It has been said that "countless wealth is being squandered in all the torrents and water courses of the world." But it might be added that unless the proper means are taken for its utilization that wealth of energy avails little more to man than that of the tides in Jupiter.

It seems at first sight a very simple matter to place a wheel in position to take up the energy of water; but in practice that arrangement is generally found to involve more or less costly construction in the way of dams, basins, canals, flumes and even tunnels. This is particularly the case where the use of turbines is contemplated, and this consideration is frequently sufficient to annihilate the expediency of thus attempting to utilize a known and otherwiso available source of power.

These adverse conditions are forcibly illustrated in the mountainous districts of the North American Continent. Water power is there in abundance, but it is that of mountain torrents; as a rule inconsiderable in volume of water, but, on account of the configuration of the country, affording large heads. The latter circumstance makes any constructive work very costly, and in most instances would put the use of an ordinary turbine out of the question.

It was from such causes that the Western States became the birth place of that system of water power of which the essential feature is an impulse water wheel. The simplification made possible in this system is that of the substitution of a pipe and nozzle of insignificant dimensions for the massive head race and wheel pit associated with the use of a turbine.

The first impulse wheels brought into use were of the very crudest description; with the increasing use of the system however came the development which attends every invention which has a large field of usefulness open to it. The impulse wheel of the present day ranks as fairly efficient among the various means of utilizing natural energy.

At this stage it becomes a question to what extent it may be desirable to employ the impulse wheel outside the conditions under which it first sprang into existence. This problem is specially interesting in a country where there is an abundance of water power, and at a time when the utilization of water power is assuming the place of one of the most important engineering questions of the day. The object of this paper is to record the results of some experimental research on this subject and also to discuss the question by the light of those results and from other considerations.

The history of the development of the impulse water wheel may advantageously be sketched briefly. The first wheels of this class were simply provided with flat projections on the rim of the wheel, and the jet was arranged to impinge normally on these flat surfaces. This was what was known as the hurdy-gurdy. It can easily be shown from theoretical considerations that the ideal efficiency of such a wheel is 50 p.c., but it is probable that most of those in use did not give a greater efficiency than from 20 to 30 per cent.

Fig. 3

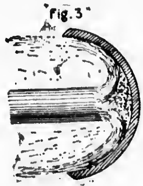
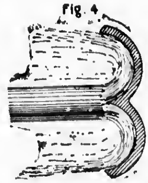


Fig. 4



The first notable improvement was that of substituting hollow cups for the flat vanes, so that the jet struck the interior part of the cup and was deflected back again until it left the vane, travelling, with respect to the vane, in almost the opposite direction to that in which it was travelling before impact, as shewn in fig. 3. This formation at once largely increased the efficiency, but in practice the efficiency was still far from what it theoretically might be.