

has 200 telephones. The staff at Champaign, not including the manager, is 1 wire chief, 100 dollars; 2 switchmen at 50 dollars, 100 dollars; 1 information and trouble clerk, 22 dollars; 1 night switchman, 35 dollars: total, 257 dollars per month = £53 10s. There is a university student who is learning and is paid 1s. an hour when he is engaged. There is also 1 outside trouble-man at 70 dollars per month, or £14 11s. 8d.

At Urbana there are 600 telephones. The apparatus for these is housed in a back room of a brick building, and there is not much room. The staff consists of 1 inside man at £162 10s. a year and 1 outside man at £150 a year. A student sleeps in the exchange, who gets £2 10s. a month for doing so.

The rates for individual lines are—Business, £6 5s. per annum; residence, £3 15s. per annum throughout the area. The radius of the area is about three miles from Champaign. Urbana then reaches another two or three miles. The manager informed me they pick up young men and train them. Their present staff was built up in this way. He stated it did not cost much for maintenance. He had been at Lewiston, and said that after the board had been five years in use it was better than it was at starting. He would say the same of South Bend. Both of these were automatic exchanges, and he found that the more automatic apparatus was worked the better it became, which is in keeping with what was stated by men at other automatic exchanges that had been visited. The Champaign exchange is paying 12 per cent., and the annual expenses amount to 7 to 8 dollars, or about £1 10s. to £1 13s., per telephone. This does not include taxes, insurance, heat, light, and the like. The whole mechanical work is done at a small bench. There are no lathes or machinery of any kind beyond vices and some small tools. The case is the same at Urbana.

Decatur was visited (population, 35,000, scattered). It has 2,700 telephones, mostly automatic, on 2,000 lines. This town is about fifty miles from Champaign. The conditions, staff, &c., are very similar to those at Champaign. The rates are the same. The manager is well satisfied with the operation of the plant and its economy. He says there are no sub-exchanges, which he considered was a mistake. He would not consider a manual board except in places where a girl had to be employed for other reasons, and would have spare time to operate such a board.

When visiting the Independent Company at Detroit it was found that at Crest, about three miles distant from the manual exchange, it had installed automatic switches for 300 lines. The subscribers on these could, by simply taking the receiver off its hook, cause a lamp to light before an operator at the main exchange, where the connection was completed by the usual cord methods. This system had been in operation only a month, but it was giving satisfaction.

At Buffalo the same thing was being done. The supervisor said that at first she was opposed to the method, but was now quite a convert to it, the results had been so satisfactory.

At Cleveland the North auto-manual apparatus had been installed about four or five miles out for a couple of hundred lines. This was arranged to be worked from the main exchange by girls at a special board. It was not continued long, as undue delay seemed to result in completing connections. This seemed to be due more to the methods used than to the mechanism.

The Strowger System.

The Strowger system is a full automatic system, manufactured by the Automatic Electric Company, of Chicago. The extent to which it is in operation, and the rapid strides it has made of recent years, have already been referred to.

At the subscriber's station a common battery telephone of the usual manual type may be used. Attached to this is a disc cut into the circuit, so as to make and break contact a number of times according to the figure pulled. Mechanism placed usually at various centres responds to the impulses given rise to by the make and break. These impulses may vary in speed up to about twenty per second. The most recent form of disc is but little complicated. There are circular holes cut in the front disc through which figures from 0, 9, &c., to 1 appear. To send in, say, number 5643 the telephone-receiver is removed from its hook, the finger is inserted in the front disc opposite the figure 5, and the disc is rotated to its stop and released. The rotation winds a spring and the five impulses are sent during the return of the disc to normal. Similarly for the remainder of the figures. The removal of the receiver from the hook actuates an electro-magnet at the exchange, which causes a plunger of a Keith line-switch to be detached from a rocking-bar and thrust forward so as to close contacts. At the same time the circuit of a master switch controlling the rocking-bar of the Keith line-switch apparatus is closed, and a step-by-step device operates to bring all the remaining plungers into a position to be ready to take up the next idle trunk when another call comes in. The step-by-step device will continue acting, and will take all the idle plungers with it until it finds an idle trunk. When the end of the bank of 10 is reached the switch will still act and select idle junction positions in a backward direction. The subscriber will receive a "Busy" signal if all the trunks are engaged. When the conversation is finished the plunger is again taken in charge by the rocking-bar, which usually controls the plungers of one group of twenty-five line-switches. Four such groups are so arranged as to enable one master switch to control the four rocking-bars, and thus enable 100 subscribers to have access to ten trunks. Keith line-switches and connectors are mounted together on the one frame. They are then conveniently placed for the multiple wiring of the subscribers' lines.

The plunger having been thrust forward and the contacts made, the first set of five impulses from, say, No. 58763 actuate the electro-magnet of a first selector, and step it up to the fifth level. Each selector and connector have ten levels and ten different contacts along each level. This is called a "bank." There are usually three such banks on each switch, but on the more recent only two. Two banks are for the contacts corresponding to ring and tip of a plug, and the third corresponding to the sleeve by which the engaged test is got. Each switch has also a shaft on which are mounted brushes or wipers, which, as they pass along any level, make contact with the terminals in the banks.