April 2, 1935. H. E. PHELPS 1,996,213

SERVICE OBSERVING SYSTEM FOR TELEPHONE EXCHANGES

Filed Oct. 10, 1933 5 Sheets-Sheet 1

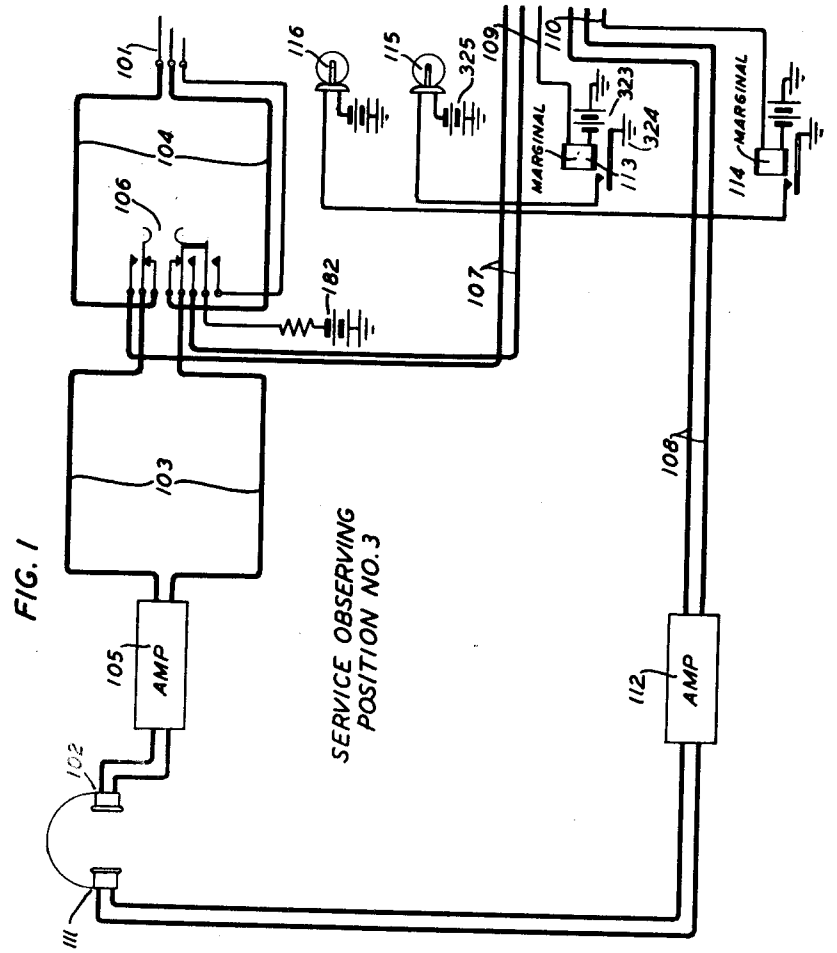


FIG. 1

FIG. 6

FIG. 2, 4 OR 5	FIG. 3
FIG. 1	

INVENTOR
H. E. PHELPS
BY
ATTORNEY

April 2, 1935. H. E. PHELPS 1,996,213

SERVICE OBSERVING SYSTEM FOR TELEPHONE EXCHANGES

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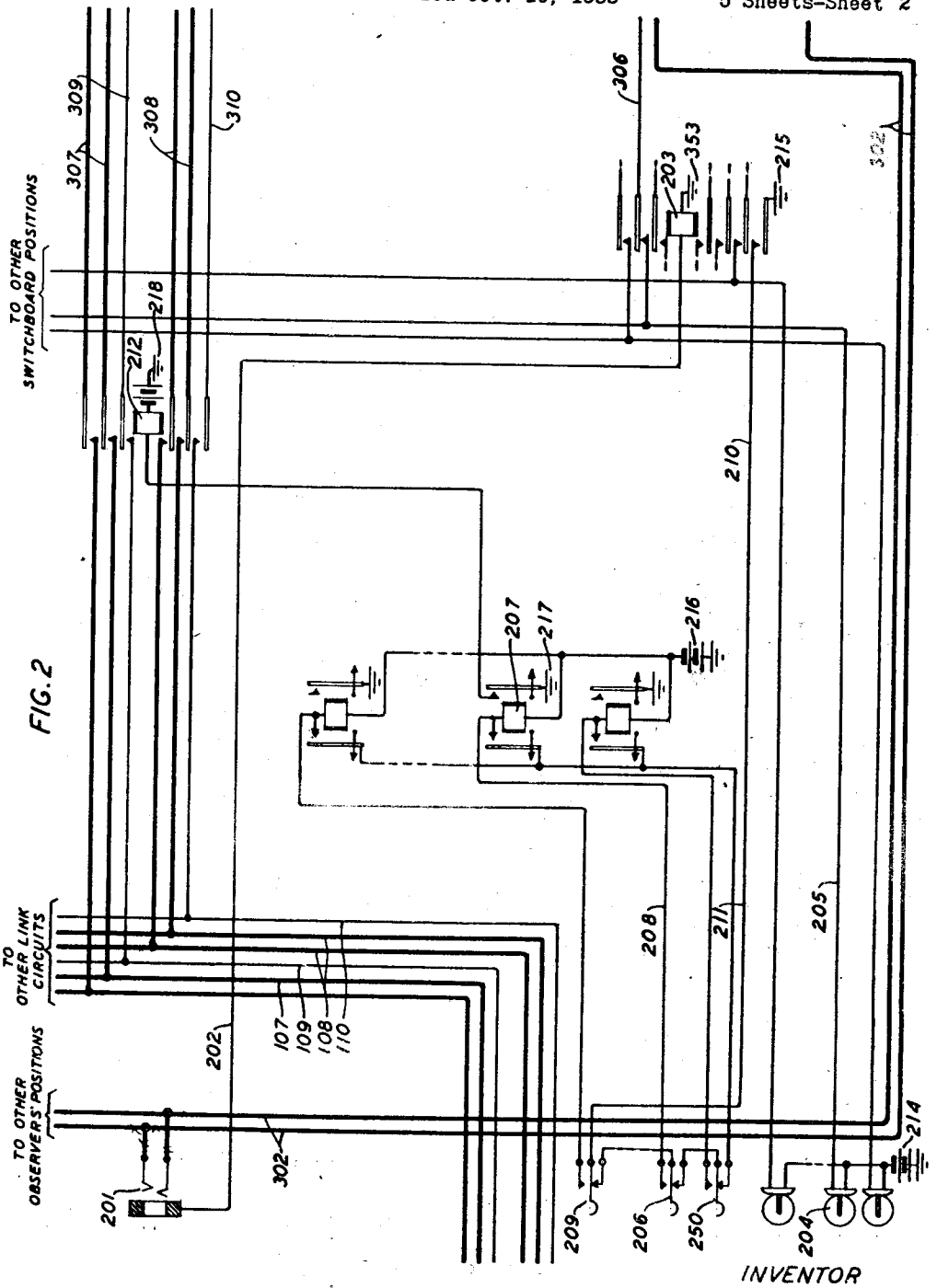


