

1,020,818.

Patented Mar. 19, 1912.

4 SHEETS—SHEET 1.

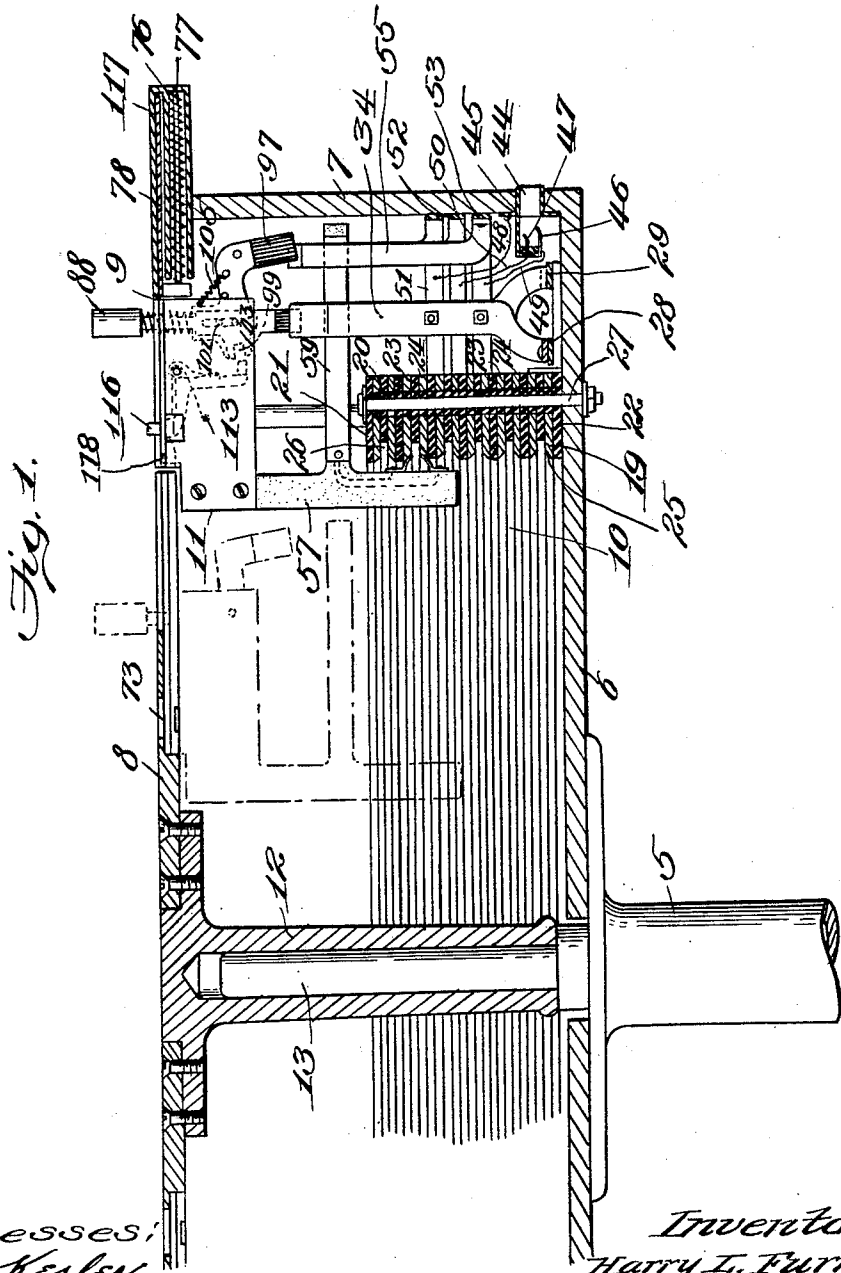


Fig. 1.

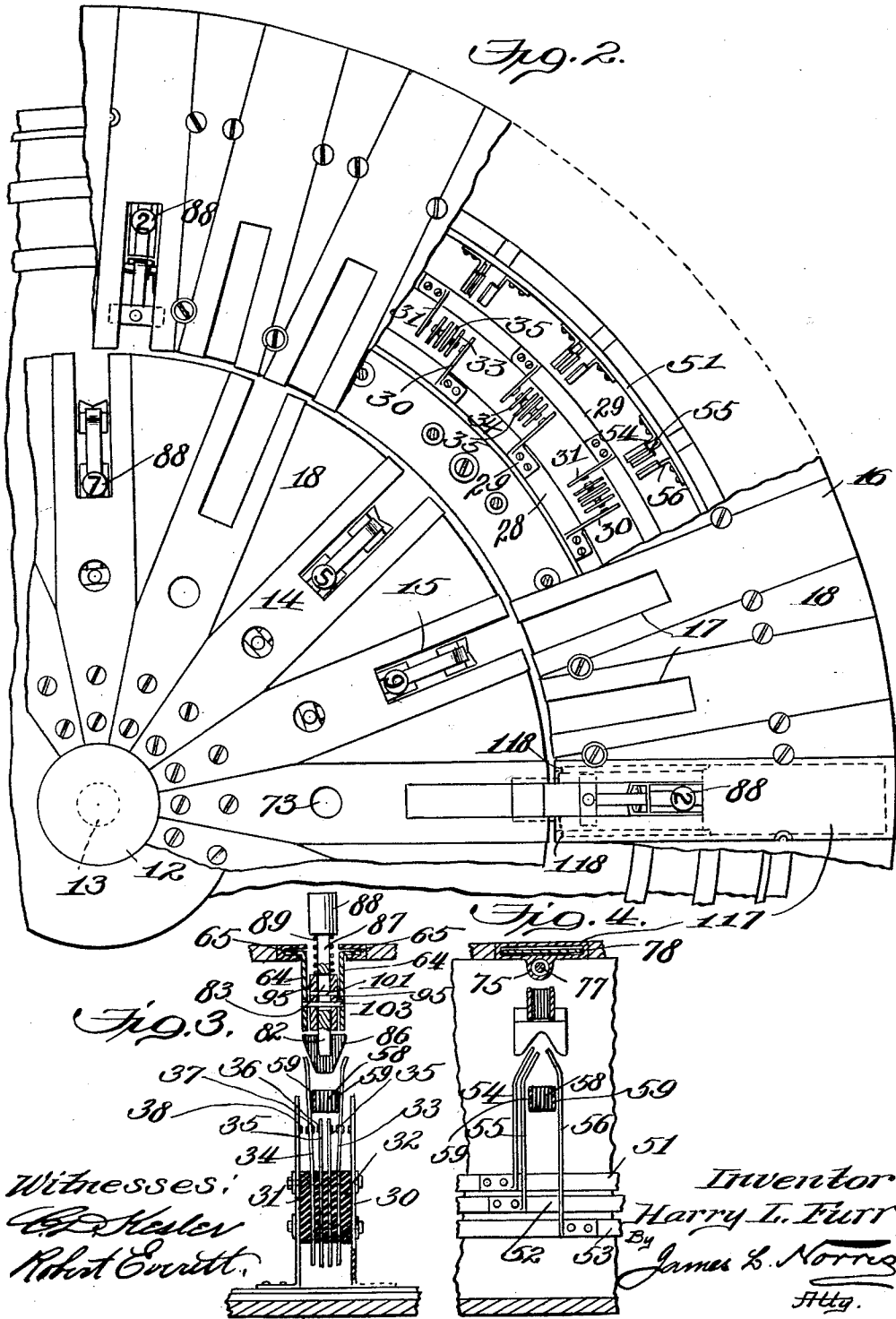
Witnesses:
Charles
Robert Smith.

Inventor
Harry I. Furr
James L. Norris.

1,020,818.

Patented Mar. 19, 1912.

