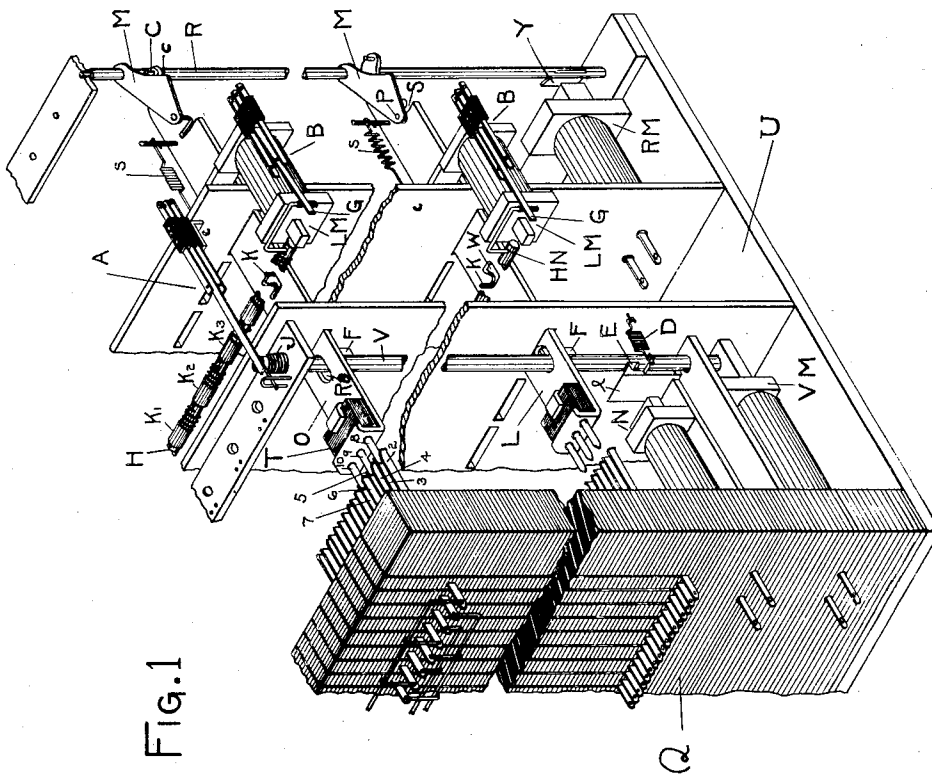
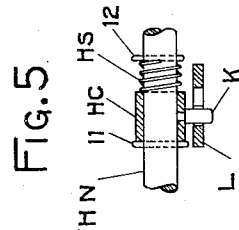


1,363,364.

Patented Dec. 28, 1920.
 2 SHEETS—SHEET 1.

