(No Model.) 4 Sheets—Sheet 1.

C. H. WILSON.

SYSTEM OF WIRING MULTIPLE SWITCHBOARDS.

No. 499,693. Patented June 13, 1893.

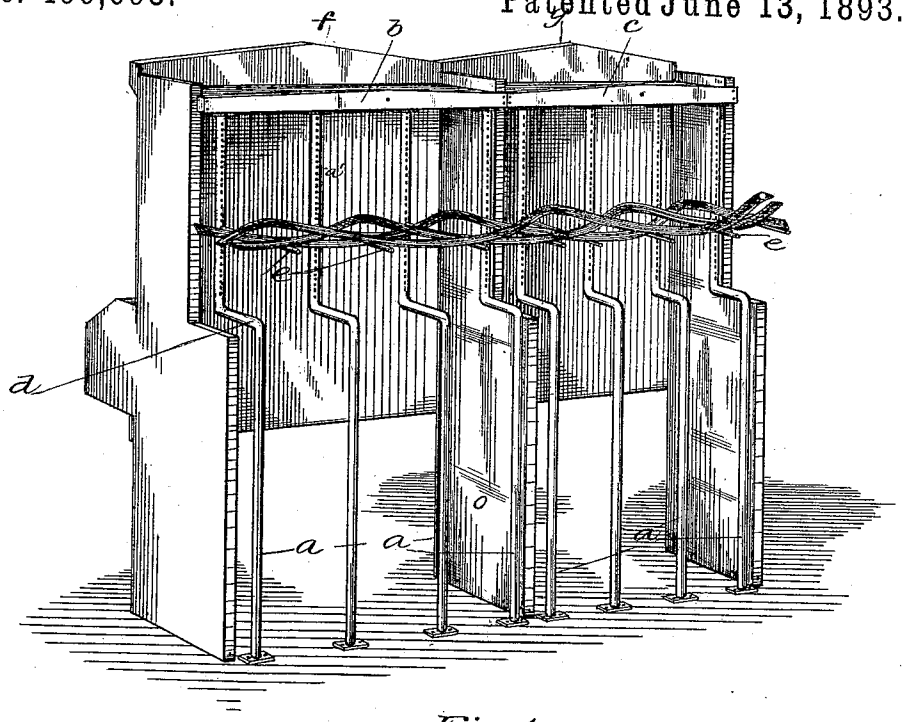

Fig. 1.

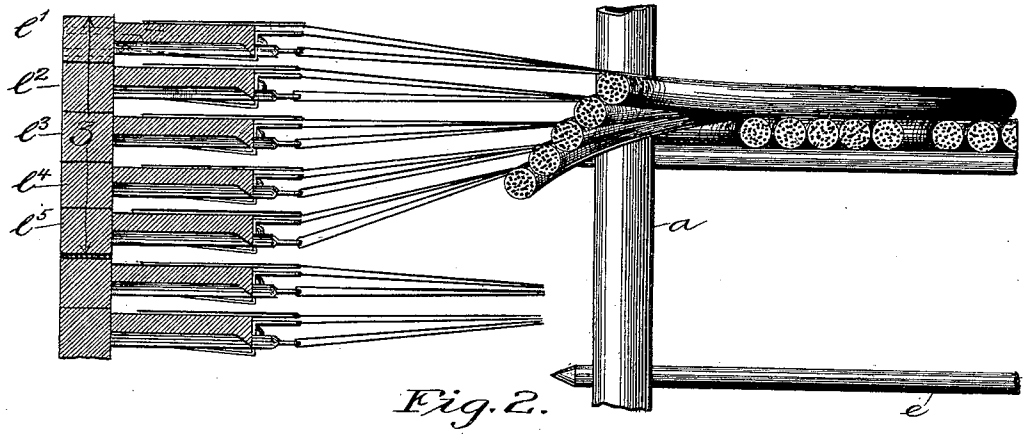

Fig. 2.

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Ella Edler

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By George P. Barton
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(No Model.) 4 Sheets—Sheet 2.

