoperative or dead tip side of the line which would surge back at the end of each signal impulse through the ring side of the line. Such induced surges occasioned by the open condition of the unused tip side of the line during audible signaling over the ring side of the line circuit only was not, of course, desirable in mixed commercial telephone and police signal circuits in the same cable. It was quite possible to build up relatively high induced voltages on the tip sides of the set-up lines and while the visual signals formed a constant discharge circuits for any voltages exceeding their ionization voltage, the present circuit makes this unnecessary because of the change in the generator output circuit which impresses potential on both sides of the set-up lines during audible signal operation. Under this circuit arrangement, during audible signal operation, the ground is removed from the ring side of the line circuit and while the generator is still grounded the ring side of the line circuits are connected to the high voltage side while the tip sides of the line circuits remain on this side of the generator circuit. In this manner the same potential is placed upon the tip sides of the substation circuits as on the ring sides, during audible signal operation, and in this manner the tip sides of the circuits are prevented from acting as a condenser inasmuch as a condenser action can only take place when there is a difference in voltage between its two plates. With this circuit arrangement there can be no capacity effects developed on any of the circuits at any time through their use as a carrier for the signal current and this eliminates any possibility of destructive surges being created on the substation lines.

The present system also has provision whereby upon throwing the key 95 up both the visual and audible signals are operated in alternation in any desired order. For example, the system can be organized so that the visual signals on the set-up circuits will flash 25 times and then the horn or howler operated for five blasts after which this cycle is repeated. This automatic operation, of course, relieves the switchboard operator from paying any attention to the signal operation and

permits him to continue with whatever work he has on hand until the call is answered. For example, with manual operation the switchboard operator may give a few blasts on the horns or howlers at the boxes and then release the master signal key for operation of the visual signals. If, however, the patrolman does not respond it may be desirable to effect a few more blasts on the horn. The operator can be relieved from this attention by setting up the automatic operation.

More important, however, is the effect that this automatic operation has in hurrying the patrolman to answer the call. A patrolman on hearing the audible signal knows that he has an interval equivalent to 25 flashes of the visual signal to get to the nearest box and respond to the call. Psychologically this repeated operation of the audible signal has much the same effect on a patrolman that a ringing telephone has in an office where everything is dropped to answer the phone. Aside from this, however, the operation of the audible signal is extremely disagreeable to nearby residents and the excessive operation results in complaints to police headquarters. Inasmuch as this excessive operation of audible signals with automatic operation is directly traceable to the slowness of the patrolman in answering his calls the patrolman rather than face the complaints will hurry to the box and answer the call.

This automatic operation of the audible and visual signals for suitable intervals in alternation is effected by throwing the key 95 up. This closes the spring contacts 97 and 112 and permits battery current to flow from battery B⁴ through the windings of relays 101, wire 98, springs 97 and 112 of key 95 and wire 113 to the grounded switch 114. As previously stated the ratio between the rotation of the flasher cam shaft 52 and the cam shaft 123 can be, say 30 to 1. The cam 120 is also so designed that its salient portion is much greater than its receding portion. For example, the effective salient portion of the cam 120 can be five times that of its receding portion. With such ratios, for 25 flashes of the flasher cams 53 and 64, i. e. 25 rotations of the cam shaft 52 the roller 121 is riding on the salient portion of the cam 120 and hence the globule 116 of mercury in the switch 114 will be held out of contact with the wires 113 and 119. Under these conditions the circuit from battery B⁴ through relay 101 and closed springs 97 and 112 of the key 95 is open and consequently the relay 101 is deenergized. Under these conditions, as previously described, only the visual signals of the set-up line circuits are operated, the current flowing from the generator 48 through wire 104, contact 103, armature 102 of deenergized relay 101, wire 109, contact 110 armatures 15 of the energized line relays 16, ring sides 10 of the corresponding lines, armatures 38 of the energized line relays 16, common contact 108, wire 71, flasher switch 63 and wire 70 to generator. When, however, the roller 121 drops into the receding portion of the cam 120 the mercury globule of the switch 114 rolls to connect the wires 113 and 119 and consequently establishes a circuit from battery B⁴ through relay 101, closed springs 97 and 112 of the switch 95 and closed switch 114 to ground. This energizes the relay 101 and draws its armature 102 into engagement with the contact 107 so that current from the generator 48 now flows through wire 70, flasher switch 63, wire 71, contact 107, wire 109, common contact 110, armatures 15 of the energized line relays 16, ring sides 10 of