FIG. 2

INVENTOR
H.E. PHELPS
BY
ATTORNEY

April 2, 1935. H. E. PHELPS 1,996,213

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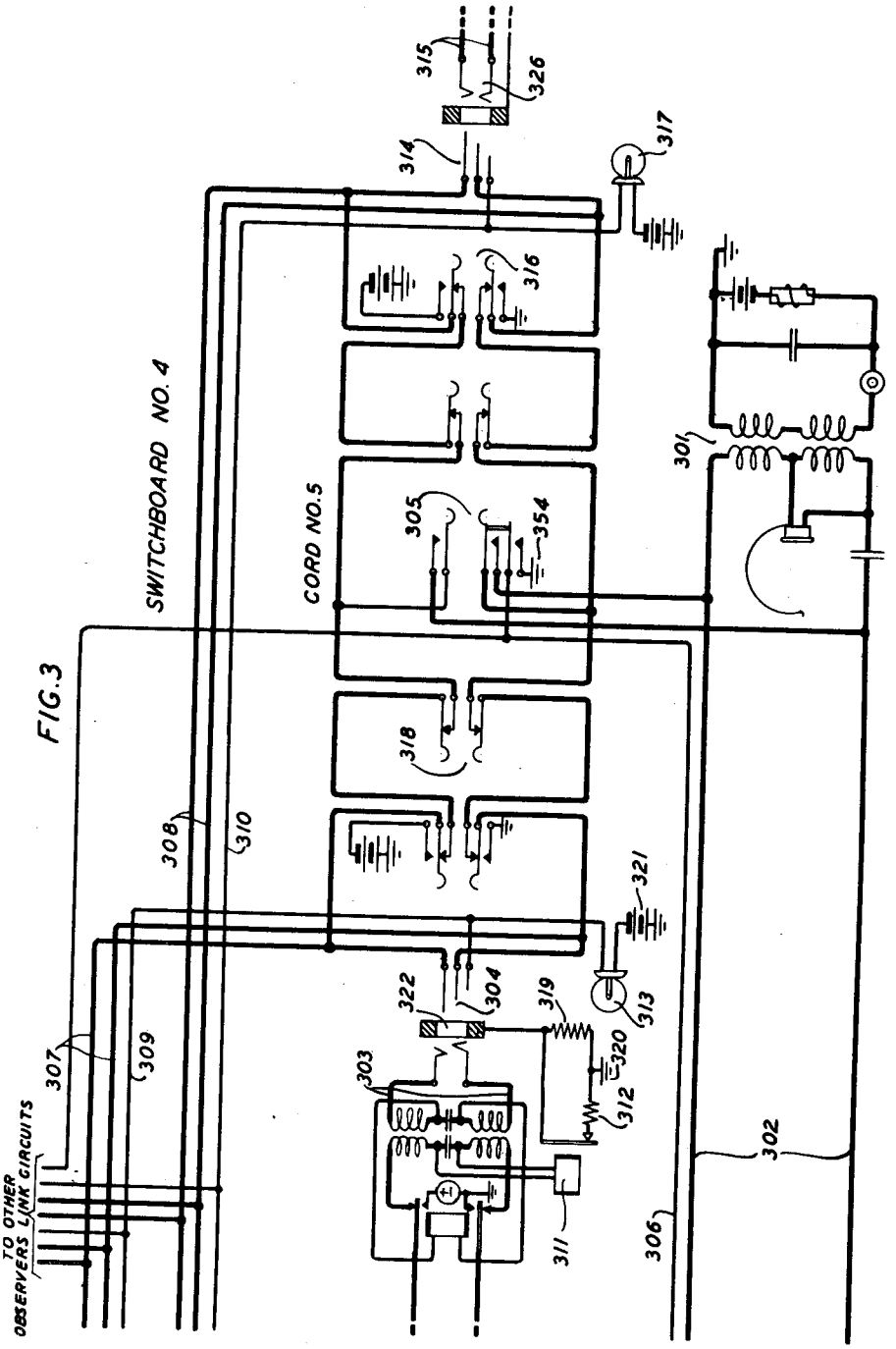


