

April 2, 1935.

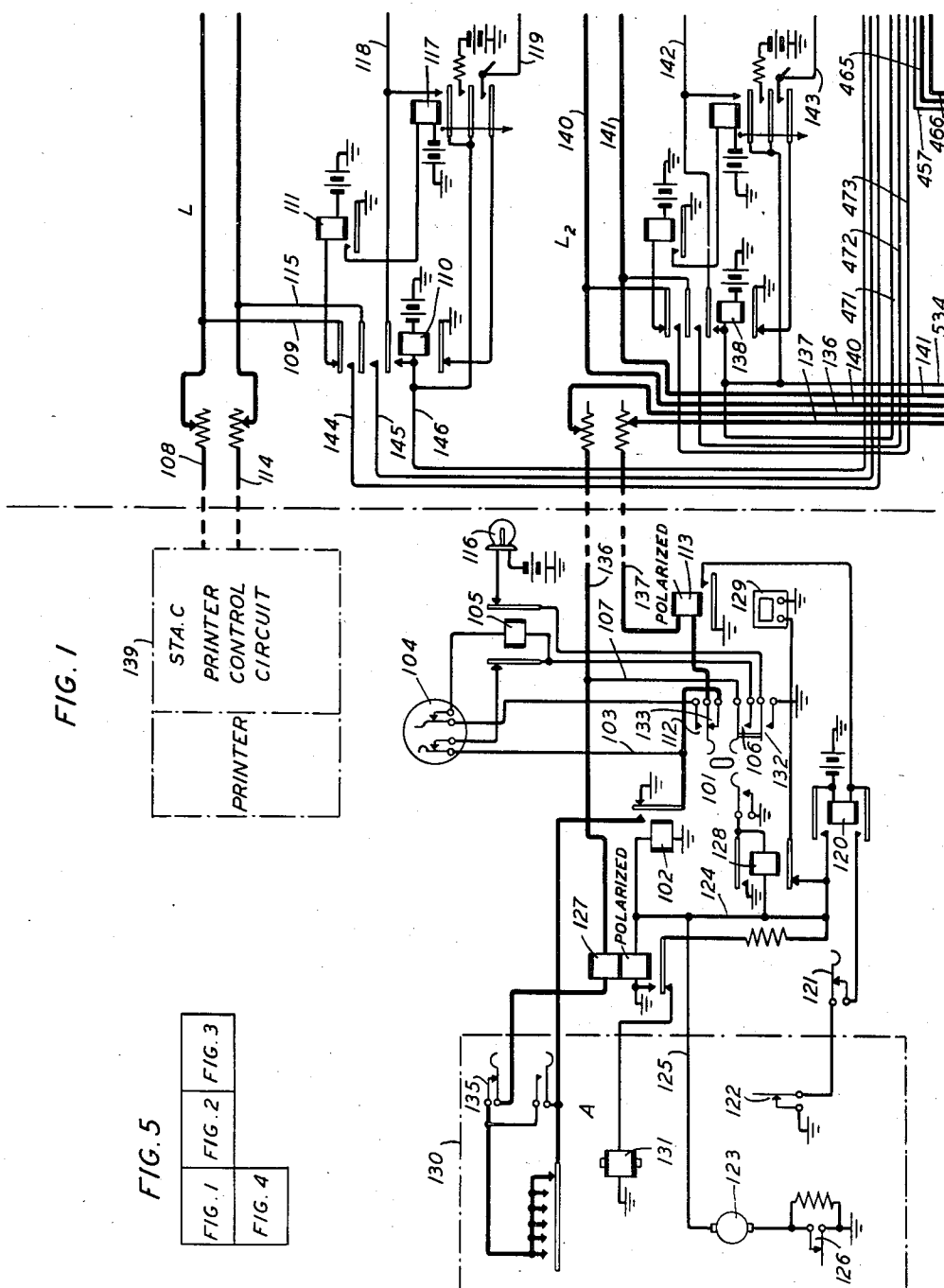
F. S. KINKEAD

1,996,516

PRINTING TELEGRAPH PRIVATE BRANCH EXCHANGE SYSTEM

Filed Dec. 21, 1933

4 Sheets-Sheet 1



INVENTOR
F.S. KINKEAD
BY *J. W. Schmied*
ATTORNEY

April 2, 1935.

