

April 25, 1944.

C. S. RHOADS

2,347,505

PHANTOM MAGNETO TELEPHONE SYSTEM

Filed May 21, 1943

2 Sheets-Sheet 1

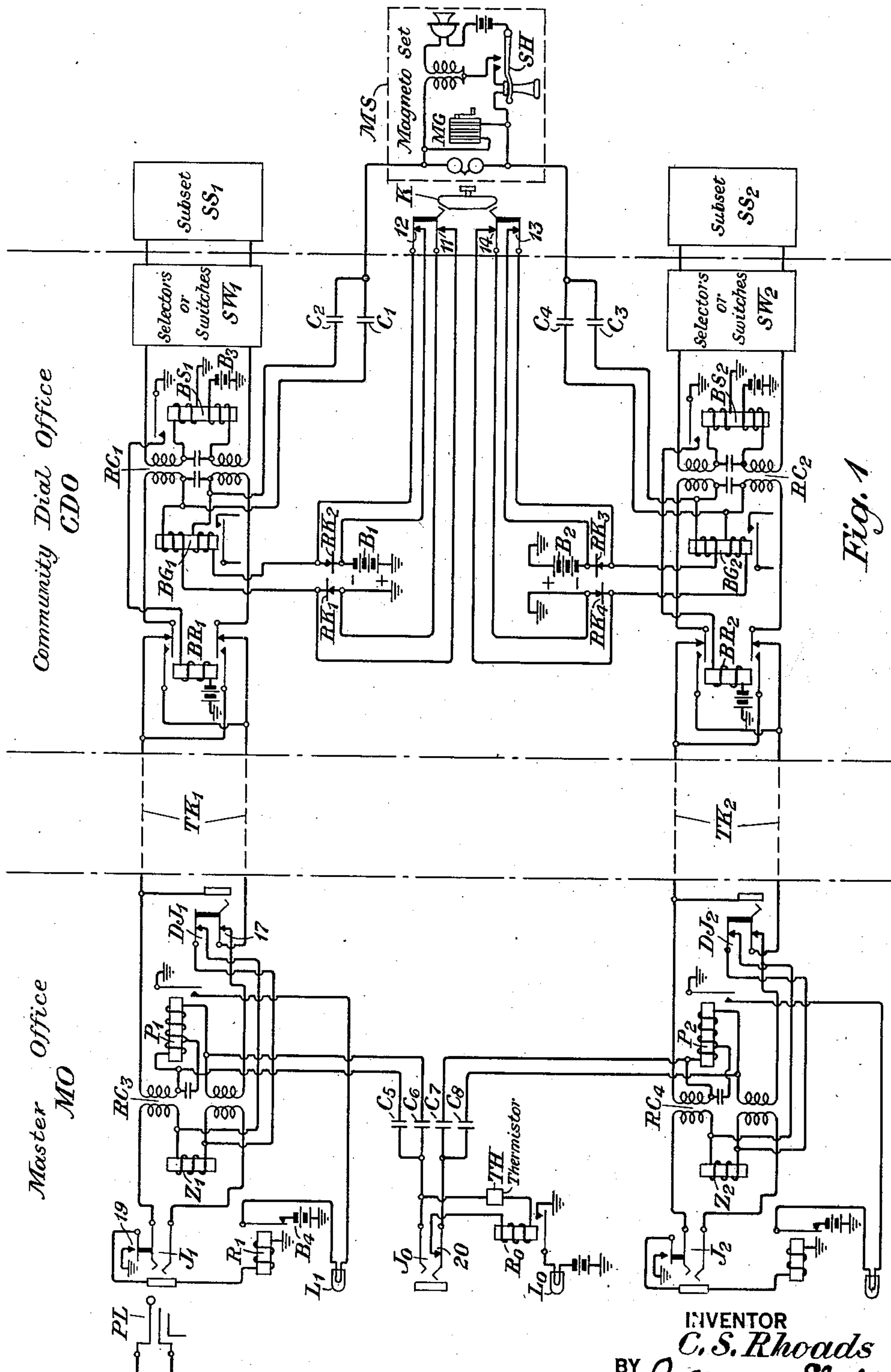


Fig. 1

INVENTOR
C. S. Rhoads
BY *Jefferson Chelich*
ATTORNEY

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2 Sheets-Sheet 2

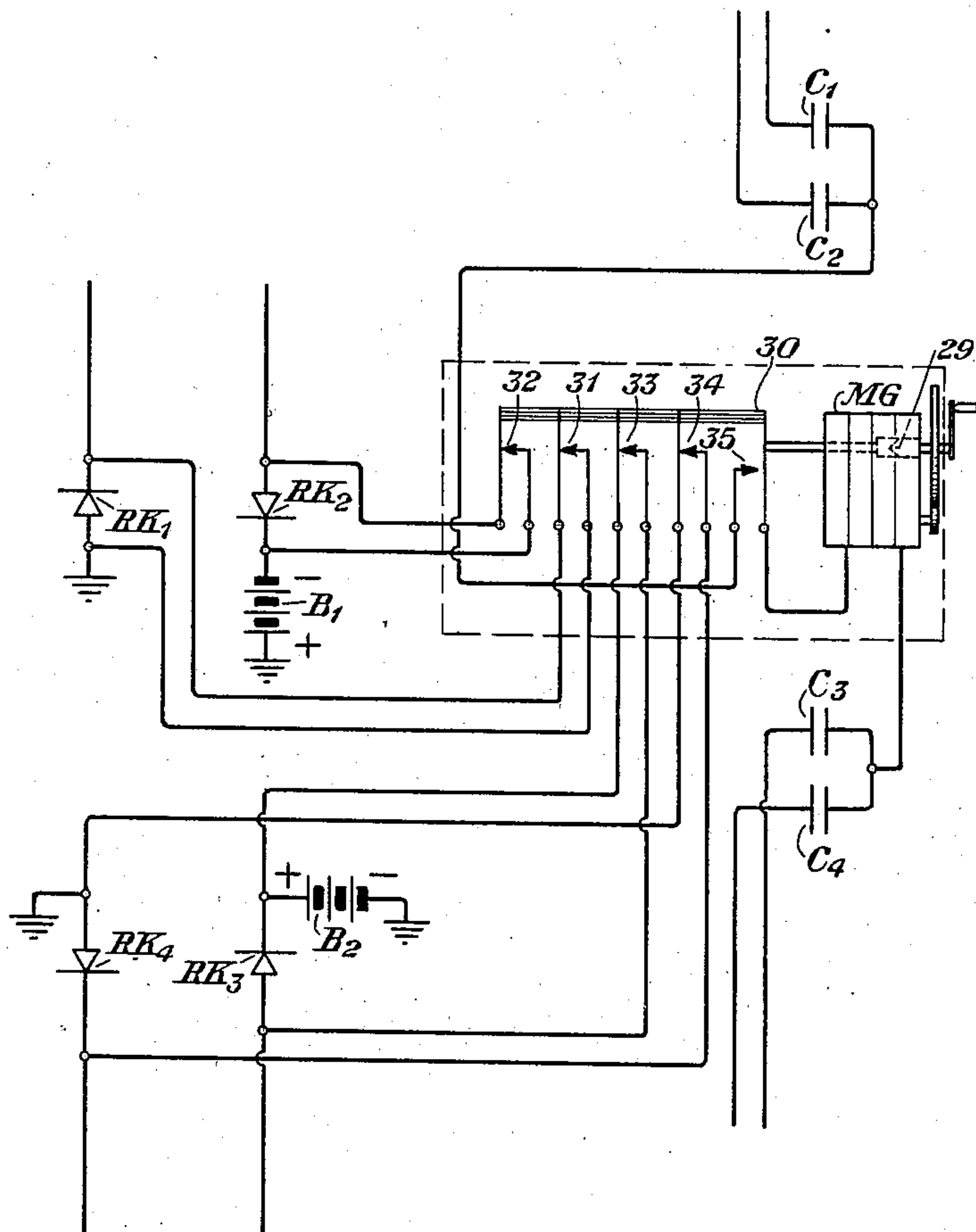


Fig. 2

INVENTOR
C. S. Rhoads
BY *Jefferson Ehrlich*
ATTORNEY

UNITED STATES PATENT OFFICE

2,347,505

PHANTOM MAGNETO TELEPHONE SYSTEM

Charles Stanley Rhoads, Albany, N. Y., assignor
to American Telephone and Telegraph Com-
pany, a corporation of New York

Application May 21, 1943, Serial No. 487,891

10 Claims. (Cl. 179—15)

This invention relates to telephone systems, and more particularly to phantom circuits for telephone systems. Still more particularly this invention relates to arrangements for providing a phantom circuit from two telephone trunk circuits, the phantom circuit being equipped with a magneto set for auxiliary signaling.

