

one main frame for all. Each exchange has a capacity of 9,600 lines. Each vertical of the main frame will accommodate 400 metallic circuits. There are no fuses on the main frame. These either are unnecessary, according to where lines come from, or are provided at pole-boxes at the distant end of the cables. Heat-coils are used, but in some classes of circuits, such as trunks, there are none. Wiring and jumpering is all very neat, and the wires where fanned out are treated with shellac. Dust is not allowed to accumulate anywhere. From the horizontal side of the main frame, which is of Western Electric Company's manufacture, the wires are run in switchboard cabling to the horizontal side of the intermediate frames, of which there are several, and then neatly jumpered to the vertical side. Cables to the switchboard are then taken out, bound together with linen thread in a suitable manner in the various iron runways, to the multiple, to answering-jacks, relay-racks, meter-racks, coil-racks, and condenser-racks. The neatness and cleanliness of everything are particularly striking, and these were features that were prominent throughout the United States and in the national telephone system in England. The main frame is all in one run, about 120 ft. long, and there is room for the addition of more verticals. The intermediate frames are broken so as to provide one for each exchange. Other frames are placed suitably relatively to the intermediate frames. The room is 16 ft. or 17 ft. high.

The usual fuse-boards, power-boards, battery charging-dynamo, and ringing-machines are provided. The wire-chief's desk is equipped for four or five positions. A motor supplied from the city current drives the charging-dynamo—1,000 amperes are used in the exchanges as discharge current. There is a gas-engine as a standby for driving a separate emergency dynamo.

Ringers are driven from the city supply or from the storage battery. There is also a small motor driving two small dynamos, one giving positive and the other negative current, for the collection or rejection of nickels when pay-stations are used. The ringers give the different tone tests, such as "Busy, back," "Don't answer," "Out of order."

A large gas-engine and motor plant is installed for working air appliances, so as to provide for the tubes for carrying tickets, and for general toll transfers upstairs.

There are six exchanges in the city, and also exchanges across the bay at Alameda, Oaklands, and Berkeley.

There is a fine large luncheon and retiring room, a portion of which at one end is screened off to be used as a hospital when necessary. This room is on the third floor, and will shortly be used as the position for a fourth exchange of 9,600 lines. At one end there is a cafeteria. Girls give their orders for food on a ticket, get it at cost price, and pay at the end of the month. The room is about 40 ft. by 80 ft.

In the toll operating-room there are ten recording positions. For toll-work proper there are thirty positions, with a calculagraph between each two positions. Seven or eight pairs of cords are used at each position. The different exchanges are designated by cards on the multiple field along the face of the board.

The number of toll lines assigned to each operator varies, but all tolls are multiplied so as to increase team-working. The whole is laid out on practically a "no waiting" or "no delay" basis. It was observed that the girls were very smart.

As there are several exchanges in the city and adjoining cities across the bay, but only one "toll" or "long-distance" exchange, calls for long distance have to come from the A boards of the several exchanges through the outgoing trunks to the "record positions." A ticket is here made out, and the subscriber advised that the operator will call him. Meantime the ticket is timed and put in an air carrier, which takes it quickly to a special position. These air carriers all lead to one "receiver" at the special position. The operators at the toll-boards have also air carriers to and from this special position. The arrival of a ticket through these air carriers causes a lamp to light to attract attention. The ticket is then removed. At the toll-board the subscriber's line is held so that no other subscriber can get him—i.e., a test is put on his line and kept there for a period, say, up to five or six minutes. Of course, if he wants the line himself he can have it. When the toll line required is got the subscriber is rung and the connection put through. The two supervisory lamps enable control to be kept by the operator. The time of the beginning and ending of the conversation is watched, and calculagraph impressions taken on the ticket. There is no checking to the distant station, no recording in any way of incoming calls. All writing is kept down as much as possible. Operators are engaged on costly circuits, and the object aimed at is to keep the wires busy with legitimate work and the operators free to devote attention to seeing that conversations are expedited in every way.

On receiving a call at "record" a ticket is made out and passed away through air carriers to the special position already referred to. Here it is examined and dropped into an air-slot which conveys it quickly to the proper toll position, a lamp lights, the ticket is removed, and the connection made as soon as possible. Subscribers are taken up through trunks back to the B boards. This trunk has been arranged between B and record board, and when the record passes away the ticket the attendant also "order-wires" the toll-board where the subscriber's line is held until the ticket arrives from the special position. This is done by the toll-board operator taking up the subscriber on the multiple on her board of the trunk assigned at the "record position" to the B operator of the exchange at which the subscriber is. The toll-board operator must ring the subscriber back. On completion of the conversation the toll operator puts the card into the slot conveyor or air carrier, and it is taken back to the special position. There it is examined, and, if chargeable, passed into a tray beside the air receiver; if not chargeable it is passed to another girl for further treatment. Tickets passed into the tray are at once dealt with. There are enough tickets arriving in the day busy hours to keep two girls employed here. They complete the forms and sort them into pigeon-holes just in front of them. The forms are next day sent on to the accountant to be further dealt with. Any inquiry about the cost of a connection immediately after it has been made causes no confusion, as in a minute or less it is in its proper place in the pigeon-hole, and is easily found.