

Sept. 3, 1940.

P. H. CHASE

2,213,834

SIGNAL

Filed June 5, 1937

2 Sheets-Sheet 1

FIG. 1.

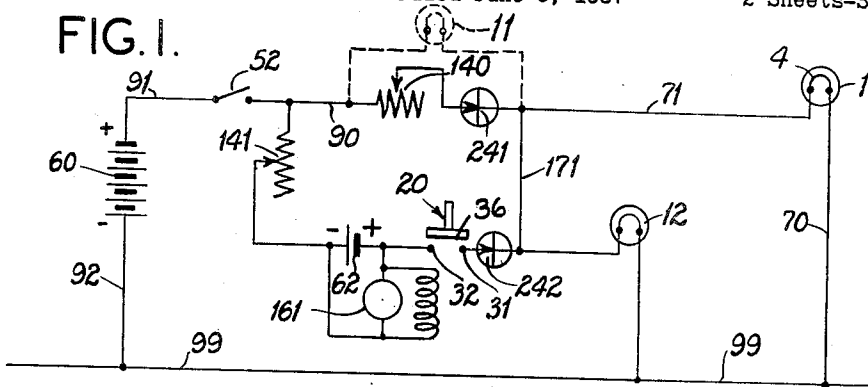


FIG. 2.

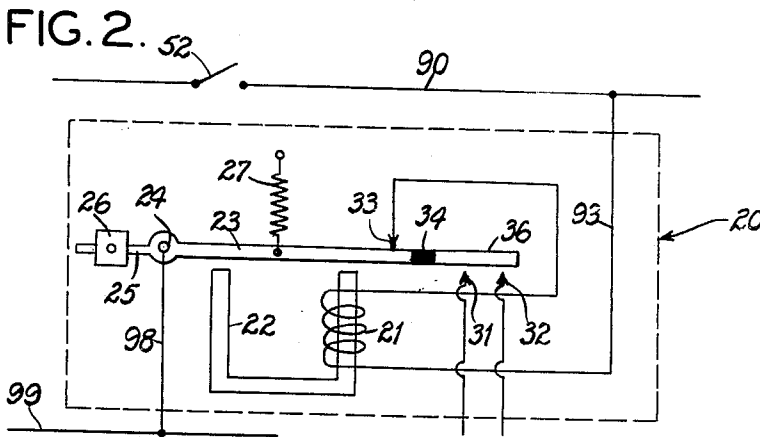
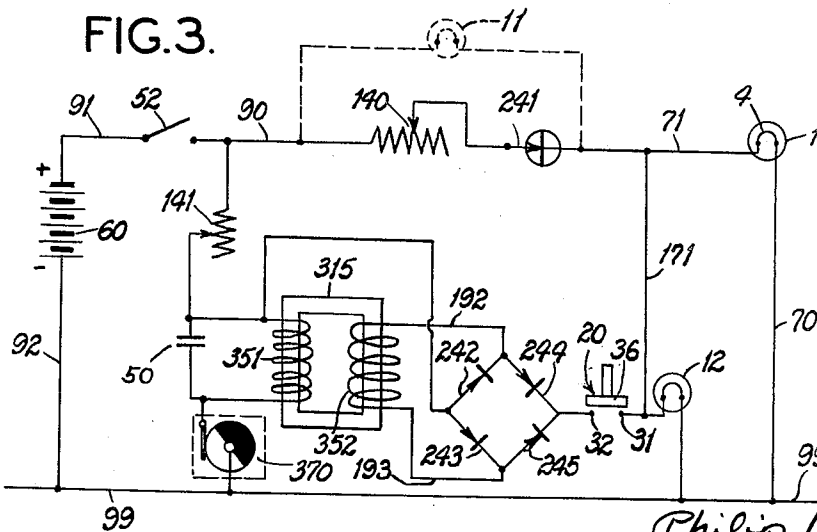


FIG. 3.



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FIG.4.

