April 29, 1930. K. W. MACKALL 1,756,490

TRAFFIC SIGNALING SYSTEM

Filed Sept. 12, 1924 9 Sheets-Sheet 1

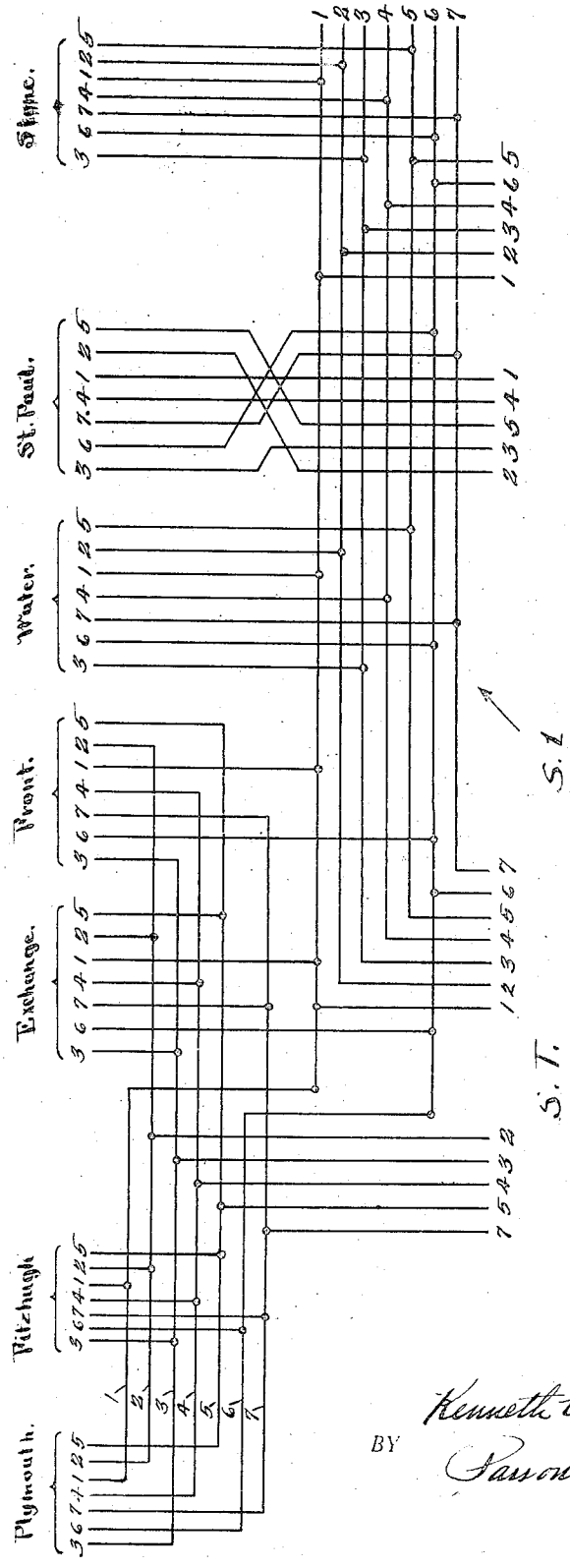

Fig. 1.

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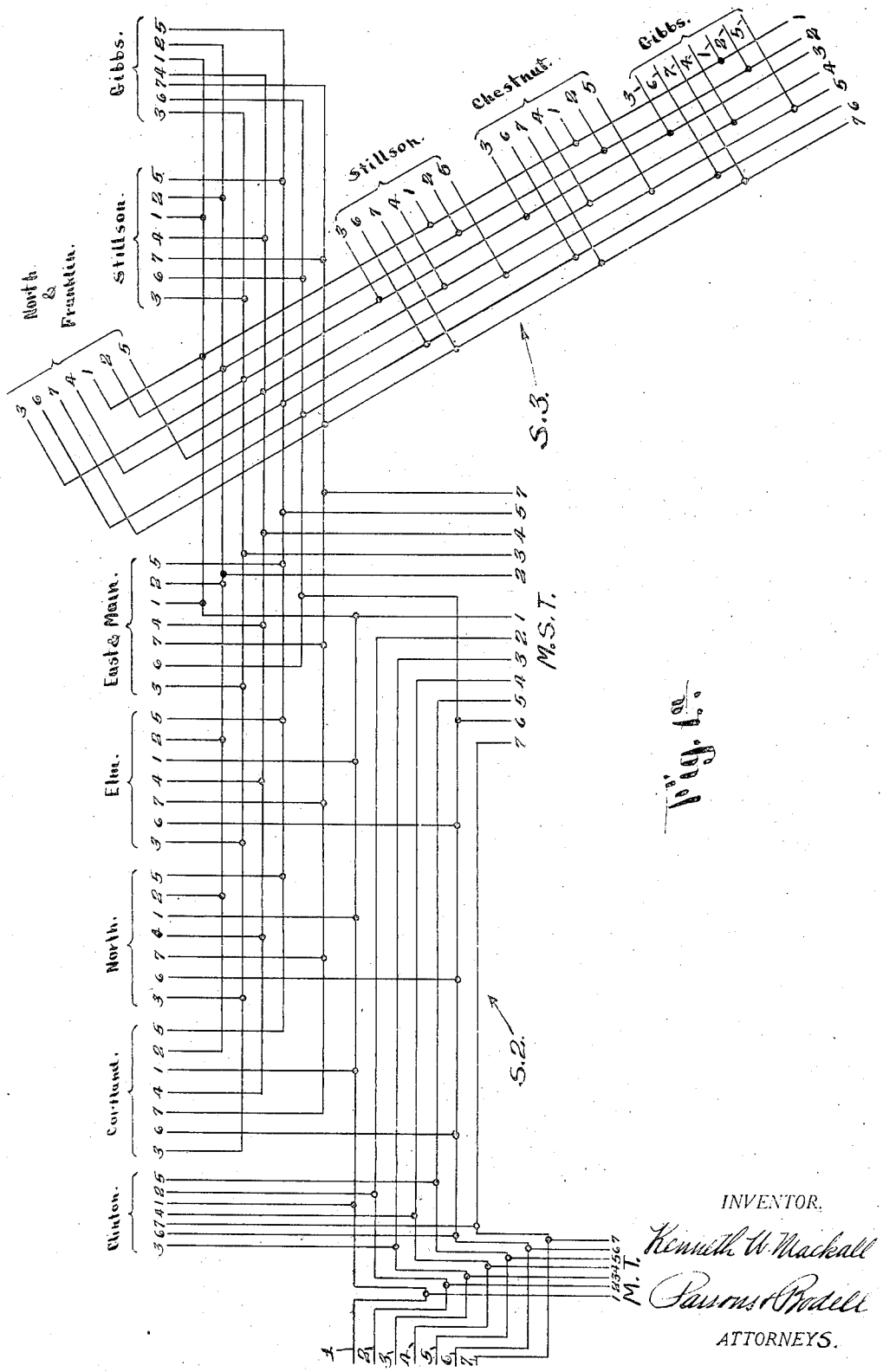
TRAFFIC SIGNALING SYSTEM