A community dial office, generally unattended, is often connected to a master or operator office, generally attended, by a number of trunk circuits to enable subscribers in the area of the community dial office to communicate with the operator or subscribers in the area of the master or operator office and, via that office, with operators or subscribers at more remote points. The apparatus at the community dial office is usually arranged so that a subscriber may automatically select one of the trunk circuits by properly operating his dial set. It may happen, however, that the selectors or switches that control the selection and seizure of one of the trunks are busy or that all of the trunks are busy, in which case the operation of the dial set to establish a connection to the operator at the master office or to any of the subscribers reached via that office will be of no avail. Such a situation may be quite serious, especially during periods of emergency.

Accordingly it is an object of this invention to provide a phantom circuit by connection of apparatus to two telephone trunk circuits to enable a subscriber to signal either an operator at the master office or a subscriber in the area of the master office when all selectors or switches or trunks are busy. The phantom circuit of this invention involves additional equipment including a magneto telephone set arranged so that the operation of the magneto generator of the set will not interfere with signaling over the trunk circuits or cause false operation of the trunk circuits.

This invention will be better understood from the more detailed description hereinafter following when read in connection with the accompanying drawings, in which Figure 1 illustrates a master office and a community dial office interconnected by trunk circuits and provided with a magneto telephone set inserted in a phantom circuit for use with the trunk circuits as side circuits, and Fig. 2 shows schematically switching contacts controlled by the magneto generator of the magneto telephone set and arranged to prevent interference with and false operation of the equipment of the trunk circuits.

Referring to Fig. 1 of the drawings, two trunk circuits TK₁ and TK₂ of a group of similar trunk

circuits are shown interconnecting a community dial office CDO, usually unattended, and a master office MO at which one or more operators may be in attendance. Each of these trunk circuits TK₁ and TK₂ may be employed for two-way signaling in a well known manner between the two offices and between subscribers connected to the two offices. A magneto telephone set MS may also be connected to the community dial office CDO and this set may be located in the area of the community dial office in the same manner that the subscribers' telephone sets SS₁ and SS₂, for example, are so located. The magneto set MS is connected to the trunk TK₁ over parallel paths which include condensers C₁ and C₂ extending to the upper and lower portions of the primary windings of the transformer or repeating coil RC₁. The magneto set MS is likewise connected to the trunk TK₂ by two parallel paths including condensers C₃ and C₄ which extend to the upper and lower portions of the primary windings of the repeating coil or transformer RC₂. The upper and lower windings of the battery and ground relay BG₁ associated with trunk TK₁ are connected to ground and battery B₁, respectively, the paths to ground and battery including contacts 11 and 12, respectively, of the switching device K. Similarly the upper and lower windings of the battery and ground relay BG₂ associated with trunk TK₂ are connected to battery B₂ and ground through the contacts 13 and 14 of the switching device K. When the switching device K is operated, the contacts 11, 12, 13 and 14 will be opened, in which case the upper and lower windings of relay BG₁ will be connected to ground and battery B₁ through the rectifying elements RK₁ and RK₂, respectively, and the upper and lower windings of relay BG₂ will be similarly connected to battery B₂ and ground through the rectifying elements RK₃ and RK₄, respectively. The switching device K may be hand-operated or it may, if desired, be controlled by the operation of the magneto generator MG of the magneto set MS, as will be described more particularly with respect to Fig. 2. However, whenever the device K is operated it controls the addition of the rectifiers RK₁ to RK₄ to the relays BG₁ and BG₂ of the two trunk circuits TK₁ and TK₂. As will be explained hereinafter, these rectifiers rectify the current of the magneto generator MG, enabling the rectified current to flow through the windings of the relays BG₁ and BG₂ unidirectionally and thereby prevent the release or "chatter" of these relays. The rectifiers therefore prevent false op-

eration of the switching apparatus controlled by these relays.