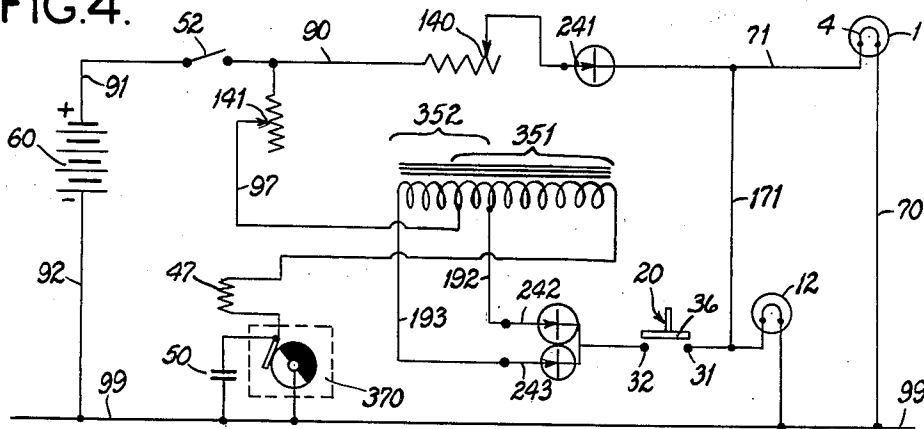
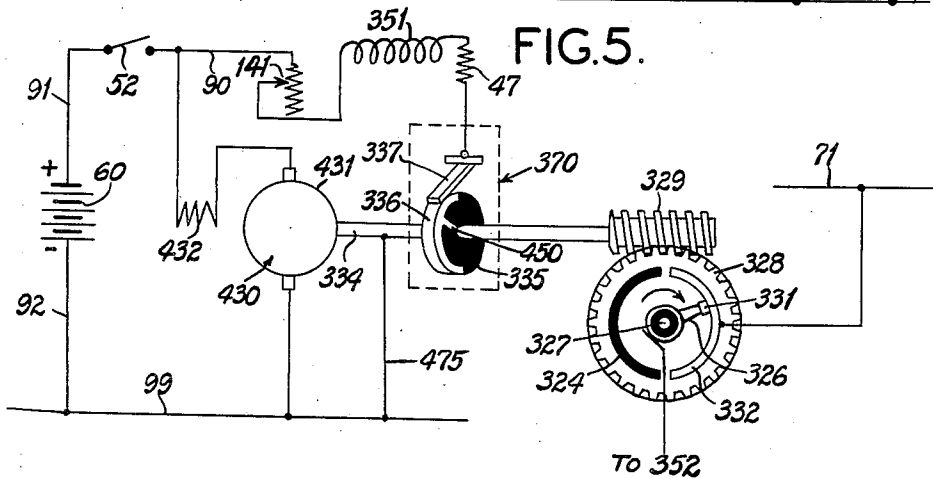


FIG.5.



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UNITED STATES PATENT OFFICE

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SIGNAL

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Application June 5, 1937, Serial No. 146,582

9 Claims. (Cl. 177—329)

This invention relates to signals and with regard to certain more specific features to a direct-current, light signal system.

This application is a continuation-in-part of my application, Serial No. 689,556, filed September 15, 1933 for Signal, eventuated into Patent No. 2,082,789, dated June 8, 1937.

Among the several objects of the invention may be noted the provision of a signal light which by recurring variations in light intensity more quickly attracts the attention of the observer; the provision of a more effective "stop" and/or direction signal light; the provision of means for recurrently varying signal light brightness without opening the signal circuit; the provision of a pilot lamp which indicates the operation and condition of the system; the provision of a variably modulated light signal; the provision of effective signal lamp operation in the event of burn-out of the pilot lamp and/or the stoppage of certain of the apparatus; and the provision of a multiple-purpose system wherein a single lamp affords illumination and a signal. Other objects will be in part obvious and in part pointed out hereinafter.

The invention accordingly comprises the elements and combinations of elements, features of construction, and arrangements of parts which will be exemplified in the structure and circuits hereinafter described, and the scope of the application of which will be indicated in the following claims.

