

The salient features of several automatic exchanges visited will now be set forth.

San Francisco has four automatic exchanges, all on the two-wire system—that is, there is no third circuit formed over these wires by using the earth. They have been working two years. There are 15,500 stations in San Francisco, and on the other side of the harbour, in Oakland and Berkeley, there are about 11,000. There are several exchanges on the Oakland side, all on the three-wire system. One system works into the other without difficulty. On Oakland side there are two exchanges, each of 700 stations, attended to by one man, and with no person in attendance at night.

The main office in San Francisco is a handsome seven-story brick building, which cost £50,000. The switchboard is on the top floor, and is equipped for about 6,000 lines. About 4,000 are in use, serving 6,400 stations. This exchange is called C: the others are J, M, and S. The number of persons attending to these is set out below:—

Exchange.	Stations.	Foreman.	Switchmen.	Apprentices.	Tester and Wire-chief.	Complaint Clerk.	Outside trouble.
C	6,400	1	6	2	1	1	4
J	2,900	1	3	2	1	1	3, or 1½ each.
M	2,600	1	3	1	1	1	
S	3,500	1	3	2	1	1	2

There is an ordinance of the city by which wire-workers are to be paid 3.75 dollars, or 15s. 7d. a day. These men are so paid except the apprentices, who get 8s. 4d. to 10s. 6d. a day.

There is only one man on at night in any exchange, and but for the desire to have a man about the building there is no special need for that in J and M. It is obvious from the number of outside-trouble men, who attend to cable and line faults and the subscribers' telephones, that the latter do not give undue trouble even though they have the dial mechanism attached. Records showed the calls per week as ranging from 358,000 to 313,000, or about 3.5 per day per station.

On the sixth floor is a workshop, where there are about fifteen men. These are engaged principally in manufacturing and making up private branch exchange and apartment boards for use in subscribers' premises. Some of these apartment boards were visited, and the proprietors stated that they gave every satisfaction. One of these boards was left without a visit from any officer of the company for two months as an experiment, and there was no complaint in that time. The working of the switches in these apartments by the various arrangements made indicated the flexibility of the system to provide for varied classes of service.

Two other automatic exchanges were visited. They were equipped for about 4,000 lines, with about 2,700 stations each. The buildings were substantial, built of brick, and one story high. It was astonishing to find so few people about. There was a man at the distributing-frame, one at the test-table, one at the complaint-table, and three others for switch purposes in each office. One room was 55 ft. by 90 ft., and it was not nearly half-filled with the switches for the 4,000 lines. The ringing and charging machines, a gas-engine, and the light and charging power boards were in a fine basement. The secondary cells were also below. The voltage used for talking is 48. There is a special Weston relay which gives an alarm when the battery voltage is too low or too high. This enables back E.M.F. cells to be cut in or out of circuit at the proper time. There are lamps in various positions which glow when there is any trouble on the switches, and these serve as guides to attendants as to where trouble is to be looked for.

The Chinese are numerous subscribers to the automatic, as they can call their person without requiring to speak English to an operator.

Los Angeles (population 330,000) has the three-wire system. Some of the apparatus is seven years old and giving entire satisfaction. There is no trouble about wear of parts. Wipers, like plugs in a manual board, wear a little, but are easily renewed. They have Keith line-switches mounted circularly, and covers for them. The covers are for keeping out dust, but they are seldom used. Some Keith switches are mounted in square cabinets. This is found to be better, as all parts and connections are more easily accessible.

The equipment in this exchange (main) takes more room than the more recent exchanges, as when it began a first selector was required for each line. This is not so now, and first selectors are only about 10 per cent. of the number of lines, and Keith line-switches—one of which is required for each line—take quite little room as compared with first selectors.

The switches have lamps, bells, fuses, and other devices for denoting trouble and the part of the board it is in. Men are in attendance removing trouble and testing switches to obviate it. Some are good men, some apprentices. The latter watch for trouble: if they find any they cannot remedy they make out particulars on a paper and file it beside the row of switches. The good man then takes it up. It is claimed one good man can look after switches for 1,000 lines. The switch-room is 66 ft. by 75 ft., and there is equipment for 11,000 lines in it. There are 9,000 lines now operating with about 13,000 stations. The room will accommodate about 15,000 lines. This is about one-third of a square foot per line. A little over 0.4 of a square foot is more usually allowed.

When a subscriber thinks he has cause for complaint he rings up a number which takes him to the trouble-room, where there are four female clerks in the busy hours. He is told his trouble will be inquired into. The clerk makes out a ticket and passes it on to another girl, who tries to get the called person and also calls the person complaining. In 70 per cent. of the cases reported there is no real trouble, the difficulty being that the called person does not answer or is not in. Automatic