J. F. CASEY.

TELEPHONE SYSTEM.

No. 394,832. Patented Dec. 18, 1888.
To all whom it may concern:

Be it known that I, JOHN F. CASEY, a citizen of the United States, residing at St. Louis, in the State of Missouri, have invented certain new and useful Improvements in Telephone Systems, of which the following is such a full, clear, and exact description as will enable any one skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, forming part of this specification.

My invention relates more particularly to improvements in trunking between central offices, being more particularly adapted but not necessarily confined to the telephone system known as the "Law system" and described in United States Patents Nos. 220,874, 278,613, and 319,880, the first mentioned granted to F. Shaw and the last two to F. Shaw and W. A. Childs.

My invention relates more especially to an improvement in the method of trunking between central offices described in Patent No. 278,613, aforesaid.

The object of the invention is to facilitate trunking between central offices, so as to save time and render the service better.

The invention consists, briefly, in an extended call-circuit between central offices, which extended call-circuit is provided with one or more operators' outfits, and also in providing the switch-boards at said central offices with a trunking-section or devices and means whereby trunking-connections can be quickly made at each office.

I will now proceed to describe my invention in detail by referring to the accompanying drawings, in which—

Figure I is a diagrammatic view of my invention applied to two central offices in which any system of telephone-exchange may be employed. Fig. II is a diagrammatic view showing my invention applied to the Law system between two large central offices. Fig. III is a diagrammatic view of my invention applied to the Law system between a large central office and a small one, showing also a modification of the switch-board at the large station.

The same figures of reference indicate the same or corresponding parts throughout the several views.

I have designated in the diagram the two offices by "central office A" and "central office B," where the central offices are large ones—such as would be located in large cities; and where a small central office is illustrated I have designated it by a corresponding small letter, as in Fig. III, where I have indicated the same by "central office b," which is such an office as would be in a small town where but little telephonic communication is carried on.

Having more particular reference to Fig. I, central offices A and B are to be considered as having any number of subscribers connected with said offices, only a few subscribers being shown to prevent confusion. Any system of connecting the subscribers of the same central office with each other may be supposed to be employed. When it is desired to connect one subscriber with a subscriber in another central office by the methods now in vogue, great delay and embarrassment ensue. In the first place, the subscriber calls to the central office. The central office makes connection with the other central office, calls said second office, and asks for the subscriber called, so that the operator at the first central office has to signal the second central office, ask for the desired subscriber, and the second central office then makes the connection, giving the called subscriber one of the trunks, the operator at the first-mentioned central office doing the same. Here we have several operations to reach the desired subscriber, which takes a great deal of time and is very unsatisfactory. In my invention I provide each central office with a call-circuit and extend said call-circuit to the other central office, and there provide said circuit with an operator's outfit, the said call-circuit being always intact and extending permanently from one central office to the other. By this means, when the central office A, for instance, receives a call for a subscriber in central office B, the central office A calls for the subscriber asked for, and the said call is heard in the central office B at the same time that it is heard in the central office A, so that connection can be made at the same time at central office B that it is made at central office A, for both operators that make the connections in each office hear the call at the same time. This obviates
the necessity of the central office A first making connection with central office B, then calling up said central office B, and then waiting until said central office B makes the connection. By my invention a connection can be made between subscribers connected with different central offices as expeditiously as between subscribers belonging to the same central office. As a matter of fact, in practice, by my invention, which I have now in constant daily use, I am enabled to make connections quicker between subscribers belonging to different stations than those belonging to the same station.

15 1 2 3 4 in the diagram of Fig. I represent trunk-lines, which extend from one central office to another.

