tages of such a gate are simplicity, strength, durability and tightness when closed. Defects are found in them to quite an extent.

They are hard to govern, have to be counterbalanced by means of weights, and usually require high decking over the wheel case to cover the gate when it is raised, adding to the cost of the wheel. The stationary chutes of this class of wheel are easily clogged by means of weeds, sticks, leaves, &c., which become wedged into the narrowest part of the wheel. The guides not being movable, this rubbish can only be taken out by hand, a very disagreeable task.

This type of wheel gives very good percentage at from full to part gate. The "Hercules" and "Risdon" are fair types of this kind of gate. This style of gate is not, however, suitable for this country, Canada. Especially in the winter here are our streams subject to anchor ice; and these wheels between the stationary guide get packed solid with anchor ice, and require the application of muscular force and crow-bars to make a clearance, a task not to be entreated on a cold winter's day.

The last style of gate I shall mention is that of the Register gate, which consists of a ring or cylinder fitted concentric between the stationary guides and the wheel, and containing a series of openings corresponding to that of the orifices of the guide passages, and by turning the regulator cylinder, the guide passages can be covered. This style of gate contains all of the good points of the other styles of gates, and is found to have fewer defects than the others. It has the least number of parts, is of great strength, is always a tight gate, is not easily clogged, for the movement of the register will usually release any obstructions that will pass through a properly constructed rack. Gates of this style give perfect admission of the water to the buckets at full gate, and maintain a good result at part gate.

Wheels with gate of this type have few tender parts, and practically nothing to wear and are easily governed, not subject to be choked by anchor ice, and are probably the nearest to perfection of any type of wheel built. It is often argued against this type of wheel gate that they do not give the same percentage of useful effect as some of those built with fly-trap and cylinder gate. You will notice by the efficiency curves of the different types of wheels what they are doing. They are characterized by fewness of parts, simplicity of construction, and above all are not easily clogged, and can be closely regulated. This gate tends to close itself by the action of the water, which is a desirable feature where close regulation is demanded as in electrical work, and the cost of the motor, even if three or four per cent. is wanting in efficiency, at part gate; they will still recommend themselves to users of water power in this country as the best type of water wheel of any built for all round work. Wheels of this type are best illustrated by the "Victor," the "Boss," the "Flenniken," and others.

I have endeavored to present to the members present an impartial sketch of an American type of turbine wheel. Some of my remarks may be open to criticism; they are entirely founded, however, upon practical experience amongst water wheels, and as one finds things so must he speak. But I can hardly leave off here, and yet I fear I encroach upon your good nature, for the placing of our turbine is a most important matter. It seems to me that this matter is one which all users of water power should be thoroughly acquainted with. The necessity of large tail race and wheel pit is of great moment to the success of the turbine. There are many wheels upon the vast number of streams on this continent that are developing only from forty to sixty per cent. of useful effect, when seventy or eighty per cent. or more might be obtained if the wheels were placed properly, and the flumes and penstocks were of proper dimensions.

No hard and fast rules can be given to regulate the dimensions of the flume, penstock and tail race.

In many instances where the head is high or moderately so, the adaptation of turbine wheels on horizontal shafts has been successfully carried out, and without any sensible loss of power by this arrangement, and when it is considered that the loss of power by transmission through gears is wholly saved, and no loss of head is sustained by the use of the draft or suction tube, the advantage of this arrangement must find favor with electrical engineers. In situations which admit of the use of turbines mounted upon horizontal shafts, they make a specially desirable arrangement for driving dynamos, the power being generally transmitted directly by straight belt to the motor from the wheel shaft; the neat appearance and the small space occupied by them, and the ease with which repairs can be made to them, are advantages that more than compensate for the extra cost in the first place. In fact, nearly all moderate or high heads which are used to develop power for electrical purposes are having horizontal wheels placed.

For many kinds of work where the changes of load are light, or where there is a considerable load upon the wheel at all times, there is seldom a wheel that cannot be successfully regulated. But when the load is subject to heavy changes, and at times only a small per cent. of the power is used, as is frequently the case in electrical work, it then becomes important that the wheel should have a proper gate and run at proper speed.

In order that the governor may act upon the gate without loss of time, it is necessary that the gate and its connections should have little or no lost motion. Those gates are to be preferred which tend to close themselves, either by their own weight or through the action of the water. Good results may, however, be obtained with others where the lost motion is reduced to a minimum.

Another point not generally understood, but which has an important effect upon the regulation, is the speed at which the wheel is run, depending, of course, upon the size of wheel and head under which it works. In order to control a heavy change of load with the least variation of speed, it is necessary that the governor should operate the gate as quickly as possible without running by or racing. Now the faster the wheel runs, the faster the governor may be made to operate without danger of racing. Ten per cent. increase in the speed of the wheel, will permit of the governor operating nearly twice as fast. Again, the faster the wheel runs the less it will be affected by a change of load. Given any water wheel and any head of water, there is a speed at which it will develop the most power. It will readily be seen that if the wheel be running at a speed above this point of maximum efficiency, when the motion is reduced by an increase of load the efficiency will increase and tend to retard the reduction, while if the wheel is running below this point of maximum efficiency, the efficiency will be