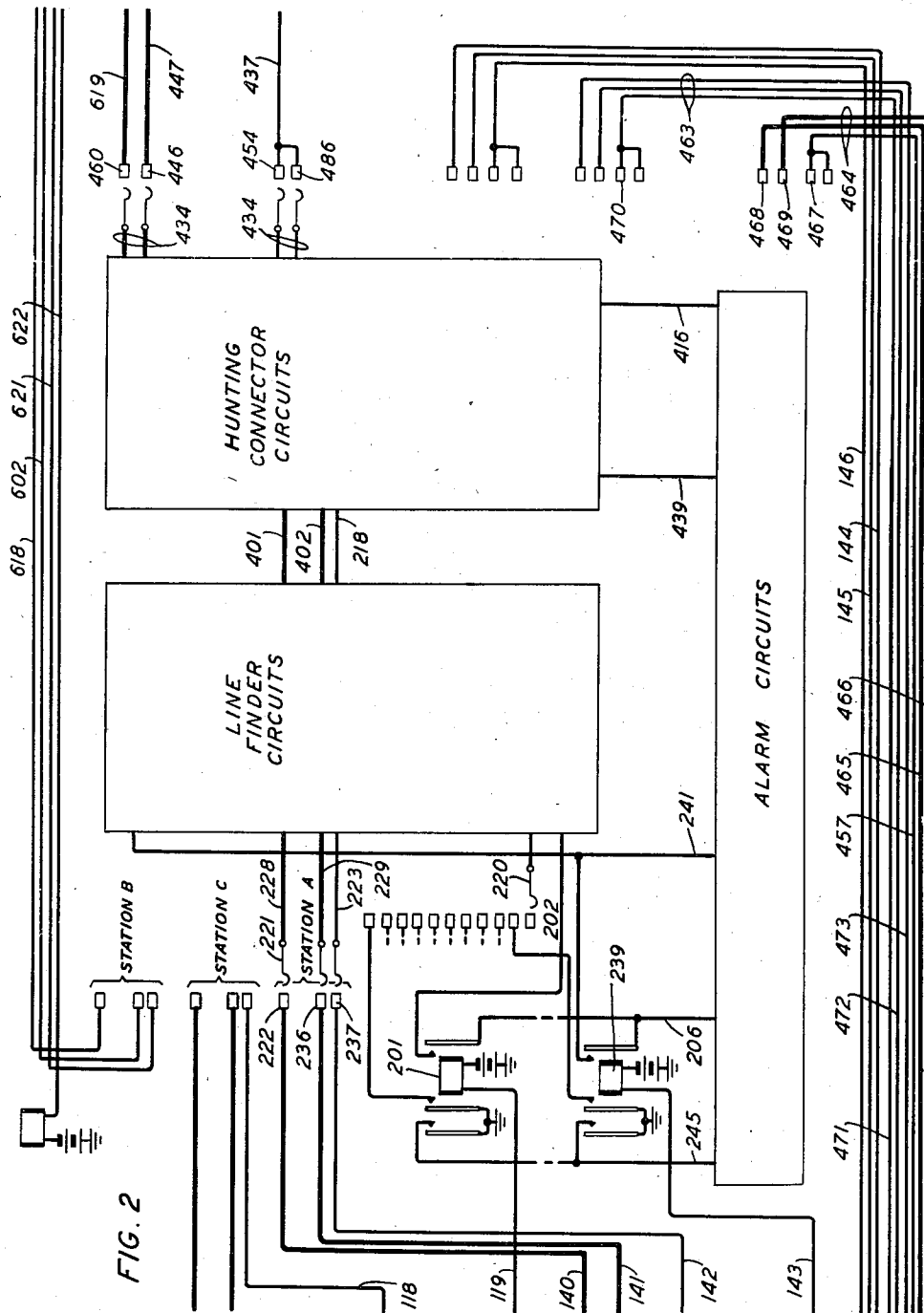
F. S. KINKEAD

1,996,516

PRINTING TELEGRAPH PRIVATE BRANCH EXCHANGE SYSTEM

Filed Dec. 21, 1933

4 Sheets-Sheet 2



INVENTOR

F. S. KINKEAD

BY

J. W. Schmied

ATTORNEY

April 2, 1935.