7 is the extended call-circuit, which extends permanently between the central offices and is always intact. It preferably passes around each central office, and may be provided with one or more operators’ outfits at each office. It may be suitably grounded at each office or near the central-malleable circuit in itself. The same is shown in Fig. I a subscriber belonging to central office A talking to a subscriber belonging to central office B, and also a subscriber of central office B talking to a subscriber in central office A. It is to be understood in trunking from one office to another that certain trunk-wires are to be used—say the wires having the odd numbers when talking from office A to office B and the wires having the even numbers when talking from office B to office A. This being settled upon beforehand no confusion arises. To prevent the operator from breaking in on a circuit or wire when the same is in use, the Law system employs means to indicate that the line is busy before disturbing the line or breaking in on it, the same being described in Patent No. 319,855 asforesaid. This makes no part of my invention, but is used in connection with it to prevent the operator from breaking in on a trunk-wire or subscriber when they are busy, so that confusion does not arise, each wire being subjected to a busy test before connection is made. I have shown in Fig. I some of the lines provided with one subscriber and some with several. It may be here remarked that individual-subscriber circuits may be used, or circuits having several subscribers on the same may be employed. These features make no difference so far as my invention is concerned.

Having now more particular reference to Fig. II, 1 2 3 4 5 6 are the trunk-wires, as before, and 7 the extended call-circuit, as previously described. The switch-boards at the two central offices are those known as the "Law switch-boards," which are described in the patents above, said switch-boards being made up of sections X, Y, and Z with a trunk-section T at the end of each. An operator presides over each section of the switch-board, or two operators may preside over each section of the switch-board, which is preferably horizontally arranged, one of said operators being on each side of the same. For the sake of clearness, however, I will describe each section of the switch-board as presided over by one operator.

Each operator takes care of a certain number of subscribers which are all located in a common call-circuit, there being as many call-circuits as there are sections to the switch-board. An individual talking-circuit runs from each subscriber to the central office. In the diagram I have represented several call-circuits passing around to a multiplicity of subscribers therein, but show only two subscribers to each call-circuit connected by an individual talking-wire with the central office, said individual talking-wire being shown as grounded at the subscriber’s end. The fixed terminal of each talking-circuit is present in every section of the switch-board, so that the fixed terminal of the individual wires occur as many times in the entire switch-board as there are sections in the switch-board. The fixed terminals are represented diagrammatically by black dots. At the center of each section of the switch-board is a series of flexible or extensible connections, which I have represented diagrammatically by small circles to distinguish them from the fixed terminals. Each subscriber has a flexible or extensible terminal. The flexible connections of the subscriber in the call-circuit of a certain operator will occur in the section of the switch-board presided over by said operator. I have represented in the diagram by a dotted line the flexible or extensible terminals connected with their respective individual talking-circuits. I have represented the operators taking care of the different sections by corresponding small letters x, y, and z. The subscribers in the signalling-circuit taken care of by operator x would have a fixed terminal in each section of the board and a flexible or extensible terminal in the section X of the board only. Two subscribers are shown in the diagram as having such terminals in each section of the board.

It will be seen that the sum of the flexible or extensible terminals in the sections X, Y, and Z is equal to the number of fixed terminals in each section. These features are not part of my invention, but constitute the Law system, and are here alluded to to illustrate how my invention can be applied to such system, and to illustrate the advantages that will accrue by using my invention in connection with the same.

T is the trunking-section. Each individual talking-circuit has a fixed terminal in the trunking-section T, as clearly shown in the diagram. The trunk-wires terminate in said section as flexible or extensible terminals. Passing around the switch-board to each operator is the circuit 7, which has an operator, 8, therein at the trunk-section at station A. This circuit 7 is extended to central office B, and there passes around to each
operator at the different sections of the switch-board at central office B. This circuit may be a complete metallic circuit or may be suitably grounded, as shown in the diagram. At the central office B the circuit 7 is provided with an operator, 9, located at the trunking-section T. Each of the operators at the different sections of the switch-board at the two offices is provided with a transmitter, which may be thrown in the circuit 7 at the will of the operator by actuating a switch near each of said operators. Should one of the subscribers of operator 8 at central office A call for a subscriber in central office B, the operator 8 immediately switches her transmitter in the call-circuit 7 and announces the fact, which is heard by the trunk-operator 8 at central office A, and is simultaneously heard by the trunk-operator 9 in the extended call-circuit at central office B. The operator 8 thereupon takes a flexible connection of one of the odd trunk-wires and puts it in the fixed terminal of the calling subscriber, and the operator 9 simultaneously holds off of the flexible end of the corresponding trunk-wire and places it in the fixed terminal of the called subscriber. I have shown clearly in the diagram these connections, having represented by arrows the path of the circuit.

