MICROWAVE

MEASUREMENT

Power measurement

- Measurement of low power (0.01mw-10mw)bolometer
- Measurement of medium microwave power (10mw- 10w)calorimetric techniques
- Measurement of high power (>10W) calorimetric watt meter

Measurement of low microwave power

Bolometer and thermocouples

Bolometer ---

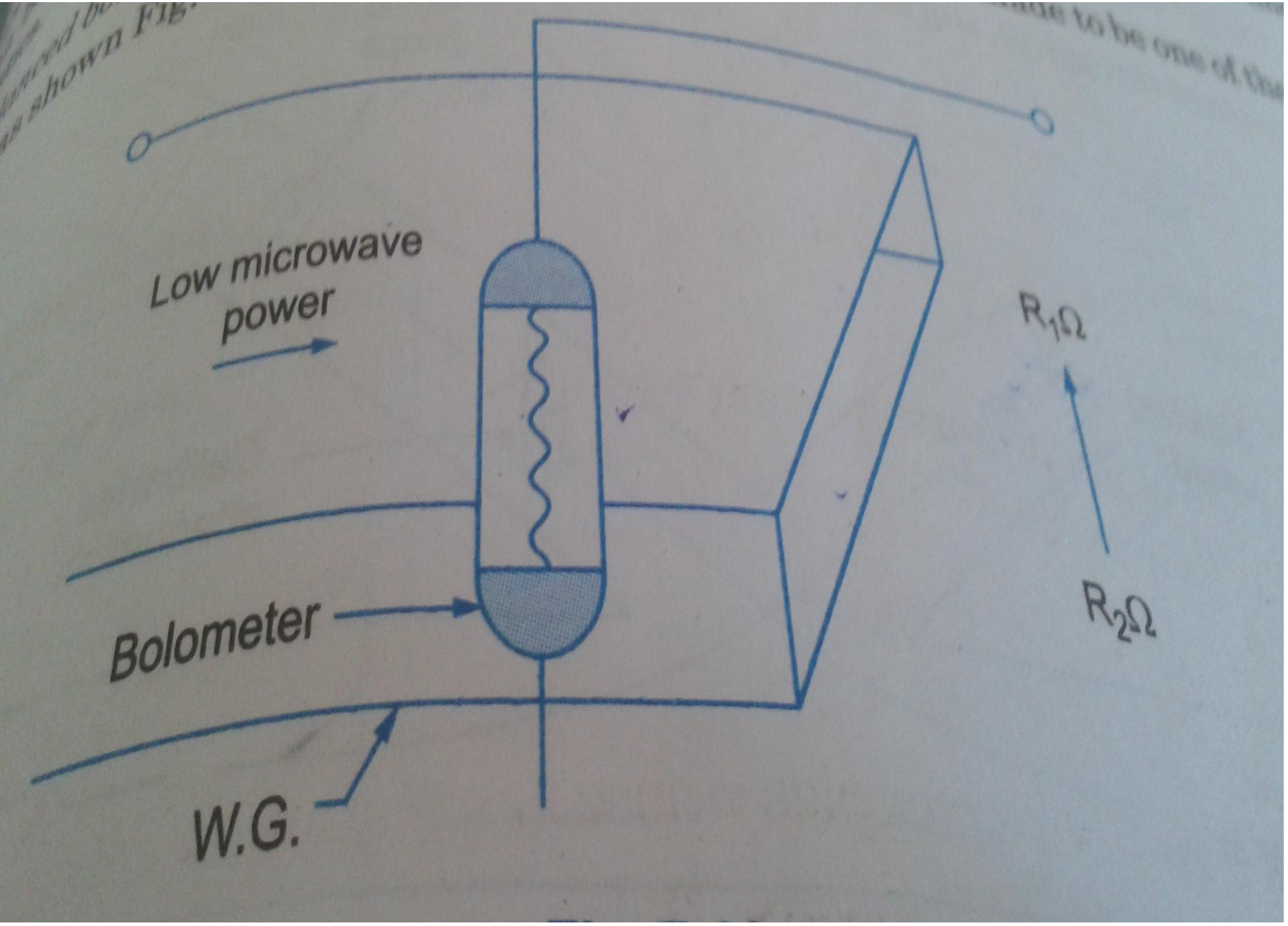
a) Barretters
b) Thermistors

Barretters

- Positive temperature coefficients
- Fine platinum wire mounted in a catridge
- Thermistors – negative temperature coeff , semiconductor devices

