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The Specific Heat and Residual Resistivity of Binary and Ternary Noble Metal Alloys

Thomas H. Davis III

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in partial fulfillment of the requirements
for Doctor of Philosophy

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ABSTRACT

Electronic specific heat and residual resistivity measurements have been made on the $Ag_{\alpha}Au_{1-\alpha}$ binary and the $Ag_{\alpha}(60at.\%Au-40at.\%Cu)_{1-\alpha}$ ternary disordered alloy systems as well as the two individual samples of $Ag_{0.5}(72at.\%Au-28at.\%Cu)_{0.5}$ and $Ag_{0.5}(84at.\%Au-16at.\%Cu)_{0.5}$. The residual resistances of the binary and ternary systems are found to obey Nordheim's rule only as a first approximation. Specific heat measurements on the binary system confirm previously published results. Two theories explain the latter either in terms of electron-phonon interactions or electron-impurity interactions. These theories have been extended to a ternary mixture of noble metals, where each predicts a different concentration dependence for the electronic specific heat. The measured results on the ternary alloys are compared with the analytical predictions to distinguish between the two processes involved.

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I. INTRODUCTION

The study of the electronic properties of pure metals and intermetallic compounds has advanced significantly in recent years. With the wealth of available data and the agreement of the data with the theoretical calculations, it appears that we have a good qualitative as well as quantitative understanding of the electronic properties of these materials.

The same is not true in the case of disordered alloys. There has been much theoretical work in an attempt to describe the systems, but most of the work has been qualitative in nature with little hope of quantitatively comparing their predictions to experimental results. In addition, there is considerably less data available in the case of disordered alloy systems, since some of the more refined experimental techniques used in the investigation of pure metals and intermetallic compounds are not possible. The large increase in the scattering rate due to the disorder in the crystal lattice of bulk alloys prevents experiments which require $\omega_c\tau>>1$, such as the de Haas-van Alphen effect, from being performed. Therefore, it seems plausible that if quantitative as well as qualitative agreement between theory and experiment is to be obtained, it will probably be in one of the more simple alloy systems. Alloys of the noble

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metals is one such system. Two possible measurements on the bulk alloys of this system are the specific heat and residual resistivity.

Nordheim[1], as early as 1931, attempted to explain the Ag-Au binary alloy residual resistance results in terms of perturbation theory. More recently the specific heat result of Green and Valladares[2] on this same system have been explained in terms of the electron-impurity interaction by Stern[3], and the electron-phonon interaction by Haga[4]. Martin[5] has also measured the specific heat of the Ag-Au system and extended the measurements to cover the entire alloy range. The present work is mainly concerned with measuring the specific heat and residual resistivity of the Ag-Au alloy series and examining the results in detail in terms of the two theories available. In addition, the theories and measurements have been extended to ternary Cu-Ag-Au alloys to test the validity of the theories in this regime and possibly to distinguish between the two physical processes involved in the explanation of the previous Ag-Au data.

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II. ALLOYS-GENERAL DISCUSSION

Alloys of the three noble metals of copper, silver and gold form an interesting series for investigation. The Fermi surfaces of the pure metals are quite well known from de Haas-van Alphen and other data, and there is good agreement between this data and band structure calculations*. The pure metals have a band structure which is only slightly more complicated than the alkali metals, most of the Fermi surface being free-electron-like. The Fermi surface does contact the Brillouin zone faces in the <111> directions, but these are the only large distortions from a spherical shape.

Since the band structures of the three pure metals are all quite similar, one would not expect that the band structure of the isoelectronic alloys of these materials would differ drastically from that of the elements themselves. In fact, Faraday rotation experiments[8] have been performed on the Ag-Au binary alloys and indicate that the area of contact of the Fermi surface with the Brillouin zone boundaries varies linearly from pure silver to pure gold. This means that the shape of the Fermi surface in the Ag-Au alloys can be calculated from an average potential and the properties of the alloys near the Fermi energy can be calculated by perturbation theory[8]. More recent de Haas-van Alphen measurements[9]

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on the dilute alloys of the Ag-Au system have cast some doubt on the results of the Faraday rotation experiments and complicate the analysis of even the most simple of alloy systems.

Metallurgically, the ternary alloys of Cu-Ag-Au form a continuous solid solution except for a eutectic region associated with the Cu-Ag rich portion of the ternary diagram[10]. All of the alloys crystallize in the face centered cubic structure, as in the pure metals, with an overall variation in lattice constant of only 10% over the entire ternary diagram[11]. Of particular interest is the Ag-Au binary system where the variation in lattice constant is only 0.25% over the entire series.

The alloys of the noble metals are metallic and one expects the specific heat of these materials to behave as in other metallic substances. In particular, one expects a contribution from the excitation of electrons in the conduction band of a metal, which is linear in the temperature and is related to the density of electron states $N(E_F)$ at the Fermi level by the expression

$$C_{el} = \gamma T = \frac{\pi^2 k_B^2}{3} N(E_F)\, T \quad , \qquad (1)$$

where k_B is the Boltzmann constant.

Another contribution to the specific heat is due to the lattice vibrations. In the Debye approximation, the phonon heat capacity per mole is given by

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$$C_L = 9R \left(\frac{T}{\Theta_D}\right)^3 \int_0^{\Theta_D/T} \frac{z^4 e^z}{(e^z - 1)^2} dz \quad , \qquad (2)$$

Here R is the molar gas constant, and Θ_D is defined through the relation $k_B \Theta_D = \hbar \omega_D$, ω_D being the maximum cut-off frequency of the assumed normal mode spectrum. When $T << \Theta_D$, the upper limit of the integral in (2) tends to infinity, giving at low temperatures

$$C_L = \frac{12 \pi^4 R}{5} \left(\frac{T}{\Theta_D}\right)^3 \quad , \quad T << \Theta_D \, . \qquad (3)$$

The derivations of both the lattice and electronic specific heat expressions are well known[12,13] and only the results are quoted above. Even at low temperatures, the Debye temperature computed by fitting the lattice specific heat to equation (3) begins to deviate from a constant value, indicating failure of the elastic continuum approximation and the departure of the phonon density of states from the Debye ω^2 dependence. Since it has been shown[13] that under the proper choice of Θ_D equation (3) is exact for any material at temperatures close to absolute zero, the density of phonon states is frequently written[14] as an expansion in the even powers of ω. The next order contribution to the density of states is thus proportional to ω^4 and in calculating the lattice specific heat, the next order contribution is a

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term proportional to T^5. This term is frequently included in the fitting of metallic specific heat data to represent the deviation from the ω^2 frequency distribution.

There are two other possible contributions of the specific heat in the noble metal alloys. Gold possesses a nuclear electric quadrupole moment. In the pure metal there is no nuclear contribution to the specific heat at low temperatures because, in the cubic symmetry of the lattice, the nuclear levels are degenerate. However, in the disordered alloys, although the lattice remains f.c.c., the cubic symmetry of the charge distribution is disturbed. The resulting electric field gradients split the degenerate nuclear levels and give rise to Schottky-type specific heat anomolies. The high temperature tail of such an anomoly can be represented to lowest order by a constant divided by T^2. Such nuclear contributions have been observed at He^3 temperatures in Ag-Au[5] alloys and in Cu-Au alloys[15]. At He^4 temperatures this effect is small and not observable.

There is another possible contribution to the specific heat which can seriously alter the results. This contribution can occur if transition metals in small quantities are added to the alloys. There has been much theoretical work to explain these effects and the

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quantitative effects have been measured experimentally[16] for typical transition metals which appear frequently as contaminants. For example, 2.3 ppm (by weight) of Fe in gold gives an apparent increase in the electronic specific heat coefficient of 3%. Therefore, it is necessary to be extremely careful in preparing noble metal alloys to prevent contamination of the alloys with transition metal impurities.

In the case of the resistivity of the alloys, it was first shown by Matthiessen[17] that the increase in the resistance of a metal due to a small concentration of another metal in solid solution is in general independent of the temperature. The resistance is then the sum of a temperature independent part and a temperature dependent part. The temperature independent portion is the residual resistivity, which can be measured at very low temperatures where the temperature-dependent resistivity is zero. This resistivity arises solely from the disordered condition of the lattice structure of the alloys and is zero in a perfect crystal of a pure metal.

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III. THEORY

As noted in Section II., Faraday rotation experiments on Ag-Au binary alloys indicate that the area of contact of the Fermi surface neck with the Brillouin zone boundaries varies linearly from pure silver to pure gold. This implies that the Fermi surface can be calculated from an average potential and that properties of the alloys near the Fermi surface can be calculated by perturbation theory. Two theories[3,4] which make this assumption have been presented to explain the specific heat results of the Ag-Au binary alloy series[2]. The two theories have been extended to include the ternary alloy system of Cu-Ag-Au and the basic assumption of an average potential has also been extended, although there is no direct confirmation in other than the Ag-Au alloys.

In all of the remaining calculations, it will be assumed that a ternary alloy is being considered. The results will hold equally as well in the case of the binary alloys by proper substitution of the atom fractions. The following notation will be adopted for the calculations: α= atom fraction of silver, $(1-\alpha)x$= atom fraction of gold $(1-\alpha)(1-x)$= atom fraction of copper, $V_{Ag}(\underline{r})$= potential of the silver ion, $V_{Au}(\underline{r})$= potential of the gold ion, and $V_{Cu}(\underline{r})$= potential of the copper ion.

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The basic assumption of both theories is a perfect lattice with a potential at each lattice point, which is the average potential at a lattice point in the alloy. This periodic potential has the form

$$V_p(\underline{r}) = \alpha V_{Ag}(\underline{r}) + (1-\alpha)\left[xV_{Au}(\underline{r}) + (1-x)V_{Cu}(\underline{r})\right] \quad . \tag{4}$$

Using this periodic potential, the band structure of the alloy can be calculated to zero order. The resultant Fermi surface and density of states varies linearly between that of the pure constituents. The zero-order Bloch states for the crystal have the form

$$\Psi_{\underline{k}}(\underline{r}) = N^{-\frac{1}{2}} U_{\underline{k}}(\underline{r}) e^{i\underline{k}\cdot\underline{r}} \quad , \tag{5}$$

where $U_{\underline{k}}(\underline{r})$ is normalized in a unit cell and has the periodicity of the lattice. The energy of a state $\underline{k}$ to zero order is $E_{\underline{k}}$.

Both the theory of Haga[4] and the theory of Stern[3] can be obtained from the temperature dependent perturbation expansion for the total energy of a system of interacting electrons and phonons. The expansion gives[4,18]

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$$E_{Tot} = \sum_{\underline{k}} f_{\underline{k}} E_{\underline{k}} + \sum_{\underline{k},\underline{q}} \frac{|V_{ep}(\underline{q})|^2 f_{\underline{k}}(1-f_{\underline{k}-\underline{q}})(1+n_{\underline{q}})}{E_{\underline{k}} - E_{\underline{k}-\underline{q}} - \hbar\omega_{\underline{q}} + i\delta}$$

$$+ \sum_{\underline{k},\underline{q}} \frac{|V_{ep}(\underline{q})|^2 f_{\underline{k}}(1-f_{\underline{k}-\underline{q}}) n_{\underline{q}}}{E_{\underline{k}} - E_{\underline{k}-\underline{q}} + \hbar\omega_{\underline{q}} + i\delta} \qquad (6)$$

$$+ \sum_{\underline{k},\underline{l}} \frac{V_{ei}(\underline{l}-\underline{k})|^2 f_{\underline{k}}(1-f_{\underline{l}})}{E_{\underline{k}} - E_{\underline{l}} + i\delta} \quad ,$$

where f and n are the Fermi and Planck distribution functions, respectively, and $V_{ep}(\underline{q})$ and $V_{ei}(\underline{l}-\underline{k})$ are the coupling constants for the electron-phonon and electron-impurity interactions and will be discussed in following paragraphs.

The energy of a quasi-particle, $E'_{\underline{k}}$, at the state of wave vector $\underline{k}$ can be obtained by differentiating E_{Tot} with respect to $f_{\underline{k}}$[19]. At low temperatures both Haga and Stern neglect the imaginary part of the second and third terms in (6) to give

$$E'_{\underline{k}} = \varepsilon_{\underline{k}} - i\Gamma_{\underline{k}} \quad , \qquad (7)$$

$$\varepsilon_{\underline{k}} = E_{\underline{k}} + \sum_{\underline{q}} |V_{ep}(\underline{q})|^2 \left[\frac{1-f_{\underline{k}-\underline{q}}+n_{\underline{q}}}{E_{\underline{k}}-E_{\underline{k}-\underline{q}}-\hbar\omega_{\underline{q}}} + \frac{f_{\underline{k}-\underline{q}}+n_{\underline{q}}}{E_{\underline{k}}-E_{\underline{k}-\underline{q}}+\hbar\omega_{q}} \right] \qquad (8)$$

$$+ \sum_{\underline{l}} \frac{|V_{ei}(\underline{l}-\underline{k})|^2}{E_{\underline{k}} - E_{\underline{l}}} \quad ,$$

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$$\Gamma_{\underline{k}} = \pi \sum_{\underline{k}} |V_{ei}(\underline{l}-\underline{k})|^2 \, \delta(E_{\underline{k}} - E_{\underline{l}}) \quad . \tag{9}$$

In Haga's analysis, the last term of equation (8) is neglected and only the electron-phonon interaction is considered as contributing to the real part of the energy. In Stern's analysis, the second and third terms in equation (8) are neglected and only the electron-impurity interaction is considered as contributing to the energy.

Virtual Crystal Approximation

In this section, Stern's analysis of the problem is extended to a ternary alloy of noble metals. The potential of the alloy can be written as

$$V(\underline{r}) = V_p(\underline{r}) + V_{ei}(\underline{r}) \quad , \tag{10}$$

where $V_p(\underline{r})$ is given by (4) and

$$V_p(\underline{r}) = \sum_{\underline{g}} \left[\alpha S(\underline{g}) + (1-\alpha)\left(xG(\underline{g}) + (1-x)C(\underline{g})\right)\right] e^{i\underline{g}\cdot\underline{r}} \quad , \tag{11}$$

$$V_{ei}(\underline{r}) = \int V(\underline{k}) \, e^{i\underline{k}\cdot\underline{r}} \, d^3\underline{k} \quad . \tag{12}$$

Here $\underline{g}$ are the reciprocal lattice vectors, while $S(\underline{g})$, $G(\underline{g})$ and $C(\underline{g})$ are the $\underline{g}$th Fourier components of the potential from the silver, gold and copper ions respectively, and $V(\underline{k})$ is the $\underline{k}$th Fourier component of the alloy potential with the condition $V(\underline{g})=0$.

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The matrix elements of $\langle \underline{k}|V_{ei}(\underline{r})|\underline{l}\rangle$ can be calculated for a particular configuration of atoms and reduced to a sum of terms, including products of lattice sums and matrix elements of the constituent ionic potentials integrated over a unit cell. The product $\langle \underline{k}|V_{ei}(\underline{r})|\underline{l}\rangle \langle \underline{l}|V_{ei}(\underline{r})|\underline{m}\rangle$ can be calculated and involves products of the lattice sums and matrix elements. Since the calculation is done for a particular configuration of atoms and since the number of atoms is large, an average over all possible configurations of the atoms is representative of the disordered alloy. The lattice sums can be averaged and the correction to the energy calculated. A complete calculation is shown in Appendix A.

The result for a ternary alloy is given by

$$\varepsilon_{\underline{k}} = E_{\underline{k}} + N^{-1} \sum_{\underline{l}} \frac{\alpha(1-\alpha)\,|\langle \underline{k}|V_A(\underline{r})|\underline{l}\rangle|^2}{E_{\underline{k}} - E_{\underline{l}}} + N^{-1} \sum_{\underline{l}} \frac{(1-\alpha)x(1-x)\,|\langle \underline{k}|V_B(\underline{r})|\underline{l}\rangle|^2}{E_{\underline{k}} - E_{\underline{l}}}, \tag{13}$$

where the principal value of the integral is taken to exclude the contribution from the states, which contribute to real scattering. The matrix elements in (13) are defined as follows

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$$\langle \underline{k}|V_A(\underline{r})|\underline{l}\rangle = \langle \underline{k}|x\left(V_{Ag}(\underline{r})-V_{Au}(\underline{r})\right)+(1-x)\left(V_{Ag}(\underline{r})-V_{Cu}(\underline{r})\right)|\underline{l}\rangle$$

$$= \int e^{i(\underline{l}-\underline{k})\cdot\underline{r}}\ U_{\underline{k}}^{*}(\underline{r})\ V_A(\underline{r})\ U_{\underline{l}}(\underline{r})\ d^3\underline{r} \quad , \tag{14}$$

and

$$\langle \underline{k}|V_B(\underline{r})|\underline{l}\rangle = \langle \underline{k}|V_{Au}(\underline{r})-V_{Cu}(\underline{r})|\underline{l}\rangle$$

$$= \int e^{i(\underline{l}-\underline{k})\cdot\underline{r}}\ U_{\underline{k}}^{*}(\underline{r})\ V_B(\underline{r})\ U_{\underline{l}}(\underline{r})\ d^3\underline{r} \quad , \tag{15}$$

where the integration is taken over the volume of a unit cell. In the case of a binary alloy such as Ag-Au where x=1, then (13) reduces to

$$\varepsilon_{\underline{k}} = E_{\underline{k}} + N^{-1} \sum_{\underline{l}} \frac{\alpha(1-\alpha)\,|\langle \underline{k}|V_{Ag}(\underline{r})-V_{Au}(\underline{r})|\underline{l}\rangle|^2}{E_{\underline{k}} - E_{\underline{l}}} \quad , \tag{16}$$

in agreement with the results of Stern.

Using the expression (13) for the energy, the density of states at the Fermi level and the coefficient of the electronic specific heat, γ, can be obtained giving

$$-\frac{\gamma-\gamma_o}{\gamma_o} = \alpha(1-\alpha)\ K + (1-\alpha)x(1-x)\ L \quad , \tag{17}$$

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where γ_o is obtained from the zero order density of states and

$$K=-(2\pi)^{-3}N^{-1}\frac{\partial}{\partial E_{\underline{k}}}\int\frac{|\langle\underline{k}|V_A(\underline{r})|\underline{1}\rangle|^2}{E_{\underline{k}}-E_{\underline{1}}}d^3\underline{1}\quad , \tag{18}$$

$$L=-(2\pi)^{-3}N^{-1}\frac{\partial}{\partial E_{\underline{k}}}\int\frac{|\langle\underline{k}|V_B(\underline{r})|\underline{1}\rangle|^2}{E_{\underline{k}}-E_{\underline{1}}}d^3\underline{1}\quad . \tag{19}$$

As before, this expression can be reduced to Stern's result for a binary alloy by the proper adjustment of the atom fractions.

Equation (9) shows that the electrons also have a transition probability $P_{\underline{k}}=2\Gamma_{\underline{k}}/\hbar$, which results in a dc transport relaxation time given by[20]

$$\frac{1}{\tau_{\underline{k}}}=V(2\pi hN)^{-1}\int\left[\alpha(1-\alpha)|\langle\underline{k}|V_A(\underline{r})|\underline{1}\rangle|^2+(1-\alpha)x(1-x)|\langle\underline{k}|V_B(\underline{r})|\underline{1}\rangle|^2\right]|\nabla_{\underline{1}}E_{\underline{1}}|^{-1}(1-\cos\theta)dS_{\underline{1}}, \tag{20}$$

where $\tau_{\underline{k}}$ is the relaxation time of an electron state $\underline{k}$, $dS_{\underline{1}}$ is an element of area in the Fermi surface at $\underline{1}$ and cylindrical symmetry in the scattering about $\underline{k}$ is assumed. Equation (20) shows that the relaxation

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time, and thus the residual resistance, varies with concentration. In particular, for a binary alloy, they are proportional to $\alpha(1-\alpha)$ as first shown by Nordheim[1].

Electron-Phonon Enhancement Model

In Haga's analysis of the binary alloy, the Fourier transform of an atomic potential[21] is used as the coupling constant in the electron-phonon interaction, viz.

$$V_p(\underline{q}) = N \int V_p(\underline{r})\, e^{-i\underline{q}\cdot\underline{r}}\, d\underline{r} \quad . \qquad (21)$$

Here N is the number of cells per unit volume, $\underline{q}$ is the difference between the wave vectors of the initial and final states of an electron and $V_p(\underline{r})$ is the potential given by (4). Neglecting Umklapp processes, neglecting the $\underline{q}$ dependence of $V_p(\underline{q})$ and considering only longitudinal phonons which obey the Debye approximation, one obtains

$$V_{ep} = V_p \left(\frac{\hbar q}{2NMs}\right)^{\frac{1}{2}} \quad , \qquad (22)$$

where M is the ionic mass and s the velocity of sound.

The term $E_{\underline{k}}$ in the denominator of (8) is replaced with $\varepsilon_{\underline{k}}$, the energy of the quasi-particle at the state of wave vector $\underline{k}$. This replacement makes equation (8) equivalent to the lowest order approximation of the

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electron-phonon interaction as calculated by the Green function method[22,23,24]. Again assuming the Debye approximation is valid for phonons, (8) can be integrated to give[18,22]

$$\varepsilon_{\underline{k}} = E_{\underline{k}} + \lambda_{ep} \frac{k_B\Theta_D}{3} \left[\ln \left(\frac{\varepsilon_{\underline{k}} - k_B\Theta_D}{\varepsilon_{\underline{k}} + k_B\Theta_D} \right) + \left(\frac{\varepsilon_{\underline{k}}}{k_B\Theta_D} \right)^3 \ln \left| \frac{\varepsilon_{\underline{k}}^2}{\varepsilon_{\underline{k}}^2 - (k_B\Theta_D)^2} \right| - \frac{\varepsilon_{\underline{k}}}{k_B\Theta_D} \right] \quad (23)$$

where

$$\lambda_{ep} = \frac{m_e \, q_m^2 \, V_P^2}{8\pi^2 \hbar^2 \, N \, M \, k_F \, s^2} \quad (24)$$

Here m_e and k_F are the band mass and wave number at the Fermi level of an electron, q_m is the radius of the Debye sphere, Θ_D is the Debye temperature and the electron energy levels are measured from the Fermi energy.

Using the energy of the quasi-particle, the density of states can be calculated. In the presence of the level broadening $\Gamma_{\underline{k}}$, which is assumed to be constant in the neighborhood of the Fermi level, the

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density of states at the Fermi level $N(E_F)$, is given by

$$N(E_F) = \pi^{-1} \int_{-\infty}^{\infty} \frac{N(\varepsilon_{\underline{k}})\ \Gamma}{\varepsilon_{\underline{k}}^2 + \Gamma^2}\, d\varepsilon_{\underline{k}} \quad . \tag{25}$$

By substituting the density of states found from (23) into (25), the density of states at the Fermi level becomes

$$N(E_F) = N_o\left(1 + \lambda_{ep} G\left(\frac{\Gamma}{k_B \theta_D}\right)\right) \quad , \tag{26}$$

$$G(y) = 1 - y^2 \ln\left(1 + \frac{1}{y^2}\right) \quad , \tag{27}$$

where N_o is the zero-order density of states and is assumed to vary linearly between the pure constituents of the alloy. The density of states of the alloy, and thus the electronic specific heat, can be analyzed as a function of the level broadening due to the electron-impurity scattering. A complete derivation of the electron-phonon enhancement model appears in Appendix A.

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IV. EXPERIMENT

Samples

The samples used in this work have been prepared by induction melting the proper amount of 99.999+% pure silver shot and gold spatter and 99.9999% pure copper rod in a graphite crucible under an inert helium atmosphere. During the melting process, the samples are held in their molten state for a period of time to ensure eddy-current mixing of the constituents. After casting, the binary Ag-Au alloys are cold worked, but the cold working is eliminated in the ternary alloys due to their extreme hardness in the as cast condition. All of the alloys are electrolytically etched in a 10% KCN solution using stainless steel electrodes and then sealed in evacuated vycor envelopes. The binary Ag-Au alloys are homogenized at 800^{o}C for 72 hours and the ternary alloys at 725^{o}C for 72 hours. All of the alloys are quenched in cold water after the homogenizing period.

The ingots are machined by cutting out an axial section for a resistivity specimen and tapping them at the top and bottom for attachment of the addenda for specific heat measurements. In addition, the ternary specimens all have an additional cylindrical section cut from the top of the ingot for future investigation. The resistivity specimens are machined

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in the form of a parallelopiped of dimensions .100" x .100" x 1.25". In the machining operations, solid tungsten carbide taps, drills, tool bits, slitting saws and flycutters are used to prevent transition metal contamination of the samples. The binary Ag-Au alloy samples are given a final etch in KCN and are ready for measurement. Due to the extensive machining, the binary Ag-Au resistivity specimens are given a second heat treatment at 800^{o}C for 72 hours with a subsequent quench before measurement. The ternary specific heat specimens are etched thoroughly to remove surface contamination and are sealed along with the resistivity specimens in evacuated pyrex ampoules. They are then heat treated at 425^{o}C for 72 hours and quenched in cold water, so as to shatter the ampoules and to ensure a rapid quench.

The temperature of 425^{o}C has been chosen for heat treating the ternary alloys, since it is slightly above the transition temperature for ordering of the equiatomic Cu-Au binary alloy. Very high temperature quenches have been avoided, since there is evidence in the literature[15,25] that they can produce partial ordering. This ordering is due to quenched in vacancies and subsequent room temperature annealing. A complete phase diagram is not available for the ternary alloys, but it is assumed that the transition temperature as well as the tendency for ordering decreases rapidly as silver

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is added to the Cu-Au binary. Therefore, the 425°C temperature is assumed to be above the transition temperature for all of the ternary alloys, yet not excessively high so as to produce significant ordering after the quench. The ternary specific heat alloys are given a final etch in KCN prior to measurement. All of the final specific heat specimens contain approximately two moles of material, to produce a significant specific heat for measurement.

Specific Heat Measurements

A standard calorimeter, based on a design by Manchester[26] employing a mechanical heat switch, has been used in all of the He^4 specific heat measurements. The design of this calorimeter has been described previously[27] and is described in detail in Appendix C.

The sample and the attached addenda are suspended by nylon threads within the two vacuum cans of the calorimeter. The outer can is immersed in a He^4 bath and both cans are held at a common vacuum of 5×10^{-7} mm Hg, the high vacuum seal of the outer can being provided by a gold O-ring. The inner can contains a small helium chamber, which is maintained at 1.2°K by pumping on the condensed helium with a small external pump. This inner can also contains the heat switch, which consists of two indium faced copper jaws connected thermally to the helium bath

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with copper braid. The heat switch mechanism is pivoted on teflon bearings and is actuated by an actuating rod, which passes through the top of the probe and is raised and lowered manually. Both vacuum cans are suspended from the top of the calorimeter with thin wall stainless steel tubes. All of the tubes contain radiation shells and all electrical leads are thermally anchored to prevent stray heat leaks. The entire calorimeter is contained in a stainless steel dewar with a nitrogen heat shield.

Screwed into the top of the sample there is a .164" dia. x 1.375" long threaded copper rod to make contact with the jaws of the heat switch. A threaded Cu-Be cylindrical shaped boss is screwed into the bottom of the sample, the heater and thermometer assembly being clamped to this boss. The heater is wound from #50 insulated manganin wire and has a nominal resistance of 1782 ohms at 4.2^{o}K. The lead resistance, with the heater removed, has been measured at helium temperature so that a correction can be applied to the data for the leads power. The heater currents, which in the experiments are either .22 ma or .5 ma depending on the sample specific heat, are generated by a constant current supply. Both the heater current and the integrated heat pulse given to the sample are measured with a Hewlett Packard 2401C Integrating Digital Voltmeter. The digital voltmeter and the heater are turned on simultaneously

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with a simple gating mechanism, employing mercury wetted relays. The power supplied to the sample is given by, $\Delta Q = I_H \int_0^t V_H \, dt$, where I_H is the measured heater current and $\int_0^t V_H \, dt$ is the measured time integrated voltage developed across the heater.

Temperatures are measured with a CryoCal, Inc. four terminal encapsulated germanium resistor. The thermometer has been calibrated in the range 1.2 to 4.2°K against the 1958 He^4 vapor pressure scale[28] with an error of less than .0005°K. A temperature versus resistance table has been generated at .01°K intervals and a Legendre polynomial interpolation scheme, using this table, is employed to find the actual temperature. The thermometer resistance measurements are made by standard d.c. techniques. The thermometer resistance is monitored with a #7536 guarded Leeds and Northrup potentiometer, using an Astrodata nanovoltmeter as a null detector. The out-of-balance voltage from the nanovoltmeter is monitored with a chart recorder to give continuous observation of both ΔT of a heating period and the drift rate of the sample due to heat leaks. A graphical extrapolation of this drift rate to the center of the heating period is used to remove the heat leak contribution. The temperature at the beginning and end

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of the heating period is reduced to the null condition using the chart recorder data. The temperature increment, ΔT, has been chosen so that by using the finite difference approximation, $C(\bar{T}) = \Delta Q / \Delta T$, the resultant error of approximately $1/4\ (\Delta T/T)^2$ remains less than .1% in the He^4 temperature range.

A detailed description of the procedure used in a specific heat measurement is given in Appendix D. The calorimeter is cooled to $77^{\circ}K$, with liquid nitrogen in the outer shield of the metal dewar and helium and hydrogen exchange gases in the inner dewar and inner and outer can, respectively. The hydrogen gas is then pumped out of the probe and liquid helium transferred into the inner dewar. The sample and the inner can are cooled to $4.2^{\circ}K$ by condensing helium in the helium chamber of the inner can with the heat switch closed. After cool down, the temperatures of the outer bath and the inner helium chamber are lowered to $1.2^{\circ}K$ by pumping on both. In this condition the helium lasts approximately 14-16 hours, so that normally, 150 data points can be taken in a single night. The data is reduced by hand initially and then fed to a computer for complete analysis. A least squares fit of the data is obtained in the He^4 region and various plots of the results are obtained.

