way the branch lines and feeders of the trunk railways, which are now operated in many cases at a loss, mainly by reason of the inadequate service to which they are limited by the use of the steam locomotive, would, if electrically equipped for a light and frequent service, become a productive part of the system to which they stand at present in the relation of a necessary evil.

It seems, therefore, reasonably clear that in the development of the system of secondary railways which are coming into being as the result of a pressing economic necessity, the electric motor is to find a new and widely extended field of usefulness. The great desideratum at present for this work is a successful alternating railway motor which, it is safe to anticipate, will be added to the list of standard equipment in the very near future. Under present conditions, while the use of the booster or of polyphase transmission apparatus with rotary transformers has made commercially possible the supply of current for distances up to twenty miles, or even more, from the power house, their availability has been lessened by the drawback of excessive loss in the one case and of great cost in the other.

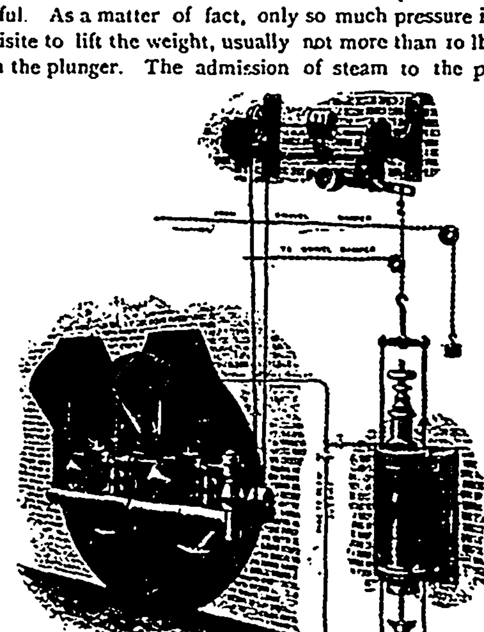
Before leaving this part of the subject, however, it would be as well to point out, in view of the alacrity with which the possibilities which we have been discussing are being taken up as a new and promising field for the exercise of their peculiar abilities by the versatile and talented class of gentlemen known as promoters, that there is no reason to suppose that such a wholesale programme of light railway construction and conversion of existing steam branches would be an immediately profitable or possible undertaking. In many cases the gains made will be in the form of a general public benefit rather than a concrete return in dividends for the money invested. The smaller and more profitable openings for the construction of these lines will afford a field for private enterprise, but any comprehensive scheme will undoubtedly demand, in the form of governmental aid, the support of the public, who will be its main beneficiaries.

We may now consider briefly the position likely to be attained by the electric motor as a successor to the steam locomotive in the operation of the great trunk lines. Here the conditions differ materially from those which have led in so short a time to a practically complete possession of the field of street railway traction, and which seem likely to produce similar results in the case of the secondary railways. It must be conceded that no opening or necessity exists for the construction of new trunk lines operated electrically in competition with existing steam roads. The eventual triumph of electricity over steam, for heavy locomotive purposes, will come in due course as a result of the establishment of its superiority for the service, but its general adoption will be delayed beyond that point by a natural reluctance to wipe out the capital represented by existing equipment. It must be recognized that the evolution which attends all branches of mechanical development has produced in the steam locomotive of to-day a type admirably adapted to the work which it has so far been called on to perform. It is in the continual demand on the part of the public for higher and higher speeds between terminal points, and the still more imperative necessity, in the face of keen competition and lowering rates, for a reduction of operating expenses to the minimum point, that we may expect to find ultimately the most favorable contributing cause for the general adoption of electric motive power on the trunk systems. The direct rotary action of the electric motor and the practical limitation of its power only by the capacity of the stationary source of supply, entail the possibility of an increase in rates of speed up to the highest point at which a perfectly constructed roadbed without grades and curves will hold a car on the track. A recent study of the operation of the Pennsylvania Railway would seem to show that such savings in fuel, labor and maintenance accounts would follow its re-equipment for electric traction as to make it commercially desirable, even under present conditions.

It is no extravagant prediction to say that members of this Association who witnessed, in 1885 and 1886, at the Toronto Exhibition, the modest beginnings of electric traction in Canada, will see it supersede the steam locomotive in the operation of the Canadian Pacific and Grand Trunk Railway systems.

THE CURTIS DAMPER REGULATOR.

The Curtis damper regulator consists of a composition cylinders accurately bored and reamed, within which is a long, loose-fitting plunger, fitted with water grooves, thus being both tight and frictionless. As the pressure is always one way, the plunger merely rests on the collar of the rod, and there can be no cramping even if the rod should be out of line with the bore of the regulator. The motion of the plunger is communicated by a yoke and chain to the lever of the damper, on which is hung sufficient weight to open the damper and overhaul the plunger. In some styles of damper regulators it is needful to have street-water pressure to do the work, and in many cases this is not available, and is always sloppy and wasteful of water. Where street pressure is not available, steam from the boiler is condensed in long coils of pipe, in order to obtain under pressure the large quantity of water requisite to operate the regulator. All this waste is avoided when using the Curtis regulator, as the steam used would not make a quart of water a day. The plunger is operated by steam direct from the boiler, and the whole pressure in the boiler is therefore available to operate the damper if needful. As a matter of fact, only so much pressure is used as is requisite to lift the weight, usually not more than 10 lbs. to the inch on the plunger. The admission of steam to the plunger is



graduated by the side set screw, so that the same stately, steady movement is accomplished with either high or low steam. The admission of steam is controlled by a sensitive, metallic diaphragm, which operates the valve on a motion of a two hundredth of an inch, or one-eighth of a pound pressure. To operate it, a given load—say 60 or 100 pounds to the inch—is produced on the regulator diaphragm, by screwing the handle in. When the pressure in the boiler reaches the limit, it lifts this load, and permits steam to enter the space over the plunger, slowly pushing it down and closing the damper. When the boiler pressure falls below the limit, the valve closes, and the pressure, passing from the bottom to the top of the piston, puts the piston in equilibrium, and allows the weight, slowly settling down, to open the damper, thus controlling the pressure at the desired limit. All the working parts are of the best composition, and in operation have been tested by