Should a subscriber in the call-circuit of operator 8 at central office B call for a subscriber in central office A, the same operation is repeated. The operator 8 puts her transmitter in the call-circuit 7 and announces to the trunk-operator 8, as well as to the trunk-operator 9, that a trunk-connection is to be made, and the trunk-operator 8, simultaneously with the trunk-operator 9, makes the required connection. I have represented also in the diagram a subscriber of operator 8 in central office B talking with a subscriber belonging to operator 8 at central office A, the path of the circuit being represented by arrows, as in the previous case. It will be noted that any other connections may be made at will.

It will be noted, further, that the trunk-operators have before them all the subscribers in the two offices, and can make any connection rapidly and expeditiously.

It will be apparent also by my invention that the two can practically make the connections in the same time, and thus that no more time is employed in making the two connections than would be in making one connection, for the two operators move together in their operations and receive the announcement at the same instant. When any operator receives a call for a subscriber of her own city, she, of course, does not call into the circuit 7. She leaves her transmitter for said circuit in its normal condition and takes the flexible terminal of her own subscriber and connects it with the fixed terminal of any of the subscribers in her city, all of which fixed terminals are before her. She presides only over the flexible terminals of the subscribers in her call-circuit. This latter is the Law system, and is here referred to to distinguish it from the trunking operation just described.

In Fig. III is shown a modification of the switch-board at central office A, and also a small central office connecting trunk-wires with the large central office A. It may be here remarked that the same form of switch-board as shown in Fig. II could be used at central office A, and, vice versa, the switch-board shown in Fig. III could be used in place of the switch-board shown in Fig. II. The modification in the switch-board relates only to the trunking-section circuits and terminals, the switch-board in every other respect being the same as heretofore alluded to. In this switch-board I carry the odd-numbered trunk-wires through every section of the board, and have a terminal of each of said odd trunk-wires in each section of the board. These terminals are designated by T. These are the trunk-wires that are used in trunking from the large station to the small one. The other wires, 2, 4, terminate in a flexible connection at the trunking-section T, as before. The terminals 2, 4, are fixed terminals. The terminals of the lines 2, 4 are arranged peculiarly, at one side of the section T. The flexible terminals at the center of the section T may be flexible terminals of subscribers of central office A. The operator to section T will therefore have his subscribers to attend to, and may also make the trunking connections in addition to his trunking duties. At central office B, I have shown but one section, X, of the switch-board; but any number of sections may be used to accommodate the subscribers of said central office. The trunking-wires 1 2 3 4 terminate in fixed connections, preferably to one side of the switch-board, at central office B. At this central office I have shown but nine terminals and illustrated the connections for but four subscribers. The number of flexible connections at the center of the board is equal to nine—the number of subscribers at said office, as before explained. The call-circuit 7 passes around the central office A to all the operators, as previously described, and is extended to the central office B, where it is grounded or provided with a return-circuit and furnished with a receiver, 3, as before. The receiver 8 in said extended call-circuit, referred to in the previously-described arrangement at central office A, is dispensed with. The subscribers' call-circuit, presided over by operator 8 at central office B, is extended to central office A, and is there provided with a receiver, 10, so that the receiver 10 receives every call that is made by the subscribers at central office B. The operator to said receiver 10, however, takes no notice of any of these calls except when they are for subscribers at central office A. The operator 10 may take care of the calls received on the telephone 10 and make trunking-connections in addition to her regular duties, or a sepa-
rate operator may be located at receiver 10. Where the central office b is very small, the operator x at said office makes connections between all of her own subscribers, and also makes the trunking-connections, the calls of which are received at telephone 9. The advantage of the switch-board at central office A in this modification is that each operator at the different sections can make her own trunking-connections with central office b. While making these connections she switches her transmitter in the call-circuit 7 and notifies the operator at central office b that one of the subscribers at central office b is desired. The operator at said latter station connects the flexible terminal of said subscriber to the trunk-wire, and the connection is made at central office b practically simultaneously with the connection at central office A. In the diagram in Fig. III I have represented one subscriber of operator x at central office A talking with a subscriber at central office b, and have shown in said diagram the connections for the same and the path of the circuit. I have also represented in said diagram a subscriber at central office b talking with a subscriber at central office A, and represented the connections and path of the circuit as before. In making the latter connection it will be noted that the operator at central office A hears the calls in receiver 10 at the same time that the operator x at central office b does, who presides over the subscribers at said central office. Therefore the operator at central office A can make the trunking-connection as quickly as the operator at central office b, and does so simultaneously with the operator at central office b, so that a connection between the subscribers of different central offices can be made in the same time as between subscribers of the same central office. It is to be observed that the operators x, y, and z at central office A cannot make the trunk-connections except when a subscriber of the large office desires a subscriber of the small office. When a subscriber of the small office desires a subscriber of the large office, the trunking-connections at the large office must be made by an operator at the section T. It will be obvious that my invention can be used from any central office to any other central office, and that by an extension or multiplication of the circuits and connections any central office may be provided with trunking facilities extending to several central offices; also, that two or more extended call-circuits could be used where one was not sufficient to accommodate the business between central offices. Having now fully set forth my invention and described its operation and advantages, what I wish to claim and secure by Letters Patent of the United States as my invention is:

1. The combination, with central-office exchange systems, of trunk-wires extending between the same, connections at each office for establishing communication between any subscriber and any of said trunk-wires, so that any subscriber may be coupled with any other subscriber at the different offices, a switch-board-operator's call-circuit extending between said central offices, passing to switch-board operators, and an operator's outfit for said extended call-circuit at each of said offices, for the purpose described.

2. The combination, with two central offices, of trunk-wires extending between said offices, connections at said offices whereby any subscriber may be connected with any trunk-wire and with any subscriber of the other office, a switch-board-operator's call-circuit at one of said offices extended to the other office, and passing to switch-board operators at the different offices, and an operator's outfit in said call-circuit at each office, for the purpose described.

3. The combination, with central-office exchange systems, of trunk-wires extending between said offices, connections at said offices for connecting any subscriber with any trunk-wire, so that any subscriber may be connected with any other subscriber at the different offices, a switch-board operator's call-circuit passing to switch-board operators permanently intact and extending between said central offices, and an operator's outfit permanently located in said extended call-circuit at the different offices, for the purpose described.

4. The combination, with central-office exchange systems having switch-boards made up of sections, substantially as X Y Z, &c., and provided with a trunking-section, of a series of trunk-wires extending between said central offices, connections at said central offices for giving said trunk-wires to the subscribers at the different offices, a call-circuit extending between said offices, a trunk-operator's outfit permanently in said call-circuit at each office, a switch-board operator's outfit at each section of the switch-board at each of said offices normally disconnected from said extended call-circuit, and switches for throwing said last-mentioned outfits into said extended call-circuit at will, for the purpose described.