Filed Sept. 12, 1924 9 Sheets-Sheet 2



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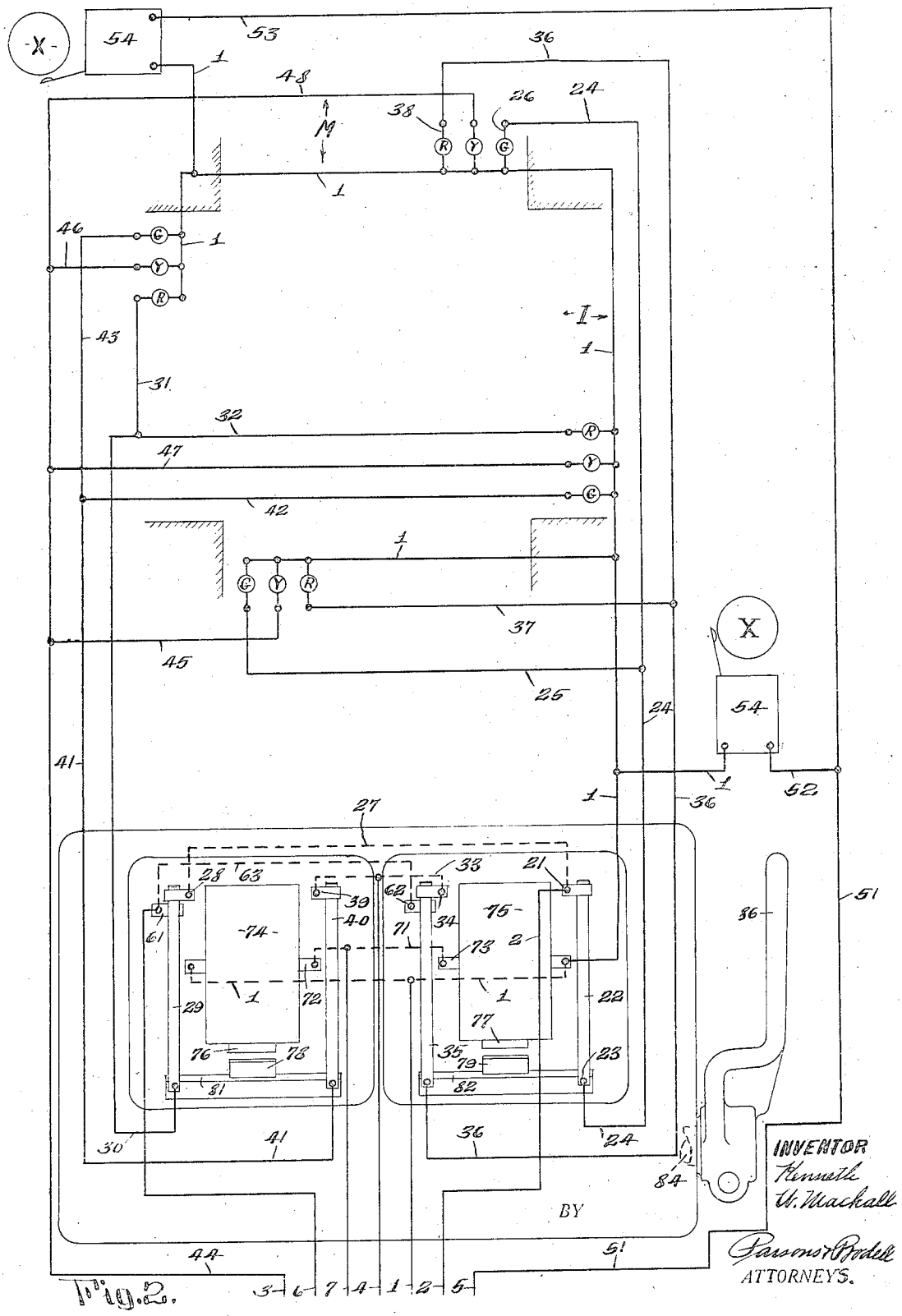
TRAFFIC SIGNALING SYSTEM

Filed Sept. 12, 1924 9 Sheets-Sheet 3



April 29, 1930. K. W. MACKALL 1,756,490

TRAFFIC SIGNALING SYSTEM

Filed Sept. 12, 1924 9 Sheets-Sheet 4

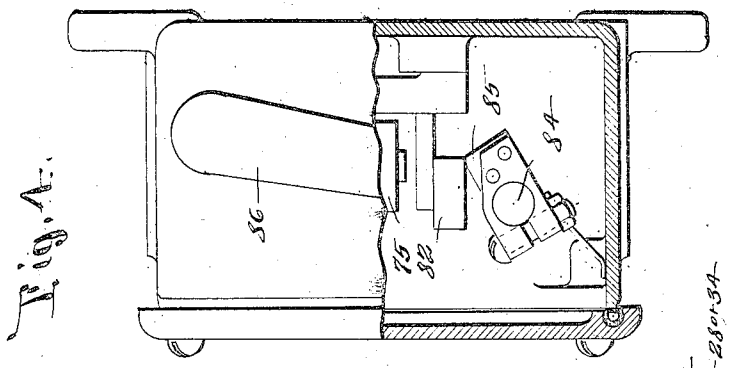


Fig. 4.

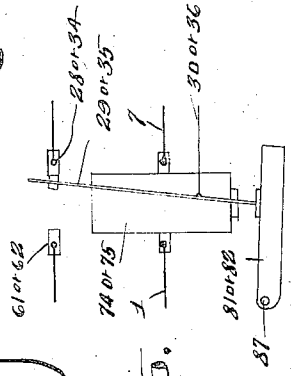


Fig. 5.

