TABLE I. Display of all pressure run data for the C_{44} shear constant for two copper crystals. The echo number is n, and the echo arrival time is T_n. T_0 is the zero-pressure transit time and R_g the pressure gauge resistance.

Crystal length (cm)	Experiment No.	n	Run No.	$\frac{-1}{nT_0}\frac{dT_n}{dR_g}$ (10^{-3} ohm^{-1})	Experiment average
1.86	1	7	1	1.92	
			2	1.97	
			3	1.93	
			4	1.93	
			5	1.92	
			6	1.91	1.93
	2	7	1	1.90	
			2	1.90	
			3	1.84	
			4	1.79	1.86
1.31	1	8	1	1.91	
			2	1.84	
			3	2.04	
			4	1.93	
			5	2.04	
			6	1.94	
			7	1.87	1.94
	2	8	1	2.00	
			2	1.98	1.99
		10	3	1.93	
			4	1.95	
			5	1.94	1.94

Table I gives a complete breakdown of the data taken on the pressure derivative of the C shear constant of copper, by crystal, experiment and run, several runs being shown in Fig. 1. The reproducibility is typical of these experiments; this particular shear constant has been chosen to be shown in detail in Fig. 1 and Table I because it is the one in which occurs the greatest disagreement with the previous work of Lazarus.[6]

RESULTS

The room temperature values of the elastic shear constants C, C', and the isothermal bulk modulus B_T for copper,[16] silver,[17] and gold, as used in the determination of the pressure derivatives, are given in Table II. Since

TABLE II. Elastic constants of copper, silver, and gold, at 25°C which were used in evaluation of the pressure derivatives of the elastic constants. Units are 10^{12} dyne cm^{-2}. The values for gold shown in parentheses for comparison are the older determination of Goens, and the recent data of Neighbours and Alers (300°K).

Metal	C	C'	B_s	B_T	Source
Cu	0.7510	0.2334	1.370	1.332	Schmunk[a]
Ag	0.4613	0.1528	1.036	1.015	Bacon and Smith[b]
Au	0.4202	0.1471	1.726	1.661	Present measurements
	(0.4202)	(0.1473)	(1.667)		Goens[c]
	(0.4195)	(0.1460)	(1.729)		Neighbours and Alers[d]

[a] See reference 16. [b] See reference 17. [c] See reference 18. [d] See reference 19.

[16] R. E. Schmunk, M. S. thesis, Case Institute of Technology, to be submitted to Acta Metallurgica.

[17] R. Bacon and C. S. Smith, Acta Metallurgica 4, 337 (1956).

the values of the zero-pressure elastic constants of gold were measured anew in the performance of this work, using a different method than the previous investigators, a comparison is shown in Table II in parentheses between the presently determined values, and the values determined by Goens[18] using the resonant bar technique. The agreement of the shear constants is especially good, but the present value of the adiabatic bulk modulus is three and one half percent higher than Goens' value. On the other hand, the present value of the bulk modulus is three percent lower than that calculated from Bridgman's[4] value of the isothermal bulk modulus ($B_T = 1.709\times10^{12}$ dyne cm^{-2}) by means of the equation

$$B_s \cong B_T(1+TV\beta^2 B_T/C_p), \qquad (6)$$

where β the cubical coefficient of thermal expansion equals 4.26×10^{-5} (C°)$^{-1}$ and the specific heat is $C_p = 6.03$ cal (mole$-$C°)$^{-1}$. V is the molar volume and T is room temperature, taken as 300°K. The value of Bridgman's B_s thus obtained is 1.77×10^{12} dyne cm^{-2}.

TABLE III. Pressure derivatives of the elastic constants of copper, silver, and gold. The average values shown for copper have been weighted according to the number of experiments performed.

Crystal, length, and orientation	dB_s/dP	dC/dP	dC'/dP
Cu—1.31 cm [110]	5.69	2.38	0.580
Cu—1.86 cm [110]	5.66	2.32	0.580
Cu—3.22 cm [100]	5.47	···	···
Average—Cu	5.59	2.35	0.580
Ag—1.49 cm [110]	6.18	2.31	0.639
Au—2.53 cm [110]	6.43	1.79	0.438

Also shown in Table II are very recent values for silver and gold privately communicated by Neighbours and Alers[19] who used the ultrasonic pulse-echo technique. The agreement is excellent and confirms our value of B_s for gold. We may pause to pay tribute to the work of Goens, whose shear constants for gold, obtained by an older and more difficult technique, are so well confirmed.

Table III shows the values of the pressure derivatives of the elastic constants for the silver and gold crystals and for each copper crystal measured. As already stated, each entry in Table III is the result of at least two experiments and each experiment is composed of several runs.

The spread in the results obtained using several copper crystals, shown in Table III, is two percent in the case of the shear constant derivatives and four percent for the bulk modulus derivative. These figures

[18] E. Goens, Ann. Physik 38, 456 (1940).

[19] J. R. Neighbours and G. A. Alers, preceding paper [Phys. Rev. 111, 707 (1958)].