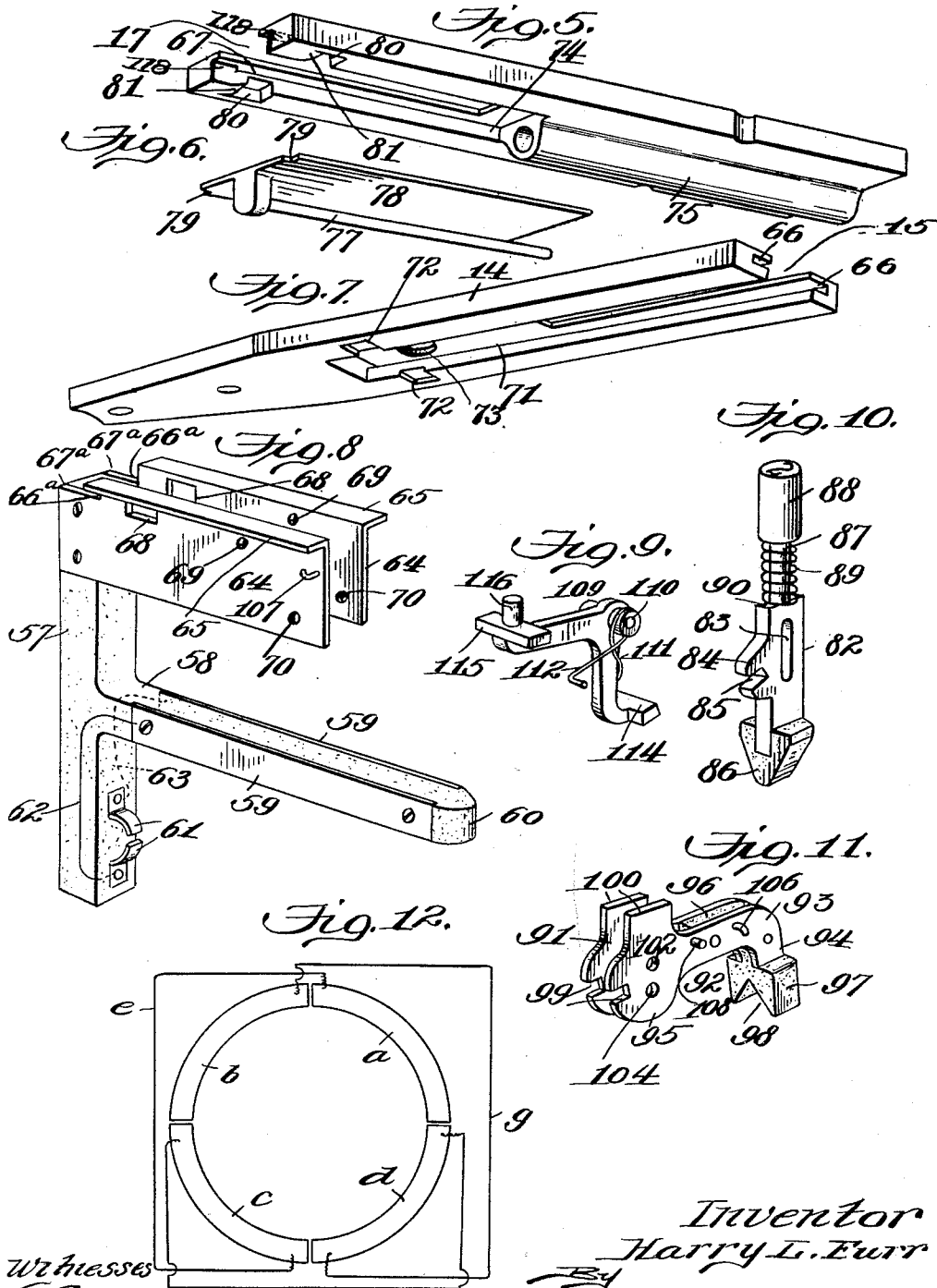
4 SHEETS—SHEET 2.



1,020,818.

Patented Mar. 19, 1912.

4 SHEETS-SHEET 3.



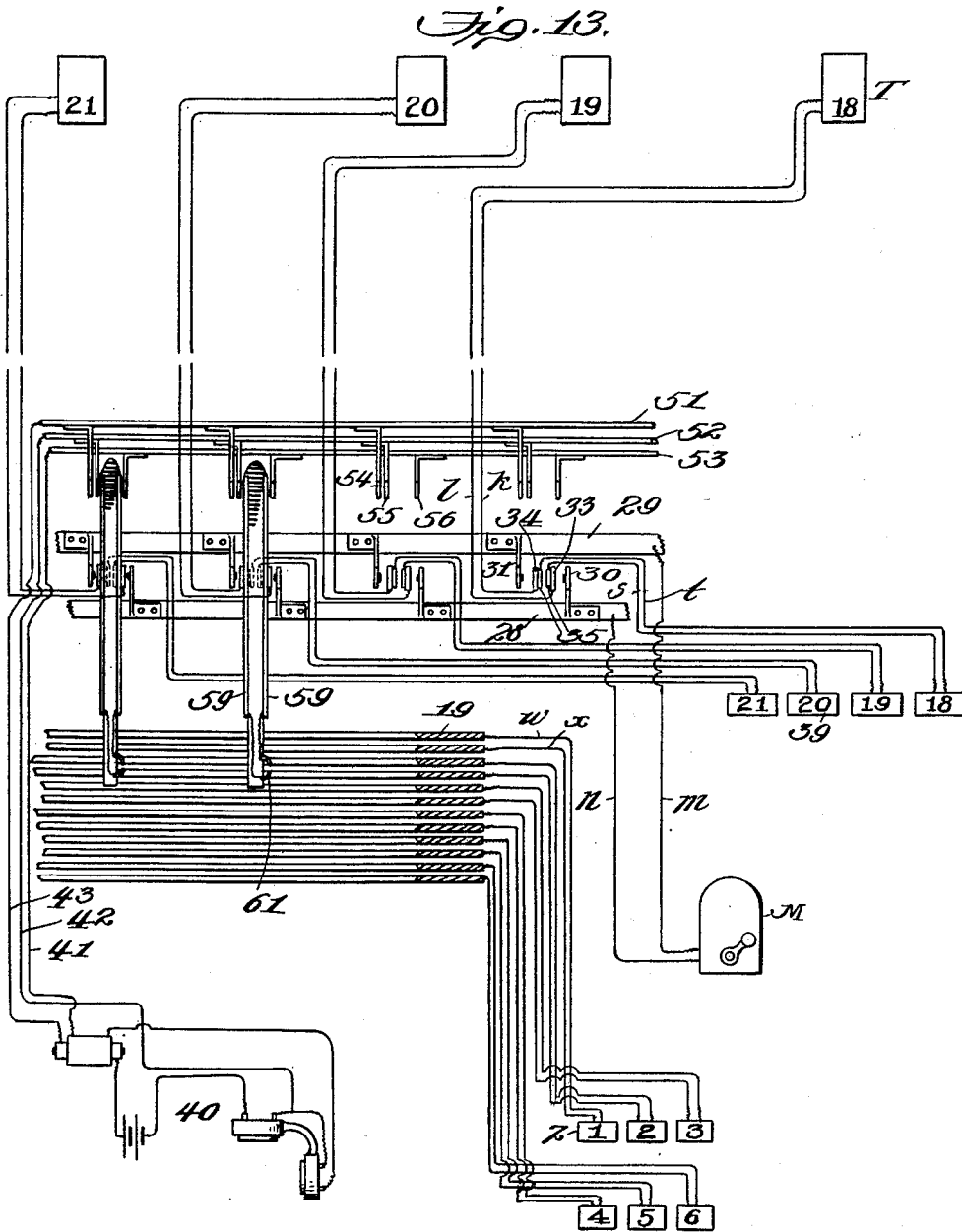
Witnesses
Ed. Hessler, Jr.
Robert Everett.

Inventor
Harry L. Furr
By James L. Norris, Atty.

1,020,818.

Patented Mar. 19, 1912.

4 SHEETS—SHEET 4.



Witnesses:
Ed. Hasler
Robert E. Smith

Inventor
Harry L. Furr
James L. Norris
Atty.

UNITED STATES PATENT OFFICE.

HARRY L. FURR, OF HARRISONBURG, VIRGINIA.

ELECTRICAL SWITCH MEANS.

1,020,818.

Specification of Letters Patent.

Patented Mar. 19, 1912.

Application filed March 25, 1909. Serial No. 485,701.

