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A Simple Splat-Cooling Equipment

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A Splat-cooling equipment is described which uses three LPT 100 B optotransistors with high commuting speed to detect the falling drop and to trigger a moving cylinder agaínst a fixed block.

É descrito um equipamento de "splat-cooling", o qual usa três optotransistores LPT 100 B com alta velocidade de comutação para detectar a gota que cai e para disparar um cilindro móvel contra um bloco fixo.

The large range of technical applications of amorphous semiconductors is the origin of the continuosly increasing interest in amorphous solids. Several methods are available for their production. The most common ones are bases either on the quick cooling of a liquid or on the sublimation of a gas onto a cooled amorphous substrate. Other methods include cooling by bombardment with inert gas ions, high energy neutron irradiation, chemical precipitation from solutions, etc..

Duwez and Willens[1] developed a quenching method which consists essentially in projecting a drop at high velocities against a metallic wall. A higher cooling rate can be obtained by squashing the drop between two metallic blocks, of good heat conducting material (Dixmier and Guinier)[2]. Shirigu et *al* [3] evaluated the cooling rate and found that if the blocks are cooled with liquid nitrogen, values of 10^8 K/s may be attained.

Here we report the development of equipment where the material is cooled between two metallic cylindrical blocks, M and M', at room temperature, one of them fixed (Fig. 1). When the receptacle *RP* which contains the moltem metal rotates, a drop falls, under gravity, through a fixed hole. For synchronizing the fall of the drop with the squashing between the cylinders, an electronic detection system is used. Duringthe fall the drop interrupts a focused light beam which falls on an optotransistor. The optotransistor then passes from the saturated state to the

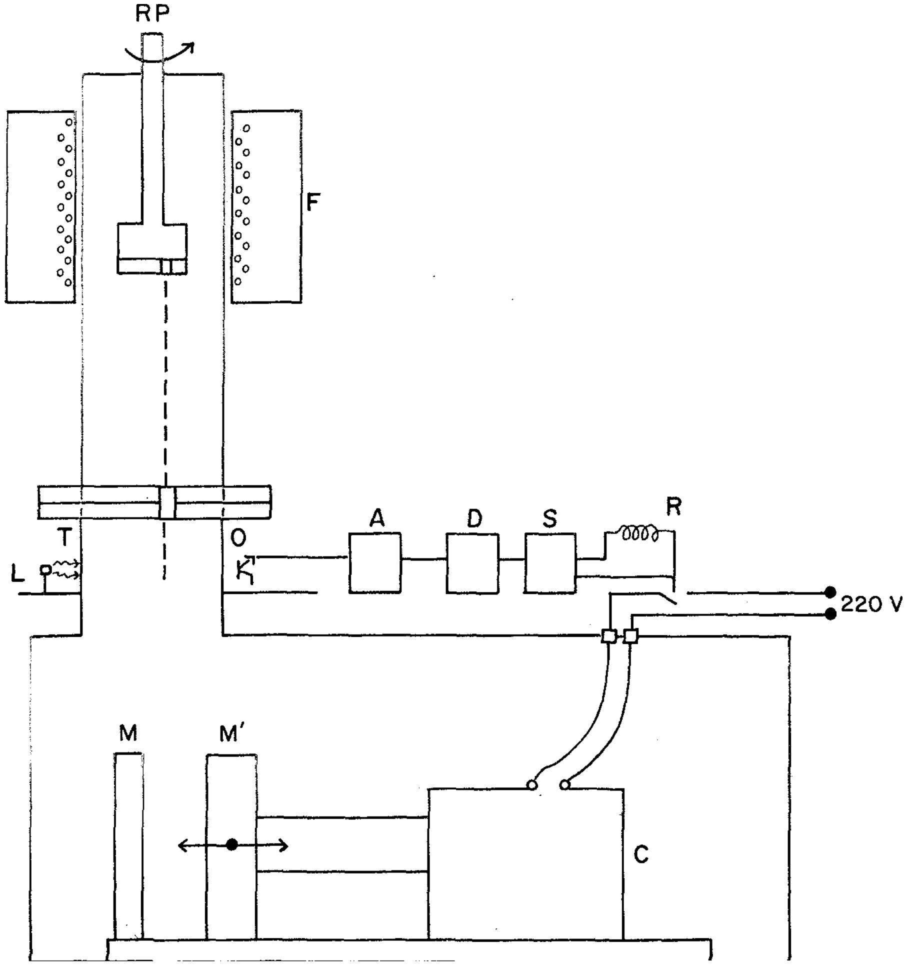

Fig.1 - Diagram of splat-cooling equipment. F = furnace; *RP* = receptacle; T = "Lucite" tube; L = light bulb; O = optotransistor; A = amplifier; D = delay; S = shaping; R = relay; C = coil; M, M' = metal blocks.

cutting state, and produces a signal which actuates the squashing mechanism. To increase the effective detection zone three optotransistors can be used instead of one, being enough the switching of one of them to trigger the system (Fig.2). The detection system is external to the *Lucite* tube T. The whole mechanical part of the system shown in the diagram is enclosed in an inert atmosphere

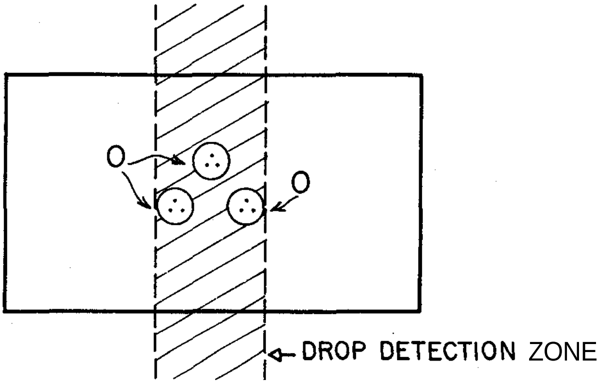

Fig.2 - View of the three optotransistors O as seen from the light bulb. Drop cletection zone is shaded.