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Resistivity Measurements

The resistivity measurements are made by the standard four terminal method. All four contacts to the sample are made with .010" thick phosphor bronze material. The current is supplied to the sample, in series with a standard resistor, with a Hewlett Packard 6101A power supply. The voltages developed across the standard resistor and the sample are monitored with the Hewlett Packard Integrating Digital Voltmeter. A reversing switch in the circuit allows the current to be reversed, in order to adjust the data for thermal emfs. Measurements are made at the three fixed points of room temperature, nitrogen boiling point and helium boiling point. A more complete description of the apparatus is given in Appendix C.

The voltage developed across the standard resistor is used to calculate the current passing through the sample. The current along with the sample voltage determines the sample resistance. A traveling microscope is used to measure the voltage contact length, while the sample cross sectional area is calculated from the weight of the sample, its density and average length. The average length of the sample is measured with a traveling microscope, while the sample density is determined from the atomic weight of the alloy and the lattice constant. A two dimensional fit of the lattice constant has been made, which covers the entire ternary phase diagram and

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produces lattice constants with an accuracy of .1%. The total estimated accuracy of the resistivity measurements is 1.5%. A more complete description of the experimental procedure and data analysis is given in Appendix D.

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V. EXPERIMENTAL RESULTS AND DISCUSSION

Resistivity Results

Table I shows the measured resistivities of the binary alloys, as well as the sample of pure silver and Table II shows the measured resistivities of the ternary alloys, as well as pure copper. The accuracy of all the resistivity values is discussed elsewhere and is 1.5%. The room temperature measurements involve another error, in that the samples have been measured at the ambient temperature of the dewar and have not been corrected to any standard temperature. Therefore, these values are quoted as being the resistivity at $295 \pm 3^{\circ}K$. In the remainder of the discussion, the values of the resistivity at $4.2^{\circ}K$ will be referred to as the residual resistance.

Until recently, there have been no reliable data for the resistivity of the Ag-Au binary series for comparison with the present work. The values of the resistivity used by Nordheim were measured in 1911 by Beckman[29]. These results were obtained at $20^{\circ}C$ and were extrapolated to zero temperature by subtracting off a temperature-dependent resistance, which Nordheim assumed varied linearly between the room temperature resistivities of pure silver and pure gold. On the basis of this extrapolation, Nordheim concluded that the residual resistivity of the Ag-Au

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TABLE I.

Resistivity data for binary Ag-Au alloys

Alloy atom percent		ρ 295±3°K (μΩ-cm)	ρ 77°K (μΩ-cm)	ρ 4.2°K (μΩ-cm)
Ag	Au			
2.0	98.0	2.836	1.067	0.584
5.0	95.0	3.672	1.890	1.401
10.0	90.0*	5.120	3.268	2.801
10.0	90.0#	5.113	3.275	2.788
17.5	82.5	6.911	5.111	4.627
25.0	75.0	8.488	6.745	6.239
50.0	50.0	11.147	9.407	9.020
70.0	30.0	9.747	8.127	7.774
80.0	20.0	7.723	6.199	5.835
90.0	10.0	5.135	3.668	3.360
98.0	2.0	2.375	1.047	0.736
100		1.618	0.270	

* Sample No. 1 # Sample No. 2

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TABLE II.

Resistivity data for ternary Ag-Au-Cu alloys

Alloy atom percent			ρ 295±3°K (μΩ-cm)	ρ 77°K (μΩ-cm)	ρ 4.2°K (μΩ-cm)
Cu	Ag	Au			
100			1.690	0.186	
40.0		60.0	13.523	11.675	11.194
36.0	10.0	54.0	13.654	11.911	11.455
32.0	20.0	48.0	13.571	11.787	11.338
28.0	30.0	42.0	12.549	10.831	10.406
24.0	40.0	36.0	11.593	9.919	9.538
20.0	50.0	30.0	10.412	8.776	8.379
12.0	70.0	18.0	7.370	5.874	5.500
4.0	90.0	6.0	3.829	2.413	2.092
14.0	50.0	36.0	11.036	9.382	8.975
8.0	50.0	42.0	11.268	9.562	9.155

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alloys was symmetric in shape and could be described by the expression $\rho_o = C\alpha(1-\alpha)$, where C is a constant and α is the concentration of silver. There is only fair agreement between the original room-temperature data and the present room-temperature values, with the maximum deviation being 10% at the equiatomic alloy. Thus there is a corresponding discrepancy between the present measured residual resistances and Nordheim's extrapolated values.

Linde also investigated the Ag-Au binary alloy system[30] but only at low concentrations of one noble metal dissolved in the other. These data show that one atom percent silver dissolved in gold produces the same change in resistivity as one atom percent gold dissolved in silver, namely 0.38 μΩ-cm/at.%. Thus Linde's data support the conclusion of Nordheim that the residual resistivity curve for the binary alloys is symmetric in the constituents. Linde's measurements have been repeated at helium temperature for the case of Ag as the solvent[31], but only recently has the experiment with Au as a solvent been repeated at helium temperatures. Boes et.al.[32], in connection with experiments on the Kondo effect in Ag-Au-Yb alloys, have measured the resistivity of the Ag-Au binary alloy series at 77°K and 4.2°K. Their values are in complete agreement with the present work. The present data yield a change in residual resistance of 0.298 μΩ-cm/at.% for one atom percent

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silver alloyed in gold and a change of 0.375 μΩ-cm/at.% for one atom percent gold alloyed in silver. Thus the symmetry of the measured resistivity changes is no longer exact.

Specific heat Results

Each specific heat run on a particular sample consists of taking approximately 150 data points between 1.3°K and 4.2°K in a single cool-down to helium temperatures. The data are least-squares analyzed and fitted to an expression of the form

$$C/T = \gamma+\beta T^2+\delta T^4 \quad , \qquad (28)$$

where γ is the coefficient of the electronic specific heat and β is related to the Debye temperature by the expression $\beta = \frac{12\pi^4}{5} R \left(\frac{1}{\theta_D} \right)^3$, R being the molar gas constant. Each data point is divided by the magnitude of the specific heat, so that fractional, rather than absolute, differences are minimized in the fit giving each data point equal weight. The results of such a fit are given in Table III for the binary Ag-Au alloy series and in Table IV for the ternary alloy specimens.

There are two distinct errors associated with these measured quantities. The first type of error results from uncertainties in the alloy compositions, statistical errors in the least squares determinations and uncertainties in the temperature resolution, etc., all of which can be

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TABLE III.

Results of fitting the relation $C=\gamma T+\beta T^3+\delta T^5$ to specific heat data for binary Ag-Au alloys, where $\beta=\frac{12\pi^4 R}{5}(1/\Theta_D)^3$.

alloy at. %		γ	Θ_D	δ
Ag	Au	(mJ/mole $^oK^2$)	(^oK)	(mJ/mole $^oK^6$) $\times 10^{-3}$
	100	0.6988±.0023	161.7±0.1	-0.97±0.43
5.0	95.0	0.6947±.0023	165.7±0.1	-0.73±0.37
10.0	90.0*	0.6915±.0023	170.1±0.1	-0.50±0.25
10.0	90.0#	0.6904±.0023	170.2±0.1	-0.45±0.25
17.5	82.5	0.6808±.0023	176.1±0.1	-0.24±0.12
25.0	75.0	0.6653±.0022	181.6±0.1	-0.11±0.06
50.0	50.0	0.6467±.0022	198.2±0.1	0.07±0.04
70.0	30.0	0.6417±.0022	209.5±0.1	0.12±0.06
80.0	20.0	0.6423±.0022	214.8±0.1	0.10±0.05
90.0	10.0	0.6424±.0022	219.8±0.1	0.07±0.04
100.0		0.6470±.0022	225.2±0.1	0.03±0.02

*Sample No. 1 #Sample No. 2

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TABLE IV.

Results of fitting the relation $C=\gamma T+\beta T^3+\delta T^5$ to specific heat data for ternary Cu-Ag-Au alloys, where $\beta=\frac{12\pi^4 R}{5}(1/\Theta_D)^3$.

alloy at. %			γ	Θ_D	δ
Cu	Ag	Au	(mJ/mole $^oK^2$)	(^oK)	(mJ/mole $^oK^6$) x10^{-3}
40.0		60.0	0.6891±.0023	204.9±0.1	0.66±0.33
36.0	10.0	54.0	0.6854±.0023	204.3±0.1	0.60±0.30
32.0	20.0	48.0	0.6807±.0023	206.7±0.1	0.52±0.26
28.0	30.0	42.0	0.6740±.0023	209.9±0.1	0.39±0.20
24.0	40.0	36.0	0.6679±.0022	212.7±0.1	0.28±0.14
20.0	50.0	30.0	0.6643±.0022	216.2±0.1	0.22±0.11
12.0	70.0	18.0	0.6590±.0022	220.1±0.1	0.15±0.08
4.0	90.0	6.0	0.6462±.0022	222.6±0.1	0.06±0.03
14.0	50.0	36.0	0.6576±.0022	208.3±0.1	0.23±0.11
8.0	50.0	42.0	0.6559±.0022	201.9±0.1	0.26±0.13

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reasonably estimated. The second type of error is systematic in nature and is difficult to calculate. As long as internal consistency is observed with data taken in the same manner and with the same equipment, then it is only the first type of uncertainty which is important. Since these conditions have been observed for this series of measurements, the estimated errors are: 0.33% uncertainty in the γ values, $0.1^{o}K$ uncertainty in the θ_D values and 50% uncertainty in the δ values. The total uncertainty, for comparison with data taken by other investigators, is perhaps double the estimated measurement errors due to the possibility of systematic errors.

There is generally good agreement between the present value of the specific heat coefficient for silver with those values of other investigators[33]. In the case of gold, there is good agreement only with the most recent measurement by Martin[16]. As he has pointed out, this is probably due to the lack of high purity gold in past years and the effect of transition metal impurities on the determination of the specific heat.

The data for the Ag-Au binary alloys from the present work agree well with the measurements of Martin[5] over the entire alloy range and reasonably well with the limited data obtained by Green and Valladares[2]. A comparison of the present data with those of Martin points out the need

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for internal consistency, in that there seems to be an almost constant error of approximately one percent in the γ values between the two sets of data. However, the relative values of γ compare well and the difference must be attributed to a difference in the systematic errors in the two sets of data.

Discussion

Figure 1 shows the residual resistivity results for the binary Ag_{α}-$Au_{1-\alpha}$ and ternary Ag_{α}-(60at.% Au-40at.% Cu)$_{1-\alpha}$ alloys. The resistivity of the binary and ternary alloys can be analyzed on the same basis as Nordheim[1] or Stern[3]. Referring to the expression for $1/\tau$ given by (20), it is assumed that the integrals of the two matrix elements involved are constant across the alloy series and that $1/\tau$, and thus the residual resistance, varies with concentration as

$$\rho_o=\rho_o'+\rho_o''=C\alpha(1-\alpha)+D(1-\alpha)x(1-x) \quad , \qquad (29)$$

where C and D are constants and the concentrations of the three constituents are defined in Section III. For the binary Ag-Au alloys, x=1 and ρ_o'' is zero. A least squares fit of the data for the Ag-Au alloys to the relation given by (29) yields the value of C = 35.06 $\mu\Omega$-cm.

In the case of the ternary alloys, the term ρ_o'' of (29) is not zero but is linear in $(1-\alpha)$, varying from zero at the pure

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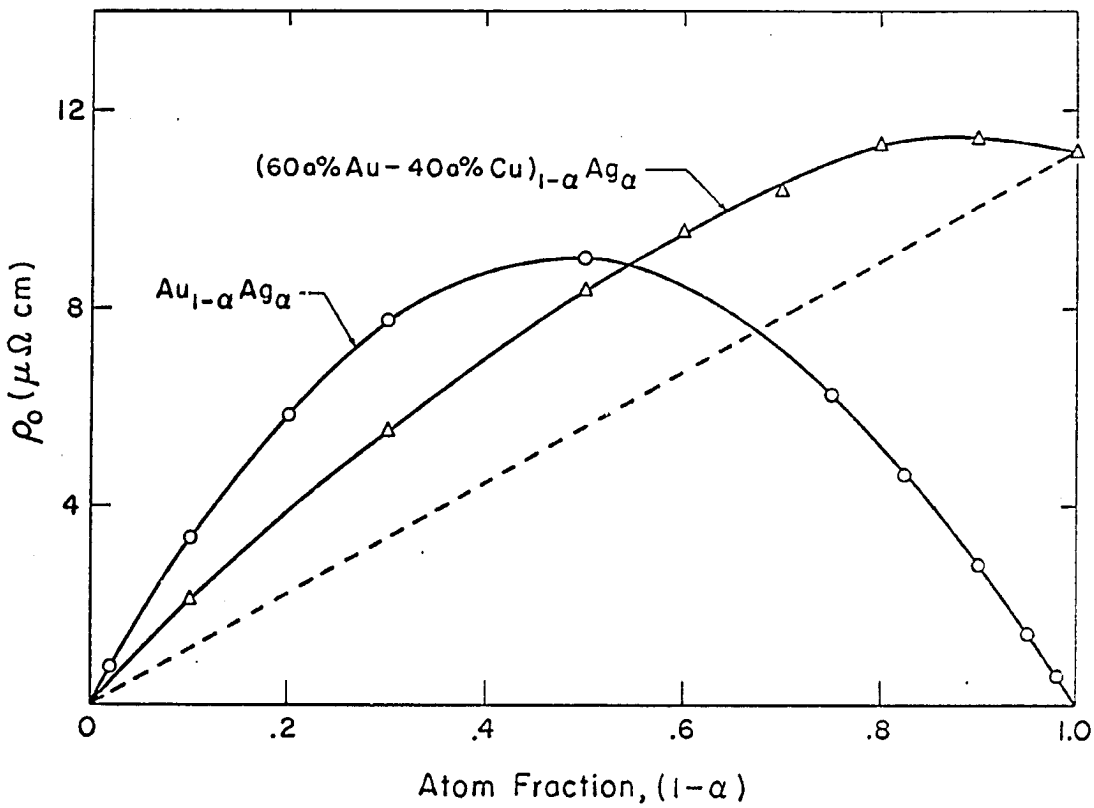

Figure 1. The residual resistivity of Ag_α-$Au_{1-\alpha}$ binary alloys and $Ag_\alpha(60at.\%\ Au\text{-}40at.\%\ Cu)_{1-\alpha}$ ternary alloys.

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silver end to a value of unity at the pure copper-gold alloy. For a copper-gold alloy with fixed concentrations of its constituents alloyed with silver, as in the case under consideration where x=0.6, the factor x(1-x) does not introduce any further concentration dependence and ρ_o'' is shown by the dotted line in Figure 1. The concentration dependence of ρ_o' for the ternary alloys is also parabolic in $\alpha(1-\alpha)$ and is shown by the difference in the solid and dotted line of the ternary data in Figure 1. A least squares fit of the ternary resistivity data to equation (29) yields C = 11.82 μΩ-cm and D = 11.19 μΩ-cm.

If one ignores the linear term ρ_o'' in the expression (29) for the ternary alloy and looks only at the parabolic portion ρ_o' it is in fact possible to predict the reduction in the term C for the ternary alloys from the term C for the binary alloys. Equation (14) shows the matrix element for the determination of C in the ternary alloy. This matrix element is an integral involving the sum of two terms, one depending on the differences between the silver and gold potential in a unit cell and the other on the difference between the copper and silver potential. The relative importance of these two terms can be determined from the binary residual resistance data[30] for the alloys of the noble metals, shown in Table V. Since the resistance change produced by the addition of copper to silver is

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TABLE V.

Change in resistivity due to one atomic percent of one noble metal dissolved in another.

Alloy	$\Delta\rho$ $\mu\Omega$-cm/at.%
Cu in Au	0.485
Au in Cu	0.55
Cu in Ag	0.068
Ag in Cu	0.140
Ag in Au	0.38
Au in Ag	0.38

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much less than that produced by the addition of gold to silver, it can be seen that the matrix elements of the difference between the copper and silver potentials must be significantly smaller than the matrix elements of the difference between the silver and gold potentials. If it is assumed, in fact, that the matrix element of the difference between the copper and silver potentials is zero, one obtains the simple relation

$$C_{Ternary}/C_{Binary} = x^2 \quad , \qquad (30)$$

where x is the concentration of gold in the copper-gold binary alloy being added to silver to form a ternary alloy. For the particular ternary series being considered, equation (30) yields $C_{Ternary}/C_{Binary} = 0.36$ while the experimental resistivity data yields $C_{Ternary}/C_{Binary} = 0.34$. There will be further consideration of equation (30) when the specific heat results are discussed.

Although it is possible to predict the major changes in the residual resistivity on these simple considerations, this treatment is only approximately correct. Thus if one ignores the linear term ρ_o'' in the ternary residual resistivity, equation (29) shows that $\rho_o'/\alpha(1-\alpha)$ should be independent of solute concentration. Figure 2 shows the concentration dependence of $\rho_o'/\alpha(1-\alpha)$ for the binary and ternary alloys. The results of Boes et.al. on the

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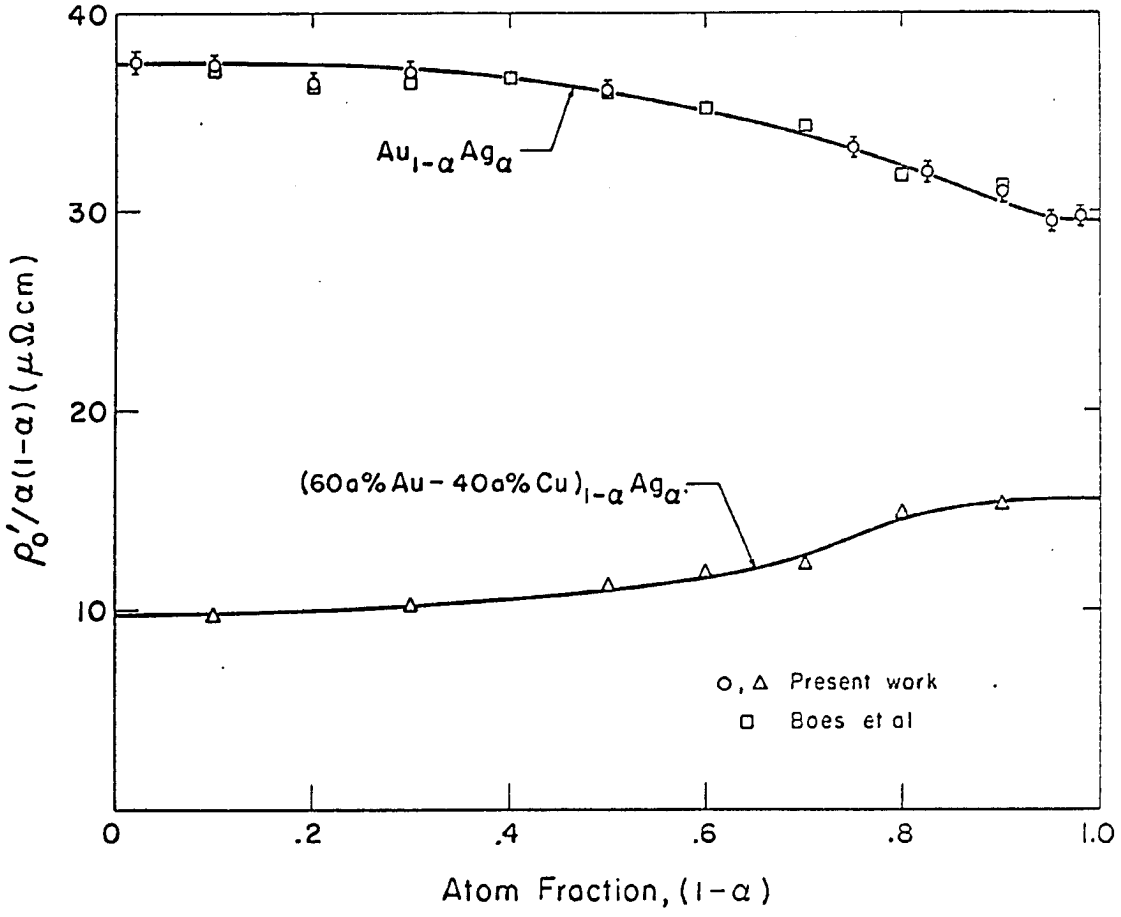

Figure 2. $\rho_o'/\alpha(1-\alpha)$ for binary $Ag_\alpha Au_{1-\alpha}$ alloys and ternary Ag_α(60at.% Au-40at.% Cu)$_{1-\alpha}$ alloys.

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binary Ag-Au alloys have been included to show the good agreement with the present work. Clearly Nordheim's rule for the binary alloys and the generalization of Nordheim's relation, represented by the term ρ_o' for the ternary alloys, is only obeyed as a first-order approximation since the curves are not completely flat. In particular, the asymmetry in the binary alloy data, as discussed in the comparison of the present data with those of Linde, is clearly evident.

There are several possible explanations for the deviations of the data from the generalized Nordheim's rule. To begin with, the possibility of scattering terms from higher order perturbation theory have been neglected in the analysis. Verboven has shown[34] for a binary alloy, that the third order term in the perturbation expansion for ρ is proportional to $\alpha(1-\alpha)(1-2\alpha)$. Again on the basis of a τ which varies across the alloy series only as the concentration dependence, the addition of a third term with the concentration dependence found by Verboven would considerably improve the fit to the present data.

The effects of band structure changes in going across the alloy series have been neglected. Dingle temperatures from de Haas-van Alphen measurements[9], Hall effect data[35], and deviations from Mathiessen's rule[36] in noble metal alloys, all indicate that for impurity scattering, τ is

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anisotropic. If the Fermi surface of the noble metals is divided into the two extreme regions of the neck where the electrons have p-like symmetry, and the larger belly region where the electrons have s-like symmetry, then the measurements above indicate that $\tau_{Belly}/\tau_{Neck} \simeq .25$ to $.4$.

Ziman[37] has explained this effect in terms of the short-range effect of the perturbation on the lattice potential when isoelectronic materials are alloyed. The perturbed potentials are thus more effective in scattering the electrons with s-like symmetry which have their maximum amplitude at the lattice site, than the p-electrons which have their maximum amplitude between the lattice sites. Therefore, s-wave impurity scattering dominates in the determination of the resistivity. In going across the alloy series from pure silver to pure gold in the binary alloys and from pure silver to the copper-gold binary in the ternary alloys, the Fermi surface becomes less free-electron or s-like and more p-like. Therefore, one could expect a variation in $\rho_o'/\alpha(1-\alpha)$ simply because the relative number of s and p-states is varying across the alloy series. Unfortunately this cannot completely explain the alloy data, since there is a decrease in the value of $\rho_o'/\alpha(1-\alpha)$ when gold is added to silver in the binary alloys but an increase in the same quantity when the copper-gold binary is added to silver in the ternary alloys. This difference occurs even though both alloy systems have

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the same trend towards less free-electron-like Fermi surfaces.

The ternary alloy data is further complicated by a change in the lattice constant, which has been neglected in the analysis. It is difficult to assess the effect of this lattice constant change on the ternary resistivities. For example, the measured volume derivatives of the residual resistivity $d\ln\rho_0/d\ln V$ are of different signs[38] when copper and gold are added to silver and it is not possible to conclude what would happen in the case of a copper-gold alloy being added to silver.

Finally, contrary to the results of Faraday rotation experiments, de Haas-van Alphen data for the dilute Ag-Au binary alloys indicate that the simple constituent weighted potential may not be completely justified. These measurements indicate that for trace amounts of gold added to silver the area of contact of the Fermi surface with the Brillouin zone boundary is larger than the linearly interpolated value, while for trace amounts of silver added to gold the same quantity is smaller than the linearly interpolated value. On the basis of Stern's theory, the de Haas-van Alphen neck area varies as if the difference between $V_{Ag}(\underline{r})$ and $V_{Au}(\underline{r})$ is larger when gold is added to silver than when silver is added to gold. On this qualitative basis, the effective scattering potential at the gold end of the series would be smaller than that calculated

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with the linearly varying periodic potential. On the basis of data analyzed with the average periodic potential one would then expect a possible assymmetry in the data, with $\rho_0'/\alpha(1-\alpha)$ being larger at the silver than at the gold end of the alloy series. This conclusion is in agreement with the observed residual resistivity behavior. Since there are no de Haas-van Alphen data for the ternary alloys, a similar analysis is not possible.

Comparison of equations (17), (18), (19) and (20) shows that both $1/\tau$ and $(\gamma-\gamma_0)/\gamma_0$ are proportional to the same matrix elements. We can analyze the electronic specific heat data, following Stern and Martin, by assuming the expressions (18) and (19) are constant. With this assumption, equation (17) can be written

$$\gamma = \gamma_0' + \gamma_0'' = \gamma_0\left[1+L(1-\alpha)x(1-x)\right] + \gamma_0 K\alpha(1-\alpha) \quad . \quad (31)$$

Here K and L are constants and γ_0 is the zero-order density of states, which varies linearly between the pure constituents in agreement with the Faraday rotation experiments. In the expression (31), γ_0' is equal to γ_0 for the binary Ag-Au alloys since x=1.

Figure 3 shows the binary Ag-Au electronic specific heat data. The dotted line shows the linear variation of γ_0 and the solid curve is a least-squares fit of the data to an expression shown by (31) with K =-0.138. This

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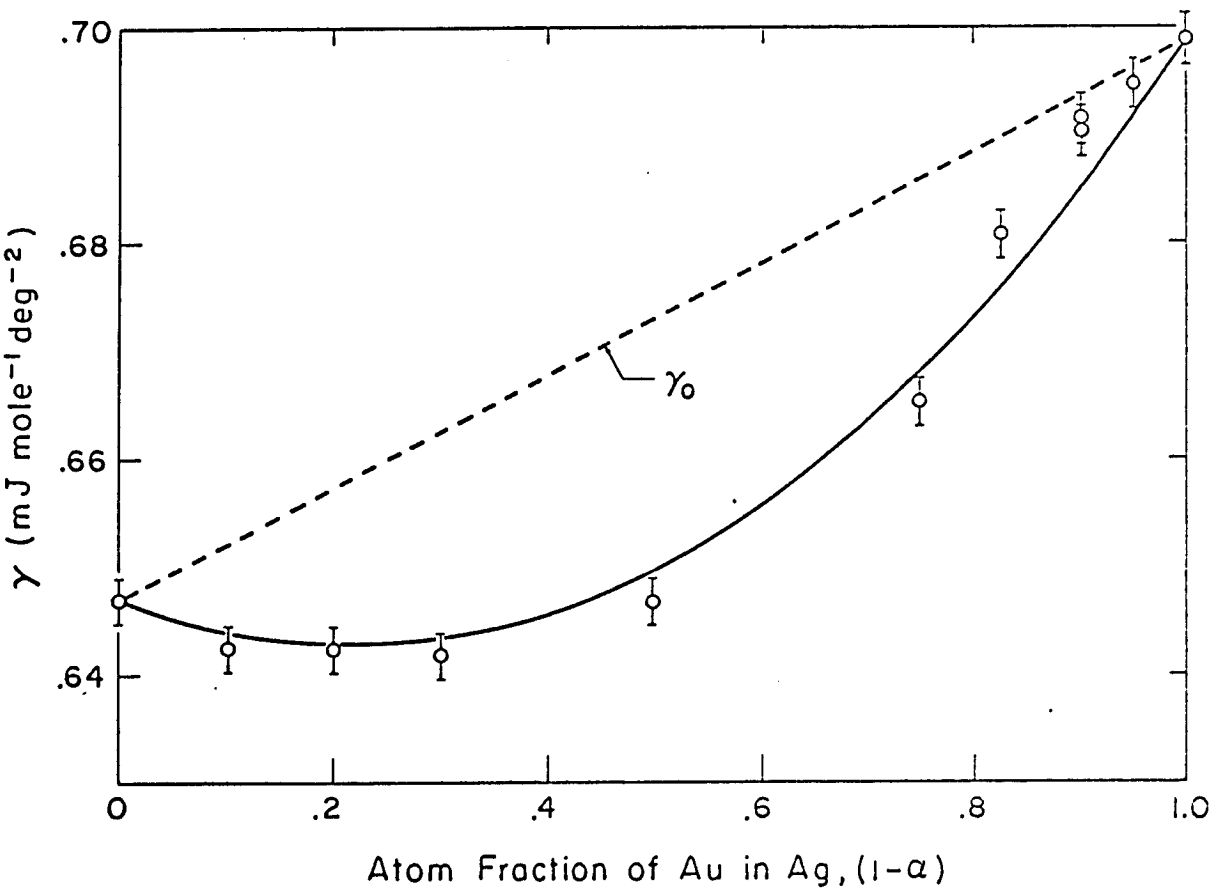

Figure 3. The electronic specific heat of $Ag_{\alpha}Au_{1-\alpha}$ binary alloys.

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value of K is identical to Martin's value of -0.14 for the same alloys; the agreement shows the importance of internal consistency when comparing the values of the electronic specific heat. In the original analysis of Green and Valladares data for the silver-rich binary alloys of Ag-Au[2], Stern used a γ value for pure gold measured by another investigator and obtained an incorrect value of K =-0.33.

Although the fit to the present data yields the same value of K that was found by Martin, there are some obvious differences in the data. In particular, the present work gives a significant deviation from parabolic behavior at the pure gold end of the alloy series. Martin measured two alloys in this range of composition, namely 90 and 95 atom percent gold in silver. His result for the latter specimen is in agreement with the variation found in the present work, while that for the former is consistent with an essentially parabolic behavior. Martin concluded, on the basis of a spectrographic analysis of the 95 atomic percent gold sample, that the sample was contaminated with transition metal impurities and on this basis made an adjustment in the γ value, which brought this data point into better agreement with parabolic behavior. In the present work, four data points have been obtained for this composition range and all indicate a systematic deviation

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from the parabolic dependence, which could be explained on the basis of transition metal contamination. Although a spectrographic analysis of the specimens has not been made, all of the specimens have been prepared in a consistent manner and it is highly improbable that only these four specimens would be contaminated.

