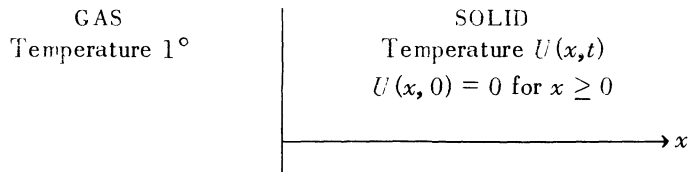# ON A CERTAIN NONLINEAR INTEGRAL EQUATION
OF THE VOLTERRA TYPE

J. H. ROBERTS AND W. R. MANN

1. Introduction. In an earlier paper by Mann and Wolf [1], the following problem of heat transfer between a gas at constant unit temperature and the semi-infinite solid was considered:

GAS		SOLID
Temperature $1°$		Temperature $U(x,t)$
		$U(x, 0) = 0$ for $x \geq 0$
		$\longrightarrow x$

(1.1) $$U_t(x, t) = U_{x,x}(x, t) ,$$

(1.2) $$U(x, 0) = 0 ,$$

(1.3) $$|U(x, t)| < M , \qquad\qquad x > 0 , \quad t > 0 ,$$

(1.4) $$U_x(0, t) = \frac{-[1 - U(0, t)]}{K} f[1 - U(0, t)] = -G[U(0, t)] .$$

It will be noted that, in boundary condition (1.4), Newton's Law of Cooling has been replaced by the weaker, more realistic hypothesis that the net rate of heat exchange from the gas to the solid, $-KU_x(0,t)$, is some function, $KG[U(0,t)]$, of the surface temperature. In every heat transfer problem of physical significance, the following conditions must be satisfied by $G[U]$:

(1.5) $$G[U] \text{ is continuous,}$$

(1.6) $$G[1] = 0,$$

(1.7) $$G[U] \text{ is strictly decreasing.}$$