S. A. KOLTONSKI.

INTERCOMMUNICATING TELEPHONE SYSTEM.

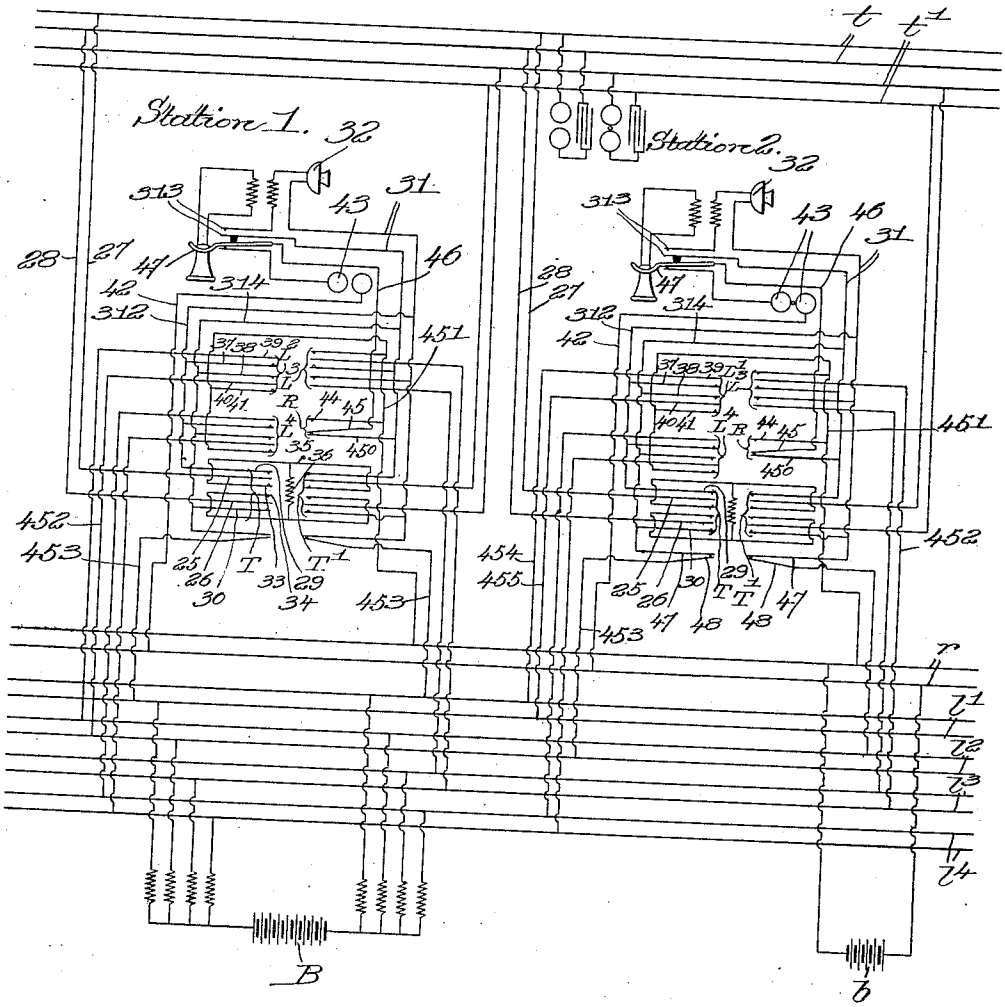
APPLICATION FILED NOV. 10, 1911.

1,097,760.

Patented May 26, 1914.

4 SHEETS—SHEET 1.

Fig. 1.



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4 SHEETS—SHEET 2.

Fig. 2.

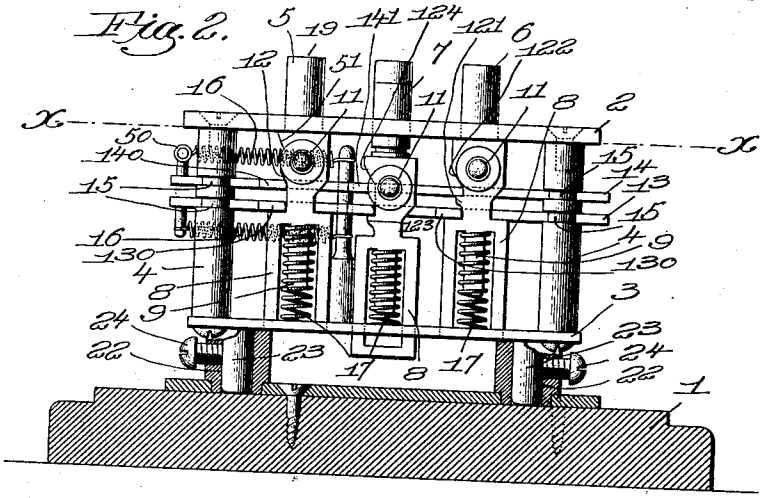


Fig. 3.

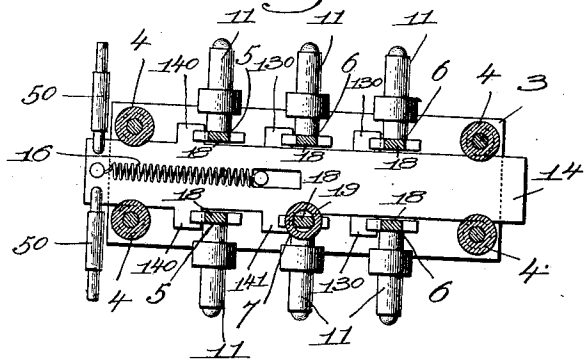


Fig. 4.