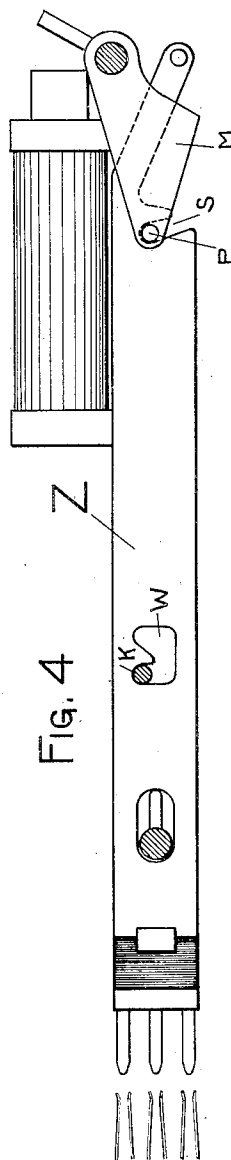
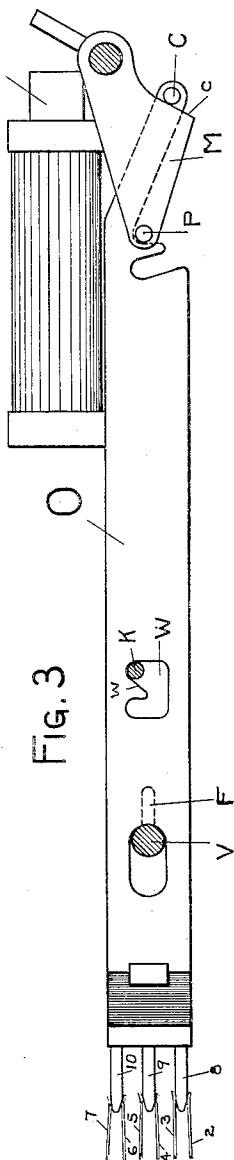
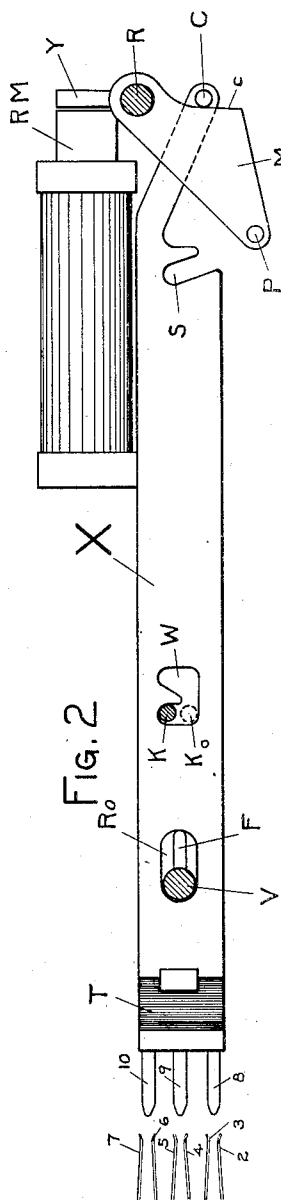


INVENTOR

Frank M. Slough

1,363,364.

Patented Dec. 28, 1920.
 2 SHEETS—SHEET 2.



INVENTOR

Frank M. Slough

UNITED STATES PATENT OFFICE.

FRANK M. SLOUGH, OF ROCHESTER, NEW YORK, ASSIGNOR TO THE STROMBERG-CARLSON TELEPHONE MANUFACTURING COMPANY, OF ROCHESTER, NEW YORK, A CORPORATION OF NEW YORK.

SELECTOR-SWITCH.

1,363,364.

Specification of Letters Patent.

Patented Dec. 28, 1920.

Application filed November 5, 1917. Serial No. 200,317.

To all whom it may concern:

Be it known that I, FRANK M. SLOUGH, a citizen of the United States, and residing at Rochester, in the county of Monroe and State of New York, have invented certain new and useful Improvements in Selector-Switches, of which the following is a full, clear, concise, and exact description.

This invention relates to a telephone switch, and is particularly designed for use as a line switch, or trunk finder switch, although obviously it may be used for many other purposes.

The invention particularly relates to a switch of the cross-bar type in which groups of intersecting bars are provided, and whereby the conjoint action of a bar of one group with that of another group is arranged to cause inter-engagement between sets of terminal contacts, the same being in the form of contact springs mounted in a bank.

This application relates to subject-matter similar to that disclosed in applicant's co-pending application, Serial No. 200,318, filed November 5, 1917.

One of the objects of my invention is the provision of a simple switch structure of the above type, by means of which large groups of lines may be served.

Another object is to provide such a structure by means of which the connection of lines will be accomplished with rapidity and certainty, and wherein the parts will be readily maintained in their adjusted positions.

Another object is the provision of a structure of this kind which can be cheaply manufactured and inexpensively maintained in operation.

Another object is to make the aforesaid connections in such a way that the electrical contacts will be accompanied by a wiping of the contact surfaces that they may be kept clean.

Other objects and advantages will appear as the description of the invention progresses.