In the accompanying drawings, in which are illustrated several of various possible embodiments of the invention:

Fig. 1 is a diagrammatic layout of one form of the invention;

Fig. 2 is a diagram showing a contactor device of the type that may be used in Fig. 1;

Fig. 3 is a diagrammatic layout of a modification of the form of circuit shown in Fig. 1;

Fig. 4 is a diagram illustrating a modification of the form of the circuit shown in Fig. 3; and,

Fig. 5 illustrates a combined contactor and interrupter device adapted to be used with the embodiments shown in Figs. 3 and 4.

Similar reference characters indicate corresponding parts throughout the several views of the drawings.

Fig. 1 herein substantially corresponds to Fig. 19 of my said application, Serial No. 689,556 (Patent 2,082,789) and in fact is almost identical with said Fig. 19 of said application, with exception of formalities.

It is known practice to mount on the rear of a motor vehicle an electric "stop" signal which is lighted upon the application of the brakes, by the closing of a switch actuated from the foot brake mechanism. It thus gives a signal often anticipatory of the slowing and complete stopping of the vehicle. Such a "stop" light signal is usually contained in or adjacent to the electric rear light housing, often is the same color as the tail light, and sometimes consists of one of the filaments in a two-filament lamp, the other filament being used for the tail light.

Consequently, the efficacy of the usual "stop" light signal is greatly reduced, particularly at night, because once it is lighted it is usually unchanging and may be similar in appearance to the tail light. It does not continue to give an unmistakably distinctive signal warning that a vehicle is slowing, stopping, or has stopped.

The practice of signalling "left" and "right" turns by hand is little observed and when done, often escapes notice, or is not understood. Such hand signals are usually inconvenient to the driver of a closed vehicle, particularly during inclement weather. Electric direction signals of the usual types are subject to similar difficulties as the "stop" light.

The provision of means for causing the flickering or blinking of "stop" and direction light signals may afford a warning signal different from the tail light, but these results have often been secured at the expense of added complications and liability of complete impairment of operation of the signal devices, and, among certain other disadvantages, omit means indicating to the vehicle driver the operation and condition of the signal system.

The present invention secures the advantages of a controlled modulated signal by relatively simple apparatus, and provides for the inclusion of a pilot lamp when desired, under the eyes of the driver, or of another occupant of the vehicle, which indicates the operation and condition of the signal system.

It is to be understood that the method and apparatus of the present invention is useful in other applications than to vehicles; for example, on crossing gates, traffic signals, switchboard signals and the like, wherein similar requirements may exist. The vehicle application is used merely by way of example.

Modification of Fig. 1

Referring now more particularly to Figure 1, there is illustrated at numeral 1 an electric sig-

nal lamp with filament 4, connected by wire 71, in series with one-way electric valve 241, and resistor 140, wire 90, switch 52 and wire 91 to a battery 60. The signal lamp circuit is completed by wires 92, 99 and 70.

For example, as applied to a motor vehicle, the signal lamp 1 may be a six to eight volt tungsten filament automobile type lamp of three to thirty-two rated candle power; the switch 52 may be actuated, for example, by the foot-brake mechanism to close the switch when the brake pedal is depressed in case the signal lamp is for a "stop" warning, or the switch may be actuated manually in case the signal lamp is for a direction signal; the battery may be the usual lead storage battery, and the wire 99 may be replaced by the metal frame of the vehicle.

The one-way electric valve 241, such, for example, as a copper oxide-copper rectifier, is connected so that the signal lamp current from the battery 60 will pass through it but substantially no current can pass in the oppositedirection. The resistor 140 may be omitted in case the resistance of the valve alone is sufficient and in case no variable modulation effect afforded by the resistor is desired. Alternatively, under some conditions the valve 241 may be omitted.

An auxiliary battery 62 is in series with the contacts 31, 32 of the contactor 20 and in parallel with (shunting) valve 241 and resistor 140, and is connected so that its voltage aids or adds to that of the main battery 60.