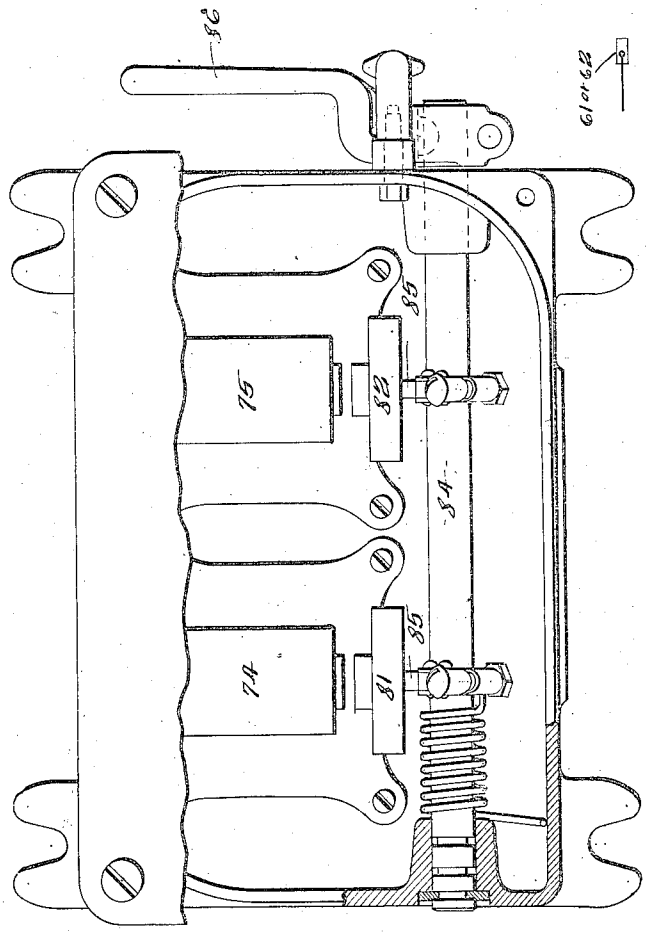


Fig. 3.

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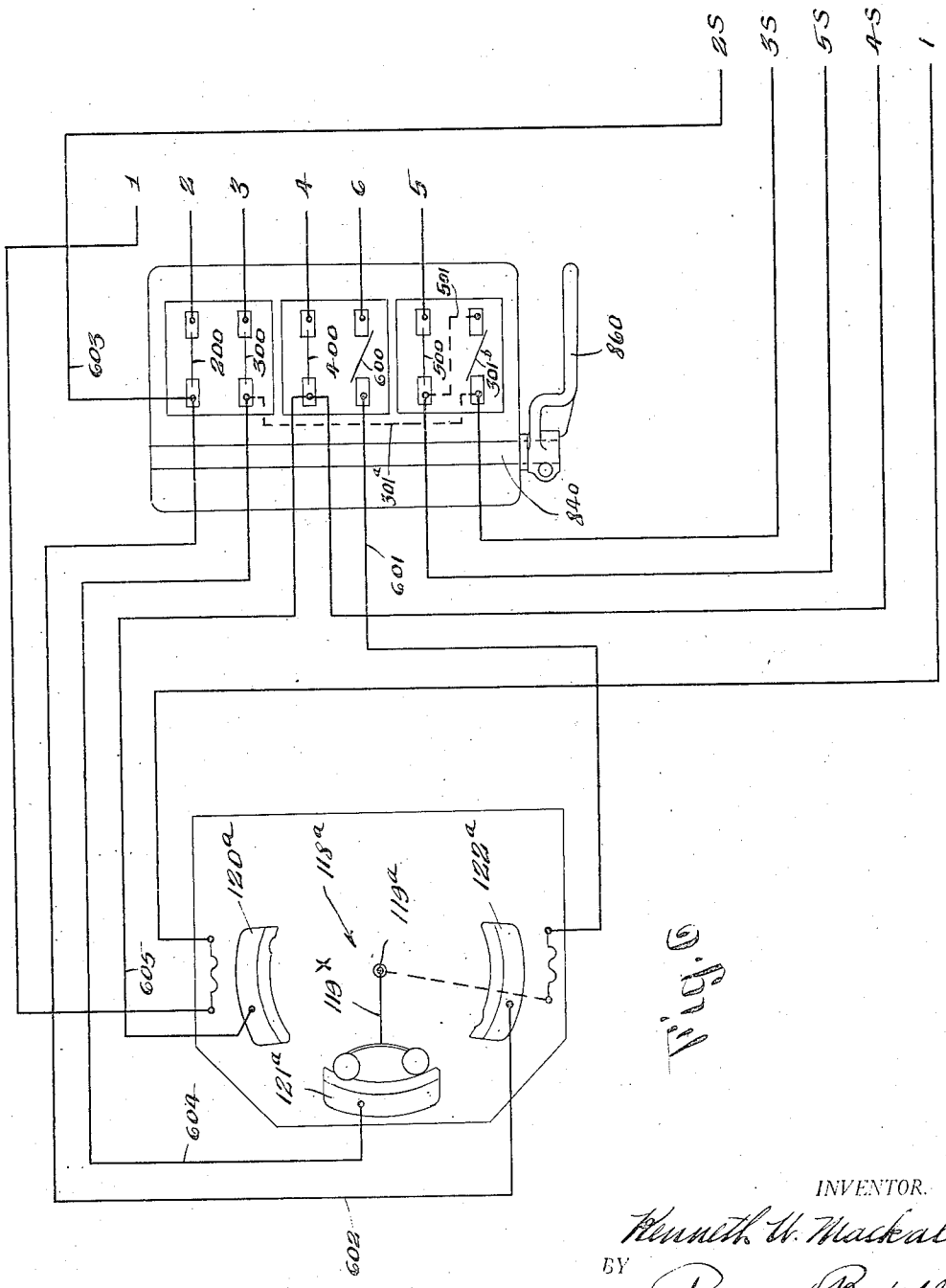

Fig. 6.