Figures 3 and 4 show a block diagram of the system and the electronic circuit. For the excitation, a 0.5 watt light bulb L with a lens was used. As detectores high commuting velocity (2.8 μs) LPT 100 B optotransistors *O*, with an attached condensing lens were used. Its highest sensitivity lies in the 8000 Å region and falls off further than 13,000 Å. For the materials (Sn-Pb alloys) and temperatures (500°C) at which we are working the wave length of the thermal radiation emitted by the drop

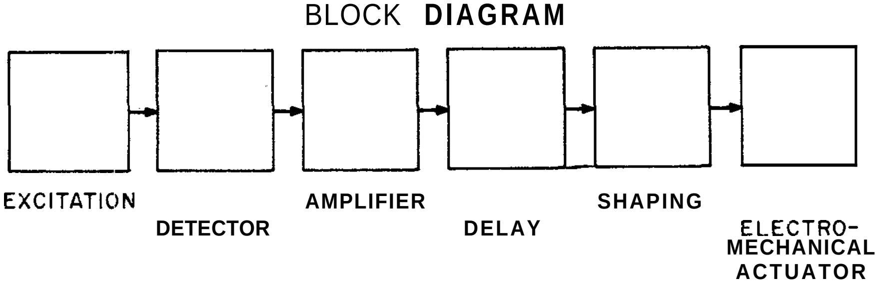

Fig. 3 - Block diagram.

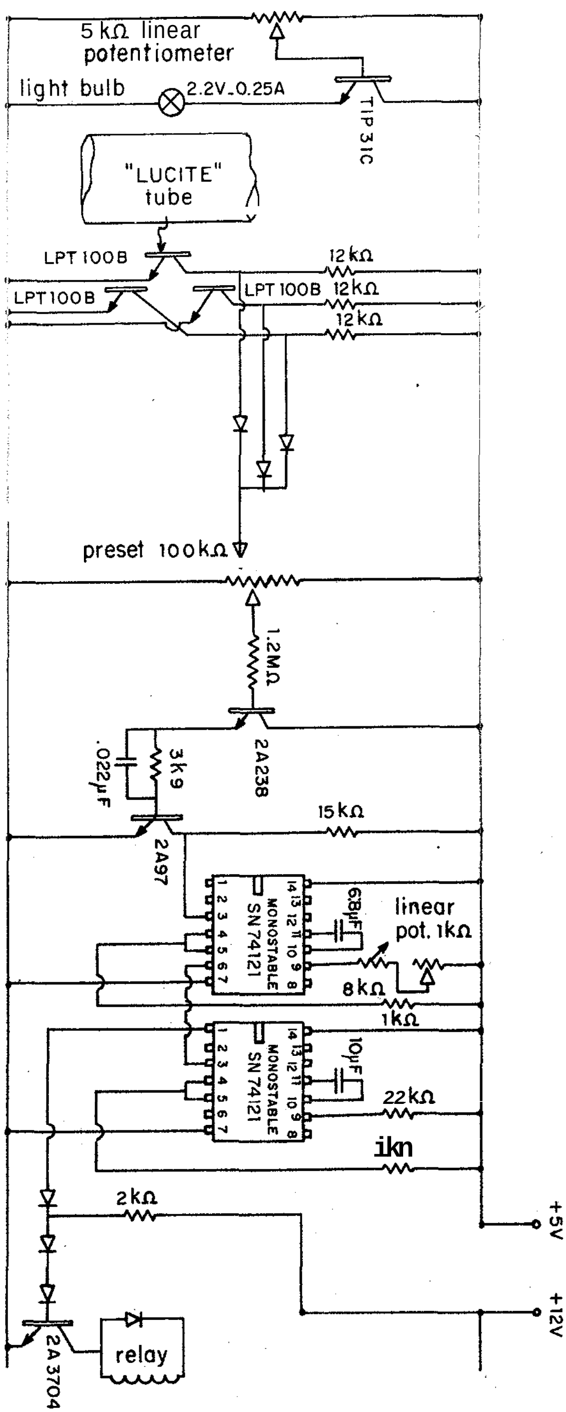

Fig. 4 - Electronic circuit.

is not short enough to saturate the optotransistors, even when interrupting the light beam and therefore the change of state occurs. The signal generated by any of the optotransistors is amplified and delayed with a monostable SN 74121 (with negative edge triggering) with a 50 ns wide pulse. A potentiometer allows the output pulse to be delayed. The required pulse width for actuating the relay is obtained with a second monostable which is triggered with the negative part of the output pulse of the first nionostable. The relay provides A.C. current to a coil which actuates the piston. Should the path of the drop be very long it is better to use a D.C, device to actuate the piston. The device as described was used successfully with paths of the order of 40 cm. The cooling rate has not been measured but can be estimated as $10^5 - 10^6$ K/s on hand of previous experiments with similar piston and anvil equipment.

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