At the master office MO the upper and lower primary windings of the repeating coil or transformer RC₃ are connected by the parallel condensers C₅ and C₆ to one side of a jack J₀ which may terminate the phantom circuit and the upper and lower primary windings of the repeating coil of transformer RC₄ are similarly connected by condensers C₇ and C₈, respectively, to the other side of the jack J₀. These condensers are inserted in the circuit so that the alternating current produced by the magneto generator MG of the magneto set MS may alone cause the ring-down relay R₀ to be operated. The relay R₀ will be employed to light a lamp L₀ to signal the operator at the master office for auxiliary or emergency purposes. The operation of the phantom circuit of this invention will be described somewhat more fully hereinafter.

The trunk circuits TK₁ and TK₂ and the apparatus associated with these trunk circuits are of the usual type and they will be described only briefly. Whenever the subscriber having the telephone set SS₁ connected to the community dial office CDO desires to communicate with the operator at the master office MO, he will operate his dial set in the usual way. This will cause the selector or switching apparatus SW₁ to find an idle trunk such as TK₁ and seize the trunk to complete a path to the master office. When the trunk TK₁ is seized, current will flow from the battery B₃ through the lower winding of relay BS₁, the lower secondary winding of repeating coil RC₁, through the apparatus SW₁ to the telephone set SS₁, and back over the upper conductor extending to the telephone set SS₁, through the apparatus SW₁ and then through the upper secondary winding of the repeating coil RC₁, the upper winding of relay BS₁ and ground. As relay BS₁ operates it establishes an obvious circuit for the operation of the relay BR₁. When relay BR₁ operates, its two armatures reverse the connections to the conductors of trunk TK₁, whereupon current will flow from battery B₁ over a circuit including contacts 12 of the switching device K, the lower winding of relay BG₁, the lower primary winding of the repeating coil RC₁, the lower armature and make contact of relay BR₁, the upper conductor of trunk TK₁, the upper primary winding of repeating coil RC₃, the windings of relay P₁, the lower primary winding of repeating coil RC₃, the contacts 17 of the dial jack DJ₁, the lower conductor of trunk TK₁, the upper armature and make contact of relay BR₁, the upper primary winding of repeating coil RC₁, the upper winding of relay BG₁, contacts 11 of the switching device K and ground. The flow of this current through the windings of the polarized relay P₁ is now in such a direction as to cause the relay P₁ to become operated. As relay P₁ becomes operated it completes a circuit to illuminate lamp L₁, the circuit including the armature and make contact of relay P₁, the lamp L₁, the armature and back contact of relay R₁, battery B₄ and ground. The illumination of the lamp L₁ will attract the operator's attention and she will therefore insert her plug PL into the jack J₁ which is associated with the lamp L₁ and trunk TK₁ to answer the call.

Upon the insertion of plug PL into jack J₁ a circuit will be established to operate relay R₁, this circuit including the upper contact 19 of

jack J₁, the winding of relay R₁ and ground. When relay R₁ operates it opens the circuit of lamp L₁, thereby extinguishing the lamp L₁. The operator's set will then be connected to the telephone set SS₁, over trunk TK₁ to allow the operator and the subscriber to speak to each other. A subscriber's set such as SS₂ may likewise be connected to the operator at the master office through the equipment at the community dial office CDO and over trunk TK₂ in the manner already described in respect to telephone subscriber's set SS₁.

The dial jacks DJ₁ and DJ₂ are shown connected to the trunks TK₁ and TK₂, respectively. The operator may connect her dial set to either of these jacks for connecting the trunk TK₁, for example, to any one of the various subscribers' sets such as SS₁, SS₂, etc. When the dial set is connected to the jack DJ₁, the dial pulses will be transmitted over the trunk TK₁ to operate the relay BG₁ in accordance with the pulses produced by the dial, whereupon the armature of the relay BG₁ will close its contact a number of times to control switching apparatus for selecting any desired one of the various telephone circuits such as SS₁, SS₂, etc. The switching apparatus has not been shown in detail as it is not required for an understanding of the invention.