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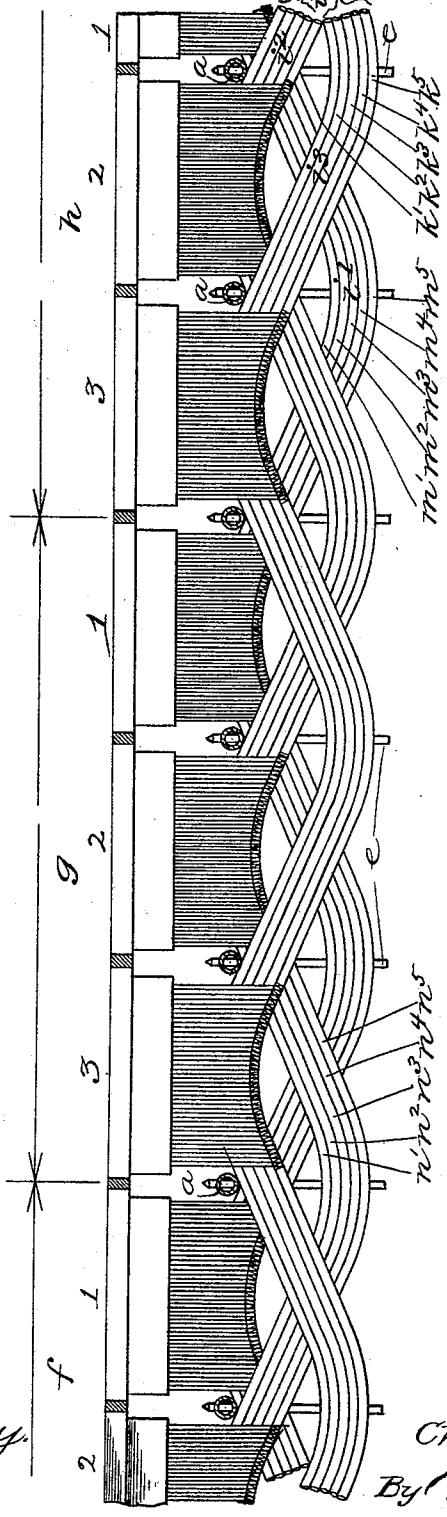

Fig. 3.

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(No Model.) 4 Sheets—Sheet 3.

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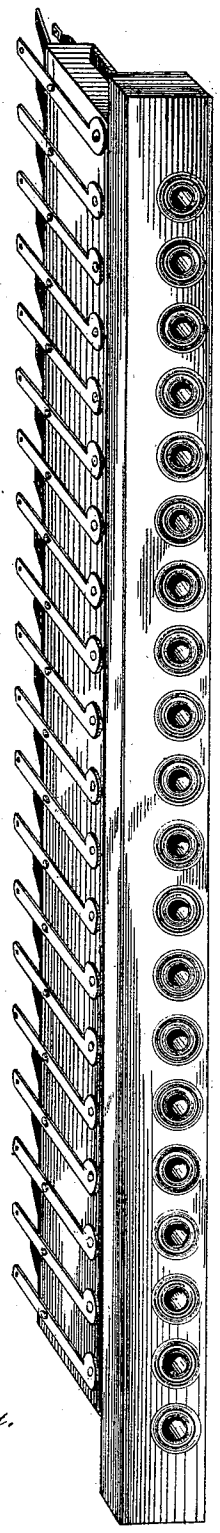

Fig. 4.

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(No Model.) 4 Sheets—Sheet 4.