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TRAFFIC SIGNALING SYSTEM

Filed Sept. 12, 1924 9 Sheets-Sheet 6

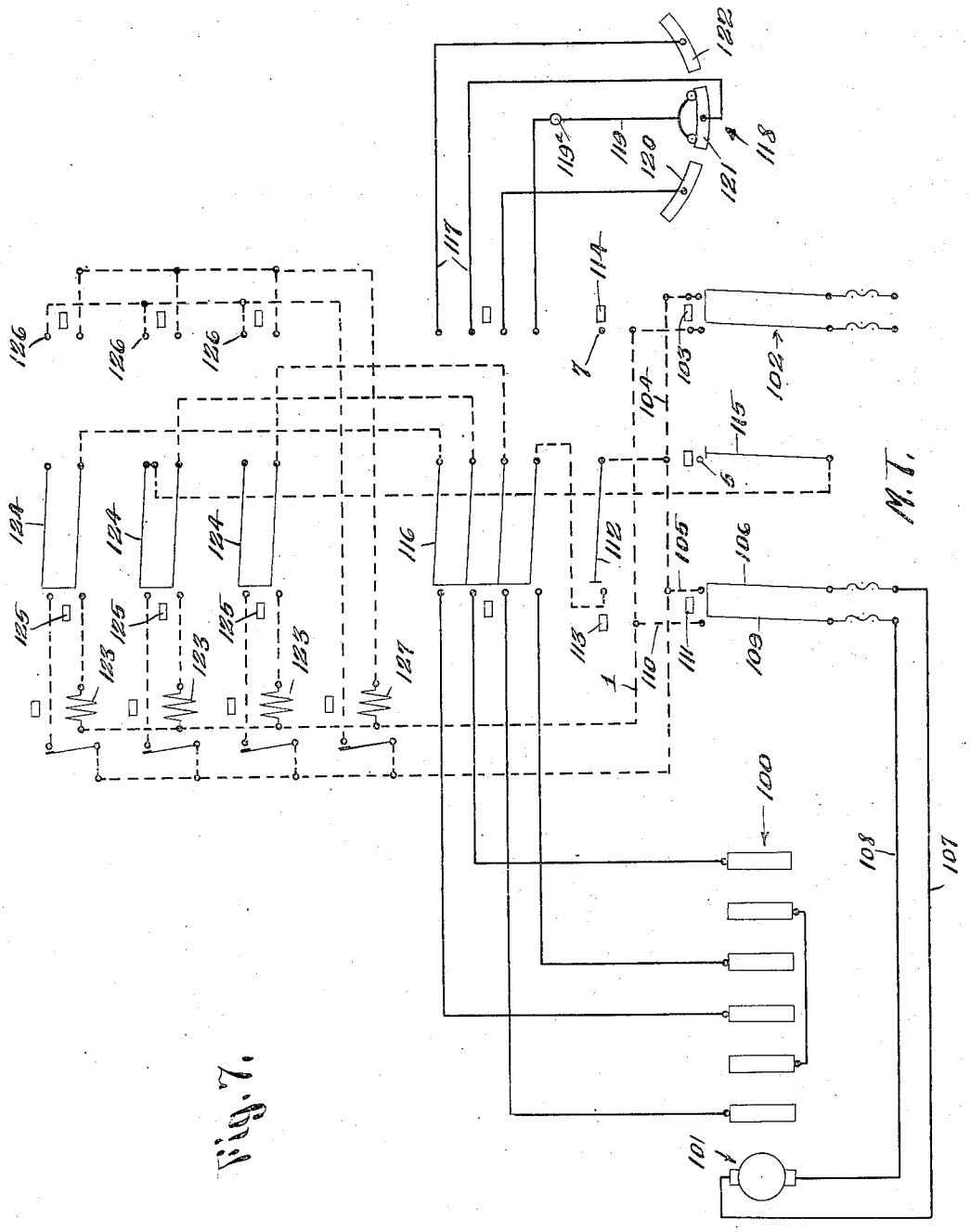

Fig. 7.

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TRAFFIC SIGNALING SYSTEM

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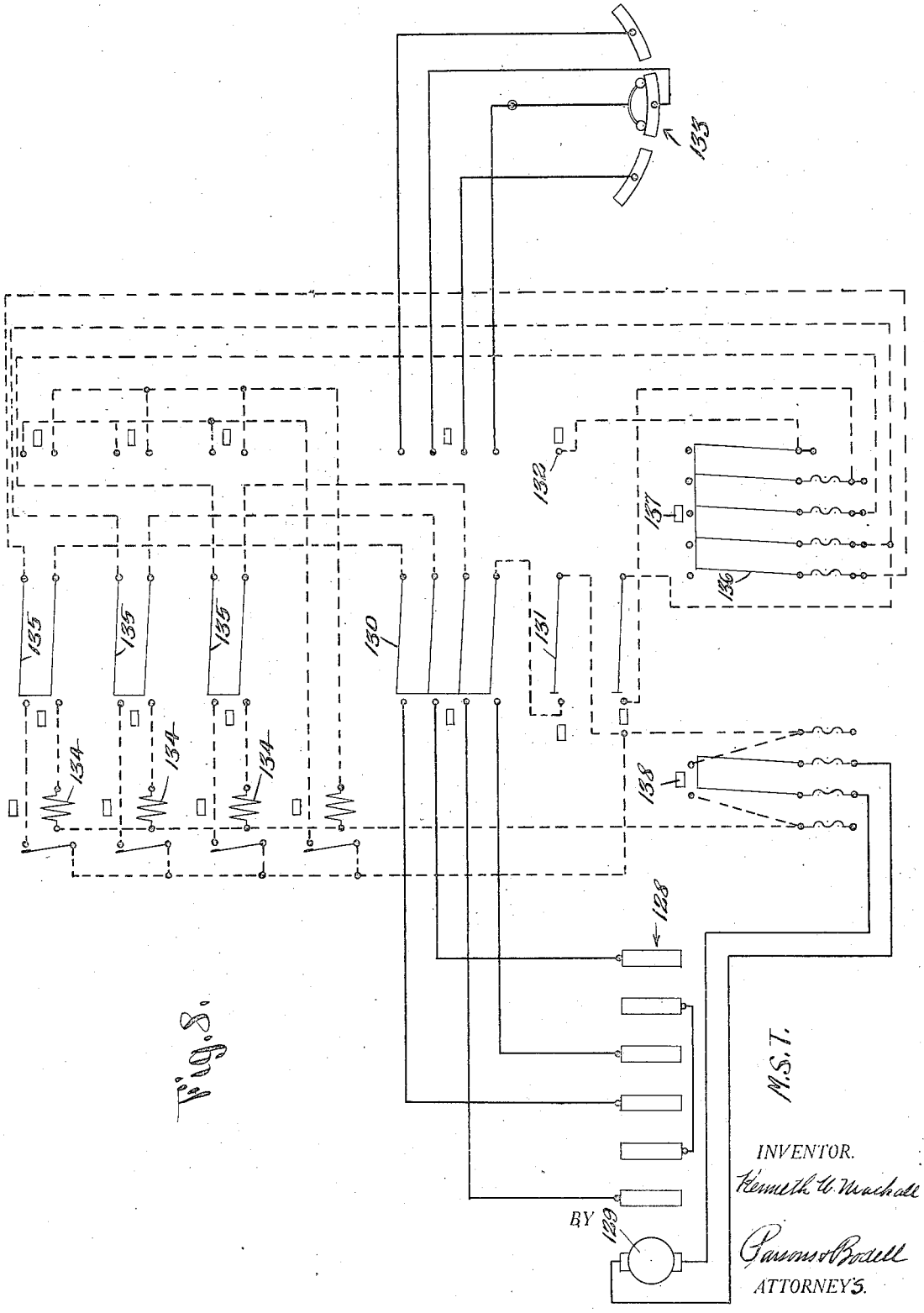

Fig. 8.