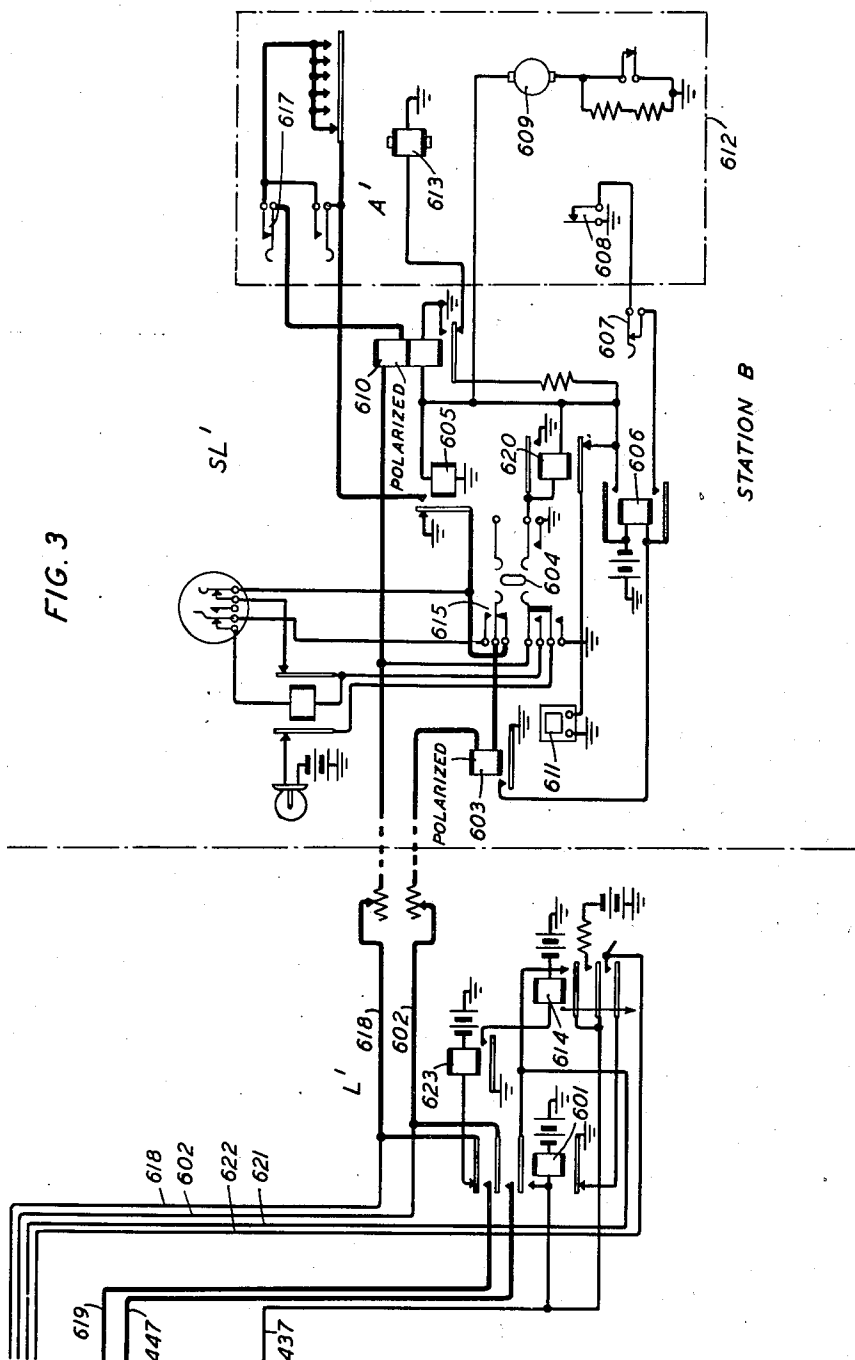
F. S. KINKEAD

1,996,516

PRINTING TELEGRAPH PRIVATE BRANCH EXCHANGE SYSTEM

Filed Dec. 21, 1933

4 Sheets-Sheet 3



INVENTOR
F. S. KINKEAD
BY *J. W. Schmied*
ATTORNEY

April 2, 1935.