To all whom it may concern:

Be it known that I, HARRY L. FURR, a citizen of the United States, residing at Harrisonburg, in the county of Rockingham and State of Virginia, have invented new and useful Improvements in Electrical Switch Means, of which the following is a specification.

This invention relates to switch means particularly adapted for use in central telephone offices or telephone exchanges, but may be used for other purposes to which it may be adapted.

The primary object of the invention is to overcome and avoid the numerous disadvantages and inconveniences incident to switch boards now commonly employed and involving the use of a plurality of cords and jack plugs, and to replace the latter with means that may be expeditiously and positively operated to set up a connection between any number of subscribers' circuits with certainty and effectiveness.

Other objects and advantages will be hereinafter enumerated and for the purpose of practically demonstrating the invention in one form, an operative structure is disclosed in the accompanying drawings that may be preferred for many applications, and in these drawings: Figure 1 is a transverse vertical section through a portion of a switch means embodying the features of the invention. Fig. 2 is a top plan view of sufficient of the switch means to illustrate the construction thereof, portions thereof being broken away. Figs. 3 and 4 are detail sectional views of portions of the mechanism. Figs. 5 to 11, both inclusive, illustrate detail perspective views of parts of the switch means. Fig. 12 is a diagrammatic view of a portion of the circuit contact members showing the manner of connecting said members to obviate "cross-talk." Fig. 13 is a diagrammatic view of the apparatus particularly illustrating the circuits.

The switch means comprises a pedestal or stand 5 adapted to be supported on a suitable base and may be of any preferred construction. On the stand or pedestal 5 a bed 6 is secured and has an outer inclosing wall 7, the said bed 6 and wall 7 forming a casing or inclosure for the essential devices of the switch means.

The essential devices of the switch means include a movable carrier 8, a fixed rim 9

with which the carrier coöperates, a multiple contact means 10, a plurality of contact slides or shiftable circuit making elements 11 which are positively movable from the carrier into the rim and vice versa and adapted to coöperate with the multiple contact means, and the necessary electrical and telephonic accessories and equipments, some of which have a particular construction in accordance with the features of the invention and which will be more fully hereinafter specified. By the terms "carrier" and "fixed rim" is meant any movable or shiftable means and fixed receptive device or support with which freely yet positively movable contact slides or circuit making means may operate and become effective through the manipulation of an operator to practically connect up telephonic instruments of any number of subscribers in accordance with the predetermined arrangement or capacity of the switch means.

The carrier 8, as shown for the purpose of demonstrating one practical form of the invention, consists of a rotatable table having a depending socket 12 fitted over a post 13 rising from the stand or pedestal 5, the said table embodying a plurality of radially arranged arms 14 each comprising a seat 15 for one of the contact slides or shiftable circuit making elements 11. The fixed rim 9 is also provided with a plurality of radial arms 16 of any desired number and adapted to coincide with the arms 14 of the carrier 8, the said arms 16 of the rim each having a seat 17 to receive one of the contact slides or shiftable circuit making elements 11. The spaces between the arms 14 and 16 are closed by a suitable filling 18 so as to render the inclosure for the essential devices of the switch means as perfectly dustproof as possible.

The carrier 8 and fixed rim 9 as shown are of circular form to render the switch means conveniently accessible for operation and to minimize the dimensions without materially diminishing the capacity of the switch means relatively to or as compared with the capacity of switch boards now commonly employed in telephone exchanges, central offices, or other locations. The fixed rim 9 is practically a continuous supporting means having seats therein at regular intervals and the use of any analogous device possessing the latter characteristics is contemplated, and, furthermore, the

freely rotatable or shiftable carrier 8 of circular form may be replaced by any other equivalent device having an unrestricted sliding movement relatively to a supporting means and provided with seats for normally receiving and carrying the contact slides or shiftable circuit making elements 11.

The wall 7 extends uninterruptedly around the casing and the bed 6 is impermeate except at the center where it is applied to the upper extremity of the pedestal 5 around the base of the post 13, and by this means the inclosure for the switch devices and including the said bed 6 and wall 7 is dustproof with advantages in maintaining the interior of the inclosure in a clean condition. The multiple contact means 10 is composed of a plurality of superposed metal plates or bars 19 held in spaced relation by interposed insulating strips or plates 20 and also having upper and lower insulating strips 21 and 22 to form a top covering for the contact means and an interposed insulation between said means and the bed 6. The plates or bars 19 and the insulating strips 20, 21 and 22 are arranged in circular form in concentric relation to the socket 12 and post 13 to provide a circular bank of contacts corresponding to the contour of the remaining parts of the switch means and particularly the carrier 8 and fixed rim 9, though the said bank of contacts or multiple contact means may be of other contours and correspond to a change in contour of the carrier and rim. The multiple contact means or bank of contacts 10 provides the prime medium for establishing a talking circuit between two subscribers desiring to communicate with each other, or between a number of subscribers simultaneously without any two of the subscribers placed in communication interfering in the least with any of the other subscribers that may have at the time their talking circuits active through the said multiple contact means. The metal plates or bars 19 are arranged in coöperative pairs 23 and 24, each plate or bar of the coöperating pairs having the inner adjacent corners cut away or beveled as at 25 and the inner edges projecting beyond the interposed insulating means or strips to provide seat spaces 26 between the coöperating pairs of plates or bars. In other words, a portion of the interposed insulating strips 20 in alternation is of less width than the remaining portion of said strips, as clearly shown by Fig. 1. The several bars embodied in the multiple contact means 10 are held in fixed position by bolts 27 extending vertically therethrough at intervals and also through the insulating plates 21 and 22 and the bed 6, the said bolts preferably having their nutted extremities accessible at the under side of the bed for convenience in assembling and dissociating the said multiple

contact means relatively to the bed and the remaining devices of the switch means. Each plate or bar 19 is composed of segments, preferably four in number, as shown by Fig. 12, the segments being respectively designated by *a*, *b*, *c* and *d*. Throughout the bank of these contact plates or bars the joints in the latter are disposed out of alinement, or the joints between the segments of one plate or bar are disposed over the unbroken or continuous portions of the next succeeding plate or bar, or between the unbroken portions of contiguous plates or bars, and each plate or bar is made continuous through the medium of connecting wires *e*, *f*, and *g*, the wire *e*, for instance, and as shown by Fig. 12, connecting the segment *a* and one extremity of the segment *c*, the wire *f* connecting the opposite extremity of the segment *c* and the one extremity of the segment *d*, and the wire *g* connecting the remaining extremity of the segment *d* and the segment *b*. This form of wire connection is carried out uniformly in relation to all of the plates or bars 19, and the wires are arranged adjacent to the outer edges of the said plates or bars and will be formed into a suitable cable for condensing the same within the inclosure. The object of this segmental construction of the plates or bars 19 and the connecting wires as just explained is to avoid "cross-talk" which might ensue in view of the proximity of the several plates or bars if the particular construction and arrangement described was not adopted. It will be understood that the wires *e*, *f*, and *g* will be suitably insulated and as the inner edges of the several plates or bars 19 are free for engagement with portions of the contact slides or shiftable circuit making elements 11, the said plates or bars will practically operate as continuous plates owing to the wire connections explained without the disadvantages incident to actual continuous plates or bars arranged in proximity and subject to the disadvantages and annoyances incident to "cross-talk". Each pair of the plates or bars 19 is connected by wires *w* and *x* to a signal means or indicator *z*, as shown by Fig. 13, the said signal means or indicator being illustrated in this instance as an annunciator of any preferred type. Each pair of bars or plates 19, wires *w*, *x* and signal or indicating means *z* will be included in each telephonic circuit established by means which will be more fully hereinafter explained the moment the subscribers cease talking or hang up their receiving instruments or actuate a local means to inform a central office or exchange when any call is completed or when connection between two subscribers that may have been established is to be broken, and though the signaling or indicating devices *z* are included in the talking circuit that is set up

between two subscribers through the medium of the individual pairs of bars or plates composed of two of the bars or plates 19, the current on the line or active during the maintenance of any of the talking circuits is not strong enough to operatively affect the individual signaling or indicating devices z , and the latter devices only become operative when the strength of the current is increased by the final action or manipulation of one of the subscribers, as hereinbefore indicated.