FIG. 3

INVENTOR
H. E. PHELPS

BY

ATTORNEY

April 2, 1935. H. E. PHELPS 1,996,213

SERVICE OBSERVING SYSTEM FOR TELEPHONE EXCHANGES

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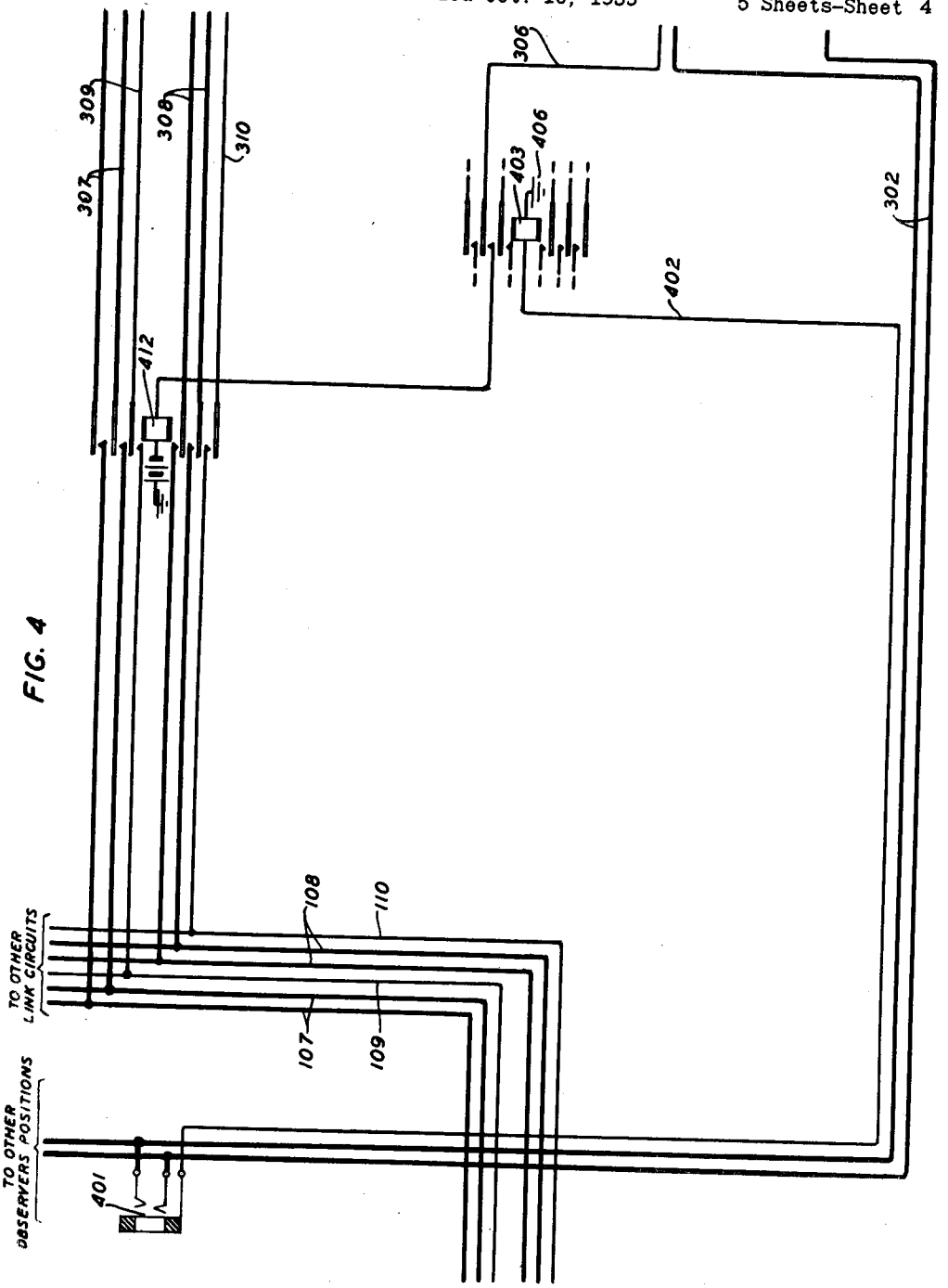


FIG. 4

INVENTOR
H.E. PHELPS
BY
ATTORNEY

April 2, 1935. H. E. PHELPS 1,996,213

SERVICE OBSERVING SYSTEM FOR TELEPHONE EXCHANGES

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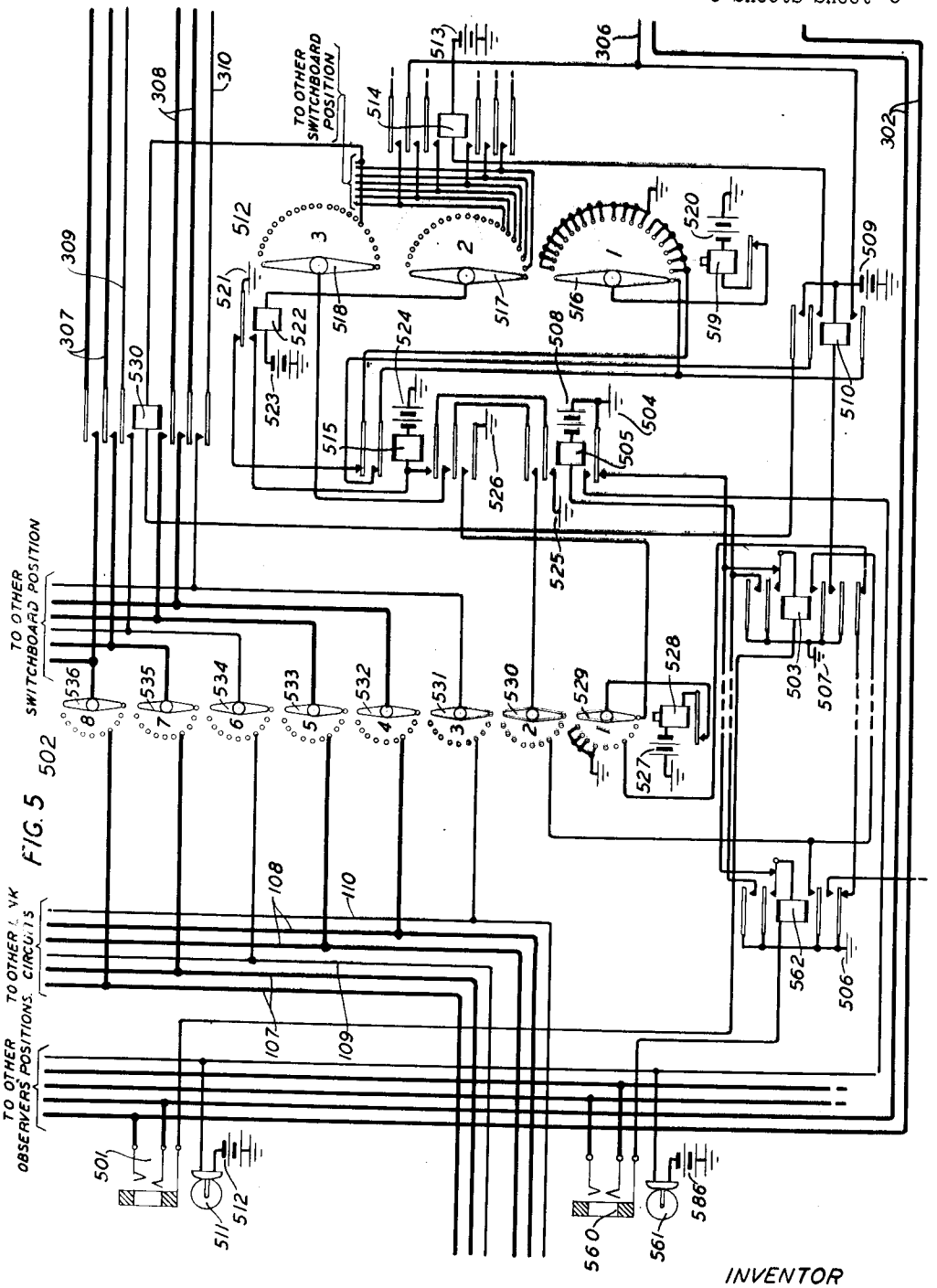