The ternary alloy electronic specific heat values are shown in Figure 4. The dotted line in the curve is the variation of γ_o' given in equation (31), where L =-.0082 is determined from the γ values of silver and the pure copper-gold alloy along with the corresponding values of γ_o. The solid curve is a least-squares fit to $(\gamma-\gamma_o')/\gamma_o=K\alpha(1-\alpha)$, which yields for the present data K = -.019. In order to determine γ_o for the ternary alloys, the value of γ for copper has been assumed to be $0.7000\pm.0023$ mJ/mole$^oK^2$, as found in a previous experiment[27] with the present apparatus.

The values of K, determined from the binary and ternary alloys, can be compared in a similar manner to the residual resistivity data. In fact, if the assumption is again made that the matrix elements of the difference between the copper and silver potential are zero, then one obtains

$$K_{Ternary}/K_{Binary} = x^2 \quad , \qquad (32)$$

where again x is the atom fraction of gold in the copper-gold alloy. Unfortunately, in testing the validity of this expression, one must compare fractional quantities since

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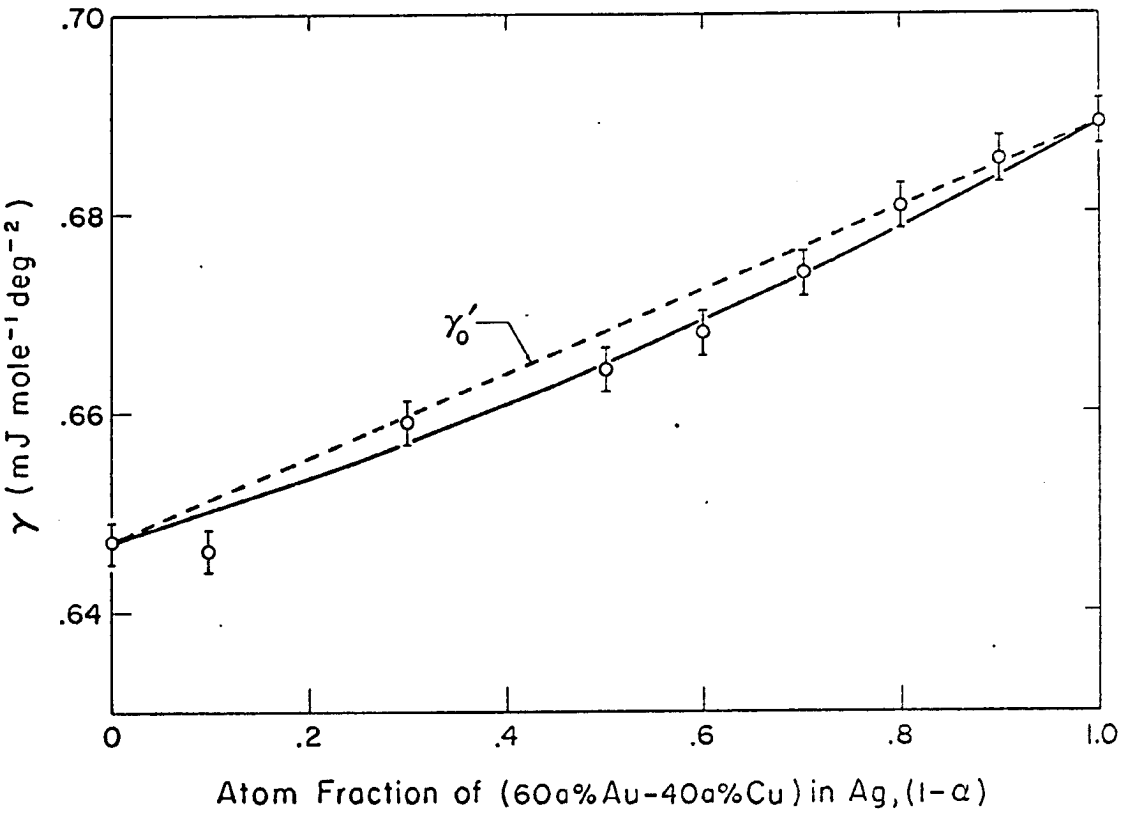

Figure 4. The electronic specific heat of $Ag_{\alpha}(60at.\%\ Au\text{-}40at.\%\ Cu)_{1-\alpha}$ ternary alloys.

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K is a fractional deviation of the electronic specific heat and the ratio shown by (32) has a large uncertainty associated with it. This is to be contrasted to the case of the residual resistivity where absolute values are compared and the uncertainty is correspondingly smaller.

In addition to the ternary alloy series containing 60 atomic percent gold in copper, two other alloys have been measured to test the validity of (32) and (30). These two alloys contain 72 atomic percent gold in copper and 84 atomic percent gold in copper. The two copper-gold alloys were alloyed with 50 atomic percent silver to form a ternary alloy. The data from these two alloys as well as the data from the $Ag_{0.5}$-$Au_{0.5}$ and the $Ag_{0.5}$-(60at.% Au-40at.% Cu)$_{0.5}$ alloys have been used in the following analysis. The data are analyzed by taking the ratios of $\rho_o{}'_{Ternary}/\rho_o{}'_{Binary}$. From equation (29), we have

$$\frac{\rho_o{}'_{Ternary}}{\rho_o{}'_{Binary}} = \frac{C_{Ternary}}{C_{Binary}} \quad , \qquad (33)$$

since the common factor $\alpha(1-\alpha)$ is the same for all four alloys. For the specific heat values, the ratios of $(\gamma_o''/\gamma_o)_{Ternary}/(\gamma_o''/\gamma_o)_{Binary}$ are formed, which from (31) yield

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$$\frac{\gamma_o''}{\gamma_o \text{ Ternary}} \Big/ \frac{\gamma_o''}{\gamma_o \text{ Binary}} = \frac{K_{Ternary}}{K_{Binary}} \qquad (34)$$

Again the common factor $\alpha(1-\alpha)$ has been eliminated since it is the same for all four alloys.

By comparing equations (33), (34) and equations (30), (32) we see that both of these ratios should be equal to x^2 for the ideal case of the difference between the silver and copper potentials being zero. Figure 5 shows the results of the analysis. The dashed curve shows the x^2 dependence of (30) and (32), while the data points are the ratios defined by (33) and (34). As expected, the normalized values do not fall exactly on the predicted curve, since the idealized difference condition is not exactly satisfied. However, there is surprisingly good agreement between the normalized values of the resistivity and the specific heat despite the large errors in the latter.

Again many effects have been neglected in the analysis of the electronic specific heat. Higher order scattering effects have been neglected, as well as variations in the lattice constant and effects of changes in band structure. Previously it has been concluded from de Haas-van Alphen data on noble metal alloys that the effective scattering potential near pure gold may in reality be smaller, in comparison to the effective scattering potential

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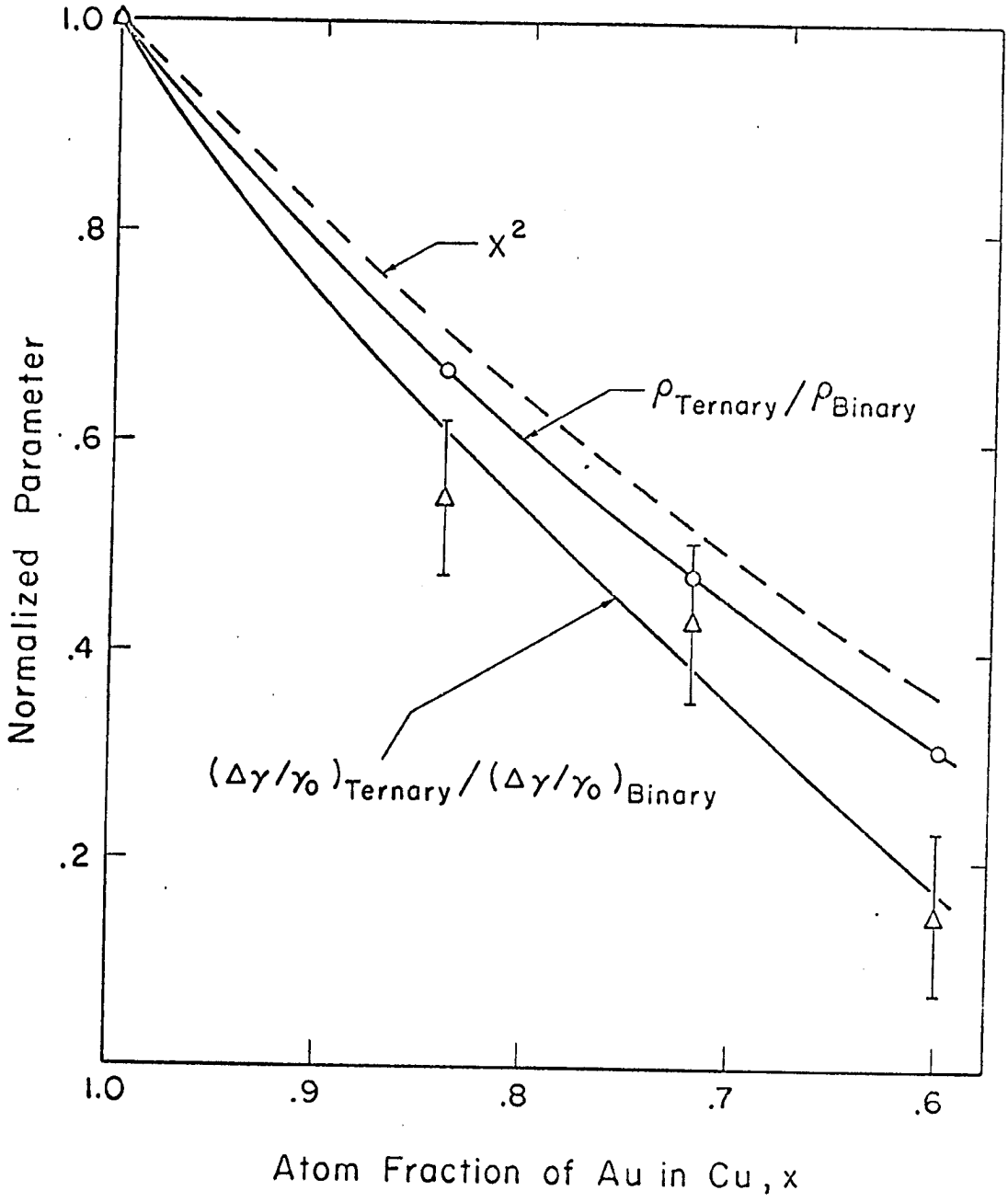

Figure 5. Comparison of normalized values of ρ_0' and γ_0''/γ_0 as a function of the gold concentration in copper for $Ag_{0.5}(Au_xCu_{1-x})_{0.5}$ ternary alloys.

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near pure silver. Thus, since the matrix elements of this potential are the same in the expressions for both the resistivity and specific heat, the resulting deviations from the predicted behavior should be similar in both. Therefore, the de Haas-van Alphen data could also explain the deviations in the specific heat for compositions near pure gold.

Another explanation of the deviations of the electronic specific heat from the predicted dependence is related to the behavior of the d bands on alloying. Optical measurements[39] have shown that the energy at the top of the d bands varies considerably across the Ag-Au alloy series and is much closer to the Fermi level in gold than in silver. In his original analysis, Stern concluded that, if the matrix element of the scattering potential coupled from the s and p-states at the Fermi level to the d states below the Fermi level, there would be a positive contribution to K in equation (31). This contribution would destroy agreement with experiment. He therefore assumed that the matrix elements only coupled s and p-states. However, if there were a small amount of coupling to the d-states, one would expect this to be largest in gold, where the d-states are closer to the Fermi level. This could produce a variation in the magnitude of K across the binary alloy

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series with K being less negative toward the gold end of the series. No optical data is available for the ternary alloys and therefore it is impossible to draw any conclusions concerning the variation of K in this series.

Despite these complications and the difficulty in assessing their relative importance, the present data show that the essential concentration dependences are predicted surprisingly well by the theory. This is probably due to the fact that the major contribution to the integrals of the matrix elements for the effective scattering potential are due to the s-states at the Fermi surface, with other variations in parameters appearing as smaller perturbations on the predicted shapes.

Haga's analysis of the electronic specific heat in terms of the electron-phonon interaction has also been applied to the present results. Unfortunately, in his original analysis of the Green and Valladares data for the Ag-Au system, Haga also used a questionable value of γ for gold. This perhaps led to better agreement between theory and experiment than is possible in the case of the present data.

Using $V_{ep} = 2/3E_F$ in equation (24), one can estimate that $\lambda_{ep} = .17$ and $.18$ for silver and gold, respectively. Therefore, making Haga's assumption that they are equal, we obtain from equation (26)

$$\gamma = \frac{\gamma_{Ag}}{1+\lambda_{ep}} \left[1+b(1-\alpha)\right]\left[1+\lambda_{ep}G(y)\right] \quad , \qquad (35)$$

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where b is determined from the γ values of pure silver and pure gold. The quantity $y = \tau/k_B\theta_D$ in this equation is determined from the residual resistivity, which Haga assumed to obey Nordheim's rule. In the evaluation of y, a parameter, a, is included to represent the difference between $1/\tau$ obtained from the residual resistance and the scattering probability in the present problem. Therefore one can write

$$y = \frac{a\alpha\ (1-\alpha)\hbar}{2\tau k_B\theta_D} \quad , \tag{36}$$

where τ is calculated from $\rho_o = m/ne^2\tau$.

Using the specific heat data, one can calculate for each data point the quantity

$$\lambda_{ep}(\alpha) = \frac{1+b(1-\alpha)-\gamma/\gamma_{Ag}}{\gamma/\gamma_{Ag} - \left[1+b(1-\alpha)\right]G(y)} \quad . \tag{37}$$

By varying the magnitude of a in equation (29) above, one can determine an optimal value where λ_{ep} becomes concentration independent. Haga's analysis gives $\lambda_{ep} = .074$ and $a = 0.8$.

The above calculation has been repeated using the present data for the binary alloys, except the actual concentration-dependent resistivity has been used instead of assuming Nordheim's rule. One obtains a fair fit to the data with $\lambda_{ep} = 0.05$ and $a = 0.4$. The results are

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quite sensitive to the choice of the magnitude of a, but the above value seems unreasonably low. Haga himself indicated that its value should be close to unity. Again considering the results in the analysis of τ for impurity scattering in noble metal alloys, one concludes that the major contribution to τ is from the s-like electrons on the belly of Fermi surface. The belly regions of the Fermi surface comprise the major portion of the Fermi surface and the s-wave scattering is isotropic, so one would conclude that the level broadening is properly calculated for these states with a value of a which is close to unity.

Therefore, Haga's value of 0.8 for the magnitude of the parameter a has been assumed and the value of λ_{ep} adjusted so that the zero-order density of states passes below the lowest specific heat data point. The results are shown in Figure 6 with $\lambda_{ep} = 0.044$, as a function of varying a. An increase in λ_{ep}, which results in a decrease of the zero-order density of states, gives a worse fit to the data. Correspondingly a decrease in λ_{ep}, which raises the zero-order density of states gives a negative electron-phonon enhancement. Clearly such behavior is not reasonable. Therefore the above value of λ_{ep} is a reasonable estimate for the assumed value of a. One can see that no value of a, including a equal to 0.8, gives a particularly good fit to the data.

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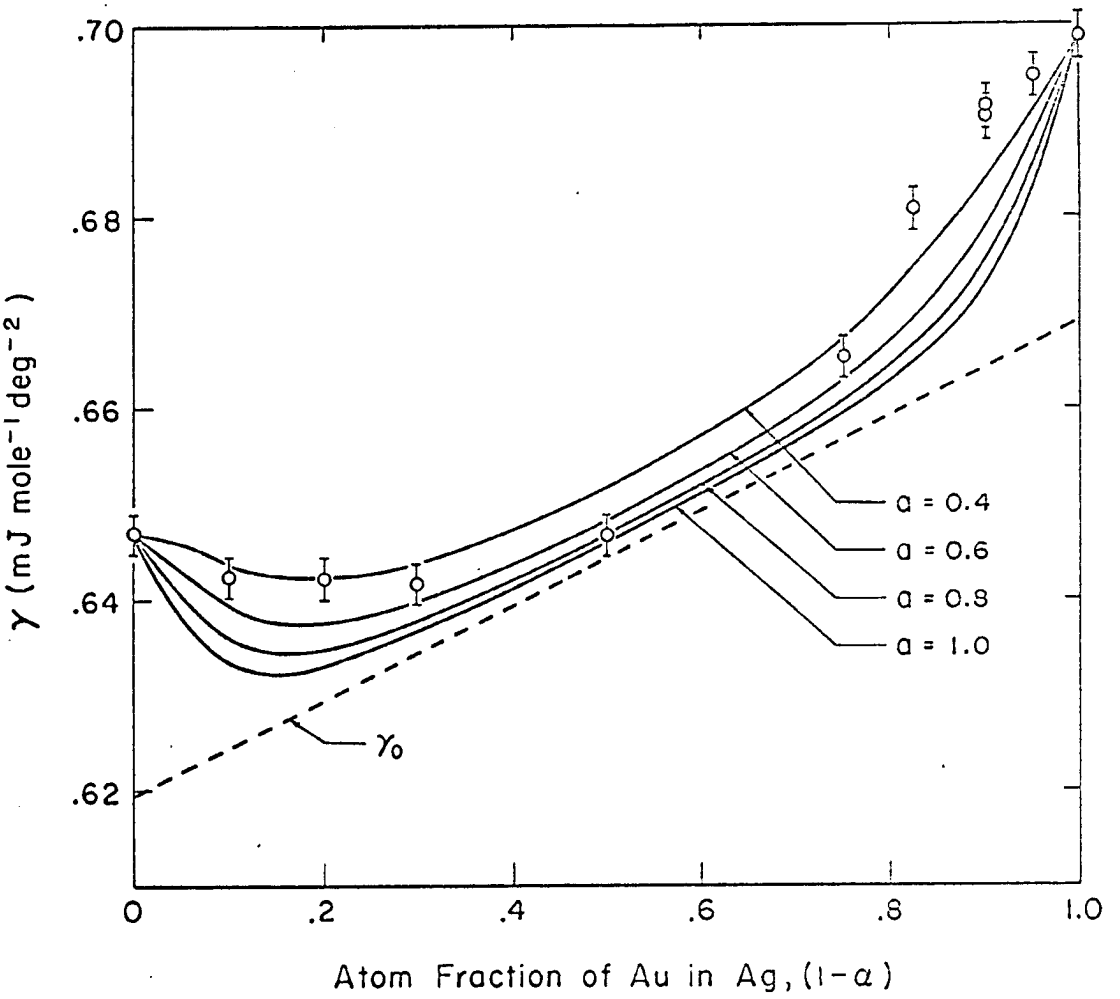

Figure 6. Fit of electron-phonon enhancement model to $Ag_{\alpha}Au_{1-\alpha}$ binary specific heat data.

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This seemingly obtuse way of obtaining a fit to the binary data does not alter the qualitative results, when the theory is applied to the ternary specific heat data. With the above values of a and λ_{ep} for silver and the known resistivity of the ternary alloys, one can adjust the zero-order density of states to give the measured value of γ for the Cu-Au binary alloy. The level broadening in the Cu-Au binary alloy can be calculated from the resistivity data. It is found that the quenching of the electron-phonon interaction is almost complete, so that the zero-order density of states corresponds very closely to the actual measured value of γ at this point. Once the zero-order density of states is known, the remainder of the curve can be generated using equation (28).

The results of such calculations are shown in Figure 7. One expects an initial rapid decrease in the electronic specific heat as the Cu-Au binary alloy is added to silver, due to the quenching of the electron-phonon interaction. This behavior is not observed in the data. Such a discrepancy does not imply that the electron-phonon interaction is non-existent in these alloys, but rather the present data cannot be explained merely on the basis of the electron-phonon interaction as formulated by Haga. In this connection, it should be noted that the electron

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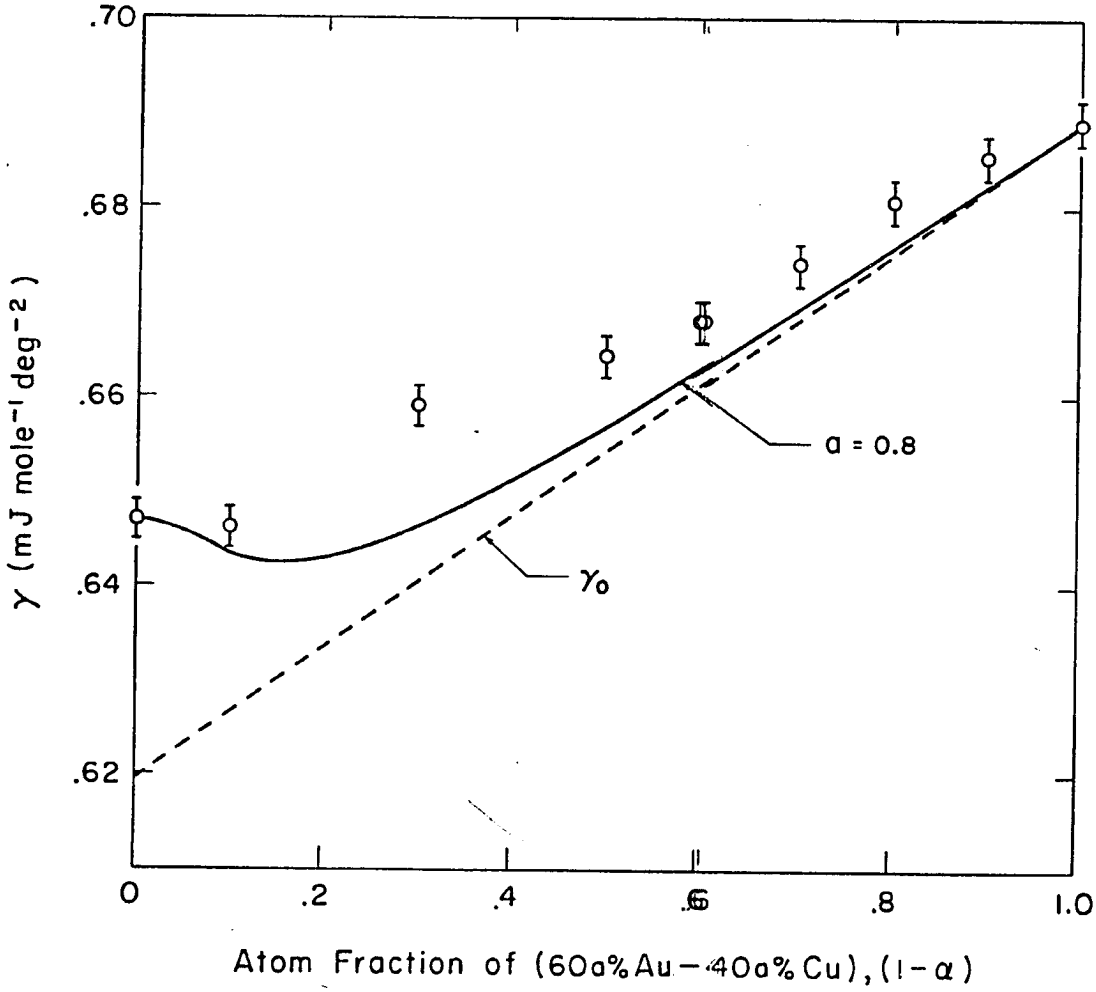

Figure 7. Fit of electron-phonon enhancement model to ternary $Ag_{\alpha}(60at.\%\ Au\text{-}40at.\%\ Cu)_{1-\alpha}$ specific heat data.

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phonon enhancement of γ for silver and gold is probably small, since there is close agreement between their band, optical and specific heat masses[18].

Figures 8 and 9 show the Debye temperatures for the binary and ternary alloys respectively. The Debye temperatures differ by less than $5^{o}K$ from the linearly interpolated value across the entire binary alloy series and by less than $3^{o}K$ over the entire ternary alloy series. Some authors have used this small deviation from linearity as an argument for the electron-phonon interaction being small, however, it is not completely clear that this is valid.

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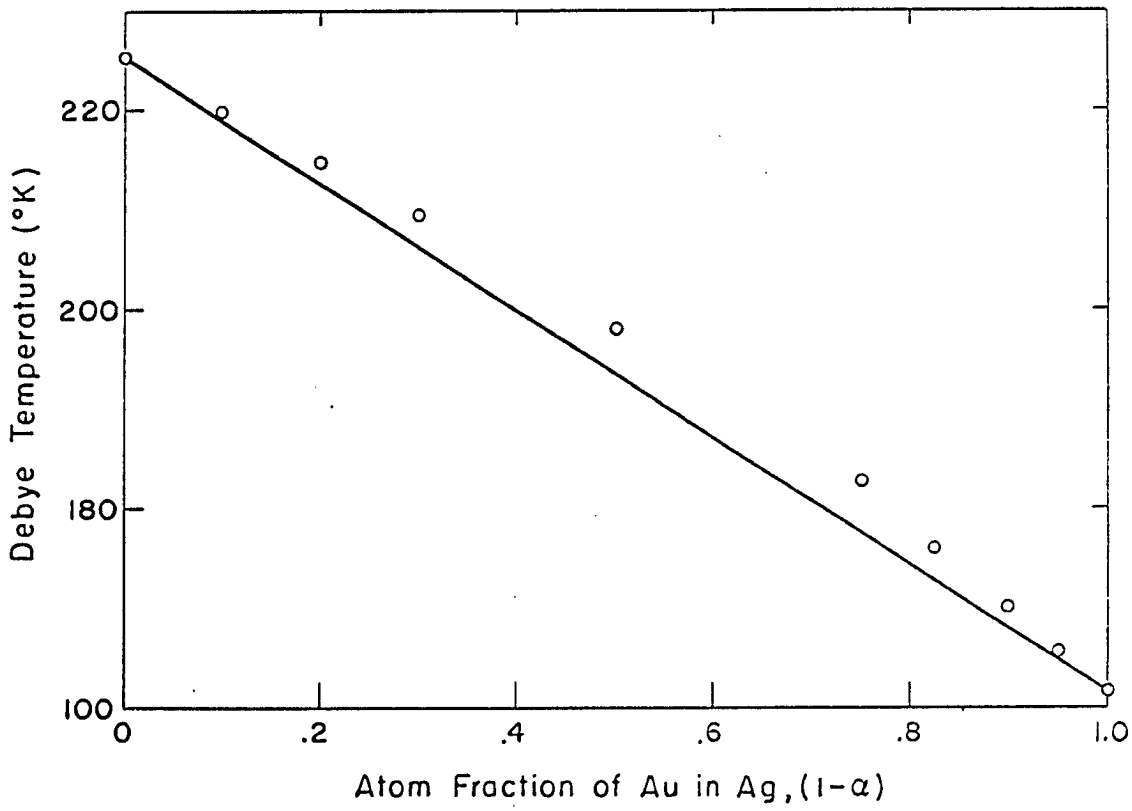

Figure 8. The Debye temperatures of $Ag_{\alpha}Au_{1-\alpha}$ binary disordered alloys.

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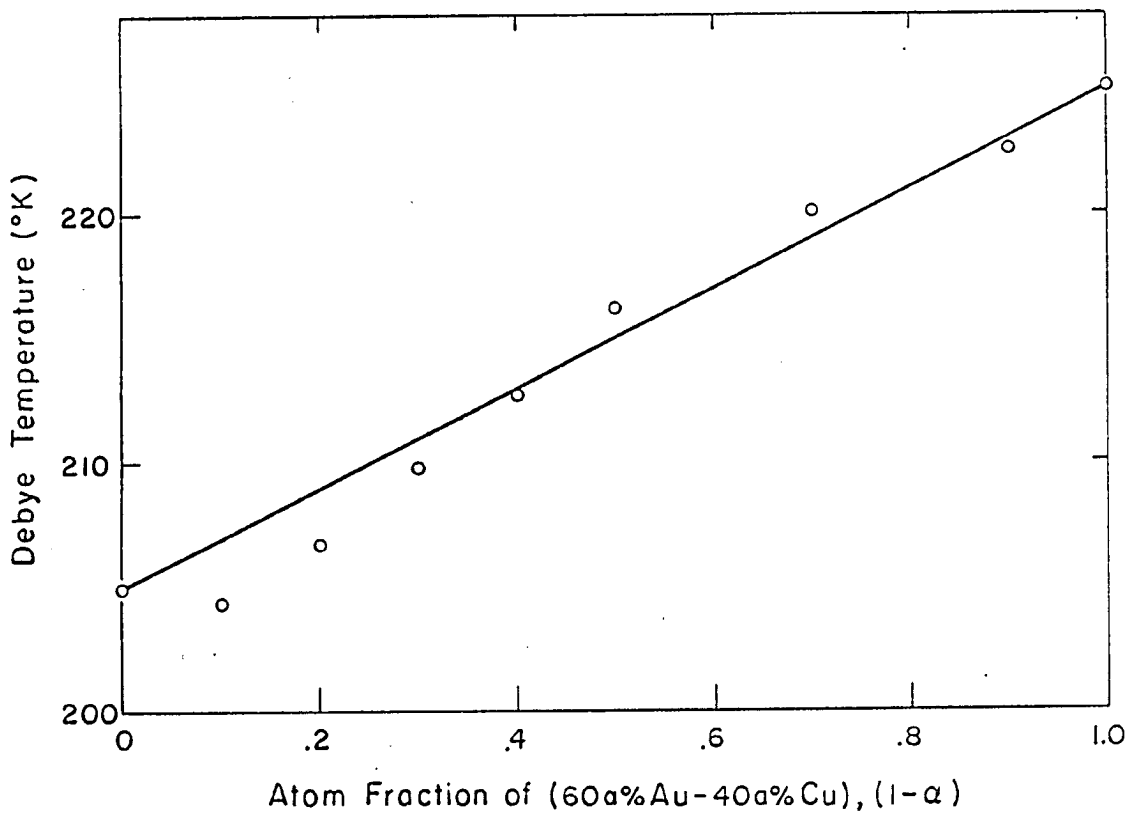

Figure 9. The Debye temperature of Ag_{α}-(60at.% Au-40at.%)$_{1-\alpha}$ ternary disordered alloys.

