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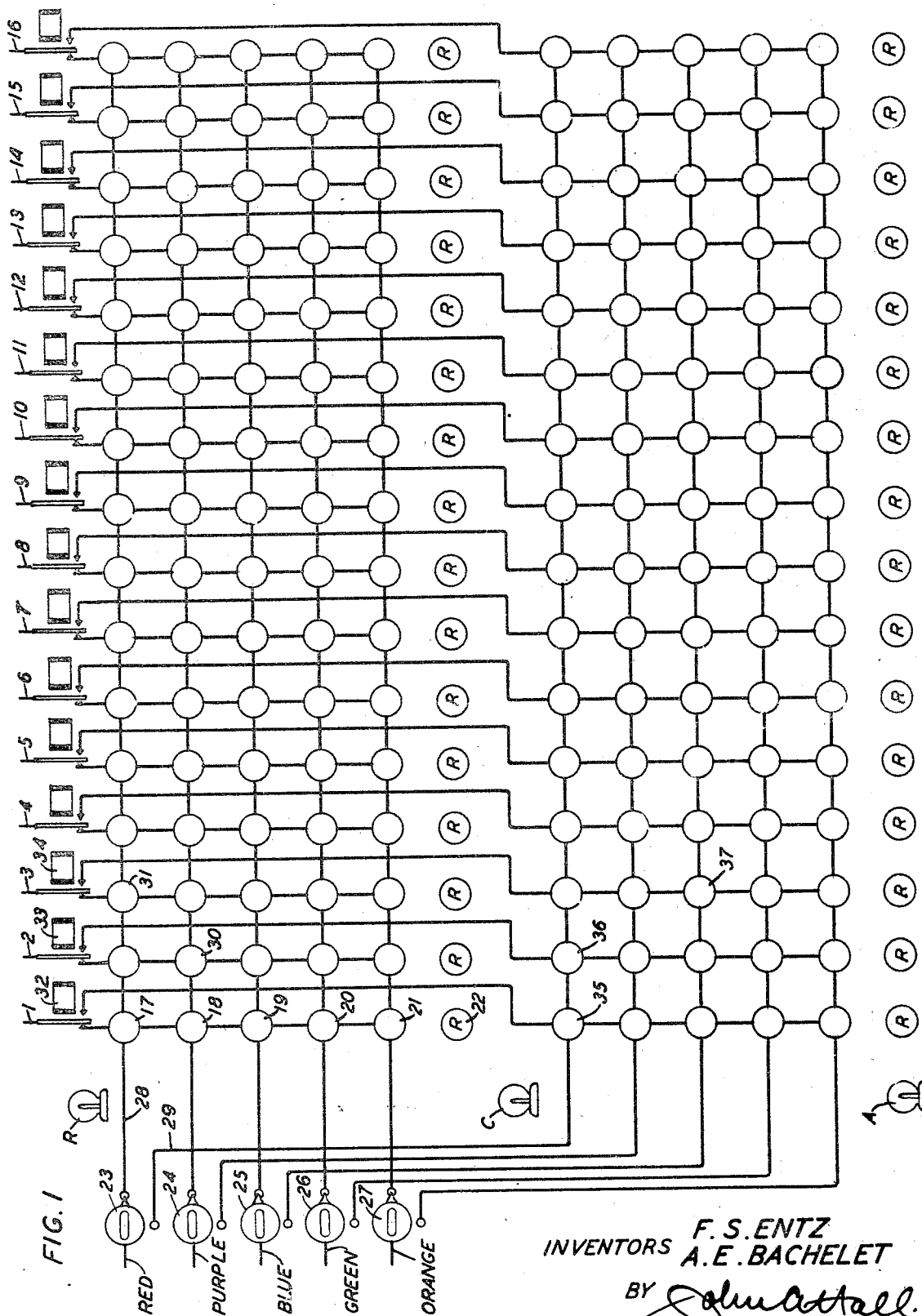
F. S. ENTZ ET AL