FIG. 5

INVENTOR
H. E. PHELPS
BY
ATTORNEY

Patented Apr. 2, 1935

1,996,213

UNITED STATES PATENT OFFICE

1,996,213

SERVICE OBSERVING SYSTEM FOR TELEPHONE EXCHANGES

Henry Edison Phelps, Tuckahoe, N. Y., assignor to American Telephone and Telegraph Company, a corporation of New York

Application October 10, 1933, Serial No. 693,009

20 Claims. (Cl. 179—175.2)

This invention relates to telephone exchange systems and more particularly to such a system providing means whereby an observer at a central point may determine the character of service being rendered by the telephone operators in establishing connections between subscribers.

This type of central office system, which is commonly referred to as a service observing system, is usually provided in order that the operating supervisors may collect data concerning, for example, the quality of service the subscribers are receiving in general, or the time elements of the service as an aid in determining the circuit and apparatus requirements in various parts of the system, and also that they may have a means for detecting particular irregularities which may have been complained of by certain subscribers. In order that complete data may be obtained a system of this nature should provide means, under control of the observer, whereby progress of a call from its initiation to its completion may be followed and whereby all signals, circuit conditions and operations performed in "building-up" the circuit, maintaining conversational connection and finally "breaking-down" the connection may be observed. For economic reasons it is, of course, desirable that duplication for the specific purpose of providing service observing facilities of the apparatus necessary for the usual steps of completing and supervising the telephone connections, be so far as possible avoided.

An object of the invention, therefore, is to reduce the amount of terminal equipment used at a service observing position.

Another object is to provide automatic means under control of an observer for making connection with any busy telephone channel for purposes of observation.

Still another object is to provide means whereby the condition of the supervisory signals at the operator's position may be indicated at the service observing position.

According to a feature of the invention means are provided whereby the observer's equipment may be connected to a cord circuit being used by a telephone operator in completing a connection.

According to another feature means are included whereby the condition of the supervisory signals at the operator's position may be observed at the service observing position.

According to another feature means are provided whereby the service observing equipment may be connected to both ends of the operator's cord circuit whereupon observations may be maintained on both the calling and called lines even though the circuit between these two lines may be broken within the cord circuit.

A full understanding of the operation of the system contemplated by the invention as well as an appreciation of the various features may be gained from a consideration of the following detailed description read in connection with the annexed drawings in which:

Figure 1 shows a service observer's telephone set and a portion of the associated circuits individual to a service observing position;

Fig. 2 shows a monitoring jack at the service observing position for monitoring on an operator's telephone circuit and a service observing link circuit for connecting the observer's equipment to any cord circuit which the operator may elect to utilize in setting up a connection;

Fig. 3 shows a portion of two telephone lines, an operator's cord circuit used in establishing a connection between such lines and the operator's telephone circuit associated therewith. While the circuit here shown is of the type used to provide toll or long distance connections, the invention is applicable also in the instance of cord circuits of other types;

Fig. 4 and Fig. 5 show modifications of the link circuit shown in Fig. 2; and

Fig. 6 shows the arrangement of the above figures in illustrating the system contemplated by the invention (Figs. 2, 4 and 5 are interchangeable).

Referring now to the drawings let us assume, for purposes of description, that the service observer at observing position No. **3**, shown in Fig. 1, desires to determine the quality of service being rendered by the operator at switchboard position No. **4**, shown in Fig. 3. Assuming that the link circuit provided is of the type shown in Fig. 2, the service observer will insert her plug **101** in jack **201** which is provided at her observing desk and which is individual to operator's position No. **4**. The right hand receiver **102** of the observer's set is thereby connected through amplifier **105**, conductors **103**, break contacts of key **106**, conductors **104**, plug **101**, jack **201**, conductors **302** to the operator's telephone set **301** at switchboard position No. **4**.

Let it be assumed now that the operator receives a call over line conductors **303** and that she elects to use her fifth cord (which we shall assume is the one shown in Fig. 3) in answering the call. She will therefore insert plug **304** in jack **322**. She next operates key **305** which connects her telephone set **301** to the cord circuit and also connects ground **354** through the lower make contact

of the key to conductor 306 which is individual to the fifth cord.

The service observer will, at this point operate her key 106 which disconnects receiver 102 from the monitoring connection previously traced and connects it, through make contacts of key 106, to conductors 107 and thence to the two outer upper make contacts of relay 212. Operation of key 106 also completes a circuit from battery 182, lower make contact of key 106, sleeve of plug 101 and jack 201, conductor 202, winding of relay 203 to ground 353, relay 203 operating over this circuit.

The operation of relay 203 completes a circuit traced from battery 214, lamp 204, conductor 205, middle upper make contact of relay 203, conductor 306, lower make contact of key 305 to ground 354, lamp 204 being energized over this circuit. Lamp 204 is located at the service observer's position and is individual to the fifth cord at whichever switchboard position the service observer is in connection with at the time. The lamp thus, by lighting, indicates to the observer that the operator has elected to use her fifth cord circuit. The other make contacts of relay 203, except the lower outer, are associated with other cords at the switchboard position and with other indicator lamps at the observer's position.