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VI. CONCLUSIONS

The experimentally determined residual resistances and electronic specific heats of the Ag_{α}-$Au_{1-\alpha}$ binary alloy system, Ag_{α}-(60at.% Au-40at.% Cu)$_{1-\alpha}$ ternary alloy system and the two samples of $Ag_{0.5}$-(72at.% Au-28at.% Cu)$_{0.5}$ and $Ag_{0.5}$-(84at.% Au-16at.% Cu)$_{0.5}$ have been explained in terms of the virtual crystal model of Stern and the electron-phonon enhancement model of Haga. The results cannot be explained quantitatively or qualitatively in terms of the electron-phonon interaction as formulated by Haga. The electron-impurity interaction and the virtual crystal model gives reasonable results with the simple assumptions of constant matrix elements and pure s-wave scattering. The effective scattering potentials have a dominant effect on the magnitudes of the specific heat and residual resistances, with other varying quantities appearing as smaller deviations from the theoretical functional forms.

It has been assumed that the Fermi surface in the alloys varies linearly between the pure constituents but this has only been verified by Faraday rotation experiments in the Ag-Au alloys. There is need for Faraday rotation experiment on more of the alloys considered to verify this assumption. Positron annihilation studies, which are also

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sensitive to the cross sectional area of the Fermi surface, could also be used in these bulk alloys to investigate the variation in neck size.

Since the data seem to be consistent with the electron-impurity interaction, a first principles calculation of this interaction would be interesting. The pseudopotential form factors exist for all of the noble metals and it should be possible to perform the zero-order calculation, assuming an average periodic potential and then treat the electron impurity interaction with perturbation theory. Unfortunately, this requires a large amount of computer time, since a complete band structure calculation must be done for each alloy considered.

Pauli spin susceptibility measurements on the ternary alloys would also be interesting, since the results are proportional to the density of states at the Fermi level. Electron-phonon enhancement effects do not alter the density of states as measured by this method but the interpretation of the data is difficult due to other contributions to the total susceptibility.

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VII. ACKNOWLEDGEMENTS

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APPENDIX A. THEORY

The purpose of this section is to examine the effect of the electron-impurity and electron-phonon interaction on the electronic specific heat and residual resistivity of a ternary alloy of the noble metals. The calculation is an extension of the theories of Stern[4] and Haga[3], which have been applied to binary alloys of the noble metals.

The model considered is a perfectly disordered alloy with three constituents distributed at random on a perfect lattice. It is further assumed that, to zero order, the crystal can be represented as a periodic arrangement of potentials with the potential at each lattice point being the average potential at a lattice point in the alloy. This periodic potential is then of the form

$$V_p(\underline{r}) = \alpha V_{Ag}(\underline{r}) + (1-\alpha)\left[xV_{Au}(\underline{r}) + (1-x)V_{Cu}(r)\right] \quad . \qquad (A1)$$

In this expression the symbols have the following meaning: α is the atom fraction of silver in the alloy, $(1-\alpha)x$ is the atom fraction of gold, $(1-\alpha)(1-x)$ is the atom fraction of copper, $V_{Ag}(\underline{r})$ is the potential of the silver ion, $V_{Au}(\underline{r})$ is the potential of the gold ion, and $V_{Cu}(\underline{r})$ is the potential of the copper ion.

Using this periodic potential, the band structure of the alloy can be calculated with the resultant Fermi

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surface and density of states varying linearly between the pure constituents. The Bloch states to this order have the form

$$\Psi_{\underline{k}}(\underline{r}) = N^{-\frac{1}{2}}\, U_{\underline{k}}(\underline{r})\, e^{i\underline{k}\cdot\underline{r}} \quad , \qquad \text{(A2)}$$

where $U_{\underline{k}}(\underline{r})$ is normalized in a unit cell and has the periodicity of the lattice. The energy of the state at $\underline{k}$ to zero order is $E_{\underline{k}}$.

The starting point for the consideration of the two interactions being considered is the derivation of the total energy of a system of interacting electrons and phonons to second order in temperature dependent perturbation theory. The expression for the energy is[4,18]

$$E_{Tot} = \sum_{\underline{k}} f_{\underline{k}}\, E_{\underline{k}} + \sum_{\underline{k},\underline{q}} \frac{|V_{ep}(\underline{q})|^2\, f_{\underline{k}}(1-f_{\underline{k}-\underline{q}})(1+n_{\underline{q}})}{E_{\underline{k}} - E_{\underline{k}-\underline{q}} - \hbar\omega_{\underline{q}} + i\delta}$$

$$+ \sum_{\underline{k},\underline{l}} \frac{|V_{ep}(\underline{q})|^2\, f_{\underline{k}}(1-f_{\underline{k}-\underline{q}})\, n_{\underline{q}}}{E_{\underline{k}} - E_{\underline{k}-\underline{q}} + \hbar\omega_{\underline{q}} + i\delta} \qquad \text{(A3)}$$

$$+ \sum_{\underline{k},\underline{l}} \frac{|V_{ei}(\underline{l}-\underline{k})|^2\, f_{\underline{k}}(1-f_{\underline{l}})}{E_{\underline{k}} - E_{\underline{l}} + i\delta} \quad ,$$

where f and n are the Fermi and Planck distribution functions respectively, and $V_{ep}(\underline{q})$ and $V_{ei}(\underline{l}-\underline{k})$ are the coupling constants for the electron-phonon and electron-impurity interactions.

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The energy $E'_{\underline{k}}$ of a quasi-particle at the state of wave vector $\underline{k}$ can be obtained by differentiating E_{Tot} with respect to $f_{\underline{k}}$[19]. At low temperatures, the imaginary part of the second and third terms in (A3) can be neglected, yielding

$$E'_{\underline{k}} = \epsilon_{\underline{k}} - i\Gamma_{\underline{k}} \quad , \tag{A4}$$

$$\epsilon_{\underline{k}} = E_{\underline{k}} + \sum_{\underline{q}} |V_{ep}(\underline{q})|^2 \left[\frac{1-f_{\underline{k}-\underline{q}}+n_{\underline{q}}}{E_{\underline{k}}-E_{\underline{k}-\underline{q}}-\hbar\omega_{\underline{q}}} + \frac{f_{\underline{k}-\underline{q}}+n_{\underline{q}}}{E_{\underline{k}}-E_{\underline{k}-\underline{q}}+\hbar\omega_{\underline{q}}} \right] \tag{A5}$$

$$+ \sum_{\underline{l}} \frac{|V_{ei}(\underline{l}-\underline{k})|^2}{E_{\underline{k}} - E_{\underline{l}}} \quad ,$$

$$\Gamma_{\underline{k}} = \pi \sum_{\underline{l}} |V_{ei}(\underline{l}-\underline{k})|^2 \, \delta(E_{\underline{k}} - E_{\underline{l}}) \quad . \tag{A6}$$

If it is assumed, according to Stern, that the electron-impurity interaction dominates and that the second and third terms of (A5) are small, then we have what will be referred to in this analysis as the Virtual Crystal Model. If it is assumed, according to Haga, that the electron-phonon terms dominate and that the last term in (A5) is small, then we have what will be referred to as the Electron-Phonon Enhancement Model.

Virtual Crystal Model

The following analysis is an extension of Stern's

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theory of the electron-impurity interaction to a ternary alloy of the noble metals. The expressions for the ternary alloy can be reduced to Stern's results for the binary alloy by proper substitution of the atom fractions of the constituents.

The potential of the alloy is written as

$$V(\underline{r}) = V_p(\underline{r}) + V_{ei}(\underline{r}) \quad , \qquad (A7)$$

where $V_p(\underline{r})$ is given by (A1) and

$$V_p(\underline{r}) = \sum_{\underline{g}} \left[\alpha S(\underline{g}) + (1-\alpha)\left(xG(\underline{g}) + (1-x)C(\underline{g})\right\}\right] e^{i\underline{g}\cdot\underline{r}} \quad , \qquad (A8)$$

$$V_{ei}(\underline{r}) = \int V(\underline{k}) e^{i\underline{k}\cdot\underline{r}} \, d^3\underline{k} \quad . \qquad (A9)$$

Here $\underline{g}$ are the reciprocal lattice vectors; $S(\underline{g})$, $G(\underline{g})$ and $C(\underline{g})$ are the $\underline{g}$th Fourier components of the potential from the silver, gold and copper ions respectively, while $V(\underline{k})$ is the $\underline{k}$th Fourier component of the alloy potential with the condition $V(\underline{g})=0$. $V_{ei}(\underline{r})$ can be calculated as a superposition of the difference between the actual potential in the unit cells of the alloy and the assumed periodic potential $V_p(\underline{r})$, i.e.

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$$V_{ei}(\underline{r}) = \sum_N \left[V_{Ag}(\underline{r}-\underline{R_N}) - V_P(\underline{r}-\underline{R_N})\right] P_1$$
$$+ \sum_N \left[V_{Au}(\underline{r}-\underline{R_N}) - V_P(\underline{r}-\underline{R_N})\right] P_2 \qquad \text{(A10)}$$
$$+ \sum_N \left[V_{Cu}(\underline{r}-\underline{R_N}) - V_P(\underline{r}-\underline{R_N})\right] P_3 \quad .$$

Here R_N are the positions of the lattice points and P_1, P_2 and P_3 are factors which are 1 if the site being considered is silver, gold or copper respectively and are 0 otherwise.

The matrix elements $\langle \underline{k}|V_{ei}(\underline{r})|\underline{l}\rangle$ can be formed and the integrals transformed back into a unit cell with the result

$$\langle \underline{k}|V_{ei}(\underline{r})|\underline{l}\rangle =$$
$$N^{-1}\left[(1-\alpha)\sum_N P_1 e^{i(\underline{l}-\underline{k})\cdot\underline{R_N}} - \alpha\left(\sum_N P_2 e^{i(\underline{l}-\underline{k})\cdot\underline{R_N}} + \sum_N P_3 e^{i(\underline{l}-\underline{k})\cdot\underline{R_N}}\right)\right]$$
$$\langle k|V_A(\underline{r})|l\rangle + N^{-1}\left[(1-x)\sum_N P_2 e^{i(\underline{l}-\underline{k})\cdot\underline{R_N}} - x\sum_N P_3 e^{i(\underline{l}-\underline{k})\cdot\underline{R_N}}\right]$$
$$\langle k|V_B(\underline{r})|\underline{l}\rangle \quad , \qquad \text{(A11)}$$

where

$$\langle \underline{k}|V_A(\underline{r})|\underline{l}\rangle = \langle \underline{k}|x\left(V_{Ag}(\underline{r})-V_{Au}(\underline{r})\right)+(1-x)\left(V_{Ag}(\underline{r})-V_{Cu}(\underline{r})\right)|\underline{l}\rangle$$
$$= \int e^{i(\underline{l}-\underline{k})\cdot\underline{r}}\, U^*_{\underline{k}}(\underline{r})\; V_A(\underline{r})\; U_{\underline{l}}(\underline{r})\; d^3\underline{r} \quad , \qquad \text{(A12)}$$

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and

$$\langle \underline{k}|V_B(\underline{r})|\underline{l}\rangle = \langle \underline{k}|V_{Au}(\underline{r})-V_{Cu}(\underline{r})|\underline{l}\rangle = \int e^{i(\underline{l}-\underline{k})\cdot\underline{r}}\, U^*_{\underline{k}}(\underline{r})\; V_B(\underline{r})\; U_{\underline{l}}(\underline{r})\; d^3\underline{r} \quad . \tag{A13}$$

The square of this matrix element can be obtained by considering $\langle \underline{k}|V_{ei}(\underline{r})|\underline{l}\rangle\langle \underline{l}|V_{ei}(\underline{r})|\underline{m}\rangle$, which yields

$$\begin{aligned}
&\langle \underline{k}|V_{ei}(\underline{r})|\underline{l}\rangle\langle \underline{l}|V_{ei}(\underline{r})|\underline{m}\rangle = \\
&N^{-2}\left[(1-\alpha)^2A+\alpha^2(B+C+2D)-2\alpha(1-\alpha)(E+F)\right]\ \langle \underline{k}|V_A|\underline{l}\rangle\langle \underline{l}|V_A|\underline{m}\rangle \\
&+ N^{-2}\left[(1-x)^2B+x^2C-2x(1-x)D\right]\ \langle \underline{k}|V_B|\underline{l}\rangle\langle \underline{l}|V_B|\underline{m}\rangle \\
&+ N^{-2}\left[(1-x)(1-\alpha)E-(1-\alpha)xF-\alpha(1-x)(B+D)+\alpha x(D+C)\right] \\
&\qquad \left[\langle \underline{k}|V_A|\underline{l}\rangle\langle \underline{l}|V_B|\underline{m}\rangle + \langle \underline{k}|V_B|\underline{l}\rangle\langle \underline{l}|V_A|\underline{m}\rangle\right] \quad .
\end{aligned} \tag{A14}$$

In (A14), the quantities A,B,C,D,E, and F are various products of lattice sums and the probability functions P_1, P_2 and P_3. These sums have been calculated for a particular distribution of atoms. Because of the large number of atoms involved, the value of a physical quantity found by averaging over all possible distributions of the three constituents is representative of the disordered alloy. Therefore, the following equations show the quantities A through F along with their averages over all possible distributions of the atoms. The

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averaging is shown in detail for the quantity A and the results are quoted for the remainder of the quantities. In the averaging process we have used the fact that $V_{ei}(\underline{g})=0$ and have therefore assumed that $\underline{l}-\underline{k}\neq\underline{g}$ and $\underline{m}-\underline{l}\neq\underline{g}$.

$$\langle A\rangle_{AVG} = \left\langle \sum_M \sum_N P_1 P_1 e^{i(\underline{l}-\underline{k})\cdot \underline{R_M}} e^{i(\underline{m}-\underline{l})\cdot \underline{R_N}} \right\rangle_{AVG} = \langle P_1 P_1 \rangle_{AVG}$$

$$= \sum_{M\neq N}\sum e^{i(\underline{l}-\underline{k})\cdot \underline{R_M}} e^{i(\underline{m}-\underline{l})\cdot \underline{R_N}} \overline{P_1 P_1} + \sum_N e^{i(\underline{m}-\underline{k})\cdot \underline{R_N}} \overline{P_1}$$

$$= \sum_{M,N}\sum e^{i(\underline{l}-\underline{k})\cdot \underline{R_M}} e^{i(\underline{m}-\underline{l})\cdot \underline{R_N}} \overline{P_1 P_1} - \sum_N e^{i(\underline{m}-\underline{k})\cdot \underline{R_N}} \overline{P_1 P_1}$$

$$+ \sum_N e^{i(\underline{m}-\underline{k})\cdot \underline{R_N}} \overline{P_1} \qquad \text{(A15)}$$

$$= \alpha(1-\alpha)N\delta_{\underline{m},\underline{k}} .$$

Similarly we find

$$\langle B\rangle_{AVG} = \langle P_2 P_2\rangle_{AVG} = (1-\alpha)x\{1-(1-\alpha)x\}N\ \delta_{\underline{k},\underline{m}} ,$$

$$\langle C\rangle_{AVG} = \langle P_3 P_3\rangle_{AVG} = (1-\alpha)(1-x)\{1-(1-\alpha)(1-x)\}N\ \delta_{\underline{k},\underline{m}} ,$$

$$\langle D\rangle_{AVG} = \langle P_2 P_3\rangle_{AVG} = -(1-\alpha)x(1-\alpha)(1-x)N\ \delta_{\underline{k},\underline{m}} ,$$

$$\langle E\rangle_{AVG} = \langle P_1 P_2\rangle_{AVG} = -\alpha x(1-\alpha)N\ \delta_{\underline{k},\underline{m}} ,$$

$$\langle F\rangle_{AVG} = \langle P_1 P_3\rangle_{AVG} = -\alpha(1-\alpha)(1-x)N\ \delta_{\underline{k},\underline{m}} .$$

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Substituting these averages into (A14) gives the expression for the energy of the quasi-particle, namely

$$\varepsilon_{\underline{k}} = E_{\underline{k}} + E_2(\underline{k}) = E_{\underline{k}} + \sum_{\underline{1}} \frac{\alpha(1-\alpha)}{N} \frac{|\langle \underline{k}|V_A|\underline{1}\rangle|^2}{E_{\underline{k}} - E_{\underline{1}}}$$

$$+ \sum_{\underline{1}} \frac{(1-\alpha)x(1-x)}{N} \frac{|\langle \underline{k}|V_B|\underline{1}\rangle|^2}{E_{\underline{k}} - E_{\underline{1}}} \quad . \tag{A16}$$

In this expression, the principal part of the sum is taken to exclude those states which contribute to real scattering. Using (A16), the density of states can then be calculated from

$$N(E) = \frac{1}{4\pi^3 V} \int \frac{dS}{|\nabla_{\underline{k}} \varepsilon_{\underline{k}}|} \quad , \tag{A17}$$

where V is the volume of the alloy, and the integral is over the constant energy surface in $\underline{k}$ space, $\varepsilon_{\underline{k}}=E$.

Stern assumes, following Jones[40], that $E_2(\underline{k})$ of (A16) depends only on $E_{\underline{k}}$. Then, substituting (A16) into (A17) yields

$$N(\varepsilon_{\underline{k}}) = N_o(E_{\underline{k}}) \left[1 - {}^{\partial E_2(\underline{k})}/_{\partial E_{\underline{k}}} \right] \quad , \tag{A18}$$

where $N_o(E_{\underline{k}})$ is the zero order density of states at $E_{\underline{k}}$. If the Fermi level in zero order is at $E_{\underline{k}}$, then in the alloy it will be at $\varepsilon_{\underline{k}}$, and the electronic specific

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heat coefficient will be given by

$$\gamma = \gamma_o \left[1 - {}^{\partial E_2(\underline{k})}/_{\partial E_{\underline{k}}} \right] \quad , \qquad \text{(A19)}$$

where γ is the electronic specific heat coefficient in the disordered alloy and γ_o is the zero-order coefficient which is proportional to the zero order density of states.

Using the expression for $E_1(\underline{k})$ given by (A16) and changing the sum into an integral, (A19) can be written as

$$\frac{\gamma-\gamma_o}{\gamma_o} = \alpha(1-\alpha)K + (1-\alpha)x(1-x)L \quad , \qquad \text{(A20)}$$

where

$$K = -\frac{1}{2\pi^3 N} \frac{\partial}{\partial E_{\underline{k}}} \int \frac{|\langle \underline{k}|V_A(\underline{r})|\underline{l}\rangle|^2}{E_{\underline{k}} - E_{\underline{l}}} d^3\underline{l} \quad , \qquad \text{(A21)}$$

and

$$L = -\frac{1}{2\pi^3 N} \frac{\partial}{\partial E_{\underline{k}}} \int \frac{|\langle \underline{k}|V_B(\underline{r})|\underline{l}\rangle|^2}{E_{\underline{k}} - E_{\underline{l}}} d^3\underline{l} \quad . \qquad \text{(A22)}$$

These expressions reduce to Stern's result for the binary Ag-Au alloy system if the atom fraction of copper is replaced by zero; that is, x=1.

The alloy electron states have a dc transport relaxation time to second order in perturbation theory,

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which can be calculated from the scattering probability given by $P_{\underline{k}}=2\ \Gamma_{\underline{k}}/\hbar$ and equation (A6). $P_{\underline{k}}$ is the scattering probability of an electron at state $\underline{k}$ and $\Gamma_{\underline{k}}$ is the level width of the electron state. The relaxation time is[20]

$$\frac{1}{\tau_{\underline{k}}} = \frac{V}{2\pi\hbar N}\int\left[\alpha(1-\alpha)\,|\langle\underline{k}|V_A|\underline{1}\rangle|^2+x(1-x)(1-\alpha)\,|\langle\underline{k}|V_B|\underline{1}\rangle|^2\right] (1-\cos\theta)\,|v_{\underline{1}}E_{\underline{1}}|^{-1}\,dS_{\underline{1}} \quad , \qquad \text{(A23)}$$

where $\tau_{\underline{k}}$ is the relaxation time of an electron state $\underline{k}$ and $dS_{\underline{1}}$ is an element of area in the Fermi surface at $\underline{1}$. Cylindrical symmetry in the scattering about $\underline{k}$ is assumed.

Electron-Phonon Enhancement Model

In Haga's analysis of the binary alloy, the Fourier transform of an atomic potential is used as the coupling constant in the electron-phonon interaction. For the ternary alloy under consideration, this gives

$$V_p(\underline{q}) = N\int V_p(\underline{r})\,e^{-i\underline{q}\cdot\underline{r}}\,d\underline{r} \quad . \qquad \text{(A24)}$$

Here N is the number of cells per unit volume, $\underline{q}$ is the difference between the wave vectors of the initial and final states of an electron and $V_p(\underline{r})$ is the

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potential given by (A1). Haga neglects the Umklapp processes, neglects the $\underline{q}$ dependence of $V_p(\underline{q})$ and considers only longitudinal phonons which are assumed to obey the Debye approximation and obtains

$$V_{ep} = V_p \left(\frac{\hbar q}{2NMs} \right)^{\frac{1}{2}} , \qquad \text{(A25)}$$

where M is the ionic mass and s the velocity of sound.

The terms $E_{\underline{k}}$ is the denominator of (A5) are replaced with $\varepsilon_{\underline{k}}$, the energy of the quasi-particle at the state of wave vector $\underline{k}$. This replacement makes equation (A5) equivalent to the lowest order approximation of the electron-phonon interaction as calculated by the Green function method[22,23,24]. Equation (A5) can be integrated to give[18,22]

$$\varepsilon_{\underline{k}} = E_{\underline{k}} + \lambda_{ep} \frac{k_B \Theta_D}{3} \left[\ln \left(\frac{\varepsilon_{\underline{k}} - k_B \Theta_D}{\varepsilon_{\underline{k}} + k_B \Theta_D} \right) + \left(\frac{\varepsilon_{\underline{k}}}{k_B \Theta_D} \right)^3 \ln \left| \frac{\varepsilon_{\underline{k}}^2}{\varepsilon_{\underline{k}}^2 - (k_B \Theta_D)^2} \right| - \frac{\varepsilon_{\underline{k}}}{k_B \Theta_D} \right] , \qquad \text{(A26)}$$

where

$$\lambda_{ep} = \frac{m_e \, q_m^2 \, V_p^2}{8\pi^2 \hbar^2 \, N \, M \, k_F \, s^2} . \qquad \text{(A27)}$$

Here m_e and k_F are the band mass and wave number of an electron at the Fermi level, q_m is the radius of the Debye sphere and Θ_D is the Debye temperature.

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Using (A27), the density of states can be found from its definition to be

$$N(\varepsilon_{\underline{k}}) = N_o(E_{\underline{k}}) \Big/ d\varepsilon_{\underline{k}} / dE_{\underline{k}} \quad , \qquad (A28)$$

$$N(\varepsilon_{\underline{k}}) = N_o(E_{\underline{k}}) \left[1 + \lambda_{ep} F\left(\frac{E_{\underline{k}}}{k_B \theta_D} \right) \right] \quad , \qquad (A29)$$

$$F(y) = 1 - y^2 \ln \left| \frac{x^2}{1-x^2} \right| \quad . \qquad (A30)$$

Here as before $N_o(E_{\underline{k}})$ is the density of states to zero order and varies linearly between the pure constituents. The level breadth, given by (A6) is related to the scattering probability of a quasi-particle at the state $\underline{k}$ by

$$P_{\underline{k}} = 2 \Gamma_{\underline{k}} / \hbar \quad . \qquad (A31)$$

It is known that when the probability of staying in a state damps exponentially with time, a level is broadened into the Lorentzian type[41] . Using the Lorentzian form and assuming that $\Gamma_{\underline{k}}$ is constant in the neighborhood of the Fermi level, then the number of states between E and E+dE is given by

$$N(E)\,dE = \frac{1}{\pi} \sum_{\underline{k}} \frac{\Gamma}{(\varepsilon_{\underline{k}} - E)^2 + \Gamma^2} \, dE \quad . \qquad (A32)$$

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Therefore, the density of states at the Fermi level is written as,

$$N(E_F) = \pi^{-1} \int_{-\infty}^{\infty} \frac{N(\varepsilon_{\underline{k}})\ \Gamma}{\varepsilon_{\underline{k}}^{\,2} + \Gamma^2}\, d\varepsilon_{\underline{k}} \qquad (A33)$$

where $\varepsilon_{\underline{k}}$ is measured relative to the Fermi level. By substituting (A29) into (A33) and integrating we obtain

$$N(E_F) = N_o\left(1 + \lambda_{ep} G\left(\frac{\Gamma}{k_B \theta_D}\right)\right) , \qquad (A34)$$

where N_o is the zero-order density of states and the function G is defined by

$$G(y) = 1 - y^2 \ln\left(1 + \frac{1}{y^2}\right) \qquad (A35)$$

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APPENDIX B. SAMPLE PREPARATION

As stated in the main text, the samples which have been prepared cover the complete binary Ag_{α}-$Au_{1-\alpha}$ disordered alloy series and the Ag_{α}-(60at.% Au-40at.% Cu)$_{1-\alpha}$ disordered ternary alloy series along with the two individual samples of $Ag_{0.5}$-(72at.% Au-28at.% Cu)$_{0.5}$ and $Ag_{0.5}$-(84at.% Au-16at.% Cu)$_{0.5}$. Figure B1. shows the phase diagram for the Ag-Au binary alloys which exhibit no tendency for long range ordering and therefore present little difficulty in sample preparation. In the case of the ternary alloys, no such complete phase diagram exists. A melting point curve, shown in Figure B2, is available in the literature[10] and outlines a eutectic region associated with the copper-silver rich ternary alloys. The atom fractions of the constituents in the ternary alloys have been chosen to remain outside of this eutectic boundary. Although no complete ternary phase diagram exists, it is known from the copper-gold binary phase diagram, shown in Figure B3, that there must be a tendency for the ternary alloys to order. This should occur at low silver concentrations near the regions of the intermetallic compounds of copper-gold. In particular, (60at.% Au-40at.% Cu) forms the δ ordered phase below approximately 360^{o}C, (72at.% Au-28at.% Cu)

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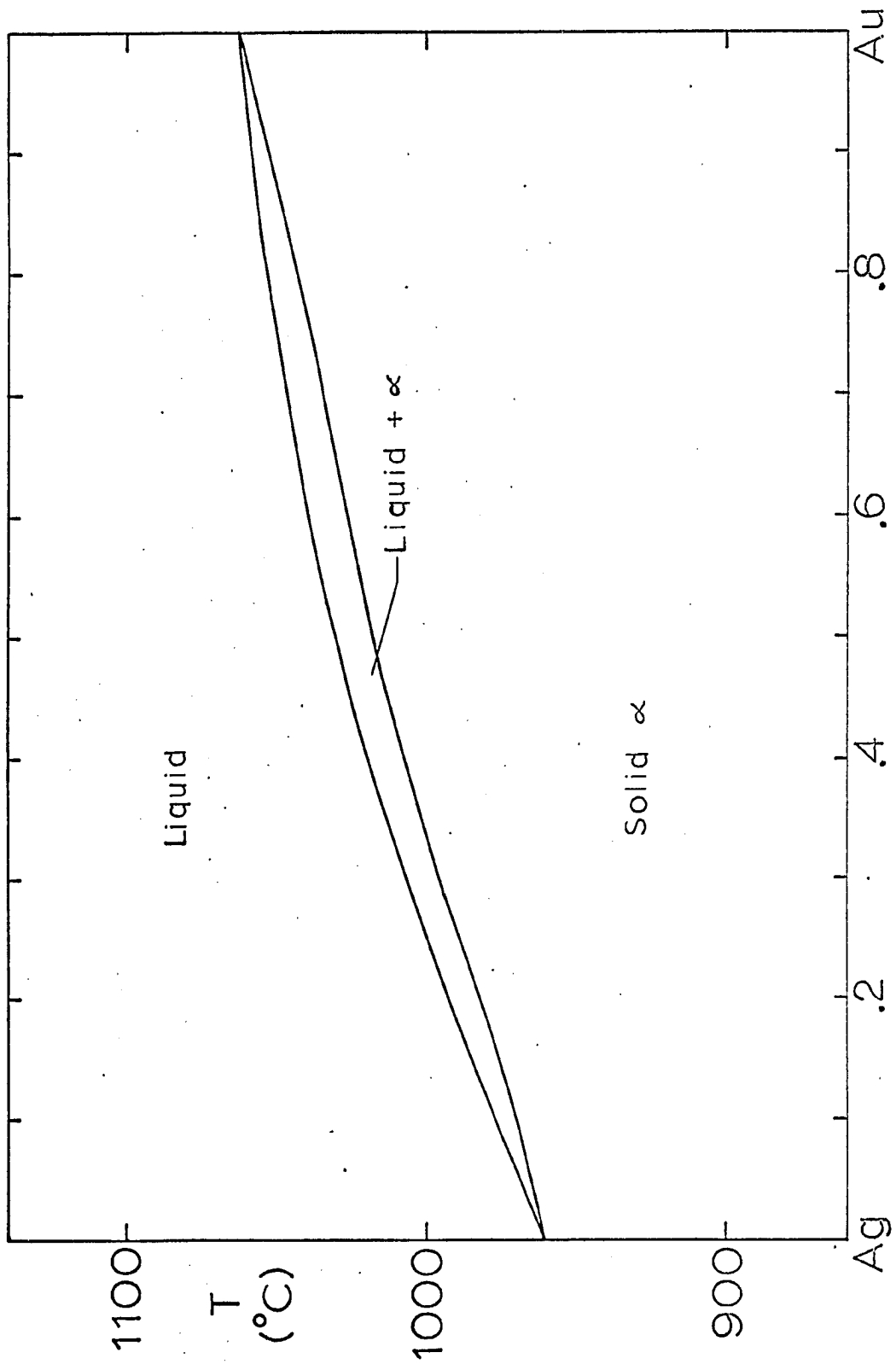