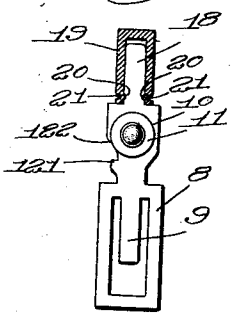


Fig. 5.

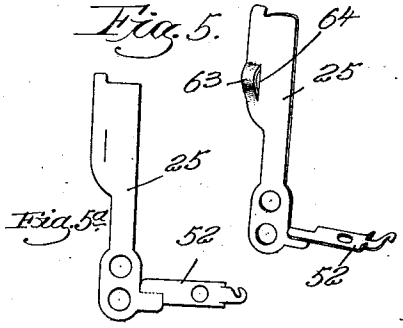


Fig. 5a.

Fig. 6.

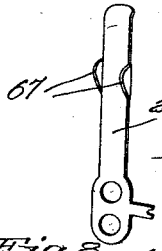


Fig. 7.

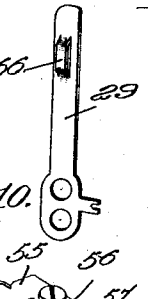


Fig. 9.

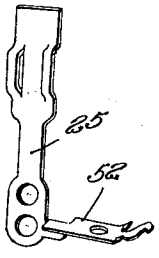
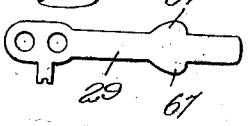


Fig. 10.



Fig. 8.



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4 SHEETS—SHEET 3.

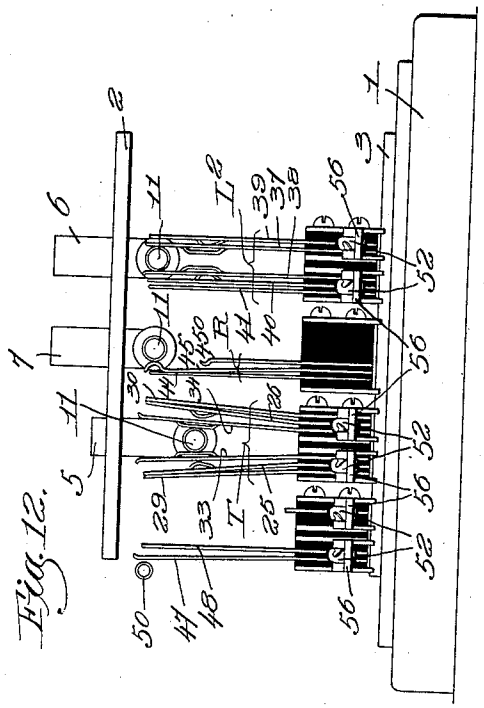


Fig. 12.

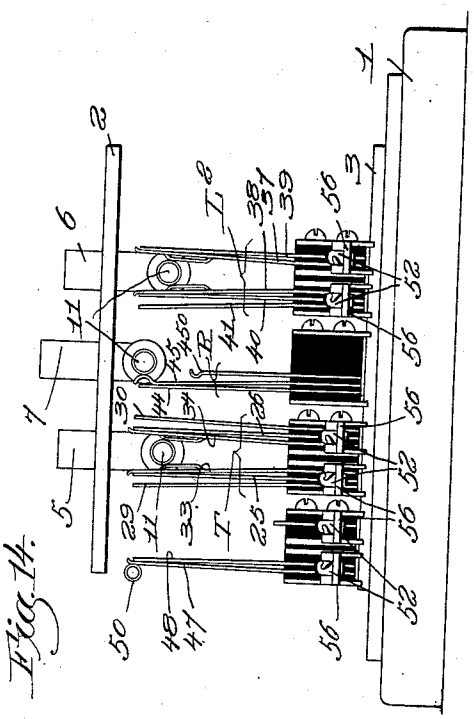


Fig. 14.

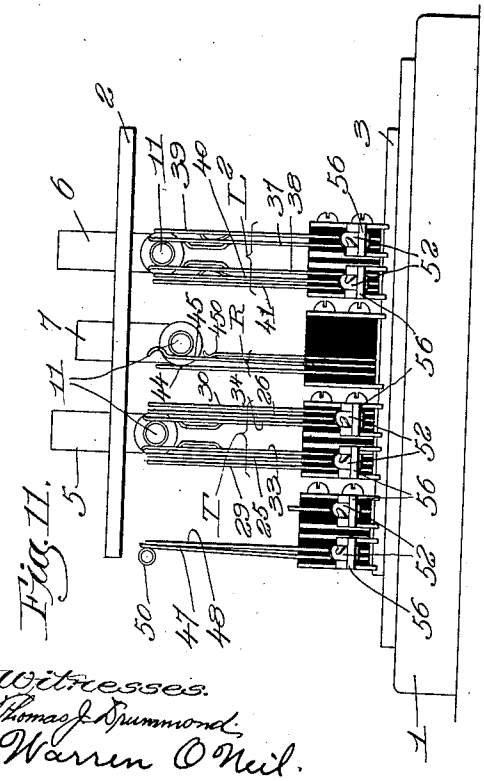


Fig. 11.