In order to facilitate the explanation and understanding of this invention, it will now be described as a line switch or trunk finder, and as such, might be arranged to serve, for example, a group of 100 subscribers' lines

and a corresponding group of trunk lines, ordinarily less in number, and commonly of from 10 to 20% of the number of subscribers' lines. It is of course obvious that in the following description, the terms "incoming lines" and "outgoing lines" might be substituted for lines, or subscribers' lines and trunk lines, respectively.

The embodiment of the apparatus herein disclosed comprises two sets of longitudinally movable bars or shafts, and means whereby the said bars may be longitudinally displaced to release, what I call a plug carriage, at the intersection of the displaced line and trunk bars.

The plug carriage referred to contains insulated, metallic plugs carried at one extremity thereof, each adapted to plunge when the plug carriage is released between a pair of contact springs mounted in an insulating bank.

For a more complete description of the device, reference is now made to the drawings in which Figure 1 shows an isometric view of the switch with parts broken away for the sake of exposing other operative parts. Only two plug carriages are shown in Fig. 1, the others being merely indicated in various ways, but it will be understood that the other plug carriages not shown are like the illustrated plug carriages and operated in the same way.

Fig. 2 shows a plan view of one of such plug carriages together with certain associated parts which control the operation of the plug carriage, the position of the plug carriage and the position of the associated parts being that which they would assume when the plug carriage is in its normal or unoperated position and with the assumption that the other plug carriages in the same vertical row are also unoperated.

Fig. 3 shows a plan view illustrating such a plug carriage and associated controlling elements when in their fully operated position.

Fig. 4 is a plan view illustrating such a plug carriage and associated elements in the position which they would assume when another plug carriage in the same vertical row has been previously operated, such as the plug carriage of Fig. 3; the plug carriage of Fig. 4 being shown in its unoperated

locked condition, that is, in the condition wherein it is prevented from operating by the previous operation of the other plug carriage in the same vertical row, as for instance, the plug carriage of Fig. 3.

Fig. 5 shows a detailed construction of key-pin carrying collars which mount on the horizontal line bars to control the release of adjacent plug carriages.

Referring now to the figures in all of which like reference numerals are used to designate like parts, and referring particularly to Fig. 1, reference being, however, also had to the other figures, for the sake of better understanding the disclosure of Fig. 1; at O, I show a plug carriage which has just been permitted to operate by the power of the coiled spring *s*, by the conjoint operation of the vertical trunk bar *V* and the horizontal line bar *H*, the operation of these two bars serving to unlock the plug carriage O and allow it to move from its normal unoperated position to the fully operated position.

At L, I show a locked-out plug carriage which has been locked in its normal or unoperated position by the rotation of a vertical rod *R*, caused to rotate by the movement of the plug carriage O; the locking of the plug carriage L being accomplished by the projection of the key-pin *P* into the slot *S* of the plug carriage L.

The rotatable rod *R*, carries a plurality of latching members *M*, one for each associated plug carriage of which there may be 100 more or less, only two being shown in the embodiment of Fig. 1. These latching members *M*, are rigidly secured to the rod *R*, and all move together when the rod is rotated. A restoring magnet *RM* is arranged to rotate the rod *R* to restore any operated plug carriage, such as the plug carriage O, to its normal or unoperated position by engaging the pin *C* on the extremity of the plug carriage O. The vertical rod *V* and the horizontal rod *H* are in Fig. 1 shown in their fully operated position. A horizontal rod *HN* controlling the operation of the plug carriage L is shown in its normal or unoperated position, wherein by means of a carriage key-pin *K* resting as illustrated in the key-way *W*, the plug carriage L is kept in its normal or unoperated position; the springs *G* tending to force the horizontal rods *H* and *HN* to their normal position, and the magnets *LM* are so arranged that they may when energized longitudinally displace the horizontal line bars *H* and *HN* against the pressure of the springs *G* to unlock the associated plug carriages.

For the sake of clearness, the line bars *H* and *HN*, and the collars *HC* which carry the key pins *K* are shown in Fig. 1, as being broken away to expose the key-pin *K* and the key-way *W*.