The magneto set MS may be located on the same premises as either the sub-set SS₁ or the sub-set SS₂ or at a different location. Whenever the subscriber's set SS₁, for example, receives a busy signal after dialing the operator or any of the subscribers in the areas of the two offices, the magneto generator MG may then be operated by hand for establishing a phantom circuit to the operator at the master office to attract her attention. Such a busy condition is not infrequent for it may arise whenever the selectors or switches such as SW₁ and SW₂ are busy or when the trunks TK₁ and TK₂ are busy. The hand generator MG will transmit an alternating current over the phantom circuit provided by the trunk circuits TK₁ and TK₂ to operate the relay R₀ at the master office, as already stated. The interconnected circuit will include one path over the parallel condensers C₁ and C₂ and through the upper and lower primary windings of the repeating coil RC₁, the two conductors of the trunk TK₁, the two primary windings of repeating coil RC₃, the parallel condensers C₅ and C₆ associated with the trunk TK₁, the thermistor TH, the winding of relay R₀, the contact 20 of jack J₀, and then back over parallel circuits including condensers C₇ and C₈ associated with trunk TK₂, the upper and lower primary windings of repeating coil RC₄, the two conductors of trunk TK₂, the two primary windings of the repeating coil RC₂, the parallel condensers C₃ and C₄ to the generator MG. This alternating current will cause relay R₀ to operate as already stated and complete an obvious circuit to illuminate lamp L₀. The operator's attention will be attracted by lamp L₀ and upon the insertion of her plug PL into jack J₀ to answer the call, the lamp L₀ will be extinguished.

When plug PL is inserted into jack J₀ the operator's telephone set will be connected to the magneto set MS to enable the operator and the subscriber controlling the magneto generator MG to talk with each other. The talking path at the master office will include the condensers C₅ and C₆ which are connected to trunk TK₁, and the condensers C₇ and C₈ which are con-

connected to the trunk TK₂. The talking path at the community dial office CDO will include the condensers C₁ and C₂, which are connected to trunk TK₁, and condensers C₃ and C₄ which are connected to trunk TK₂. The telephone transmitter and receiver of the magneto set MS will be connected to this phantom circuit when the telephone receiver is removed from its switch-hook SH.

It is noted that the upper terminal of the magneto generator MG is connected through parallel paths including condensers C₁ and C₂ and the upper and lower windings of relay BG₁ to ground and battery B₁, respectively, and that the lower terminal of magneto generator MG is connected to the upper and lower windings of relay BG₂ and battery B₂ and ground, respectively. The alternating current of magneto generator MG may therefore traverse the windings of both relays BG₁ and BG₂ and cause their false operation. These relays will alternately open and close their respective make contacts in response to the generated current. As the make contacts of these relays are closed, the existing connections (not shown) established through the armatures of these relays to trunks TK₁ and TK₂ will be opened and hence the trunks TK₁ and TK₂ may be released. Hence existing communication over trunks TK₁ and TK₂ will be terminated. In other words, the operation of the magneto generator MG may cause the relays BR₁ and BR₂ to "chatter" and thereby interfere with talking or signaling over the two trunks TK₁ and TK₂. Such a condition is undesirable. This undesirable condition, however, may be overcome by simply operating switching device K.

When the switching device K is operated, it will insert rectifying elements into the circuits of the windings of relays BG₁ and BG₂. With the device K operated, contacts 11 and 12 will be opened and rectifiers RK₁ and RK₂ will be connected between the upper and lower windings of relay BG₁ and ground and battery B₁, respectively. Similarly contacts 13 and 14 will be opened, interposing rectifiers RK₃ and RK₄ in the circuits between the upper and lower windings of relay BG₂ and battery B₂ and ground, respectively. Thus, by so operating device K, current will now flow unidirectionally through the upper windings of relays BG₁ and BG₂ over a circuit which includes rectifier RK₁, the upper winding of relay BG₁, condenser C₁, the generator MG, condenser C₃, the upper winding of relay BG₂, rectifier RK₃, battery B₂ and ground. Current will also flow unidirectionally through the lower winding of relays BG₁ and BG₂ over a circuit which includes battery B₁, rectifier RK₂, the lower winding of relay BG₁, condenser C₂, generator MG, condenser C₄, the lower winding of relay BG₂, rectifier RK₄ and ground. The unidirectional currents now traversing both windings of relays BG₁ and BG₂ will be superimposed upon the direct currents previously supplied to these windings by batteries B₁ and B₂. Thus an increased current will traverse the windings of relays BG₁ and BG₂ and these relays will be held operated while the hand generator MG is operated. These relays remaining operated they will hold the trunks TK₁ and TK₂ connected to the subscribers' sets such as SS₁ and SS₂ and not interfere with communication over the two trunk circuits.

