

Oct. 19, 1943.

J. BAUMFALK
COMMUNICATION SYSTEM

2,332,290

Filed Aug. 4, 1942

5 Sheets-Sheet 1

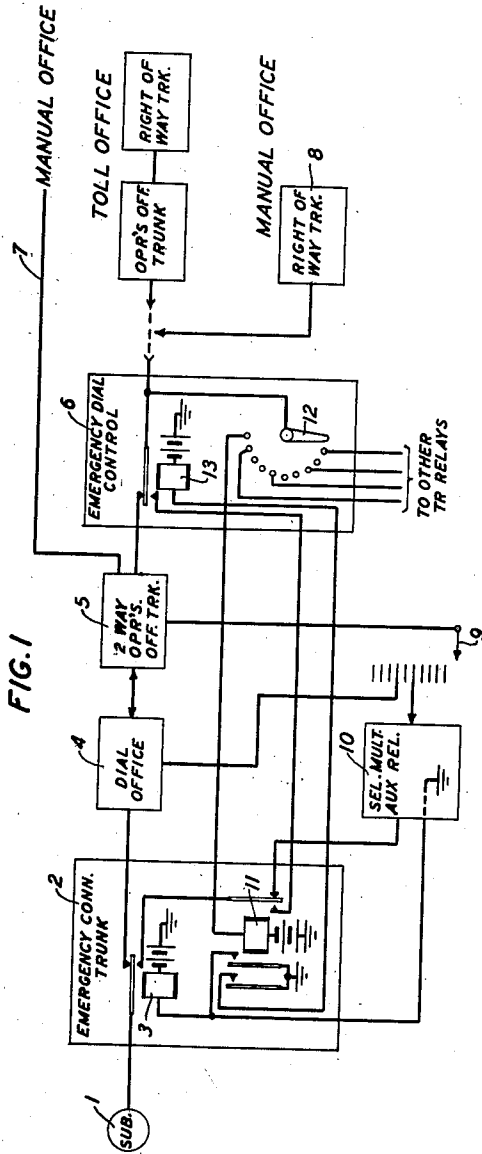
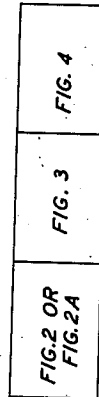


FIG. 5



INVENTOR
J. BAUMFALK
BY *John A. Hall*
ATTORNEY

Oct. 19, 1943.

J. BAUMFALK

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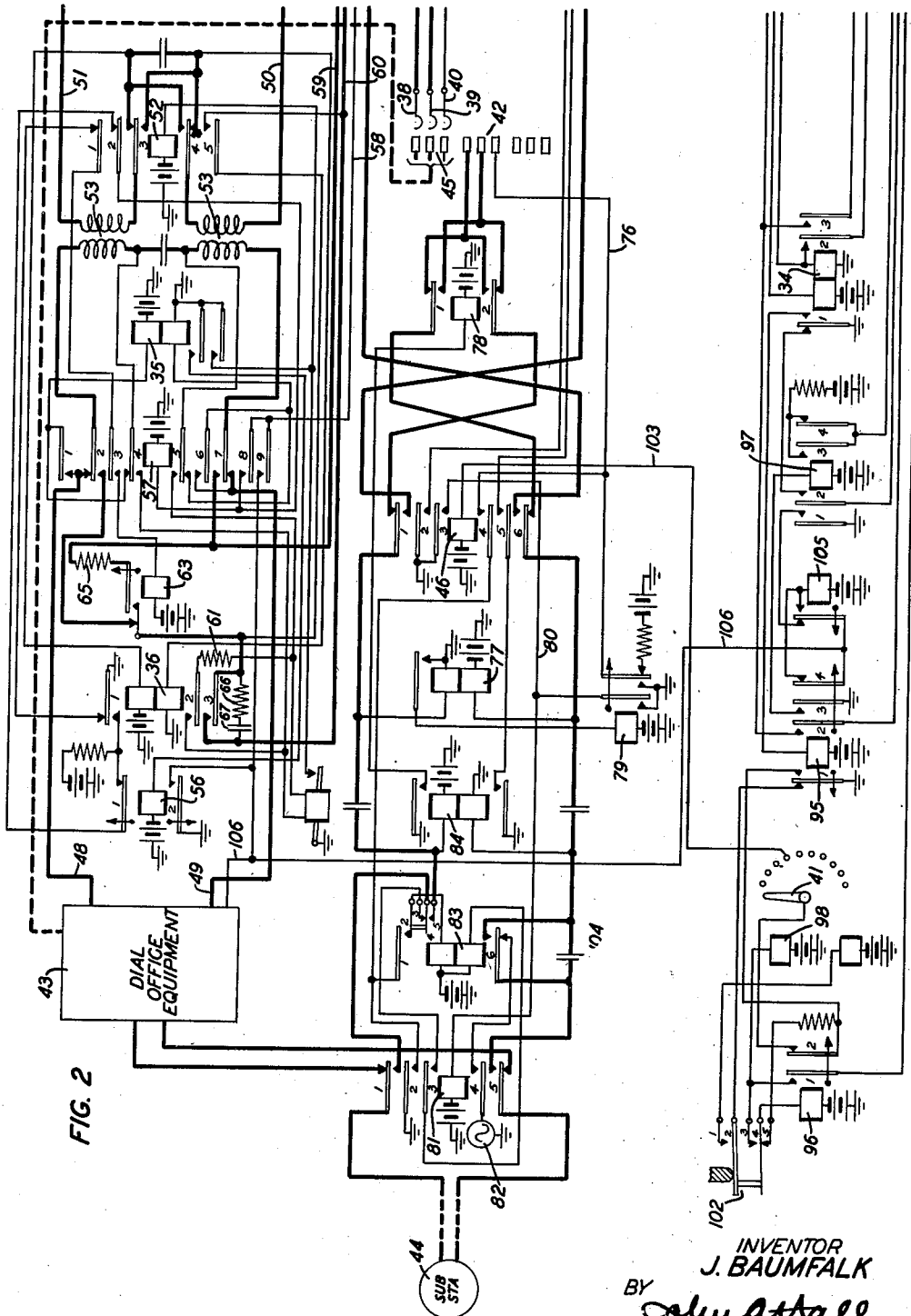


FIG. 2

INVENTOR
J. BAUMFALK
BY *John Attall*
ATTORNEY

Oct. 19, 1943.