In order to follow the progress of the call further the observer now momentarily operates key 206 which is located at the observer's position and which is individual to the fifth cord circuit at switchboard position No. 4. (Lamp 204 by lighting has, as described above, indicated that the fifth cord circuit is being used by the operator.) Operation of key 206 completes a circuit traced from battery 216, winding of relay 207, conductor 208, upper make contact of key 206, break contact of key 209, conductor 210, lower outer contact of relay 203 to ground 215, relay 207 operating over this circuit. Relay 207 is slow-to-release and remains operated while key 206 is restoring to normal whereupon a locking circuit for the relay is established, traced from battery 216, winding of relay 207, left make contact of relay 207, conductor 211, break contacts of key 250 and key 206, break contact of key 209, conductor 210, lower outer make contact of relay 203 to ground 215.

As relay 207 operates a circuit is completed from battery 218, winding of relay 212, right make contact of relay 207 to ground 217, relay 212 operating over this circuit.

Relay 212, by operating, connects: (1) conductors 107 to monitoring conductors 307 (through the two outer upper make contacts of relay 212) which are connected to the talking conductors at plug 304 the answering end of the cord circuit, (2) conductors 108 to monitoring conductors 308 (through two inner lower make contacts of relay 212) which are connected to the talking conductors at plug 314 the calling end of the cord circuit (3) conductor 109 to conductor 309 (inner upper make contact of relay 212) which is connected to the sleeve circuit at the answering end of the cord circuit, and (4) conductor 110 to conductor 310, (outer lower make contact of relay 212) which is connected to the sleeve circuit at the calling end of the cord circuit.

Right hand receiver 102 of the observer's telephone set is now connected for monitoring on the answering end of the cord circuit over conductors 107 and conductors 307 while left hand receiver 111 is connected for monitoring on the calling end of the cord circuit over conductors 108 and conductors 308. Amplifiers 105 and 112 are shown associated with these respective circuits but need not be included if not required or may be supplanted by other forms of repeating apparatus.

Marginal relay 113 is connected in parallel with the answering supervisory lamp 313 over conductors 109 and 309, while marginal relay 114 is connected in parallel with calling supervisory lamp 317 over conductors 110 and 310. These relays through their operation, which is controlled in a manner now to be described, control the energization respectively of lamps 115 and 116.

As shown telephone line 303 is provided with a supervisory relay 311 which controls the resistance of the line sleeve circuit. When the relay is in operated condition, due to the presence of a talking connection at the other end of the line, the sleeve circuit will present a high resistance path to ground 320 through resistance 319. When the relay is in released condition, however, due to the breaking down of the talking connection at the other end of the line a shunt path of a lesser resistance to ground 320 is provided through the break contact of the relay and resistance 312. The resistances of these respective paths are of such a value that when plug 304 is inserted in jack 322, the current flowing from battery 321 through lamp 313, sleeve of plug 304 and jack 322, resistance 319 to ground 320 will not be sufficient to light lamp 321 but, if the path to ground be completed through resistance 312 instead of through resistance 319, the current flow will be sufficient to cause lamp 313 to light. It is evident therefore that, when the cord circuit is connected to line 303, answering supervisory lamp 313 will remain dark on the high resistance sleeve circuit present on a held line but will be lighted on the low resistance sleeve circuit present when the line is released. Now marginal relay 113 at the service observing position operates in a manner similar to lamp 313 just described, i. e., when the operating circuit is completed from battery 323 through the winding of relay 113, conductor 109, inner upper make contact of relay 212, conductor 309, sleeve of plug 304 and jack 322 and through resistance 319 to ground 320, the current flow is not sufficient to cause operation of relay 323, but when the path to ground is completed through break contact of relay 311 and resistance 312 instead of through resistance 319, the current flow is sufficient that the relay operates. Operation of relay 113 in turn completes a circuit for energization of lamp 115, traced from battery 325, lamp 115, make contact of relay 113 to ground 324. Therefore as relay 113 operates in step with lamp 313 and as it controls by its operation the energization of lamp 115 at the service observing position, the observer, by noting the condition of lamp 115, may ascertain the condition of answering supervisory lamp 313 at the switchboard position. In a like manner lamp 116 at the service observing position indicates the condition of calling supervisory lamp 317.

The switchboard operator, having inserted answering plug 304 in jack 322 and having operated key 305 as mentioned above, now converses with the calling party and obtains whatever information is needed to complete the call. The observer, through the monitoring connections to the answering and calling cords traced above, is enabled to listen to the conversation between the operator and the calling party.

Assuming that the operator finds that the calling subscriber desires a connection with line 315;

she will insert plug **314** in jack **326**. Now line **315** has a circuit similar to that of line **303** and as the line is open at its distant end a low resistance sleeve circuit will be presented and calling supervisory lamp **317** will light. (As pointed out above the operation of lamp **317** is similar to that of lamp **313** which has been explained.) The lighted condition of lamp **317** is indicated to the observer as relay **114** and lamp **116** at the service observing position operate, as pointed out above, in step with lamp **317**.

The operator having inserted calling plug **314** in the jack of the desired line operates her ringing key **316** which places ringing potential across the tip and ring conductors of the desired line, thereby causing operation of the signaling relay in the line. As monitoring conductors **308** are also connected across the tip and ring of the calling cord, connection of ringing potential to the tip and ring by operation of key **316** is repeated through conductors **308**, conductors **108** and through amplifier **112** to receiver **111**, this connection causing a click in the receiver and indicating to the observer that ringing potential has been applied to the called line. A second click, caused by release of key **316**, indicates to the observer the removal of ringing potential.

Now when the called party responds, calling supervisory lamp **317** is extinguished due to the increased resistance of the sleeve circuit and lamp **116** at the service observing position is likewise extinguished indicating to the observer the response of the called party.