Figure B1. Phase diagram of silver-gold binary alloy

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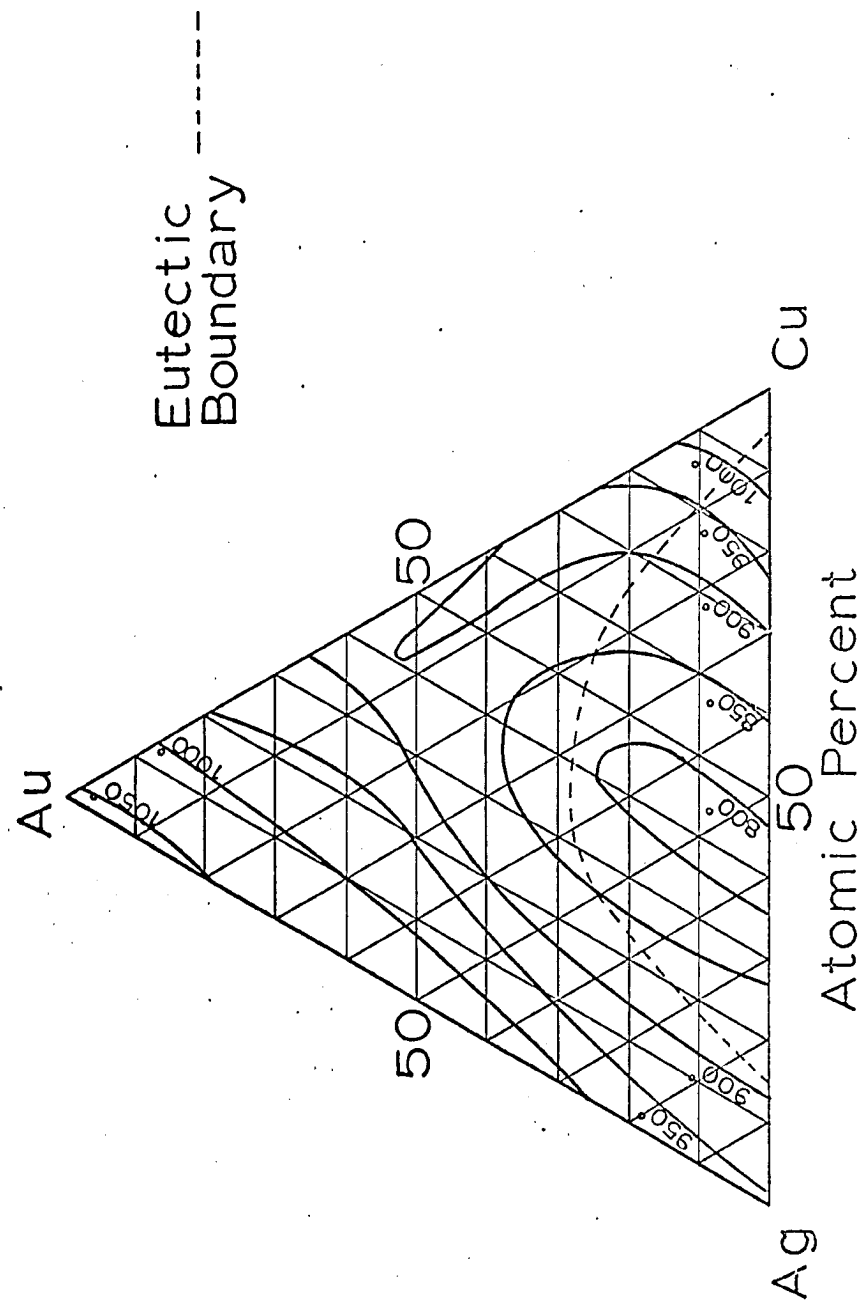

Figure B2. Liquidus diagram for copper-silver-gold ternary alloy system

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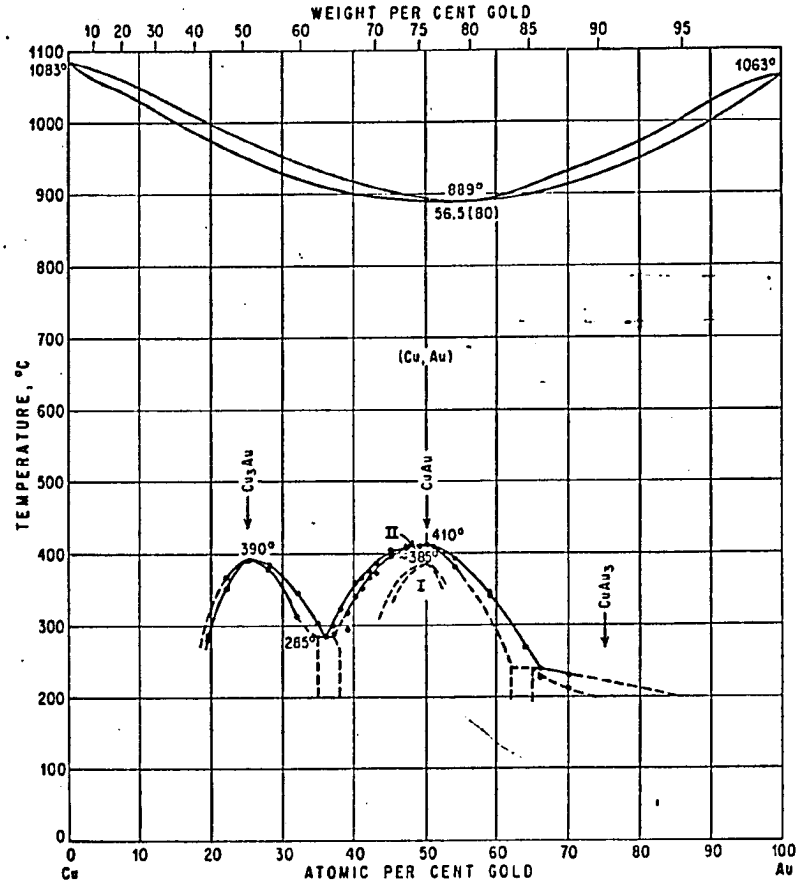

Figure B3. Phase diagram of copper-gold binary alloy

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forms the δ ordered phase below approximately 120°C and (84at.% Au-16at.% Cu) shows no tendency for ordering. The methods used to ensure disordered solutions of the ternary alloys are discussed in the description of their preparation.

All of the material used in making the alloys has been purchased from American Smelting and Refining Company. The gold is in the form of 99.999+% pure gold spatter; the silver is in the form of 99.999+% pure silver shot; and the copper is in the form of 3/8" diameter rod and is 99.9999% pure. In making the ternary alloys, the copper rod is cut to the approximate size needed with a carbide saw and etched thoroughly in HNO_3 before weighing.

All of the alloys have been prepared by induction melting the proper amount of materials in a graphite crucible under an inert helium atmosphere. Figure B4 shows a schematic of the experimental apparatus. Very pure reactor grade graphite has been purchased from Union Carbide Corporation for use in the crucibles and has been machined with carbide tipped tool bits to the desired size. The machined crucibles for most of the samples are 1-1/2" O.D. x 1-3/16" I.D. x approximately 6"long. After machining, each of the crucibles is baked out for approximately one half hour at 100°C above the maximum temperature to be reached in the melting process. The support for the crucible consists of a mullite rod, which

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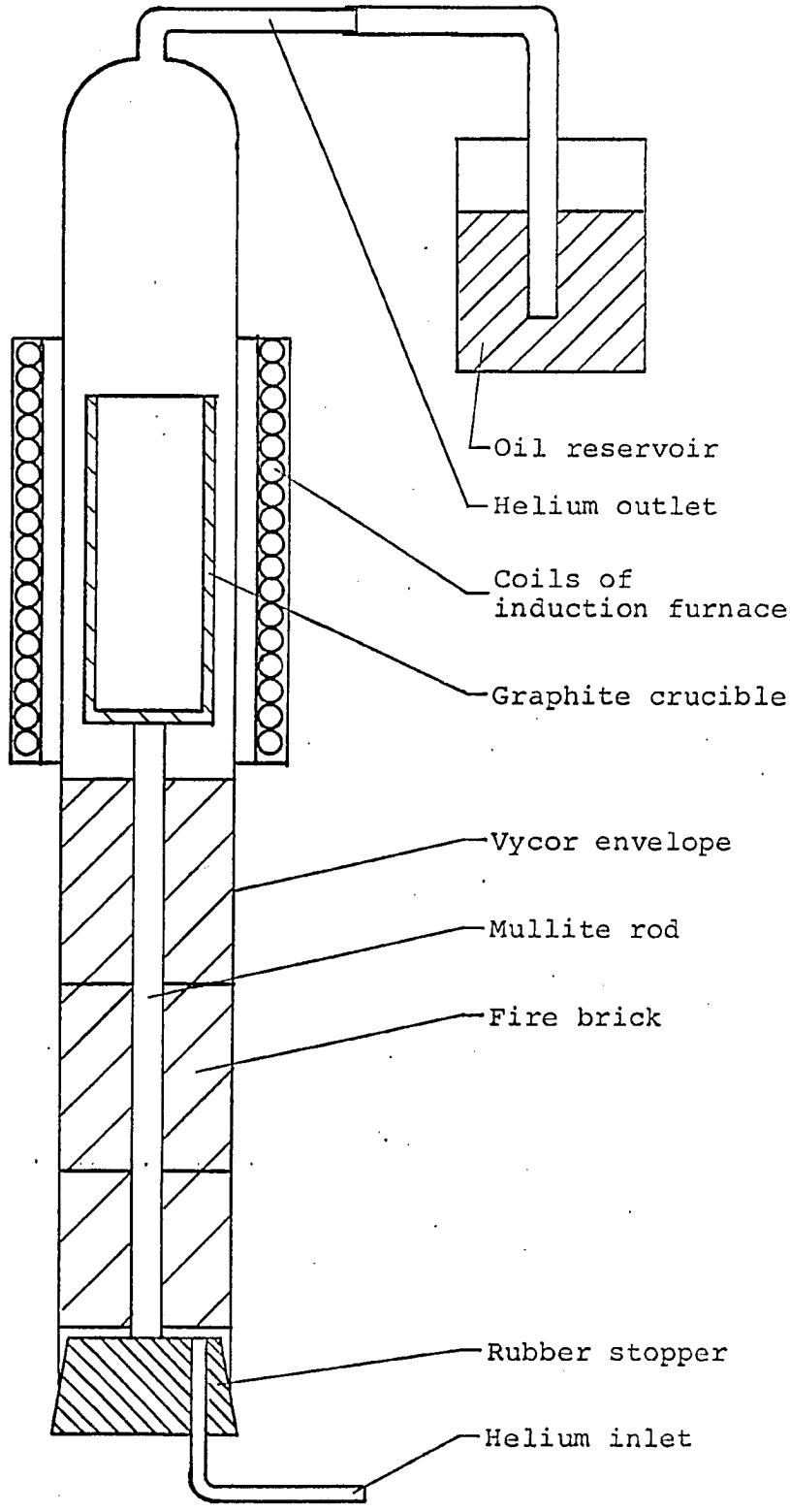

Figure B4. Schematic diagram of induction melting apparatus

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is surrounded by high temperature fire brick machined to a cylindrical shape to fit inside the vycor envelope. The bottom end of the 2" I.D. vycor envelope is sealed with a rubber stopper which contains a piece of glass tubing for admitting helium gas. The top of the envelope is necked down to 3/8" diameter and is bent at right angles to the axis of the envelope so as to prevent foreign material from dropping into the crucible. During the melting process, helium gas is constantly bubbled through an external oil reservoir.

To melt a sample, the crucible filled with the constituents is placed in the oven and helium gas is bubbled through the envelope until all of the air is displaced. The induction furnace is turned on and the power is slowly increased until all of the material within the crucible is molten. The molten solution is held above its melting point for 15 to 30 minutes. During this period, eddy current mixing ensures a homogeneous distribution of the constituents. After the mixing period, the power is slowly decreased until solidification occurs. The helium atmosphere is maintained until the sample returns to room temperature, then it is weighed and compared to the total constituent weight to determine if any significant contamination has occurred during the melting process. Following the formation of the initial ingot, the preparation of the binary alloys differs from that of the ternary alloys and they will be discussed separately.

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The binary alloys are first cold worked in three perpendicular directions. The alloys are pressed between oil hardened tool steel plates and compressed in each direction to approximately 60 to 70% of their original length. The alloys are then drilled and tapped with a small 8-32 hole. Solid carbide drills and taps have been used in the preparation of all of the alloys as well as carbide tipped slitting saws and tool bits for machining operations. The small 8-32 hole allows a threaded stainless steel rod to be screwed into the sample to act as both a suspension mechanism and an electrode for purposes of electrolytic etching. The samples are etched in this case, as well as all other etches, in a 10% solution of KCN in water. The cathode consists of four equally spaced strips of stainless steel sheet placed around the sample. An etching current of approximately 2 amps is used and etching times are of the order of 3 to 5 minutes. With the surface contamination removed, the alloys are placed in an evacuated vycor ampoule and homogenized at 800^{o}C for 72 hours. At the end of the homogenization, the samples are removed from the oven and quenched in cold water to retain the disorder. Using a carbide tipped slitting saw, an axial section is cut from the ingot large enough to produce a .100" x .100" cross section resistivity sample. This resistivity sample is machined using a carbide tipped flycutter to the desired cross section and the ends are

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squared off. The remaining specific heat sample is machined flat on the top and bottom surface and then drilled and tapped top and bottom with 8-32 holes. The 8-32 holes allow mounting of the addenda as discussed in Appendix C. The specific heat samples are given a final etch and are then ready for measurement. Due to the extensive machining of the resistivity specimens, they are given another heat treatment, in vacuo, at 800°C for 72 hours and quenched in cold water before measurement.

The ternary alloy samples as cast are already so hard that they are impossible to cold work to any degree. They are therefore tapped with a small 8-32 hole and etched in KCN as in the case of the binary alloys. They are then sealed in an evacuated vycor ampoule and homogenized at 725°C for 72 hours after which they are quenched in cold water. The samples are machined, and in addition to the specific heat specimen and resistivity specimen taken from the binary alloys, a thin cylindrical section is cut from the top of the samples for possible metallographic analysis or diffractometer measurements. The specific heat samples are again etched in KCN to remove surface contamination. The specific heat specimens and resistivity specimens are then sealed in an evacuated pyrex envelope. This envelope breaks on quenching and ensures a rapid quench. There is some evidence in the literature[15,25]

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that in the case of copper gold binary alloys, which have a tendency to order, quenching from temperatures just below the melting point can produce a more ordered sample than quenching from just above the transition temperature. This is due to the fact that a high quench temperature quenches in vacancies and subsequent annealing can produce ordering. To avoid this problem the method used by Martin is employed. That is, all of the ternary alloys are heat treated and quenched in distilled water from 425^{o}C,which is slightly above the highest ordering temperature in the copper gold binary series. After quenching, the specific heat specimens are again etched in KCN and are then ready for measurement along with the resistivity specimens.

Table BI shows some of the more important data involving the specimens which have been measured and Figure B5 is a photograph of the majority of the specimens which have been measured. The resistivity specimens are .100" x .100" x approximately 1.25" long and the specific heat specimens are approximately 1-1/4" diameter by 1-1/4" high. As the picture shows, all of the specimens are polycrystalline with the grain size in the alloys ranging from a very small value to approximately .200" in size. In the binary alloy series, the samples remain silver in color until approximately 50 at.% gold is added to silver and then the characteristic gold color is dominant. In the ternary series the colors range from

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salmon at (60at.% Au-40at.% Cu) to a gold color at intermediate alloys and then to the silver color at the pure silver end.

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Table BI. Alloy data

Alloy atom percent			Alloy constituent weights			Atomic weight	Lat. const.	S.H. spec. weight	S.H. spec. gram-moles
Cu	Ag	Au	Cu	Ag	Au	(gms.)	(Å)	(gms.)	
		100			412.222	196.967	4.0784	408.710	2.07502
	5.0	95.0		11.3021	392.042	192.512	4.0773	367.444	1.90868
	10.0	90.0		22.6016	371.348	188.057	4.0766	351.365	1.86840*
	10.0	90.0		22.6027	371.337	188.057	4.0766	351.252	1.86780#
	17.5	82.5		39.5655	340.485	181.377	4.0760	348.297	1.92029
	25.0	75.0		59.2742	324.463	174.685	4.0757	330.398	1.89140
	50.0	50.0		122.445	223.572	152.425	4.0760	307.571	2.01786
	70.0	30.0		172.2075	134.7475	134.606	4.0785	266.578	1.98044
	80.0	20.0		194.5075	88.7907	125.699	4.0806	267.452	2.12772
	90.0	10.0		212.790	43.1814	116.791	4.0831	240.655	2.06056
	100			224.6215		107.880	4.0861	221.809	2.05607
40.0		60.0	63.9446		297.186	143.608	3.9229	276.404	1.92471
36.0	10.0	54.0	56.5024	26.6245	262.605	140.035	3.9370	267.152	1.90774
32.0	20.0	48.0	49.4381	52.4379	229.772	136.462	3.9520	239.185	1.75275
28.0	30.0	42.0	42.5128	77.2985	197.596	132.891	3.9679	265.725	1.99957
24.0	40.0	36.0	36.0198	101.8766	167.418	129.317	3.9844	251.168	1.94224
20.0	50.0	30.0	29.8277	126.5454	138.639	125.744	4.0013	247.065	1.96480
12.0	70.0	18.0	17.3253	171.511	80.5229	118.598	4.0357	219.984	1.85486
4.0	90.0	6.0	6.1181	233.606	28.4357	111.453	4.0694	219.397	1.96851
14.0	50.0	36.0	20.4772	124.115	163.156	133.748	4.0237	251.208	1.87822
8.0	50.0	42.0	12.1166	128.522	197.109	141.752	4.0460	276.557	1.95099

*sample no. 1 #sample no. 2

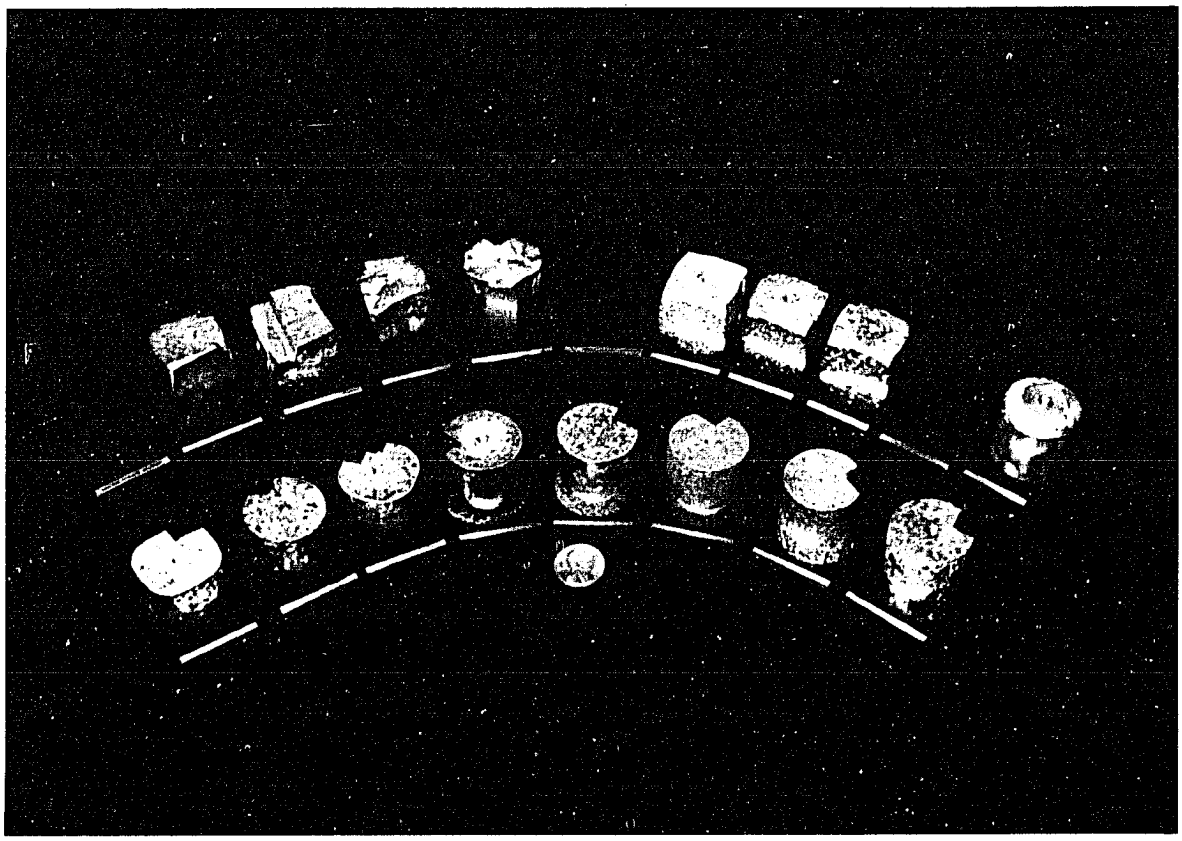

Figure B5. Photograph showing majority of samples measured. Smaller resistivity samples are placed directly in front of larger specific heat samples where they exist. Back row is silver-gold binary alloy system and front row is copper-silver-gold ternary alloy system. Reading from left to right the samples are:
Back row: 98at.% gold-2at.% silver (ρ only), 95at.% gold-5at.% silver, 90at.% gold-10at.% silver, 82.5at.% gold-17.5at.% silver, 75at.% gold-25at.% silver, 50at.% gold-50at.% silver (ρ only), 30at.% gold-70at.% silver, 20at.% gold-80at.% silver, 10at.% gold-90at.% silver, 2at.% gold-98at.% silver (ρ only), 100at.% silver.
Front row: 60at.% gold-40at.% copper, 90at.%(60at.% gold-40at.% copper)-10at.% silver, 80at.%(60at.% gold-40at.% copper)-20at.% silver, 70at.%(60at.% gold-40at.% copper)-30at.% silver, 60at.%(60at.% gold-40at.% copper)-40at.% silver, 50at.%(60at.% gold-40at.% copper)-50at.% silver, 30at.%(60at.% gold-40at.% copper)-70at.% silver, 10at.%(60at.% gold-40at.% copper)-90at.% silver.

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APPENDIX C. APPARATUS

Specific Heat Apparatus

The basic mechanical components of the apparatus can be broken down into three categories: the probe or calorimeter, the metal dewar and the supporting vacuum systems. Figure C1 shows the basic configuration of the calorimeter inside the metal dewar. The metal dewar is constructed of stainless steel, except where noted, and consists of the sections labeled A through D in the figure. Region A is a permanently sealed vacuum space isolating the liquid nitrogen bath from room temperature. Region B is the liquid nitrogen space which has a capacity of 7 liters. The bottom 30 inches of the inside wall of this section is made of copper to facilitate cooling of the top portion of the probe. Contact of the probe with the nitrogen bath is made by a set of springy copper fingers as shown in the drawing and discussed in subsequent paragraphs. Section C is an externally pumped vacuum space which isolates the nitrogen bath from the liquid helium bath. Region D, the inner helium dewar, has an overall depth of 41-1/2 inches and a liquid helium capacity of 7 liters.

The entire metal dewar is rigidly attached to a 100 pound cast iron base mounted on shock absorbers to reduce vibrations transmitted through the floor.

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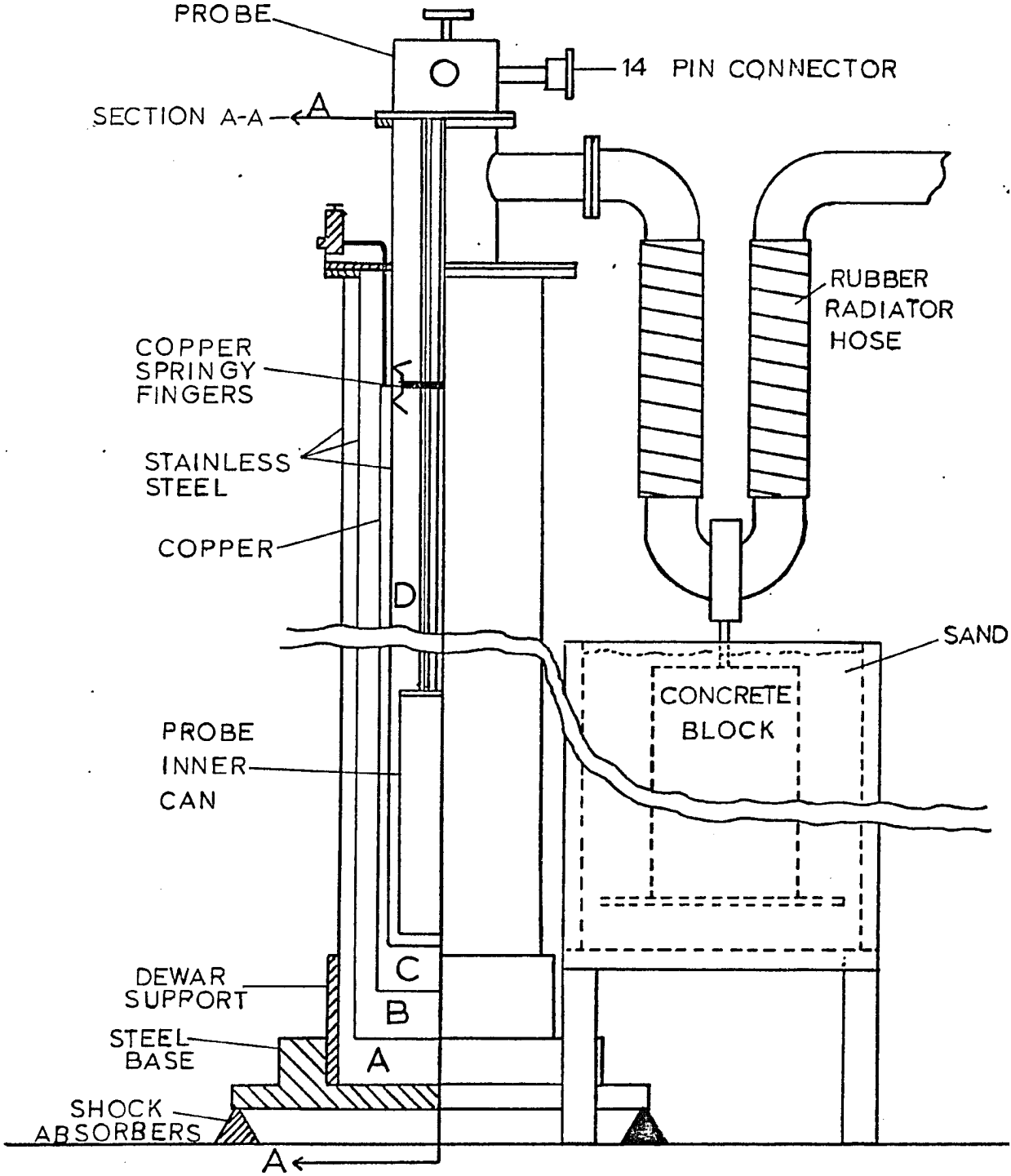

Figure C1. Overall view of metal dewar and calorimeter.

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Vibrations transmitted along the pumping line for the inner dewar are also damped by means of two flexible rubber radiator hoses. The U-shaped section of the pipe between the two hoses is connected to a concrete block with a board attached to the bottom. The concrete block assembly is completely embedded in a 12" x 16" x 20" box filled with sand. The tension produced by the block in the sand, in conjunction with the flexible hoses, effectively reduces the pump vibration transmitted along the pumping line and thus reduces extraneous heating of the sample.

The pumping line for the main helium chamber, along with the remainder of the supporting vacuum systems, is shown in the schematic representation of Figure C2. The three inch diameter main pumping line is connected to a Heraeus E135 oil sealed mechanical pump. Changes in pumping speed can be obtained by use of the three inch Kinney bellows sealed valve, (V16), or two smaller Kerotest valves, (V18, V19). A manostat is also available for maintaining the constant pumping speeds necessary for any temperature calibrations.