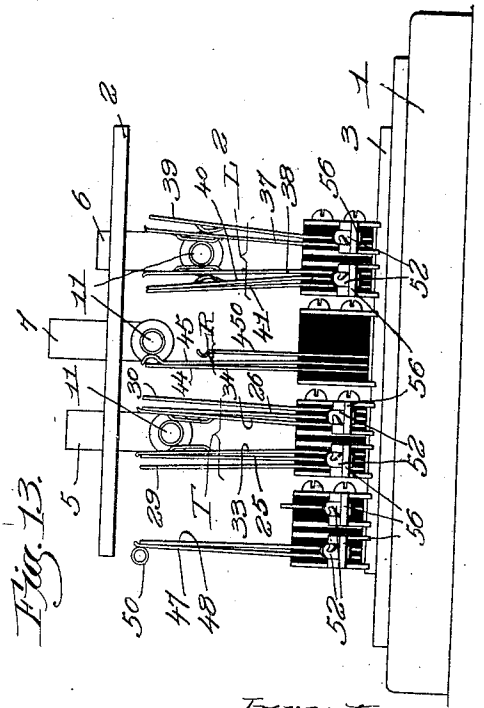


Fig. 13.

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4 SHEETS—SHEET 4.

Fig. 15.

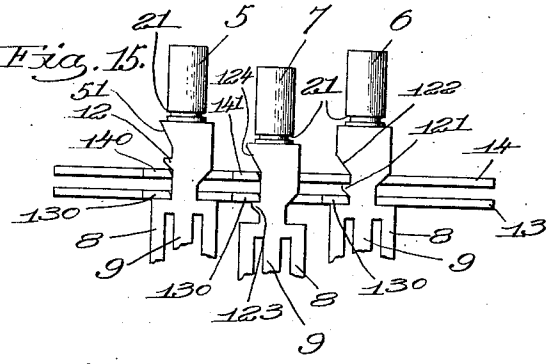


Fig. 16.

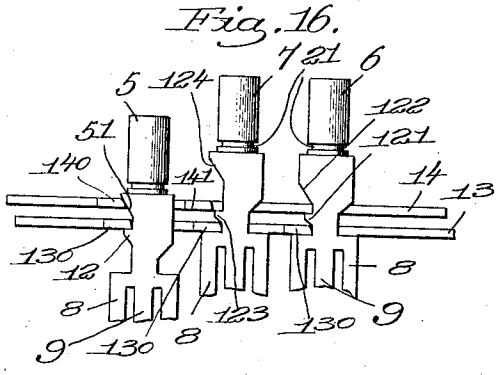


Fig. 17.

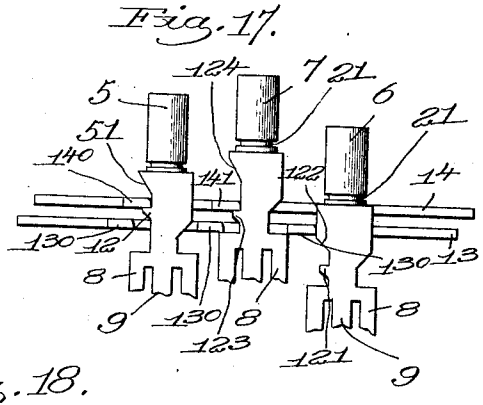


Fig. 18.

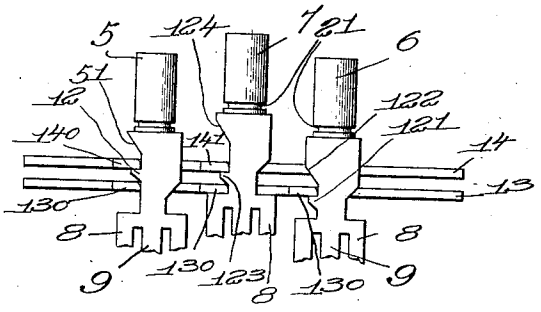


Fig. 19.

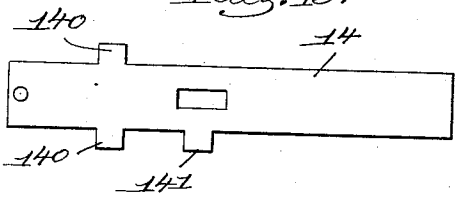
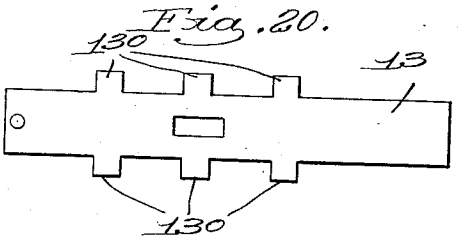


Fig. 20.



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UNITED STATES PATENT OFFICE.

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INTERCOMMUNICATING TELEPHONE SYSTEM.

1,097,760. Specification of Letters Patent. Patented May 26, 1914.

Application filed November 10, 1911. Serial No. 659,460.

To all whom it may concern:

Be it known that I, STANISLAW A. KOLTONSKI, a subject of the Czar of Russia, residing at Boston, county of Suffolk, and State of Massachusetts, have invented an Improvement in Intercommunicating Telephone Systems, of which the following description, in connection with the accompanying drawing, is a specification, like characters on the drawing representing like parts.