Fixed on and insulated from the bed 6 outside of the multiple contacts 10 are two conducting strips 28 and 29 which extend fully around the said bed and at intervals have contiguous pairs of yielding contact arms 30 and 31 connected thereto, each arm 30 being secured to the contact strip 28, and the arms 31 fixed to the contact strip 29. The lower extremities of the arms 30 and 31 are bent or deflected so that the main body of each arm will extend upwardly in a plane between the inner opposing edges of the contact strips 28 and 29. The arms 30 and 31 are arranged in parallel relation and have an insulating supporting block 32 interposed and secured to each pair at a point intermediate with relation to the vertical extent of said arms, and between each pair of arms 30 and 31 is a pair of circuit making arms 33 and 34 held by the block 32 and having their upper yielding extremities projecting above the upper ends of the said arms 30 and 31, as clearly shown by Fig. 3. Between the arms 33 and 34 and also held by the block 32 is a pair of shorter conducting arms 35 which are normally in contact with the circuit making arms 33 and 34. The conducting arms 35 have contacts 36 on the outer faces of their upper extremities to engage adjacent contacts 37 carried by and extending through the circuit making arms 33 and 34, the outer terminals of the contacts 37 being adapted to engage contacts 38 on the inner sides of the arms 30 and 31. A magneto or other analogous device M is connected by wires m and n to the strips 29 and 28 respectively, and the circuit making arms 33 and 34 are respectively connected by wires k and l to a subscriber's telephone T , as shown by Fig. 13, four of these subscribers' telephones being illustrated. The conducting arms 35 are respectively connected by wires s and t to annunciators or analogous devices 39 bearing numbers or other indicating characters corresponding to specific designations of the several subscribers' telephones. It will be understood that there will be as many annunciators or other devices 39 coöperating with or connected up to the switch means as there are subscribers' telephones and also there will be as many annunciators or analogous signaling means z as there are pairs

of contact plates or bars 19 in the multiple contact means or bank 10. If there are no subscribers connected up to form a talking circuit through the medium of any one of the pairs of plates or bars embodied in the multiple contact means 10, all of the arms 30, 31, 33, 34 and 35 will be in their normal position, as shown at the right of Fig. 13, and each subscriber's telephone will then be in condition for immediate actuation of a corresponding annunciator or analogous signaling device 39 when any one of the subscribers releases his receiver from the usual switch hook or actuates any other local instrumentality that may be employed to make the circuit through the wires k , l , arms 33 and 34, arms 35 normally in contact with said arms 33 and 34, and wires s , t , to the annunciators or analogous signaling devices 39 to operate the one annunciator or signaling device 39 having a designating means corresponding to that of the calling or local telephone placed in operation by the subscriber. Each of the circuits including an annunciator or signaling device 39 and one of the subscribers or local telephones is independent of the remaining similar circuits, and therefore only one of the annunciators or signaling devices 39 will be operated. The annunciators or analogous devices 39 serve as calling signals and indicate to the operator at the exchange or central station and in charge of the switch means including such annunciator the subscriber desiring to be connected up with some other subscriber.

The operator's equipment is of the usual type or may be of any preferred form and essentially consists of a receiver and transmitter with the usual electrical appurtenances, as at 40, Fig. 13, and from this equipment three wires 41, 42 and 43 extend and may be included in a cable as usual and provided with a terminal plug, not shown, to coöperate with the socket 44, see Fig. 1, including a casing 45 and spring contact fingers 46 and 47 respectively connected by wires 48, 49 and 50 to metallic strips 51, 52 and 53 secured to the inner side of the wall 7 and extending completely around the interior of the inclosure. In radial alinement to the arms 30, 31, 33, 34 and 35, vertically extending spring contact arms or yielding conductors 54, 55 and 56 are respectively connected to the conducting strips 51, 52 and 53, the said arms or conductors 54, 55 and 56 being normally separated, as clearly shown by Fig. 4. The wires 41, 42, 43, conducting strips 51, 52 and 53, and the arms or yielding conductors 54, 55 and 56 form the essentials of the operator's answering circuit when the contact slides or circuit making elements 11 are brought into service or shifted from the carrier 8 into the fixed rim 9 and actuated, as will be more fully hereinafter specified.

The contact slides or shiftable circuit making elements 11 are practically or essentially similar in construction and each comprises a depending post or hanger 57 having an outwardly directed projection 58 with metallic contact plates 59 secured to opposite sides thereof and preferably countersunk to avoid the formation of obstructing shoulders or edges at opposite sides of the said projection. The projection 58 stands out in a plane at right angles to the post or hanger 57 and has a reduced free end 60, the plates 59 terminating some distance short of the free end or terminal 60. The post or hanger 57 and projection 58 are formed from some suitable insulating material, and below the projection 58 and on the same side of the post or hanger from which the said projection extends a pair of opposed metal contacts 61 is secured, the said contacts having their free extremities curved or given a convex contour and the ends separated by an intervening space, as clearly shown by Fig. 8, to render them effective in engaging the plates or bars 19, as shown by Fig. 1. Each post or hanger 57 carries a single pair of contacts 61 and said contacts are individually connected to the plates 59 by wires 62 and 63. Each contact slide 11 is also provided with a slide head consisting of a pair of plates 64 secured to the upper end of the post or hanger 57, the said plates being applied to opposite sides of the post or hanger and held in spaced relation. The plates 64 project from the post or hanger 57 in an outward direction and have upper outwardly extending flanges 65, one on each, to slidably engage grooves 66 and 67 respectively formed in the side walls of the seats 15 and 17 in the arms 14 and 16 of the carrier and fixed rim. The flanges 65 terminate short of the inner extremities of the plates 64 where shoulders 66^a are formed, one on each plate, by means of recesses 67^a so as to give a clearance over the upper end of the post or hanger 57 for a purpose which will be more fully hereinafter explained. The plates 64 also have slots 68 and openings 69 and 70 formed therein in transverse alinement, the slots 68 being located adjacent to the post or hanger 57 under the flanges 65 and the openings 69 positioned close to the flanges and nearer the free ends of the plates, and the openings 70 are formed in advance of the openings 69 near the lower edges of the plates 64. In addition to the grooves 66 and 67 in the opposite side walls of the seats 15 and 17 formed in the arms 14 and 16, the said arms are also constructed or have detail features to render the operation of the contact slides or shiftable circuit making elements effective in relation thereto. The under side of each arm 14 is formed with a channel 71 having near its inner terminal laterally extending recesses or seats 72

between which the top of the arm 14 is formed with an opening 73. Each arm 16 is also constructed with a channel 74 in its under side of less longitudinal extent than the channel 71 in each arm 14, and depending from the under side of each arm 16, beginning at the rear terminal of the channel 74, is a longitudinal socket 75 in which is disposed a spring 76 engaged by a rod 77 movably extending into and associated with the said socket and forming part of a closing slide 78 also slidable in the groove 67 of each seat and operating to close the several seats of the arms 16 when the flanges 65 of the plates 64 forming the slide heads of the shiftable circuit making elements 11 are released or drawn inwardly from the seats 17 of the arms 16 into the seats 15 of the arms 14. When the slide heads of the circuit making elements 11 are pushed outwardly into the seats 17 of the arms 16 the outer terminals of the flanges 65 strike the adjacent corners of the covering slides 78 and push the latter ahead to clear the several seats 17 progressively, the inner corners of the covering slides 78 being cut away as at 79 to render the contact of the outer ends of the flanges 65 more positive and also to facilitate and insure a full outward movement of the slide heads of the circuit making elements into the seats 17 of the arms 16 in accordance with predetermined proportions and dimensions and the arrangement of the several spring arms hereinbefore described and the coöperative means in addition to the projections 58 which will now be explained.