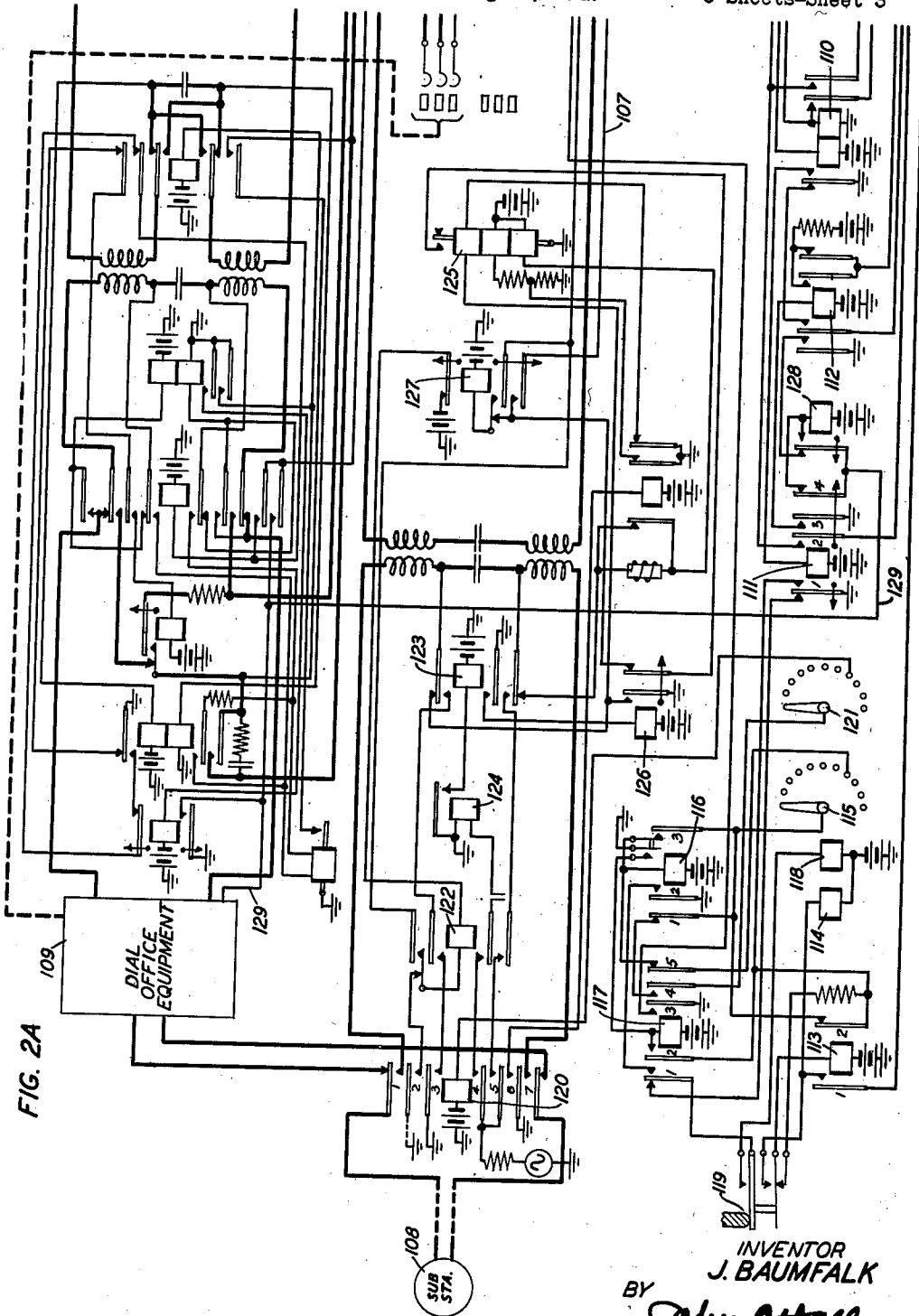
J. BAUMFALK

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COMMUNICATION SYSTEM

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5 Sheets-Sheet 3



INVENTOR
J. BAUMFALK

BY

John Attall

ATTORNEY

Oct. 19, 1943.