The contactor device 20 (see also Figure 2) recurrently closes and opens the contacts 31 and 32, at a frequency within a suitable range, so long as switch 52 remains closed.

As generally applied to the usual types and sizes of automobile electric lamps, the frequency of closing the contacts should preferably fall between two and ten per second, because of the relation of persistence of vision and lag in filament incandescence and cooling to desirable variability or modulation of light from the signal lamp, but the frequency for a given signal device need not remain constant and, in some embodiments, it may be desirable for it to vary, for example, with the speed of the vehicle.

When switch 52 is closed, and contacts 31, 32 are open, the signal lamp current passes through valve 241 and resistor 140, and the voltage on the signal lamp is the voltage of main battery 60 less the drop through valve 241, resistor 140 and the connection therewith. The total resistance of the valve and/or resistor may be of such value that signal lamp brightness is only little, or substantially less (but still distinctly visible), than if the valve and resistor were omitted. After a fraction of a second, contacts 31, 32 close and connect battery 62 in series with and aiding the main battery 60, thus increasing the voltage on the signal lamp circuit to the sum of the two battery voltages and increasing the signal lamp brightness above that corresponding to supply from only the main battery 60. If the valve 241 is omitted, the current through battery 62 is the algebraic sum of the signal lamp current and of the current through the resistor 140, but if, as is preferable, the valve is included, the current through the battery 62 is only that of the signal lamp under the total voltage.

While contacts 31—32 are closed, with valve 241 included, there is no current flow through resistor 140. Though the inclusion of aiding battery 62 in the signal circuit tends to reverse the direction of current through the resistor 140, the

valve 241 prevents such flow. The purpose of valve 241 is to prevent the added load on battery 62 of a reverse current through resistor 140. With valve 241 omitted reverse flow of current takes place and the current through battery 62 is the sum of the signal lamp current and the current through resistor 140. It is clear that such reverse current flow exists only while contacts 31—32 are closed, usually only during the short periods the signalling equipment is in operation. Further, the amount of the reverse current flow through resistor 140 is determined by the sum of its resistance and the resistances of resistor 141 and valve 242. However, if valve 241 is omitted, the value of resistor 140 will be made such as to limit the current therethrough to values suited to the battery 62, and avoid attaining a short-circuit value.

For example, it has been found on a signal lamp circuit, such as is usually employed on an automobile that, with a 6 volt main battery 60, a 21 candle power 6-8 volt tungsten lamp, an auxiliary battery voltage of 2 volts and a valve and resistor of 1.2 ohms total resistance or less, there is a modulation which affords a distinctive signal. Thus while the contacts 31—32 are open the signal lamp current passes through resistor 140 and would be about 1.75 amperes, corresponding to 3.9 volts on lamp 4, that is, 6 volts less the IR drop through resistor 140, the resistance of valve 241 being negligible. With contacts 31—32 closed, valve 241 omitted, and the resistor 140 of a value of 1.2 ohms, the total current through the auxiliary battery 62 would be approximately 4.42 amperes. This is the sum of about 2.75 amperes lamp current and 1.67 amperes

$$\left(\frac{E}{R} = \frac{2}{1.2}\right)$$

reverse current through resistor 140, with both resistor 141 and valve 241 omitted, or, if resistance 141 is included its resistance assumed to be negligible. The value 2.75 amperes corresponds to 8 volts on the lamp 4, which is 6 volts from the battery 60 plus 2 volts from battery 62. The value of 4.42 amperes is not a short-circuit value for battery 62 which together with battery 60 delivers 2.75 amperes for the signal lamp. This 2.75 amperes is the value of current with valve 241 included and also if valve 241 is omitted.

In the shunting or parallel circuit is also included resistor 141 and valve 242, although these may be omitted. Under some conditions a resistor such as 141 may be useful in regulating the modulation produced by the auxiliary battery or generator. The valve 242 may be useful under some conditions; for example, to prevent current reversal through the auxiliary source, or to provide modulation only in a direction aiding the main battery in case the auxiliary source is alternating current.