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April 29, 1930. K. W. MACKALL 1,756,490

TRAFFIC SIGNALING SYSTEM

Filed Sept. 12, 1924 9 Sheets-Sheet 8

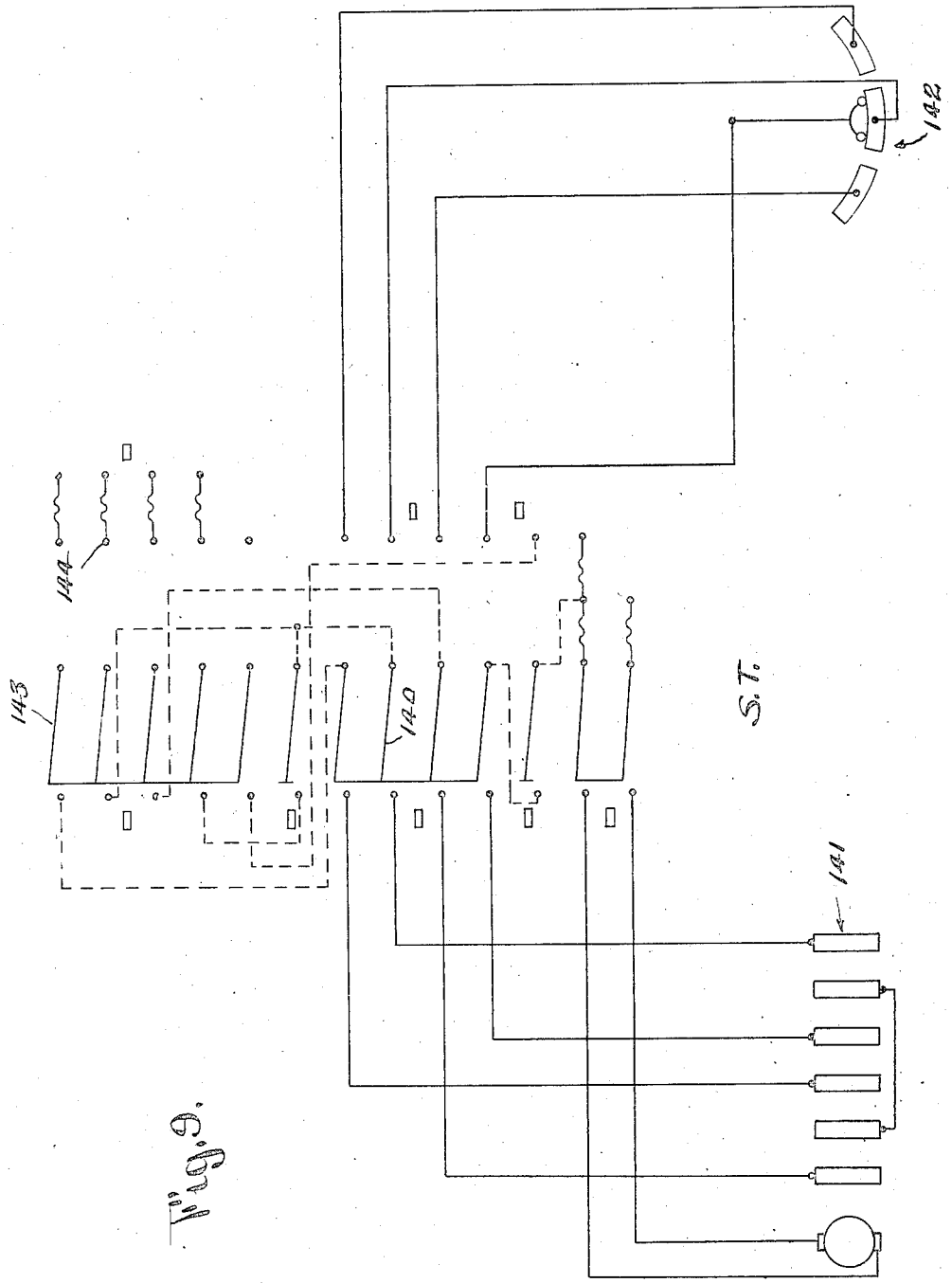

Fig. 9.

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TRAFFIC SIGNALING SYSTEM

Filed Sept. 12, 1924 9 Sheets-Sheet 9

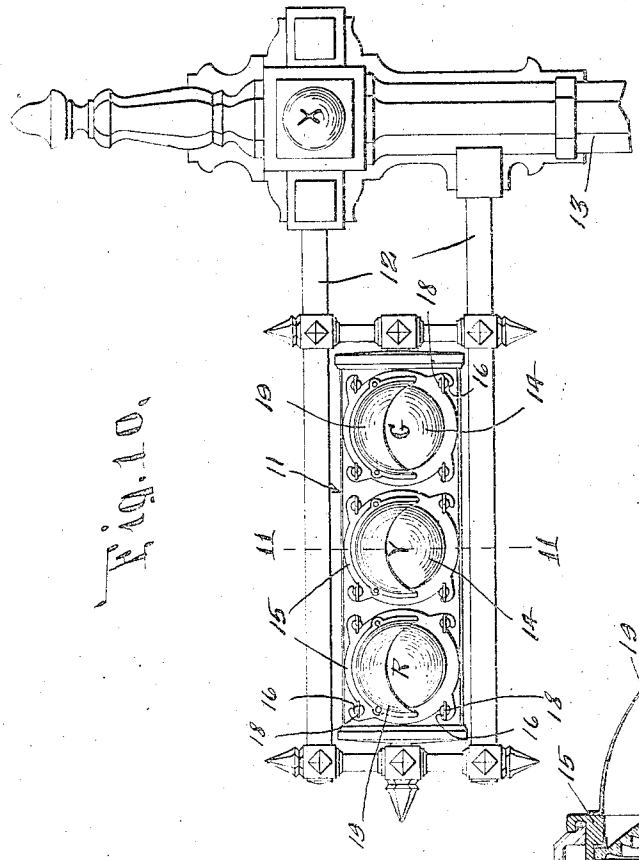

Fig. 10.

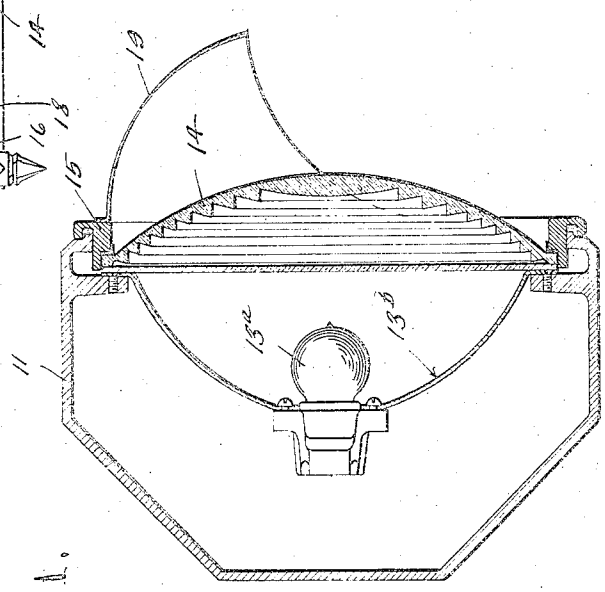

Fig. 11.

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Patented Apr. 29, 1930 1,756,490

UNITED STATES PATENT OFFICE

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TRAFFIC SIGNALING SYSTEM

Application filed September 12, 1924. Serial No. 737,273.

This invention relates to traffic signaling systems for controlling the traffic at the intersections of thoroughfares, right of ways, streets, etc., and has for its object a particularly simple, efficient combination and arrangement of the co-operating parts by which a plurality or groups of signals located at different street intersections are operated from a single station, and all the stop signals or other signals of like import may be set to stop all traffic from such central station, and also by which all the stop signals or other signals of like import of the group of signals at one or each intersection may be set independently of the other groups other objects appear throughout the specification.