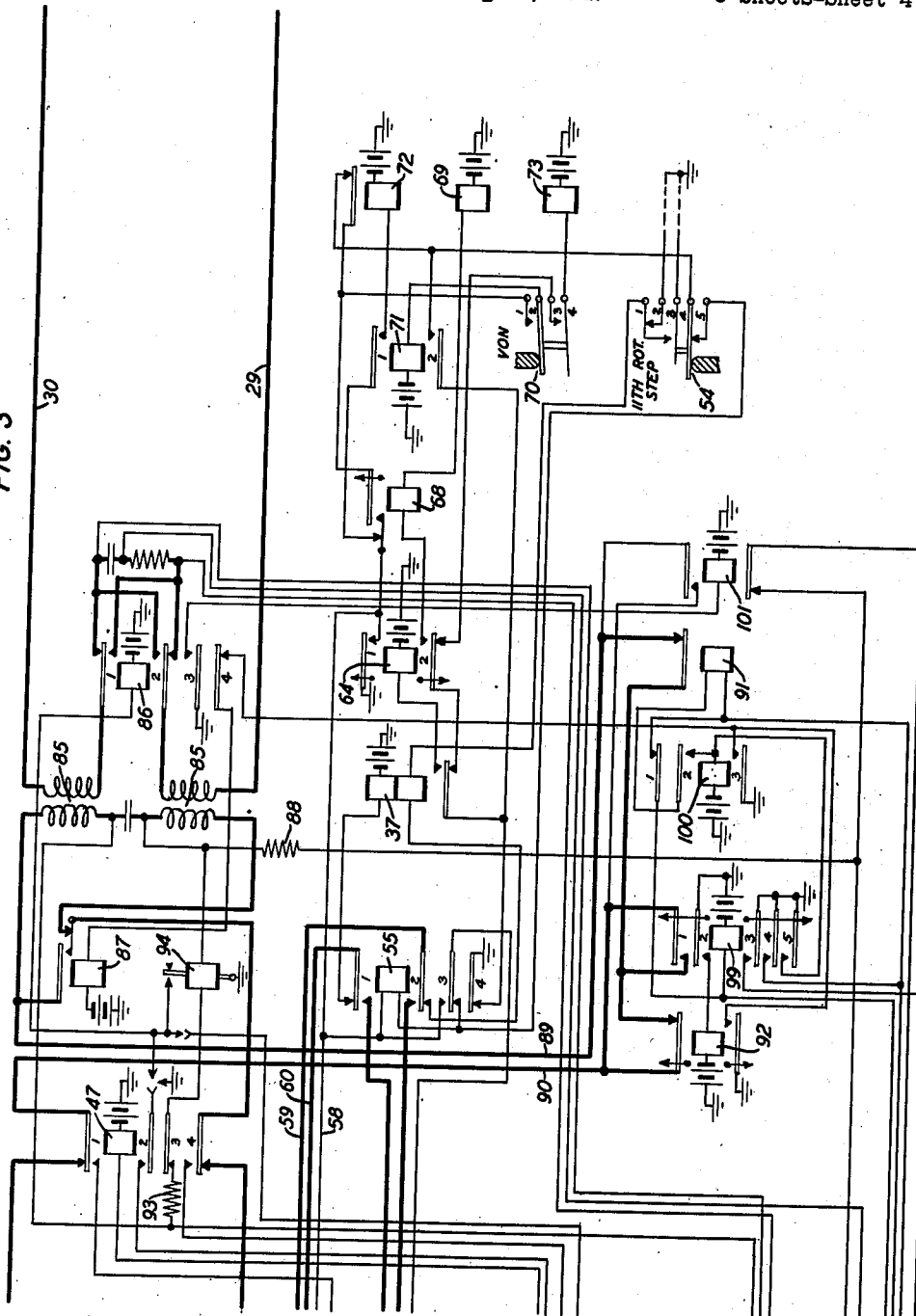
J. BAUMFALK
COMMUNICATION SYSTEM

2,332,290

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5 Sheets-Sheet 4

FIG. 3



INVENTOR
J. BAUMFALK

BY *John A. Hall*
ATTORNEY

Oct. 19, 1943.

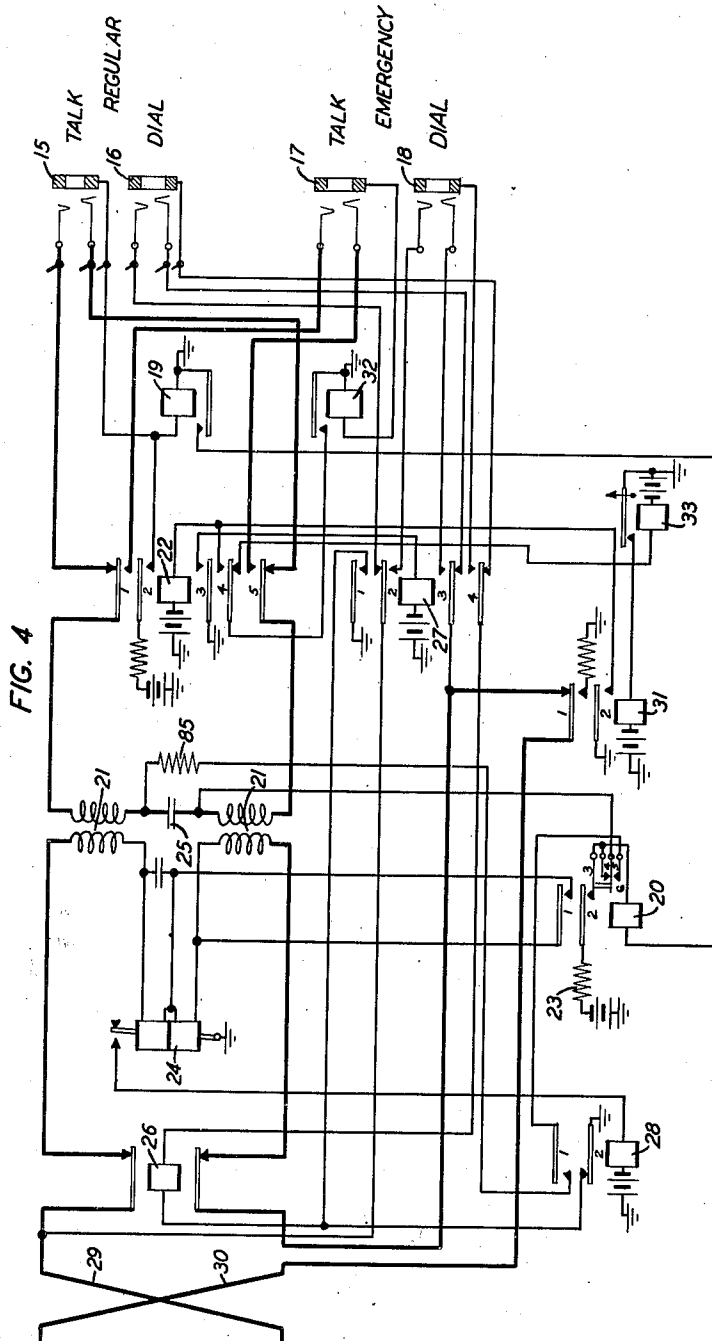
J. BAUMFALK

2,332,290

COMMUNICATION SYSTEM

Filed Aug. 4, 1942

5 Sheets-Sheet 5



INVENTOR
J. BAUMFALK
BY
John A. Hall
ATTORNEY

UNITED STATES PATENT OFFICE

2,332,290

COMMUNICATION SYSTEM

John Baumfalk, Clifton, N. J., assignor to Bell Telephone Laboratories, Incorporated, New York, N. Y., a corporation of New York

Application August 4, 1942, Serial No. 453,521

9 Claims. (Cl. 179-27)

This invention relates to communication systems and particularly to special service telephone systems.

The object of the invention is to provide means to establish emergency connections to certain preferred lines in a group served by machine switching means regardless of the busy condition of the lines themselves or the busy condition of the trunks leading to such group of lines.

For certain emergency conditions it is necessary that connections be established to certain given lines without delay. Where such lines are in what is known as a community dial exchange they may be busy or all trunks to such area may be busy and it is the object of this invention to provide access to such lines irrespective of such busy conditions.

This invention provides means supplementary to the means disclosed in my copending application Serial No. 453,522, filed Aug. 4, 1942, where means to give access to a central office regardless of busy conditions is disclosed.

Generally in such community dial exchanges there are certain levels or groups accessible to incoming selectors that are not used in normal service. In accordance with the present invention such normally idle groups, reached through a single digit operation, are employed to establish direct connections to certain preferred lines, the number of lines thus served being limited by the number of normally unused levels or groups. Such direct connections are then established through the contacts of a transfer relay individual to the preferred line which serves to sever all connection between such line and the machine switching equipment of the community dial exchange whereby any existing connection to the preferred wanted line is summarily dismissed.

Thus each preferred line has two designations, one a plural digit designation used in regular service and another a single digit designation used in emergency service.

