is shown in Fig. 6. The low-pressure pump, intensifier, controls, and pressure cell are plainly visible in this view.

In addition to the high-pressure equipment, a dead-weight assembly was constructed for measurement of pressures up to 30,000 psi, Fig. 7. Pressure coils were calibrated with reference to this dead-weight assembly, and periodic checks were made with the Watertown standard and Dr. Bridgman's laboratory.

All measurements were made with specially adapted Foxboro instruments or with specially designed alternating-current bridges. Accuracies of measurement were in most cases better than 0.1 per cent.

Experimental Results. All measurements on gold chrome were compared to manganin standards. Fig. 8 shows the pressure-resistance characteristics of two typical gold-chrome samples. The two samples had received a different degree of annealing after the drawing process, and had been baked after being formed into a coil as described previously.

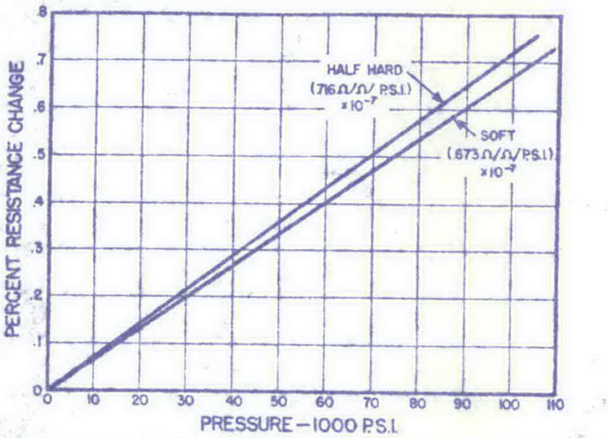

Fig. 8 Pressure Versus Resistance Change for 2.1 Per Cent Gold Chrome

The pressure coefficients of 0.716 and 0.673 $\times 10^{-7}$ ohm/ohm/psi are typical of several samples tested. A remarkable degree of linearity of resistance change versus pressure was noted and, even more important, the complete absence of drift, so annoying with manganin. Linearity was good to less than 0.25 per cent.

The gold-chrome alloy was found to follow rapid changes of pressure, coming to equilibrium within a second or so. No hysteresis during pressure-cycling was observed. When first exposed to pressure, the gold-chrome coils showed an initial zero shift, but in all cases this was well under 1 per cent of the initial value. Furthermore, all measurable zero shift occurred in the first pressure cycle, as compared with manganin, which often required several cycles before repeatable results would be obtained.

Fig. 9 shows the temperature-resistance properties of a 2.1 per cent gold-chrome coil which had been pressurized to greater than 100,000 psi several times. It is interesting to note that one of the effects of exposure to pressure-cycling is to perform the same type of stabilization to temperature as accomplished by extended baking of the new coil.

For purposes of comparison, Fig. 10 shows the pressure sensitivity of a Foxboro manganin coil as compared to a typical gold-

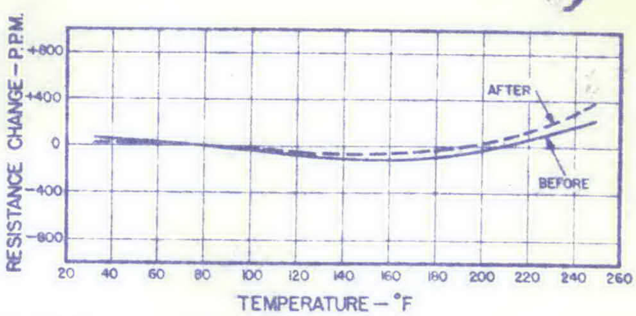

Fig. 9 Effect of 100,000-Psi Pressure Cycle on Temperature Versus Resistance Change for 2.1 Per Cent Gold Chrome

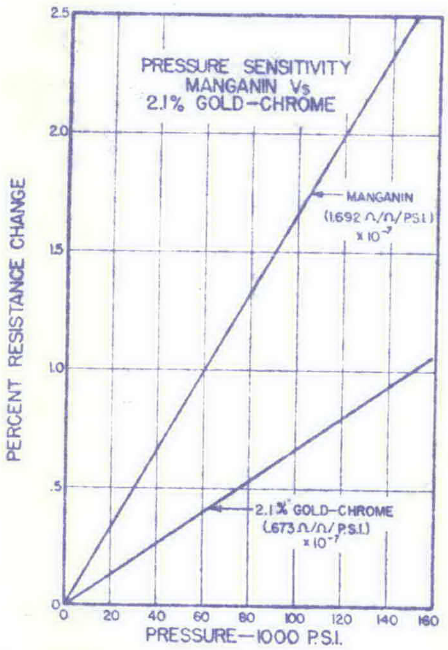

Fig. 10 Pressure Sensitivity of Manganin Versus 2.1 Per Cent Gold Chrome

chrome coil. The manganin coils had pressure coefficients ranging from 1.69 to 1.72 $\times 10^{-7}$ ohm/ohm/psi. Therefore it appears that gold chrome has about 33 per cent of the sensitivity of good-quality manganin, but its ability to discriminate between pressure changes and temperature changes more than overweighed this loss in sensitivity.

Conclusion

Recent observations on gold chrome have confirmed these earlier findings on the linearity and stability of the pressure characteristics. Since 2.1 per cent gold chrome so nearly fulfills all of the requirements of a pressure-sensing device for industrial-control applications, it is recommended that this material be considered seriously as a standard for pressure measurements, replacing the existing manganin standard for application to industrial-control problems.