A direct-current generator 161 is illustrated in parallel with the auxiliary battery, but may be replaced by any other suitable means for charging the battery 62, if it is a storage battery. On the other hand, if, for example, it is desired fully to modulate the signal lamp voltage only when the generator is rotating (for example, with the generator on a motor vehicle and driven from the transmission or from the engine), the storage battery 62 may be omitted and a generator used alone. Depending upon the voltage regulation characteristics of the generator, the degree of modulation of the signal lamp may be kept substantially constant over a wide

range of generator speed, or may vary with the generator speed. If the generator is of the alternating current type, the frequency of modulation may be determined by the change in speed thereof, or the frequency of modulation may be controlled independently of the generator speed, or of the frequency of an alternating current source which may take the place of the generator.

A pilot lamp 11 is included in the embodiment of Figure 1, for example, in parallel with resistor 140 and valve 241, and numeral 12 indicates a pilot lamp connected in parallel with the signal lamp.

The contactor device of Fig. 2 (for use in Fig. 1)

An example of the character of the contactor device 20 that may be used as indicated in Figure 1 is illustrated in Figure 2. A coil 21 is wound about a magnetic core 22, which is associated with an armature 23 pivoted at 24, with an extension 25 on which is mounted a counterweight 26. The armature is normally retracted from the core 22 by a spring 27. The armature 23 is adapted to make contact with contact 33 when the armature is retracted as shown and, when the armature moves toward the core 22, to break the contact with 33.

Upon closing of switch 52, in addition to the current passing through wire 90, resistor 140, valve 241, and wire 71 to the signal lamp 1, the current for the shunt coil 21 passes through wire 93, coil 21, contact 33, armature 23 and back to the battery through wires 98, 99 and 92, and magnetic flux is produced through the core and armature.

An extension 36 is relatively insulated as at 34 from and operated by the armature, so that when the armature moves toward the core it connects contacts 31 and 32.

By the attraction of the armature 23, the restraining force of spring 27 is overcome, the armature 23 moves downward, contact is broken between armature and contact 33, and contact is made by extension 36 between contacts 31 and 32.

Immediately upon the opening of the circuit through coil 21 by the aforesaid breaking of contact between armature 23 and contact 33, the magnetic flux through the core 22 and armature 23 rapidly decreases, the spring 27 retracts the armature, contact is broken between contacts 31 and 32, and then contact is re-established between armature 23 and contact 33. Thereupon the circuit connections become the same as at the instant switch 52 was closed, and as long as the switch remains closed this same cycle of operation will take place repeatedly. The function of the contactor 20 also can be performed by other suitable means.

Modification of Fig. 3

Figure 3 illustrates the signal system of Figure 1 (similar reference characters indicating corresponding parts), except that the auxiliary battery 62 and generator 161 are replaced by an alternating-current source comprising a transformer 315 with its secondary coil 352 connected in the shunt or parallel path. The primary coil 351 of the transformer is connected to the main battery 60 (when switch 52 is closed) through interrupter 370, which is actuated by means hereinafter described, at a frequency suitable for effective transformer and signal action. I have found this interruption frequency to range from about 25 to 100 per second, preferably of

the order of 50 per second. The interrupter frequency need not have a fixed relation to the frequency of the signal modulation, but is preferably at least five times as great. Upon the making and breaking of the current through the primary coil 351, alternating currents are induced in the secondary coil 352. The valve bridge, consisting of electric valves 242, 243, 244 and 245, permits the passage of both the half-cycle currents in the direction adding to the voltage of battery 60 (during the intervals when contactor 20 is closed) and thus the voltage on signal lamp 1 is increased by "full-wave rectification."

Under some conditions single wave rectification is sufficient, in which case three of the four valves are omitted, and the remaining valve, 242 for example, is connected in lead 193 and lead 192 is connected to contact 32.