1,871,310

COMMUNICATION SYSTEM

Filed Aug. 22, 1930

3 Sheets-Sheet 1



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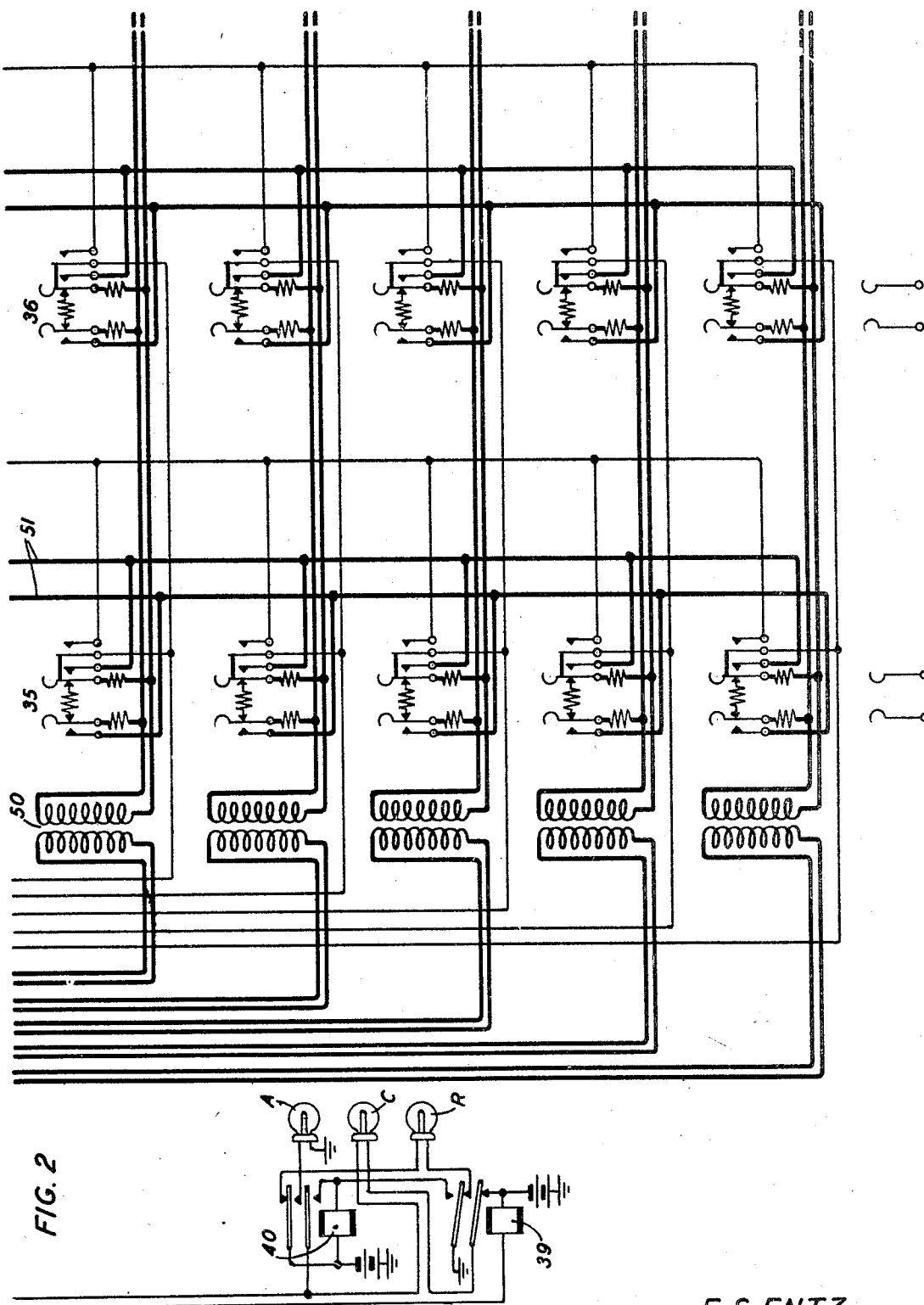