The observer is now enabled to listen to the conversation of the calling and called parties and to observe the condition of the various supervisory signals. As receiver **102** is connected to the answering end of the cord and receiver **111** to the calling end; the observer will be able to monitor on each line even though the operator may operate one of the "cord splitting keys" such as **318** in order to converse with one of the parties to the exclusion of the other. Should the operator disconnect one or both ends of the cord circuit from the connected lines in order to connect them with other lines, the observer will remain connected to the same cord for observation thereon.

After the parties have been connected and the conversation has been started, the operator will ordinarily release her key **305** thereby disconnecting her telephone set from the cord circuit. Release of key **305** removes ground **354** (lower make contact of key) from conductors **306** and **205** thereby interrupting the energizing circuit of lamp **204**. The lamp is therefore extinguished indicating to the observer that the operator has disconnected her telephone set from the cord circuit.

Now when the observer wishes to disconnect from the cord circuit, either before or after the termination of the conversation she releases key **106**. Release of key **106** returns receiver **102** to a monitoring connection on the operator's telephone set (through plug **101**, jack **201** and conductors **302**) and removes battery **182** from the sleeve of plug **101** thereby interrupting the operating path of relay **203** which releases. Release of relay **203** in turn removes ground **215** (lower outer make contact of relay **203**) from conductor **210** thereby interrupting the holding circuit of relay **207** which thereupon restores to normal. Release of relay **207** in turn removes ground **217** from the operating circuit of relay **212** which thereupon restores to normal thereby opening the monitoring and supervisory connections between the two ends of the cord circuit and the observer. The observer may now withdraw her plug from monitoring jack **201** or may, by again following a procedure similar to that outlined above, observe on other cords of the same operator's position.

It will be apparent from the above that the observer has been enabled to follow the progress of the call from its initiation to its completion, to observe the operation of the various supervisory signals, to monitor on the conversations of the subscribers and that of the operator, in short, to obtain complete information relative to the service rendered.

Let it now be assumed that the circuits of Fig. 1 and Fig. 3 are connected through a link circuit of the type shown in Fig. 4 instead of through the circuit of Fig. 2. The arrangement shown in Fig. 4 may be used when it is desired to follow the operations of the switchboard operator from one cord to another as she shifts her own connections from cord to cord. The circuit of Fig. 4 operates in conjunction with the circuits of Fig. 1 and Fig. 3, the operation of which circuits have been described in detail above.

Assuming now that the observer inserts her plug **101** in jack **401** and operates her key **106**, battery **182** is thereby connected through the lower make contact of key **106**, sleeve of plug **101** and jack **401**, conductor **402**, through the winding of relay **403** to ground **406**, relay **403** operating over this circuit. Operation of relay **403** connects a plurality of relays, such as **412**, each of which is individual to a cord circuit at switchboard position No. 4, to the conductors leading to contacts of the respective cord circuit "talk" keys. In the instance of relay **412**, illustrated, the connection is through conductor **306** which leads to key **305**.

Assuming again now, as we did when describing the previous system including Fig. 2, that the switchboard operator elects to utilize her fifth cord in answering a call, she will operate "talk" key **305** thereby connecting ground **354** to conductor **306**. This completes the operating circuit of **412** which, when operated, connects the monitoring and supervisory conductors of the observing position to the calling and answering ends of the fifth cord, in a manner similar to that described above in connection with the operation of relay **212**.

Now should the operator release key **305** and operate a similar key in one of her other cord circuits, ground **354** will be removed from conductor **306**, thus interrupting the operating circuit of relay **412** which releases and opens the observing connections to the fifth cord while the operating circuit of a relay similar to **412**, but associated with the other key operated, will be completed, thus connecting the observer to the next cord. That is, each time one key, such as **305**, is released and another operated, an associated relay, such as **412**, is at the same time operated thus keeping the monitoring and supervisory conductors of the observer's position in connection with the particular cord being used by the operator.

The circuits of Figs. 1 and 3 may also be connected by the type of link circuit shown in Fig. 5. This type of link circuit may serve a plurality of switchboard positions, two positions being served by the circuit illustrated. Jack **501** is associated with position #4 while jack **560** might, for example, be associated with position #5. The complete circuit associated with jack **560** is not il-

lustrated in detail, as it is similar to that associated with jack 501 which is shown, but it might be here pointed out that each jack has associated with it relays, (in the instance of jack 501, relays 503 and 510 and in the instance of jack 560, relay 562 and a relay similar to 510, not shown) which serve to direct the link, when seized, to the proper position. Lamps, such as 511 and 561, are associated with each jack to indicate when a common link is in use. These lamps are connected in multiple so that they are energized simultaneously. A group lamp, common to all the positions served by the one link circuit may of course, be utilized if desirable rather than a lamp individual to each position. The link circuit is provided at each end with a selector, selector 502 serving to "find" or select the conductors leading to the proper observer's position and selector 512 serving to "find" or select the conductors leading to the proper cord circuit. The wiring of the selectors has not been completely shown, in the instance of selector 502, only the wiring of the fourth contacts of each arc, which are associated with observer's position #3, being completely shown and in the instance of selector 512, only the wiring associated with cord #5 being completely shown.

Referring now to the system of Figs. 1, 5 and 3, let us assume, as before, that the observer inserts her plug 101 in jack 501 thereby connecting right-hand receiver 102 over conductors 104 and 302 for monitoring on operator's telephone set 301. The observer now operates key 106 which completes a circuit from receiver 102, amplifier 105, conductors 103, outer upper and inner lower make contacts of key 106, conductors 107 to the fourth contacts of the seventh and eighth arcs of selector 502. Operation of the key also connects battery 182 through the sleeve of plug 101 and jack 501, winding of relay 503, upper break contact of relay 503, break contact of relay 505 to ground 504, relay 503 operating over this circuit.

Operation of relay 503 (1) removes ground 506 from the fourth contact of arc #1 of selector 502 (previously supplied through lower break contact of relay 503) and connects ground 507 to the fourth contact of arc #2 of the selector (lower inner make contact of relay 503), (2) removes ground 504 from its own operating circuit and substitutes a holding ground 507 (inner upper make contact of relay 503), (3) completes a circuit from battery 506, winding of relay 505, upper outer make contact of relay 503 to ground 507, relay 505 operating over this circuit, and (4) completes a circuit from battery 509, winding of relay 510, lower outer make contact of relay 503 to ground 507, relay 510 operating over this circuit.

