ABSTRACTS

DEPARTMENT OF POWER ENGINEERING

SECTION OF MECHANICAL ENGINEERING

1. THE CYCLONE FURNACE AND ITS ADAPTABILITY FOR BURNING LOW GRADE COALS OF INDIA FOR POWER GENERATION. G. Jaya Rao, *Power Engineer*, 1957, 7, No. 1, pp, 2–14.

The principle, constructional details, and advantages of Cyclone Furnaces are described. The fuel characteristics suited for cyclone firing are dealt with in detail such as ash fusion temperature, slag viscosity and flow characteristics in the solidification range. The cyclone firing possibilities for Indian low grade and lignitic coals are discussed on the basis of laboratory tests. Large-scale tests of low grade and lignitic coals in a cyclone furnace are recommended.

2. POOL BOILING HEAT TRANSFER WITH MERCURY. C. F. Bonilla, J. S. Busch, A. Stalder, N. S. S. Mahmud and A. Ramachandran, *U. S. Atomic Energy Commision Report*, *NYO*-7638, 1956.

Mercury was boilded on a horizontal low-carbon steel plate at pressures from 4 mm. of mercury to 45 psia, depths of 2–10 cm., heat velocities of 4000–200,000 BTU/hr.sq.ft., and with and without wetting agent additions. The nature of the boiling and the necessary temperature differential were observed. Film boiling of mercury, and presumably all liquid metals, is undesirable because of the high boiling surface temperatures required, as well as the greater variability or fluctuation of the heating surface temperature. Nucleate boiling at a given heat velocity Q/A required decreasing temperature differences with increases in pressure, at all pool depths. With the addition of 0·02% Mg and 0·0001% Ti to mercury, nucleate boiling and higher heat transfer coefficients are obtained. This is probably due to the better wetting of the surface. The same effect is obtained on steel after long boiling with pure mercury. Under the conditions investigated, no important variations in liquid temperature with depth occurred, all of the liquid being substantially at the saturation temperature of the vapour phase. However the greater the depth the higher the plate temperature necessary to obtain nucleate boiling at a given velocity. Noise and vibration may occur under certain conditions during the nucleate boiling of pure mercury. They are more likely to occur at moderate submergences, low pressures and with poor wetting of the heating surface.

3. MEASUREMENT OF HICH TEMPERATURES IN GAS STREAMS. G. Srikantiah and A. Ramachandran, *Electrotechnics*, 1955, No. 25, pp. 26–38.

The different methods of temperature measurement in high temperature high velocity gas streams developed till now with their scope and limitations are discussed critically.

Section of Civil & Hydraulic Engineering

1. On a Two-Dimensional Problem in the End-Block Design of Post-Tensioned Prestressed Concrete Beams. K. T. Sundara Raja Iyengar, *Proceedings of the First Congress on Theoretical and Applied Mechanics, Kharagpur*, 1956, pp. 107–12.

This paper reports the study that has been made on the Theory of Elasticity solution of the anchorage zone stresses of a beam post-tensioned by two cables with anchorages symmetrically arranged about the centre line of the end section. The following stress function is obtained:

$$\phi = \Sigma B_n \frac{\cos \frac{n\pi y}{b}}{\left(\frac{n\pi}{b}\right)^2}\left[1 + \frac{n\pi x}{b}\right]e^{-\frac{n\pi x}{b}} - \frac{2py^2}{4b}$$

$$+ \int_0^\infty \frac{A(\alpha)\cos \alpha x}{\alpha^2 \cosh \alpha b}\left[\alpha y \sinh \alpha y - (1 + \alpha b \coth \alpha b)\cosh \alpha y\right] d\alpha.$$

Details of calculations to obtain the expressions for B_n and $A(\alpha)$ are explained.

2. Stress Concentration in Post-Tensioned Prestressed Concrete Beams. Gerald Pickett and K. T. Sundara Raja Iyengar, *Journal of Technology*, December 1956, 1 (2), 105–12.

The use of the multiple Fourier method to analyse the stress distribution in the end regions of a post-tensioned prestressed concrete beam has been shown. The multiple Fourier method demonstrated here is a relatively new method for solving those problems for which the " Saint Venant Principle " is not applicable.

The actual three-dimensional problem and a two-dimensional simplified representation of it are treated. The two-dimensional case is treated first and rather completely to gain further experience with multiple Fourier procedures. The appropriate Galerkin Vector for the three-dimensional case is found and the required relations between the arbitrary functions are stated.

DEPARTMENT OF INTERNAL COMBUSTION ENGINEERING

1. Heat Transport by Liquids Enclosed in Vertical Tubes. K. P. Singh* and H. A. Havemann**, *Published in Proceedings of the Second Congress on Theoretical and Applied Mechanics, National Physical Laboratory, New Delhi, October* 1956.

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SUMMARY

This paper presents experimental results on the rate of heat transfer by natural convection achieved by liquids—metallic and conventional, at normal state and with a change to the vapour phase—whilst being totally enclosed in vertical tubes.

For mercury and water as the heat transmitting medium the results are represented in non-dimensional form to allow evaluation for different tube sizes; and in dimensional form for diethyl ether, diphenyl and water for the case that the liquid boils in the lower portion and condenses in the upper portion of the tube. The influence of the diameter of the tubes and of the pressure inside the tube was ascertained for boiling water.

2. CENTRIFUGAL AND THERMAL STRESSES IN ROTATING DISCS. K. P. Singh, *Published in Proceedings of the First Congress on Theoretical and Applied Mechanics, Indian Institute of Technology, Kharagpur, November* 1955.

This paper deals with a tabular method for calculation of centrifugal and thermal stresses in a disc of varying thickness. This method is a combination and continuation of the solutions indicated by Stodola and others. It can be applied to both solid and centre-bored discs and takes into account the change in thermal coefficient of expansion and modulus of elasticity with temperature. This method of solution is not limited to any specific form of disc profile or temperature distribution, but it is assumed that the disc is symmetrical about the axis of rotation, and the change in thickness of the disc is gradual. In this solution advantage is taken of the principle of superposition of stresses for calculating the unknown hoop stress at the inner radius or at the centre of a disc. A worked example is also given which makes it easier to understand the proposed method.

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