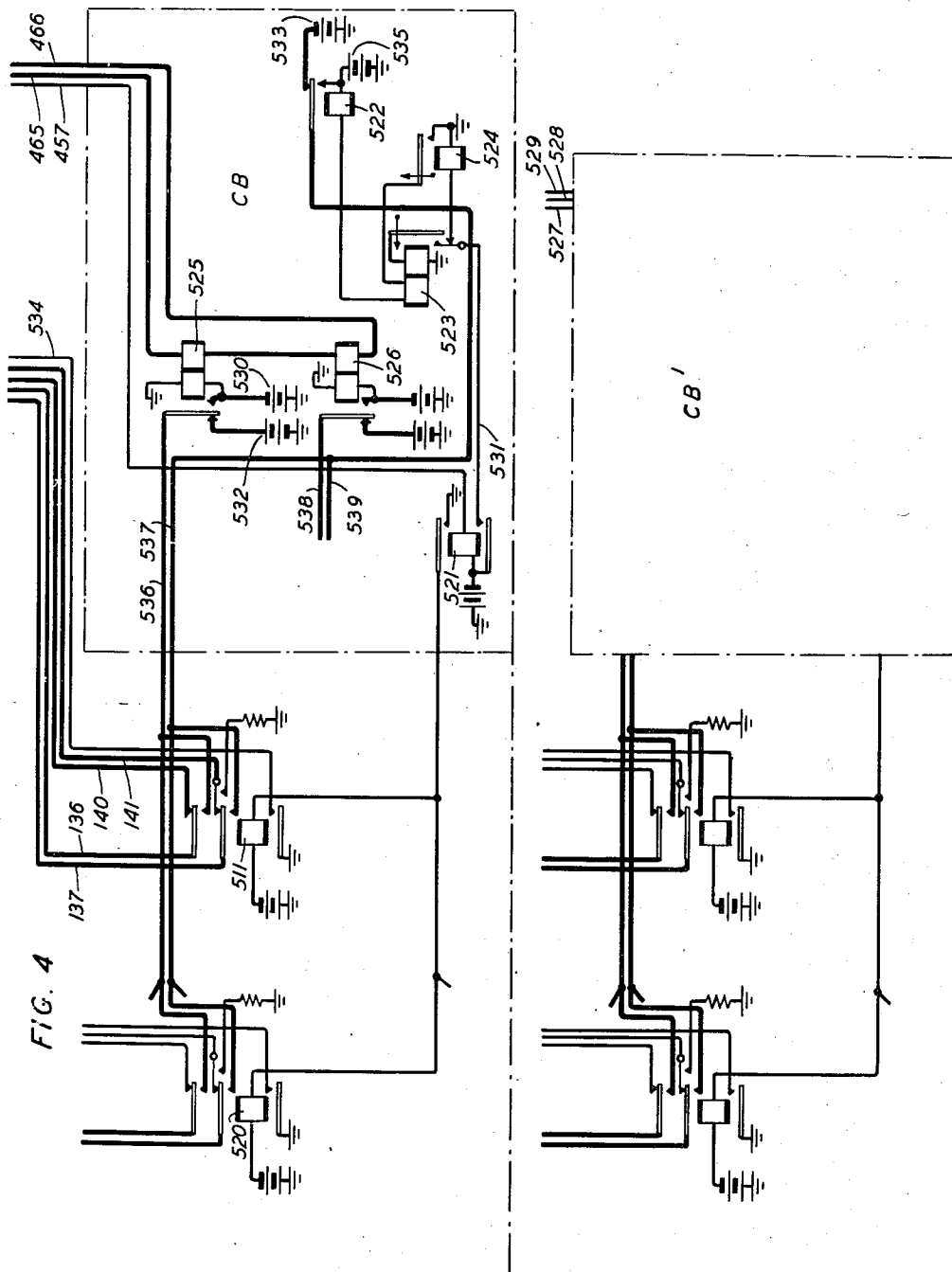
F. S. KINKEAD

1,996,516

PRINTING TELEGRAPH PRIVATE BRANCH EXCHANGE SYSTEM

Filed Dec. 21, 1933

4 Sheets-Sheet 4



INVENTOR
F. S. KINKEAD
BY *J. W. Schmied*
ATTORNEY

UNITED STATES PATENT OFFICE

1,996,516

PRINTING TELEGRAPH PRIVATE BRANCH
EXCHANGE SYSTEMFullerton S. Kinkead, Ridgefield Park, N. J., as-
signor to Bell Telephone Laboratories, Incor-
porated, New York, N. Y., a corporation of New
York

Application December 21, 1933, Serial No. 703,419

8 Claims. (Cl. 178—2)

This invention relates to printing telegraph systems and more particularly to telephone exchange systems wherein automatically and di-
rectly operable switches are employed at a
central office for establishing telegraphic con-
nections between two or more subscribers' stations.

The invention has for its main object to inter-
rupt any established connection between two sub-
scribers' stations for the purpose of including
either of the interconnected stations in a broad-
cast circuit.

In the system described herein is a group ar-
rangement of conference, or broadcast circuits
whereby the subscribers' stations may be ar-
ranged in groups and any group selected for
connection to any subscriber's station in another
group.

Heretofore in private branch exchange sys-
tems employing conference circuits, the broad-
cast group was arranged on a nonseizure basis
and should any station be busy at the time a
call is made to it for the purpose of including it
in a broadcast circuit, the subscriber wishing to
establish the broadcast circuit would receive a
busy signal in the same manner as in the es-
tablishment of an individual connection. Upon
receipt of the busy signal the subscriber releases
his call key so as to restore to normal the equip-
ment at the central office which was operated by
a call. A system of the character just described
is disclosed in U. S. Patent 1,958,930, granted to
F. J. Singer on May 15, 1934.

A feature of the present invention is the pro-
vision of a broadcast group arranged on a seizure
basis whereby all stations in any group may be
connected for broadcast purposes to a calling
subscriber's station at any time even though one
or more stations in the desired group is engaged
in an individual connection thereby interrupting
a message that is being transmitted over the in-
dividual connection.

Another feature is the provision whereby no
subscriber can interrupt an established broadcast
circuit designed on a seizure basis for the purpose
of establishing an individual connection with one
of the stations engaged in the broadcast circuit.
In the preferred form illustrated and described
herein, the invention contemplates, like that dis-
closed in Patent 1,958,930, supra, the provision
of a one hundred line machine switching tele-
graph private branch exchange system employing
automatically operated line finder and hunting
connector switches of the step-by-step type.
However, it is understood, like in Patent 1,958,-
930, that the number of lines may be increased

as the machine switching telephone systems,
which are well known in the art by adding one
or more selector switches of the step-by-step
type with the necessary rotary single movement
switches for handling call numbers of two or
more digits.

Other objects and features will be found in the
following detailed description and accompanying
drawings.