This invention relates to intercommunicating telephone switch apparatus and particularly to telephone switch apparatus of the branch exchange type which is provided with a holding coil or other resistance and means to substitute said holding coil for the telephone set in the trunk line circuit whenever it is desired to establish communication between two local stations in the system without disconnecting the trunk line circuit.

One of the objects of my present invention is to provide a novel construction whereby this substitution of the holding coil for the telephone set in the trunk line circuit is effected automatically by the depression of any local or intercommunicating key.

Another object of the invention is to provide a telephone switch apparatus with a restoring key, the depression of which operates to restore all the other keys, both trunk line and local, to normal open-circuit position.

Still another object is to provide a telephone switch apparatus in which two latch plates serve to control all the keys, and one of the latch plates also operates to control the local battery cut-out.

Still another object is to provide a simple and efficient manner of connecting the separable key set and circuit spring base which permits these parts to be readily disconnected whenever it is desired to separate them for purposes of repair or otherwise.

Still another object is to provide a circuit spring having such a construction that the key-engaging portion can always be made of the correct shape and in such a way that it cannot become distorted or bent out of its proper lines.

In general the object of the invention is to improve a telephone switch apparatus of this character, all as will be more fully hereinafter set forth and then pointed out in the appended claims.

Referring now to the drawings wherein I have illustrated some embodiments of my invention, Figure 1 is a diagram view showing the circuits of a switch embodying my invention; Fig. 2 is a side view of the key set of the switch apparatus with the circuit springs omitted and the circuit spring base shown in section; Fig. 3 is a section on the line x—x, Fig. 2; Fig. 4 is a detail of one of the keys; Figs. 5, 6, 7, 8 and 9 are detail views of circuit springs used in my apparatus; Fig. 5^a is a view of the blank from which the circuit spring in Fig. 5 is made; Fig. 10 is a view of the circuit spring support; Fig. 11 is a fragmentary view showing the normal position of the keys and circuit spring; Fig. 12 is a similar view showing one of the trunk line keys depressed for closing the talking circuit; Fig. 13 shows one of the local keys depressed for closing a local ringing or signaling circuit and also shows the trunk line key in position for closing the holding coil circuit; Fig. 14 shows the position of the keys when a local circuit is closed for talking purposes. Figs. 15, 16, 17 and 18 show the positions of the keys and latch plates corresponding to the positions of the circuit springs shown in Figs. 11, 12, 13 and 14. Fig. 19 is a view of the upper latch plate; Fig. 20 is a view of the lower latch plate.

The switch apparatus herein shown is of that type which comprises a key set and a circuit spring base carrying circuit springs separable from each other. The circuit spring base is shown at 1 and it supports the circuit springs which are controlled by the keys of the key set in usual manner. These circuit springs are shown as arranged in groups, each group of springs constituting a unit and comprising the springs coöperating with any key, this feature of construction being similar to that described in my former Patent No. 947,340, January 25, 1910. The arrangement and construction of the circuit springs will be more fully hereinafter referred to.

The key set is formed with two plates 2 and 3 connected together by suitable posts 4, and these plates sustain the keys which control the circuit springs as usual in devices of this class. In the drawings I have illustrated a switch apparatus which has two trunk keys 5 and three local or intercommunicating keys 6 besides one restoring key 7. These keys are each constructed as shown best in Fig. 4, that is, each comprises a body portion 8 of skeleton shape provided with a spring-guiding finger 9 situated within the

skeleton portion, said body being formed with the neck 10 that carries the arms of rolls 11 that engage the circuit springs and also formed with the fingers for engaging the latch plates 13 and 14 that hold the keys depressed. These latch plates are guided in grooves 15 formed in the posts 4 and are acted on by springs 16 as usual in devices of this class.

The latch plate 13 has arms 130 to cooperate with fingers on each of the keys, as seen in Fig. 20, and the latch plate 14 has arms 140 and 141 which coöperate with the trunk line keys 5 and restoring key 7, respectively, (see Fig. 19). The trunk line keys each have a beveled finger 12 normally situated above both latch plates, but which is adapted to engage the projection on either latch plate according to the manner in which the system is being used, as will more fully hereinafter appear. The local keys 6 each have a beveled finger 121 and a cam 122 to coöperate with a projection 130 on the latch plate 13, and the restoring key 7 has a beveled finger 123 and a cam surface 124 to cooperate with the projections 130 and 141 on the latch plates 13 and 14, respectively. The manner in which said fingers and projections coöperate to hold the keys in the desired positions will be more fully hereinafter explained.

Each key is held in its elevated position by a spring 17 which is received within the skeleton frame 8 and encircles the finger 9, said spring resting against the bottom plate 3. Said bottom plate 3 is provided with slots in which the skeleton portions of the keys play, said slots acting to hold the keys in their proper position and prevent them from turning. Each key is formed at its upper end with a stem 18 adapted to receive a cap or thumb-piece 19 which projects through the face plate 2. For holding this cap in place I form the stem 18 with a portion of reduced diameter and then upset a portion of the cap to enter the portion of reduced diameter. As shown in Fig. 4 the stem is provided with notches 20 and the material of the cap is upset at 21 to enter and fill the notches, thus locking the cap to the stem.

