a first cousin of the fall increaser, 6,000 or 7,000 of which are now in use the world over, though it was 10 years before anyone would use it, except its inventor.

The fact that the fall increaser is only of limited application, and cannot practically be added to a plant already in operation (it must be built into the foundations of the power house) has also much to do with the delay, up to date, of its use in operation.

Its value at any mill site depends on the regime of the river; whether there is back-water, to a material extent, and during enough days in the year.

The situation must also be such as to permit of the conveyance of the freshet water to be utilized to the fall increaser inlets; no long head-race canal.

The writer of this has had cases in which the estimated additional first cost for putting in fall increasers would be returned in value of the *additional* kilowatt hours produced in one average year, or less; and from that the situation ranges up to periods and measurements of back-water so small that it does not pay to build fall increasers; even though first cost is paid but once (operation and maintenance are merely nominal), while the average additional kilowatt hours produced are produced and gained every year.

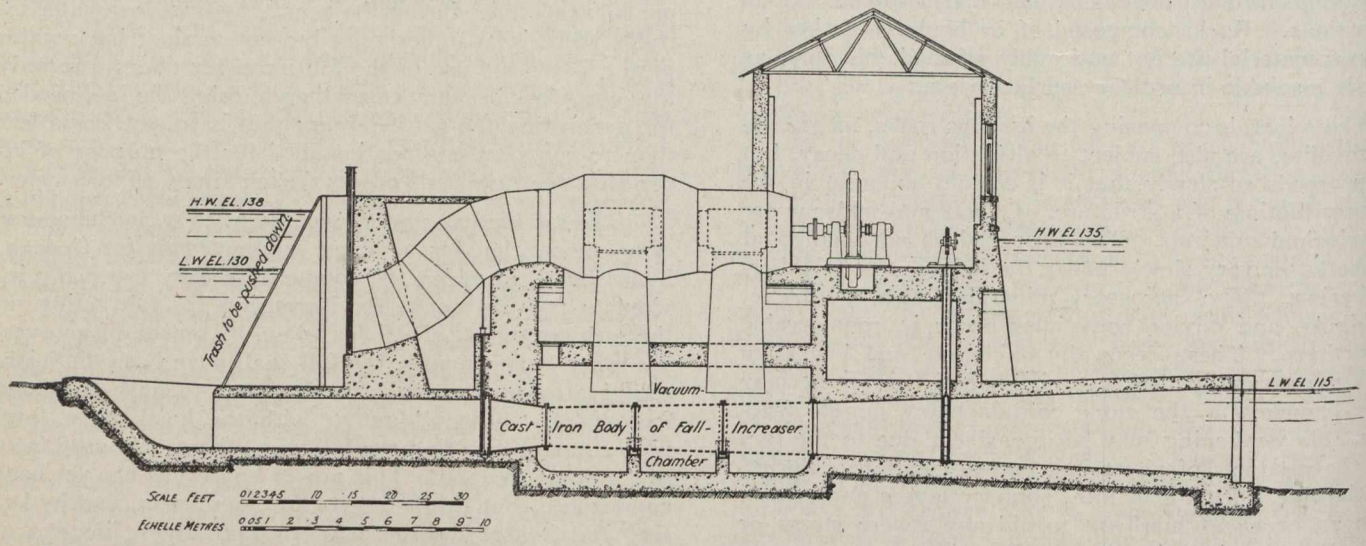
The money considerations involved are well shown by the results of some examinations made. In one case, for an estimated additional cost of $50,000 an additional 8⅓ million kilowatt hours, distributed during times of high water, (that is, when sorely needed), would be secured on the average, annually, forever. The net profit was estimated at not less than $23,000 per annum, forever. This plant has not yet been begun, and may be fitted with fall increasers when built.

In another case, fall increasers would produce, in an average year, 158 million kilowatt hours. They would keep the power practically constant throughout the back-water half of the year, instead of having it fall from some 250,000 h.p. down to about half that amount, during that period; (not considering the low-water half of the year). The additional cost entailed by building them would have been, as per estimate, one million dollars.

It might be thought, at first view, that fall increasers would have offered notable advantages at the Wasdell's Falls, Ont.,* power house, recently put in service, but impending improvements both in the Severn River and at Lake Simcoe outlet will do much to make the fall at this power house nigh constant throughout the year.

Incidentally fall increasers would greatly aid in keeping the racks clear of trash, which, when fall increasers are installed, needs only to be pushed down, and within range of their action, so as to pass through them; instead of having to be raked and lifted up and carried ashore. See the illustration, which is of an extreme case of back-water; only 3 ft. of fall left out of 12 ft. fall at ordinary water, on which account a siphon penstock is shown, to be kept clear of air at the summit by a small (an inch or two) fall increaser acting as an air exhauster.

Roughly and generally speaking, the "operating water" is double the turbine discharge, and the fall acting on the turbine is increased 50%, which increases the power given out by 80%. So long as back-water does not diminish the fall more than 33%, fall increasers will restore (from the fall and power then obtaining) the full, or normal, fall and power, and be of material benefit also, beyond the 33% mark.



Cross-section of a Power House, Showing Application of Fall Increaser. It Shows Also the Use of a Syphon Penstock. Note the Low Fall Remaining at Extreme High Water.

* See *The Canadian Engineer*, October 8, 1914, page 509, for full description of this development.

THE ROGER'S PASS TUNNEL IN B.C.

Since the publication of our last article descriptive of the progress already made in driving the 5-mile tunnel for the Canadian Pacific Railway under Roger's Pass at Glacier, B.C., the work has been advanced by the contractors, Foley, Welch & Stewart, with the greatest possible rapidity. On the east side the pioneer bore has been advanced considerably over a mile while the 8 x 11-ft. centre heading and the full tunnel section had been driven, on October 1st, a distance of 3,100 and 400 ft. respectively. At the western end the approach cut, requiring the excavation of 350,000 cubic yards, has been completed at that time, and the pioneer bore has been advanced over 2,000 ft. In the main tunnel portal a number of small headings have been worked for a considerable distance.