The operation of relay 505 completes a circuit from battery 512, lamp 511, lower outer make contact of relay 505 to ground 504, as well as a circuit from battery 566, lamp 561, lower outer make contact of relay 505 to ground 504, lamps 511 and 561 being lighted over this circuit to indicate to other observers that the common link circuit is in use.

Now, assuming that the operator has operated her "talk" key 305, a circuit is completed from battery 513, winding of relay 514, upper inner make contact of relay 510, upper inner break contact of relay 515, lower outer make contact of relay 510, conductor 306 to ground 354, relay 514 operating over this circuit. Ground 354 is also applied, through conductor 306 and lower outer make contact of relay 510, to the first contact of arc #1 of selector 513 thereby completing a circuit through brush 516, break contact and winding of stepping magnet 519 to battery 520, this circuit being effective to start selector 512. By the operation of relay 514, ground 354 is also applied through conductor 306 and middle upper make contact of relay 514 to the sixth contact of arc #2 of selector 512.

Selector 512 having been started, as previously mentioned, continues its stepping action by virtue of an operating circuit traced from battery 520, winding of stepping magnet 519, break contact of stepping magnet 519, brush 516 and contacts of arc #1 of selector 512, upper outer break contact of relay 515 and upper break contact of relay 522 to ground 521. This stepping action continues until the sixth contacts of the arcs are reached whereupon a circuit is completed from battery 523, winding of relay 522, brush 517, sixth contact of arc #2 of selector 512, middle upper make contact of relay 514, conductor 306, lower make contact of key 305 to ground 354, relay 522 operating over this circuit.

The operation of relay 522 interrupts, at its upper break contact, the operating circuit traced above by which the stepping magnet 519 of selector 512 was energized and the selector therefore stops with its brushes, 516, 517 and 518 in engagement with the sixth contacts of arcs #1, #2 and #3 respectively. The operation of relay 522 also completes a circuit traced from battery 524, winding of relay 515, upper make contact of relay 522 to ground 521, relay 515 operating over this circuit.

Relay 515, upon operating, locks up on a circuit controlled by relay 505, traced from battery 524, winding of relay 515, lower inner make contact of relay 515, upper inner make contact of relay 505 to ground 525 and, by its operation, (1) completes a path from battery 527, winding of stepping magnet 528, break contact of stepping magnet 528, brush 529 and first contact of arc #1 of selector 502, lower outer make contact of relay 515 to ground 526, stepping magnet 528 being energized over this path to start the brushes of selector 502, and (2) interrupts, at its upper inner break contact, the energizing path of relay 514 which thereupon releases.

Release of relay 514 interrupts, at its middle upper make contact, the energizing circuit of relay 522 which thereupon releases. The release of relay 522 does not again start selector 512 (energizing circuit thereof previously completed through break contact of relay 522 when in released condition) however, as the energizing circuit of stepping magnet 519 has been previously interrupted by operation of relay 515.

The stepping action of magnet 528 having been started, as stated, above, continues as ground is applied to each contact of arc #1 from relays (similar to 503) associated therewith, until the brushes reach the fourth contacts of the arcs when the energizing circuit is interrupted, relay 503 being in operated condition thereby removing ground 506 from the fourth contact of arc #1, and the selector brushes stop.

Now with the brushes of selector 502 in contact the fourth contacts of the associated arcs and with the brushes of selector 512 in contact with the sixth contacts of the associated arcs, a circuit is completed to operate relay 530, traced from battery 509, upper outer make contact of relay 510, winding of relay 530, sixth contact of arc #3 of selector 512, brush 518, lower middle

make contact of relay 515, upper outer make contact of relay 505, brush 530 and fourth contact of arc #2 of selector 502, lower inner make contact of relay 503 to ground 507, relay 530 operating.

As previously pointed out monitoring conductor pairs 107 and 108 are connected to the fourth contacts of arcs #7 and #8 and arcs #4 and #5 respectively of selector 502 and operation of relay 530 connects these conductors, through its two outer upper and its two inner lower make contacts, to conductor pairs 307 and 308 respectively and through these last mentioned conductors to the answering and calling ends of the cord circuit. In the same manner supervisory conductors 109 and 110 are connected through conductors 309 and 310 to the sleeve circuits of the answering and calling cords.

As in the instances of the two systems previously described, the observer through conductors 307 and 308 is now enabled to monitor on the conversations of the two subscribers as well as that of the operator and is, by operation of lamps 116 and 115, appraised of the conditions of the supervisory signals 313 and 317. In fact the functioning of the system, in general, is similar to that described above, the type of connecting link circuit alone being different.

Assuming now that the observer, having finished her check, removes her plug 101 from jack 501 (or restores key 106 to normal position), the energizing circuit of relay 503 is interrupted by removal of battery 182 and the relay therefore restores to normal. The release of relay 503, (1) places ground 506 on the fourth contact of arc #1 of selector 502 thus completing an energizing circuit for stepping magnet 528 and starting the brushes which continue to rotate until they reach normal position or until another ungrounded contact is found on arc #1, (2) interrupts the operating path of relay 510 by removal of ground 507, relay 510 thereby restoring to normal and (3) interrupts the energizing path of relay 505 by removal of ground 507, relay 505 thereupon restoring to normal.

Release of relay 510 interrupts the operating path of relay 530 by removal of battery 509, relay 530 thereupon restoring to normal, while the release of relay 505, by removing ground 525 from the holding path of relay 515, causes its release. Release of relay 515 extends the operating path of selector magnet 519 through its (relay 515) upper outer break contact to the break contact of relay 522 and thereby to ground 521, the stepping magnet being energized over this circuit to rotate the selector brushes to normal position.

The circuits now having been restored to normal condition may be utilized for the next observation.

While certain specific embodiments of the invention have been selected for illustration and description, it is not intended to indicate that the invention is so limited. It is, in fact, intended to indicate the limitations of the invention only by the attached claims.