As above stated, the key set with the keys therein is made separable from the circuit spring base containing the circuit springs. In order to provide a simple means of fastening these two parts together, I have herein shown one of the parts as provided with sockets to receive positioning pins carried by the other part. The sockets may be made in a variety of ways and may be formed on either part. In the illustrated embodiment of the invention the sockets are formed on the base 1 and the pins are carried by the key set 2, and the pins and sockets are so arranged that the pins may be entered into or removed from the sockets simply by movement of the key set toward or from the base. One convenient construction is illustrated in the drawings wherein the sockets are shown at 22 and the pins at 23, said pins being held in the sockets by suitable clamping screws 24. The clamping screws 24 are readily accessible so that the operation of removing the key set from the circuit spring base for purposes of repair or otherwise is a very simple one.

Before describing the constructional features of the circuit springs, I will refer to the circuits of my improved apparatus. Each key controls a group of circuit springs. The two trunk line keys 5 control the two groups of trunk line circuit springs designated generally by T, T'. The three local or intercommunicating keys 6 control other groups of circuit springs which are designated generally L', L^2, L^3 and L^4, (the system shown being adapted for a branch exchange having four local telephones) and the restoring key 7 controls a group of springs designated generally by R. The two trunk line circuits are shown in Fig. 1 at t and t'. The intercommunicating circuits are shown at l', l^2, l^3, l^4, said circuits being herein connected to a local battery B.

r designates a ringing circuit which is supplied with current from a battery b and which is suitably connected to the various instruments at the branch exchange for signaling from one to the other.

The trunk line groups of circuit springs T, T' each comprise two central springs 25, 26 that are connected by wires 27, 28 to one of the trunk lines, two talking circuit springs 29, 30 that are connected to the transmitter circuit 31 which leads to the transmitter 32, and also two holding coil circuit springs 33 and 34 which are connected with a holding coil circuit 35 that includes a resistance or holding coil 36. Provision is made so that when the trunk line key 5 is fully depressed, as seen in Figs. 12 and 16, it will close the trunk line springs 25, 26 against the talking circuit springs 29 and 30 thereby connecting the instrument 32 with the trunk line through the following circuit: wire 27, trunk line spring 25, talking circuit spring 29, wire 312, talking circuit 31, transmitter 32, contacts 313 which are closed when the telephone receiver is taken off the hook 47, wires 31 and 314, talking circuit spring 30, line circuit spring 26 and wire 28. Each depression of the key carries the finger 12 beneath the projection 130 on the latch plate 13, thus locking the key in its depressed position.

When the trunk line key is in intermediate position with its finger 12 engaging the projection 140 on the upper latch plate 14, as seen in Fig. 17, then the trunk line circuit springs 25 and 26 are closed against the holding coil circuit springs 33, 34 and

are disconnected from the talking circuit springs 29, 30 whereby the holding coil is substituted for the telephone set in the trunk line and the continuity of said line is maintained. The groups of local circuit springs L′, L², L³, L⁴, are identical and each comprises a pair of talking circuit springs 37 and 38 connected to the transmitter circuit 31 and a pair of line springs 39, 40 connected to one of the intercommunicating circuits. The line springs 39 and 40 of the group L′ will be connected to the intercommunicating circuit l' and this corresponds to station 1, for instance. The line springs for the group L² which correspond to station number 2 will be connected to the intercommunicating circuit l^2, etc. In addition each group of local circuit springs includes a signal circuit spring 41 which connects with the ringing circuit r which is also connected by a wire 42 with the bell 43 of the telephone in usual manner. The arrangement of these local circuit springs is such that when any one of the local keys 6 is fully depressed, the line spring 40 is closed against the ringing spring 41, as shown in Fig. 13, thus completing the circuit through the bell of the branch instrument corresponding to the particular key depressed and giving a signal at such instrument; while when said key is in an intermediate position, as shown in Fig. 14, the ringing circuit is opened and the talking circuit springs are closed against the line circuit springs, thus connecting the instrument with the intercommunicating line. The ringing circuit will be traced later on. The fingers 121 on the local keys are so arranged that they normally stand just above the projections 130 on the latch plate 13, as seen in Fig. 15, so that when any local key is depressed the finger 121 thereon will move the latch plate 13 forward, thus releasing any other key which may be depressed, and will be carried some distance beneath the latch plate when the key is in ringing position, as seen in Fig. 17. Upon releasing the key it will assume its intermediate talking position by the action of its spring 17 and will be held in such position by the engagement of the finger 121 with the projection 130 on the latch plate 13, as seen in Figs. 14 and 18. The group R comprises three contacts 44, 45 and 450, the contact 44 being connected by wire 451 to one side of the ringing circuit r, and the contact 45 being connected to the wire 46 that leads to the hook 47 of the telephone. These springs are so arranged that when the restoring key is depressed, as seen in Figs. 11 and 15, the springs 45, and 450 are closed together, while when said key is elevated the springs 45 and 44 are closed together, as seen in Fig. 12. When the springs 45 and 450 are closed together the ringing circuit is in condition to be closed by the depression of a key at another local telephone set. The restoring key is normally depressed, but when any other key has been depressed said restoring key is released by the latch plates and moves into its elevated position thereby closing the contacts 44 and 45. As a result whenever a party is through using his telephone and hangs up the receiver the circuit controlled by the contacts 44 and 45 and which include a buzz or other signal will become closed, thus setting the buzz or signal in operation, said buzz or signal continuing to sound until the restoring key has been depressed to its normal position.