Referring to the drawings:

Figure 1 shows two subscribers' stations with
their respectively associated equipment at the
central office. In the lower portion is shown a
schematic layout of the necessary equipment for
receiving and sending printer messages at a sub-
scriber's station, say station A, including a trans-
mitter and receiving printer with associated driv-
ing motor and control circuit therefor. In the
upper portion is shown an oblong representing
the equipment at a second subscriber's station,
say station C; the equipment at station C being
intended to be identical with that of station A.
Stations C and A are shown connected for es-
tablishing a call to and receiving a call from
any other subscribers' station. The central office
equipment associated with station A is shown
connected as one branch of a broadcast group.

Fig. 2 shows, in oblongs, line finder switches,
a hunting connector switch and the associated
miscellaneous alarm circuits. These figures
shown in oblongs, are intended to be identical
with the figures of corresponding numbers dis-
closed in Patent 1,958,930, supra.

Fig. 3 shows in schematic layout, the necessary
equipment for receiving and sending printer mes-
sages at another subscriber's station, say station
B, including a transmitting and receiving printer
with associated driving motor and control circuit
therefor. Also shown in this figure is equip-
ment associated with station B, at the central
office. Station B is shown connected for estab-
lishing calls to and receiving calls from other
subscribers' stations.

Fig. 4 shows the equipment provided for select-
ing groups of subscribers' stations for broadcast
purposes. The upper portion is equipped for
selecting one group of which station A of Fig. 1
is a member and in the lower portion equipment
for selecting a second group.

Fig. 5 shows the relative arrangements of Figs.
1 to 4.

Operation of the broadcast circuit

Assuming that station C desires to call a group
of other stations including station A for broad-

cast purposes, the subscriber at station C operates call key such as key 101 at station A, and the call is automatically established through the line finder, to the hunting connector switch both shown in Fig. 2 in a manner described in Patent 1,958,930, supra, for establishing the individual connection to station B. When the hunting connector switch is seized and the subscriber receives the signal, such as the extinguishing of lamp, for example, lamp 116 at station A, indicating that the system is prepared to receive the dialing impulses, a dial such as dial 104 at station A, is operated to send the broadcast code number of the desired group. A grounded conductor is immediately connected in the circuit extending over the sleeve circuit conductor 457, through the winding of start relay 521 to grounded battery. Relay 521, in operating, closes (1) at its upper armature and contact an obvious operating circuit extending in parallel paths through the windings, in parallel, of the cut-through relays 511 to 520 to grounded battery, and (2) at its lower armature a circuit extending from grounded battery, lower armature and front contact of relay 521, conductor 531, make-before-break contacts of relay 523, through the winding of relay 524 to ground. Relays 511 to 520 operate and thereby cut through the tip and the ring conductors extending from each of the stations in the desired group to grounded positive battery 532 and grounded negative battery 533, respectively. The grounded negative battery 533 is now connected in a circuit extending to ground at the armature and back contact of a relay, corresponding to relay 102 at station A, at each of the stations in the desired group. At the front contact of the relay, corresponding to relay 102 at station A, the circuit extending to the grounded positive battery 532 is opened. The tip conductor 136 and ring conductor 137 extending from station A which is included in the desired group, is shown, in detail, connected to the outer upper and inner upper armatures respectively of relay 511 and the operation of relay 511 actuates these armatures into engagement with their respectively associated front contacts to close a circuit extending through the batteries 532 and 533. Each of relays 511 to 520, in operating, closes at its lower armature and contact, a circuit for operating the cut-off relay of the line extending to one of the stations of the desired group, the cut-off relay 138 associated with station A being operated over the circuit including conductor 534. The ground which operates relay 138 is extended directly to the sleeve multiple of the associated line on the connector switch over the lead 471. The cut-off relays, in operating, make the lines extending to the stations in the desired group busy to subsequent calls for individual connections.

Relay 524 operates in response to the operation of relay 521 described above, and closes a circuit extending through the left winding of relay 523 and the winding of relay 522 to grounded battery. Relay 523 is made slow operating in order to ensure the complete operation of relay 522 before relay 523 operates. Relays 523 and 522 operate. Relay 522 in operating, disconnects grounded negative battery 533 and connects in its place grounded positive battery 535 to the ring conductors extending to the stations in the desired group and this reversal of current operates a polarized relay, corresponding to relay 113 at station A, at each of the desired stations. This reversal, like that described in the above

mentioned Patent 1,958,930 for the establishment of the individual connection between station A and station B, is only momentary because relay 523 in operating causes relay 524 to release. However, the release of relay 524, being of the slow-to-release type, is retarded sufficiently to regulate the duration of reverse current. The operation of the polarized relay at each of the desired stations, causes the printer motors thereof to start operating simultaneously in a manner described in Patent 1,958,930, supra.