Where all trunks to the community dial exchange are busy, a certain one of these trunks is especially equipped so that an operator at the distant end may gain access thereto irrespective of the busy condition thereof and by use of the single digit designation set up a direct connection from the trunk to the preferred wanted line. Such direct connection is in the nature of a by-path about the normally used machine switching means at the community dial exchange.

A feature of the invention is a means responsive to a single digit operation for extending a direct

connection to a preferred line otherwise normally reached through a plural digit operation.

Another feature of the invention is a trunk from a distant point which may be seized, summarily cut off from existing connections at such distant point and summarily extended at the near end to a given preferred line by a single digit operation. Such trunk is provided at the distant point with a monitoring point of access so that if time permits an announcement that the trunk is about to be taken for emergency service can be given.

Other features will appear hereinafter.

The drawings consist of five sheets having five figures as follows:

Fig. 1 is a schematic circuit diagram to explain the fundamental mode of operation; and

Figs. 2, 2A, 3 and 4 arranged as indicated in Fig. 5 form two alternative complete circuit diagrams showing the manner of operation in detail.

This invention provides emergency or right-of-way means whereby an operator may reach one of a small number of stations assigned for certain emergency service. Station 1 is connected to a line leading through an auxiliary circuit generally represented by the rectangle 2, where the line is normally connected through the contacts of a relay 3 to the regular dial office apparatus represented by the rectangle 4. By the normal manipulation of this apparatus the subscriber at station 1 may set up connections to other subscribers in the same office or may extend his line to a distant office over a two-way trunk to an operator's office. The two-way trunk is represented by the rectangle 5 and is shown as passing through an emergency control circuit 6 to either a toll or a manual office. Other trunks like that indicated by the rectangle 5 will pass as indicated by the line 7 directly to a manual office—this being the normal arrangement. In the same manner an operator at the distant manual office may extend a connection either over the normally arranged trunks such as 7 or over the right-of-way trunk 8 passing through the apparatus 6 to the trunk circuit 5 and may then control the apparatus of the dial office 4 to reach any one of the subscribers thereat.

If a call is to be extended to the subscriber at station 1 by the operator at a distant office the normally available means will be employed as just described. If the line to station 1 is found to be busy and there is an available trunk such as 7 or the right-of-way trunk 8, then an incoming selector of the dial office 4 represented by the arrowhead 9 is set by the operator on a special num-

ber known to such operator for reaching the busy wanted subscriber 1. The incoming selector 9 will be directed to select a special apparatus 10 which will cause the immediate operation of relay 3 to break the then existing connection between the line to station 1 and the apparatus of the dial office 4 and transfer such line over the contacts of a relay 11 to a path established over the incoming selector 9. Thus even though the subscriber at station 1 is busy a right-of-way connection to his line may be immediately established.

If now the distant operator finds all the trunks, including the right-of-way trunk to the office having subscriber 1 busy she will seize the right-of-way terminals of the trunk 8 whereupon the existing connection thereto is disrupted and the operator gains control of the selector 12. By dialing a special number, which may be the same as the number used to set the incoming selector 9, the operator will set the selector 12 on to the terminal leading to relay 11. Relay 11 is operated and in turn causes the operation of relays 3 and 13 so that a connection is immediately established from the right-of-way trunk 8, over the front contact of relays 13, 11 and 3 in series to the line leading to substation 1.

In this schematic drawing both a toll office and a manual office is indicated as the source of an emergency call to the station 1. In Fig. 4 the details of the right-of-way trunk from the manual office are shown but the details of the circuit from the toll office are omitted since the invention is believed to be clear through the explanation of the one way of carrying out the invention. With such details of the right-of-way trunk from the manual office fully explained, those skilled in the art will be able to practice the invention when alternative terminal arrangements are required.

Fig. 4 shows an outgoing trunk from a manual office to a dial office. This trunk is supplied with multiplied talk and dial jacks 15 and 16, respectively throughout the manual switchboard, and a single appearance pair of emergency talk and dial jacks 17 and 18 respectively. An operator extending a connection to the distant dial office will plug into jacks 15, whereupon the sleeve relay 19 will be operated. Relay 19 closes a circuit from ground, its armature and front contact winding of ring seating relay 20 through contacts 4 and 5 of relay 20, lower right-hand winding of repeating coil 21, armature 5 and back contact of relay 22 to the ring of jack 15. If the ring of the plug is properly seated in this jack, a battery connection will be found in the cord circuit which will cause the operation of relay 20. Relay 20 locks through its contact 3 and armature 2 to resistance 23 and battery. The lower winding of relay 24 is short-circuited to signal the circuits at the distant end of the trunk, and a circuit is prepared for bridging the condenser 25 under control of relay 26 to operate the supervisory relay in the cord circuit.

The dialing cord may then be inserted in the dial jack 16, whereupon the off-normal relay 26 is operated from the sleeve of jack 16, back contact and armature 4 of relay 27, winding of relay 26, back contact and armature 2 of relay 28 to ground. The off-normal relay 26 disconnects the tip and ring conductors 29 and 30 respectively from the repeating coil 21 and gives a clear path to the tip and ring of the jack 16. The tip conductor 29 passes through armature 2 and back contact of relay 27 to the tip spring of jack 16 and the ring conductor 30, passes through armature 1 and back contact of relay 27

31, armature 3 and back contact of relay 27 to the ring of jack 16. It may be noted that cord circuits for cooperation with jacks 15 and 16 are clearly shown and described in detail in Patent No. 2,302,587 granted on Nov. 17, 1942, to H. W. Ulrich. The incoming selector at the distant end of the trunk may now be dialed and a connection extended through the dial office apparatus thereat to a wanted subscriber. The dialing cord is removed from jack 16 as soon as the last digit is dialed.

At the other end of this trunk the tip conductor 29 and the ring conductor 30 connect to the circuit of Fig. 3. Upon seizure of the trunk a line relay 34 will respond. This in turn will operate a relay 35, relay 35 will operate relay 36 and relay 36 will operate the line relay 37 of the incoming selector represented by the tip, ring and sleeve brushes 38, 39 and 40 respectively. Relay 34 also controls the code selector represented by the wiper 41. The incoming selector and the code selector will both respond to the pulses of the first digit. If the first digit is one which represents a normal connection in this dial system office the brushes 38, 39 and 40 will be set on a set of terminals 42 leading to the dial office equipment 43, from which a connection may be extended to a station 44, and the wiper 41 will be set on a blank terminal. If the trunk is busy then a connection will be set up by plugging into the emergency jacks 17 and 18 as will be described in detail hereinafter. Then a special one-digit number will be dialed which will set the code selector on a terminal individual to the wanted line. It may be noted that the brushes of the incoming selector will also be set on terminals 45 individual to the wanted line by this connection will be ineffective due to the operation of relays 46 and 47, since it is necessary to drop off any connection to the two-way trunk which might have been established from the dial office equipment over conductors 48 and 49.