The high vacuum system is necessary to ensure thermal isolation of the sample, requiring pressures on the order of 10^{-6} mm Hg in the calorimeter inner and outer can. This vacuum is obtained by use of a two inch Heraeus oil

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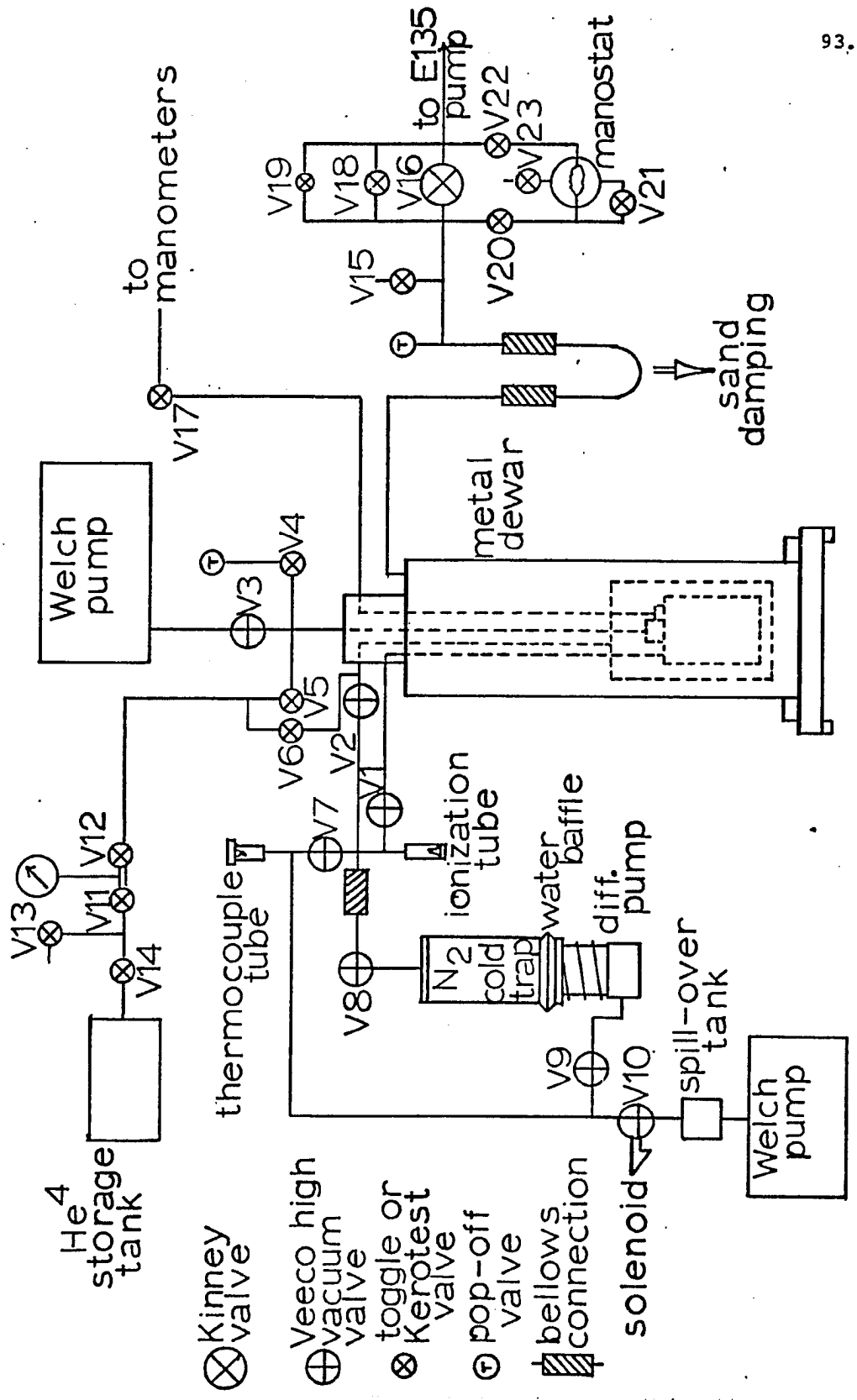

Figure C2 External plumbing schematic

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diffusion pump, with a Welch 1400 mechanical pump supplying the backing pressure. A water cooled baffle, together with a liquid nitrogen cold trap, prevent back streaming of the diffusion pump oil. Connection of the high vacuum system to the calorimeter is made by means of a flexible stainless steel bellows with Heraeus "Quick Fit" rubber O-ring connectors to minimize transmitted vibrations. The high vacuum pressures are monitored with a Heraeus Ionivac 2 ionization gauge and the backing pressure with a NRC thermocouple gauge. In the event of malfunctions, several safety devices are present in the high vacuum system. A thermostat has been installed on the cooling coils of the diffusion pump so that, in the event of a water failure, the heater on the diffusion pump is turned off. In the event of a power failure, a solenoid valve placed between the backing pump and the diffusion pump seals in the pressure on the high vacuum side. The spillover tank above the backing pump catches any oil which is forced up into the pumping lines. An electrical relay prevents the entire system from reactivating when the electrical power is restored.

The remaining vacuum system is for pumping on the liquid helium contained in the probe liquid helium chamber. The pumping line is connected to a Welch 1400 mechanical pump and isolation can be obtained with a

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Veeco bellows sealed valve, (V3). The remainder of the plumbing in this section of the apparatus is for introducing exchange gas into the probe and for storing the helium gas which is condensed in the liquid helium chamber of the probe. Also shown in the diagram is the connection for the probe vapor pressure bulb to a set of external mercury and oil manometers.

The probe or calorimeter contains the sample, heat switch, refrigerant and the internal vacuum plumbing. Figure C3 shows the arrangement of the lower portion of the probe. The sample, as mentioned in Appendix B, is tapped on the top and bottom surfaces with a 8-32 hole. A 1-3/8" x .164" diameter copper rod, which is threaded over the bottom 3/8", is screwed into the top of the sample. The rod contains two small perpendicular holes for insertion of the nylon mounting threads and provides the means for contact of the sample with the jaws of the mechanical heat switch. Into the bottom of the sample is screwed a small 1/4" high x 1/2" diameter cylinder of Cu-Be with an integral 1/4" long 8-32 threaded section along the cylinder axis. The boss shoulders on the bottom surface of the sample and provides a place for clamping the heater and thermometer assembly. The heater and thermometer assembly is made of Cu-Be with the top portion being a clamp for attachment to the sample and the bottom portion containing a small tapered hole. A tapered brass coil form is

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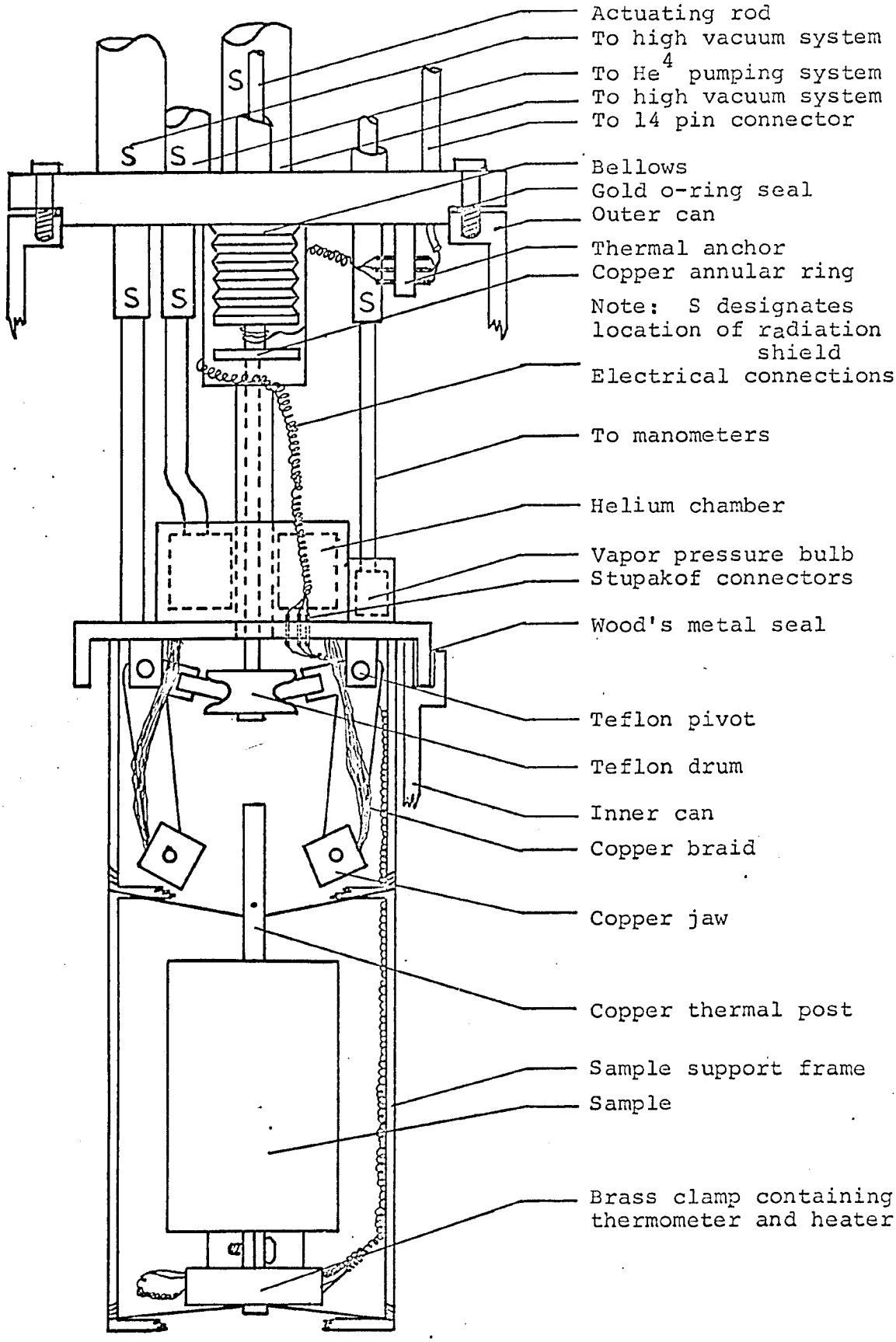

Figure C3. Lower portion of the calorimeter showing the outer can, vacuum lines, heat switch mechanism sample location and thermometer assembly.

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pressed into this hole. A heater is wound on the outside of the coil form and a germanium resistance thermometer is lacquered inside the coil form using GE-7031 lacquer. On the very bottom of the assembly is a small screw for attachment of nylon threads to stabilize the sample when it is suspended in the probe. The entire assembly of sample plus addenda is suspended by nylon threads which are lacquered in place to a brass sample support frame. This frame can be removed from the probe if desired.

The heat switch assembly is also contained within the inner can. The jaws and arms of the switch are made of copper and pivot on teflon bearings to minimize frictional heating. The jaws are thermally anchored to the helium chamber with copper braid and are faced with indium following the suggestion of Manchester[26]. This facing reduces the sticking with the thermal post and increases the cooling rate of the sample from liquid nitrogen temperature. The heat switch is operated by means of a teflon drum attached to the actuating rod. The vertical movement of the 1/8" diameter stainless steel actuating rod opens and closes the jaws of the heat switch. The actuating rod passes through the center of the helium chamber and is enclosed along its entire length by a concentric 1/4" diameter stainless steel tube, which is maintained at a common vacuum with the inner can. The actuating rod is thermally anchored to

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the outer can by soldering a copper ring between the rod and the bellows, which in turn is soldered to the outer can. In addition, copper braid is soldered between the copper ring and the copper housing surrounding the bellows assembly.

The top of the inner can, which contains the liquid helium chamber and the vapor pressure bulb, is machined out of a single piece of copper to provide good thermal contact between the two chambers for calibration of the germanium thermometer against helium vapor pressures. The helium chamber is machined in the form of a ring and has the volume of 4.5 cm^3. The pumping line for this chamber is made of 12 mil wall stainless steel tubing and increases in diameter from 1/8" to 1/2" at the top of the outer can and from 1/2" to 1" at the nitrogen heat shield. This variation in diameter maintains a high pumping speed which varies as $T^{-1/2}$ and $(dia.)^4$ along the length of the probe. A 1" pumping line, separated from the probe by (V3) as shown in Figure C2, is attached to a Welch 1400 mechanical pump for pumping on the condensed helium in the chamber. The vapor pressure bulb has a volume of 0.68 cm^3 and is connected to the top of the probe with a 1/8" stainless steel tube. This tube is enclosed concentrically from the top of the outer can to the probe head with a sealed 1/4" diameter stainless steel tube. The helium bath, surrounding the outer can and this

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tube, freezes out the trapped air providing a good vacuum and thus isolation of the vapor pressure line.

The brass inner can surrounding the sample and heat switch assembly can be attached in either of two ways. If it is necessary, as in thermometer calibrations, to have different pressures in the inner and outer can, then the inner can is attached with a vacuum tight Wood's metal seal. A common vacuum is permissible in a standard specific heat run, and in this case the inner can is merely screwed into place. The pumping lines for both the inner and outer can are 1/2" diameter stainless tubing from the top of the outer can to the nitrogen shield where they are enlarged to 5/8" diameter to the probe head. The pumping line from the outer to the inner can is 1/8" diameter stainless steel tube.

The nitrogen heat shield of the probe is approximately 30" above the bottom of the inner can. The pumping lines are soldered to a copper ring which in turn is soldered along its circumference to a set of copper springy fingers. These springy fingers contact the inside wall of the metal dewar. The point of contact occurs just above the point where the vacuum jacket begins separating the nitrogen bath from the helium bath. This provides thermal contact of the heat shield with the $77^{o}K$ liquid nitrogen at this point.

All of the pumping lines are provided with radiation shields, which are thermally anchored to the top of the

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outer can and thus the surrounding helium bath. These shields, which are designated by S in Figure C3, are made of copper and consist of overlapping plates soldered into a copper cylinder similar to a venetian blind. The baffles are in turn soldered into the stainless steel lines at the top of the outer can.

The brass outer can is attached to the probe by means of 20 equally spaced Allen head screws around its circumference. A gold O-ring is squeezed between the copper beryllium surfaces of the outer can and the top of the outer can. A vacuum tight seal is obtained by gradually and successively tightening the 20 screws in a clockwise or counter-clockwise direction until further tightening becomes extremely difficult. The gold O-ring is made from .030" diameter chemically pure gold wire. The wire is cut to the required length and the ends are held together in compression with a small jig while they are fused together with a small torch. The resulting beaded junction is filed back to its original diameter and the entire O-ring is annealed with a soft flame.

All electrical connections to the inner can pass through a 14 pin vacuum sealed connector at the probe head and are fed through nylon spaghetti. These leads are passed down a 1/8" stainless steel tube to the top of the outer can. A section of this stainless tube, just above the top of the outer can, has been cut out and

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replaced with a coiled section of 3/16" diameter soft copper tubing. The coiled tubing, sitting in the helium bath, acts as a radiation baffle for the electrical leads line, which is kept at a common vacuum with the outer can. Thermal anchoring of the leads takes place just inside the outer can where they are soldered to short insulated sections of copper wire which are in intimate thermal contact with the top of the outer can. Further thermal anchoring is provided by wrapping the coiled leads around the bellows housing and lacquering them in place. The leads are fed into the inner can through individual type Stupakoff feed-through terminals soldered into the top of the inner can. The coiled leads inside the inner can are tied and lacquered with nylon thread to the brass support frame and are then attached to the heater and thermometer respectively.

The circuitry used to measure the temperature of the sample using a germanium resistance thermometer is shown schematically in Figure C4. As mentioned previously, the Cryocal Inc. four terminal encapsulated germanium thermometer is cemented into the addenda assembly using GE-7031 lacquer. The thermometer leads are connected to the vacuum tight Stupakoff terminals in the top of the inner can using coiled #37 gauge manganin wire. From the Stupakoff connectors, coiled #40 gauge copper wire is wound

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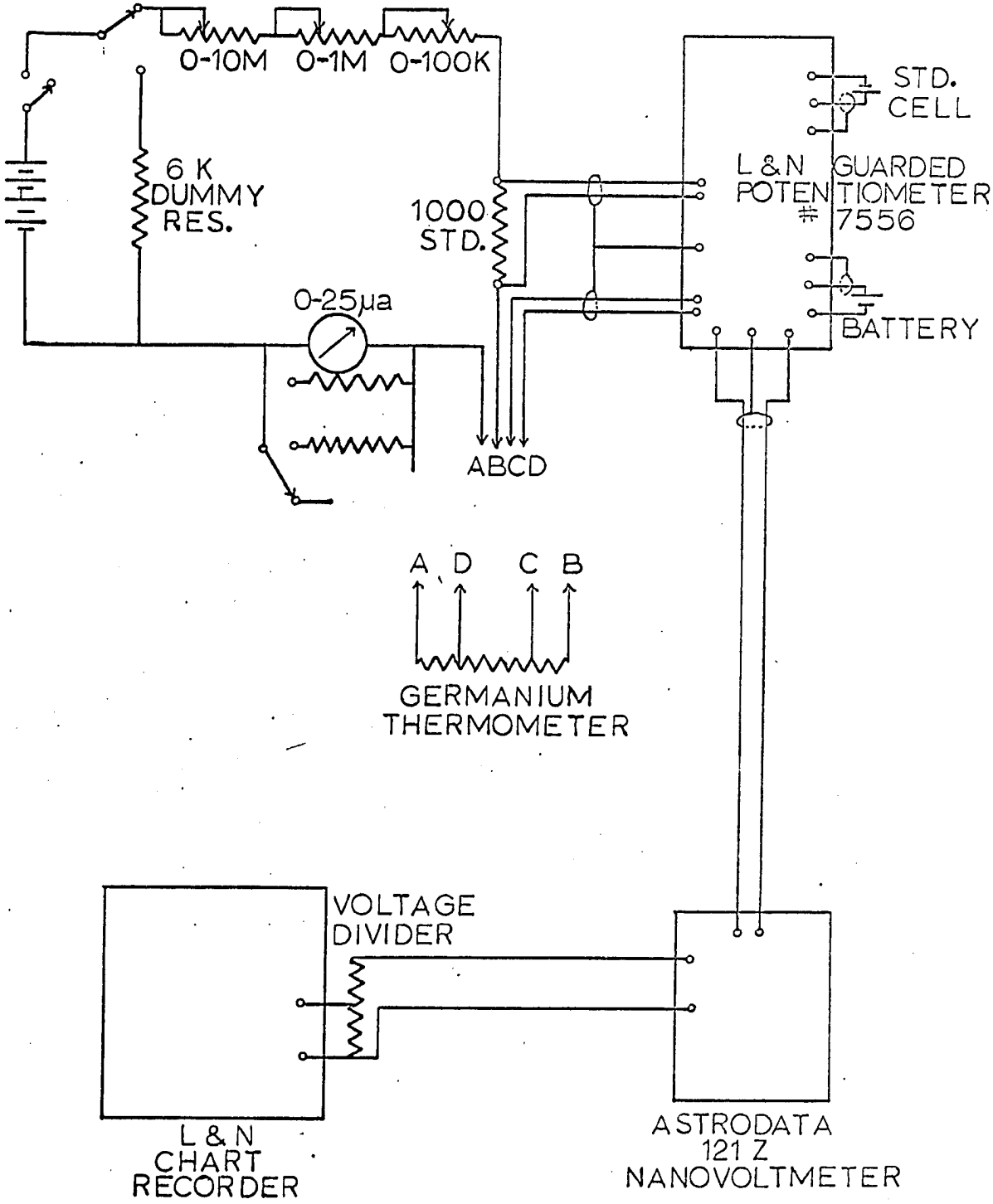

Figure C4. Block diagram of thermometer circuit

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around the bellows housing as a heat sink and soldered to the insulated copper terminals at the top of the outer can as shown in Figure C3. The connections from this thermal anchor to the 14 pen connector are also made with #40 copper wire enclosed in nylon spaghetti. Low thermal solder is used in all of the solder connections which involve the measurement of the voltage drop across the thermometer.

The germanium resistance thermometer was calibrated in the range 1.2°K to 4.2°K against the 1958 He^4 vapor pressure scale[28] at the Westinghouse Research Laboratories by Dr. J. A. Rayne. For approximate use, the resistive temperatures were fit to an equation of the form:

$$\log T_R = a + b(\log R) + c(\log R)^2 \quad . \qquad (C1)$$

The coefficients in equation (C1), for the temperature range of interest, are: a=2.95749, b=-1.00170, c=0.080088. The deviations of the true temperature, as determined by the helium vapor pressures, from the resistive temperature T_R, are plotted as $T-T_R$ versus T_R in Figure C5. For reduction of actual data, a smooth curve has been drawn through the deviation plot data of $T-T_R$ and a table has been generated to give the actual temperature versus the resistance at intervals of approximately $\Delta T \simeq .01°K$. The actual temperature equivalent to a resistance value is then determined from the table by Lagragian interpolation.

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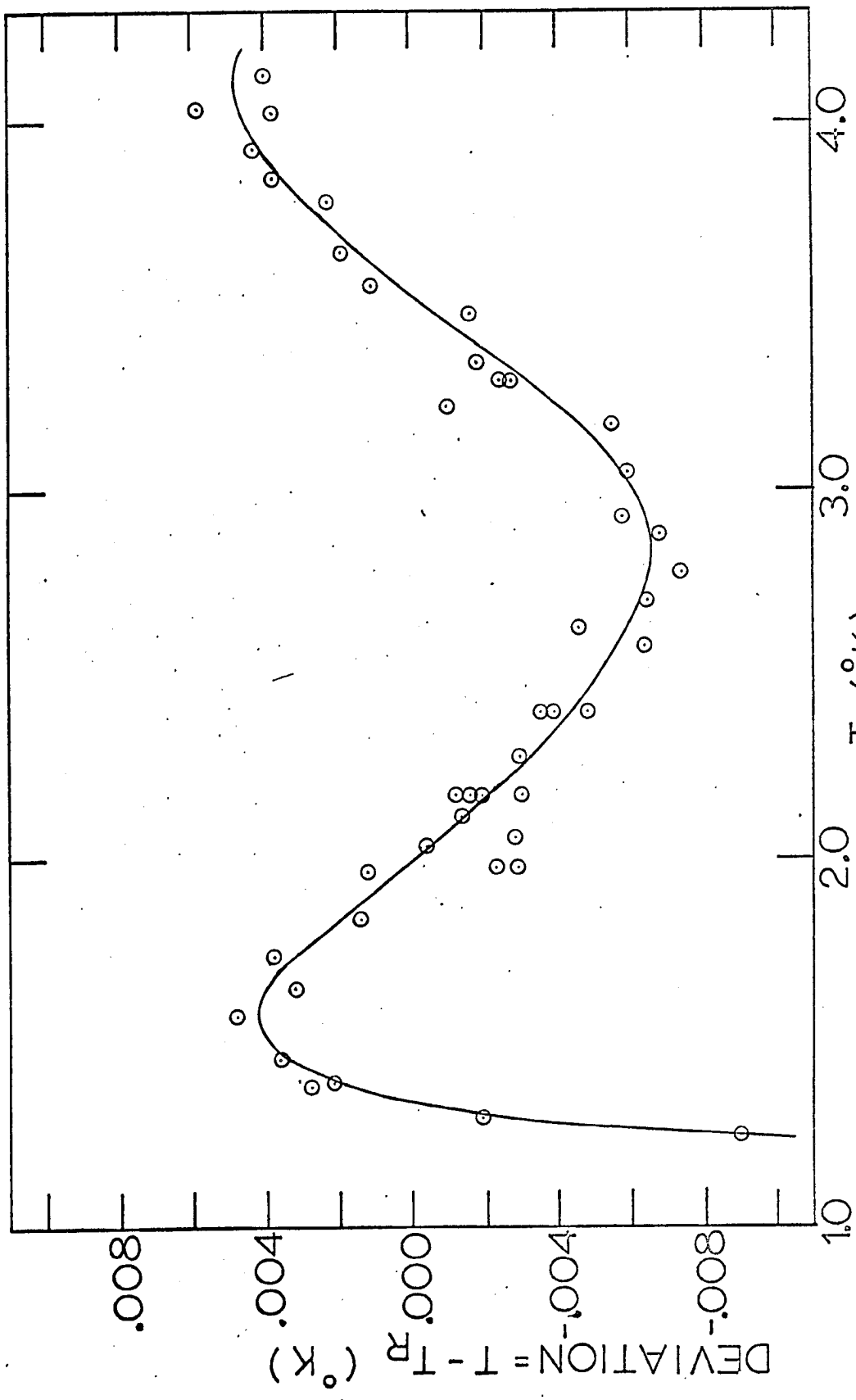

Figure C5. Deviation plot of $T-T_R$ versus T_R for the germanium thermometer

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The current source for the germanium thermometer is a standard 6 volt storage battery with the output controlled by the series of three resistances as shown in Figure C4. The 0-10M and 0-1M are divided in 10 steps and the 100 K resistor is a 10 turn Borg micropot. A thermometer current of 2 microamps is used at helium temperatures with the current increasing gradually to 1 milliamp at room temperature. The current is measured as a voltage drop across a Leeds and Northrup 1000 ohm secondary standard resistor. The original accuracy of this resistor of .05% has been increased to .001% by recalibrating it with a NBS type primary resistance standard. This recalibration has been completed with the resistors directly in the final circuit and using the same measuring equipment as used to measure the thermometer currents. The 25 microamp meter can be set to full scale readings of 2500, 250, and 25 microamps for coarse current adjustments. A 6K dummy resistor is placed in the circuit so that when the thermometer current is turned off in the 1000 ohm standard, the battery is not open circuited and only a short time is required for stabilization of the battery when it is switched back into the circuit. A Leeds and Northrup guarded six dial potentiometer is used to measure the thermometer current and thermometer voltages. Maximum readings of the potentiometer on its three scales are 1.6 volts, .16 volts and .016 volts with steps of 1,

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0.1 and 0.01 microvolts respectively. A 120 amp hr. 6 volt low discharge Willard battery is used as the working cell for the potentiometer. The low discharge working battery, Eppley standard cell, null detector and connecting lead wires are all individually guarded to prevent current leakage paths and are highly insulated from ground. A copper box encloses the standard cell and low discharge battery and another box encloses the thermometer current supply battery to act as electrostatic shields along with the potentiometer case. An Astrodata Model 121 A d.c. nanovoltmeter is used as a null detector and gives a 3 volt signal for a full scale reading on any sensitivity setting. This output signal is reduced by a 300:1 voltage divider and supplier to a Leeds and Northrup Speedomax W strip chart recorder for monitoring the potentiometer out-of-balance voltages.

A schematic representation of the heater circuit is given in Figure C6. The sample heater is wound from #50 gauge manganin wire and has a resistance of 1782.84 ohms at 4.2^{o}K. Coiled #37 gauge manganin wire is used to connect the heater to the Stupakoff connectors in the inner can. The resistance of these leads has been measured at 4.2^{o}K and a correction is made for this lead resistance under the usual assumption that half of the leads power is conducted to the sample. The total lead resistance is 30.93 ohms giving a power correction factor of 99.15% of the power going to the sample. The four

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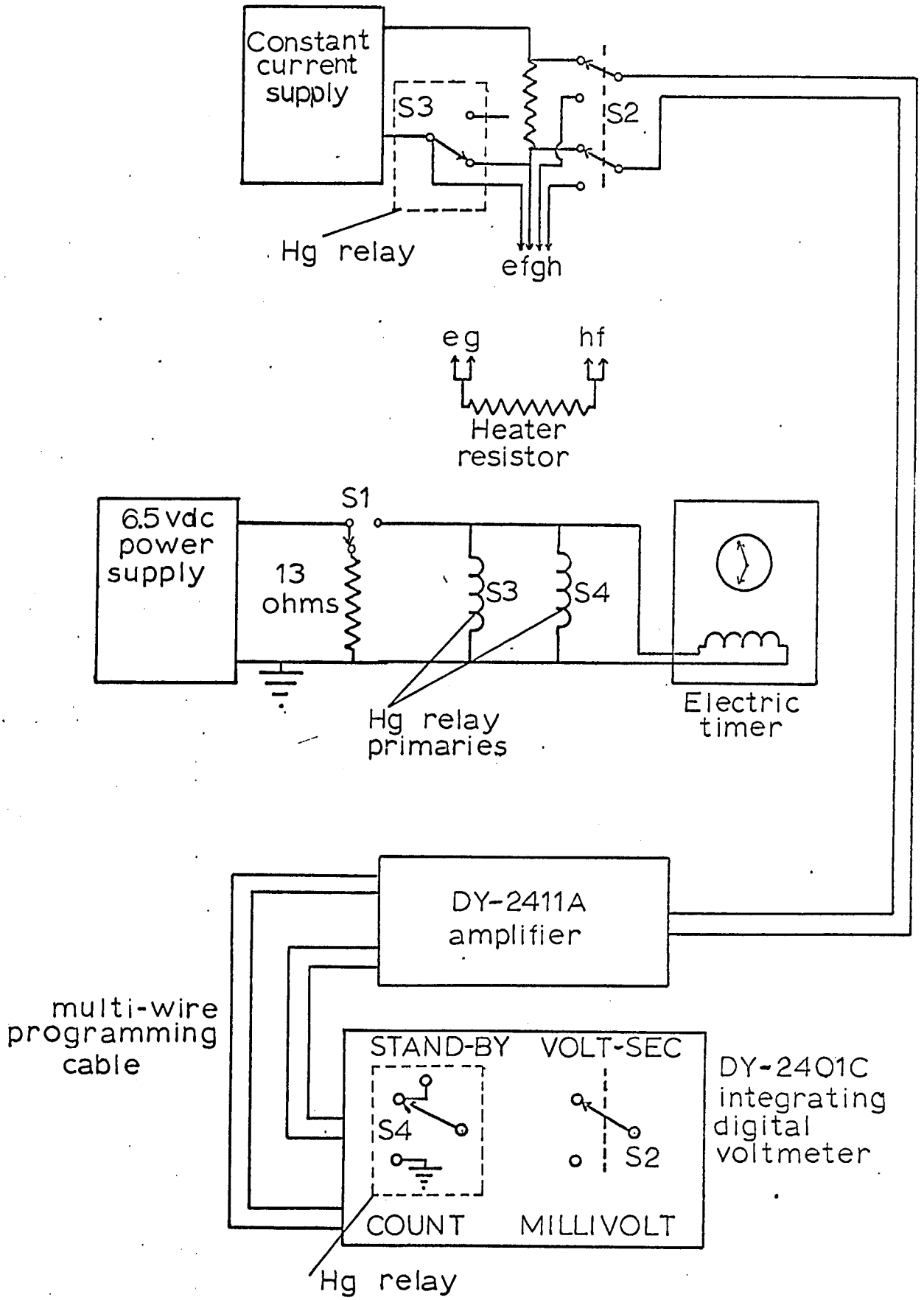

Figure C6. Block diagram of heater-timer circuit

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heater leads soldered to the top of the two Stupakoff connectors are #40 gauge copper wire and are wired in a similar manner to the thermometer leads. The heating current is generated with a Electronic Measurements Model C612 constant current supply which has a current regulation better than .1% and less than a millisecond transient response time for recovery from a step change of 0-100 volts. Heating current, for the samples measured, is either .22 ma or .5 ma depending on the temperature and sample specific heat. Heating times are kept below 45 seconds. The heater current is measured as a voltage drop across a Leeds and Northrup 100 ohm secondary standard resistor. This resistor has been recalibrated with a NBS primary standard resistance in the final circuit and using the same measuring equipment that is used to measure the actual currents. The resultant value for the resistor was 99.938 $\pm$ .001 ohms. The Hewlett Packard Model DY-2411A Guarded Data Amplifier and DY-2401C Integrating Digital Voltmeter, which are externally programmed by external closures to ground, are used in two different functional modes as controlled by switch S2. In the MILLIVOLT mode the digital voltmeter reads the thermometer current I_H across the 100 ohm resistor. This measurement is taken immediately after the heating period of a data point. In the VOLT SEC mode S2 switches the input leads of the digital voltmeter across the potential leads

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of the heater. When S4 is closed to ground the voltmeter is gated to read the time integral of the heater voltage V_H until the gate S4 is again opened. The power supplied to the sample is calculated as $\Delta Q = I_H \int_0^t V_H dt$ which can be corrected for the heater leads power. The time integration of the voltage technique includes any change in the heater resistance due to over heating of the heater resistor during a heating period. This effect is quite small at helium temperatures.