In Fig. 5, however, the construction of one of these collars *HC* is shown in detail, together with other associated parts.

By referring to Fig. 5, at *HN* is shown a line bar, and at *L* a plug carriage, and at *K* a key-pin carried by the line bar and rigidly secured to a collar *HC* mounted on the line bar. The collar is prevented from sliding on the line bar in one direction by the stop pin 11 mounted thereon, but is allowed to slide in the opposite direction against the pressure of the spring *HS* which is carried on the line bar between the collar *HC* and the stop pin 12 fastened to the line bar. The function of the spring *HS* and the yielding mounting for the key pin *K* on the line bar *HN* will be later described in connection with the release of an operated plug carriage.

It will be understood that other key-pins, such as at *K*₁, *K*₂ and *K*₃ are also carried by the line bars *H* and *HN* to lock and unlock other plug carriages in the horizontal row not shown.

A set of contact springs *A*, is arranged to be operated by each vertical rod and adapted to make and break electrical contacts when the associated vertical rod was operated. Likewise sets of contact springs as *B* are arranged to be operated making and breaking electrical contacts whenever the associated horizontal line bars are operated.

A latch *e*, is provided for each vertical bar *V*, and is arranged to engage an extension thereof *E*, when the vertical bar is in its fully operated position, and arranged to hold the said vertical bar in this position. An electromagnet *VM* is provided for each vertical bar, and is adapted to displace the same downwardly against the action of a spring *J* and to cause the vertical bar *V* to take such a position, that it may be latched in this position by the action of the latch member *e*, which engages the projection *E* on the vertical bar. An electromagnet *N* is provided to withdraw the latch member *e* from its latching position against the spring *D*, to release the vertical bar and restore it to its normal position. The vertical bar carries keys *F*, each of which may when the vertical bar is in its normal position engage an edge of a slot *R*, of the associated plug carriage to prevent the plug carriage from operating.

Three pairs of contact springs comprising the springs 2, 3, 4, 5, 6 and 7, are arranged in an insulating bank *Q*, each pair of contact springs being adapted to receive an interconnecting plug member 8, 9 and 10. These plug members 8, 9 and 10 are embedded in a block of insulating material *T*, carried by the associated plug carriages.

In the switch construction of my invention I do not require that connecting wires be connected to these plug members, and I

thereby obviate the practical difficulty of maintaining electrical connection with these plug members in their various positions.

A frame U is shown carrying the various operating parts of my switch structure. This frame may be of any suitable construction, and in the embodiment illustrated is shown as being constructed of sheet metal.

Referring now more specifically to Fig. 2, which shows a plug carriage and associated parts in its normal or unoperated position, at X, I show a plug carriage, comprising the plugs 8, 9 and 10 embedded in an insulating block T, having key-slots R, and W therein, the plugs 8, 9 and 10 being adapted to be plunged between the springs 2 and 3, 4 and 5, 6 and 7, respectively, to interconnect the spring 2 with the spring 3, the spring 4 with the spring 5, and the spring 6 with the spring 7; the springs 2, 4 and 6 being trunk or outgoing line springs, and the springs 3, 5 and 7 being line or incoming line springs. It will be understood that, as illustrated in Fig. 1, the springs 2, 4 and 6 are connected in multiple with like springs 2, 4 and 6 arranged in the same vertical bar and opposite other plug carriages in the same vertical row. It will also be understood that the line springs 3, 5 and 7 may be connected as shown in the drawing of Fig. 1, each in multiple with other line springs 3, 5 and 7 in the same horizontal row and opposite to other plug carriages arranged in the same horizontal row.

The plug carriage X is provided with a slot S adapted to receive the pin P, carried by the member M whenever the member M is rotated on the shaft R to latch the plug carriage X. The plug carriage X also carries at its extremity the pin C, adapted to engage the cam surface c of the member M. An electromagnet RM is provided to attract an armature Y to rotate the bar R, carrying a plurality of members M. The result of such an operation is to cause the plug carriage X to be restored to its normal position as illustrated in the drawing of Fig. 2, after having been in its operated position illustrated in Fig. 3.