Bolometer

- Square law device and produces current that is proportional to the applied power


Low microwave power
Bolometer
W.G.
$R_1\Omega$
$R_2\Omega$

Balanced bolometer bridge

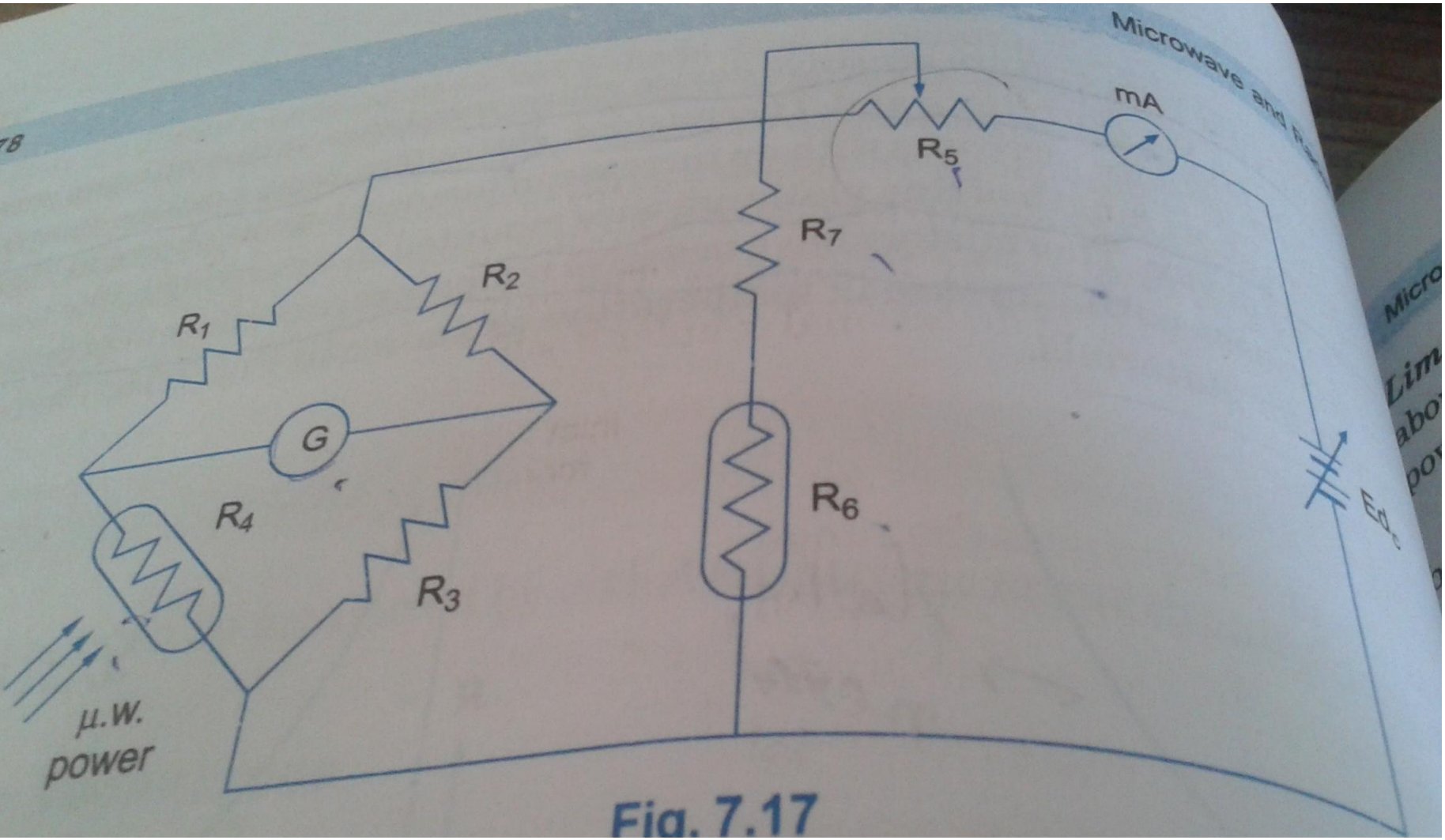


Fig. 7.17

reduced. Thus more

