I. INTRODUCTION.

The characteristic of inhomogeneous turbulence is the dependence of its average properties on position. If the fields (velocity, temperature...) are separated into a mean part and a proper turbulent part of zero mean, it is possible to derive, from the fluid dynamics equations, a system of equations describing the mean fields and a system of equations describing the proper turbulent fields. The two systems, however, are coupled and interaction terms appear in both. These terms are responsible of the deformation of the mean profiles as compared with the laminar solutions and of the inhomogeneity of the proper turbulence.

The interaction processes between the mean fields and the proper turbulence are intricated and poorly understood. In general however they are mainly confined to some large scale eddies and homogeneous models can often be used to described the statistical dynamics of the proper turbulence at the smaller scales.

In the absence of a sufficient understanding of the interaction mechanism, however, the equations for the mean fields cannot be solved.
Yet, the determination of the mean quantities (wind and mean temperature profiles in the atmosphere, mean velocity distribution over a channel cross section, average transport properties in the ocean etc...) is the

primary objective in most practical applications. This problem is very often approached by semi-empirical theories which incorporate experimental data with dimensional analysis.

It would be extremely interesting to have a theory which could predict the mean profiles completely i.e. without resorting to experiments for the determination of dimensionless constants. Some attempts to construct such a theory from a variational principle are reported here.

To give a definite frame to the discussion, attention is focused on the concrete case of turbulent incompressible isothermal flow between two parallel plates which is briefly described in the next section.

II. TURBULENT FLOW BETWEEN PARALLEL PLATES.

Separating the velocity field $\underline{V}$ into a mean part $\underline{u}$ and a proper turbulent part $\underline{w}$ of zero mean, we obtain, from the Navier-Stokes equations, the fundamental equations, in non-dimensional form.

$$\frac{\partial u_i}{\partial t} + \frac{\partial}{\partial x_j}\left[u_i u_j + \langle w_i w_j \rangle\right] = -\frac{\partial p}{\partial x_i} + \nabla^2 u_i \tag{2.-1}$$

$$\frac{\partial w_i}{\partial t} + \frac{\partial}{\partial x_j}\left[w_j u_i + w_i u_j + w_i w_j - \langle w_i w_j \rangle\right] = -\frac{\partial r}{\partial x_i} + \nabla^2 w_i \tag{2.-2}$$