It would have been better to place the two penstocks transversally to the flume, as at P.P. in Fig. 2, instead of placing them one ahead of the other, as in Mr. Bell's case.

J. A. GRENIER, C. E.

Montreal, 20th Oct., 1893.

*Editor* CANADIAN ENGINEER:

The last ENGINEER contains the problem of two turbine water wheels in line with and supplied by the one flume, the first wheel—or the one next the flume—yielding less power when the water is shut off from the second wheel than when both are taking their supply. The writer offers the following solution: When both wheels are taking water the head is drawn down in the penstocks, as shown in your diagram; the cross sectional area of the flume not being sufficient for the amount of water required by the two wheels, consequently the first wheel receives the benefit due the impact from the fall of the water from the level of the head in the flume to the level in the penstocks, and that not only from the water it is to use itself, but also from that to be used by the second wheel. The difference of the effect of the water on the two wheels being what would be due to an additional head equal to double the difference of height of the two levels over the head in the penstock. When the water is shut off from the second wheel, the area of the flume being then sufficient for the supply, the head does not lower, and the first wheel receives only the benefit due from the then existing head, which would be up to the level of water in the flume, or nearly so. If the flume would be deepened so as to supply a sufficient quantity of water to prevent the head drawing down when the two wheels were open, these irregularities would in all probability cease. The writer thinks that when the first wheel is shut off the second wheel will yield more power than it did before, for the reason that it will have a higher head of water over it.

R. S.

## TECHNICAL EDUCATION FOR ENGINEERS.

BY CHAS. F. KINSEY.

The young engineering student soon finds out that theory which has been impressed on his mind at the School of Science, and practice, do not quite agree, but he need not be discouraged at that; his business is to keep theory in his mind and make practice come as near to it as possible. Up to the present time we have been unable to make the conditions in a working boiler room conform to all the rules laid down for us in theory, but that must not prevent an engineer from trying to get as near as possible to it. With diligence, about a year spent with the boilers makes him proficient in the art of firing them, drawing fires and cleaning, keeping up a steady pressure of steam, making joints and all the necessary little details which go towards making a successful fireman, and we all know a good fireman can be made a good engineer, but a poor one never. He is now introduced to the engines, and after a very few weeks he may be safely relied upon to start and stop them without damaging them. Then follows the use of the indicator. Of course, the young fireman has used the indicator at the School of Science, but now he uses it under working conditions, and the cards he takes off makes him feel disposed to despise theory or condemn the engineer; but here the engineer comes to his help and explains to him that up to the present time we have not been able to make engines conform to all the rules laid down for us in theory, but he must still keep theory in mind and must try and make the engine work as near as possible to it. Then comes the calculating of the diagrams for horse power, water consumption, amount of steam used, condition of the engine and a host of other little things that only an indicator can expose, and here the education that our young man received in the beginning begins to shine. Having learnt mathematics, he can figure up areas of pistons, cubic contents of cylinders, mean effective pressures, speeds of pistons and revolutions, in half the time that we old heads with our laborious style of figuring can do. He has horse-powers and percentages of clearance for certain sized cylinders on the tip of his tongue; logarithms and constants have no more terrors for him than his dinner; he has initial pressures, cut offs, expansion curves, release, terminal pressures, back pressures and compression all off by heart; in fact, when it comes to figures he is master of the situation. After a couple of years spent in this manner, during which time he has learnt to set valves, repair cross-heads and crank pin brasses, and keep the engine in good working order, he may be trusted alone with them. He now tackles the dynamos, he is taught their principles, how they work, how to fix the brushes and set them, how to wire up for lamps and repair them, how to avoid short circuits and grounds, and the best means to get rid of them if they do appear in spite of all attention. After becoming thoroughly acquainted with the care of dynamos, electric lighting and wiring, a very short time suffices to enable him to understand and successfully operate electric motors. During his probation in the engine room he has acquired a knowledge of steam pumps, hydraulic and power elevators, and a smattering of mill-wrighting, steam-fitting and heating. Our young man who decided to become an engineer is now as efficient in his profession as the best man amongst us, and we now call him a first-class engineer. Engineers, he has now advanced as far as we have got. Both the young engineer and the old engineer are daily expecting greater changes to take place in the profession; we who are old cannot sustain the strain much longer, we must give way sooner or later, but the young man with his superior training is prepared to receive much more. What the future has in store for us, none can tell, but we can rest assured with the thought that if we train the young engineer thoroughly he will not disgrace our profession in years to come, but will be found fully capable of performing any task set before him as well as we have done during the last twenty years that have passed.

## SUNDRY NOTES ON HEAT.

BY CHARLES HEAL, TORONTO.

The object of the study of steam, and its application, is to obtain the greatest possible amount of work with the least possible expenditure of fuel. In order to arrive at a correct understanding of the principles which underlie the economical production and use of steam, we must study among other subjects the nature and effects of heat. Here a difficulty meets us which we cannot altogether overcome; that difficulty is to define what heat really is; it is, however, so familiar to us in the effects it produces on our bodies, and on objects around us, that we need not be deterred in our inquiries from our inability to solve the question.