The vertical bar shown in Fig. 2, is in its normal position, and in this position the key members such as F carried thereby, are in their normal position which is within the slot R, of the associated plug carriages, and when in this position prevents the said plug carriages from operating, even though they would otherwise be free to operate by the displacing of one of the line bars, such as the line bar carrying the key-pin K, shown within the slot W of the plug carriage X; that is, should the line bar carrying the pin K be displaced so that the pin K should take the position shown by the dotted circle K₀, the plug carriage X will be held in its normal position due to the position of the

member F associated therewith, and only such a plug carriage will be released to take its fully operated position as would have in addition to the displaced line bar an associated displaced vertical bar, and it is only by the conjoint action or displacement of an associated line bar and associated vertical bar that any particular plug carriage may be released to operate. Fig. 3 shows such a released plug carriage wherein the vertical bar V has been longitudinally displaced, so that the key member F is moved to a position below that of the plug carriage O in addition to the momentary actuation or longitudinal displacement of the associated horizontal bar carrying the pin K.

In passing it may be stated that in the switch construction of my invention it is only necessary that the horizontal or line bar be momentarily displaced, the pin during the operation of the plug carriage taking the successive positions of K₀ of Fig. 2, and of K of Fig. 3 relative to the plug carriage, being moved from the position of K to K₀ of Fig. 1 by the energization of the line electromagnet LM, and being thereafter upon the deenergization of this magnet moved to the position K of Fig. 3.

In the above description it is assumed that the vertical bar corresponding to the trunk to be used for the next connection, will be previously displaced and that the switch is so used that a subsequent actuation of any line bar releases the associated plug carriage.

It will be seen in view of the above description that in the switch construction I provide a plurality of plug carriages for each line bar, each of the said plug carriages being individual to a trunk bar and that the converse is also true, that is, each plug carriage above referred to as being individual to a trunk bar is only one of a plurality individual thereto, there being one for each line adapted to be served by the trunk bar.

The method of making an interconnection between the two sets of jack springs 2, 4 and 6, and 3, 5 and 7 by means of the plugs 8, 9 and 10 is illustrated in Fig. 3, showing an operated plug carriage.

Fig. 4 shows a plug carriage which is in its normal position, but which is in the same vertical row as the plug carriage of Fig. 3, and is prevented from operating subsequent to the operation of the plug carriage of Fig. 3 by the actuation by the plug carriage of Fig. 3 of apparatus common to both of these plug carriages. This common apparatus consists of the rotatable shaft R, which carries a plurality of members M, each being individual to a plug carriage.

The member M as has been described, carries the pin P, and the plug carriage itself carries a pin C. When the plug carriage

such as O is operated, the pin C propels the associated member M, by engaging the adjacent surface thereof and rotates the supporting rotatable bar R, carrying all of the members M to the position shown in Figs. 3 and 4; Fig. 3 showing the position of an operating plug carriage with relation to the position of the associated pin P, and Fig. 4 showing the position of an unoperated plug carriage relative to the position of the pin P of an associated member M, in the latter case the pin P locking the plug carriage Z by entering the slot S, and is held in this position by the pin C of an operated plug carriage pressing against the surface *c* of the associated member M, so that the pin P is firmly held in the slot S of plug carriage Z, assumed to be in the same vertical row and which is prevented from operating subsequent to the operation of the plug carriage O.

At the end of the connection period in order to restore the operated plug carriage O and the locking pins P to their normal position, it is only necessary to energize the common electromagnet RM to attract the armature Y, and the cam surface *c* of the member M associated with the operated plug carriage will engage the pin C of the plug carriage to propel it to its normal position against the action of the operating spring *s* of the plug carriage. Also the cam surface *w* of the slot W will engage the pin K of the horizontal line bar and momentarily cause the slidably mounted collar HC carried on the line bar and which carries the pin K to be displaced against the power of the spring HS, which is a relatively weak spring, without moving the line bar HN, the displacement being such that the pin K will take the successive positions of K₀ of Fig. 2, and finally to the normal position of K of Fig. 2.