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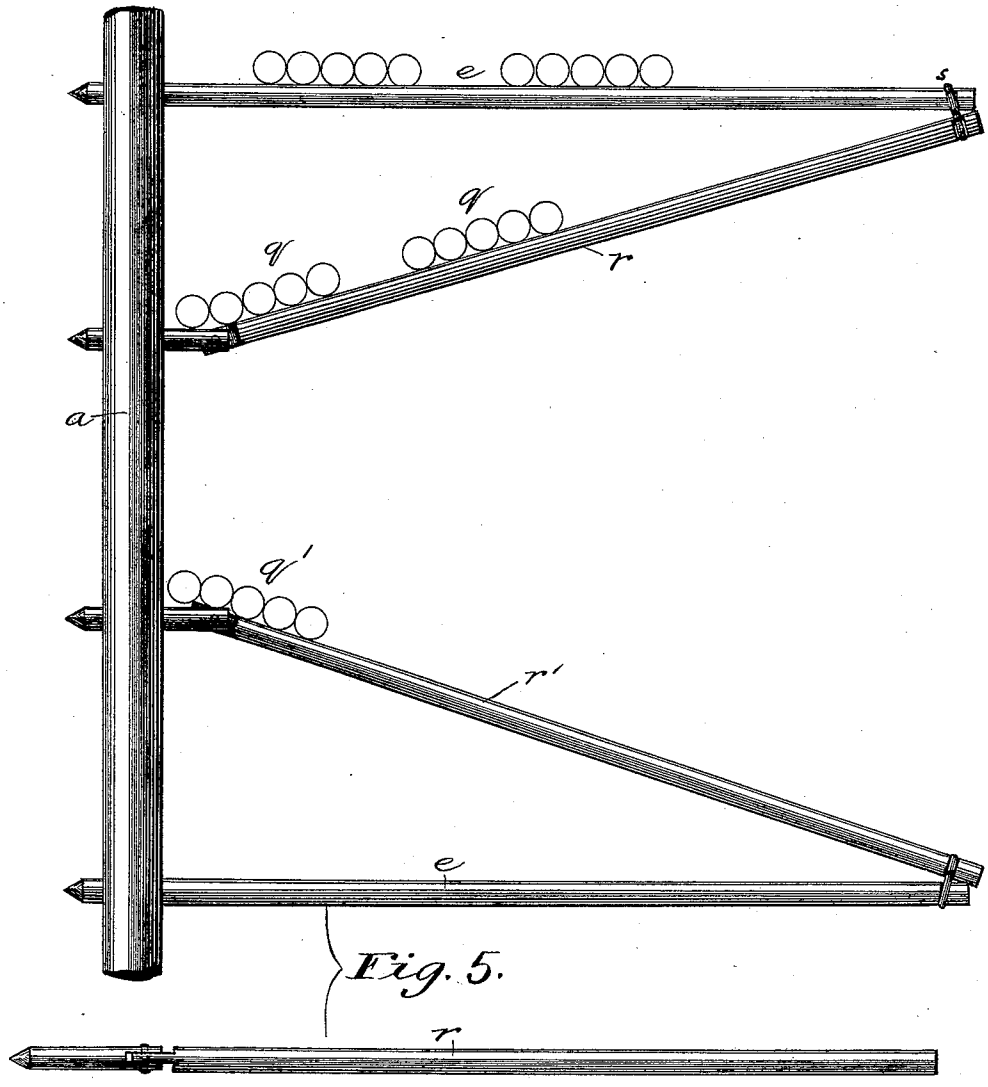

Fig. 5.

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UNITED STATES PATENT OFFICE.

CHARLES H. WILSON, OF CHICAGO, ILLINOIS, ASSIGNOR TO THE WESTERN ELECTRICAL COMPANY, OF ILLINOIS.

SYSTEM OF WIRING MULTIPLE SWITCHBOARDS.

SPECIFICATION forming part of Letters Patent No. 499,693, dated June 13, 1893.

Application filed October 8, 1888. Serial No. 287,602. (No model.)

To all whom it may concern:

Be it known that I, CHARLES H. WILSON, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in System of Wiring Multiple Switchboards, of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

In telephone exchange systems, in which multiple switch-boards are required to afford facilities for the operators to work in making the connections and disconnections between the line terminals, the problem of disposing the wires and making the connections with the different switches on the different boards has been considered quite difficult. It is necessary that the wires shall be brought within a comparatively small space, that the connections of the wires with the switches shall be perfect, and the cables carrying the wires, so disposed that the connections may be made accessible. In connection with these requirements it is desirable for the sake of economy and for the sake of reducing as far as possible the induction between the wires, that the length of the cables should be reduced as far as possible.

The multiple switch-board of a telephone exchange, as is well known, is made up of duplicate sections. The different sections are frequently spoken of as different boards. It would seem to me, however, more accurate to speak of the whole as a multiple switch-board, and to speak of each duplicate part as a section of the multiple switch-board. The line terminals, which are usually spring-jack switches, may be built up in strips, each strip consisting of twenty, and five strips arranged one above the other would be sufficient for one hundred lines; thus in an exchange having three thousand lines each section of the switch-board would contain three thousand spring-jack switches; these switches would be placed in the section, one above the other, and in any number of divisions, say six, each division containing five hundred and being made up of twenty-five strips, placed one above the other, and these twenty-five strips being divided horizontally into five subdivisions, each subdivision of five strips containing one hundred terminals. It is desirable that the frames carrying the terminals, may not be loaded with the weight of the cables.