In addition to the circuit springs above described my apparatus embodies local battery cut-out circuit springs 47, 48 which connect the local battery with the instrument so as to permit of communication between the instruments of the branch exchange without the use of the current from the trunk line. These local battery cut-out circuit springs are controlled by the upper latch plate 14, and for this purpose said latch plate carries arms 50 which are so situated that when the latch plate is in retracted position said arms will engage the circuit spring 47 and close it against the circuit spring 48. When the trunk line key is depressed, however, for establishing communication with the main central exchange, the upper latch plate 14 is moved to the left, Fig. 2, by the inclined surface 51 on said trunk line key thereby to permit the spring contacts 47, 48 to separate from each other and cut out the local battery B. The latch plate is held in this position by the depressed trunk line key, but whenever said key is released into its intermediate position, as shown in Figs. 13 and 14, said latch plate 14 is permitted to move to the right thereby cutting the local battery in so that communication may be established between the individual instruments of the branch exchange.

Having now described the group of springs R with their connections and the local battery cut-out springs, the ringing circuit will be apparent. Assuming that the key 6 corresponding to the group of springs L² at station 1 is fully depressed for the purpose of calling up station 2 the ringing circuit will be as follows: from ringing line wires r through wire 451, ringing contact 41, line wire contact 40, wire 452 to one side of the circuit l^2, thence through wire 453 to the local battery cut-out springs 47, 48, thence through wire 314, spring 450, spring 45, wire 46 to the telephone hook, bell 43, wire 42 back to the ringing line wire r. When the operator at station 2 depresses the proper key 6 to establish talking communication between stations 1 and 2 the talking circuit will be as follows: starting from line wires l', thence

through wire 453 at station 1, local battery cut-out springs 47, 48, wire 314, wire 31, contacts 313, transmitter 32, wire 31 to the other pair of local battery cut-out springs 47, 48, wire 453 to the other side of circuit l', thence to wire 454 leading to the line wire spring 39 of group L' at station 2, thence through talking circuit spring 37, wire 314, wire 31 to transmitter 32 at station 2, thence through contacts 313 and wire 31, wire 312, talking circuit spring 38, line circuit spring 40 of group L' at said station 2, thence through wire 455 back to the circuit l'. The line circuit springs have associated therewith line terminals 52 to which the wires are soldered or connected in usual manner. In my present improvement I make these terminals integral with the line circuit springs thereby avoiding any danger of a bad electrical connection between the line circuit spring and the terminal such as might occur if the two were made of separate parts.

In Fig. 5 I have shown a line circuit spring 25 which is made from a blank such as shown in Fig. 5[a] by bending the portion 52 of said blank into a plane at right angles to the body of the line circuit spring thereby to form the line terminal. The advantage of this construction is that a perfect electrical connection between a line terminal and its circuit spring is always insured. It is desirable to support the line terminals 52 so as to prevent their becoming bent during the process of wiring up. I have accordingly provided a supporting member 53 for each terminal which is of the shape shown in Fig. 10 and which may conveniently be bent or pressed into shape from sheet metal. This support is made of heavier metal than the circuit spring and is provided with the body portion 54 which is clamped to the circuit springs of the group and which is also provided with the laterally-extending arm 55 having at its end the supporting portion 56 that is situated directly under the line terminal 52. Said terminal may conveniently be secured to this support by a binding screw 57 to which the wires may be connected if a soldered connection is not desired. This makes a rigid structure which prevents the terminals from becoming bent or thrown out of alinement.

In the manufacture of these circuit springs for a telephone switch apparatus it is essential that the portions thereof which are engaged by the arms 11 of the keys should always have the proper shape so that the depression of the keys will cause the proper circuit springs to be brought into contact. In my former Patent No. 947,340 the circuit springs were given their desired shape by providing each of them with an offset. I have found, however, that during the manufacture of circuit springs it is not always possible to make these offsets exact duplicates of each other. In my present invention I provide for always securing the correct shape of the circuit springs by so constructing the key-engaging portions thereof that they will be supported at both ends. In the circuit spring 25 shown in Fig. 5 the key-engaging portion 63 is made by slitting the body of the circuit spring along the line 64 and then upsetting or forcing the portion 63 outwardly to form the cam projection. This portion 63 has both ends thereof secured to the body of the spring 25 and, therefore, its proper shape will always be maintained.

In Fig. 7 I have shown a talking line spring 29 in which the key-engaging portion 66 is formed by providing the body of the circuit spring with two parallel slits and forcing the material between the slits outwardly to form the required cam projection. This cam projection is also connected at both of its ends to the body of the spring and, therefore, its proper shape will always be maintained. In Fig. 6 I have shown another way of making one of the talking circuit springs from a blank such as shown in Fig. 8 and which is provided with the two wings 67 that are bent at right angles to the body to form the key-engaging cam portions, as clearly seen in Fig. 6. Fig. 9 shows another way in which the line circuit springs may be made.