i.e. the current through R_3 will be

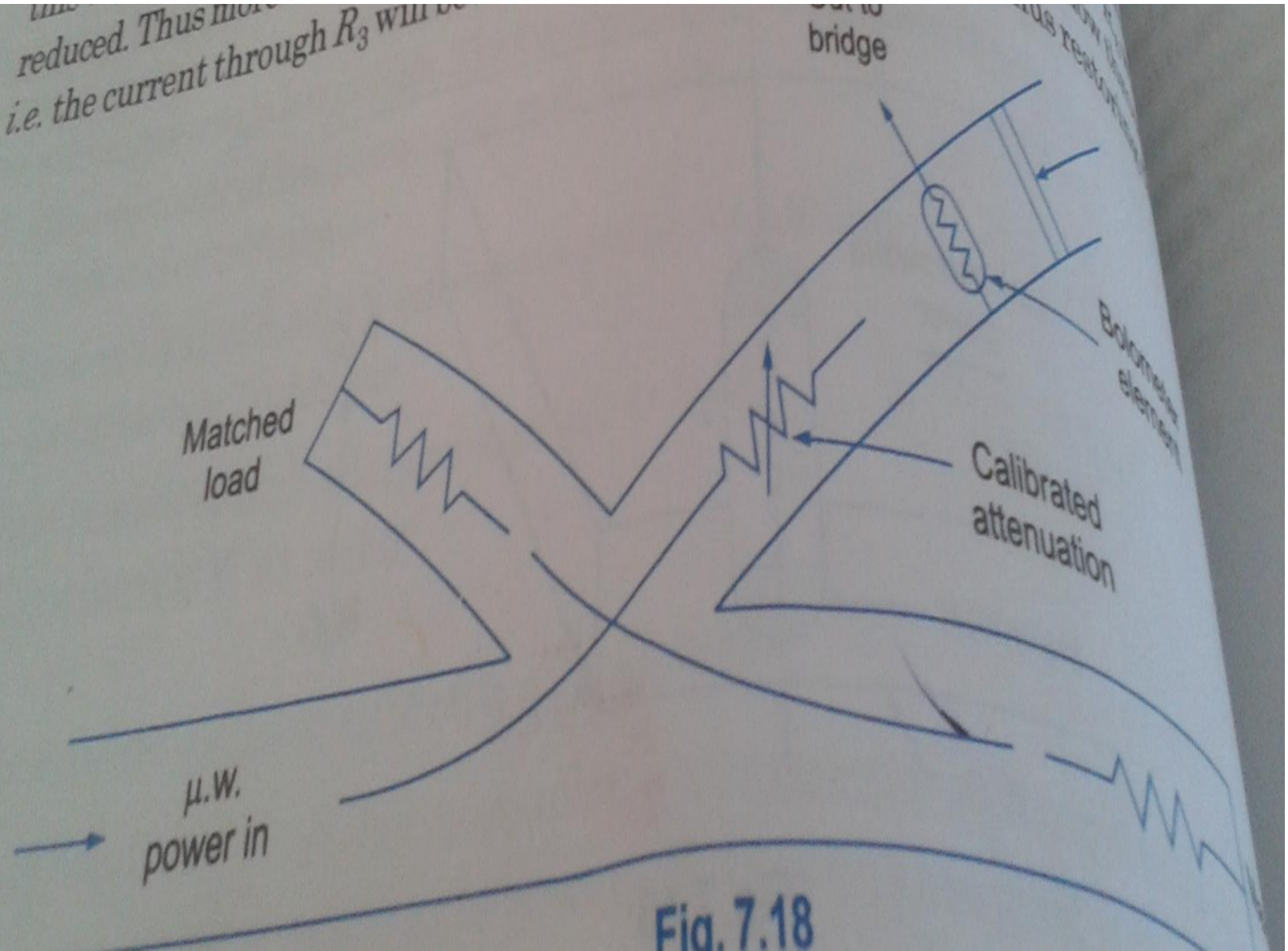
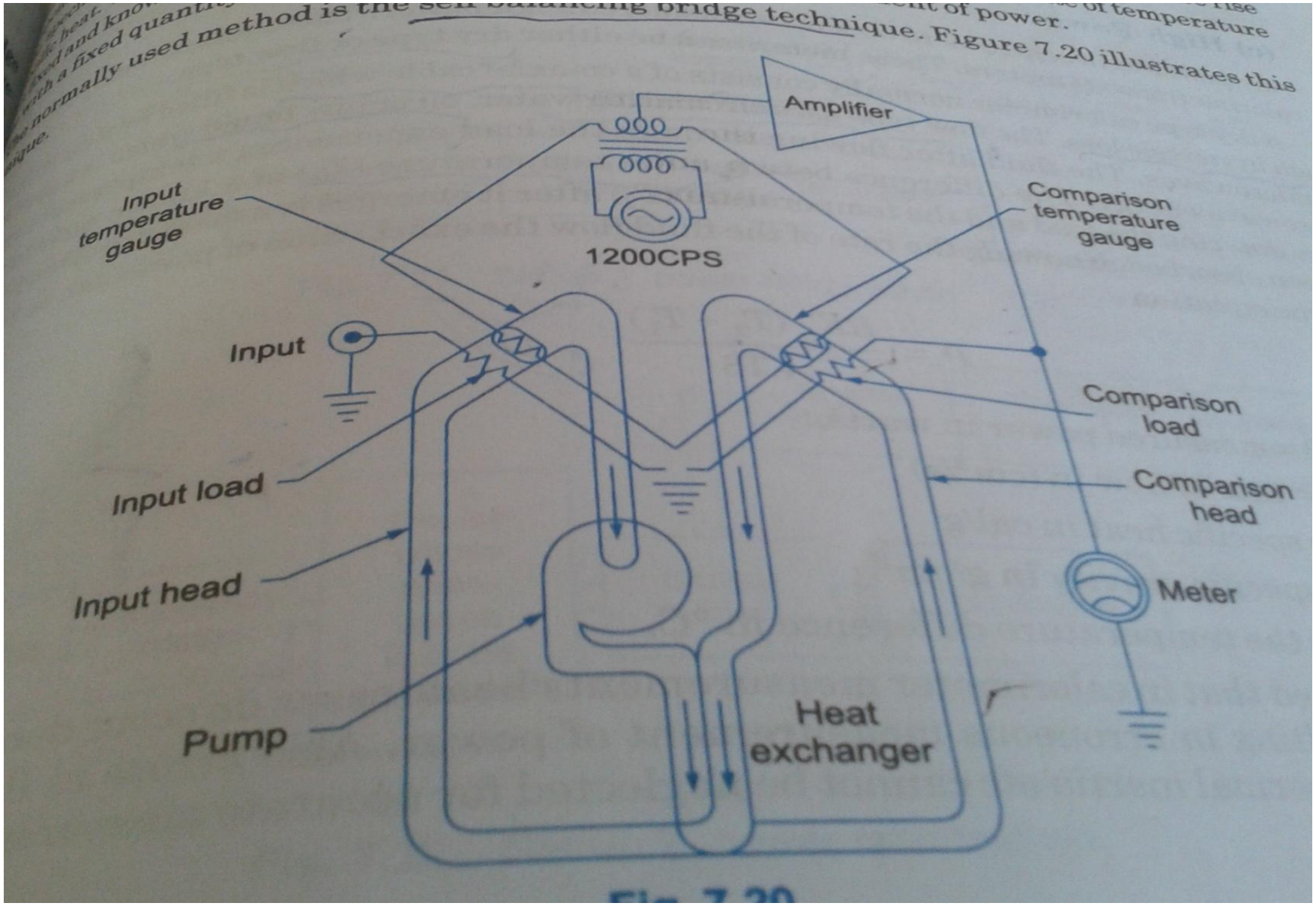