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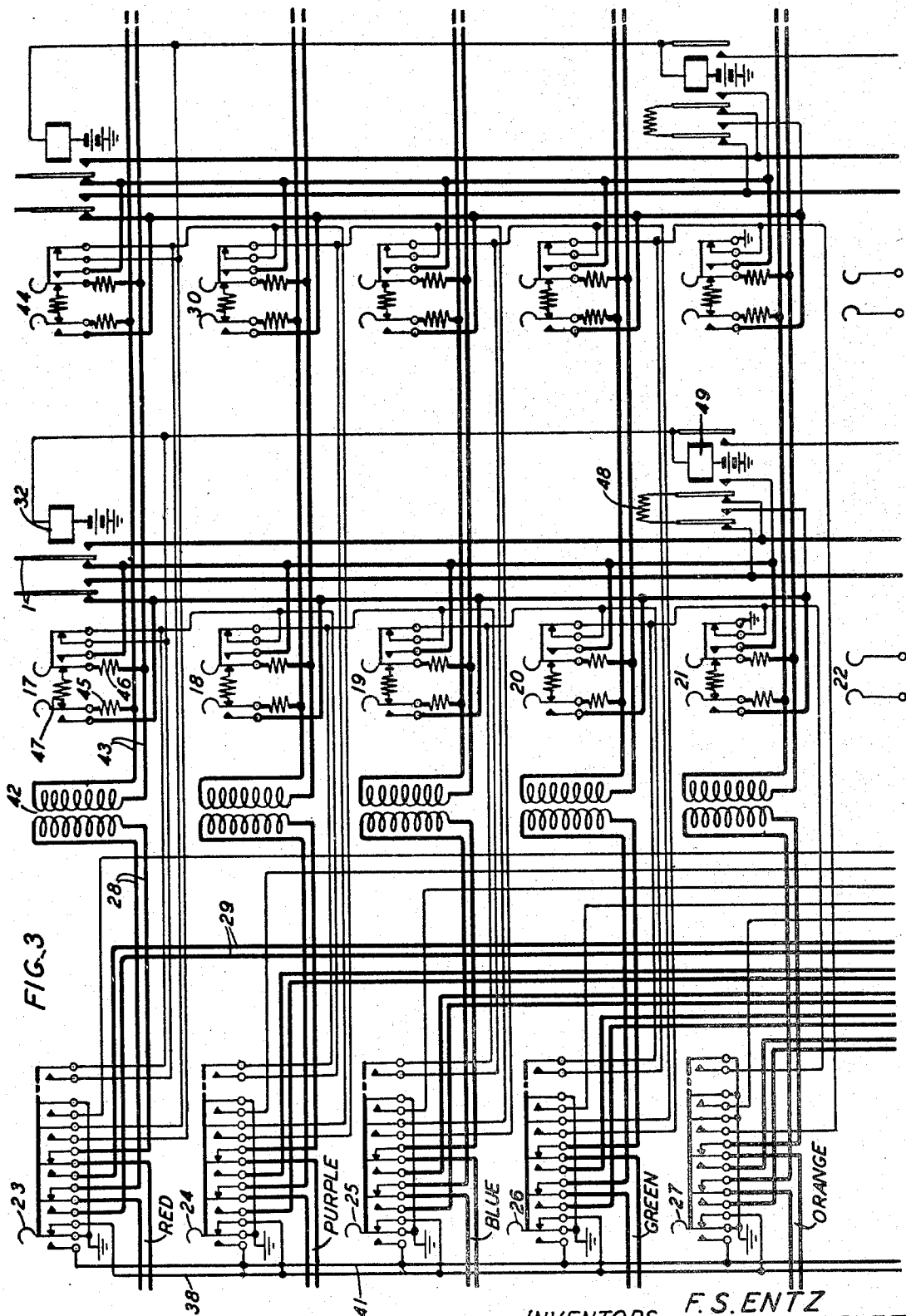
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UNITED STATES PATENT OFFICE

