AERO ENGINE SCHOOL
COURSE NOTE
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AVON.

PYROMETRIC EQUIPMENT.

The purpose of the pyrometric equipment is to indicate, by means of a cockpit instrument, the internal temperature of the engine. The temperature measured is that of the gas stream in the jet pipe, and is closely related to the more critical temperature of the turbine assembly. The indicated temperature is referred to as Jet Pipe Temperature (J.P.T).

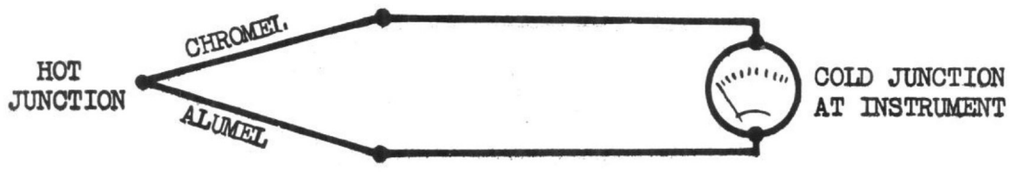
PRINCIPLE.

The Thermocouples.

An electric current is created in a closed circuit of two dissimilar metals if the junctions of the two metals are at different temperatures. This simple arrangement is called a thermocouple. The Electro Motive Force (EMF) generated by the thermocouple is small and depends on the metals used. An Avon thermocouple generates approximately .004 volts (4 millivolts) for a temperature difference of 100°C and uses CHROMEL and ALUMEL, two nickel alloys.

Temp. Difference.	Generated Voltage.
0°C	0 mv
100	4.10
200	8.13
300	12.21
400	16.39
500	20.64.
600	24.90
700	29.14
800	33.31

The junctions are referred to as the "cold" or "reference junction" and the "hot" or "measuring junction". An instrument can be coupled into the circuit to the cold junction by a pair of leads, and the instrument itself then becomes, in effect, the cold junction.



But if the temperature of the cold junction changes it will cause a change in temperature difference and therefore an error in hot junction reading. This is offset mechanically by a device inside the cockpit instrument.

The thermocouples are spaced around the jet pipe and a mean reading taken to allow for any temperature variation. The thermocouples are connected in parallel and the generated EMF is therefore the same as for one thermocouple at a given temperature difference. The number of thermocouples varies on different installations.

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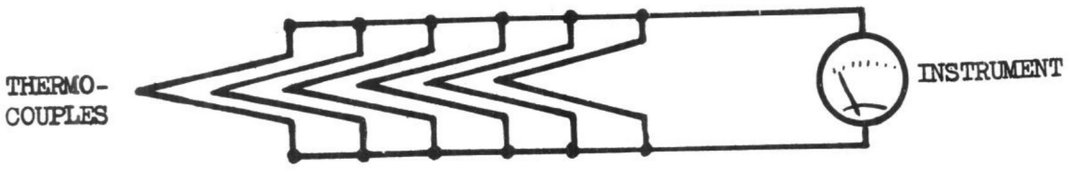

EQUIPMENT.

1. Thermocouples.

Each thermocouple consists of the chromel/alumel wires partly embedded in porcelain and contained inside a nickel chrome tube as a protection against shocks and corrosion. Two holes in the outer tube allow a gas flow over the exposed chromel/alumel junction.

2. The Leads.

From the thermocouples to the gauge the leads are chromel and alumel, and of equal resistance.

3. The Instrument.

The indicating instrument is a millivoltmeter, calibrated in degrees Centigrade from 0 - 800°C.

Compensation for changes in cold junction (i.e. cockpit) temperature is by means of a bi-metal strip bearing upon the pointer spring, and so arranged that the instrument, when disconnected, indicates cockpit temperature.

OPERATION.

If the couples and the instrument are both at 0°C there is no temperature difference and therefore no generated EMF. The instrument therefore reads 0°C.

If the couples are heated to 600°C, a temperature difference of 600°C causes a generated EMF or 24.90 mv. and the instrument therefore reads 600°C.

If the ambient temperature rises and produces a cold junction temperature of 30°C the temperature difference is reduced to 570°C and the generated EMF falls to 23.62 mv. The instrument would therefore read 570°C. However, the compensating device in the instrument is at 30°C and mechanically increases the pointer reading to 600°C thus maintaining a true reading of the hot junction temperature.

SERVICING.

This must be carried out in accordance with the instructions laid down in the Air Publication.