Heretofore in multiple switch-boards the cable-rack has been so connected with the frame of the switch-board proper as to frequently bend or warp the same when loaded down with the mass of wires necessarily required to make the connections.

My invention herein relates to the manner of disposing or arranging the cables at the rear of the board.

As to the state of the art prior to my invention, reference is made to Letters Patent No. 367,730, granted John A. Seely August 2, 1887, for cable rack for switch-boards, application filed January 31, 1887; and Letters Patent No. 385,846, granted James A. Cook and Frank B. Cook, July 10, 1888, for wiring switch-boards, application filed July 25, 1887. When the cables are run directly from one board to the other as described in the said Cook and Cook patent, in large exchanges it has been found difficult to take out one cable with any one of the attached strips of spring-jack switches for inspection or repairs; sometimes it has been found necessary to cut the cable, and considerable space has been required between the cables and rear ends of the springs or connecting pieces of the spring-jack switches.

My invention consists: in running the cables between the different sections at an angle, so that there will be sufficient slack to permit of readily pulling back any one of the cables at the rear of the strip to which its wires are attached for inspection or repairs, the different cables being so disposed with respect to the spring jack switches, with which they are connected that they may be readily separated, for the purpose of permitting any cable to be thus drawn back behind the others.

My invention will be readily understood by reference to the accompanying drawings in which—

Figure 1 is a rear perspective view of two sections of multiple switch-board, provided with my cable-rack. Fig. 2 is a section illus-

trating my method of connecting the wires of the cables with their respective strips of spring-jack switches upon one division of the switch-board. Fig. 3 is a plan showing my arrangement of the cables at the rear of the board, upon the rack. Fig. 4 is a perspective view of a strip containing twenty spring-jack switches. Fig. 5 is a view showing the jointed pins as used for separating the cables at the rear of the switch board.

Like parts are indicated by similar letters and numerals of reference throughout the different figures.

The cable rack which I preferably use and which forms a part of my invention will be readily understood by reference to Fig. 1.

The standards *a* may be of gas pipe, extending from cross pieces *b* and *c* of the different sections to the floor, each being bent back as shown at *d* to afford room for the cords and weights below the bend. It will be seen that the upper portion of each of the pipes is provided with pin holes, placed at short distances apart, and these upper portions of the pipes are placed quite near to the rear of the spring jack switches, say within three or four inches thereof, one pipe coming preferably directly behind each divisional strip of the board placed between and supporting the strips of spring jack switches. Pins *e* inserted in the pin holes and arranged in horizontal rows serve as the supports proper for the cables. These pins may be placed at such distances apart vertically as to provide a little room between the cables so that the cables may, if desired, be spread apart.

It will be seen that the pipes *a*, *a* are so arranged behind the switch board that when loaded with a large number of cables, there will be no serious strain upon the upper portion of the frame of the switch-board. I have shown the pipes as extending to the floor; it is evident, however, that they might be supported in any manner below the portion of the board which carries the spring jack switches, so as to relieve the upper portion of the switch-board from the weight of the cables without departing from my invention.

I will now describe the manner of disposing the cables at the rear of the switch-board in accordance with my invention. The strip of spring jacks illustrated in Fig. 4 may be considered as one of the strips of spring jack switches, with which connections are to be made. We will consider that each section *f*, *g*, of the switch-board consists of three divisions, and that each division consists of twenty-five strips like the strip shown in Fig. 4, placed one above the other, and each set of five strips, we will consider as a subdivision, thus each subdivision would contain a hundred spring jack switches or line terminals. In multiple switch-board systems, usually, a test wire is required for each line, and thus forty wires would be required for making the connections with a single strip of twenty spring jack switches. As has been done heretofore, I preferably form the forty wires or whatever the number may be that are required for each strip of spring-jacks into a cable, and thus there are as many cables in the system as there are strips of spring jack switches on each section. In the system referred to, seventy-five cables would be required to carry the connections for the telephone lines and the test wires. For each subdivision of spring jack switches, that is, for one hundred spring jack switches, five such cables are required. It is preferable in multiple switch board systems, to arrange the spring jack switches or line terminals in the same order on each of the sections.

