10/23

October 1.

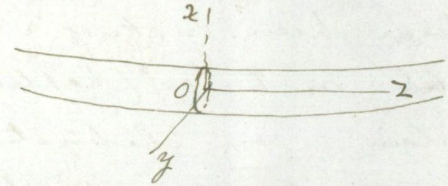
Φ,

You are, indeed, a man of great perspicuity; nevertheless I am almost tempted to wish that you had something the matter with as a punishment for coming so near & not writing to me.

You are right about the Adiabatics. It is most extraordinary that <u>all</u> writers say that adiab. transfn takes place "without gain or loss of heat." The asses! Look at Tait's Sketch of Thermodynamics. In reading his account of Carnot's Engine, you wonder how the Deuce the Engine does work, you end by believing that all fundamental principles of dynamics are wrong, & then (as McKay says) damn everything

[The body is supposed isotropic, & the stresses are connected with strains by usual eqns.]

Take the problem of plane flexure of a beam — bent in plane xz.



Let w_1 = weight per unit of vol.

I think you will find that the condns

$$N_1 = N_2 = T_1 = T_3 = 0, \quad \frac{dT_2}{dx} + \frac{dN_3}{dz} = 0, \quad \frac{dT_2}{dz} = w_1$$

will be satisfied by the forms

$$u = a(x^2 - y^2) + cz^2 + 2fyz + 2gzx$$

$$v = -2f\,zx + 2gyz + 2axy$$

$$w = 4g\left(1+\frac{\mu}{\lambda}\right)\left(x^2 - \tfrac{1}{2}z^2\right) + gy^2 - 4a\left(1+\frac{\mu}{\lambda}\right)zx + 2fxy.$$

For a particle on mean fibre near O, we ought to have $u = cz^2$, $v = 0$, $w = 0$.

This wd give $c = \frac{1}{2\rho}$, $g = 0$.

$$\therefore 2a\left(1+\frac{\mu}{\lambda}\right) = \frac{1}{2\rho} + \frac{w_1}{2\mu}$$

Hence $T_2 = 2\mu f y + w z$.

$f = 0$ for $y = 0$, $v = 0$ } by symmetry

Compare with the particular case in Thomson & Tait (p. 553).

Treat torsion & traction in same way. I have worked this only <u>once</u>.

It turns out after all that Tait is giving Carnot's own faulty theory of the subject; but scarcely a hint of this is to be found in Tait's writing; it was by looking at Baynes that I discovered the fact.

I think it doubtful (or doubtable) that Heat is the Ultimate form of all Actual Energy. [By the way I always use in my lectures the symbol Æ to denote Actual (or Kinetic) Energy]. How does Thomson make out that it is? Why might not heat have a tendency to transform into Electrical E? The principle of Dissipation of E is by no means clearly justified.

I think the fundam.l =n. of Thermodynamics,

$$dH = dE + dW$$

deserves to be contrasted in some respects with the ordinary =n. of E of visible motion. This is the =n. of a system into which E is pumped, & the E pumped into it (viz., dH) is not taken up by it as Æ wholly. I have not thought enough of this, but perhaps you will see something in it. Compare it with any ordinary case of motion of a particle or machine.

I have been looking at Elasticity lately, as the last Chapter of Statics will contain a very elaborate introd.n to the subject. The subject is vast beyond all management; but I am rather satisfied with the view I have given of it, as it will be useful as an introd.n to Clerk Maxwell & also to Applied Mech.cs The Clar. Press will send you proofs to Antrim. Second ed.n is vastly improved — contains everything manageable. Bring your Lamé & Thomson & Tait with you. There are some points which I must submit to you about the displacements of particular kinds of small strain.

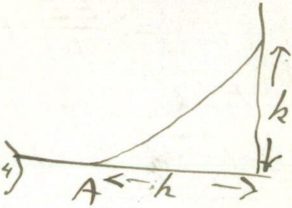
I group a good deal under the following problem:— 10(23

Given the character of the stress system to be produced, determine the corresponding strains as quadratic functions of the co-ordinates.

(6)

I make eqn. of beam refd. to horizl. & vertl. axes at A to be

$$y = \frac{k}{h}x - \frac{W(h^2+k^2)^2}{24lh^4EI}(h^3x - 2hx^3 + x^4)$$



Am I not right in saying that the components of stress on an element plane tangential to the surface of any strained body must be balanced by the external forces applied to element?

JM

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We get the bending moment in this case of flexure

$$= \frac{EI}{\rho} + \frac{EI}{\mu} w_1$$

I think. The usual expression is $\frac{EI}{\rho}$, but term in w_1 is, I suppose, negligible.

[Bending Mt. $= -\int N_3 x \, dS'$].

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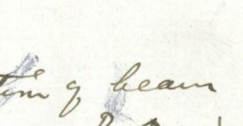
Don't you think that the displacements for a given kind of stress can be got in this way? This way gives Thomson's (or rather St Venant's) forms (in p. 553) at once. He takes a particular case of bending, & oracularly adds on corrections to the displacements of simple circular flexure.

I sent Townsend a solution of beam AB resting on ground & against wall in non-limiting equilm.



He is to send me his soon. We do not quite agree, I believe. I have also found direction of R. He has not, so far at least. This is well worth looking into.