What is claimed is:

1. In a service observing system, a busy telephone channel, a cord circuit associated therewith and means for observing on the busy telephone channel at any time while the cord is associated therewith, said means including conductors independent of the telephone channel connected to the cord circuit associated with the busy channel.

2. In a service observing system, a service observing position, a telephone operator's position, a cord circuit at said operator's position comprising answering and calling cord conductors for interconnecting telephone lines, and automatic means for connecting the service observing position to said answering and calling cord conductors for purposes of observation.

3. In a service observing system, a service observing position, a telephone operator's position, an operator's cord circuit at said operator's position including answering and calling cord conductors for interconnecting telephone lines, and automatic means initiated at the service observing position for connecting the service observing position to the answering and calling cord conductors.

4. In a service observing system, a means for observing on a busy telephone channel comprising conductors connected to each end of an operator's cord circuit independent of the plug terminals of said cord circuit.

5. In a service observing system, an operator's cord circuit, a service observing position, and link circuits connecting each end of said cord circuit independently to said position.

6. In a service observing system, telephone lines, a service observing position, an operator's position, a plurality of cord circuits for interconnecting said telephone lines at the operator's position, a key associated with each cord circuit, a link circuit independent of said telephone lines, means for connecting one end of the link circuit to the service observing position, and means controlled by operation of a key associated with one of the cord circuits for connecting the other end of the link circuit thereto.

7. In a service observing system, a service observing position, an operator's position, a plurality of jacks at the operator's position, telephone lines terminating at said jacks, cord circuits at the operator's position for interconnecting the telephone lines, means at the service observing position for monitoring on a telephone line connected by a cord circuit and means, also at the observing position, for indicating the condition of the sleeve circuit associated with said connected line.

8. In a telephone exchange system, a service observing position, a plurality of operators' positions, a plurality of cord circuits associated with each operator's position, a link circuit and an automatic switching mechanism at each end of the link circuit, one switching arrangement serving to connect one end of the link circuit to one of the cord circuits and the other switching arrangement serving to connect the other end of the link circuit to the service observing position.

9. In a telephone exchange system, a service observing position, an operator's position, a plurality of jacks at the operator's position, telephone lines terminating at said jacks, supervisory signals at the operator's position for indicating the condition of said telephone lines and signals at the observing position for indicating the condition of said supervisory signals.

10. In a service observing system, a service observing circuit, an operator's position, telephone lines terminating at said operator's position, link circuits at said operator's position for interconnecting said telephone lines and means for connecting each end of one of said link circuits independently to said service observing circuit for observing on said link circuit.

11. In a telephone exchange system, a service observing position, an operator's position, a plu-

rality of jacks at the operator's position, telephone lines terminating in said jacks, a plurality of link circuits for interconnecting said telephone lines and means for connecting each end of one of said link circuits independently to the service observing position for observing on said link circuit.

12. In a telephone exchange system, a service observing position, an operator's position, telephone lines terminating at the operator's position, a plurality of link circuits at the operator's position for interconnecting the telephone lines, means for connecting the service observing position and the operator's position, and means at the observing position for indicating which link circuits are being used for interconnecting said lines.

13. In a service observing system, a service observing circuit, a plurality of operator's cord circuits for interconnecting telephone lines and means operating without attention on the part of the service observing operator for connecting the observing circuit independent of said telephone lines in turn to each cord circuit utilized for interconnecting the telephone lines.

14. In a service observing system, telephone lines, a plurality of telephone operators' positions, an operator's telephone circuit at each of said operators' positions, a plurality of cord circuits for interconnecting said telephone lines at each of said operators' positions, means for connecting any of said operator's telephone circuits to any cord circuit at her position, a plurality of service observing circuits, means for connecting one of said service observing circuits to any one of said operator's telephone circuits, other means for disconnecting said service observing circuit from the operator's telephone circuit, and automatic switching means, jointly responsive to the operation of said other means and said means for connecting the operator's telephone circuit to a cord circuit, for establishing a connection independent of the telephone lines and the operator's telephone circuit between the service observing circuit and the cord circuit connected to the operator's telephone circuit.

15. In a service observing system, telephone lines, a plurality of telephone operators' positions, an operator's telephone circuit at each of said operators' positions, a plurality of cord circuits for interconnecting said telephone lines at each of said operators' positions, means for connecting any of said operator's telephone circuits to any cord circuit at her position, a plurality of service observing circuits, means for connecting one of said service observing circuits to any one of said operator's telephone circuits, other means for disconnecting said service observing circuit from the operator's telephone circuit, and automatic switching means, jointly responsive to the operation of said other means and said means for connecting the operator's telephone circuit to a cord circuit, for establishing independent connections between each end of the cord circuit connected to the operator's telephone circuit and the service observing circuit.

16. In a service observing system, telephone lines, an operator's cord circuit for interconnecting said telephone lines, an operator's telephone circuit associated with said cord circuit, a service observing position and a link circuit independent of said telephone lines and of said operator's telephone circuit, for connecting said cord circuit and said observing position for observing on said cord circuit.

17. In a service observing system, telephone lines, a service observing circuit, a plurality of operators' cord circuits for interconnecting said telephone lines, and means including an automatic selector switch for connecting said service observing circuit independent of said telephone lines with one of said cord circuits for observing thereon.

18. In a service observing system, telephone lines, a plurality of service observing circuits, a plurality of operators' cord circuits for interconnecting said telephone lines, and means including an automatic selector switch for connecting one of said service observing circuits independent of said telephone lines with one of said cord circuits for observing thereon.

19. In a service observing system, telephone lines, a service observing position, a plurality of operators' cord circuits for interconnecting said telephone lines, an operator's telephone circuit associated with said cord circuits, and means controlled at said service observing position for connecting said position independent of said telephone lines and of said operator's telephone circuit with one of said operators' cord circuits for observing thereon.

20. In a service observing system, telephone lines, a plurality of service observing positions, a plurality of operators' cord circuits for interconnecting said telephone lines, and means including a plurality of automatic selector switches for connecting one of said positions independent of said telephone lines with one of said operators' cord circuits for observing thereon.

HENRY E. PHELPS.