Modification of Fig. 4 (a variation of Fig. 3)

The transformer may have separate primary and secondary coils as illustrated in Figure 3 or, as illustrated in Figure 4, these coils may be connected as an auto-transformer. The choice between separate or combined coils depends upon various conditions, for example, the utilization of another source for transformer supply than the battery 60 which would require insulation therefrom.

Figure 4 also illustrates two one-way electrical valves 242 and 243 connected respectively in the outside secondary coil connections 192 and 193 for the positive polarity auxiliary supply lead and the intermediate or tap connection 97 for the negative polarity auxiliary supply lead, which is also one of the primary leads. This valve and coil connection arrangement provides supply of current from the secondary coil 352 into the signal circuit (when contacts 31, 32 are closed) during both the intervals when the primary current is being made and broken, and also is commonly known as "double-wave rectification."

In case the transformer primary is supplied from an alternating-current source instead of from an interrupted direct-current source, the interrupter 370 can be omitted and the intermediate tap 97 generally will be connected at the mid-point of the secondary coil, that is, equidistant from leads 192 and 193. With interrupted direct-current supply, the tap may be sufficiently displaced from the mid-point to substantially equalize the effective direct-current voltages in each half wave, and this is preferable with the lower frequencies of interruption.

As the interrupter 370 makes and breaks the current through the relatively high inductance of the primary circuit, if its contacts are subject to rapid wear or burning under such duty, the connection of a condenser 53 across the terminals of the primary coil 351 (Fig. 3) or across the interrupter (Fig. 4) is desirable.

Figure 4 also illustrates at numeral 47 a current limiter, in series with the primary coil 351. This is useful under some conditions, for example, to limit the flow of direct-current through the primary coil, in event that the interrupter should become inoperative in the closed position, and to prevent greatly increased primary coil current determined only by the resistance thereof.

I have found suitable for the current limiter a motor vehicle type tungsten lamp of rated current capacity several times as great as the normal effective primary coil current, because of the

great increase in filament resistance, with moderate increase in current therethrough.

Contactor and interrupter of Fig. 5 (for use in Figs. 3 and 4)

Figure 5 illustrates a combined contactor and interrupter device affording certain advantages when used with the embodiments of Figures 3 and 4.

The motor 430 (illustrated conventionally with armature 431 and field 432) is energized from the battery 60 when switch 52 is closed. For motor vehicle signal purposes I have found that motors such, for example, as are commonly utilized to operate small fans, and the like, are suitable for contactor and interrupter drive, as they are small and reliable, and operate at speeds of the order of 40 to 100 revolutions per second. The motor shaft 334 is electrically connected to the wire 99 (grounded for example as at 475). On the motor shaft 334 is mounted the interrupter 370 consisting of a cylindrical insulating drum 335, a metallic segment 336 comprising part of the periphery of the drum and electrically connected to the motor shaft at 450. A brush 337 bears on the periphery of the drum. The primary coil circuit is therefore made and broken once for each revolution of the motor shaft.

Also on the motor shaft is mounted a worm 329 which engages with a worm gear 323 that drives contactor 326. The worm gear 323 is mounted on shaft 327 and also mounted thereon, but insulated therefrom, is brush arm 326 carrying contactor brush 331 energized from transformer secondary 352. Also, insulated from arm 326 and the frame of the vehicle is contact 332, connected to wire 71 and arranged to be contacted by brush 331, as the brush rotates, say in a clockwise direction. Under some conditions, the use of a shunt-wound motor may be preferable and other alternative means of driving the interrupter-contactor, such, for example, as speed-governed drive from the vehicle engine, or the like, may be used.

The brush 331 and the contact 332 are equivalent in function to the contacts 31 and 32 of the foregoing figures. The number of teeth of the worm gear determines the contactor speed and therefore the frequency of signal modulation.

Numerical 324 indicates a dead or spacer contact surface over which brush 331 passes.

It is apparent that the apparatus and methods of Figures 1 to 5 are adapted for the modulation of one or more signal lamps selectively or simultaneously, and for single or dual purposes, and that the various signal effects may readily be produced, for example, those described in my co-pending application Serial No. 44,941, filed October 14, 1935, for Signal, eventuated into Patent No. 2,125,668, dated August 2, 1938.

