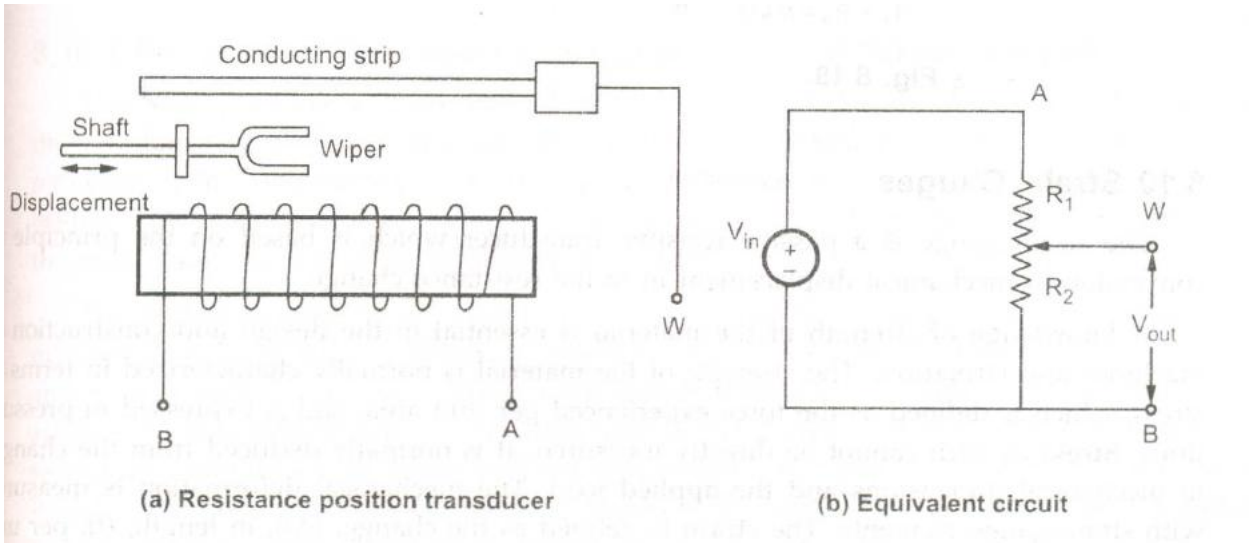
RESISTANCE POSITION TRANSDUCER & STRAIN GAUGES

In many industrial measurements and control applications, it is necessary to sense position of the object or the distance that object travels. For such applications, simple resi~tanceposition transducer is very useful.

It works on the principle that resistance of the sensing element changes due to the wiations in physical quantity being measured.

A simple resistance position transducer is as shown in the Fig.



The transducer consists a sliding contact or wiper. A resistive element is mounted with the sliding contact which is linked with the object whose position is to be monitored.

Depending upon the position of the object, the resistance between slider and the one end of resistive element varies. The equivalent circuit is as shown in the Fig. 8.18 (b). *The* output voltage Vout depends on the position of the wiper. Thus depending upon position of the wiper, the output voltage is given by,

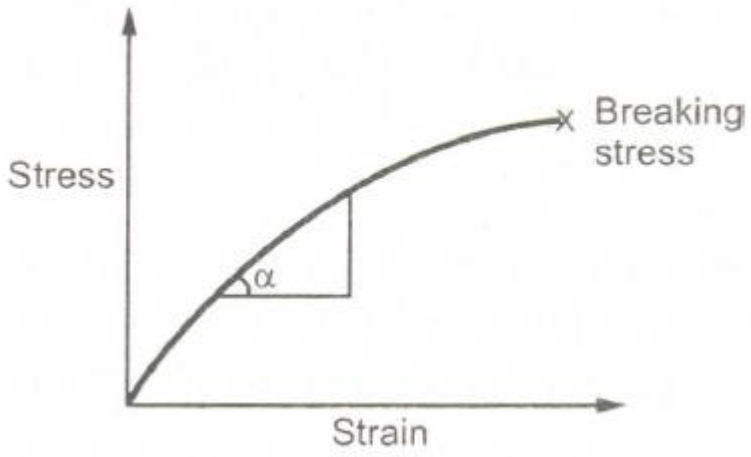
$$V_{out} = \frac{R_2}{R_1 + R_2} V_{in}$$

Thus You I is proportional to R2 i.e. wiper position. The output voltage is measured using voltmeter which is calibrated in centimeters and allows direct readout of the object position.

Strain gauges:

The strain gauge is a passive resistive transducer which is based on the principle of conversion of mechanical displacement in to the resistance change.

A knowledge of strength of the material is essential in the design and construction of machines and structures. The strength of the material is normally characterized in terms of stress, which is defined as the force experienced per unit area, and is expressed in pressure units. **Stress** as such cannot be directly measured. It is normally deduced from the changes in mechanical dimensions and the applied load. The mechanical deformation is measured with strain-gauge elements. The **strain** is defined as the change, *(td),* in length, *(I),* per unit length and is expressed as *t:.;{* in microstrains.



Stress-strain curves for typical metals specimen

The most common materials used for wire strain gauges are constantan alloys containing 45% Nickel and 55% Copper, as they exhibit high specific resistance, constant gauge factor over a wide strain range, and good stability over a reasonably large temperature range (from O°C to 300°C). For dynamic strain measurements, Nichrome alloys, containing 80% Nickel and 20% Chromium are used. They can be compensated for temperature with platinum.

Bonding cements are adhesives used to fix the strain gauge onto the test specimen. This cement serves the important function of transmitting the strain from the specimen to the gauge-sensing element. Improper bonding of the gauge can cause many errors.

Basically, the cement can be classified under two categories, viz, solvent-setting cement and chemically-reacting cement. Duco cement is an example of solvent-setting cements which is cured by solvent evaporation. Epoxies and phenolic bakelite cement are chemically-reacting cements which are cured by polymerization. Acrylic cements are contact cements that get cured almost instantaneously. The proper functioning of a strain gauge is wholly dependent on the quality of bonding which holds the gauge to the surface of the structure undergoing the test.