When the switch as above described in detail is operated as a line switch, the operation may preferably be as follows:—

Assuming that a call initiates on a line represented by a horizontal row of contact sets, such as the springs 3, 5 and 7, the bar H corresponding to this line and to the said contact sets will be displaced toward the electromagnet LM, thus moving all of the pins K, K₁, K₂, K₃, etc., carried by this line bar from a position within the slots W, as illustrated at K in Fig. 2, to a position such as K₀ of Fig. 2. One of the trunk bars of the switch will have previously been displaced to the position of the trunk bar V described in connection with Fig. 3, that is, the key member F associated with one of the plug carriages will be displaced below the level of the slot R₀ of the plug carriage. The other trunk bars of the switch may be either in their normal position as illustrated in Fig. 2, thus preventing by their key

members F the operation of the associated plug carriage, or they may be, if the trunk to which they belong is at the time in use, in the position of Fig. 3, but in such a case as shown in Fig. 4, such an associated plug carriage will be prevented from operating by the pin P of the associated member M projecting into the key slot S of the plug carriage.

Used as a line switch, the operation of the switch in view of the above description may be briefly summarized as follows:—

The subscriber taking his receiver from the hook will by suitable circuit connections energize the electromagnet LM. This electromagnet will displace the pin K in the slot W of each of the plug carriages associated with the line. We will assume that one trunk has been preselected for this connection in a suitable manner. This will be done by the previous operation of the electromagnet VM actuating a trunk bar V which will be latched by a latching member *e*. The plug carriage such as O, will now be free to operate and will plunge its plugs 8, 9 and 10 into the jack springs 2, 3, 4, 5, 6 and 7, interconnecting the line wires connected to springs 3, 5 and 7 to the trunk conductors 2, 4 and 6. The line magnet LM is thereupon deenergized restoring the pin K to the position shown in Fig. 3. The member M of the operated plug carriage is propelled from the position relative to the plug carriage in Fig. 2, to the relative position shown in Fig. 3. Other plug carriages belonging to other lines each of which are also individual to the trunk line such as Fig. 4 will be locked by the pin P carried upon the member M. The completion of this connection will cause apparatus not shown to actuate the electromagnet VM of another idle trunk line to preselect another trunk bar V.

At the end of the conversational period the parts will be restored to normal by the momentary operation of the electromagnets N and RM which will operate in the manner previously described to restore the plug carriage and trunk bar to normal position. The trunk bar may be again selected for a subsequent connection to any associated line.

It is obvious that many modifications may be made in this invention without departing from the spirit thereof, and I desire it to be understood that the invention is to be limited merely by the scope of the following claims.

What I claim is:—

1. In a telephone switch, the combination with a plurality of displaceable bars divided into two groups, the bars of one group being arranged at an angle to the bars of the second group, contact sets arranged at the intersections of the bars, an operating member for each of the contact sets and adapted

to operate by the conjoint displacement of a bar of each set, and a rotatable bar common to all of the operating members associated with one of the said bars operable under the control of an operated member to lock the other operating members common to the bar in their normal or unoperated position.

2. In a telephone switch, the combination of sets of intersecting bars, contact sets at the intersections of the said bars, contact operating members for each of the said contact sets, propelling means for the said contact operating members and individual thereto, an unlocking member for each contact operating member carried by each of the intersecting bars adjacent the intersections thereof, and a locking member common to a plurality of contact operating members adapted to be controlled by each of the said last-named members and adapted when separately operated to restore any displaced one of said members to its normal position.