It may be noted that similar trunks which are not equipped for this emergency service may be illustrated by the circuit diagram of Fig. 4 as so far described and ignoring the extra equipment of the emergency talk and dial jacks 17 and 18. In this case the tip and ring conductors 29 and 30 will be connected to the tip and ring conductors 50 and 51 respectively. In this arrangement when the central office end of the trunk in Fig. 4 is seized the relay 36 will be directly controlled and this by its control of the line relay 37 will result in the operation of the incoming selector. Therefore when this special one-digit number is dialed the brushes 38, 39 and 40 will be set on the contact set 45 and a path established thereover to station 44. Since the equipment of relay 34, the code selector 41 and the relay 47 are not present in this instance the setting of the incoming selector on the terminal set 45 will be effective.

Now for purposes of illustration it will be assumed that the outgoing trunk of Fig. 4 is an ordinary circuit and is not equipped for emergency service. Therefore, conductors 29 and 30 are connected to conductors 50 and 51 of Fig. 2 respectively. When the trunk is seized, as described hereinbefore a circuit may be traced from ground, the lower winding of relay 36, back contact and armature 4 of relay 52, lower right-hand winding of repeating coil 53, conductor 50, conductor 29, tip of dial jack 16, through the dial circuit, ring of dial jack 16, conductor 30, conductor 51, upper right-hand winding of repeating coil 53, armature 3 and back contact of relay 52,

upper winding of relay 36 to battery. Relay 36 responds and closes a circuit from ground, armature 1 and front contact of relay 36, back contact and armature 1 of relay 56, back contact and armature 2 of relay 52, winding of relay 57 to battery. Relay 57 responds and locks through its front contact and armature 8 to the sleeve conductor 58 of the incoming selector on which ground will shortly appear. Now a circuit is closed from ground, springs 2 and 3 of contact assembly 54 (11th rotary step) lower winding of line relay 37, back contact and armature 2 of relay 55, tip conductor 59, front contact and armature 1 of relay 57, lower left-hand winding of repeating coil 53, armature 5 and front contact of relay 57, resistance 61, armature 2 and front contact of relay 36, front contact and armature 4 of relay 57, upper left winding of repeating coil 53, armature 2 and front contact of relay 57, normal contacts of relay 63, armature 3 and front contact of relay 36, ring conductor 60, armature 1 and back contact of relay 55, upper winding of line relay 37 to battery. Relay 37 responds and closes a circuit from ground, armature 4 and back contact of relay 55, armature and front contact of line relay 37, winding of first slow relay 64 to battery. Relay 64 places ground on the sleeve conductor 58.

When the operator at the distant end dials relays 36 and 37 respond to each open circuit interval by releasing their armatures. Upon the first release of the armatures of relay 36 a circuit is established from ground armature 1 and back contact of relay 36, back contact and armature 1 of relay 52, armature 3 and front contact of relay 57, winding of slow-releasing relay 63 to battery. Relay 63 responds and holds operated over the complete train of pulses only releasing an interval after the last pulse of the train. The circuit for the energization of relay 37 during the operated intervals of relay 36 may now be traced from the tip conductor 59, resistance 61, armature and front contact of relay 63, armature 3 and front contact of relay 36 to the ring conductor 60, so that relay 37 is now controlled by this one contact of relay 37. This point is bridged by the resistance 66 and condenser 67 for spark control.

Upon the first release of the incoming selector line relay, ground is extended from the armature and back contact of relay 37, over the armature 2 and front contact of relay 64, winding of second slow relay 68, winding of vertical magnet 69 to battery. The vertical magnet responds to each impulse separately and the slow relay 68 responds to the train of impulses as a whole. On the first vertical step of the switch the vertical off-normal contacts 70 operate and close a circuit from ground, armature 1 and front contact of relay 64, front contact and armature of relay 68, springs 1 and 2 of the vertical off-normal contacts 70, winding of relay 71 to battery. Relay 71 prepares circuits for the rotary magnet 72 and the release magnet 73. At the end of the digit when the second slow relay 68 releases the rotary magnet 72 is energized from ground, armature 1 and front contact of relay 64, normal contacts of relay 68, armature 1 and front contact of relay 71, winding of rotary magnet 72 to battery. The rotary magnet steps the brushes on to the first set of terminals and opens the circuit of relay 72.

Upon the first energization of relay 71 the ground from armature 1 of relay 64 is extended over the armature and back contact of magnet

72, thence over springs 4 and 5 of contact set 54 to the winding of relay 55 and in parallel therewith over the back contact and armature 3 thereof to the sleeve brush 40. Since relay 55 is short-circuited at this time it does not operate. As the rotary magnet 72 operates the brush 40 comes in contact with the sleeve of the first trunk of the selected level and as the relay 71 releases the rotary magnet is deenergized. When the rotary magnet closes its back contact it now depends on a ground from the sleeve of the trunk to cause the energization of relay 71 to start another rotary step. As long as grounded sleeves are encountered the relay 71 and the rotary magnet 72 will control each other's circuit and step the switch. An idle trunk will have battery on its sleeve and this will cause the energization of relay 55 which cuts through the tip and ring conductors 59 and 60 to the brushes 38 and 39 respectively and releases the line relay 37 and the first slow relay 64. The relay 55 locks through the winding of relay 71 and extends ground from the sleeve of the selected trunk over its armature 3 and front contact to the sleeve wire 58. The release circuit is held open during use of the switch by armature 4 of relay 55. When the ground is taken off the sleeve wire 58 and relay 55 releases the magnet 73 is operated and the switch releases.

If the dial office represented generally by the rectangle 43 is small there may be several levels of the incoming selector which are not normally employed, in which case if the number of stations such as 44 is the same as or less than the number of such available idle levels, then the arrangement disclosed in Figs. 2 and 3 may be employed. The line represented by the tip, ring and sleeve conductors 74, 75 and 76 respectively will be connected to the first set of contacts of such an idle level and may be reached as described by dialing one digit. Thus there may be several stations such as 44 each designated by a special one-digit number in addition to their regular numbers.