The cables or wires required for a subdivision of spring jack switches I run in parallel curves back of the switch-board from the connections of one subdivision on one section to the corresponding subdivision on the next section and thus from section to section. We will suppose five such cables are required. The connections with the spring jacks are preferably made before the strips are placed upon the switch board. The first cable with its strips of spring jack switches connected therewith to correspond with the different sections of the board, is placed upon the lower row of pins and the strips inserted in the proper places in the different sections; the next cable is then brought into place upon the pins and its strips of spring jack switches are placed directly over the strips of the first cable, and so on until we have one subdivision in each section complete. These five cables or whatever the number may be, as before stated, are run together parallel. Such a set or group of cables or wires I have sometimes termed a band of cables or conductors. Another band of cables and their attached strips of spring jacks are next brought into place in the same manner to form another subdivision of spring jack switches on the next division which is in the same position vertically on the next sections, and so on till each division of each section is complete as to one subdivision. Thus if there are three divisions on each board, three bands will be required; if four divisions, four bands, and so on. A group of bands corresponding in number to the divisions on each of the sections of the switch board being thus brought into place with their attached strips of spring jack switches, pins are inserted above this group and the operation is repeated until the work is done.

In Fig. 3 I have shown a plan of corresponding subdivisions of spring jack switches upon adjacent sections *f*, *g*, *h*, of a multiple switch-board, subdivision 3 of section *f*, and subdivision 1 of section *h* being shown broken away and subdivision 3 of section *f* being omitted. We will consider each subdivision 1, 2, 3, of each of the sections *f*, *g*, *h*, as made up of five strips similar to the strip illustrated in Fig. 4 placed one above the other. In Fig. 2 I

have shown a transverse vertical section of five strips forming a subdivision, thus placed one above the other, the section including two strips of the next subdivision below, together with the manner of running the cables and connecting the wires of the cables with the spring jack switches. The five strips 3 of Fig. 2 may be considered as corresponding with any one of the subdivisions, 3 of Fig. 3. The bands or cables I have lettered i', i^2, i^3 to distinguish one set or band from the others. When speaking of a set or group of wires connecting with corresponding subdivisions on the different sections, generally I shall designate such conductors as a band or group i. As before stated, each group or band i consists of a sufficient number of insulated conductors to make the connections with corresponding subdivisions of spring jack switches on the different sections of the switch board, and they are preferably, though by no means necessarily, laid up in cables, each band or group i containing as many cables as there are strips of spring jack switches in the subdivisions respectively, thus as shown in Figs. 2 and 3 band or group i^3 is made up of five cables k', k^2, k^3, k^4, k^5, each of said cables carrying forty conductors and corresponding respectively with strips l', l^2, l^3, l^4, l^5 of a subdivision 3. Band or group i' consists in like manner of five cables m', m^2, m^3, m^4, m^5, which are connected in the same way with the different strips of subdivisions 1 of the different sections. Band or group i^2 consists of cables n', n^2, n^3, n^4, n^5, which are in like manner connected with the corresponding subdivisions on the different sections of the switch board. It will be seen that each band or group approaches its subdivision of spring jack switches on section h, and then is curved back, and then again approaches its subdivision of spring jack switches on the next section g and so on, so that considerable slack is left between the consecutive corresponding subdivisions on the different sections. The pins e extending to the rear horizontally afford a support for the cables. Three bands or groups being in place as shown in Fig. 3, I insert another horizontal row of pins above the pins e to form supports for the next set of bands or groups.

The subdivision of spring jack switches 1, 2, 3, &c., of the different sections of the board are preferably arranged horizontally as shown, each subdivision consisting of five strips of spring jack switches. The vertical space thus occupied by each subdivision would depend upon the thickness of the strips. The cables, however, connecting with a horizontal row of subdivisions are disposed so that vertically there will be only two thicknesses of cables behind each such row of subdivisions of switches. Thus as shown in Fig. 3 the bands or groups i', i^2, i^3 cross each other, but in no instance do the three bands cross one another in position to bring the three layers or bands directly one above the other so as to make three thicknesses or layers of cable. Thus the vertical space occupied by all the cables of each of the horizontal rows of subdivisions, will not be greater than twice the diameter of one of the cables used. In this manner I am enabled to bring the cables within much less space vertically than the vertical space required for the subdivisions of spring jack switches. This method of disposing the cables makes it practicable to use much larger cables than heretofore has been thought possible, at the same time affording ample space for spreading the cables apart when required. It is evident that the same principle would obtain and the same results be accomplished if the number of divisions of the different sections and the number of strips in each subdivision were increased or varied from the number shown in the drawings.

