diminishing in passing through turbine – condensation, due to work done would produce this, and so would increase of pressure

(a) is inconvenient, leading to excessively high velocities, such that the vanes bust themselves and the wheel; but can be managed, perhaps, if necessary; it would be more convenient to have a turbine of the pressure type, but without Parson's step-reduction, which has much friction and chopping, on account of the multiplicity of guides and blades. The question is, $\frac{dv}{dx}$ being supposed practically unavoidably positive throughout, it looks absurd to expect advantage by contracting the outlet.

Glad to hear that Harriette and baby are well. Love to all from here

Your affectionate brother

Maurice F. FitzGerald

32. Eglantine Avenue.
Belfast.

Oct 2n 1896

7/118

Dear George

I suppose I didn't make it evident that the equation

$\frac{dv}{dx}(u^2 - \gamma pv + Tu\cos\theta)$ = so and so, does not assume any particular final value of u or anything else –; it is true at any stage of the proceedings

I am ~~not~~ sure that the adiabatic expansion leading to condensation doesn't make any gigantic difference from the fact that, in an ordinary nozzle, the pressure and velocity of steam at the neck come out right by calculation – I mean that $u^2 = \gamma pv$

finds both the true neck-velocity <u>and</u> the neck pressure, on calculating the value of γ for that particular part of the adiabatic expansion curve — within less than 1 per cent at any rate — and I don't think the experiments were dependable, as to the pressure, at least nearer than that; moreover there must be in any experiments some friction as well as conduction of heat by the metal of nozzle, towards the ~~hot~~ outer end; which would (the latter I mean) raise the value of γ, if it be appreciable. As soon as the jet gets clear of the nozzle, if the narrowest place be the end, it expands very quickly, so that immediately outside the pressure isn't the same (on account of curvature of lines of flow) in the centre as at ~~edge~~ surface of jet

As long as the steam is in the turbine however this doesn't occur; ~~that~~ the only thing we can control is a, by widening the cross section of the crown, (or the reverse)  as is done with

Section of wheel

water turbines; (Jonval type I have taken). Now if $\frac{da}{dx}$ be <u>positive</u> in the wheel ~~lhen~~ coming up to outlet ~~from which~~

$$\frac{dV}{dx}(u^2 - Tu\cos\theta - \gamma PV) = u^2\frac{da}{dx}(u + T\cos\theta) + VT\sin\theta\frac{da}{dx}$$

will require, at end of passage, where $\cos\theta = 0$, $u^2 > \gamma PV$ unless either ~~$\frac{dV}{dx}$ be negative~~ (a) $\frac{dV}{dx} = 0$ throughout; i.e. the steam be expanded to outside pressure before it enters the turbine (b) the area of passage be <u>contracted</u>, contrary to water turbine rule, at discharge or (c) the volume be