the corresponding lines and through horns 40 to ground, the other side of the generator 48 being, of course, permanently grounded through wire 104. Therefore when the roller 121 drops into the receding portion of the cam 120, the horns 40 of the set-up circuits will periodically operate until the roller 121 is again raised by the cam 120, the switch 114 opened and the relay 101 deenergized to return to visual signal operation. As long as the cam 120 rotates with the contacts 97 and 112 of the key 95 closed 25 flashes of the visual signals will be followed by 5 blasts of the horns and this cycle repeated until the patrolman answers the call.

It will be noted that under conditions of audible signal operation through the tilting of the switch 114 the tip sides of lines are charged with the same potential as the ring sides. Therefore the tip sides of lines can have no condenser action and cannot create destructive surges, as previously explained with reference to manual operation of the audible signals, by throwing the key 95 down.

The placing of the fixed resistance 105 across the output circuit of the signal current generator 48 is to insure that under no condition can this generate without some load in its output circuit. In a frequency converter it is quite possible that the open circuit voltage may be quite a bit higher than the voltage of the same circuit when the circuit includes some portion of the total load to which it might be subjected in practice. Inasmuch as the signal current generator may operate in actual service on any number of signals from one up to the total number, it is quite possible that a voltage may develop which is more or less in proportion to the load on the generator. For example, assume a generator having an output of 350 watts operating a total of 70 signals each of 5 watts. Many times it will happen that only one or two signals will be required and under such conditions it is more than possible that the voltage of the generator output will be considerably higher than when the full number of signals are used. Inasmuch as the generator output circuit includes the flasher which opens and closes this circuit once each second, approximately, voltage surges due to the open circuit voltage of the generator might be excessive and to prevent this condition the fixed resistance 105 is placed across the generator output and this resistance made sufficiently large so that even when no signal load exists across the generator output circuit this fixed resistance will have the effect of stabilizing the generator voltage and thereby preventing too great a change in the signal output voltage from all conditions of load varying from no load to full load.

The main generator fuse 106 is placed between the generator and its fixed resistance so that in the event of any short circuit the generator will be properly protected whether such trouble occurs through the shorting of this resistance or because of trouble beyond the resistance.

From the foregoing it is apparent that the present invention provides a police signal system in which under all conditions of signaling operation both the tip and the ring sides of the lines are charged so that neither side can act as a condenser and result in any destructive voltage surges; the system also incorporates a simple and reliable automatic signal operation by which the visual signals at the selected police boxes can be operated say for 25 flashes and this followed by 5 blasts of the horn, etc. this relieving the switch-

board operator from attention to this detail and also tending to hurry the policeman in answering such calls; the present system also embodies a fixed resistance across the generator output circuit so that a load is imposed upon the generator at all times regardless of the number of signals being operated with the result that excessive voltages due to the varying load upon the generator are avoided.

10 I claim:

1. A police signal system adapted for service over telephone lines connecting a central station with a plurality of substations, comprising a power source at said central station and associated with said substation circuits, a visual and an audible signal device at each of said substations, each of one type of said signal devices being connected across the respective circuit and each of the other type of said signal devices being connected from one side of the respective circuit to ground, means for grounding said power source and connecting the other terminal of said power source with both sides of said line circuit for the operation of said grounded signal devices and means for connecting said power source across said line circuits for the operation of the other type of said signal devices.