The pin holes a' of the different pipes a are quite near together in order that the pins e may be adjusted vertically to any desired position. The space between the pin holes may be equal to one half or one third the thickness of a strip of spring jack switches. By removing certain of the pins space will be gained so that the cables may be crowded far enough apart to permit of ready access to the terminals or connections with the switch.

When any strip is to be removed its cable at the rear is brought directly opposite, that is to say, as nearly as may be in the same horizontal plane, the cables above the one to be removed being raised and those below lowered to afford sufficient space to permit of the withdrawal of the strip. The strip may then be unfastened from the front of the switch boards and carried back upon long plugs provided with long handles. In this manner any strain upon the wires is avoided.

Sometimes it is desirable to get at the connections of the wires with the spring jack switches when it is not necessary to remove the particular strip. In such case I have found it convenient to separate the cables at the rear of the connections requiring attention as illustrated in Fig. 5; thus suppose the connections with strip p are found imperfect, the cables q q' at the rear of said strip may be separated as shown, so as to make the connections with strip p accessible. In doing this work I preferably use jointed pins r r'. One of these pins as pin r being inserted in place of one of the ordinary pins e as shown is bent upwardly, thus raising the cables q. By means of a ring s or other suitable device pin r may be held in its elevated position. The lower jointed pin r' may be bent down as shown, thus lowering the cables q'.

I have not considered it necessary to describe in detail the manner of connecting the wires with the strips of spring jack switches. I would only say on this point that the cables are measured off in proper lengths and the connections made in the usual manner,

after which the cables are brought behind the switch board with their attached strips and the strips are inserted in the proper order.

As before stated I preferably begin with cable m' of the lower band or group i' and place them in position one after the other, that is, first the cables m', m^2, m^3, m^4, m^5 of subdivisions 1, then the cables n', n^2, n^3, n^4, n^5, of subdivisions 2 and then the cables k', k^2, k^3, k^4, k^5 forming band or group i^3 which are connected with the spring jack switches of subdivisions 3. In Fig. 1 I have shown at the rear of the upright board or leg o between the sections f, g, two pipes a instead of one as illustrated in Fig. 3. It will be understood that I do not in any way limit my invention to the precise constructions shown or to the special manner of grouping the spring jack switches upon the switch board or of mounting the spring jack switches upon rubber strips, since these details admit of innumerable modifications which will readily suggest themselves to those having any special knowledge on the subject of telephone exchange apparatus.

Under the provisions of and for the purpose set forth in the rule 107 I disclaim "groups of cables at the rear of multiple switch-boards, the wires of the cables being connected to spring-jack switches in the usual manner, the cables being slack between the sub-divisions of the switch-board whereby any strip of spring-jack switches may be withdrawn to the rear of the mass of cables, as described."

Having thus described my invention, I claim as new and desire to secure by Letters Patent—

1. The combination with a switch board consisting of duplicate sections, each section containing strips of spring jack switches or telephone line terminals arranged in divisions, of wires connected with the spring jack switches at the rear of the board, said wires being laid up in cables, the cables being arranged in curved parallel layers, bands or groups, the wires of each layer, band or group being connected with corresponding sets or subdivisions of removable spring-jack switches or terminals on each of the sections of the switch-board, the connections being made from the portions of the cables approaching nearest to the switch board, the curves of the cables corresponding to the divisions of the switch board.

2. The combination with removable spring jack switches arranged in the same order on each of two or more sections of a switch board, of telephone lines connected with corresponding subdivisions of said spring jack switches, the wires forming the connections between the corresponding subdivisions being formed into a group or band and curved to allow slack in passing from one division to another, the different groups or layers being arranged in the same order, and adapted to be spread apart to permit of the withdrawal to the rear of one cable with the spring jacks of a subdivision connected therewith.

3. The combination with a switch board of electric wires, each connected with corresponding switches, distributed on the different sections or duplicate parts thereof, said switches being removable at the rear, and the wires being formed in slack cables and run in separate curved groups or bands, said groups or bands being supported at the rear and adapted to be separated or spread apart to permit of the withdrawal of any cable with its attached spring jack switches of one of the sections.