The invention consists in the novel features and in the combinations and constructions hereinafter set forth and claimed.

In describing this invention reference is had to the accompanying drawings in which like characters designate corresponding parts in all the views.

Figures 1 and 1[a] taken together illustrate diagrammatically a system, including three sections.

Figure 2 is a diagrammatic view of the wiring and operating means for one group of signals, that is, a group at one intersection.

Figure 3 is an elevation with the cover broken away of the local switch at one intersection.

Figure 4 is an end elevation partly in section of the switch shown in Figure 3.

Figure 5 is a fragmentary detail view of a portion of the switch shown in Figure 3.

Figure 6 is a diagrammatic view of manual local control at one intersection.

Figure 7 is a diagrammatic view of the master or remotely operated switch for the sections of the system, this switch being located at main station or tower.

Figure 8 is a diagrammatic view of the wiring and switches located at one of the main subtowers.

Figure 9 is a diagrammatic view of the connections and switches at the subtower.

Figure 10 is an elevation of the means for supporting the signals.

Figure 11 is a sectional view on line 11—11, Figure 10.

This traffic signaling system comprises in its entirety a plurality, that is, two or more sections, each section including groups of signals located at different points, as street intersections, each group comprising a set of stop and go signals presented in one direction, as for instance north along one street, and stop and go signals presented in the opposite direction, as south along the same street, a second set of stop and go signals presented in one direction as east, along the intersecting street and stop and go signals presented west along the intersecting street, control means located at the main station for controlling the operation of the signals of all the groups, and normally operating signals of like import of one set of each group of all the sections and the signals of the opposite import of the other set of each group, a sub-operating station for each section, and means for cutting out the substations from the main station to operate such stations individually, and means for operating the sections from one of the substations, whereby in effect the substation becomes a main station and for convenience is called a main substation.

The invention further includes means by which all the stop signals can be set from the control station and also local means by which all the stop signals can be set in one or each intersection independently of the signals of the other intersections. In this embodiment of my invention but one intersection is shown, as provided with a local means for setting all the stop signals.

M designates the main street, which for convenience is considered as running in a general direction north and south, and I the intersection streets. S^1, S^2 and S^3 designate the sections of the system, M T the main control tower, M S T the main subtower, and S T the subtower.

Each group of signals, that is, the signals located at each intersection comprises stop and go signals, a stop and go signal being presented north on the main street, and a stop and go signal south on the main street, these constituting one set of signals, and a

stop and go signal presented east on the intersecting street, and a stop and go signal west on the intersecting street, these constituting a second set of signals.

The stop signals are designated R, and the go signals by the letter G. Also associated with each set of signals is an intermediate or warning signal which shows in all directions preliminary to a change in the signals, in order that the intersection or crossing may have time to clear preliminary to the stopping of the traffic along one street and the starting of the traffic on the other street. These preliminary or warning signals are usually amber or yellow lights and are designated Y.

In addition to the preliminary or warning signal consisting of the yellow or amber lights, an auditory signal may be provided as one or more electrically operated bells X.

The signal lamps are R, Y, G and are supported in a suitable casing, the lamps being preferably arranged in a horizontal line with the yellow lamp Y between the red and green lamps R and G, 11 is the casing supported by arms 12 extending from a post 13, there usually being a unit consisting of a post, casing and lamps at each corner of the street intersection. Each signal comprises an electric bulb 13^a located in the casing, a reflector 13^b and a diffusing lens 14. This lens is held in an annular frame 15 removably secured to the casing in any suitable manner, the annular frame being here shown as formed with slots 16 for receiving bolts on which turn nuts 18.

These lenses are red, yellow and green in color and give the color to the signals, the lenses are also constructed to widely diffuse the light and to prevent bright sunlight from reflecting therefrom or therethrough from the rear side of the lens and giving the effect in daytime that the signal is illuminated when it is not intended to be illuminated. Also visors or hoods 19 are provided over each lens, these visors being carried by the annular frame. The visors are for the purpose of shading the lens from sunlight in order to give greater visibility to the signals in the sunlight.

The lamps R, G and Y of the sets of each group are connected to operate so that when the red lamps presented north and south are illuminated, the green lamps presented east and west will be illuminated and vice versa, and the yellow lamps are illuminated when the signals are changed or about to change from red to green or from green to red. Also the bells X are sounded at the same time that the yellow lights are illuminated.

The group of signals at each intersection is provided with means by which all the red signals may be illuminated at the same time to stop all traffic, the connections for each group of signals is shown in Figure 2 in which 1 designates the return bus wire or cable, or what may be considered the negative conductor. 2 is a bus wire which when the circuit therethrough is closed by a suitable switch, cuts in, the green signals G for north and south traffic and the red signals R for east and west traffic, the current flowing through conductor 2 to a contact 21 thence through conductor 22 to a contact 23 thence through conductor 24, thence through leads 25 and 26 to the green signals G facing south and north, and also from a contact 21 through bridge wire 27 and conductor 28, conductor 29, wire 30 and leads 31 and 32 therefrom to the red signals R facing west and east, all of these signals being connected to the return bus cable wire 1.

To illuminate the green signals facing east and west and the red signals facing north and south, the circuit is closed by a suitable switch through bus cable 4 to a conductor 33 and the current flows thence to contact 34, conductor 35, wire 36 and leads 37 and 38 therefrom to the red signals R on the north and south street, also from the conductor 33, to the contact 39, conductor 40, wire 41 to leads 42 and 43 therefrom to the green lamps G for the east and west traffic.

To illuminate lamps Y, the circuit is closed by a suitable switch through the conductor 3, and the current flows through wires 44 and leads 45, 46, 47 and 48 to all the yellow lights and thence through the return wire 1. Also at the same time the circuit is closed by a suitable switch through the wire 5, thence through conductor 51 and leads 52 and 53 therefrom through the magnets which operate the bells X, these magnets being located in boxes 54.

In order to set all the signals at red and cut out all the green signals, so that the traffic is stopped in all directions, as in the case of emergency, a suitable emergency switch is operated to close the circuit through the bus wire 7, and the current then passes through the bus wire 7 to wire 71 connected at 72 and 73 to the windings of solenoids 74, 75, the cores 76 and 77 of which act on armatures 78, 79 and these armatures lift switch arms 81 and 82 carrying respectively the conductors 29 and 40 and the conductors 22 and 35, so that when the armature is attracted and the switch arms 81 and 82 lifted, and the circuits connected to the bus wires 2 and 4 are broken at the contacts 21 and 34 and 39 and 28, and the circuit made between contacts 61 and 62 and contacts 28 and 34, so that the current passes from the main conductor 6 to the contact 61, thence through conductor 29 and wire 30 and leads 31 and 32 for the red signals R for the west and east traffic and from the contact 61 through wires 63, the contact 62 thence through conductor 35, wire 36 and leads 37 and 38 to the red signals R have the north and south traffic.

