Coopers Hill. Staines.

60/129 Nov. 17.

Dear Ball,

I don't see any flaw in your reasoning, but I am certain that there is only one point of zero acceleration, because the equations determining it are linear and give definite values for (x, y, z), its co-ordinates. I shall again study your proof after I sufficiently fortify my knowledge of Screws.

I want now to discuss the matter with you from another point of view — Quaternions. Well, Quaternions show at once the possibility of a Theory of Screws — a theory dealing with velocities (displacements)

Fans" impossible!

I should like to have your opinion about the the impossibility signalised above, and also Fitzgerald's ideas thereon. So that when you have read this letter, you might send it to him, as I am so busy with several things that I have not time to write to him.

Yours very truly,

Geo. M. Minchin.

For since any one velocity system
is a twist about a screw, i,
the vector displacement
of P (any point in the body)
is of the form

$$a\, i + b\, V i (\rho - \alpha),$$

where $\overline{OA} = \alpha$, the vector to a point on the Screw.
Another displacement would be

$$a' i' + b' V i' (\rho - \alpha'),$$

and the superposition of these gives a
result of the form $A\theta + B V\theta(\rho - \xi), \quad (?)$
which is the resultant twist.
Alas! this seems not to be true of the
composition of two "Fans"
[I thought of calling the two lines
JA and JB which determine
the Canonical form of
an acceleration system a "Fan".]
If i_1 is the unit vector in dir^n.
of JA, j_1 " " " JB,
the Canonical form of an accel^n system
in the Solid body is

$$a_1 i_1 V i_1 \overline{\rho - \alpha_1} + b_1 V j_1 \overline{\rho - \alpha_1}, \quad \text{where } \overline{OJ} = \alpha_1$$
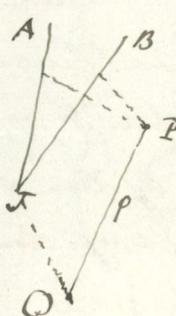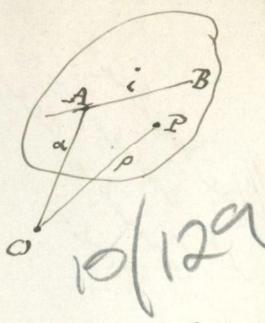
Another possible acceleration system (with ref.
to a "fan" i_2, j_2 at end of α_2) is

$$a_2\, i_2\, V i_2\, \overline{\rho - \alpha_2} + b_2\, V j_2\, \overline{\rho - \alpha_2}.$$

Now I am almost satisfied that these are
not superposable so as to give

$$A\theta V\theta(\rho - \xi) + B V\psi(\rho - \xi), \quad \left[\text{for all values of } \rho\right]$$

and therefore not superposable at all, since
every possible acceleration system is a
"Fan". This is a truly curious result —
two possible independent acceleration
systems of a solid body are not, generally,
superposable.
I believe that in uniplanar motion
they are.
If it was you or any one else who had
discovered the "Fan", there is not the slightest
doubt that two Fans would have
compounded one Fan; but I am so
unlucky, that the moment I found the
"Fan", Nature resolved to checkmate me
at the outset by rendering a "Theory of