The station 44 may be reached by dialing the incoming selector on to the set of terminals 42 and then going through the regular dial office equipment 43. If the station 44 is busy, however, it may be approached by dialing the special one digit to set the incoming selector on the set of terminals 45.

The bridge across the tip and ring including the resistance 61, may now be traced over the tip conductor 75, back contact and armature 2 of relay 78, back contact and armature 1 of relay 46, upper winding of relay 77 to ground and over the ring conductor 74, back contact and armature 1 of relay 78, back contact and armature 6 of relay 46, lower winding of relay 77 to ground. Relay 77 responds and operates the sleeve relay 79, which grounds the sleeve conductors 76 and 58. Relay 79 also grounds conductor 80 which causes the operation of relay 81. This in turn disconnects station 44 from the dial office equipment 43 and establishes a ringing circuit for station 44 which may be traced from a source of ringing current 32, armature 4 and front contact of relay 81, back contact and armature 6 of relay 83, front contact and armature 5 of relay 81, station 44, armature 1 and front contact of relay 81, contacts 4 and 3 controlled by armature 1 of relay 83, front contact and armature 3 of relay 81, lower winding of relay 83 to battery. If station 44 is idle it will be run through the lower winding of relay 83. If it is busy, and when it

answers, the increased current through the lower winding of relay 83 will cause this relay to operate and extend the talking circuit back to the incoming selector circuit. Relay 83 locks to ground on armature 2 of relay 81. Talking current for station 44 is supplied through the windings of relay 84. Relay 84 in operating causes the operation of relay 78 which reverses the tip and ring toward the distant end and causes the operation of the polarized relay 24 as a signal that the subscriber has answered. Relay 24 opens the circuit of off-normal relay 26 and closes a bridge through resistance 85 towards the operator's cord circuit to operate the usual supervisory signal therein.

When the subscriber at station 44 hangs up relays 84 and 78 will be released and the cord circuit supervisory signal at the distant end will be operated. When the operator takes her plug out of the jack 15 relay 36 will be released, resulting in the release of the incoming selector and the restoration of the connection to normal in the usual manner. When the line relay 77 and the sleeve relay 79 restore, relay 21 will be released and the line of station 44 will be reconnected to the dial office equipment 43.

Let it now be assumed that all trunks from the distant end are busy and that even the trunk of Fig. 4 is busy. It may be noted that this trunk is only shown with its essential outgoing equipment, but that it also has incoming equipment and that it may as well be involved in a connection established in either direction. The operator will therefore plug into emergency jack 17. This causes the operation of sleeve relay 32 whereupon ground is extended from the armature and front contact of relay 32, armature 4 and back contact of relay 22, winding of slow release relay 33 to battery. Relay 33 operates relay 31, whereupon the ring conductor 30 of the trunk is opened to give a disconnect signal to the incoming selector of Fig. 3 or some switch in the dial office equipment 43 leading out over conductors 48 and 49. The relay 24 if operated will be released and the relay 28 will restore to normal to allow the off-normal relay 26 to be operated when the dialing cord is connected to jack 18.

Relay 31 causes the operation of relay 22 which in turn causes the operation of relay 27 and opens the circuit for relays 33 and 31. Relay 33 is slow to release to allow sufficient time for the disconnect signal to the distant end. Relay 22 locks to ground supplied by the armature of relay 32. The tip and ring conductors 29 and 30 are closed through the front contacts of relay 27 to a bridge in the dial cord circuit to bring up the line relay at the distant end of the trunk. These conductors now extend to the circuit of Fig. 3, so the tip conductor 29 may be traced through the lower right-hand winding of repeating coil 85, armature 2 and back contact of relay 86, through the right-hand winding of relay 34 to ground, and the ring conductor 30 may be traced through the upper right-hand winding of repeating coil 85, armature 1 and back contact of relay 86, through the left-hand winding of relay 34 to battery. Relay 34 responds in this circuit and will follow the dial pulses from the distant end.

It will be shown that relay 34 controls the code switch represented by wiper 41 and the incoming switch represented by brushes 38, 39 and 40, simultaneously. Through its armature 3, relay 34 controls relay 36. A circuit may be traced from ground, the lower winding of relay 36, back contact and armature 4 of relay 52, lower

right-hand winding of repeating coil 53, back contact and armature 4 of relay 47, normal contacts of relay 87, lower left-hand winding of repeating coil 85, resistance 88, armature 3 and front contact of relay 34, upper left-hand winding of repeating coil 85, conductor 89, through contacts of relays 91 and 92 to conductor 90, armature 1 and back contact of relay 47, upper right-hand winding of repeating coil 53, armature 3 and back contact of relay 52, upper winding of relay 36 to battery. Relay 36 thus responds to the operation of relay 34 and will follow the dial pulses and control the incoming switch in the manner hereinbefore described.

When this circuit is seized at the operator office relay 34 operates as described. Relay 34 operated connects resistance 88 in parallel with resistance 93 and relay 94 across the tip and ring looking toward relay 36 as described. Relay 34 also operates relay 95 which in turn operates relays 96 and 97. Relay 96, operated, provides an operating path for the rotary magnet 98 of the code selector and relay 97 operated provides an operating path for the pulse corrector relays. Relays 34, 95, 96 and 97 are now operated.

When the operator at the distant end dials, relay 34 will follow the dial pulses. Relay 95 holds over pulsing and on the first pulse of each digit relay 99 operates. The path for relay 99 may be traced from battery, winding of relay 99, armature 1 and back contact of relay 100, armature 2 and front contact of relay 97, back contact and armature 1 of relay 34 to ground. Relay 99 locks over armature 1 and back contact of relay 100, front contact and armature 4 of relay 99 to ground. At the same time relay 99 operates relay 100, from its armature 5 and relay 92 from its armature 2. Relay 100 establishes a circuit from ground, its armature 3 and front contact, back contact and armature 4 of relay 86, winding of relay 87 to battery. Relay 92 also closes a circuit for relay 87. Relay 87 holds the circuit of relay 36 closed.

Relay 92 is slow to release and hence responds to the train of pulses of the digit as a whole, and hence holds relay 87 operated during dialing. Relay 99 holds the connection between conductors 89 and 90 closed in place of relay 92. Relay 100 locks under control of the back contact of armature 1 of relay 34, opens the locking circuit for and releases relay 99 and prepares the circuit for the operation of relay 91. Relay 99, released, opens the circuit for relay 92 and allows relay 92 to operate in series with relay 100 if relay 34 is still released. The loop to relay 36 is opened when relay 99 releases and remains open only until relays 92 and 91 release. Because relays 99 and 92 are slow-releasing relays the open period to relay 36 is timed to provide adequate time for the operation of the vertical magnet 69 of the selector and of the switches beyond.