The switch or relay including the solenoids 74, 75 and switch arms 81 and 82, may be of any suitable form, size and construction.

The emergency switch located at one inter-

section, by which an officer at such intersection may cut out the signals at such intersection from the control of the tower, and operate the signal at such intersection manually is shown diagrammatically in Fig. 6, and also the manual switch for operating the signals is shown, the latter being similar to the manually operable switches 119, Fig. 7, 149, Fig. 9 and 132, Fig. 8.

The cut out switch may be of any suitable form, size and construction, and includes switch arms 200, 300, 400, and 500, normally in closed position to connect the bus wires 2, 3, 4 and 5 to the branches of these wires leading to the signals, these branches being designated 2^s, 3^s, 4^s and 5^s. These switch arms are operated in any suitable manner as by a rock shaft 840 and handle 860, similar to the rock shaft 84, and handle 86 of the switch shown in Figs. 3 and 4, normally when the switch at such intersection is in the control of one of the towers, the current passes to illuminate the green lamps north and south and the red lights east and west through bus wire 2, switch arm 200 to the wires 2^s. To illuminate the green signals east and west and the red north and south, the current passes from bus wire 4, switch arm 400 and wire 4^s, to the signals. To illuminate the yellow signals the current passes from bus wire 3, switch arm 300, bridge wire 301^a, to the wire 3^s. And if the bell circuit is open, the current passes through bus wire 5, switch arm 500, to wire 5^s. In each case the current returns through the wire 1 which may be considered as always negative.

The bus wire 5 which supplies the current for the bells is also connected through the switch arm 500 to a wire 501, to the yellow lamp circuit 3^s, through switch arm 301^b, so that, when the switch is thrown to off position to connect in the manually operable switch, the bell will ring, when the yellow lights are energized in synchronism with the operation of the manually operated switch and in synchronism with the tower switches. The switch also includes manually open switch arms 600 and 301^b. When the switch is operated to open the circuit at the switch arms 200, 300, 400 and 500, it closes the circuit through bus wire 6 and the yellow light circuit through bus wire 3^s.

The wire 6 may be considered as a positive wire live at all times as it is only effective to cut in all the red signals when the relay switch operated by the magnets 74, 75 or handle 86, Figs. 2, 3 and 4, is operated.

Upon the operation of the switch handle 860 to throw the arms 200, 300, 400 and 500 to off position and the arms 600 and 301^b to on position, the operation of the signals at a particular intersection are as follows.

Assuming that the officer at the particular corner is to set the green signals north and south and the red signals east and west; he operates the switch arm 119^x into engagement with the contact 122^a, whereupon the current flows from the positive wire 6, switch arm 600, wire 601, to the center terminal 119^a of the manual switch 118^a thence through switch arm 119^x to contact 122^a, thence through wire 602, and 603, through the signal circuit 2^s, and thence through the common return wire 1. The officer then shifts the arm 119^x into engagement with the central contact 121^a, whereupon the current passes through common live wire 6, switch arm 600, wire 601, central terminal 119^a, switch arm 119^x, contact 121^a, wire 604, wire 301, thence through the yellow signals circuit 3^s back through the return wire 1, and also from the wire 301^a through the switch arm 301^b, through bridge wire 501 to the bell signal wire 5^s thence through the return wire 1. The officer then shifts the arm 119^x into engagement with the switch contact 120^a, whereupon the current passes through the common live wire 6, contact 600, wire 601, to the central terminal 119^x of the switch 118^a, thence through the switch arm 119^x to contact 120^a thence through wire 605 to signal circuit wire 4^s, thence through the common return wire 1.

If during the manual operation of the signals at a particular intersection the towerman wishes to set all signals at red, including those at the particular intersection, he either operates the handle 86, Fig. 2, or a switch in the bus wire 7 to energize the solenoids 74, 75, so that, all the red lamps will cut in.

The emergency switch arms 81, 82 may be operated independently or locally, and as here shown means is provided at each intersection for operating the switch arms 81, 82 mechanically. This mechanical means consists of a shaft 84 having rocker arms or cams 85 thereon engaging with the arms 81, 82 so that when the shaft is rocked, the shaft arms will be operated to the same effect as if these were operated by the solenoids 74, 75.

The shaft 84 is provided with a suitable handle 86. These switches are arranged so that they open by gravity, that is the switch arms 81, 82 move downwardly by gravity when the solenoids are de-energized or when the operator releases his hold on the handle 86. As seen in Figure 5 the parts 81 or 82 are pivoted at 87, the conductors 29, 40, 35 and 22 rising therefrom. The conductors 29 and 35 are normally engaged with the contacts 28 and 34 and when the parts 81 and 82 are rocked upwardly and shifted into engagement with the contacts 61, 62. The conductors 40 and 35 normally engage the contacts 39, 21 and when the parts 81, 82 are rocked upwardly are shifted out of engagement therewith.

In the system here illustrated, there are three sections along the main street, one section including the intersecting streets desig-

nated for convenience Plymouth, Fitzhugh, Exchange, Front, Water, St. Paul and Stone, another section designated Clinton, Cortland, North, Elm, East, Stillson and Gibbs and a third section comprises Franklin, Stillson and streets intersecting Franklin Street as Stillson, Chestnut and Gibbs. All of these sections are normally controlled from the main tower M T. The first section may be controlled by the subtower S T independently of the main tower M T and the third section may be controlled by the main subtower M S T and the officer in the main subtower M S T may take control of the entire system when the officer in the main tower is off duty.

Master switches operated automatically are located in the main tower M T and the main subtower M S T and the subtower S T. The master switch located in the main tower M T is shown diagrammatically in the Figure 7 and operates to close at intervals the circuits through the main wires 2, 3 and 4 which are connected in circuit to the lamps R Y G.

In Figure 7, 100 designates the master, automatic switch of the main tower M T, this switch being of any suitable form, size and construction, well known to electricians, and including contacts mounted on a movable member as a drum which is actuated from an electric motor 101 connected in the supply mains by a switch 102 operated by a suitable handle designated 103.

Upon the closing of the switch 102, the current passes through the motor 101, through wire 104, branch wire 105, switch arm 106, conductor 107, through motor and through wire 108, through switch arm 109, wire 110 to the main return wire 1.

The switch arms 106 and 109 form part of a switch member operated by a suitable handle designated 111 for cutting out the motor and the automatic switch at the main tower. The wire 104 for convenience is in circuit with the wire 6 by which all of the red lights are illuminated when the circuit is closed through the wire 7 by the operation of the solenoid switches 74, 75.

