chloride can be made in a form resistant to boiling water and is already finding uses in surgery, so that it may prove to be superior to rubber for the purpose of the drip-feed injection of penicillin.

We wish to thank the Chief Scientific Officer, Ministry of Supply, for permission to publish this communication.

¹ Cowan, S. T., *Lancet*, i, 178 (1945).

² Huelsbusch, Foter and Gibby, *Science*, **104**, 479 (1946).

³ Hughes, Maj. K. E. A., R.A.M.C., 21 A.G., Penicillin Therapy and Control Report, p. 315.

⁴ Cavallito, C. J., *Science*, **105**, 235 (1947).

⁵ Yudkin and Pulvertaft, *Lancet*, ii, 265 (1946).

LONDON'S TRANSPORT SYSTEM

THE fourteenth annual report, recently issued by the London Passenger Transport Board, makes interesting reading. Since the undertaking is now vested in the British Transport Commission, this is the Board's final report, and it has therefore devoted one section to a review of the way in which it has discharged its functions since July 1933.

Here is an example of the operation of a very large centralized concern run on lines similar, from many points of view, to those which must be adopted in the even larger organisation of nationalized industries or utilities. There can be no doubt that in this instance the arrangement has proved in most ways an outstanding success: the Board has, in the main, achieved its object of providing "a passenger transport service, by rail and road, worthy of London as a great metropolitan city". Few Londoners would deny this: it is not so certain that the inhabitants of some other capital cities would be equally enthusiastic about the transport facilities available to them.

The magnitude of the Board's achievement can better be appreciated by reference to some of the figures contained in the report. The area served covers some 2,000 square miles, with a population in 1933 of 9,358,000. One of the first tasks was to rationalize the unrelated and often wasteful competitive services operated by the many transferred undertakings. During the pre-war years the number of vehicles owned rose from 11,753 to 12,819, and the annual mileage run by them increased from 515 to 573 million miles, providing more than nine million passenger journeys a day in 1933 and ten million in 1939—the usual calculation indicates that if the tickets issued daily were placed end to end they would stretch from London to New York. The receipts from fares rose concurrently from about 27 million pounds to nearly 31 million pounds sterling a year. While this expansion was in progress, the many types of buses and coaches were being replaced by standard designs, the maintenance system was overhauled, new equipment was introduced to increase reliability and efficiency and, most important of all, a vast programme of new works was undertaken in conjunction with the 'main line' railway companies.

The outbreak of war caused a great setback to this steady growth. As a result of evacuation, the 'blackout' and bombing, the volume of traffic was so reduced that the system ceased to be self-supporting. But after 1941, traffic again increased and reached a peak of 4,259 million journeys in 1946, totalling 11,479 million passenger miles. The number of journeys made per head of population per year is a measure of the 'travel habit'; this figure rose from

just over 100 before the War to nearly 130 in 1946, which certainly indicates no reluctance on the part of the public to travel.

Mention may be made of some of the technical innovations originating with the Board. In 1938 re-designed rolling stock was introduced on the 'underground' railways, the electric motors being installed beneath the floors of the carriages. This eliminated the waste of one car in a seven-car train to house the power plant, and thus gave a 14 per cent increase in carrying capacity. The Board was among the first to recognize the advantages of the oil engine as compared with the petrol engine from the point of view both of performance and of economy in operation and maintenance. It accordingly adopted the oil engine from 1934 onwards as the standard power unit for all new buses and coaches. It was also a pioneer in the large-scale use of the pre-selective gear box and fluid flywheel transmission, which not only ease the work of the driver but also materially increase the comfort of passengers by virtue of the smoother running which they give. Before the War, the trams on many routes were replaced by trolleybuses; but since the War the financial advantage of the trolleybus has decreased to such an extent that further conversion of tramways will be to buses, which are more flexible in operation and offer wider opportunities for co-ordination of all services provided by the use of a single type of road vehicle. Another remarkably successful innovation of the Board was the novel constructional technique employed on the eastern extension of the Central Line.

The first regular passenger service in London was established in 1829, and during the succeeding century development proceeded under a multiplicity of private operators. The extraordinary complexity of the resulting system makes it difficult to offer a fair criticism of the Board's efforts, though it would appear that there is room for immediate improvement in certain directions: the rationalization of routes in the central area and, in particular, the links between the 'main line' railway stations require attention. It is, for example, impossible to get from King's Cross to Victoria station without at least one change, apart from the interstation buses which are so infrequent and circuitous in route as to be virtually useless.

The report concludes with a reference to future prospects and deplors the lack of materials and national restrictions which have prevented a more rapid recovery from the effects of war. It has been argued, however, that the present difficulties are attributable, at least in part, to the policy pursued before the War of scrapping vehicles when the body was worn out, instead of retaining the chassis with a new body and an oil engine; this criticism applies particularly to the 'ST' type of motor-bus. But the Board would probably be the first to admit that errors of judgment have occasionally been made and to acknowledge that the traffic system is still capable of much improvement.

Though the layman may occasionally wonder at some of the oddities of the system—what purpose is served, for example, by the posters informing us that London's transport is at our service when no other means of travel is available, and why does the hand-rail always travel slower than the escalator?—the Board is to be congratulated on furnishing an example of the efficiency which should be attained by all public undertakings.

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