When relay 34 reoperates relays 91 and 100 release and prepare the circuit for the operation of relay 99 on the next pulse. When the last pulse of each digit is completed and relay 34 reoperates, relay 87 will release, and when the last digit is completed, will remain released, reconnecting resistance 88 in parallel with resistance 93 and relay 94 across the trunk for supervisory purposes.

During pulsing, ground from armature 3 and front contact of relay 99 operates the code selector. On the first closure of this circuit through armature 1 and front contact of relay 96 to the winding of rotary magnet 98 the off-nor-

mal springs 102 are operated. The winding of relay 96 is transferred to the pulsing circuit but since the relay is slow to release it holds during pulsing. On subsequent pulses the rotary magnet 98 follows the pulses with the relay 96 in parallel with it. At the end of the first digit relay 96 releases, opening the circuit to its own winding and the winding of the rotary magnet 98. The code selector therefor responds only to the first digit.

When relay 96 releases it connects ground from the front contact and armature 1 of relay 95, through armature 2 and back contact of relay 96 to wiper 41 of the code selector. If the code selector has been stepped to a terminal to which a specific subscriber's emergency connector is assigned, then the following operations will take place. The ground on wiper 41 will be connected over conductor 103 to cause the operation of relay 46. Relay 46, operated, operates relays 81 and 47, disconnects the emergency connector trunk from the selector banks and connects it to the front contacts of relay 47. Relay 47 connects the connector to the repeating coil 85, releases relay 94, connects relay 86 under control of relay 84 and operates relay 77. Relay 94, released, releases relay 84 and operates relay 86 which in turn releases relay 101. Relays 94, 86 and 101 were operated in the busy use of this trunk when seized through the emergency jacks at the distant end. Relay 77, operated, operates relay 79, which holds relay 81 and makes this circuit busy to selectors by placing ground on the sleeve. Relay 81, operated, disconnects the subscriber's line from its line circuit and connects ringing current to the line as hereinbefore described. During ringing, audible ringing through condenser 104 is sent back to the emergency operator.

Due to the operation of relay 47 the line circuit to the incoming selector is opened and the brushes 38, 39 and 40 which were set on the contact sets 45 leading to the substation 44 are released and returned to normal.

When the subscriber at station 44 answers, relay 83 operates and (a) locks under control of relay 81 (b) disconnects ringing current from the line and (c) connects the line to the transmission circuit causing relay 84 to operate. Relay 84 operates relay 86 which reverses the current to the emergency operator as an answer signal and operates relay 101. The following relays are now operated, namely, relays 34, 95, 97, 46, 47, 77, 79, 84, 83, 81, 86, 105 and 101.

Relay 105 which had been operated previous to the seizure of the trunk through the emergency jacks 17 and 18, remains operated as long as the connection to the operator office trunk is held. When the operator office trunk releases ground is removed from the sleeve wire 106, releasing relay 105. When relay 105 releases, ground from the front contact and armature 1 of relay 97 is connected through the back contact of relay 105 to the sleeve wire 106 as a busy condition. Relay 105 is slow releasing to permit the switch train to release before applying the busy ground.

Disconnection is under control of the emergency operator. The subscriber at station 44 by hanging up may operate the supervisory lamp in the operator's cord circuit but may not otherwise affect the connection. When the emergency operator disconnects relay 34 releases causing all operated relays and the code selector to release restoring the circuit to normal.

The arrangement hereinbefore described was

one in which the special station is located in a small dial office area where the number of such special stations does not exceed the number of unused levels on the incoming selector. In a larger area where there are a smaller number of unused levels on the incoming selector and where there are a larger number of special stations to be served a two-digit arrangement is used. This is illustrated in Fig. 2A which may be substituted for Fig. 2 in the arrangement indicated in Fig. 5. When Fig. 2A is used an alternative arrangement of connections is indicated in Fig. 3. In this case armature 2 of relay 47 is connected to ground instead of to the front contact of relay 94, and the front contact of relay 94 is connected to conductor 107 of Fig. 2A.

The operation of the incoming selector is the same as hereinbefore described except that it will not reach any special station line by a one-digit operation as before. When a special line is wanted it will be driven to an unused level and then restored to normal while the code selector of Fig. 2A makes the selection of the particular wanted special station.

Let it be assumed that station 103 is designated for emergency calling by the number 77 in addition to its regular number in the dial office equipment 109. This circuit may be seized at the operator office either when it is free or when it is busy. If the trunk is busy then it must be seized over the emergency jacks 17 and 18. When it is free it may be seized over the regular jacks as well as the emergency jacks. If the circuit is busy then as hereinbefore described a disconnect signal will be given which will return the incoming selector to its normal position and then cause the operation of the line relay 110. The line relay 110 in operating will cause the operation of relays 111, 112 and 113 in the manner hereinbefore described.

When the operator dials relay 110 follows the dial pulses causing the code selector to step to the desired terminal. At the end of the first digit relay 113 releases. Relay 113 releases (a) opens its own operating circuits, (b) opens the circuits to the rotary magnet 114, and (c) connects ground from armature 1 and front contact of relay 111 over the back contact and armature 2 of relay 113 to the wiper 115 of the code selector. If the first digit is not the first digit of a right-of-way number, the code selector will have stepped to a terminal to which relay 116 is not connected and therefore when relay 113 releases at the end of the first digit it does not reoperate and the subsequent digits do not affect the code switch. The code switch now remains in that position until the call is disconnected. However, should the first digit correspond to the first digit of a right-of-way number, 77 as we have assumed, the code switch will have been stepped to a terminal to which relay 116 is connected and when relay 113 releases at the end of the first digit relay 116 operates. This circuit may be traced from ground, armature 1 and front contact of relay 111, armature 2 and back contact of relay 113, wiper 115 now resting on its 7th contact, armature 5 and back contact of relay 117, winding of relay 116 to battery. Relay 116 operated locks under control of relay 113 and operates relay 117. Relay 117 operated (a) locks under control of relay 111, (b) operates relay 47, (c) opens the operating circuit of relay 115 and (d) operates the release magnet 118, restoring the code selector to normal. When the code selector reaches normal relay 113 again operates through