For normal operation for all three sections of the system from the main tower M T, the circuit through conductors 6 is opened by a switch 112, Figure 7, having an operating handle designated 113. To close the circuit at the switch 112 for the purpose of illuminating all the red signals R and cutting out the green signals G, the handle 113 is operated to close the switch 112 and also the handle 114 of the switch which closes the circuit through the wires 7 operated so that the solenoids 74, 75 are energized to operate the switch arms 81, 82.

Normally when the bells X are used, a switch 115 in the main tower M T is closed, in order that the bells may operate each time the yellow lamps are illuminated. In case the yellow lamps Y are permanently set, when the system is not being operated the switch 115 may be opened in order that the bells will not be sounded.

In order to discontinue the automatic operation of the signals and to operate the signals manually, the main tower M T is provided with a double throw switch 116 normally closing the circuit through the conductors 2, 3, 4 and 5 and operable to break the circuit through the wires 2, 3, 4 and 5 and also operable to shift into connection with the conductors 117 of a manually operable switch 118 having a movable switch arm 119 operated by a handle designated 119a shiftable successively into engagement with contacts 120, 121 and 122 for closing the circuit through the conductors 2, 3 and 4, the contact 121 which controls the amber light bus wires 3 also controlling the bell circuit 5 if the switch 115 is closed. If it were not for the fact that the bell circuit 5 is at times cut out, the yellow lamps Y and bells X could be connected in the same circuit.

When the switch 116 is thrown into connection with the manual switch 118 the automatic switch 100 is disconnected. The switch 114 which sets all the red signals and can be connected in circuit to close the circuit through the bus wire or cable 7 when the switch 116 is either connecting the automatic switch or the manual switch in the circuits 2, 3, 4 and 5. Usually the lines 2, 3, 4 and 5 are not connected directly to all of the lamps, but operate through relays 123 which are normally connected in circuit by double throw switches 124 operated by handles 125. These switches 124 may be shifted individually from the position shown in Figure 7 into engagement with terminals 126 having an extra or spare relay 127 therein. Thus if any one of the relays 123 becomes inoperative, the operator at the main tower merely throws the corresponding switch 124 to connect the extra relay 127 therein.

The main subtower M S T connections are shown in Figure 8.

Normally, the section connected with the main subtower M S T and the subtower S T are operated from the main tower M T. The sub-main subtower connections are similar to those of the main tower M T and in addition include switches by means of which the main subtower takes over the control of the entire system from the main tower and switches by which the main subtower can be cut out from the control of the main tower and operate as an individual system.

128 designates the automatic switch of the main subtower M S T similar to the switch 100 of the main tower M T and operated in a similar manner from a motor 129.

130 designates a switch similar to the switch 116 of the main tower.

131 and 132 designate switches similar to the emergency switches 112 and 114 in the main tower M T, and 133 designates the manual control for the main subtower similar to the switch 118 of the main tower M T.

134 and 135 designate relays and switches similar to the relays 123 and switches 124 of the main tower. In short, the entire connections of the main subtower are similar to those in the main tower. The main subtower M S T also in addition includes a switch 136 operated by a handle designated 137 by means of which, when the switch 130 is in neutral, that is, not in connection with the automatic switch 128 or the manual switch 133, the section controlled by the main subtower is operated from the main tower. During such operation, the switch 138, which controls the flow of current through the automatic switch 137 is open. Also when the switch 136 is closed, the entire system can be controlled from the main subtower by shifting the switch 116 of the main tower into neutral position so as to open the circuits controlled by the automatic switch 100 and the manual switch 118.

By operating the switch 136 to open position and closing the switch 130, the section of the system controlled by the main subtower will be operated independently of the rest of the system controlled by the main tower M T.

The section of the system controlled by the subtower S T has substantially the same complement of automatic and manually operable switches as the main tower. However, it has no switch corresponding to the switch 136 of the main subtower M S T and hence the subtower can not take control of the entire system but can be operated independently of the rest of the system. This subtower S T, Figure 9 is provided with a double throw switch 140 similar to the switch 116 of the main tower and operating to connect in circuit with the automatic switch 141 or the manual switch 142 and is also provided with a double throw switch 143 operable to connect in circuit with the main tower.

By throwing the double throw switch 140 to neutral position and throwing the switch 143 from the position shown in Figure 9 to the reverse position in engagement with the contacts 144, the section of the system connected to the subtower is operated either from the main tower or the main subtower. But by throwing the switch 143 into the position shown in Figure 9 and the switch 140 into either one of its operative positions in circuit with its automatic switch 141 or manual switch 142, the subtower or secton S T can be operated from the subtower either automatically or manually.

When the traffic is normal, the entire system is controlled from the main tower M T and the control can be turned over from the officer at the main tower M T to the officer in charge of the main subtower M S T. When the traffic becomes heavy, the officer in the subtower S T can disconnect his section of the system from the control of the main towers M T or M S T and operate the signals in such section from the tower S T.

What I claim is:—

1. In a traffic signaling system, the combination of a group of signals of the type operable by the making and breaking of electrical circuits, said group including two sets of signals, one set including stop and go signals presented in one direction and stop and go signals presented in the opposite direction, and the other set including stop and go signals in another direction at an angle to the first mentioned direction and stop and go signals presented in the opposite direction to the last mentioned stop and go signals normally the go signals of either set being active while the stop signals of the other set are active, means for controlling the normal operation of the signals including a normally closed switch member in the circuits controlling the signals of the group, a normally idle electromagnet, an armature for the magnet carried by and movable with the switch member, means for controlling the flow of current through the windings of the magnet and thereby the actuation of the armature and the throwing of the switch out of its normally closed position, contacts for engaging the switch member when it is thrown out of its normal position, the contacts being connected in circuit with the stop signals of both sets, the switch member having a handle by which it may be operated manually to shift the armature when the magnet is de-energized and set the stop signals of both sets and break the circuit to the go signals.

2. In a traffic signal system of the type operable by the making and breaking of electrical circuits, the combination of a plurality of groups of signals located at different street intersections, each group comprising a set including a pair of stop and go signals presented in one direction along one street and stop and go signals presented in the opposite direction and the other set including stop and go signals presented in one direction along an intersecting street and stop and go signals presented in the opposite direction along the intersecting street, electrical circuits including a timing switch for normally controlling the signals at all the intersections, a movable switch member for each group of signals normally closing the said circuit through the stop and go signals, means for setting all the stop signals of all the groups and breaking the circuit through the go signals, said means comprising a normally idle electromagnet for each group of signals, the magnet having an armature connected to said switch member to move the same and a remote switch for con-

trolling the flow of current through the windings of all the magnets thereby actuating the armature and the switch member to break the circuit through all the go signals and close the circuit through all the stop signals, each switch member having a handle by which it may be manually operated independently of the electromagnet and of the switch members at other intersections.

In testimony whereof, I have hereunto signed my name at Syracuse, in the county of Onondaga and in the State of New York, this 29th day of August, 1924.

KENNETH W. MACKALL.