3. In a telephone switch, the combination with a plurality of displaceable bars divided into two groups, the bars of one group being arranged at an angle to the bars of a second group, a jack and plug switch at each intersection of the said bars, and means whereby the actuation of a bar of one of the said groups and a subsequent operation of a bar of the other of the said groups in either order of operation will operate a jack and plug switch at the intersections of the said bars,

4. In a telephone switch, the combination with a plurality of longitudinally displaceable bars divided into two groups, the bars of each group being arranged at an angle to the bars of the other, a jack and plug switch at each intersection of the said bars, and means whereby the actuation of a bar of each group in any order will operate a jack and plug switch at the intersections of said bars.

5. In a telephone switch, the combination with a plurality of flexible contact springs arranged in pairs, a spring propelled switching member for each pair, a group of longitudinally movable bars, a second group of longitudinally movable bars arranged at right angles to the first group of bars, and a third group of bars arranged parallel to one of the groups of bars, each bar of the second group being associated with a particular bar of the third group, and a plug and jack switch operated by the conjoint actuation of a bar of the first group and a bar of the second group, the bar of the third group being caused to operate by the operation of the said plug and jack switch, the said bar of the third group thereafter restoring the said plug and jack switch to its normal or unoperated position.

6. In a telephone switch, the combination with a jack panel therefor, a plurality of flexible jack springs mounted rigidly in the

said panel, a plurality of plug carriages for the said switch, each carrying rigid metallic plugs, two sets of controlling bars, the bars of one set being arranged at an angle to the bars of the second set, there being a plug carriage mounted in a frame at the intersections of the bars and adapted to be operatively locked and unlocked by each of the adjacent intersecting bars, and propelling means individual to each of the plug carriages to cause the same to operate when unlocked by the said intersecting bars and a restoring bar arranged parallel to one of the aforesaid bars common to a group of plug carriages controlled thereby to operatively lock the unoperated associated plug carriages when one of the plug carriages is operated.

7. In a telephone switch, the combination with a plurality of displaceable bars divided into three groups, the bars of the first group being arranged at an angle to the bars of the second, plug and jack switches at the intersections of said bars, and means whereby the conjoint actuation of a bar of the first and second groups will operate a plug and jack switch at the intersection of the said bars, and cause a bar of the third group to lock other associated plug and jack switches.

8. In a telephone switch, the combination of a plurality of displaceable bars divided into two groups, the bars of the first group being arranged at an angle to the bars of the second group, spring contacts mounted at each intersection of the said bars, spring contact actuating means therefor, means whereby the conjoint displacement of a bar of each group will operate the adjacent spring actuating means, and independent means common to all of the spring actuating means associated with a bar of one of the sets to lock all of the associated unoperated spring actuating means.

9. In a telephone switch, the combination of a plurality of displaceable bars divided into two groups, the bars of the first group being arranged at an angle to the bars of the second group, contact sets mounted at each intersection of the said bars, contact set actuating means therefor, means whereby the conjoint displacement of a bar of each group will operate the adjacent contact set actuating means, and independent means common to all of the contact set actuating means associated with a bar of one of the sets to lock all of the associated unoperated contact set actuating means, the said independent means being actuated by the operated contact set actuating means.

10. In a telephone switch, the combination of a plurality of displaceable bars divided into two groups, the bars of the first group being arranged at an angle to the bars of the second group, contacts mounted at each intersection of the said bars, contact actu-

ating means therefor, means whereby the conjoint displacement of a bar of each group will operate the adjacent contact actuating means, independent means common to all of the contact actuating means associated with a bar of one of the sets to lock all of the associated unoperated contact actuating means, and means to cause the said independent means to restore the operated contact actuating means to normal position.

11. In a telephone switch, the combination of a plurality of displaceable bars divided into two groups, the bars of the first group being arranged at an angle to the bars of the second group, spring contacts mounted at each intersection of the said bars, spring contact actuating means therefor, means whereby the conjoint displacement of a bar of each group will operate the adjacent spring actuating means, independent means common to all of the spring actuating means associated with a bar of one of the sets to lock all of the associated unoperated spring actuating means, the said independent means being actuated by the operated spring actuating means, and means associated with the said independent means to cause the said independent means to restore any operated spring actuating means to normal position.

