

of a larger size. With the automatic depreciation taken at 8 per cent., instead of $6\frac{1}{2}$ per cent., the first cost of manual at £2 2s. per line would about enable annual charges on both systems to balance. The maintenance is taken as the same on both systems, but should be less on the automatic. If automatic were used there would be a toll-board required at a capital cost of about £1,200, bearing interest and depreciation charges of 12 per cent. = £144 annual charges. The outside plant, subscribers' instruments, and the number of outside-trouble men required would be the same in both systems. The outside lines would require to be maintained in good order, as common battery would be used with both. In the study just made the depreciation on manual has been taken as slightly higher than that on automatics, because, judging by the attitude of engineers, it may be considered that manual common-battery switchboards will have an increasing percentage of obsolescence. The dials for the automatic have been heavily depreciated for the same reason.

Both manual and automatic switchboards have a longer physical life than that calculated upon, but such a study has to be made on a conservative basis. It should be remembered that as the manual board is added to, the cost per line increases, whereas it is practically unchanged in the automatic. Increased calling-rate per subscriber increases the cost of both, as more positions and operators are then required in the case of the manual, and more switches in connection with automatics.

It will be interesting to see how manual common battery and automatics work out in respect of annual charges for exchanges as small as those consisting of 500 lines. For manual the cost per line would be about £3 = £1,500, plus £300 for installing, or, say, £1,800.

<i>Annual Charges.</i>	£
Interest 4 per cent., depreciation 8 per cent. = 12 per cent. on £1,800	216
1 wire-chief and frameman	180
7 operators at £70, for supervision day, evening, and toll work	490

£886

For automatics the cost per line would be £5 = £2,500, plus £300 for installing = £2,800.

<i>Annual Charges.</i>	£
Interest 4 per cent., depreciation 8 per cent. = 12 per cent. on £2,800	336
1 switchman	200
2 toll operators at £80	160
1 information and complaint clerk at £80	80
Also 500 dials at £1 = £500.	

Interest 4 per cent., depreciation 12 per cent. = 16 per cent. on £500 = £80

Maintenance of dials at 1s. each = 25

105

Total £881

A toll-board would be required for either system, at a cost of about £100, with increased annual charges the same for both systems—probably £30. A learner would be required at these small places if automatics were to be only in small places, so as to provide for times of illness, absence, holidays, &c., of the switchman. As, however, automatics, if placed at small offices, would also be used at large offices where learners would be available, a relief could always be afforded a small office without keeping a permanent second man attached.

Maintenance of these small exchanges is taken as being the same, and the plant, subscribers' telephones, and number of outside-trouble men would be alike.

Were the comparison made with magneto-manual it would appear in a less favourable light.

The suggestion conveyed by this study is that automatics could be used for exchanges as small as those of 500 lines. There would be practically no monetary advantage, but there would be no loss as compared with manual common battery, and as the subscribers increased some saving would be expected to follow. There would be available then in these small exchanges the advantages that have been earlier referred to as resulting from the use of automatics. Night service would be no extra cost.

Where there are two or more manual exchanges in a city, as compared with a single exchange, there is an increased advantage to be got from the use of automatic, because all of these manual exchanges require more operators and more apparatus. The subscribers require more positions, as each operator cannot attend to so many calls when a proportion of them has to be made through a second operator at a junction position. The junction or B positions, with space for them and operators, also have to be provided. Under these circumstances no saving in outside plant is to be looked for from automatics as compared with manual, as only a certain proportion of connecting lines or junctions are required, and they are about the same for both systems.

It is usually claimed for the automatic system that besides the two, or three, or perhaps more principal exchanges, according to the size of the city, that will take care of the greater number of the subscribers, smaller satellite exchanges may be placed here and there to provide for subscribers further out, and this is sometimes done. Los Angeles and Columbus, in the United States, have several such satellites. In one of the cities where automatics were in use the engineer informed me that to serve from central between 650 and 700 subscribers at a distance of about three miles would have cost £9,600, whereas the service by a satellite exchange cost £5,600 with about the same annual charges in either case. The suitability of satellites, however, needs to be carefully considered in each