The condensers C₁ and C₂ provide a low impedance path between generator MG and trunk

TK₁ for the alternating current generated and condensers C₃ and C₄ provide a low impedance path between trunk TK₁ and relay R₀ so that only the generated current may actuate relay R₀. The return path for the generated current includes condensers C₇ and C₈, trunk TK₂ and condensers C₃ and C₄. The rectifying elements RK₁ to RK₄ prevent the flow of alternating current through the windings of the relay apparatus common to trunk TK₁ or trunk TK₂ except in rectified form. Thus alternating current will be transmitted over the trunks acting as transmission paths extending between the two offices, but the trunk control apparatus will receive only direct current.

The rectifiers RK₁ to RK₄ interposed in the circuits between the hand generator MG and the windings of relays BG₁ and BG₂ provide in effect a full wave rectifying circuit. Both halves of each cycle of alternating current produced by the generator MG will be rectified and the rectified current will be added to the battery currents previously flowing through these relay windings. Thus the rectified currents and the battery currents will be caused to aid each other, increase the holding action of relays BG₁ and BG₂ and prevent their "chattering." This is an important feature of this invention.

Fig. 2 shows schematically an arrangement for inserting the rectifiers RK₁ to RK₄ of Fig. 1 into their respective circuits upon the operation of the hand generator MG. The crank of the hand generator MG when rotated controls a cam 29, which in turn may move the insulating bar 30 to the left so as to open all of the contacts 31, 32, 33 and 34 simultaneously. Contacts 31 and 32 bridge the rectifiers RK₁ and RK₂, respectively, and contacts 33 and 34 bridge rectifiers RK₃ and RK₄, respectively. When the arm 30 is caused to move to the left in response to the rotation of the crank of the generator MG, the contacts 31 to 34 will be opened, thereby inserting the rectifiers RK₁ to RK₄ in their respective paths, as already described hereinabove with respect to Fig. 1. At the same time contact 35 will be closed to establish a path between the hand generator MG and the condensers C₁ and C₂. The contact 35, therefore, interposes the hand generator MG in series between the parallel condensers C₁ and C₂ and the parallel condensers C₃ and C₄. These condensers are connected to the trunk circuits as shown in Fig. 1. The switching arrangement of Fig. 2 is automatic in operation and opens the bridge circuit to the rectifiers just as soon as the crank of generator MG is properly rotated. Although the arrangement of Fig. 2 illustrates how the magneto generator MG may simultaneously close a plurality of contacts such as 31 to 35, it will be understood that the cam device 29 may close but one contact which in turn may control the operation of a relay (not shown), the relay controlling the contacts 31 to 35 which shunt the rectifiers RK₁ to RK₄. The relay obviously may be located either at the station of the magneto telephone set MS or at the community dial office CDO. The contacts 12—14 associated with the relay may be adjacent to the relay or remote therefrom, as desired.

Although it has been stated that the magneto set may be operated whenever a busy condition develops on the trunk circuits between the two offices, the magneto set may also be used even when the trunk apparatus is idle. The magneto phantom circuit provides an additional path be-

tween the two offices for special use both for signaling and talking during emergencies. The cost of the equipment required to set up the phantom circuit is quite small. The additional equipment is simple and may be appended to the trunk apparatus whenever desired. The magneto phantom circuit will be operable whether or not the trunk circuits are transposed with respect to each other.