Fig. 7.18

Calorimeter techniques (Medium Power)



(*c*) **High Power**. Any power between 10 W to 50 kW is considered power. These are normally measured by calorimetric wattmeters. These meters can be either dry type or flow type.

A dry type calorimeter normally consists of a co-axial cable which is filled by a dielectric with a high hysteresis loss. The flow type uses circulating water, oil or any liquid which is a good absorber of microwaves. The fluid after flowing through the load experiences a temperature rise due to microwave energy. The difference between the temperature (T_1) of a known quantity of liquid before entering the load and the temperature (T_2) after it emerges is a measure of the power which has been absorbed. Knowing the rate of the fluid flow the absorbed value of power can be calculated by using the equation

$$P = \frac{R K \rho (T_2 - T_1)}{4.18}$$

where P = measured

where, P = measured power in watts,

R = rate of flow in (cm^3/s)

K = specific heat in cal/g

ρ = specific gravity in g/cm^3

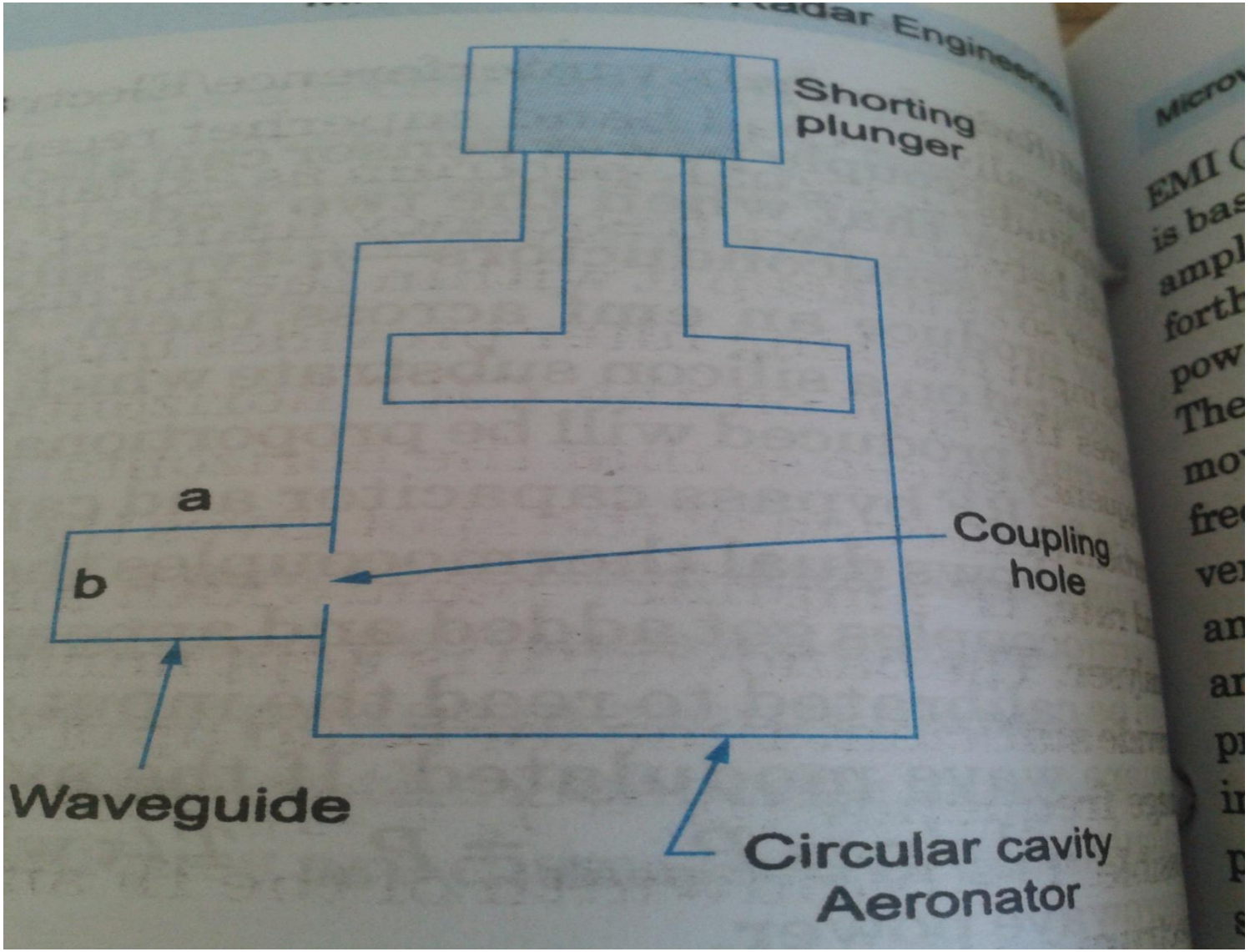
and $(T_2 - T_1)$ is the temperature difference in °C.

