CHAPTER V

COMPARISION OF THE LORENTZ TRANSFORMATION USING COORDINATE VELOCITIES WITH THE NEW FORM.

IN the preceeding chapters we have found, using the assumptions:

- 1. Transformation is linear.
- 2. The composition of two transformations is a transformation

of the same form.

3. The transformation is symmetric. ,

and working with proper velocities, that the Lorentz transformation is

$$\mathbf{x}^{\dagger} = (1 + \mathbf{v}^{2}/\mathbf{k}^{2})^{\frac{1}{2}}\mathbf{x} - \mathbf{v}\mathbf{t},$$

$$\mathbf{t}^{\dagger} = -\mathbf{v}\mathbf{x}/\mathbf{k}^{2} + (1 + \mathbf{v}^{2}/\mathbf{k}^{2})^{\frac{1}{2}}\mathbf{t},$$
 (1)

by equations (11) and (12), Chapter II, and equation ($\mathbf{5}$), Chapter IV:

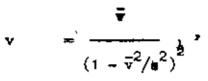
As stated in Chapter I the equation of the Lorentz transformation may be written

$$x' = \frac{x}{(1 - \bar{v}^{2}/c^{2})^{\frac{1}{2}}} - \frac{\bar{v}}{(1 - \bar{v}^{2}/c^{2})^{\frac{1}{2}}}$$

$$t' = \frac{t}{(1 - \bar{v}^{2}/c^{2})^{\frac{1}{2}}} - \frac{\bar{v}x}{c^{2}(1 - \bar{v}^{2}/c^{2})^{\frac{1}{2}}} , \qquad (2)$$

where $\overline{\mathbf{v}}$ is the coordinate velocity of S[†] in S and c'is the coordinate: velocity of light.

The relation between the proper velocity v and the coordinate velocity \overline{v} is given by the equation



according to the definition in Chapter 1.

We shall now verify that when we substitute $\frac{\overline{v}}{(1-\overline{v}^2/c^2)^2}$ for v in equations (1) we obtain equations (2).

Substituting $v = \frac{\overline{v}}{(1 - \overline{v}^2/k^2)^2}$ into equations (1) we get, after some manipulations,

$$x' \cdot = \frac{x}{(1 - \overline{v}^2/k^2)^2} - \frac{\overline{v}}{(1 - \overline{v}^2/k^2)^2} \left\{ 3 \right\}$$

and $t' = -\frac{1}{k^2} \frac{\overline{v}}{(1 - \overline{v}^2/k^2)^2} + \frac{1}{(1 - \overline{v}^2/k^2)^2} \left\{ 3 \right\}$

which is the same as equations (2) if $k = c_{\bullet}$