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COMMUNICATION SYSTEM

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This invention relates to communication systems and particularly to switching arrangements for interconnecting incoming and outgoing communication channels.

5 In modern practice most radio broadcast-
ing stations transmit programs which origi-
nate at points other than their own studios.
There are a number of wire systems known,
for example, as the red network, the purple
10 network, the blue network, the green net-
work and so forth into which programs origi-
nating at different points at different times
are transmitted. A description of these wire
line systems is contained in the Bell System
15 Technical Journal for January 1930, page
141 et. seq. Any one particular broadcast-
ing station may connect at different times one
or another of these networks to its transmit-
ter so that switching arrangements must be
20 provided for making the desired changes.
Since time is essential both from the stand-
point of continuity of broadcasting and from
the standpoint of the advertiser the change
from one network to another must be made
25 as nearly instantaneously as possible.

Heretofore these changes have been made
manually through the medium of a plug and
jack arrangement, but while this system has
in the past proved satisfactory the burden on
30 the operators is fast becoming intolerable. To
continue the present system of switching
means inevitably that the period allowed for
switching will have to be lengthened where-
as all efforts are being directed to produce
35 the opposite effect.

It is the object of the present invention
to provide means for quickly and accurately
rearranging the interconnections of program
supply circuits and program broadcasting cir-
40 cuits. For this purpose a number of net-
works which are here called incoming com-
munication channels are brought to a central
point together with a number of circuits lead-
ing directly to a number of broadcasting
45 transmitter stations such circuits being here
called outgoing communication channels.
Duplicate banks of keys are provided, one
key in each bank for each crossing point of
an incoming and an outgoing communication
50 channel. During a given period one of these

banks is effective and the incoming channels
are connected to the outgoing channels in ac-
cordance with the keys which are operated.
During this period the arrangement of chan-
55 nels which will be used during the next pe-
riod may be set up on the other bank of keys.
At the end of the first period a master in-
coming channel switch for each incoming
channel is operated whereupon the preselect-
ed arrangement of the second bank of keys be-
60 comes immediately effective.

Accordingly one feature of the present in-
vention is a duplicate set of keys for inter-
connecting incoming and outgoing communi-
cation channels one of which is effective and
65 the other of which is ineffective at any given
time, whereby the keys of the ineffective set
may be operated in any combination to pre-
pare for an arrangement desired during the
next ensuing period, in combination with
70 means for rendering either set effective.

In accordance with another feature there
is a switching means associated with each in-
coming communication channel for render-
ing the connections set up on either key set
75 effective, under control of the last previously
completed interconnection of channels. Stated
differently, this feature comprises switch-
ing means individual to each channel for con-
necting the said channel to the one key set or
80 the other, the switching means of the out-
going channels being under control of the
switching means of the incoming channels.

For purposes of illustration we will desig-
nate the two key sets as the regular and the
alternate sets respectively, the incoming com-
munication channels as red, purple, blue and
so forth and the outgoing communication
channels as one, two, three and so forth. Now
let us say that during the first period of time
90 the keys of the regular set are operated to
interconnect the red, the number one and
number three channels and the purple and
number two channels and the incoming chan-
nels keys of all incoming channels are set
95 to render the regular key set effective. Let us
say further that the schedule for the next en-
suing period calls for the interconnection
of the red, the number one and number two
channels and the blue and number three chan-
100

nels. Any time during the first period these combinations may be set up on the alternate key set without disturbing the connections then effective under control of the regular key set. If promptly at the end of the first period, and by promptly is meant within a very few seconds, the programs under way on all the incoming channels cease, then all incoming switching means are operated and the combination of interconnections set up on the alternate key set become immediately effective. But let us assume that the program coming in over the red channel runs over for one minute. At the end of the first period then the switching means for the purple and blue channels are operated to render the set up on the alternate key set effective. But outgoing channels one and three are at this time connected to the red channel through the regular key set and hence the new connection between the blue and number three channel as set up on the alternate key set does not become effective until the program on the red channel ceases and the red channel switching means is operated toward the alternate key set.

In accordance with another feature of the invention there is provided signaling means for indicating the key set which is in use and the direction of change from one key set to the other. There are three signals, one associated directly with each key set and another intermediate the two. When a single one of the first two signals is displayed it indicates that that particular key set is completely effective but when in addition the third signal is displayed it indicates that a change is being made from that key set whose signal is displayed to that whose signal is not displayed.

Other features will appear through the following description.

The drawings consist of three sheets marked Fig. 1, 2 and 3, respectively. Fig. 1 is a schematic diagram to illustrate the manner in which the apparatus operates. Fig. 2 and Fig. 3 taken together, Fig. 3 being placed above Fig. 2 form a circuit diagram of the electrical connections of the apparatus forming the subject matter of this invention.

Considering first Fig. 1, it will be noted that two banks of keys are provided, one shown in the upper part and the other shown in the lower part of the drawings. At the left there are indicated five incoming circuits denoted as red, purple, blue, green and orange. Each circuit enters a switching key such as 23, 24, 25, 26 and 27. The key 23 is used to switch the red circuit either to the upper bank of keys over circuit 28 or the lower bank of keys over the circuit 29. The circuit 28 may be connected to any one, several or all of 16 outgoing circuits denoted 1 to 16, respectively.