5. The combination, with telephone-exchange systems having a switch-board known as the "Law switch-board," made up of sections, as X Y Z, &c., and having also a trunking-section, of trunk-wires extending between said exchange systems, fixed and flexible or extensible connections for connecting any subscriber with any other subscriber of said system, operators, as x y z, &c., presiding over said sections of the switch-board and taking care of a certain number of subscribers located in a common call-circuit, an individual talking-wire extending to each subscriber at each system, a call-circuit extending between said systems and passing to each operator, and an operator's outfit permanently in said extended call-circuit at the trunking-section of each switch-board, for the purpose described.
6. The combination, with telephone-exchange systems having a switch-board known as the "Law switch-board," and made up of sections, as X, Y, Z, &c., and having also a trunking-section, trunk-wires extending between said exchange systems, fixed and flexible terminals for connecting any subscriber with any other subscriber of said systems, operators, as x, y, and z, each taking care of the different sections and presiding over a certain number of subscribers in a common call-circuit, an individual talking-circuit for each subscriber, a call-circuit extending between said systems passing to each operator, an operator's outfit permanently in said call-circuit at the trunking-section at each office, an operator's outfit at each section of the switch-board normally disconnected from said extended call-circuit, and switches for putting said latter outfits in the extended call-circuit at will, for the purpose described.

7. A telephone-exchange system having a switch-board-operator's call-circuit extended to another exchange system and passing to switch-board operators at the different offices, and a receiver permanently in said circuit at the latter office, for the purpose described.

8. The combination, with a large telephone central office provided with the Law system of exchange, substantially as set forth, and a small exchange system of the same character as described, of trunk-wires extending between the two systems, fixed and flexible connections for connecting any subscriber with any other subscriber belonging to the two systems, a call-wire passing to each operator at the large station and extended to the small station, a receiver in said extended call-circuit at the small station, a subscriber's call-circuit at the small station provided with a receiver thereat and extended to the large station, and a receiver in said last-mentioned extended call-circuit located at said large station, for the purpose described.

9. The combination, with central-exchange systems provided with switch-boards known as the "Law switch-boards," substantially as set forth, trunk-wires extending between said exchange systems, fixed and flexible connections, as set forth, for connecting any subscriber with any other subscriber of said systems, a section at which trunking is done, one or more terminals for a portion of said trunk-wires in each of the sections of the switch-boards, a call-circuit extending to each operator of the systems, and an operator's outfit located permanently in said extended call-circuit at one or more of the offices, for the purpose described.

10. The combination, with a large and small telephone-exchange system provided with switch-boards, known as the "Law switch-boards," substantially as set forth, made up of sections X, Y, Z, &c., and having a section at which trunking is done, of trunk-wires extending between said systems, fixed and flexible connections in the different sections, whereby any subscriber may be connected with any other subscriber of the two systems, a call-circuit extending between the two systems and provided with a receiver at the small station, an operator's outfit at each section in the large station for said extended call-circuit, a subscriber's circuit extended from the small office to the large one, and provided with receivers at each office, and one or more fixed terminals for a portion of the trunk-wires in each section of the switch-board at the large office, for the purpose described.

11. A switch-board connected with trunk-wires adapted for trunking between central offices, provided with flexible terminals for said trunk-wires, and having the fixed terminals of subscribers massed in said switch-board around or adjoining said flexible terminals.

12. A switch-board known as the "Law switch-board," made up of sections, substantially as set forth, and connected with trunk-wires adapted for trunking between central offices, flexible terminals for a portion of said trunk-wires, fixed terminals for the remainder of said trunk-wires in each section of the switch-board, and fixed terminals for the subscribers massed around and adjoining said flexible terminals.

13. The combination, in the telephone-exchange system, of trunk-wires extending between the central offices thereof, switch-boards at said offices of the Law type, having fixed and flexible connections in each section, for the purpose described, flexible connections for trunk-wires massed in a section, subscribers' fixed terminals adjoining the latter, a call-circuit passing to each operator at each section of the board at each office, and provided with operators' outfits, for the purpose described.

14. A telephone-exchange system having the subscriber's call-circuit extended to another central-office-exchange system, and provided with an operator's outfit at said central offices, for the purpose described.

In testimony whereof I have hereunto set my hand and affixed my seal, this 31st day of March, 1888, in the presence of the two subscribing witnesses.

JNO. F. CASEY. [L. s.]

Witnesses:
A. C. FOWLER,
HENRY L. BAILEY.