

FLOW RATE COMPUTATION
AUTOMATIC DUMPING HOPPERS

INTRODUCTION: Some of the problems encountered in obtaining acceptable product from grinding operations are discussed in this paper. In particular, the application of an EAI PC-12 Process Control Computer to this problem is considered, and a description of some initial steps towards improvements in system operation are given.

As a rule, acceptable product, fines, and oversize particles are formed in the grinding of materials. Often, however, grinding mills have widely varying characteristics, and the grindability of feed and oversize recycle changes drastically. In such cases, the efficiency of grinding (acceptable product per unit of energy input) can fluctuate beyond reason. As an initial step in improving the typical operation of such a system, an operator's guide along the following lines is considered.

It is assumed that three (or more) products are separated by size and fed to hoppers which dump automatically when certain weights are reached. A single hopper dumps every minute or so. The average rate of production over that interval for that product is then

$$R_i = W_i / t_i$$

where R_i = average rate, #/hr.

W_i = weight at which hopper dumps, #

t_i = time since last dumping, hr.

A pulse (contact closure) is generated by the dumping mechanism and this pulse is in turn used to control an analog computer circuit.

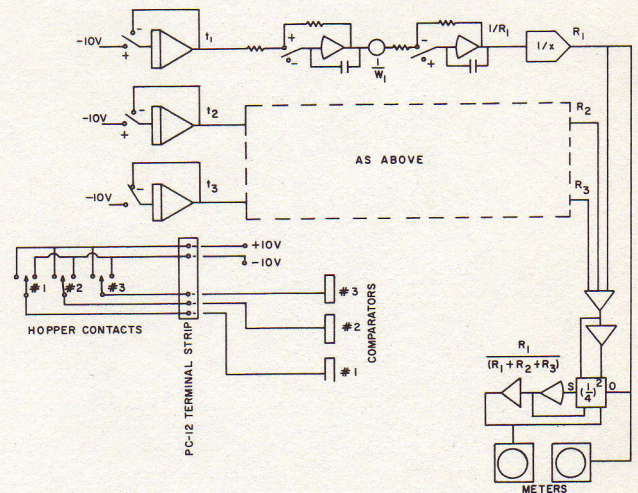


Figure 1: Dumped Hopper Circuit

A simple analog circuit is thus developed to compute R_i values and the fractional rate of production of acceptable particles, $R_j / (\sum R_i)$. Figure 1 illustrates such a computing circuit. The immediate displays of rates and fractional rates provides the mill operator with good information as to what effects he is causing by adjusting the mill operation.