In the under side of each arm 16 and formed in the members thereof which are separated by the construction of the seat 17 and channel 74, laterally projecting recesses 80 are located and have inner beveled end walls 81, the recesses 80 being materially deeper than the recesses 72 formed in the underside of each arm 14, both sets of recesses 72 and 80 being provided for the desired operation of a locking means coöperating with an operator's controller carried by each contact slide or shiftable circuit making element 11 and actuated by the operator at the central station or exchange in charge of the switch means in notifying a called subscriber and also in ascertaining if the connections or circuit between any two subscribers has been properly completed or placed in working condition. This operator's controller is shown in detail by Figs. 10 and 11, and consists of a plunger 82 having a longitudinal slot 83 therein, an inner projection 84 formed with a notch 85, a lower wedge-shaped insulating head 86, and an upwardly projecting stem 87 provided with a button 88 on which is applied a numeral or other designating character. The stem 87 is surrounded by a coiled spring 89 which is of such diameter that its lower

convolution projects outwardly beyond opposite sides of the plunger 82 at the point of intersection of the lower terminal of the stem 87 and the plunger where a shoulder 90 is formed by the reduction of the plunger in the formation of the stem, the latter preferably forming an integral part of the plunger, though it may be a separate part suitably secured to the plunger if desired. The plunger 82 is flat and is movably mounted in the rear bifurcated extremity 91 of a compressor 92, the latter structurally comprising opposite metallic bars or plates 93 with outer depending extremities 94 and inner heads 95, the said bars or plates 93 being secured against the opposite sides of an insulating strip 96 which is of the same contour as the bars or plates and extends fully down between the depending extremities 94 and terminates in a lower compressing head 97 having an inverted V-shaped recess 98 in its under side or opening through the lower edge thereof. The heads 95 of the bars or plates 93 have the bifurcation 91 formed therebetween by terminating the insulating strip 96 at a suitable distance in advance of the heads, the rear edges of the heads 95 being formed with notches 99 to aline with the notch 85 of the plunger 82 and also provided with vertical extensions 100 for engagement with the lower extremity of the spring 89 so that one spring will be effective in returning the plunger 82 to its normal position and the depressing movement of the said plunger resisted through the spring by the compressor. The plunger 82 and the compressor 92 are mounted between the plates 64, a pin 101 being first inserted through transversely alined openings 102 in the heads 95 of the compressor and the slot 83 of the plunger 82, and the said plunger and compressor are unitedly fulcrumed between the plates 64 by a pin 103 inserted through the openings 70 of the said plates and through transversely alined openings 104 in the heads 95 of the compressor below the openings 102 and also through the slot 83 of the plunger, and when the parts of the controller are thus assembled in the slide head the button 88 projects upwardly through the seat slot 15 of the arm 14 or through the seat slot 17 of the arm 16 in accordance with the position of the contact slide or circuit making element 11 in the carrier 8 or fixed rim 9.

As heretofore indicated, the controller is capable of two movements, the vertical reciprocation of the plunger 82 against the resistance of the spring 89 engaging the vertical extensions 100 as a lower abutment or stop means, and the bodily oscillating or rocking movement of the plunger and compressor on the fulcrum pin 103 engaging the plates 64 to render the compressing head 97 effective in performing the function for

which it has been devised. To prevent the controller from having oscillation at a time when such movement is undesirable, a spring 105 is connected at its lower extremity to a hook or projection 106 on one side of the compressor and at its upper extremity attached to a hook or projection 107 extending outwardly from one of the plates 64, and to limit the upward or return movement of the compressor the latter has an outwardly extending stop pin 108 at one side to bear against the end of the plate 64 carrying the hook or projection 107.

It is obviously necessary to lock the controller against oscillating movement when the contact slide or circuit making element 11 is shifted from the carrier 8 into the fixed rim 9 and vice versa and to automatically release the said controller for oscillating movement when the slide or circuit making element is pushed outwardly into the fixed rim. For this purpose a lock is provided and consists essentially of an elbow lever 109 having fulcrum means 110 at the angular intersection of the arms thereof to engage the openings 69 in the plates 64, a spring 111 engaging the lower or depending arm of the elbow lever and operating to throw the latter backwardly and particularly elevate the upper arm of the lever, the spring 111 being coiled around a portion of the fulcrum 110 and having a rearwardly extending resistance arm 112 which engages one of the plates 64 as at 113, see Fig. 1. The lower end of the lower arm of the elbow lever 109 is provided with a transversely extending locking nose 114 which is of such length as to engage all the notches 85 and 99 of the plunger 82 and heads 95 of the controller, and when the said nose engages the notches as specified the plunger will be prevented from having vertical reciprocation and the controller from having bodily oscillation or rocking movement. The rear end of the upper arm of the elbow lever is provided with a transversely extending locking bar 115 from which an operating stud 116 rises and is of such length as to project through the seats or seat slots 17 of the arms 16 when the contact slides 11 are shifted into the fixed rim 9 and through the openings 73 in the arms 14 in rear of the seat slots 15 when the said contact slides are in normal position in the said arms 14. Each contact slide or shiftable circuit making element 11 is held against movement by the locking bar 115 which terminally projects through the slots 68 of the plates 64 and engages the lateral recesses 80 when the slide or circuit making element is pushed fully outwardly into the fixed rim into a seat slot 17 and channel 74 and holds a corresponding cover slide pushed outwardly in a pocket 117 in the upper portion of the outer extremity of the arm 16 engaged by

the slide, and when it is desired to draw any contact slide or circuit making element inwardly into the carrier 8 the operator depresses the stud 116 to release the locking bar 115 sufficiently to permit the latter to ride or slide over the rear beveled walls 81 of the recesses 80 and engage the under surface of the inner extremity of the arm 16 and from the latter arm extremity pass under and bear against the lower side of the arm 14, and this maximum depression of the locking bar 115 throws the lower arm of the elbow lever 109 forwardly against the resistance of the spring 111 and causes the locking nose 114 to fully engage the notches 85 and 99 and secure the controller including the compressor against movement so as to facilitate restoration of each contact slide or shiftable circuit making element to normal position and during which operation the button or head 88 will serve as a temporary fixed means and be grasped by the operator. The parts of the controller will remain fully locked during the rear shifting movement of the contact slide into the carrier until the locking bar 115 reaches the lateral recesses 72 when said bar will be forced into the said recesses by the spring 111 and the stud 116 will be projected upwardly through the opening 73. When the contact slide has been fully retracted in its arm 14 the shoulders 66^a of the slide head or of the plates 64 engage the inner end wall of the channel 71 and the clearance in rear of the said shoulders 66^a and formed by the recesses 67^a permits the part of the slide head immediately above the upper end of the hanger or post 57 to move under the arm 14, as shown by dotted lines in Fig. 1. When the bar 115 is in engagement with the recesses 72 the locking nose 114 will not be fully disengaged from the notches 85 and 99 and the nose 114 will be free for limited outward movement in the notches when the operator depresses the stud 116 to disengage the locking bar 115 from the recesses 72 in the subsequent use of the contact slide or the shiftable circuit making element. The retention of the contact slide or circuit making element through the medium of the locking bar 115 engaging the recesses 72 is forceful enough to prevent loose movement or displacement of the contact slide that might otherwise ensue by rotation of the carrier 8 from centrifugal action, and as a consequence the operator is not restricted in rapidity of rotation of the carrier in alining the several seat slots 15 with the seat slots 17 for manipulating the contact slides and establishing talking circuits or in resetting the contact slides in normal position in the carrier.

The outer upper portion of each arm 16, as hereinbefore explained, receives the cover slide 78 and each seat slot 17 is fully cleared for the reception of a contact slide but is

immediately closed automatically when the contact slide is withdrawn from the fixed rim 9. When the several contact slides are fully pushed outwardly into the fixed rim the several parts thereof including the controller, projection 58, and contacts 61 of each slide, are disposed respectively in operative relation to the yielding conductors 54, 55 and 56, conducting arms 35, and pair of contact bars or plates 19. The cover slides 78 are slightly wider than the maximum width of the contact slides 11, and the grooves 67 of the arms 16 or seat slots 17 in the latter are deep enough to compensate for the increased width of the said cover slides. Abutments 118 are formed at the inner terminals of the grooves 67, see Fig. 1, for engagement with the recessed corners 79 of the cover slides 78 to restrict the inward movement of the said cover slides when released by withdrawal of the contact slides 11 from the fixed rim and thereby avoid projection of the inner extremities of the cover slides 78 beyond the inner edge of the fixed rim 9 and interference with the free actuation of the carrier 8.