12. In a telephone switch, the combination with non-self-restoring-switching-devices, a plurality of sets of displaceable bars, one of the sets being arranged at an angle to another bar set, a switching device being associated with each intersection of the sets of bar sets, means for displacing a bar of the first set and a bar of the other set to selectively actuate a switching device, and common restoring means for a plurality of switching devices.

13. In a telephone switch, the combination of sets of intersecting bars, plug and jack switches arranged at the intersections of the said bars, means to cause the operation of a plug and jack switch by the conjoint displacement of a bar of each set, retaining means for one of the displaced bars to retain it in its displaced position, the said retaining means being common to a plurality of plug and jack switches and independent of the actuating means for the said bar, and electromagnetic means to disable the said bar retaining means.

14. In an electrical switch, the combination of sets of intersecting bars, a plug and jack switch at each intersection of the said bars, means whereby the conjoint displacement of a bar of each set will operate the associated plug and jack switch, retaining means for one of the displaced bars, plug and jack switch restoring means associated with the displaced bar, an electromagnetic mechanism, adapted to simultaneously operate the said bar retaining means, and plug and jack restoring means whereby the said

bar is released and the said plug and jack switch is restored to normal position.

15. In an electrical switch, the combination of sets of intersecting bars, a plug and jack switch at each intersection of the said bars, means whereby the conjoint displacement of a bar of each set will operate the associated plug and jack switch, retaining means for one of the displaced bars, plug and jack switch interlocking and restoring means adapted to be actuated by the actuation of a plug and jack switch to lock all unoperated plug and jack switches associated with the said interlocking means, and an electromagnetic mechanism associated with the said retaining means and the said interlocking and restoring means to release the said retained bar, and to restore the operated plug and jack switch to normal or unoperated position, and to operatively unlock the associated plug and jack switches.

16. In combination, sets of longitudinal displaceable bars, the bars of one set being at an angle to those of another set, stationary contact terminals corresponding to each of said bars, non-self-restoring-switching-devices for interconnecting said stationary contact terminals, operating links operable by conjoint operation of said longitudinal displaceable bars in any order to actuate said non-self-restoring-switching-devices, and separate restoring means associated with each of the bars of one set to restore its associated switching devices to normal.

17. In a switch of the class described, the combination of a bank of contact sets, each contact set comprising a contact of two different classes, a connection effecting member for each set of contacts adapted by a longitudinal movement to effect connection between the contact of the one class and the contact of the other class of contacts, a movable operating bar for each class of contacts, said connection effecting member being under the conjoint control of both of the said bars, and a restoring bar associated with one of the said bars for restoring said connection effecting member.

18. In a telephone switch, a set of movable bars, a second set of movable bars, non-self-restoring-switching-devices remote from said bars, means for moving a bar of each set to actuate said non-self-restoring-switching devices, and a third set of movable bars associated with one of the other bar sets for moving one of said bars singly for restoring said non-self-restoring-switching-devices.

19. In combination, a group of lines, a second group of lines, a plurality of non-self-restoring-switching-devices, said switching devices being arranged in rows corresponding in number to the number of said first group of lines and arranged in tiers corresponding in number to the number of

the second group of lines, a set of operating bars, one for each tier, a second set of operating bars one for a row, operating links operable by conjoint actuation of a bar of each set to actuate said non-self-restoring-switching-devices, and a third set of operating bars associated with one or the other of the first two sets to restore said non-self-restoring-switching-devices to normal.

10 20. In combination, non-self-restoring-switching-devices, a set of bars movable in one direction, a second set of bars movable in another direction, operating links each

under the conjoint control of a bar of each set, propelling means for said links independent of said bars, electromagnetic means for operating a bar of each set to selectively operate a certain one of the switching devices, and electromagnetic means for actuating a displaced one of the links associated with a bar of one set to restore the said displaced link to normal.

In witness whereof, I hereunto subscribe my name this 3rd day of November, A. D. 1917.

FRANK M. SLOUGH.