The switching keys are provided in groups, those numbered 17 to 22, inclusive, being one group and being mechanically arranged so that when any one, such for instance as 17, is depressed, it will release any one of the others, such as 18, which may have been operated heretofore. By depressing one key in each of the vertical groups, the different colored network circuits may be connected to the different numbered outgoing circuits.

As an illustration, we will assume that keys 17, 30 and 31 are operated, so that with the network keys in the positions shown, the red network will be connected through keys 17 and 31 to outgoing circuits 1 and 3, respectively, and the purple network will be connected through key 30 to No. 2 outgoing circuit. For reasons which will be explained hereinafter, when all of the network keys 23 to 27, inclusive, are in their normal positions, then all of the relays 32, 33, 34 etc., will be in their normal positions.

Let it be assumed that at a subsequent period it is desired to connect the red network to outgoing circuits 1 and 2 and the blue network to outgoing circuit 3. At any time keys 35, 36 and 37 may be depressed without in any way affecting the connections established through the upper set of keys.

At the proper time we will assume that the network keys 24 to 27, inclusive, are moved to their alternate positions, but that the movement of the red network key 23 is delayed. During this delayed interval the connection through key 37 will be ineffective even though the blue network key 25 has been moved to its alternate position due to the fact that the red network key 23 still controls the relay 34. The connection through key 36 will be ineffective because the red network key 23 has not been thrown to the position where circuit 29 is active. At the end of this delay period when key 23 is thrown to its alternate position, then the connection through keys 35, 36 and 37 will all become immediately effective.

The bottom row of keys for each set marked R are for releasing purposes, so that if during the middle of the program it is desired to disconnect the red network from outgoing circuit No. 1, then the key 22 is depressed so as to release key 17.

To the left of these two sets of keys are shown three signal lamps R, C and A. When all of the keys 23 to 27, inclusive, are in the positions shown on the drawings, then the signal lamp R will be effective. During the period after keys 24 to 27, inclusive have been thrown to their alternate positions, but key 23 has not yet been so moved, signal lamp C in addition to signal lamp R will operate. When finally key 23 is thrown to its alternate position so that all of the colored net-

work keys are in their alternate positions, then both signal lamps R and C will become ineffective and signal lamp A will operate.

When a change is being made in the other direction, that is, from the alternate or bottom set of keys to the regular or upper set of keys, then lamps A and C will glow during the change-over operation and lamp R will finally glow alone when the change has been completed.

The circuit for this signal lamp arrangement is shown in detail in Figs. 2 and 3. With all of the keys 23 to 27 in their normal positions a circuit is established from ground through the normal contacts of these keys to conductor 38 leading through the winding of relay 39 to battery. Relay 39 is energized in this circuit and establishes a path from ground, the upper armature and front contact of relay 39, signal lamp R, back contact and upper armature of relay 40 to battery. When, for instance, key 24 is thrown to its alternate position then conductor 41 is grounded and a circuit is established from this ground through signal lamp C, the lower armature and front contact of relay 39 to battery, so that at this time both signal lamps R and C will glow. When finally all of the keys 23 to 27 have been thrown to their alternate positions, then the ground on conductor 38 is removed and relay 39 releases. Upon the release of this relay a circuit is established from ground, the upper armature and back contact of relay 39, winding of relay 40 to battery. Relay 40 in moving its armatures, closes a circuit through its front contact and upper armature for signal lamp A. Since the armatures of relay 39 have returned to their normal positions, the circuits for lamps R and C are broken and both of these lamps have become dark.

When in the process of change back to the normal positions of keys 23 to 27, any one of the keys is put into its normal position, then ground is again put on conductor 38 to cause the energization of relay 39. Relay 39 operates its armatures, but relay 40 is held locked in a circuit through its front contact and lower armature to the ground which is still on conductor 41. As long as relay 40 remains operated, lamp A will glow and with relay 39 also operated a circuit is established from the ground on conductor 41, through lamp C, the lower armature and front contact of relay 39 to cause lamp C also to glow. When finally all keys 23 to 27 have been restored to their normal conditions, then the ground on conductor 41 is removed and the locking circuit of relay 40 is opened, so that the condition originally described is again established whereby lamp R alone is operated.