The posts or hangers 57 of the contact slides or circuit making elements 11 are of different lengths to correspond to the varying elevations of the pairs of contacts or conducting bars or plates 19, but there are two contact slides or circuit making elements duplicate in dimensions to operate with each pair of contact or conducting bars or plates 19, and the dual groups of the contact slides have similar numerals or other designating characters on the buttons 88, or each group has designating characters of one kind, another group a different kind, and so on throughout the whole series of groups. The purpose of this similarity of dimensions of the contact slides and the application to cooperating pairs of similar designating characters, is to assist the operator in expeditiously and certainly establishing communication between any two subscribers, and the annunciators or analogous signaling devices $\approx$ bear numerals or designating characters similar to those of the several dual groups of contact slides so that when two subscribers have ceased talking and hang up their local instruments or "ring off," the operator will readily perceive through the immediate actuation and display of one of the signaling devices $\approx$ which group of contact slides should be disengaged from the fixed rim 9 and restored to normal position in the carrier 8.

Assuming that subscriber No. 21 desires to communicate with subscriber No. 20, the release of the receiver or the actuation of any other local means for signaling included in the circuit by subscriber No. 21 will result in the actuation of the corresponding annunciator or signaling device 39, and the

operator at the exchange or central office ascertaining the number of the signaling device 39 actuated immediately pushes one of the contact slides or circuit making elements 5 11, say for instance No. 2, outwardly into the fixed rim 9 by first rotating the carrier 8 and bringing the slot 15 of the arm 14 in which said contact slide has been held into coincidence with one of the seat slots 10 17 unoccupied at the time and corresponding to subscriber No. 21, and by such operation, for reasons hereinbefore explained, the controller included in the actuated contact slide will be released and the circuit making 15 arms 33 and 34 which have been normally in contact with the conducting arms 35 will be separated from the said arms 35 by the projection 58 and the signaling circuit of operator No. 21 which is normally in condition for actuating the corresponding signal 20 device 39 will be broken and the arms 33 and 34 will then be held in contact with the metallic strips or conductors 59 on opposite sides of the projection 58, and the contacts 25 61 on the lower extremity of the post or hanger 57 of the actuated contact slide will be in engagement with a pair of contact or conducting plates or bars 19, and as shown by way of example by Fig. 1, the pair of 30 contact or conducting plates or bars 19 engaged will be the second pair from the top of the multiple contact means 10. The operator has not as yet, however, completed the circuit between her equipment 40 and 35 the calling subscriber, and to accomplish this circuit completion the operator oscillates or rocks the controller in an outward direction to bring the compressor 92 thereof into operative position or so that the upper 40 ends of the conducting arms or yielding conductors 54, 55 and 56 will be drawn together by entering the inverted V-shaped recess 98 of the head 97 of said compressor, the upper 45 extremities of the conductors 54, 55 and 56 being deflected inwardly to facilitate this operation. When the operator has thus placed the equipment 40 in the circuit, the subscriber No. 21 will be requested to give the number of the subscriber with whom he 50 desires to communicate, and after the operator ascertains this number the controller is released or is permitted to automatically return to normal position, and if the subscriber called be No. 20, the remaining contact slide bearing the same numeral or designating character as that first pushed outwardly, or the remaining No. 2 contact slide, 55 is shifted into the fixed rim 9 at seat corresponding to subscriber No. 20 and the operator then presses the plunger 82 of the controller of the first shifted contact slide and the wedge-shaped head 86 of said plunger enters between and spreads apart 60 the conducting strips or arms 33 and 34 from the conducting strips or plates 59 of the projection 58 of the said first shifted slide or circuit making element. When the arms 33 and 34 have been thus separated or thrown out of engagement with relation to the conducting strips or plates 59 of the 70 projection 58 and which separation is maintained by holding the plunger 82 depressed, the operator actuates the magneto or other analogous device M to notify subscriber No. 20, the circuit including the magneto or 75 analogous instrument M without operator's equipment 40, then being through the wires *m*, *n*, conducting strips 28 and 29, arms 33 and 34 which are then in contact with the arms 30 and 31 and wires *k*, *l*, to the local instrument of subscriber No. 20, subscriber No. 80 21 being cut out during this signaling operation in relation to subscriber No. 20, in view of the fact that the arms 33 and 34 have been separated from the conducting strips or plates 59 of the projection 58 and thus the calling subscriber No. 21 is free 85 from the annoyance and unpleasantness of the vibration and sharp pulsation or shock to the ear due to the actuation of the magneto or other instrument M. The operator maintains the plunger 82 depressed until the called subscriber No. 20 answers or takes up his receiver and which may be ascertained 90 by the operator by again oscillating the controller to throw in her equipment 40, and when subscriber No. 20 responds the operator releases the depressed plunger 82 and the arms 33 and 34 reengage the metallic strips 59 on the projection 58 of the contact 95 slide corresponding to the called subscriber. The operator may at any time throw her equipment 40 into the talking set by oscillating the controller of one of the outwardly shifted contact slides and thereby compress 100 the conductors 54, 55 and 56 as hereinbefore explained. While subscribers Nos. 20 and 21 are in communication or talking, the contact slides or shiftable circuit making elements 11 included in their circuits, are 105 allowed to remain unmolested in the fixed rim 9, and during this period any other connection may be established or other subscribers included in the switch means may be placed in communication by the outward shifting 110 of other pairs of contact slides or circuit making elements 11 and brought in contact with other pairs of contact or conducting plates or bars 19 included in the multiple contact means 10. When subscribers Nos. 120 21 and 20 are through talking and restore their local instruments to normal condition, the operator at the exchange or central office or station will be apprised of this condition by the actuation of the corresponding annunciator or analogous signaling device *z*, 125 and immediately upon receiving this notice the operator will restore the contact slides or circuit making elements of subscribers Nos. 21 and 20, or the contact slides No. 2 130

to normal position within the carrier and by such operation the signaling circuits of subscribers Nos. 21 and 20 are restored to normal condition. It will be understood that the talking circuits are completed through the pairs of conducting strips or plates 59 on the projections 58 of the actuated contact slides 11 by the contacts 61 on the posts or hangers 57 of said slides engaging the same pair of plates or bars 19, and the moment that a pair of the contact slides which has been active is retracted into the carrier the talking circuit established thereby between any two subscribers will be instantly broken.

In the foregoing description of the operation of the switch means, the contact slides or shiftable circuit making elements 11 bearing the designating numeral "2" have been referred to by way of example to explain the method of establishing the talking circuit between subscribers Nos. 21 and 20, but it will be understood that other contact slides might have been referred to and would have practically demonstrated the method of connecting up said subscribers, the sole object being to use dual groups of contact slides or circuit making elements 11 coöperating with the same pair of contact plates or bars 19 in the multiple contact means 10. Furthermore it will be understood that the designating numbers or characters on the buttons 88 of the dual groups of contact slides need not necessarily be of such nature to indicate a particular position of the pairs of contacts or contact plates or bars 19 with which the dual groups are designed to coöperate, it being only necessary to preserve the dual group arrangement or to have two contact slides or shiftable circuit making elements arranged to coöperate with each pair of contact plates or bars 19. Moreover, the usual current generating means will be employed, though not shown, and located either adjacent the switch means or form a part of the switch means organization, or be in part included in the subscribers' or local telephone organizations, or arranged in any other well known or approved manner.

What is claimed is:

1. A switch means involving a multiple contact means comprising a plurality of superposed conducting elements, electrical connections, and a carrier movable adjacent to said multiple contact means and holding a plurality of independently shiftable circuit making elements which are movable outwardly from the carrier to engage with the multiple contact means and electrical connections and inwardly into the carrier when not in use, the said elements being arranged as coöperating dual groups, and each dual group caused to engage the same conducting elements of the multiple contact means.

2. A switch means involving pairs of conducting elements having electrical devices coöperating therewith, and a carrier movable with relation to the said conducting elements and electrical devices and having a plurality of circuit making elements independently shiftable outwardly from the carrier and operable in dual groups, each group engaging the same conducting elements, the dual groups of the circuit making elements varying in proportions to cause them to engage different conducting elements.