The operation of the device will be readily understood from the foregoing, but may be briefly described as follows: When the switch is in normal condition all the keys are elevated except the restoring key and the circuit springs will be as illustrated in Fig. 1. Whenever a trunk line key is fully depressed, as shown in Fig. 12, the talking circuit springs and trunk line circuit springs are closed together thereby establishing communication between the telephone and the main exchange, this operation resulting in opening the local battery cut-out. If, after getting in communication with the main exchange the party wishes to get into communication with one of the telephones of the branch exchange he will depress the proper key 6 thereby releasing the depressed trunk line key and permitting it to come into intermediate position where it is held by the upper latch plate and in which position it effects the substitution of the holding coil for the telephone set. The depression of the key 6 also releases the latch plate 14 thereby closing the local battery circuit springs 47 and 48 and cutting said battery into the local talking circuit. A full and complete depression of the local key 6, as shown in Fig. 13, will close the ringing circuit of the branch telephone desired thereby signaling to the party at such telephone that he is wanted. When the

pressure is relieved from the depressed local key 6 its spring will return it to an intermediate position, as shown in Fig. 14, where it is held by the lower latch plate 13, and in which the talking circuit springs 37, 38 are closed against the line circuit springs 39, 40 thereby establishing a talking communication with the desired telephone. When the party is through using the instrument and has hung up his receiver he depresses the restoring key, thus restoring all the previously-depressed keys to normal position and opening the buzz or signaling circuit.

While I have illustrated herein a construction which is applicable to a branch exchange system having desk sets throughout, yet it will be obvious that the invention may equally well be embodied in telephone systems having wall sets throughout or having some wall sets and some desk sets. It will also be obvious that the principle of the invention might be embodied in apparatus which differs constructionally in some respects from that herein illustrated and therefore I do not wish to be limited to the specific construction illustrated. Moreover in some embodiments of my invention the particular restoring means herein shown, to wit: the restoring key, is not essential as the keys may be restored by some other equivalent restoring means.

Having fully described my invention, what I claim as new and desire to secure by Letters Patent is:—

1. In a telephone switch apparatus for controlling a plurality of circuits, of which one is a trunk line and the others are intercommunicating circuits, the combination with a plurality of keys, one for each circuit, each key being depressible from a normal or open-circuit position to a talking or closed-circuit position, a telephone set substitute and its circuit, and mechanically actuated mechanical means directly to connect said latter circuit to the trunk line circuit in place of the telephone set by the depression of any key controlling an intercommunicating circuit.

2. In a telephone switch apparatus for controlling a plurality of circuits, of which one is a trunk line and the others are intercommunicating circuits, the combination with a plurality of keys, one for each circuit, each key being depressible from a normal or open-circuit position to a talking or closed-circuit position, a holding coil, and its circuit, and mechanically-actuated mechanical means controlled by the key for any intercommunicating circuit to effect a direct substitution of said holding-coil circuit for the telephone set.

3. In a telephone switch apparatus for controlling a plurality of circuits, of which one is a trunk line and the others are intercommunicating circuits, the combination with a plurality of keys, one for each circuit, of a holding coil and its circuit, and mechanically-actuated mechanical means rendered operative by the depression of any intercommunicating key when the trunk line key is depressed directly to connect the holding coil circuit to the trunk line in place of the telephone set.

4. In a telephone switch apparatus for controlling a plurality of circuits, of which one is a trunk line and the others are intercommunicating circuits, the combination with a trunk line key for the trunk line circuit and an intercommunicating key for each of the intercommunicating circuits, of a latch plate to hold the trunk line key depressed, a telephone set substitute, circuit connections for connecting said substitute to the trunk line in place of the telephone set when the trunk line key is in intermediate position, and means to effect the change of position of the trunk line key from its depressed or talking position to its intermediate position by the depression of any intercommunicating key.

5. In a telephone switch apparatus for controlling a plurality of circuits, of which one is a trunk line and the others are intercommunicating circuits, the combination with a trunk line key, of an intercommunicating key for each of the intercommunicating circuits, a latch plate to hold the trunk line key depressed in talking or closed circuit position, a holding coil, circuit connections for connecting said holding coil to the trunk line in place of the telephone set when the trunk line key is in intermediate position, and means associated with each intercommunicating key to release the latch plate from the trunk line key when said intercommunicating key is depressed thereby permitting the trunk line key to assume its intermediate position.

6. In a telephone switch apparatus for controlling a plurality of circuits, of which one is a trunk line and the others are intercommunicating circuits, the combination with a trunk line key, of an intercommunicating key for each of the intercommunicating circuits, a latch plate to hold the trunk line key depressed in talking or closed circuit position, a holding coil, circuit connections for connecting said holding coil to the trunk line in place of the telephone set when the trunk line key is in intermediate position, means associated with each intercommunicating key to release the latch plate from the trunk line key when said intercommunicating key is depressed thereby permitting the trunk line key to assume its intermediate position, and a second latch plate to hold said trunk line key in intermediate position.

7. In a telephone switch apparatus for controlling a plurality of circuits, of which one is a trunk line and the others are intercommunicating circuits, the combination with

a trunk line key, of an intercommunicating key for each of the intercommunicating circuits, a latch plate to hold the trunk line key depressed in talking or closed circuit position, a holding coil, circuit connections for connecting said holding coil to the trunk line in place of the telephone set when the trunk line is in intermediate position, means associated with each intercommunicating key to release the latch plate from the trunk line key when said intercommunicating key is depressed thereby permitting the trunk line key to assume its intermediate position, a second latch plate to hold said trunk line key in intermediate position, and a restoring key for releasing said second latch plate.