the off-normal contacts 119 in their normal position and the circuit to the release magnet is opened. Relay 113 operated, releases the relay 115 and provides a path for stepping the code switch as on the first digit. Relay 116 released provides a path for operating relay 120 when relay 113 releases at the end of the second digit. At the end of the second digit relay 113 will release in the manner hereinbefore described. Relay 113 released, (a) opens its own operating circuit, (b) opens the circuit to the rotary magnet 114 and (c) connects ground from relay 111 through contacts on the relays 116 and 117 to the wiper 121 to operate relay 120. This circuit may be traced from ground, armature 1 and front contact of relay 111, armature 2 and back contact of relay 113, armature 1 and back contact of relay 116, front contact and armature 4 of relay 117, brush 121 now on its 7th contact, winding of relay 120 to battery and ground. The code switch stays in this position until the end of the call and is unaffected by any further pulsing of relay 110. Relay 47 operated (a) disconnects the operator office from the operator office trunk and connects it to the connector circuit of Fig. 2A. If relay 94 is operated at this time its circuit will be open at the back contact and armature 3 of relay 47 whereupon relay 94 restores to normal. Relay 94 released releases relay 86 which in turn releases relay 101.

When relay 120 operates it (a) disconnects the subscriber's line from its line circuit in the dial office equipment 109 and connects it to the right-of-way connector circuit of Fig. 2A (b) connects the winding of relay 122 to the proper pick-up lead indicated by the broken line between ground and armature 2 of relay 120 and (c) connects the various ringing control leads for ringing the subscriber. When the subscriber 108 is on an individual line the operation of relay 120 will operate relay 122 immediately and ringing will start immediately. Relay 123 is a ringing control relay and follows ringing code interruptions from relay 124. When the office provides ringing current code directly relay 124 follows the ringing current code and in turn operates relay 123. The operation of relay 123 disconnects the supervisory relay 125 from the line and connects ringing current to the line and at the same time operates relay 126. Tripping is accomplished only during the silent interval. When relay 123 releases at the end of each ringing interval relay 125 is connected to the line; relay 125 may kick up momentarily due to the line discharging but it is ineffective since the slow release relay 126 holds the operating circuit of relay 127 open until the connector is disconnected.

The subscriber's answer is effective only during the silent interval. When the subscriber answers during such an interval relay 125 operates in turn operating relay 127. Relay 127 operated (a) releases relay 122, (b) locks under control of relay 47 independently of relay 125 and (c) connects the front contact of relay 125 to relay 86 for supervision. Relay 86 now operates under control of relay 125. Relay 86 operated reverses the current to the operator as an answer signal and operates relay 101. The following relays are now operated: 110, 111, 112, 47, 120, 86, 128, 101, 127 and 125. Relay 128 remains operated as long as the connection to the operator office trunk circuit is held. When the operator office trunk releases ground is removed from the sleeve releasing relay 128. When relay 128 releases,

ground from relay 112 is connected to the sleeve through the back contact of relay 128 to the sleeve conductor 129 as a busy condition. Relay 128 is slow-releasing to permit the switch train to release before applying the busy ground.

Disconnection is under control of the operator. When the operator disconnects relay 110 releases causing operating relays and the code selector to release, restoring the circuit to normal.

What is claimed is:

1. In a communication system, a group of lines, machine switching means for interconnecting said lines, trunk circuits from said group to a distant switching point for extending connections to and from the lines of said group, each said line being designated for purposes of calling by a plural digit designation, certain of said lines having in addition a single digit designation and means controlled over one of said trunks responsive to the use of said single digit designations for establishing connections to said certain of said lines.

2. In a communication system, a group of lines, machine switching means for interconnecting said lines, trunk circuits from said group to a distant switching point for extending connections to and from the lines of said group, each said line being designated for purposes of calling by a plural digit designation, certain of said lines having in addition a single digit designation, means responsive to the use of said single digit designations over one of said trunks for establishing a preferred connection to the corresponding certain of said lines and means responsive to the establishment of said preferred connection for removing said line from the control of said machine switching means.

3. In a communication system, a group of lines, machine switching means for interconnecting said lines, trunk circuits from said group to a distant switching point for extending connections to and from the lines of said group, each said line being designated for purposes of calling by a plural digit designation, certain of said lines having in addition a single digit designation, an incoming selector controlled over said trunks, and means for setting said incoming selector directly on said certain of said lines responsive to the use of said single digit designations.

4. In a communication system, a group of lines, machine switching means for interconnecting said lines, trunk circuits from said group to a distant switching point for extending connections to and from the lines of said group, each said line being designated for purposes of calling by a plural digit designation, certain of said lines having in addition a single digit designation, an incoming selector controlled over said trunks, means for establishing a preferred connection to said certain of said lines by controlling said incoming selector in accordance with said single digit designations and means responsive thereto for disconnecting said selected line from any connection with said machine switching means.

5. In a communication system, a group of lines, machine switching means for interconnecting said lines, a trunk circuit from said group to a distant switching point for extending connections to and from the lines of said group, each said line being designated for purposes of calling by a plural digit designation, certain of said lines having in addition a single digit designation, means in said trunk circuit responsive to control exercised over said trunk circuit from the distant end thereof in accordance with said single digit

designations for extending direct connections to said certain of said lines.

6. In a communication system, a group of lines, machine switching means for interconnecting said lines, a trunk circuit from said group to a distant switching point for extending connections to and from the lines of said group, means to give emergency access to certain of said lines regardless of the busy condition thereof comprising a transfer relay individual to each one of said lines, and an alternate path leading thereto, said alternate path being accessible from said trunk circuit through the use of a single digit line number.

7. In a communication system, a group of lines, machine switching means for interconnecting said lines, a trunk circuit from said group to a distant switching point for extending connections to and from the lines of said group, means accessible to said trunk and responsive to preferred single digit control for extending emergency connections to certain of said lines regardless of the busy condition thereof, means individual to said

trunk and responsive to preferred single digit control for extending emergency connections to certain of said lines regardless of the busy condition of said trunk.

8. In a communication system, a group of lines, machine switching means for interconnecting said lines, a trunk circuit from said group to a distant switching point for extending connections to and from the lines of said group, means controlled from the distant end of said trunk for transferring said trunk from a path through said machine switching means to one of said lines to a path leading directly to one of said lines.

9. In a communication system, a group of lines, machine switching means for interconnecting said lines, a trunk circuit terminating in said machine switching means and leading to a distant point for extending connections to and from the lines of said group, means at the said distant point to dismiss any existing connection thereto and to establish a by-path direct connection to one of said lines.

JOHN BAUMFALK.