2. A police signal system, comprising a central station, a plurality of substations connecting said central station with said substations, a power source at said central station and associated with said substation circuits, a visual and an audible signal device at each of said substations, each of one type of said signal devices being connected across the respective circuit and each of the other type of said signal devices being connected from one side of the respective circuit to ground, a signal switch associated with each of said substation circuits and operating, when closed, to energize one of the signals of its respective circuit, switch means at said central station and common to all of said substation circuits and said power source, said common switch means, in one position being adapted to ground one side of said power source and to connect the other terminal of said power source with both sides of said line circuits thereby to operate said grounded signal devices and said switch means, and in another position being adapted to connect said power source across said line circuits to supply energy to the other type of substation signal devices.

3. A police signal system, comprising a central station, a substation and a line circuit connecting said central station with said substation, a power source at said central station and associated with said substation circuit, a visual and an audible signal device at said substation, one of said signal devices being connected across the circuit and the other being connected from one side of the circuit to ground, means for grounding said power source and connecting the other terminal of said power source with both sides of said line circuit for the operation of said grounded signal device and means for connecting said power source across said line circuit for the operation of the other signal device.

4. A police signal system adapted for service over telephone circuits connecting a central station with a plurality of substations; comprising a signal power source at said central station and associated with said substation circuits; a visual and an audible signal device at each of said substations, each of one type of said signal devices being connected across the respective circuit and

each of the other type of said signal devices being connected from one side of the respective circuit to ground; a signal switch associated with each of said substation circuits and operating, when closed, to set up its circuit and connect said signal power source with its circuit and energize one of the signal devices on its circuit; a relay common to all of said circuits and said power source, the armature of said relay in one condition of relay energization being grounded and being adapted to supply energy from said signal power source to one type of signal devices in the set-up circuits as a group and the armature of said relay in the other condition of relay energization being connected across said substation circuits and power source and being adapted to supply signal energy to the corresponding other type of signal devices in the set-up circuits as a group, one end of the winding of said relay being connected to a source of energy; a single master switch having a grounded contact, a central contact element connected with the other end of the winding of said relay and manually movable from an open position to engage said grounded contact to manually energize said relay and also manually movable from said open position to engage a third contact of said switch; a motor at said central station; and switch means periodically opened and closed by said motor, said last switch means, when closed, connecting said third contact of said master switch with ground, whereby when the central and third contacts of said master switch are closed the closing and opening of said motor operated switch means periodically energizes and deenergizes said relay thereby to operate the visual and audible signal devices in the set-up circuits in a predetermined alternation.

5. A police signal system adapted for service over telephone circuits connecting a central station with a plurality of substations; comprising a generator at said central station and associated with said substation circuits; means for actuating said generator; a visual and an audible signal device at each of said substations, each of one type of said signal devices being connected across the respective circuit and each of the other type of said signal devices being connected from one side of the respective circuit to ground; a signal switch associated with each of said substation circuits and operating, when closed, to set up its circuit and connect said signal power source with its circuit and energize one of the signal devices on its circuit; a flasher actuated by the means for actuating said generator and including a flasher switch in circuit with the output of said generator; a relay common to all of said circuits and said generator, the armature of said relay in one condition of relay energization being grounded and being adapted to supply energy from said generator, through said flasher switch, to one type of signal devices in the set-up circuits as a group and the armature of said relay in the other condition of relay energization being connected across said substation circuits and generator and being adapted to supply signal energy from said generator, through said flasher switch, to the corresponding other type of signal devices in the set-up circuits as a group, one end of the winding of said relay being connected to a source of energy; a single master switch having a grounded contact, a central contact element connected with the other end of the winding of said relay and manually movable from an open position to engage said grounded contact to manually energize

said relay and also manually movable from said open position to engage a third contact of said switch; and switch means periodically opened and closed by said means for actuating said generator, 5
said last switch means, when closed, connecting said third contact of said master switch with ground, whereby when the central and third con-

tacts of said master switch are closed the closing and opening of said last switch means periodically energizes and deenergizes said relay thereby to operate the visual and audible signal devices in the set-up circuits in a predetermined alterna- 5
tion.

GUSTAV F. C. BAUER.