The general view of the switchboard (Fig. 4) shows about a third of its length.

Silk-covered wires, cotton wrapped, are used for the board, disposed in cables or bunches, each containing forty-five wires, representing a total of 3000 miles. A view is given (Fig. 3) of the rear of the switchboard showing the groups of cables and also the induction coil boxes and counterpoise weights of the operators' transmitters.

The switchboard which was erected by the Western Electric Mfg. Co. of this city and Chicago, is of the multiple type. It is presumption to set a limit to invention, but the multiple switchboard seems to have nearly reached perfection. At a recent telephone convention in this country it was described as the nearest approach to a perfect system. Its extensive adoption in this and other countries certainly speaks well for its merits. The connections are so arranged that any operator without leaving her place can connect with any subscriber. The converse is not the case. Only a limited number of subscribers can communicate with a given operator. Thus, as the board is now being worked, each operator can be called up by fifty to seventy-five subscribers. But without leaving her place the one operator can put any one of these in communication with any of the 2,500 subscribers now on the board.

Although only this number are now connected, the board is wired for 6,000, with capacity of extension to 10,000 subscribers. It is divided into 43 sections, each section in six divisions. To each division 1,000 subscribers are connected, in groups of 100. Thus each section has connected with it 6,000 subscribers' wires. For each wire a little hole in the front of the board is seen, and back of this is what is called a spring jack. This originally consisted of a pillar about 1½ inches long and as thick as a lead pencil; a simpler mechanical construction has now been adopted. It carries an insulated stud against which an insulated spring presses. In each section there is one spring jack, and there are altogether on the upper face of the board 43 for each subscriber distributed all around the room. Each 6,000 connections are contained within 6 feet of length of board, and this is repeated 43 times. *These connections are for subscribers who are to be called up only.* But the same number have to be provided for in the role of callers. All along the front of the board for its entire length, and near the edge of the projecting shelf or keyboard, is a single row of 6,000 holes beneath which are corresponding spring jacks. This row is 258 feet long; 150 of the spring jacks occupy the lineal space of one section. Back of these holes are annunciators, or drop shutters, one for each connection. The subscribers connect through the annunciator with these spring jacks. For 50 to 75 of these "calling up" connections there is one operator. Arranged in rows parallel with the front of the board there are a number of connecting plugs attached to flexible conductors. For each pair of plugs and cords there are two buttons and an annunciator, or drop shutter. A microphone hangs in front of each operator, and a receiver is held by a spring support against the ear. A hand switch for each calling subscriber is also contained upon the keyboard (Fig. 2). The general operation of making a connection is as follows:

The calling subscriber rings his bell. This produces no corresponding sound in the exchange. It merely causes a shutter to drop, disclosing his number to one of the operators. She at once closes the shutter, inserts a plug in the caller's spring jack, and pulls down the cam lever switch, thus bringing her telephone into shunt circuit with the caller's line, and asks, "What number?" The caller responds, giving, it may be, any of the 6,000 assuming the entire board to be in operation. The other plug of the pair is inserted in the proper spring jack in the upper face of the board, if the subscriber's line is not "busy;" the cam key is thrown up, and one of the buttons is depressed. This rings the bell of the subscriber who is asked for, and the two are now in communication. When through, the subscribers ring their bells. This operates the annunciator belonging to the pair of cords and plugs that is in use for their connection. At one time it may be one pair, and a second time it may be a different pair that is used. The annunciator shutter is seen to drop, the plugs are pulled out, the shutter closed, and all again is in *statu quo*. Before making the connection with the subscriber called for, the operator touches the spring jack frame with the plug. If a click is produced in the operator's telephone, it means that the subscriber is already in connection, or is "busy." If no sound is heard, the line is free.

This use of independent plugs and cords is a recent improvement. For a section of 150 calling-up spring jacks there were formerly 150 pairs of plugs and cords. Now there are only 48, and any pair that is free can be used. For each pair of cords there are a pair of buttons, one for the calling subscriber's bell, the other for the answering subscriber's bell, a cam lever listening key that enables the operator to answer the subscribers, and finally a clearing-out annunciator. In practical work, the operators can be arranged as closely as desired around the board, provided a transmitter and receiver is furnished for each. Thus an operator may be subject to fifty callers or less. But she must be prepared to put this fifty into connection with any of the 6,000 or more on the board.

The wire of a single subscriber may now be traced. It enters the cellar of the building and is carried up to the switchboard and all along its back for its entire length. At each section it is cut, and the ends are connected to its own upper division spring jack, one to the spring and the other to the stud. This is repeated forty-three times. These give the connections for being "called up." Besides these, one connection is made with the proper answering spring jack on the lower row, and thence through the annunciator to earth. Leaving out of consideration the induction coils as unnecessary to the comprehension of the board, the other end of the line may be regarded as grounded at the subscriber's end. Thus the circuit includes the general outdoor and indoor lines, and a line the length of the switchboard with the forty-three upper spring jacks, a single lower spring jack, and a "calling-up" annunciator, also in circuit and eventually grounded.

This circuit is insulated from the frames or front collars of the spring jacks. With these frames, that are nearly flush with the front of the board, a second wire is connected, that for each subscriber simply runs from spring jack to spring jack, for the forty-three main connections all around the switchboard. When a spring jack is plugged, the spring is forced away from the stud so as to break the circuit, and is brought into connection with the plug, and through it and its flexible connecting wire with the other plug and second subscriber, and thus with the ground. But the plugs also connect with the frames of the spring jacks, so that the forty-three frames are all in circuit. The second wire comes here into use. If one of the forty-three spring jacks is plugged, then, the frames of all being connected, if an operator touches any of them with a plug, the click heard in her telephone pronounces the line busy. Unless one of the spring jacks is plugged, there will be no click. This wire, called the testing wire, performs no other function whatever. But it is possible that the entire system may be placed on metallic circuit. Then the second wire wil be utilized as a metallic return. At present there are about fifty metallic circuits in use on the board. The connections in