Although this invention has been disclosed in certain specific arrangements which are deemed desirable, it will be obvious that the general principles herein set forth may be embodied in many other organizations, widely different from those illustrated, without departing from the spirit of the invention as defined in the appended claims.

What is claimed is:

1. In a telephone system, the combination of a manual office and a community dial office connected to each other by a pair of trunks, two relays each connected to one of said trunks for controlling the connection of the trunk to subscribers' circuits, a magneto telephone set including a magneto generator connected to said trunks as a phantom circuit, and means for preventing the magneto generator from falsely operating the said relays.

2. In a telephone system, the combination of two trunks, two repeating coils one terminating each trunk, two relays each connected to the midpoint of one of the repeating coils, a magneto telephone set including a magneto generator connected between the midpoints of said repeating coils so that said trunks may provide a phantom circuit for said magneto set, a plurality of rectifying elements, and means responsive to the operation of the magneto generator for inserting said rectifying elements in series with the windings of said relays so that only unidirectional current may flow through the windings of said relays.

3. In a telephone system, the combination of a telephone line, a relay connected to said line, a magneto generator, means for connecting said magneto generator to said line to energize the winding of said relay, a rectifying element, and means responsive to the operation of said magneto generator to connect said rectifying element in series with the winding of said relay so that only unidirectional current may flow through said relay windings.

4. In a telephone system, the combination of a relay having two windings, two rectifying elements, a telephone line connected to the windings of said relays, a magneto generator, and means responsive to the operation of said generator for connecting said rectifying elements to the windings of said relay so that only unidirectional current may flow therethrough.

5. In a telephone system, the combination of two trunks, two repeating coils each terminating one of said trunks, two relays one associated with each trunk and connected to the midpoint of the repeating coil of the associated trunk, a magneto telephone set including a magneto generator connected between the midpoints of the repeating coils of both trunks so that said trunks may form the side circuits of a phantom circuit, a plurality of rectifying elements, and means responsive to the operation of said mag-

neto generator for inserting said rectifying elements in circuit with said relay windings so that only unidirectional currents may traverse the windings of said relays.

6. In a telephone system, the combination of two trunks, two repeating coils each terminating one of said trunks, switching apparatus for said trunks, said switching apparatus including a relay for each trunk connected to the midpoint of the repeating coil associated with said trunk, a magneto telephone set including a magneto generator connected between the midpoints of the repeating coils associated with both trunks so that said trunks may provide a phantom circuit for said magneto set, means responsive to the operation of the generator of said magneto set for transmitting only rectified current through the windings of said relays, and apparatus controlled by the current produced by said magneto generator.

7. In a telephone system, the combination of a pair of trunks interconnecting two offices, a magneto telephone set including a magneto generator connected between both trunks at one of the offices so as to provide a phantom circuit, signal responsive means connected between both trunks at the other of the offices to complete the phantom circuit, switching apparatus connected to each trunk, and means to prevent the operation of said switching apparatus by said magneto set.

8. In a telephone system, the combination of a pair of trunks interconnecting two offices, a telephone set including a ringing generator connected between both trunks at one of the offices, signaling apparatus connected between both trunks at the other of the offices, said telephone set and said signaling apparatus providing with said trunks a phantom circuit, switching apparatus connected to each trunk, and means to prevent the ringing generator of the telephone set from falsely operating said switching apparatus.

9. In a telephone system, the combination of a pair of trunks interconnecting two offices, a telephone set including a ringing generator connected between both trunks at one of the offices, signaling apparatus connected between both trunks at the other of the offices, said telephone set and said signaling apparatus providing with said trunks a phantom circuit, switching apparatus connected to each trunk, and means responsive to the operation of the ringing generator of said telephone set to prevent the release of the switching apparatus by the current of said ringing generator when said switching apparatus is operated.

10. In a telephone system, the combination of two telephone offices connected to each other by a pair of trunks, a plurality of subscribers' circuits, two relays each connected to one of said trunks for controlling the connection of the associated trunk to one of the subscriber circuits, a magneto telephone set including a magneto generator which may be connected to said trunks as a phantom circuit when said trunks are busy, and means to prevent said magneto generator from falsely operating said relays.

CHARLES STANLEY RHOADS.