3. A switch means involving pairs of superposed conducting elements having corresponding electrical devices coöperating therewith, and a carrier freely movable with relation to said conducting elements and electrical devices and having a plurality of shiftable circuit making elements arranged in dual groups of different proportions and movable outwardly from the carrier, each dual group of circuit making elements engaging the same pair of conducting elements and corresponding electrical devices.

4. A switch means involving multiple contact means embodying a plurality of conducting elements and a movable carrier having a plurality of shiftable circuit making elements freely movable to clear the carrier and operable to electrically connect the same in dual groups, each independent group always engaging the same pair of conducting elements of said multiple contact means.

5. A switch means involving a movable support, a plurality of shiftable circuit making elements carried by the support and movable clear of the latter, and a multiple contact means having superposed longitudinally extending pairs of contact members over which the circuit making elements are shiftable to permit pairs of the said elements to engage the same pairs of members.

6. A switch means involving a multiple contact means having superposed members arranged in pairs, and a plurality of independently shiftable circuit making elements operable to electrically connect the same in dual groups so that each independent group may always engage the same pair of members of said multiple contact means.

7. A switch means involving a multiple contact means composed of distinct superposed pairs of members, corresponding electrical devices including signaling and operator's circuits, and a plurality of independently shiftable circuit making elements operable to electrically connect the same in dual groups, each independent group always engaging the same pair of superposed contact members and the adjacent electrical devices to control said circuits and establish talking circuits, the independent groups engaging different pairs of the contact members.

8. A switch means involving a multiple

contact means having banked pairs of contact members, electrical devices having subscribers' instruments and signaling means connected thereto and electrically associated in dual cooperating groups, and a plurality of independently shiftable circuit making elements operable to electrically connect the same in dual groups, each independent group of circuit making elements always engaging the same pair of contact members.

9. A switch means involving a multiple contact means composed of distinct pairs of superposed members, a plurality of shiftable circuit making elements independently operable to electrically connect the same in dual groups, each independent group engaging the same pair of said members, and a rotatable carrier in which the said elements are normally mounted in separable relation.

10. A switch means involving a multiple contact means comprising a plurality of superposed members electrically connected by conducting means in distinct pairs, electrical devices for cooperation with said contact means, and a rotatable carrier normally supporting a plurality of shiftable circuit making elements independently separable from the carrier and operable to electrically connect the same in dual groups, each independent group being operative to engage the same pair of said members and the several groups engaging different pairs of the members.

11. A switch means involving a multiple contact means, electrical devices for cooperation with said contact means, and a movable carrier supporting a plurality of independently shiftable circuit making elements which are separated from said carrier to set up engagement in dual groups with the same portions of the multiple contact means and also coacting with the electrical devices.

12. A switch means involving a multiple contact means, electrical devices for cooperation with said contact means, and a movable carrier supporting a plurality of independently shiftable circuit making elements which are moved outwardly from said carrier for engagement in dual groups with the same portions of the multiple contact means and with different portions of the electrical devices.

13. A switch means involving a fixed rim provided with a plurality of seats, a multiple contact means having banked pairs of members, electrical devices disposed in groups in proximity to the said seats, and a movable carrier having a plurality of seats to coincide with the seats of the rim and supporting a plurality of shiftable circuit making elements which are separable from said carrier for engagement with pairs

of members of the contact means and the groups of electrical devices.

14. A switch means involving a fixed rim having seats, a multiple contact means, electrical devices having subscribers' instruments and signaling means connected thereto, and a carrier freely movable in opposite directions in relation to the rim and having a plurality of seats in which shiftable circuit making elements are separably held and movable into the seats of the fixed rim to engage the multiple contact means and the electrical devices.

15. A switch means involving a fixed rim having seats, a multiple contact means having superposed pairs of members, electrical devices disposed in groups in operative relation to said seats and having subscribers' instruments and signaling means connected thereto, and a carrier freely movable in opposite directions in relation to the rim and having a plurality of seats to coincide with the seats of the rim and supporting a plurality of shiftable circuit making elements movable into the seats of the rim for engagement with the superposed pairs of members of the contact means and the groups of electrical devices, the said shiftable circuit making elements being arranged in pairs having similar dimensions and designations.

16. A switch means involving a multiple contact means, electrical devices for cooperation with said contact means, and a movable carrier supporting a plurality of shiftable circuit making elements for engagement with the multiple contact means, the shiftable circuit making elements being movable outwardly clear of the carrier and arranged in pairs, each pair having similar dimensions and designations.

17. A switch means involving a multiple contact means composed of a plurality of superposed contact members arranged in cooperating pairs, electrical devices disposed in operative relation to the contact means, and a movable carrier supporting a plurality of shiftable circuit making elements arranged in pairs, each independent pair having similar dimensions and designations to always engage the same pair of contact members.

18. A switch means involving a multiple contact means having a bank of members arranged in superposed pairs, each pair having electrical connections independent of the remaining pairs, electrical devices cooperating with the contact means, and shiftable circuit making elements provided with means to electrically connect the same in dual groups and each group having proportions differing from the remaining groups to contact with the pairs of said members and the electrical devices, each

independent group of circuit making elements engaging the same pair of contact members.

19. A switch means involving a plurality of superposed pairs of contacts having independent signaling means connected to each pair, electrical devices including signaling and operator's circuits, and a plurality of shiftable circuit making elements arranged in distinct pairs for engagement with each pair of contacts, each pair of circuit making elements independently engaging a different pair of the contacts.

20. A switch means involving a plurality of distinct superposed pairs of contacts having independent signaling devices connected to each pair, corresponding electrical devices including signaling and operator's circuits, and a plurality of shiftable circuit making elements operable to electrically connect the same in coöperative pairs and movable to and from the pairs of contacts, each independent pair of circuit making elements always engaging the same pair of contacts and also engaging the adjacent electrical devices, each circuit making element being provided with movable means for actuation by an operator for throwing in and cutting out the signaling circuits.

21. A switch means involving a multiple contact means arranged in pairs, a signaling device connected to each pair of contact means and individually operable, electrical devices including signaling and operator's circuits, and a plurality of shiftable circuit making elements operable to electrically connect the same in pairs, each independent pair engaging the same pair of the contact means, the circuit making elements being individually provided with movable means for actuation by an operator after the circuit making elements have been placed in engagement with said contact means for throwing in and cutting out the signaling circuits.

22. A switch means involving a multiple contact means arranged in pairs, coöperating electrical devices including signaling and operator's circuits, and a plurality of shiftable circuit making elements operable to electrically connect the same in pairs, each of the pairs of circuit making elements always independently engaging the same pair of contact means and adjacent electrical devices and individually provided with means movable therewith for actuation by an operator for throwing in and cutting out the signaling circuits.

23. A switch means involving a multiple contact means, electrical devices including subscribers' signaling and operator's circuits, and a plurality of shiftable circuit making elements to engage the multiple contact means and electrical devices, each

element carrying movable means for actuation by an operator after engagement with said contact means has been made for throwing in and cutting out the signaling circuits of subscribers preliminary to setting up a talking circuit between subscribers.

24. A switch means involving a multiple contact means, electrical devices including subscribers' signaling circuits and operative to complete talking circuits, and shiftable circuit making elements to engage the multiple contact means and electrical devices and individually provided with manually operative means and which is movable after engagement with said contact means for throwing in and cutting out the said signaling circuits and for completing the talking circuits.

25. A switch means involving a multiple contact means, coöperating electrical devices including subscribers' signaling circuits and operative to complete talking circuits, and shiftable circuit making elements operable to electrically connect the same in distinct pairs, each pair of the circuit making elements engaging with the same pair of the contact means and with coöperating electrical devices and each circuit making element carrying movable means operative after it has been placed in engagement with its contact means and coöperating electrical devices for temporarily throwing in and cutting out the signaling circuit corresponding thereto and establishing a talking circuit.