If may be noted that in calorimeter measurements heat loss occur due to conduction and radiations, resulting in error measurement of power. Also errors in flow determination, calibr and thermal inertia etc cannot be neglected for accurate measure

Frequency and wavelength measurement

- Slotted line technique
- Wave meter
- Electronic techniques

Wave meter

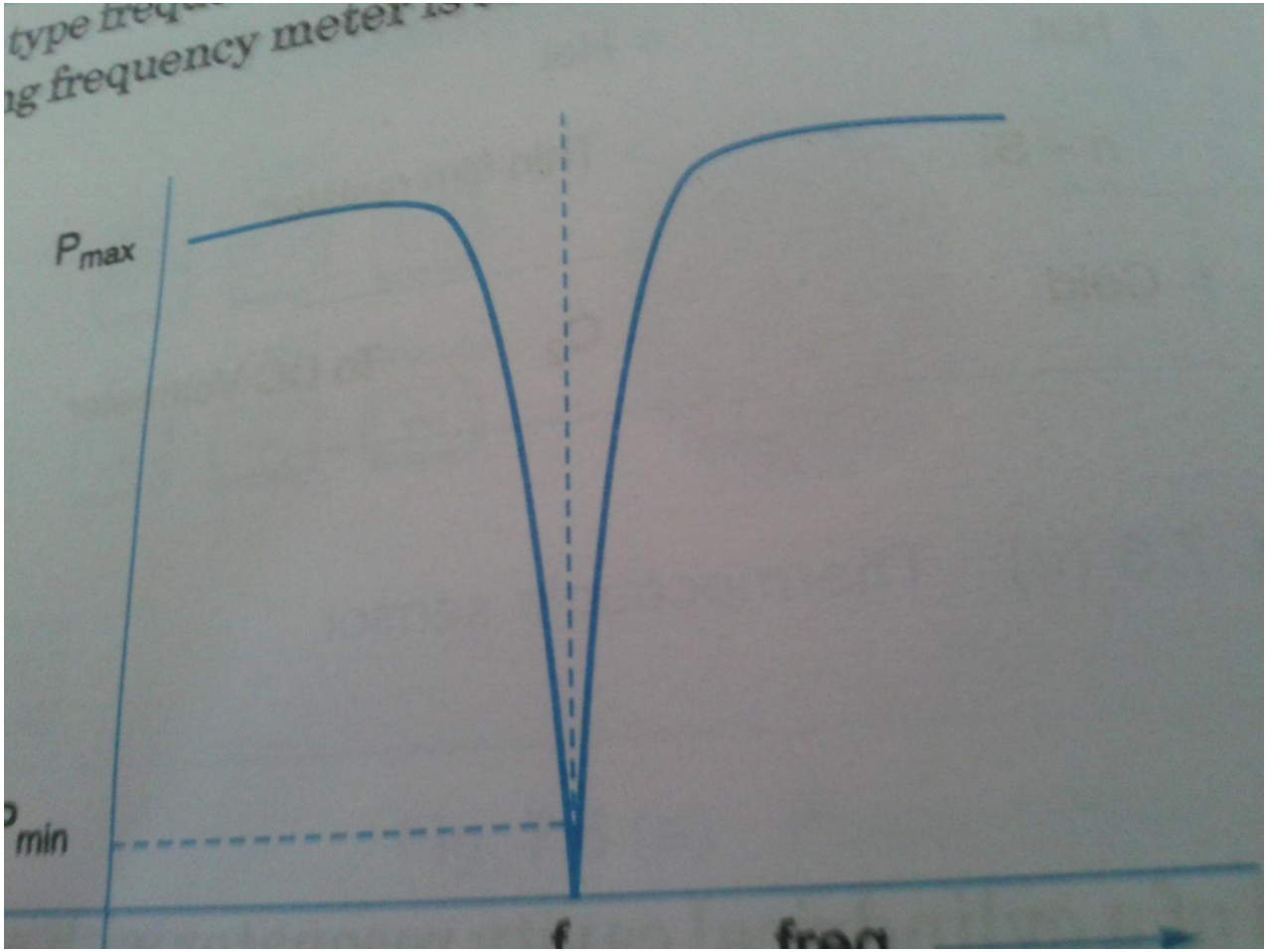

Shorting plunger
a
b
Coupling hole
Waveguide
Circular cavity Aeronator

Wave meter

- Accurate method of measurement of frequency
- Two types of wave meter
- Transmission type
- Absorption type