The engagement of the sleeve brush of the hunting connector switch with the contact connected to conductor 457 causes relays 417 and 410 shown in Fig. 4 of Patent 1,958,930, supra, to operate in a manner hereinbefore described whereby relay 417 causes the tip and ring conductor of the line extending to station A to be connected through to the hunting connector brushes, and relay 410 causes a reversal of current on the line extending to station C to thereby start the motor thereof in a manner described in Patent 1,958,930, supra. The starting of the motor at station C operates a buzzer corresponding to buzzer 129 at station A, which serves as a signal that the connection has been completed and for the subscriber to release the call key corresponding to key 101 at station A. To release the buzzer the operator momentarily operates the call key to its left hand position, upon the release of the key the subscriber starts sending the message to the desired stations, which is transmitted over conductor 465, through the right windings of relays 525 and 526, in series, and back over the conductor 466. Relays 525 and 526 respond to the message impulses. Relay 525 repeats the message impulses over conductors 536 and 537 through the printer magnet at each of the stations, preferably five, in the first subgroup of the stations in the desired group, and relay 526 repeats the same impulses over conductors 538 and 539 to the printer magnet at each of the stations, also preferably five, of the second subgroup. The circuit for repeating the message to station A which is included in the desired group is traceable from grounded positive battery 532 or grounded negative battery 530, conductor 536, front contact and outer upper armature of relay 511, conductor 136, through the equipment at station A, back over conductor 137, inner upper armature and front contact of relay 511, conductor 537, armature and back contact of relay 522 to grounded negative battery 533. The release of the equipment in the broadcast circuit is effected by transmitting a "stop" signal from the calling station only in a manner described in Patent 1,958,930, supra.

Seizure of subscriber's station

If station A is in operation and in communication with another station by an individual connection and a connection is established to the broadcast group of which station A is a member, station A is taken from the individual connection. In such an event the line finder and hunting connection switches by which the individual connection was established are returned to normal.

Assume that station A has established an individual connection with station B and that station C has established connection to the broadcast group of which station A is a member. After connection is established to conductors 457, 465 and 466 the action of relays 75

521, 522, 523 and 524 is identical with that described above. Relays 511 to 520 operate to connect conductors 136 and 137 and corresponding conductors of other station circuits comprising the broadcast group in parallel to conductors 536 and 537 respectively. The momentary reversal of polarity applied to the conductors corresponding to 137 through conductors 537 and 539 during the time relay 522 is operated causes all idle stations of the group to be started as described above. At all stations of the group previously started as the result of the establishment of individual connections, as is the case of station A, the momentary reversal of polarity applied to conductor 137 and corresponding conductors, performs another function. During the time relay 522 is operated no current will flow in the upper winding of relay 127 of Fig. 1 since both sides of its operating path are terminated in positive grounded battery. This path may be traced from positive grounded battery, make contact of relay 522, conductor 537, upper inner armature and make contact of relay 511 conductor 137, through the winding of relay 113 of Fig. 1, contacts 133 of key 101, make contact of relay 102, transmitting contacts of the printer 130, break key contacts 135 through the upper winding of relay 127, conductor 136, upper outer armature and make contacts of relay 511 of Fig. 5, conductor 536, back contact of relay 525 to positive grounded battery. Since no current is flowing in the upper winding of relay 127 its armature will be operated away from its lower contact under the influence of the current flowing through the lower winding. The path of this current is from grounded direct current source, upper armature and contact of relay 129, conductor 124, and lower winding of relay 127 to ground. Receiving printer magnet 131 therefore releases during the period relay 522 is operated. The momentary opening of the receiving magnet 131 is recognized by the subscriber at station A as a break signal. If the subscriber at station A is at the time transmitting, the break is an indication to stop transmitting.

After relay 522 has released, all subscribers' stations of the group will be in proper condition for reception of the broadcast signals.

Upon operation of relay 511 conductor 140 from the line finder switch Fig. 2 is opened at the upper outer armature and back contact of relay 511 and conductor 141 is grounded at the upper inner back contact of relay 511 and its associated auxiliary contact. With conductor 140 open and conductor 141 grounded a release condition is placed upon the line finder and hunting connector switches by which the individual connection between stations A and B was originally established. The release of the line finder and hunting connector switches is described in detail in Patent 1,958,930, supra. The release of the hunting connector removes ground from conductor 437 and causes relay 601 of Fig. 3 to release. The release of relay 601 opens permanently at its upper outer and upper middle armatures and associated make contacts conductors 618 and 602 respectively thus causing relay 610 to operate away from its back contact to release receiving printer magnet 613. A permanent open condition of the magnet 613 will indicate to the subscriber at station B that the individually established connection with station A has been interrupted. The operation of the emergency stop key 607 opens the locking path of relay 606 by interrupting the path from grounded

power source, winding and lower armature and make contact of relay 606, key 607 and motor control contacts 608 to ground. The release of relay 606 will open at its upper armature and contact the path from local grounded power source to the printer driving motor 609.