4. A switch board, in combination with telephone lines connected therewith according to the multiple system, said wires being formed in cables and run each from one subdivision of switches or terminals on one section or duplicate part to corresponding switches or terminals on the other sections or duplicate parts of the multiple board, said cables being curved between the different subdivisions with which they are respectively connected, whereby any cable may be withdrawn behind the other cables with its attached spring jacks of one section, substantially as and for the purpose specified.

5. The combination with a band or group i of cables run behind a switch board in curves to afford slack between different corresponding subdivisions of switches upon the different sections of the board, of supports for said band or group consisting of a horizontal row of pins inserted in pipes a, said pipes being supported or sustained independent of the portion of the board carrying the switches as described.

6. The combination with a switch board containing strips of spring jack switches arranged in subdivisions 1, 2 &c. on the different sections, of cables connected with said switches, the wires of each corresponding set of strips being formed into a separate cable or bundle of wires, and the different cables of the strips of each subdivision being run together from one subdivision to the other whereby the group of cables carrying the wires of each corresponding set or subdivision of strips on the different boards may be formed in a separate accessible group, substantially as and for the purpose specified.

7. Bands or groups i of cables at the rear of a switch board, the number of said bands or groups corresponding to the number of divisions in each section of the board and the number of cables or separate bundles of wires in each band or group, corresponding to the number of strips in each subdivision of strips of switches, said different bands or groups being slack between the different corresponding subdivision of switches on the different sections with which the wires of the different groups are connected according to the multiple system, substantially as and for the purpose specified.

8. The combination with the switch board

of a cable rack consisting of upright pieces or pipes *a* provided with pin holes, cables supported in layers upon rigid pins *e* inserted in said pin holes and jointed pins *r r'* adapted to be inserted in place of the rigid pins; whereby the cables may be spread apart substantially as described.

9. The combination with a horizontal row of subdivisions of switches extending across several sections of a multiple switch board, of electric cables connected therewith in bands or groups, each band or group being connected with corresponding subdivisions of switches on each of the switch boards, each group or band being curved rearwardly, in passing from one subdivision on one section to the corresponding subdivision on the next section, said bands at the rear of the board intersecting one another between the different subdivisions, whereby only two thicknesses of cable or layers are brought vertically above each other at any point substantially as and for the purpose specified.

10. The bands or layers of cables i', i^2, i^3, said bands or layers being curved rearwardly between different subdivisions 1, 1, &c. 2 2, &c. 3, 3, &c. respectively, whereby only two layers are superimposed one above the other, thereby reducing the vertical space occupied by the cables substantially as and for the purpose specified.

11. The combination with a horizontal row of subdivisions of switches extending across a multiple switch board, of electric cables connected therewith in bands or groups, each band or group being connected with different corresponding subdivisions of switches on the different switch boards and each group or band being curved in passing from one subdivision on one section to the corresponding subdivision on the next section, said bands at the rear of the board intersecting one another between the different subdivisions whereby the space at the rear of the horizontal row of subdivisions is occupied by only two thicknesses of cable vertically.

12. The combination with the switch board of a cable rack consisting of upright supports or pipes provided with pin holes, spring jack switches upon the switch board in horizontal subdivisions, the number of pin holes being a less distance apart than the thickness of a subdivision of spring jack switches, pins adapted to be inserted in said pin holes in rows, said pins being removable and cables supported by said pins whereby the position of the cables or any one of them may be varied as may be desired.

In witness whereof I hereunto subscribe my name this 4th day of October, 1888.

CHARLES H. WILSON.

Witnesses:
GEORGE P. BARTON,
ELLA EDLER.

Correction in Letters Patent No. 499,693.

It is hereby certified that the name of the assignee in Letters Patent No. 499,693, granted June 13, 1893, upon the application of Charles H. Wilson, of Chicago, Illinois, for an improvement in "Systems of Wiring Multiple Switchboards," was erroneously written and printed "Western Electrical Company," whereas said name should have been written and printed *Western Electric Company;* and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed, countersigned, and sealed this 4th day of July, A. D. 1893.

[SEAL.]

JNO. M. REYNOLDS,
Assistant Secretary of the Interior.

Countersigned:

S. T. FISHER,
Acting Commissioner of Patents.