With red network key 23 in its normal position, the red circuit is connected through normal contacts of key 23 to circuit 28 and

thence to the primary winding of transformer 42. The secondary of this transformer supplies a circuit 43 which leads to the contacts of keys 17, 44, etc. Between the circuit 43 and the keys just mentioned, there are placed protective networks, such as 45 and 46 and in the normal position of these keys a load network 47 is connected to the circuit 43. When the key 17 has been operated the load network 47 is disconnected from the circuit 43 and in place thereof the load comprising the circuit normally connected to circuit 1 is substituted. Thus the load on circuit 43 is maintained at a constant level.

The load network 48 is placed across circuit 51 while relay 49 is at normal position so that the load on the circuit leading from the secondary of transformer 50 may be maintained at a constant level and this load network remains so connected until relays 32 and 49 are operated to switch the outgoing circuit 1 from circuit 43 to circuit 50.

Normally a circuit extends from ground through the extra contacts of key 21 and thence in series through the extra contacts of keys 20, 19, 18 and 17 to the windings of relays 32 and 49 in parallel. When, however, key 17 has been operated, this series circuit is opened and relays 32 and 49 allow their armatures to rest in their normal positions against their back contacts.

Now for the purposes of illustration we will suppose that key 35 has been operated so as to connect the circuit 29 through the windings of transformer 50 and the contacts of key 35 to the circuit 51 leading to the front contacts of relay 32. When finally red network key 23 is operated to its alternate position, then the series circuit through the extra contacts of keys 21, 20, 19 and 18 will be closed through the extreme right hand pair of contacts of key 23 to the windings of relays 32 and 49 in parallel, so that now relay 32 extends the circuit 51 to the outgoing circuit 1. Relays 32 and 49 are now locked through the right hand armature and front contact of relay 49, the extra contacts of key 35 and thence through the operated contacts of key 23 to ground, so that from now on no matter which one of the keys 17 to 21 is operated, the relay 32 will remain operated until either one of the keys 23 or 35 has been restored to its normal condition.

What is claimed is:

1. In a communication system, incoming and outgoing communication channels, a first and a second set of keys for interconnecting said incoming and said outgoing channels, and switching means common to both said sets of keys for alternatively rendering said key sets effective.

2. In a communication system, incoming and outgoing communication channels, a first and a second set of keys for interconnect-

ing said incoming and said outgoing channels, a manual switching arrangement individual to each said incoming channel for alternatively connecting said channel to said first or said second key sets and an automatic switching arrangement individual to each said outgoing channel for alternatively connecting said channel to said first or said second key sets.

3. In a communication system, incoming and outgoing communication channels, a first and a second set of keys for interconnecting said incoming and said outgoing channels, a switching arrangement individual to each said incoming channel for alternatively connecting said incoming channel to said first or said second key set, and means under control of said switching arrangements for alternatively connecting said outgoing channels to said first or said second key sets.

4. In a communication system, incoming and outgoing communication channels, a first and a second set of keys for interconnecting said incoming and said outgoing channels, a switching arrangement individual to each said incoming channel for alternatively connecting said incoming channel to said first or said second key set, a switching arrangement individual to each outgoing channel for alternatively connecting said outgoing channel to said first or said second key set, and means under control of said individual incoming channel switching means for controlling said individual outgoing channel switching means.

5. In a communication system, incoming and outgoing communication channels, a first and second set of keys for interconnecting said incoming and said outgoing channels, means for alternatively rendering said key sets effective, signaling means for indicating which key set is effective and signaling means for indicating the direction of change during the operation of said first means.

6. In a communication system, incoming and outgoing communication channels, a first and a second key set for interconnecting said incoming and said outgoing channels, means individual to each said channel to connect said channel alternatively to said first or said second key set, a signal individual to each said key set and means to display one of the said signals when all channels are connected to the corresponding key set, an auxiliary signal and means to display said auxiliary signal in addition to said other displayed signal when a fraction of said connecting means have been operated to connect the corresponding channels to the other said key set.

In witness whereof, we hereunto subscribe our names this 19th day of August, 1930.

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