S3 and S4 are mercury-wetted relay contacts. When S1 is closed, 6.5 volts from a Zener regulated power supply is switched across the clutch of an electric timer and across the energizing coils of the two relays, S3 and S4. When the make-before-break switch S3 is opened, current begins flowing through the heater resistor. At the same time, the break-before-make switch S4 closes the gate on the digital voltmeter to ground which starts integrating the heater voltage. By means of a simple circuit, the lapse in time between the two switch operations of S3 and S4 has been measured and found to be approximately 1 msec. on either opening or closing. This time difference produces a negligible error in the measurements.

A simple d.c. Wheatstone bridge circuit is used to measure the helium level in the metal dewar. The circuit

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diagram for the depth gauge is shown in Figure C7. Three 47 ohm 1/10 watt carbon resistors are placed at three locations along the probe and are used as sensors for the depth gauge. When the helium level passes the carbon resistor, there is a large change in resistance due to the cooling, which is seen as a large step in the meter reading. The sensing resistors are enclosed in micarta to prevent them from being cooled excessively by the helium vapors and thus giving false meter readings. Connections to the bridge are made through a 7-pin hermetically sealed Winchester connector at the top of the probe.

Resistivity Apparatus

The resistivity measurements are made by the standard four terminal method. The .100" x .100" x 1.25" long samples are placed on the platform of the micarta tip of the measuring probe and held in place by the current and voltage contacts. All four of these contacts are made of .010" thick phosphor bronze material. The current contacts clamp the sample at its extremities and the voltage contacts, which have been filed to a pointed contact, clamp the sample at two points approximately 3/8" apart in the center of the sample. The other end of the four contacts are each clamped between two small copper blocks. The lead wires are soldered to one of these two copper blocks. The #36 gauge copper wires for the current leads pass to the top of the probe and are terminated at a Winchester

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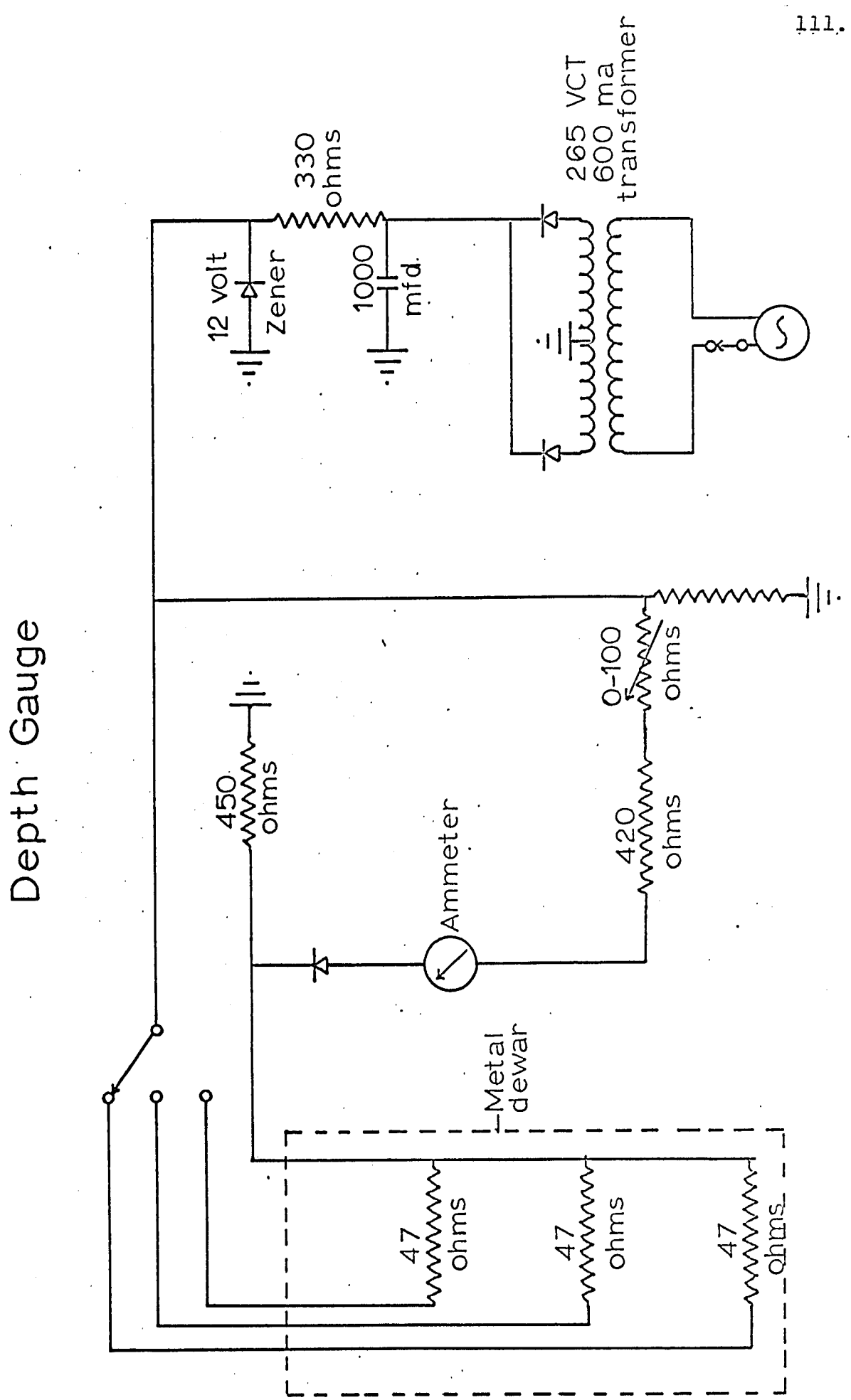

Figure C7. Depth gauge circuit

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hermetically sealed connector. The two #36 gauge copper voltage leads are passed through individual Stupakoff seals at the top of the probe and are terminated at the guarded data amplifier low thermal plug. Low thermal solder is used at all connections of the voltage leads to keep thermal emf's at a minimum.

Figure C8 shows a schematic representation of the measuring circuit. The current is supplied by a Hewlett Packard 6101A d.c. power supply. The current is fed through a junction box to a reversing switch and then through a standard resistor and the sample. The standard resistor has been calibrated with another primary standard resistor and found to be .033099 ohms. The voltages developed by the sample are fed through the guarded data amplifier to the digital voltmeter. The voltage developed across the shunt is also passed through the guarded data amplifier to the digital voltmeter.

The probe and sample are placed in a standard nitrogen jacketed helium dewar. Resistivity measurements are made at the three fixed temperatures of room temperature, liquid nitrogen boiling point and liquid helium boiling point.

Photographs of various portions of the experimental apparatus are shown in Figures C9 to C12.

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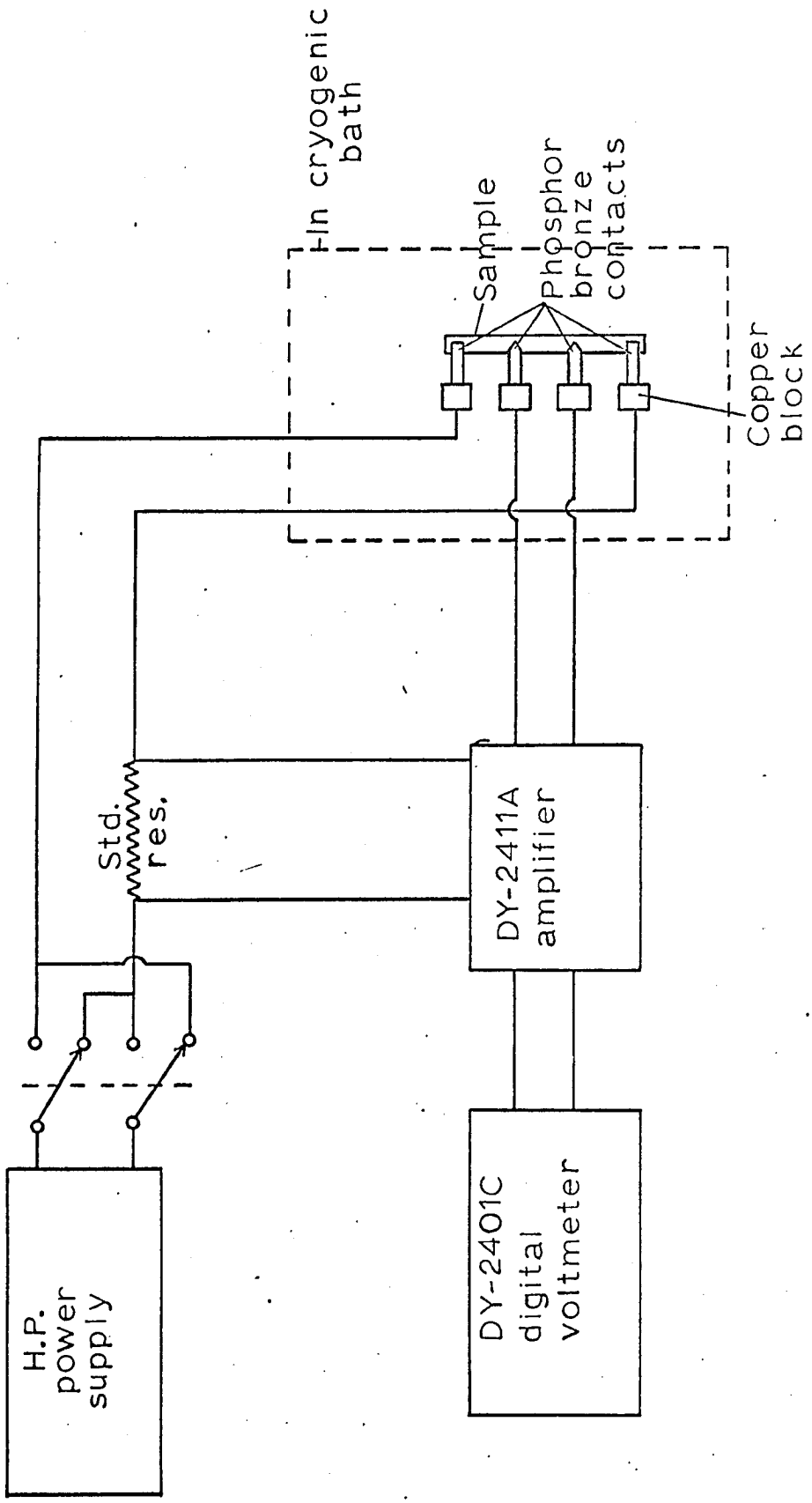

Figure C8. Schematic of resistivity measurement circuit

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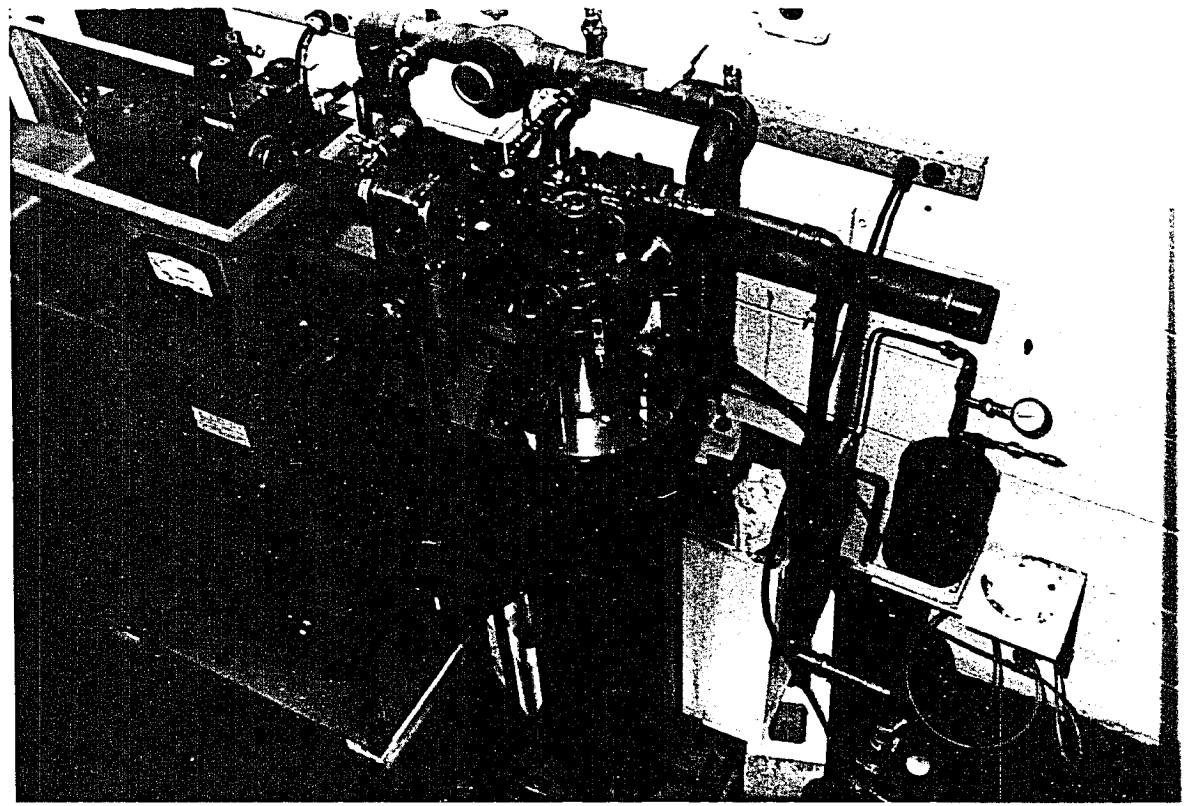

Figure C9. Photograph showing the external connections to the probe sitting in the metal dewar. The high vacuum system is shown at the left with the flexible metal bellows and quick fit connections. The dewar metal base is shown at the bottom and the dewar pumping line with the radiator hose and sand box damping system is shown behind the dewar. At the extreme right is shown the He^4 storage tank, and below it the Welch pump used to pump on the liquid helium in the helium chamber.

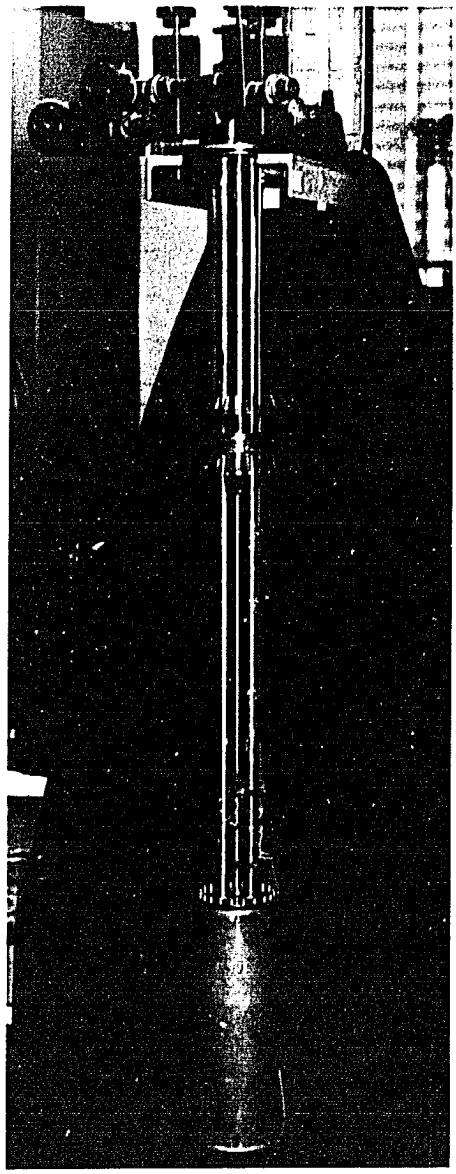

Figure C10. Photograph showing the probe with the outer can held in place by the 20 Allen head screws at bottom, the micarta enclosures for the depth gauge resistors just above the can, the copper springy fingers about three quarters of the way up the probe, and the vacuum connections and valves at the top of the probe.

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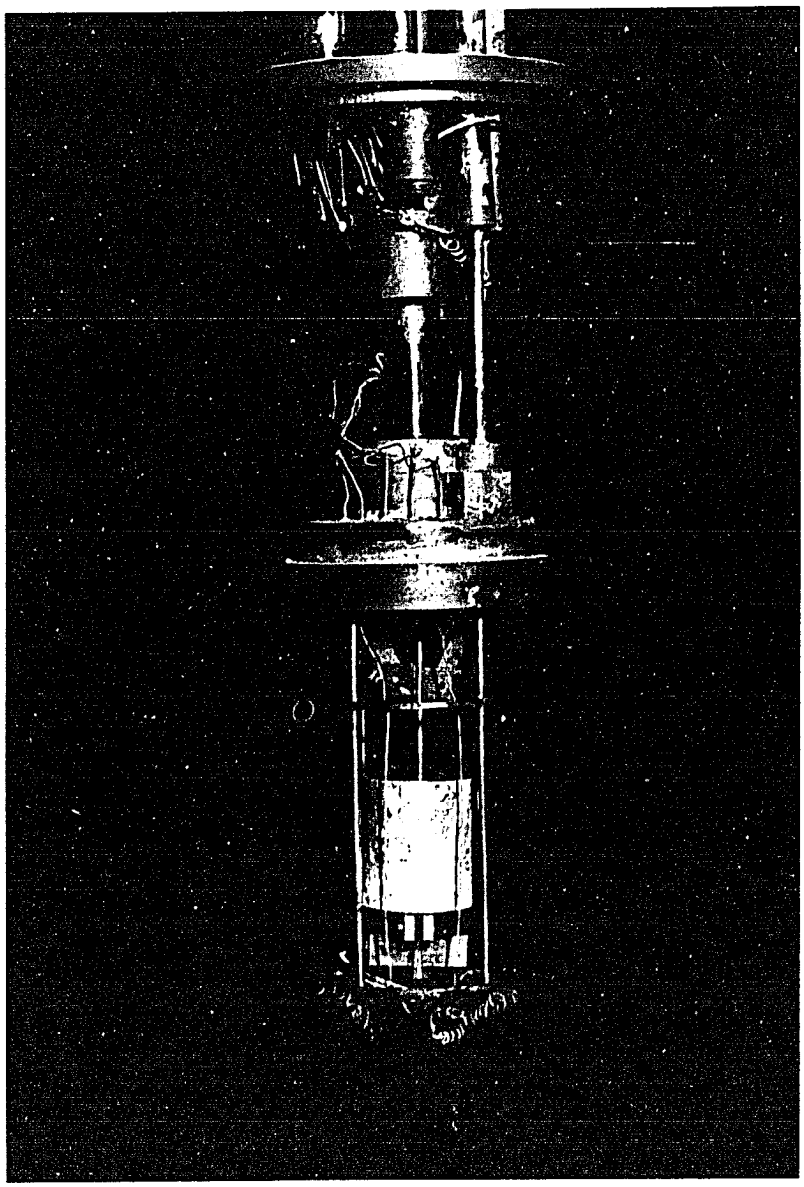

Figure C11. Photograph of the bottom portion of the probe with the outer and inner can removed. An alloy sample with the attached addenda is shown suspended from the brass cage and the jaws of the heat switch are closed on the copper rod. Also shown are the Stupakoff type feed throughs into the inner can and the thermal anchoring at the top of the outer can.

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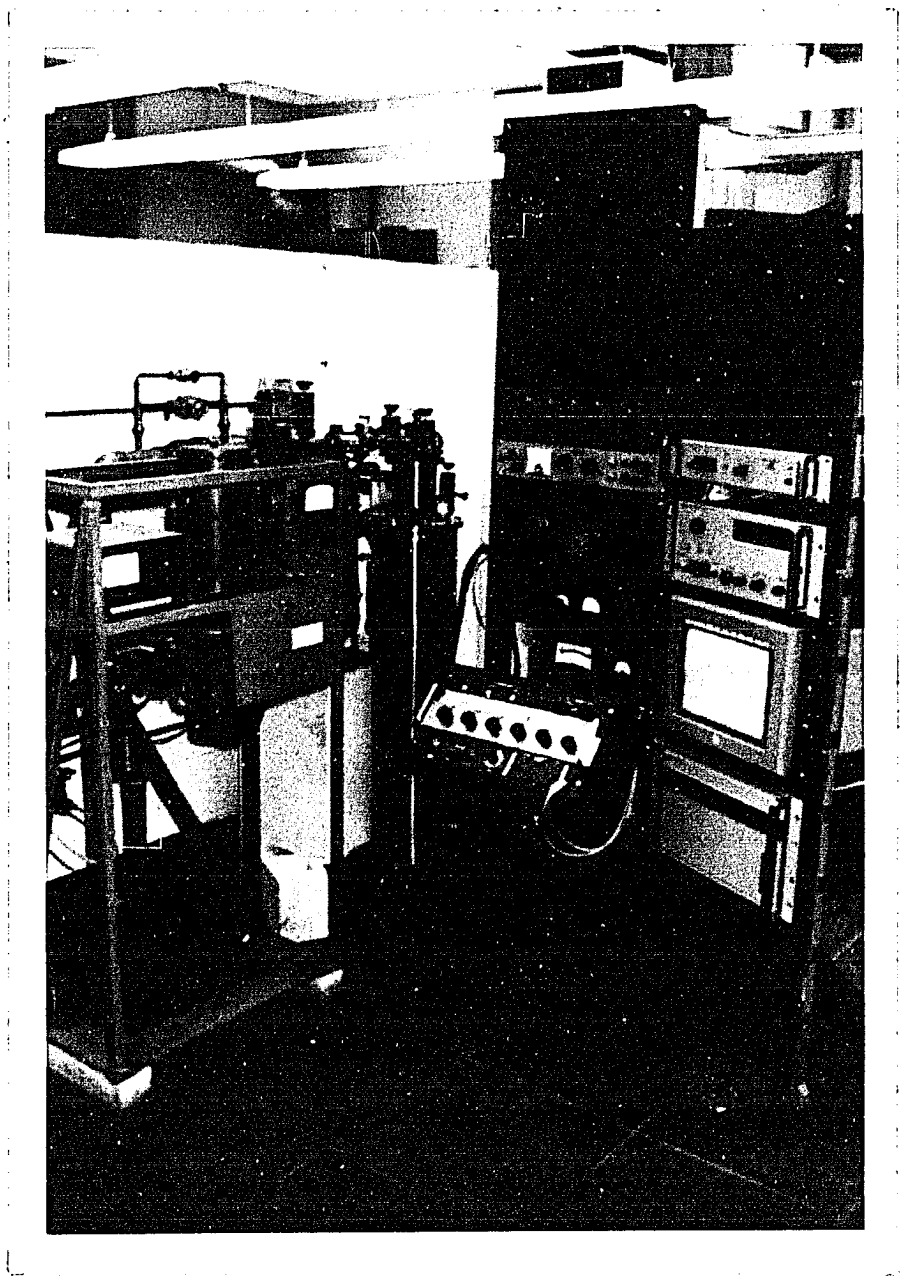

Figure C12. Photograph of the experimental station used for specific heat measurements. Shown from left to right are: the high vacuum system including the Welch backing pump, oil diffusion pump, nitrogen cold trap, and the thermocouple and ionization gauges; the metal dewar with its steel base; rack no. 1 containing the L and N potentiometer, nanovoltmeter, electric clock, and the constant current supply; and rack no. 2 containing the Hewlett Packard amplifier and integrating digital voltmeter and the L and N chart recorder.

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APPENDIX D. EXPERIMENTAL PROCEDURE AND DATA REDUCTION

Specific Heat Measurements

The first section of this appendix is devoted to a detailed description of a typical experimental run to measure the specific heat of a specimen from 1.3 to 4.2°K. Where the procedures are dependent on the specimen specific heat, they are introduced paranthetically to the basic procedure. Also, certain malfunctions occur frequently and the alternate procedures to correct these malfunctions are introduced paranthetically. All valve labeling refers to the schematic representation in Figure C2 of Appendix C.

Initial System Configuration

1. Following valves closed: V1, V2, V3, V4, V5, V6, V7, V8, V11, V12, V13, V14, V16, V17, V18, V19, V20, V21, V22 and V23.
2. Following valves open: V9, V10 and V15.
3. Welch mechanical pump supplying backing pressure to diffusion pump running.
4. Welch mechanical pump attached to probe helium chamber running.
5. Diffusion pump running with cold water in water baffle and cooling coils and N_2 cold trap filled.
6. E-135 mechanical pump turned off.
7. Helium storage tank filled with He gas to pressure of 5 psi.
8. Probe heat switch closed.

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Day 1

1. Clean and weigh specimen.
2. Attach addenda to specimen by screwing copper rod into top of specimen and copper beryllium boss for thermometer clamp into bottom of specimen.
3. Suspend specimen from cage in inner can by means of nylon threads inserted through the copper rod and lacquered to the cage with GE-7031 lacquer.
4. Attach thermometer to specimen by clamping to copper beryllium boss on bottom of specimen.
5. Complete suspension of specimen by tying nylon threads from thermometer clamp to four locations on the cage separated by 90^{o} and lacquering them in place on the cage. Extraneous heating due to vibrations can be reduced to a minimum by ensuring that there is adequate tension on all of the nylon threads suspending the specimen in this procedure. Also frictional heating, which occurs when the heat switch jaws are opened at low temperatures, can be reduced to a minimum by ensuring that the copper rod is properly centered in the jaws of the heat switch.
6. Tie off the electrical leads to the cage with nylon thread and lacquer the nylon in place so that the leads do not contact the specimen or interfere with the attachment of the inner can.

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7. Check the continuity of the electrical circuits. The heater portion of the circuits can be checked with a Simpson meter while the thermometer portion should be checked with the potentiometer.
8. Screw the inner can to the probe.
9. Make a gold O-ring and carefully anneal this ring with a gas torch just prior to attachment of the outer can.
10. Affect O-ring seal between outer can and probe.
11. Place probe in metal dewar and connect external plumbing.
12. Check that working battery of L and N potentiometer is turned on. Under normal operation of the calorimeter, this battery is left on at all times since it requires three to four days to stabilize.
13. Pump the inner and outer can overnight with high vacuum system.
    a. Close V9.
    b. Open V1, V2 and V7.
    c. When pressure is less than 100 microns Hg as indicated on thermocouple gauge, open V9 and close V7.
    d. Open V8.

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Day 2

1. Inner and outer can pressure should now be $4\text{-}8 \times 10^{-6}$ mm Hg as read by ionization gauge. (If the pressure is significantly higher, there is probably a leak in the gold O-ring seal. The probe vacuum should be sealed off by closing V1 and V2, the probe removed from the metal dewar and connected to a leak detector so that the O-ring seal can be checked for leaks).

2. Evacuate helium chamber in metal dewar.
   a. Close V15.
   b. Turn on E-135 mechanical pump.
   c. Open V16.
   d. When mechanical pump is quiet close V16 and vent pump.

3. Admit helium gas through V15 until pressure in helium chamber is slightly greater than one atmosphere as determined by pop-off valve in pumping line.

4. Admit a small amount of hydrogen exchange gas into the vacuum space between the helium and nitrogen chambers of the metal dewar by means of the small Veeco valve on the top of the metal dewar.

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5. Evacuate the probe helium chamber and the gas line to the storage tank.
   a. Open V3, V4, V5, V12 and V11.
6. Admit between 15 and 25 pipettes of H_2 exchange gas into the probe inner and outer can.
   a. Close V1, V2 and V5.
   b. Successively open V11, close V11, open V12 and close V12 until the desired number of pipettes is obtained.
   c. Open V6 and then close.
7. Pump out H_2 gas from gas lines.
   a. Open V5, V12 and V11.
8. Pressurize gas lines to 5 psi with helium from storage tank to prevent air leakage into gas lines.
   a. Close V5.
   b. Open V14 and then close.
   c. Close V11 and V12.
9. Fill liquid nitrogen chamber of metal dewar. From this point on, the nitrogen shield should be filled every 3-4 hours until the run is completed.
10. Approximately 5-7 hours are necessary to reach $77^{\circ}K$. This is equivalent to a thermometer voltage of 6.39 to 6.41 mv. with a 1 ma current.

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11. Remove H_2 exchange gas from the inner and outer can of probe.
    a. Close V8 and V9.
    b. Open V1, V2 and V7 until pressure on thermocouple gauge is less than 50 microns Hg.
    c. Open V9, close V7 and open V8 in that order.
    d. Pump for 8-12 hours.
12. Close V3 and V4 before leaving laboratory.