26. A switch means involving a circular bank of multiple contact means, circularly arranged groups of electrical devices including means for signaling and setting up talking circuits, a fixed rim of circular form arranged over the multiple contact means and electrical devices and having a plurality of radial seats, a freely rotatable circular carrier also having a plurality of seats to coincide with those in the rim, and a plurality of shiftable circuit making elements normally supported by the carrier and movable from the latter into the rim to engage the multiple contact means and electrical devices.

27. A switch means involving a multiple contact means, electrical devices including subscribers' signaling circuits and operative to complete talking circuits, a fixed rim disposed over the contact means and electrical devices, and a carrier freely rotatable in either direction and having a plurality of circuit making elements shiftable therefrom into the rim to engage the multiple contact means and electrical devices.

28. A switch means involving a multiple contact means, electrical devices including subscribers' signaling circuits and operative to complete talking circuits, a fixed rim dis-

posed over the contact means and electrical devices, a carrier freely rotatable in opposite directions adjacent to the fixed rim, and a plurality of circuit making elements disposed in the carrier and shiftable from the latter into the fixed rim to engage the multiple contact means and electrical devices and provided with locking means to prevent displacement thereof when disposed in either the carrier or the rim.

29. A switch means involving a multiple contact means, electrical devices for cooperation with said contact means, a carrier movable in relation to said contact means and electrical devices, and a plurality of shiftable circuit making elements normally disposed in said carrier and movable outwardly from the latter for engagement with the multiple contact means and electrical devices and having locking means for preventing displacement thereof when in the carrier and when engaging the contact means and electrical devices.

30. A switch means involving a multiple contact means, electrical devices for cooperation with said contact means, a fixed rim over said contact means and electrical devices, a carrier movable in relation to said rim, and a plurality of shiftable circuit making elements normally disposed in the carrier and movable into the rim to engage the contact means and electrical devices and provided with locking means for holding the same against displacement when in the carrier or in the rim.

31. A switch means involving distinct pairs of contact means having independent signaling circuits connected thereto, electrical contact devices having independent talking circuits, and shiftable circuit making elements proportioned in relative pairs for simultaneous engagement with corresponding pairs of the contact means and electrical devices.

32. A switch means involving contact means and electrical devices including subscribers' signaling and operator's circuits, and shiftable circuit making elements operable in distinct pairs, each independent pair of elements always engaging the same portions of the contact means and adjacent parts of the electrical devices and each element provided with means for temporarily breaking contact of a portion of the parts of the electrical devices from the actuated circuit making elements while the latter are in engagement with a portion of the contact means.

33. A switch means involving a plurality of contact and conducting devices arranged in independent groups, and circuit making elements independently shiftable and electrically connected in dual groups, each dual group always engaging the same corre-

sponding dual groups of the contacts and the conducting devices, and each element provided with movable means for breaking contact of a part of the conducting devices with relation thereto.

34. A switch means involving a plurality of contact and conducting devices arranged in independent groups and including in each group a subscriber's signaling circuit and an operator's circuit cooperating with all the circuits, and circuit making elements shiftable in relation to said independent contact and conducting devices and arranged in independent cooperating pairs, the circuit making elements being each provided with movable means for separating a part of the conducting devices from said elements and for connecting another part of said conducting devices thereto.

35. A switch means involving a plurality of contact and conducting devices arranged in independent groups and forming parts of electrical circuits, and shiftable circuit making elements operable to bring pairs of the same in relation to corresponding independent groups of contact and conducting devices and provided with means for electrically connecting and disconnecting a portion of said conducting devices of each group, each pair of circuit making elements always engaging the same group of contact and conducting devices.

36. A switch means involving a plurality of contact and conducting devices, and shiftable circuit making elements operable to electrically connect the same in dual groups, each dual group of circuit making elements with the same portions of said contacts and of the conducting devices and also movable to engage different parts of the contact devices and with different conducting devices, said circuit making elements being each provided with movable means operative after shifting of the said elements for separating a part of the conducting devices therefrom and electrically connecting another part of the said conducting devices therewith.

37. A switch means involving a plurality of contact and conducting devices arranged in independent groups, and independently shiftable circuit making elements operable to electrically connect the same in dual groups, each group of elements always engaging the same portions of the contact and conducting devices, the circuit making elements being individually provided with and carrying controllers having a part thereof operative for separating a portion of the conducting devices from the elements and for connecting another portion of said conducting devices with the elements.

38. A switch means involving a plurality of contact and conducting devices, a movable carrier shiftable with relation to said con-

tact and conducting devices, circuit making elements movably mounted and normally held in the said carrier and operative to bring the same in contact with the said devices, the circuit making elements carrying movable controllers to separate a portion of the conducting devices therefrom, and locking means carried by the elements to hold the controllers against movement when the said elements are shifted.

39. A switch means involving a plurality of contact and conducting devices, circuit making elements shiftable in relation to said contact and conducting devices and provided with movable controllers, and locking means carried by the elements to hold the controllers against movement when the said elements are shifted and automatically releasing the controllers when the elements are moved into engagement with the contact and conducting devices.

40. A switch means involving a plurality of contact and conducting devices forming portions of electrical circuits, and circuit making elements independently shiftable into and out of engagement with relation to different portions of the said contact and conducting devices and individually provided with and carrying movable members under the control of an operator for temporarily disengaging portions of the conducting devices from said elements.

41. A switch means involving a fixed rim having seats provided with automatically closing covers, multiple contact means and electrical devices disposed in groups adjacent to the rim, and a movable carrier also having seats with a plurality of circuit making elements shiftable mounted therein and movable into the seats of the rim to engage the multiple contact means and electrical devices, the circuit making elements opening the said covers when the elements are shifted into the rim.

42. A switch means involving a multiple contact means composed of a plurality of superposed conducting plates made in sections, the sections being terminally separated and the separated ends of each series of plate sections in the same plane being out of alinement with the separated ends of the plate sections next thereto, means for connecting the sections of each plate to prevent cross talk, and contact means for engagement with the several plates.

43. A switch means involving a plurality of contact means composed of conducting members individually made up of sections and having wires connecting the sections, the terminals of the sections being separated, and contact devices and electrical means for cooperation with the said members.

44. A switch means involving a plurality of superposed contact members and elec-

trical conducting devices cooperating therewith, the contact members and conducting devices being arranged in independent pairs and forming portions of electrical circuits, and independently shiftable circuit making elements manually operable to electrically connect the same in dual groups to engage distinct pairs of the independent contact members and conducting devices, each element being provided with a projection having conducting means to automatically separate a portion of the conducting device with which it cooperates and also with movable means to engage said contact members and connected to the conducting means on the projection.

45. A switch means involving a plurality of superposed contact members and electrical devices cooperating therewith and arranged in independent groups, and shiftable circuit making elements individually having contact means to engage said contact members and projections in advance of said contact means carrying conducting means to engage and separate a portion of the electrical devices, the conducting means on the projections being electrically connected to said contact means of the elements, the said circuit making elements being shiftable toward and from said contact members and also lengthwise of the latter, the circuit making elements being operable to connect the same in dual groups relatively to corresponding groups of the contact members and electrical devices.

46. A switch means involving a carrier freely movable in opposite directions, multiple contact means operatively associated with said carrier and comprising distinct pairs of contacts, and a plurality of contact making units operable to electrically connect the same in dual groups, each group of units being movable into engagement with the same pair of contact members, the contact units being also normally disposed in and movable outwardly from the said carrier.

47. A switch means involving a rotatable carrier, a multiple contact means operatively associated with said carrier and composed of a plurality of independent pairs of contact members, and a plurality of contact making units normally disposed in the said carrier and movable in and shiftable outwardly from and clear of the said carrier to engage the multiple contact means, the units being operable to electrically connect the same in dual groups relatively to the same pair of contact members.

48. A switch means involving a multiple contact means composed of independent pairs of superposed contact members, and a plurality of contact making units shiftable over different portions of the contact means

and operable to electrically connect the same in coöperating pairs, each pair of units being similar in dimensions but differing in dimensions from the remaining pairs, and
5 each pair of units engaging the same pair of contact members.

In testimony whereof I have hereunto set

my hand in presence of two subscribing witnesses.

HARRY L. FURR.

Witnesses:

R. B. SMYTHE,

W. C. SWITZER.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."