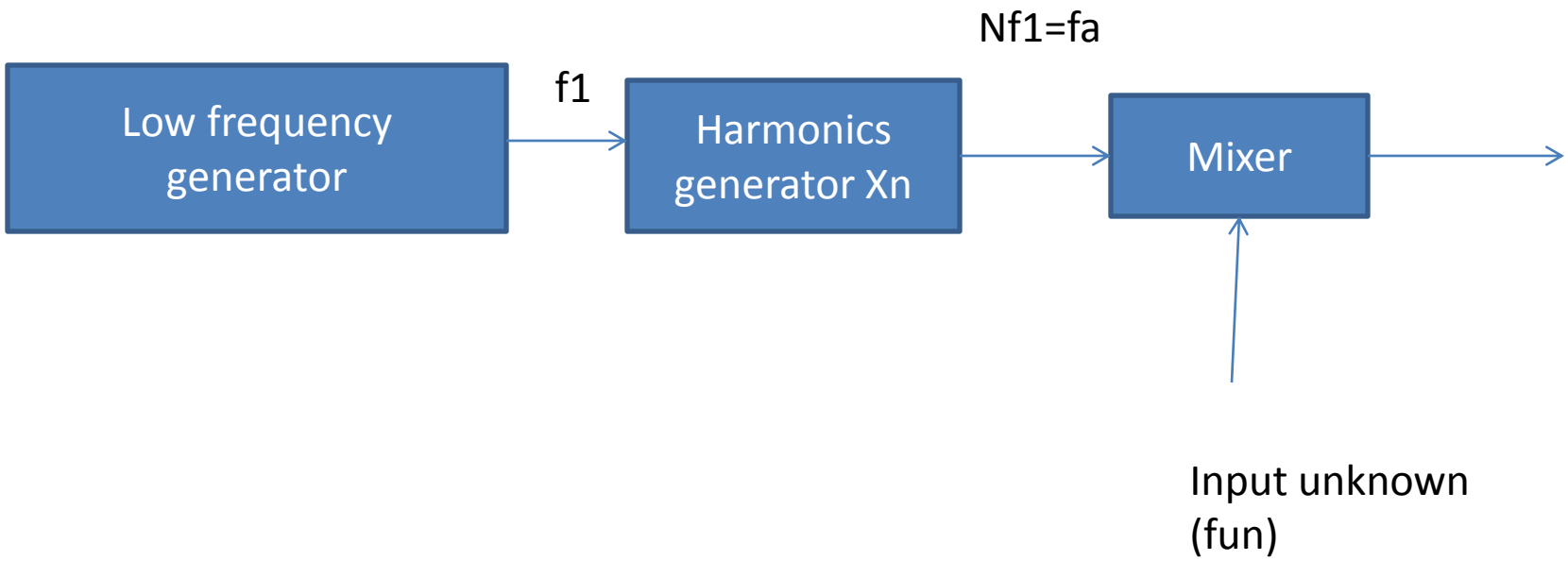
Wave meter

- Dominant mode TMo11 is normally used
- Suitable mode is TE011 because of high cavity and absence of axial current
- Polytron –an absorbing material (oscillation due to pluger)
- Power meter – connected at the output side of wave guide


P_{max}
P_{min}
freq

$$f_o = \frac{c}{2}\sqrt{\left(\frac{m}{a}\right)^2 + \left(\frac{n}{b}\right)^2 + \left(\frac{p}{d}\right)^2}$$

Cavity wave meter are rugged ,simple and highly accurate


Nf1=fa
Low frequency generator
f1
Harmonics generator Xn
Mixer
Input unknown (fun)