has equipped Saskatoon, and the equipment of Regina is contemplated. Winnipeg (population 150,000) was negotiating for 15,000 automatics, but there is no information whether this has been undertaken.

Havana, in Cuba—population 400,000—in 1910 had only 3,500 telephones. They ordered automatic equipment for 6,400 switches, then another 3,400, and again 3,000, or a total of 12,800. This was the advance in a little over a year.

Automatic opposition to the existing Bell Companies was being considered at—Seattle, population 300,000; Salt Lake City, 100,000; Wichita, Kansas, 65,000; Baltimore, Maryland, 600,000; Marshalltown, Iowa, 15,000; Leavenworth, 40,000; and at Winona and other small places. Automatic exchanges at Grand Rapids, Columbus, Dayton (Ohio), Richmond, Champaign, Urbana, and Decatur were also visited.

Grand Rapids is one of the oldest automatic exchanges. It is a three-wire system, and there is a good deal of No. 14 iron wire strung aerially. Different types of automatic apparatus are to be found here representing the various stages of development. There are over 11,000 telephones on about 9,000 lines. The population is about 130,000. There are two branch exchanges of about 1,000 lines each, and one unattended exchange. Most of the apparatus is of the older type—that is, a first selector for each line. Local batteries are at the subscribers' telephones. The company estimates that each telephone costs them 2 dollars (or 8s. 4d.) a year in excess of what it should, owing to the local dry battery. This includes labour. They have open aerial wire, in some cases two miles long. They do not transpose, and find no trouble from cross-talk. The longest lines for local service are about four miles. About 11 men are employed for outside work. This is due to the amount of open wire and the local batteries. In wet weather they increase to 15, as faults disclose themselves then. They are about to change to common-battery working, and hope thereby to effect considerable savings. They will also gradually displace first selectors by Keith switches, and thereby reduce the apparatus to be kept in order. There has been no subdivision of exchanges in three years, but some more small exchanges are to be installed. They have 36 toll lines. These take in about 80 of their own exchanges. The longest toll lines are about 150 miles, and one to Columbus is about 300 miles. They have about 1,800 toll communications a day. In looking into wear-and-tear some switches were seen that have operated from 450,000 to 600,000 times. Some shafts, wipers, and springs have been replaced, but they never need to replace many. The signs of wear were very slight. All this old apparatus is working now as well as ever, and giving good satisfaction to the subscribers and the company. In seven years the cost of renewals on apparatus for 5,000 lines amounted to 962 dollars, or £200 8s. 2d. The engineer said he considered the apparatus would wear for forty years; but of course it will be modified before that, and may even become obsolete. I spoke over several lines and found speech quite good. There are 21 persons in all the offices, including the engineer, the janitor, and the boy. There are 15 men, including the engineer, janitor, and boy in the main office. They are employed thus: 3 men take care of trouble-tickets and test with the subscribers; 3 are mostly repairing; 1 is going about testing switches in position; 2 are on at night; 2 overlap so as to keep up the force during hours when some go off duty; 1 attends to power plant; 1 attends to anything he may be called upon to do; 1 is janitor. Of these only five get the regular rate of pay. The highest rate is 85 dollars, or £17 14s. 2d. The average may be placed at about 65 dollars (say, £13 11s.) a month, or £2,799 for the main exchange and £453 for the other three per annum. The engineer is paid 125 dollars a month, or approximately £316 a year. He has grown with the business. He belongs to Grand Rapids and has never had experience in any other exchange. He was with the company when the manual was in operation, and would not like to return to manual working. Only one of the men looking after the switches in Grand Rapids has had former experience. They have got their experience on the plant. Nothing special in mechanical training is called for. Men who can manage common-battery manual can do automatic. There is no person in the branch exchanges after 10 p.m. A man attends to each, except the unattended one, from 7 a.m. to 4 p.m., and another man takes up duty from 4 to 10 p.m., at 30 dollars a month. There are 4 trouble clerks, 1 recording trouble clerk, 2 record clerks, and 3 information clerks, at about 30 dollars a month each = 300 dollars or £62 10s. a month = £750 per annum.

At the main office "information" is attended to for all the branches and the sub-exchange. Trouble can be attended to at the main or at the branches. All trouble on the unattended exchange is supervised from the main office.

It was particularly noticed that in the apparatus-room there were only 3 persons moving about attending to the switches—that is, watching for lamps, attending to bells, and operating switches to see they were quite free in all respects. Others were at various works, such as repairing switches, &c. There were 12 men in the room. This was due to the change being made to common-battery working. Later, when the change is finished, this number will be considerably reduced. It could be further reduced if the two-wire system were employed. There is a toll board for 12 positions, 3 record positions, also a switching-board of 3 positions to connect subscribers to tolls and to take care of the private branch exchange and pay stations that are manually operated; 1 pay-station position and 1 rural position. For all these purposes and for information, complaint, and other record-work there are about 50 girls for night and day work.

The unattended sub-exchange is about two and a half miles from the main exchange. It is a rented room about 24 ft. by 10 ft. There is a much smaller room beside it for a 60-ampere hour accumulator battery, which is charged from the main office. Three 100 line boards are in position and nearly all operating. There is room for another 200 lines. We called up a distant exchange, Holland, and spoke well. We timed how long it took to ring from one telephone to another in the same room by getting the connection through to the main office and back, and found it to be about as at other places—seven to eight seconds. It was shown how the secondary cells operating a relay can send a signal to the