Assume that station B has established an individual connection with station A and that station C has established a connection with the broadcasting group of which station A is a member. When the non-locking key 604 of Fig. 3 is operated to the left, relay 623 operates to cause relay 614 to operate. Relay 614 closes ground to conductor 622 to the line finder start lead. The line finder brushes closing ground to conductor 621 causes relay 601 to operate, releasing relays 623 and 614. Connection from station B to the line finder and hunting connector switches is established over conductors 618 and 602. Connection to station A from the hunting connector switch is established over conductors 471, 472 and 473. Closure of ground from the hunting connector to conductor 471 causes relay 138 of Fig. 1 to operate to connect conductors 473 and 472 to conductors 140 and 141 respectively. These operations are not described in detail since they are identical in method to those by which connection is established from station A to station B, described in detail in Patent 1,958,930, supra. The operation in this case is identical with that described above except in the manner by which the line finder and hunting connector switches are restored to normal. When the hunting connector switch brushes close on conductors 457, 465 and 466 relays 521, 522, 523 and 524 operate as described above to start idle stations of the broadcasting group and cause break signals to stations previously started as a result of individually established connections. The operation of relay 511 opens a path through conductor 140, upper outer armature and make contact of relay 138 of Fig. 1 and conductor 473 to the hunting connector causing a permanent open condition to be indicated at station B. The subscriber at station B, being notified by this open indication that station A has been seized for broadcast purposes, operates the emergency stop key 607. The operation of key 607 releases relay 606 which in turn releases relay 605. With relay 605 released the line path from the line finder through conductor 618, upper winding of relay 610, sending printer contacts and break key 617 is opened and the path through conductor 602, winding of relay 603 and contacts 615 of key 604 is grounded. These conditions existing on conductors 602 and 618 cause the line finder and hunting connector switches to release.

In the appended claims where the word "line", "circuit" or equivalent language is used in reference to the communication path between a subscriber's station and the automatic switching equipment such words or language are used in the inclusive sense of ordinary conductive lines as well as radio links, carrier links, and long telegraph lines including repeaters.

What is claimed is:

1. A printing telegraph exchange system comprising a plurality of subscribers' stations of which a plurality constitute a group, an impulse sending device at each of said subscribers' stations for selecting any one of said subscribers' stations individually for communication therewith or said group of said subscribers' stations collectively, switching apparatus common to said stations and controllable from said devices, a line intercon-

necting said apparatus and each of said subscribers' stations, means at each of said subscribers' stations for preparing the line for the transmission of impulses from said impulse sending device, a broadcasting circuit included in said apparatus for said group of said subscribers' stations, switching equipment included in said apparatus arranged to be operatively connected to a calling subscriber's station by the joint operation of said preparing means and said impulse sending device at the calling subscriber's station, characterized in this that the switching equipment in response to current impulses received from the impulse sending device at one of said subscribers' stations, is arranged to connect the line of the calling subscriber's station to the broadcasting circuit whereby connection for communication purposes is established between the calling subscriber's station and all the subscribers' stations included in the group at any time even though one or more stations in said selected group are engaged at the time in established individual connections with any other subscribers' stations of the system.

2. A printing telegraph exchange system comprising a plurality of subscribers' stations arranged in groups, a printer and driving means therefor at each of said stations, a main station, switching equipment and a source of current at said main station, a broadcasting circuit at said main station, means in said broadcasting circuit for automatically interconnecting at any time a group of subscribers' stations with any one of the other of said subscribers' stations, and means responsive to the establishment of said connection for transmitting a reversal of current to each of the subscribers' stations engaged in said connection whereby the printer at each of said subscribers' stations engaged in the connection is conditioned for operation.

3. A printing telegraph exchange system comprising a plurality of subscribers' stations arranged in groups, a printer and driving means therefor at each of said subscribers' stations, a main station, a normally open line circuit connecting each of said subscribers' stations to said main station, a broadcast circuit at said main station for each of said groups of subscribers' stations, a selective switching mechanism at said main station whereat the individual line circuits and the broadcast circuits of said subscribers' stations are terminated, circuit closing means at each of said subscribers' stations for conditioning for operation said switching mechanism, an impulse sending device at each of said subscribers' stations for sending the code signal of any desired subscriber's station or desired broadcast circuit to operate said switching mechanism to the terminal to which the desired line circuit or broadcast circuit is connected, a source of current at said main circuit, means at said main station for transmitting, in response to the establishment of a connection between a calling subscriber's station and a called subscriber's station or a group of called subscribers' stations through one of said broadcast circuits, a reversal of current from said source to each of the subscribers' stations engaged in said connection whereby the driving means for the printers at said interconnected subscribers' stations are set in operation, means at each of said broadcast circuits operable when said broadcast circuit is selected by said switching mechanism to seize for connection in said broadcast circuit the printer at a subscriber's station whose line circuit is included in the selected

broadcast group and is connected in a previously established individual connection with another of said subscribers' stations and to disable the printer at said other subscriber's station.

