# ON GROUPS OF ORDER 8!/2.

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§ 1. In the BULLETIN, vol. IV. (1898), pp. 495–510, Dr. L. E. Dickson discusses the structure of the hypoabelian groups. Among the simple groups of the system $J$, occurs one of order $8!/2$ ($p^n = 2^1$, $m = 3$); this 2.3 or senary linear group is defined as the totality of linear substitutions on 2.3 indices, as follows:

$$(1)\qquad \begin{aligned} \xi_i' &= \sum_{j=1}^{3} (\alpha_j^{(i)} \xi_j + \gamma_j^{(i)} \eta_j), \\ \eta_i' &= \sum_{j=1}^{3} (\beta_j^{(i)} \xi_j + \delta_j^{(i)} \eta_j), \end{aligned} \qquad (i = 1, 2, 3),$$

satisfying the relations

$$(2)\qquad \begin{aligned} &\sum_{i=1}^{3} \begin{vmatrix} \alpha_j^{(i)} & \gamma_j^{(i)} \\ \beta_j^{(i)} & \delta_j^{(i)} \end{vmatrix} = 1, \qquad \sum_{i=1}^{3} \begin{vmatrix} \alpha_j^{(i)} & \gamma_k^{(i)} \\ \beta_j^{(i)} & \delta_k^{(i)} \end{vmatrix} = 0, \\ &\sum_{i=1}^{3} \begin{vmatrix} \alpha_j^{(i)} & \alpha_k^{(i)} \\ \beta_j^{(i)} & \beta_k^{(i)} \end{vmatrix} = 0, \qquad \sum_{i=1}^{3} \begin{vmatrix} \delta_j^{(i)} & \delta_k^{(i)} \\ \delta_j^{(i)} & \delta_k^{(i)} \end{vmatrix} = 0, \end{aligned}$$

$$(j \neq k;\ j, k = 1, 2, 3);$$

$$(3)\qquad \sum_{j=1}^{3} \beta_j^{(i)} \delta_j^{(i)} = 0, \quad \sum_{j=1}^{3} \alpha_j^{(i)} \gamma_j^{(i)} = 0, \quad \sum_{i,j=1}^{3} \alpha_j^{(i)} \delta_j^{(i)} = m,$$

$$(i = 1, 2, 3;\ m = 1, 2, 3).$$

*The present paper determines that the above group is abstractly the alternating group $G^8_{8!/2}$, and thus establishes a new proof of its simplicity.**

Writing the substitutions (1) in square array, and considering the elements of the group as the matrices of these coefficients, we have

*Dr. L. E. Dickson in the *Proc. of the Lond. Math. Soc.*, vol. 30, "The structure of certain linear groups with quadratic invariants," pp. 81 et seq., has proved the correspondence of these groups.