in the rails can be reduced by the use of higher voltages so that this source of interference can be made less than it is with the present direct current system. Further, means have been proposed whereby the current can be confined entirely to separate conductors provided for the purpose, and not allowed to wander at will through any return circuit that may exist, as is the case with the direct current system. This can be done, of course, only at the expense of erecting a separate system for the return currents and a system of series transformers whereby these currents can be confined to this return system. The alternating current system, therefore, possesses the advantage of being able to use the rails for contact and still not allow the alternating currents to escape at will through the earth. As a matter of fact, interference with other circuits by the alternating current system is expected to be less than with the present direct current system.

The engineer has been defined as a man who could do for one dollar what any fool could do for two. The engineer, in other words, stands for efficiency. It is he who acomplishes a given result with a minimum expenditure of effort and money. Suppose we apply this criterion to the comparison between the A.C. and D.C. systems: By which of these systems can a given service be rendered most economically? In order to answer this question, we shall assume a certain typical interurban road, ascertain the first cost by both systems and the cost of operating by both systems and compare the results. Suppose the typical road which we will assume to be as follows:—

Length .. .. 60 miles.
Schedule speed.. .. .. 30 M.P.H.
Cars running half hour apart.
Number of stops.. .. .. 30; that is typical run, two miles long.
Weight of D.C. car, complete.. .. .. .. 35 tons
Weight of A.C. car, complete.. .. .. .. 41.3 tons.

It may be noted here that the above difference in weight is not the minimum that can be obtained. A large part of the difference in weight comes, as previously stated, in the induction regulator, with which it is assumed the A.C. car is equipped. Other methods of voltage control can be supplied which would be considerably lighter, but the induction regulator is selected on account of the advantages previously mentioned. The A.C. system is, therefore, working under a handicap which is greater than would be the case if some other method of control were assumed.

Fig. 1 shows the speed-time and K.W. hours curve of a D.C. car of thirty-five tons over the typical run. The equipment, gear ratio, acceleration, etc. are given on the curve.