4. In a telegraph exchange system, a plurality of subscribers' stations, certain of said stations being arranged in groups, a main station, printing telegraph equipment and a source of power therefor at each of said subscribers' stations, said source being normally disconnected from its associated equipment, a normally opened line circuit connecting each of said subscribers' stations, to said main station, switching means at each of said subscribers' stations for closing its associated line circuit, pulsing means at each of said subscribers' stations for transmitting an intermittent current over its associated line circuit, automatically operated means at said main station, sets of contacts in said automatically operated means respectively arranged to terminate the said line circuits extending to said subscribers' stations whereby an individual connection to each of the subscribers' stations may be established, other sets of contacts in said automatically operative means respectively arranged to terminate line circuits extending to groups of said subscribers' stations, whereby group connections may be established for broadcasting purposes, said automatically operated means being responsive first to said switching means and then to said pulsing means for interconnecting one of said subscribers' stations sets of contacts, means responsive to said automatically operative means for operatively connecting the power source of each of said subscribers' stations operatively interconnected through its associated printing equipment, and means at said main station responsive to the pulsing means of any one of said subscribers' stations for automatically disconnecting one of the group stations' line circuit engaged in an individual connection over another set of said contacts at which the line circuit of the station in each group terminates.

5. In a printing telegraph exchange system comprising a plurality of subscribers' stations, a connection initiating device and an impulse sender at each of said stations, printing telegraph transmitting and receiving mechanisms and a source of driving power therefor at each of said stations, a main station, a source of current at said main station for operating said mechanism, a normally deenergized circuit connecting each of said subscribers' stations with said main station, a calling line finder switch at said main station responsive to any one of said connections, initiating devices, a called line hunting connector switch at said main station arranged to select in response to the operation of the impulse sender at the subscribers' stations whereat the connection initiated device is operated, a terminal in the hunting connector switch capable of selection by the impulse sender at the calling subscriber's station for establishing at any time a connection between the calling subscriber's station and a group of called subscribers' stations for broadcasting purposes.

6. A printing telegraph exchange system comprising a plurality of subscribers' stations, a connection initiating device and an impulse sender at each of said stations, printing telegraph transmitting and receiving mechanisms and a source of driving power therefor at each of said stations, a main station, a source of current at said main station for operating said mechanism, a normally deenergized circuit connecting each of said sub-

scribers' stations with said main station, a calling line finder switch at said main station responsive to any one of said connection initiating devices, a called line, a hunting connector switch at said main station arranged to select in response to the operation of the impulse sender at the subscriber's station whereas the connection initiating device is operated, a terminal in the hunting connector switch capable of selection by the impulse sender at the calling subscriber's station for establishing an individual connection between the calling subscriber's station and a called subscriber's station, a second terminal in said connector switch capable of selection by the impulse sender at the calling subscriber's station for establishing a connection between the calling subscriber's station and a group of called subscribers' stations, and a broadcast circuit having means for establishing the last mentioned connection at a time when one or more subscribers' stations in the desired group are busy in an individual connection with other of said calling subscribers' stations.

7. A printing telegraph exchange system comprising a plurality of subscribers' stations, a connection initiating device and an impulse sender at each of said stations, printing telegraph transmitting and receiving mechanisms, and a source of driving power therefor at each of said stations, a main station, a source of current at said main station for operating said mechanism, a normally deenergized circuit connecting each of said subscribers' stations with said main station, a calling line finder switch at said main station responsive to any one of said connection initiating devices, a called line hunting connector switch at said main station arranged to select in response to the operation of the impulse sender at the subscriber's station whereat the connection initiating device is operated, a terminal in the hunting connector switch capable of selection by the impulse sender at the calling subscriber's station for establishing an individual connection between the calling sub-

scriber's station and a called subscriber's station, a second terminal in said connector switch capable of selection by the impulse sender at the calling subscriber's station for establishing a connection between the calling subscriber's station and a group of called subscriber's stations, and a broadcast circuit having means for momentarily disabling the mechanism at said subscriber's station interconnected in individual connections wherein the subscribers' stations of a desired group are included, other means for simultaneously conditioning for operation the mechanisms at all the subscribers' stations in the desired group, and still other means for causing to be restored to normal the calling line finder and the called line hunting connector switches previously operated in establishing an individual connection.

8. A printing telegraph exchange system comprising a plurality of subscribers' stations arranged in groups, a connection initiating device and an impulse sender at each of said stations, printing telegraph transmitting and receiving mechanisms and a source of driving power therefor in each of said stations, a main station, a calling line finding switch at said main station responsive to any one of said connection initiating devices, a called line hunting connecting switch at said main station arranged to select, in response to the operation of the impulse sender at the subscriber's station whereat the connection initiating device is operated, a broadcasting circuit, a terminal in the hunting connecting switch capable of selection by the impulse sender at the calling subscriber's station for establishing a connection between the calling subscriber's station and a group of called subscribers' stations through said broadcasting circuit, and means in said broadcasting circuit for permitting either station of a pair engaged in an established connection to be seized for connection in the group desired for receiving a broadcast message from another of said stations.

FULLERTON S. KINKEAD.