

and whether the paving is included, which is often the case; overhead construction costing from \$2,000 to \$10,000 per mile; cars and equipments from \$2,500 to \$4,000 each; and in addition probably a percentage of receipts is demanded by the municipality for the franchise. The franchise also has to be obtained at frequently great cost and trouble.

Against this, in favour of the automobile, no franchise is required, no permanent way, no overhead construction is needed. The busses will cost no more than the cars at the worst, and no station will be required unless the system be storage battery automobiles, and if required will be much less costly than for the electric cars both in total cost for the same traffic and for operating costs, the reason being that the station will be running at its full capacity at all times, thus requiring a smaller horse-power of plant, and having that plant operating at its highest efficiency at all times. In the case of steam or gasoline machines, no station whatever would be required. The busses would run upon any street and would never be blocked by interruption to the supply of power, street repairs, etc., and could be concentrated to meet sudden demands in a manner not approachable by the electric cars. Under these conditions the final triumph of the automobile for city transportation appears certain, the electric roads to be restricted to the inter-urban services where advantages may be had of greater speed over their own right of way than would be permissible in the case of an automobile line traversing the country highways.

It may be questioned whether automobiles will be available for winter service in such places as Montreal and Quebec, and the point will be well taken at the present time, but those who predicted the use of electric cars in those places ten years ago were laughed at, and it may safely be predicted that the winter difficulties will be overcome as were those of the electric cars. As to the system of propulsion adopted at the present time, it would appear that steam would be the cheapest, but has the disadvantage over electricity of being more noisy and complicated, and for many reasons apart from cheapness electricity has the most to commend it. A further advantage of the automobile bus line lies in the fact that the public will be guaranteed a fair competition with consequent reduction in fares, as no

monopoly can be granted, as is done at present. The automobile is in the same position as regards the city business as the electric roads were about ten years ago, and the next ten may see as great a change in this regard as the last.

ROLLING LIFT BRIDGES.

The rolling lift bridges which have been constructed during the past few years in Chicago and at other points in the United States, says Waldon Fawcett, in *The Scientific American*, constitute so distinct an advance over the types of movable structures heretofore utilized in spanning navigable waterways as to have aroused deep interest abroad. The development of the pivot bascule bridge—like the old drawbridge over a castle moat—led directly up to the invention of the rolling lift bridge, the latter type having been devised just as the Tower Bridge at London was nearing completion. The famous London structure was commenced in 1885 and completed in 1894. It provides a waterway 200 feet in width, and cost, all told, more than \$4,000,000. The advance which has been made in movable bridges of late years could not, perhaps, be better illustrated than by comparing the Tower structure with a rolling lift bridge of even greater span at the entrance to the Grand Central Station at Chicago. The weight of the iron and steel in the London bridge is 14,000 tons, while that in the Chicago bridge is but 2,250 tons, and the entire cost of the latter was \$126,000, less than the cost of the operating machinery alone of the Tower Bridge.

Trials have proved that less than twenty seconds is required for the complete operation of opening and closing the spans of one of the largest bridges. A most interesting record is that of the Rush Street Bridge, at Chicago, said to be the most active movable bridge in the world. During an average season of lake navigation comprising a little over eight months this bridge is opened between 10,000 and 11,000 times, or fully forty times every twenty-four hours. Yet the power expense for the operation of this bridge by electricity does not exceed sixty-seven cents a day. Over another rolling lift bridge in Chicago the passage of trains aggregates 1,200 daily.