It is to be understood that the electric valves or rectifiers described herein may each consist of one unit or of a plurality of units connected in series, parallel or series-parallel, as may be required by the current, voltage, and other characteristics of the signal circuit.

In view of the above, it will be seen that the several objects of the invention are achieved and other advantageous results attained.

As many changes could be made in carrying out the above constructions without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings

shall be interpreted as illustrative and not in a limiting sense.

I claim:

1. A signalling system comprising a signal means, a source of electric energy, a circuit connecting said source and said signal means, a shunt in said connecting circuit, an interrupter in the shunt, a battery in said shunt, and means permitting only one-way flow of current through said connection, the shunt connections being to opposite sides of said one-way current limiting means.

2. A system including a source of direct current, a signal means, a circuit connecting said source and said signal means, a shunt in said connection, an interrupter and a rectifier in the shunt, means for supplying current to the shunt and means preventing short circuiting of the shunt through said connection.

3. A system including a source of current, load means, a main circuit connecting said source and said load means, a shunt circuit in parallel with one lead of the main circuit, means in the shunted portion of said lead preventing short circuiting of the shunt circuit through the lead, an interrupter in the shunt circuit, a bridge rectifier in the shunt circuit and supplying current to the interrupter, a transformer having a primary winding and a secondary winding, said bridge rectifier being connected to receive current both from the secondary winding of said transformer and to receive current by a connection by-passing the transformer, the primary winding of said transformer being connected across the main circuit, and current-changing means in the last-named connection.

4. A system including a source of direct current, load means, a main circuit connecting said source and said load means, a shunt circuit in parallel with one lead of said main circuit, means in the shunted portion of said lead preventing short circuiting of the shunt circuit through the lead, a first interrupter in said shunt circuit, and an auto-transformer connected therein having a primary winding and a secondary winding, the primary winding being connected across said main circuit, a second interrupting means in said primary-winding connection, the secondary winding of said auto-transformer being connected to and feeding said first interrupter, and current-rectifying means in said connection between the auto-transformer and the first interrupter.

5. A system including a source of direct current, load means, a main circuit connecting said source and said load means, a shunt circuit in parallel with one lead of said main circuit, means in the shunted portion of said lead preventing short circuiting of the shunt circuit through the lead, an interrupter in said shunt circuit, and an auto-transformer connected therewith having a primary winding and a secondary winding, means for supplying a varying current to the primary winding, and current-rectifying means in connection with said secondary winding.

6. A signal system including a source of direct current, signal means, a circuit connecting said source and said signal means, means in one lead of said circuit resisting flow of current in a direction from the signal means to the source, a shunt circuit around said resisting means, means adapted to send a shunt current through said shunt circuit from the source toward the load means and around said resistance, and an interrupter in said shunt circuit.

7. A signal system including a source of direct current, signal means, a circuit connecting said source and said signal means, means in one lead of said circuit resisting flow of current in a direction therein from the signal means toward the source, a shunt circuit around said resisting means, means adapted to send a shunt current through said shunt circuit from the source toward the load means and around said resistance, an interrupter in said shunt circuit, and means preventing flow of shunt current through the shunt circuit in a direction from the load means toward the source.

8. A signal system including a source of direct-current, signal means, a circuit connecting said source and said signal means, valve means in one lead of said circuit permitting flow of current therein but resisting reverse flow of current, a shunt circuit around said valve means,

means adapted to send a current aiding said source through said shunt circuit between the source and the signal means and around said valve means, and an interrupter in said shunt circuit.

9. A signal system including a main source of current, load means, a circuit connecting said source and said load means, a resistor in one lead of said circuit, a shunt circuit across said resistor, and an auxiliary source of current and an interrupter in said shunt circuit, said auxiliary source of current being connected in a voltage-additive relation to the main source of current as referred to the load means, whereby the voltage on the load means, when said interrupter is closed, is greater than the voltage of the main source.

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