8. In a telephone switch apparatus for controlling a plurality of circuits, of which one is a trunk line and the others are intercommunicating circuits, the combination with a plurality of keys, one for each circuit, each key being depressible from a normal or open-circuit position to a talking or closed-circuit position, a latch plate coöperating with all of the keys to hold any one of them in talking position, means for releasing the depressed trunk line key when any intercommunicating key is depressed, a second latch plate to hold said release trunk line key in intermediate position, a telephone set substitute for maintaining the trunk line continuity, means to connect said substitute with the trunk line when the trunk line key is in intermediate position, and a local battery cut-out controlled by said second latch plate.

9. In a telephone switch apparatus for controlling a plurality of circuits, of which one is a trunk line and the others are intercommunicating circuits, the combination with a plurality of keys, one for each circuit, each key being depressible from a normal or open-circuit position to a talking or closed-circuit position, a latch plate coöperating with all of the keys to hold any one of them in talking position, a holding coil, means controlled by the trunk line key when in intermediate position to substitute said holding coil for the telephone set in the trunk line, and a second latch plate to hold the trunk line in intermediate position.

10. In a telephone switch apparatus for controlling a plurality of circuits, of which one is a trunk line and the others are intercommunicating circuits, the combination with a plurality of keys, one for each circuit, each key being depressible from a normal or open-circuit position to a talking or closed circuit position, a latch plate coöperating with all of the keys to hold any one of them in talking position, a holding coil, means controlled by the trunk line key when in intermediate position to substitute said holding coil for the telephone set in the trunk line, a second latch plate to hold the trunk line in intermediate position, and a local battery cut-out controlled by said second latch plate.

11. In a telephone switch apparatus for controlling a plurality of circuits, of which one is a trunk line and the others are intercommunicating circuits, the combination with a plurality of keys, one for each circuit, each depressible from a normal or open circuit position to a talking or closed circuit position, a latch plate coöperating with all of the keys to hold any one of them in talking position, a second latch plate to hold the trunk line key when in intermediate position, and a local battery-cut-out controlled by the second latch plate.

12. In a telephone switch apparatus for controlling a plurality of circuits, of which one is a trunk line and the others are intercommunicating circuits, the combination with a plurality of keys, one for each circuit, each depressible from a normal or open-circuit position to a talking or closed circuit position, a latch plate coöperating with all of the keys to hold anyone of them in talking position, a second latch plate to hold the trunk line key when in intermediate position, a local battery cut-out controlled by the second latch plate, and a restoring key for restoring all the keys to normal position.

13. In a telephone switch apparatus, the combination with a circuit-spring-carrying base, of a key-set frame separable from said base and provided with keys for controlling circuits, and means for removably connecting the frame to the base, said means comprising pins extending inwardly from the frame, sockets extending outwardly from the base and adapted to receive the pins, and means carried by the sockets to lock the pins thereinto said key frame having means to hold the keys in position relative to each other when the two frames are separated.

14. A line circuit spring for a telephone switch apparatus made from sheet metal having a portion of the sheet metal body thereof which is of less width than said body situated at one side of the plane of the body thereby to form a key-engaging portion, said portion being integrally connected at both ends to said body.

15. In telephone switch apparatus, the combination with line circuit springs, each having struck up from the body thereof at a point spaced from its extremity a key-engaging portion which is of less width than said body, each end of said struck-up portion being integrally connected to the body of the spring, and keys coöperating with said key-engaging portions.

16. In a telephone switch apparatus, the combination with a frame comprising two plates, of keys movably mounted in said plates, each comprising a skeleton body pre-

senting two connected sides and a central spring-positioning finger, and a spring encircling said finger and engaging one of said plates.

17. In a telephone switch apparatus for controlling a plurality of talking circuits, the combination with a plurality of groups of talking circuit springs, a key for each group, each key being depressible from a normal or open-circuit position to a talking or closed-circuit position, a normally-depressed restoring key additional to said above-mentioned keys, means for throwing said restoring key into elevated position whenever any of the other keys are depressed, means for restoring any of the other keys to normal position by the depression of the restoring key, and a signaling circuit having contacts that are closed by the restoring key when the latter is in its elevated position but are opened when the restoring key is depressed.

18. In a telephone switch apparatus for controlling a plurality of talking circuits, the combination with a plurality of groups of talking circuit springs, a key for each group, each key being depressible from a normal or open-circuit position to a talking or closed-circuit position, a normally-depressed restoring key additional to said above-mentioned keys, means for throwing said restoring key into elevated position whenever any of the other keys are depressed, means for restoring any of the other keys to normal position by the depression of the restoring key, a telephone receiver and its hook, a signaling circuit having contacts that are closed by the restoring key when the latter is in elevated position but are open when said key is depressed, and a contact in said signaling circuit which is closed when the receiver is on the hook.

19. In a telephone switch apparatus for controlling a plurality of circuits of which one is a trunk line and the others are intercommunicating circuits, the combination with a trunk line key for the trunk line circuit and intercommunicating keys for the intercommunicating circuits, each key being depressible from a normal or open circuit position to a talking or closed-circuit position and the trunk line key having an intermediate position, a telephone set substitute, and means to connect said telephone set substitute in the line in place of the telephone when the trunk key is in its intermediate position.

In testimony whereof, I have signed my name to this specification, in the presence of two subscribing witnesses.

STANISLAW A. KOLTONSKI.

Witnesses:
LOUIS C. SMITH,
THOMAS J. DRUMMOND.

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