Day 3

1. Pressure should be 1-3 x 10^{-6} mm Hg on ionization gauge. (If the pressure is significantly higher then there is again the possibility of a leak in the gold O-ring. The leak detector should be attached as a backing pump to the diffusion pump in place of the Welch mechanical pump. Leaks can be detected by alternately evacuating the helium chamber of the metal dewar with the E-135 mechanical pump and then filling the chamber with helium gas through V15.)
2. Rough out H_2 exchange gas in vacuum space between the nitrogen and helium chambers of the metal dewar with a Welch mechanical pump for approximately 30 minutes.
3. Use diffusion pump of leak detector to final pump this vacuum space for approximately 30 minutes.

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4. Make first helium transfer. (The timing of this transfer depends on the specific heat of the sample being measured. For gold with a $\theta_D = 160^oK$, approximately 36 hours is required to reach 4.2^oK. For copper with a $\theta_D = 345^oK$ less than 24 hours may be required.)

   a. Pressurize helium chamber of metal dewar to one atmosphere by admitting helium gas through V15.

   b. Monitor pressure of inner and outer can with ionization gauge: the pressure may rise by a factor of 2 initially due to warm gases but should fall to initial value in less than a minute. Any abnormal pressure rises which do not subside very quickly can indicate a leak.

   c. Retighten heat switch since differential thermal expansion has a tendency to loosen jaws on copper rod attached to sample.

   d. Open V15 before transfer tube is inserted.

   e. When transfer begins open V16 to allow gases to escape through vent on E-135 mechanical pump.

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f. Transfer helium for 1-1/2 to 2 minutes after the level passes R_H, or the highest resistor on the depth gauge.

5. Condense 2 storage cans of helium gas at 20 psi into the helium chamber of the probe.

a. With V3 and V4 closed admit helium gas through V13.

b. Open V14 and V11 and pressurize tank to 20 psi.

c. Close V13, open V5 and using V12 throttle gas into helium chamber until tank pressure reads 5 psi.

d. Repeat procedure until 2 cans are condensed.

e. Close V5, V11 and V14.

f. Close V16.

g. Open V4.

Day 4

1. Early in the morning of the fourth day, the temperature should be 20-40^{o}K depending on the specimen and the helium level should be close to R_L which is attached to the bottom of the outer can. Retighten heat switch. At this point begin the second transfer and transfer for 1 minute after the level passes R_H using the same

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procedure with valves V15 and V16 as on previous day.

2. Condense 2 storage cans of helium gas at 20 psi into probe helium chamber using same procedure as previous day.

3. Turn on electronics
   a. Power switch of guarded data amplifier.
   b. Power switch of digital voltmeter.
   c. Power switch of DC current supply.
   d. Turn on thermometer current and adjust variable resistors so that a negligible current is passing through the thermometer, allowing battery to stabilize.

4. Return at 5-6 o'clock when the temperature has reached $4.2^{o}K$. The helium level should be between R_H and R_M of the depth gauge. Retighten heat switch.

5. Calibrate the digital voltmeter as instructed in the manual.

6. With the DC current supply switch off, remove the two current supply leads from the back and short them together. Set the digital voltmeter to read the heater current across the 100 ohm standard resistor. Using the null adjustment switch on the guarded data amplifier, offset

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the zero until the thermal emfs are nulled. Reconnect the heater leads and turn on the DC heater current.

7. Calibrate the potentiometer against the standard cell and set the potentiometer zeros and thermometer current using the potentiometer, nanovoltmeter and the chart recorder.

8. Tighten heat switch and begin third transfer. Transfer in the same manner as before for 6 minutes after the helium level has passed the top resistor R_H.

9. Condense 2 storage cans of helium gas at 20 psi into probe helium chamber using same procedure as before but after condensation do not open V4.

10. Begin pumping on helium bath of metal dewar.
    a. Close V16.
    b. Start E-135 mechanical pump.
    c. Close V15.
    d. Open V16.

11. After mechanical pump has been on for approximately 5 minutes begin pumping on probe helium chamber by opening V3.

12. Take data from 1.3 to 4.2^{o}K in the next 12-16 hours. The low temperature data is taken during the night to minimize electrical and vibrational disturbances.

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a. Take data from 1.3 to 2°K first, since later in the evening it will not be possible to reach as low a temperature as is possible early in the run.

13. It is usually possible to take more than 155 data points in one evening in which case the shutdown procedure is as follows:
    a. Close V3 and V16.
    b. Open V4.
    c. Turn off electronics.
    d. Leave heat switch open.
14. If it is necessary to run an additional evening, then the same shutdown procedure is used except the heat switch is left closed and steps 8 through 13 are repeated the following evening.
15. After probe has warmed up then V8, V1 and V2 are closed.

The data taken for a single specific heat data point are shown in Figure D1. The graphical record as shown is obtained on a Leeds and Northrup chart recorder which measures the out-of-balance voltage of the Astrodata nanovoltmeter being used as a null detector for the Leeds and Northrup potentiometer. The time axis of the measurements varies from bottom to top with each inch of chart recorder representing one minute on the time axis. To measure the thermal emfs and to calibrate the chart

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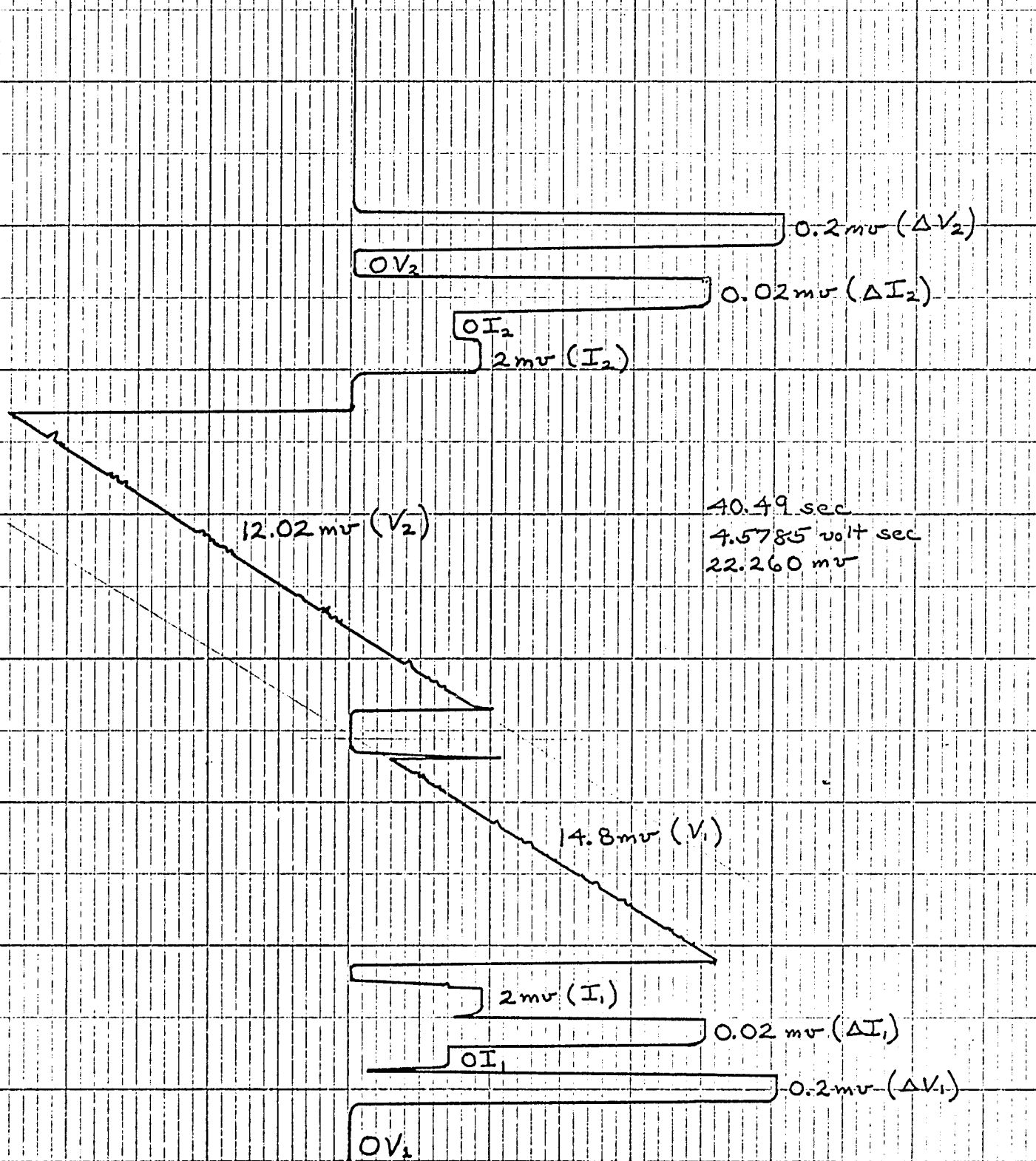

Figure D1. Graphical record of a typical specific heat data point.

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recorder, the thermometer current is turned off in the measuring circuit. With the potentiometer set on zero and the nanovoltmeter set on the desired sensitivity for the voltage drift measurements, the out of balance voltage across the germanium thermometer is monitored (OV_1). Since this out of balance voltage is due to the thermal emfs in the measuring circuit, this point is used as the potentiometric null point for voltage measurements on the germanium thermometer. The chart recorder is then calibrated for sensitivity by offsetting the potentiometer a small amount and noting the change on the chart record (ΔV_1). This calibration allows the subsequent drift rate to be reduced to the potentiometric null point. In a similar manner the zero current offset (OI_1), which includes the thermal emfs, is monitored across the 1000 ohm standard resistor used to measure the thermometer current and the chart recorder is calibrated at this sensitivity on the nanovoltmeter (ΔI_1). Having accomplished these measurements, the thermometer current is turned on and is measured across the 1000 ohm standard (I_1). The initial drift rate of the specimen (V_1) is then monitored across the germanium thermometer. When the heater current is turned on, there is a large overshoot in the thermometer temperature which drives the chart recorder off scale; therefore, the potentiometer detector button is released during the heating period. When the

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heating period is over, the potentiometer is reset to V_2 to bring the chart recorder back on scale and close to the potentiometric zero. The heating time measured on the gated clock is recorded as well as the time integral of the heater voltage as obtained from the integrating digital voltmeter. In addition, the heater current as measured across the 100 ohm standard resistor with the digital voltmeter is recorded on the chart. A further measurement of the current (I_2) and the zeros (OI_2, OV_2) and the sensitivities (ΔI_2, ΔV_2) follows each data point.

Hand reduction of the data consists of extrapolating the drift rates to the center of the heating cycle. The remainder of the data reduction is accomplished on a Univac 1108 computer. The data of each specific heat data point is punched on three cards, the second and third cards each containing the zero voltages, sensitivities and currents from the beginning and end of the data point respectively. The first data card contains the initial and final drift rate voltages and the digital voltmeter data.

The computer program reduces the data by reading each successive series of three cards. The thermometer currents and the thermometer voltages at the center of the heating cycle are reduced to the potentiometric null point by using the supplied null points and sensitivities. In calculating the thermometer current, the calibrated value of the 1000 ohm standard resistor is used as discussed in Appendix C. These results give the

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germanium thermometer resistance at the beginning and end of the heating period. The temperature equivalents to these resistances are obtained from a table of R vs T by Lagrangian interpolation. The R vs T table contains smoothed calibration data at intervals of $\Delta T \simeq .01^{\circ}K$. The average temperature $\overline{T}$ and the temperature interval ΔT are obtained from the two temperature values. The heater current is calculated using the calibrated value of the 100 ohm standard resistor. The power supplied to the sample, ΔQ, is then calculated as the product of the heater current and the time integral of the heater voltage. This power is corrected for the lead resistance of the heater. Using ΔQ and ΔT, the total specific heat of the assembly is calculated at $\overline{T}$. The addenda specific heat, which has been measured in an independent experiment and fitted to a polynomial expansion in powers of T, is calculated at $\overline{T}$ and subtracted from the total specific heat giving the specimen specific heat. The data points are then analyzed with a least squares orthogonal polynomial fitting procedure. In this fitting procedure each of the data points is divided by the magnitude of the specific heat so that fractional deviations are minimized, thus giving each data point equal weight. C/T is fit as a function of $\gamma+\beta T^2+\delta T^4$ and the corresponding values of γ, β, δ and θ_D are printed out along with the percentage deviation of each data point from the smooth curve. The percentage

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deviations are then fed to an x,y plotting routine which generates a graph of the percentage deviations versus the temperature. A further option of the program allows the specific heat data points to be plotted with a Calcomp plotter as values of C/T versus T^2 for publication or reference.

Resistivity Measurements

The procedure used for determining the resistivity of a sample is based on the standard four wire type measurement. The sample is mounted on the probe as discussed in Appendix C. The voltage contact separation is measured with a traveling microscope capable of measuring to .0001 cm. Since the contacts have a finite width, the average of the outside and inside readings is used for reduction of the data. Considering the contact finite width, the accuracy of this contact length measurement is 0.5%. The current supply is then attached to the probe and the voltage developed across the voltage contacts is monitored with the digital voltmeter. In addition, the voltage developed across the standard resistor is also measured. The current is then reversed through the sample and the standard resistor and sample voltages are again monitored. The average of the forward and reverse current voltages eliminates any thermal emf's in the measuring circuit. With the current leads on the sample extremities or approximately 3 cm apart and the voltage leads in the middle 0.8 cm of the sample, a

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current of 0.5 amps could be used with the sample remaining ohmic. This current produces typical sample voltages of 10 to 100 μv. with fluctuations of ± .1μv. The sample is then cooled to the boiling point of liquid nitrogen and the entire procedure repeated with a subsequent cooling to the boiling point of liquid helium, and another repetition of the measurements. Several measurements are made at each temperature to reduce the error due to voltage fluctuations to a negligible quantity.

In the reduction of the data, the current passing through the sample is calculated using the voltage developed across the standard resistor and the known resistance. Using this current, the resistance of the sample is calculated. To determine the sample resistivity, the voltage contact length is known from the measurements with the traveling microscope. The second quantity required in the calculations, which is the average cross sectional area of the samples, is determined in a somewhat different manner than usual. Due to several reasons, typical mechanical measurements of the two widths of the sample necessary to determine the area produces errors of the order of 2%, since a single width can only be measured to ± .001". One reason for this error is the fact that the samples, particularly the binary alloys, are very soft and machining tends to roll a slight burr at the sample edges which cannot be removed without damaging the samples.

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When mechanically measuring the width of the sample, this burr always produces an area which is slightly larger than the true average area.

To do away with the mechanical methods of measuring the area another procedure has been adopted. The sample is first weighed, which can be done to 1 part in 10,000 and produces a negligible error. The volume of the sample can then be calculated using the density of the alloy. A discussion of the determination of the alloy density and the resultant 0.5% error is contained in the following paragraphs. The average length of the sample is measured using a traveling microscope. This measurement can easily be made with less than 0.5% error. Using the average length of the sample and the volume, the average cross sectional area of the sample can be determined to 1% accuracy. Using this cross sectional area and the voltage contact length and resistivity of the sample is determined with an error of $\pm$ 1.5%.

The density determination is made by using the atomic weight of the alloys and the lattice constant. In the case of the binary alloys of silver-gold, the lattice constant is quite well known throughout the range of alloying. Therefore, in the binary alloys, the determination of the lattice constant produces a negligible error and the total 0.5% error in the density is perhaps overestimated. In the case of the ternary alloys considered,

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there is no available direct determination of the lattice constants which are necessary. Therefore, a least squares fit of the lattice constant data available has been made as a function of the two independent variables of the concentration of gold and silver in the ternary alloy. All of the lattice constant data has been taken from Pearson[11] is all of a stated accuracy of at least .05%. Fortunately, most of the data points fall in a region that is close to the desired values. The equation used to fit the lattice constant and the coefficients determined are shown in Table D1. The experimental points could all be fit to at least a 0.1% accuracy and this is the expected accuracy of the lattice constant or 0.3% accuracy for the atomic volume. Therefore it is felt that the total assumed accuracy of 0.5% in the density determination is a reasonable assumption.

In order to test the overall method of the resistivity determination, samples of 99.9999% pure copper and 99.999% pure silver have been constructed and measured at room temperature and the boiling point of liquid nitrogen. The values determined have been compared to these values of White[42] and are shown in Table D2. The results are within the combined estimated errors. In addition, the close agreement of the binary silver-gold resistivity data with the data of Boes et.al., as discussed in the main text, verifies the procedure.

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TABLE DI.

Coefficients in least squares determination of lattice constant for ternary copper-silver-gold alloys

---

$$\text{Lattice constant} = a + bx + cy + dx^2 + ey^2 + fxy + gx^3 + hy^3 + jx^2y + kxy^2$$

x = atom fraction of Ag

y = atom fraction of Au

a = 3.6149

b = 0.64517

c = 0.60007

d = -.23471

e = -.15633

f = -.55475

g = .059753

h = .019551

j = .28558

k = .23169

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TABLE DII.

Comparison of resistivity data of pure copper and silver with data of White

Material	Present Data		White's Data	
	$\rho_{20^\circ C}$ ($\mu\Omega$-cm)	$\rho_{77^\circ K}$ ($\mu\Omega$-cm)	$\rho_{20^\circ C}$ ($\mu\Omega$-cm)	$\rho_{77^\circ K}$ ($\mu\Omega$-cm)
Copper	1.690	0.186	1.690	0.196
Silver	1.618	0.272	1.618	0.270

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APPENDIX E. TABULATED SPECIFIC HEATS

The following tables include a tabulation of all specific heat data points used in the analysis of the binary and ternary alloy systems. The computed values of the total specific heat (CTOT) and the addenda specific heat (CADD) are given in the units mJ/^{o}K along with the values of T^2 in $^{o}K^2$ and C/T in mJ/mole $^{o}K^2$. In addition to the computed values of the specific heat, the smoothed values of C/T are given from the relation $C/T = \gamma+\beta T^2+\delta T^4$ using the values γ, β and δ as given in Chapter V. The percentage deviations of the computed values of C/T from the smoothed values are given in the last column of the tables. These tables are found on the following pages:

Table	Sample	Sample Run	Page
E1	50at.% Au-50at.% Ag	15	141
E2	75at.% Au-25at.% Ag	16	145
E3	30at.% Au-70at.% Ag	17	149
E4	90at.% Au-10at.% Ag #1	18	153
E5	Au	19	157
E6	Ag	20	161
E7	20at.% Au-80at.% Ag	21	165
E8	10at.% Au-90at.% Ag	22	169
E9	90at.% Au-10at.% Ag #2	23	173
E10	82.5at.% Au-17.5at.% Ag	26	177
E11	60at.% Au-40at.% Cu	28	181
E12	80at.%(60at.% Au-40at.% Cu)-20at.% Ag	29	185

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Table	Sample	Sample Run	Page
E13	95at.% Au-5at.% Ag	30	189
E14	70at.%(60at.% Au-40at.% Cu)-10at.% Ag	31	193
E15	90at.%(60at.% Au-40at.% Cu)-10at.% Ag	32	197
E16	50at.%(60at.% Au-40at.% Cu)-50at.% Ag	33	201
E17	60at.%(60at.% Au-40at.% Cu)-40at.% Ag	35	205
E18	30at.%(60at.% Au-40at.% Cu)-70at.% Ag	36	209
E19	10at.%(60at.% Au-40at.% Cu)-90at.% Ag	37	213
E20	50at.%(72at.% Au-28at.% Cu)-50at.% Ag	38	217
E21	50at.%(84at.% Au-16at.% Cu)-50at.% Ag	39	221

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TABLE E1

SPECIFIC HEAT OF 50A/0 GOLD-50A/0 SILVER ALLOY

RUN 15

JANUARY 27,1969

CTOT (MJ/DEG)	CADD (MJ/DEG)	T**2 (DEG2)	C/T (MJ/M-DEG2)	C/T FIT (MJ/M-DEG2)	PCERROR
4.0028	.9358	1.8771	1.10939	1.11611	-.602
4.2025	.9623	1.9815	1.14075	1.14224	-.131
4.3958	.9884	2.0863	1.16908	1.16846	.053
4.5705	1.0122	2.1831	1.19347	1.19267	.067
4.7595	1.0363	2.2826	1.22127	1.21757	.304
4.9150	1.0583	2.3742	1.24039	1.24050	-.009
5.1286	1.0851	2.4869	1.27069	1.26869	.158
5.3441	1.1115	2.5992	1.30105	1.29681	.327
5.6082	1.1447	2.7418	1.33586	1.33251	.251
5.7376	1.1607	2.8109	1.35291	1.34979	.231
5.8916	1.1783	2.8878	1.37452	1.36904	.400
6.0792	1.2026	2.9937	1.39677	1.39555	.088
6.2840	1.2262	3.0972	1.42428	1.42146	.198
6.5256	1.2544	3.2218	1.45536	1.45267	.185
6.6732	1.2705	3.2928	1.47549	1.47045	.343
6.8746	1.2950	3.4012	1.49933	1.49759	.116
7.0737	1.3187	3.5068	1.52299	1.52404	-.069
7.2650	1.3392	3.5979	1.54821	1.54685	.087
7.4650	1.3621	3.7002	1.57229	1.57247	-.011
7.6531	1.3833	3.7944	1.59513	1.59606	-.058
7.8914	1.4087	3.9079	1.62514	1.62450	.039
8.0218	1.4260	3.9854	1.63733	1.64390	-.400
8.2339	1.4479	4.0832	1.66427	1.66839	-.247
8.4244	1.4686	4.1755	1.68695	1.69152	-.270
8.6788	1.4968	4.3012	1.71619	1.72301	-.396
8.8431	1.5129	4.3731	1.73713	1.74102	-.224
9.0817	1.5387	4.4882	1.76447	1.76987	-.305
9.3006	1.5619	4.5893	1.79033	1.79520	-.271
9.5156	1.5809	4.6760	1.81847	1.81692	.085
9.7630	1.6089	4.8003	1.84892	1.84808	.045
9.9424	1.6261	4.8769	1.86623	1.86727	-.056
10.1468	1.6516	4.9896	1.88474	1.89552	-.569
10.3847	1.6725	5.0821	1.91523	1.91871	-.181
10.6086	1.6943	5.1787	1.94127	1.94293	-.085
10.8295	1.7192	5.2883	1.96329	1.97041	-.361
11.0331	1.7381	5.3717	1.98749	1.99130	-.191
11.2684	1.7615	5.4746	2.01360	2.01710	-.174
11.4854	1.7841	5.5738	2.03641	2.04198	-.273
11.7312	1.8077	5.6774	2.06397	2.06796	-.193
11.9485	1.8296	5.7731	2.08710	2.09195	-.232
12.1627	1.8493	5.8596	2.11142	2.11365	-.105
12.3742	1.8700	5.9496	2.13419	2.13621	-.094
12.6321	1.8945	6.0566	2.16222	2.16306	-.039
12.8530	1.9163	6.1514	2.18529	2.18683	-.071

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TABLE E1 CONTINUED

CTOT (MJ/DEG)	CADD (MJ/DEG)	T**2 (DEG2)	C/T (MJ/M-DEG2)	C/T FIT (MJ/M-DEG2)	PCERROR
13.1093	1.9405	6.2564	2.21285	2.21317	-.015
13.3378	1.9634	6.3557	2.23592	2.23808	-.096
13.5731	1.9644	6.4466	2.26193	2.26088	.046
13.8235	2.0077	6.5472	2.28848	2.28611	.103
14.0345	2.0305	6.6458	2.30761	2.31085	-.140
14.3123	2.0545	6.7491	2.33830	2.33676	.066
14.5962	2.0802	6.8595	2.36826	2.36448	.160
14.8483	2.1036	6.9602	2.39403	2.38974	.180
15.0688	2.1235	7.0455	2.41695	2.41115	.241
15.3130	2.1479	7.1500	2.43996	2.43736	.106
15.5635	2.1717	7.2518	2.46448	2.46293	.063
15.8232	2.1929	7.3424	2.49285	2.48566	.289
16.0992	2.2190	7.4538	2.51952	2.51363	.234
16.3882	2.2428	7.5551	2.55038	2.53905	.446
16.5763	2.2621	7.6375	2.56685	2.55973	.278
16.8566	2.2871	7.7436	2.59469	2.58637	.322
17.1114	2.3118	7.8484	2.61800	2.61268	.204
17.3510	2.3336	7.9407	2.64105	2.63586	.197
17.6466	2.3598	8.0517	2.66982	2.66374	.228
17.9209	2.3841	8.1545	2.69632	2.68956	.251
18.1964	2.4099	8.2636	2.72186	2.71694	.181
18.4283	2.4305	8.3506	2.74353	2.73879	.173
18.7602	2.4583	8.4675	2.77632	2.76817	.295
18.9743	2.4794	8.5564	2.79457	2.79048	.146
19.2138	2.5015	8.6496	2.81609	2.81389	.079
19.5383	2.5285	8.7627	2.84768	2.84230	.189
19.9605	2.5649	8.9155	2.88719	2.88069	.226
19.9911	2.5730	8.9494	2.88544	2.88922	-.131
20.2982	2.5969	9.0495	2.91609	2.91437	.059
20.5692	2.6180	9.1378	2.94295	2.93654	.218
20.8466	2.6436	9.2450	2.96687	2.96348	.114
21.1306	2.6693	9.3522	2.99170	2.99041	.043
21.3863	2.6899	9.4384	3.01592	3.01207	.128
21.6655	2.7159	9.5465	3.03941	3.03924	.006
21.8623	2.7332	9.6188	3.05663	3.05742	-.026
22.1242	2.7562	9.7145	3.07952	3.08148	-.064
22.4382	2.7891	9.8510	3.11039	3.11579	-.173
22.8073	2.8147	9.9574	3.13984	3.14252	-.085
23.1292	2.8410	10.0662	3.16900	3.16988	-.028
23.3892	2.8629	10.1572	3.19178	3.19277	-.031
23.6781	2.8870	10.2566	3.21727	3.21775	-.015
23.9316	2.9104	10.3536	3.23759	3.24213	-.140
24.2542	2.9370	10.4634	3.26590	3.26974	-.117
24.5523	2.9602	10.5590	3.29301	3.29378	-.023

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TABLE E1 CONTINUED

CTOT (MJ/DEG)	CADD (MJ/DEG)	T**2 (DEG2)	C/T (MJ/M-DEG2)	C/T FIT (MJ/M-DEG2)	%ERROR
24.6627	2.9865	10.6671	3.31940	3.32098	-.047
25.0864	3.0092	10.7603	3.33536	3.34441	-.271
25.4337	3.0338	10.8617	3.36827	3.36991	-.049
25.7463	3.0595	10.9669	3.39500	3.39638	-.041
25.9594	3.0781	11.0429	3.41233	3.41550	-.093
26.2691	3.1004	11.1587	3.43632	3.44462	-.241
26.5764	3.1298	11.2545	3.46358	3.46674	-.149
26.9293	3.1565	11.3630	3.49498	3.49603	-.030
27.2109	3.1818	11.4663	3.51787	3.52202	-.118
27.5342	3.2063	11.5658	3.54509	3.54704	-.055
27.7714	3.2295	11.6598	3.56182	3.57071	-.249
28.1007	3.2547	11.7621	3.59024	3.59644	-.172
28.4267	3.2786	11.8587	3.61906	3.62076	-.047
28.7720	3.3071	11.9735	3.64705	3.64965	-.071
29.0846	3.3327	12.0767	3.67235	3.67564	-.090
29.4379	3.3604	12.1881	3.70177	3.70366	-.051
29.7003	3.3801	12.2672	3.72413	3.72359	.015
29.9639	3.4053	12.3680	3.74253	3.74894	-.171
30.2957	3.4290	12.4626	3.77155	3.77277	-.032
30.6190	3.4555	12.5682	3.79716	3.79936	-.058
30.9717	3.4826	12.6762	3.82628	3.82654	-.007
31.1953	3.5001	12.7453	3.84449	3.84395	.014
31.7153	3.5393	12.9007	3.88760	3.88308	.116
32.0931	3.5653	13.0032	3.92061	3.90889	.300
32.2538	3.5853	13.0817	3.92811	3.92866	-.014
32.4962	3.6069	13.1667	3.94557	3.95006	-.114
32.8910	3.6360	13.2805	3.97836	3.97873	-.009
33.2627	3.6656	13.3961	4.00746	4.00786	-.010
33.5929	3.6912	13.4960	4.03369	4.03300	.017
33.8535	3.7109	13.5722	4.05477	4.05221	.063
34.1541	3.7461	13.7084	4.07011	4.08652	-.402
34.5766	3.7660	13.7853	4.11245	4.10590	.160
34.9186	3.8005	13.9177	4.13372	4.13925	-.134
35.1395	3.8172	13.9819	4.15127	4.15542	-.100
35.5506	3.8479	14.0991	4.18419	4.18496	-.018
35.8640	3.8744	14.2002	4.20962	4.21043	-.019
36.1862	3.8982	14.2901	4.23287	4.23310	-.006
36.4967	3.9263	14.3964	4.25435	4.25990	-.130
36.7856	3.9445	14.4651	4.27924	4.27722	.047
37.1968	3.9791	14.5951	4.30899	4.30999	-.023
37.6100	4.0071	14.6998	4.34342	4.33636	.163
37.9278	4.0340	14.7998	4.36619	4.36158	.106
38.2229	4.0569	14.8921	4.38733	4.38486	.056
38.5854	4.0874	14.9975	4.41462	4.41144	.072

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TABLE E 1 CONTINUED

CTOT (MJ/DEG)	CADD (MJ/DEG)	T**2 (DEG2)	C/T (MJ/M-DEG2)	C/T FIT (MJ/M-DEG2)	PCERROR
38.9038	4.1141	15.0956	4.43747	4.43617	.029
39.2872	4.1418	15.1973	4.46783	4.46179	.135
39.5915	4.1709	15.3035	4.48715	4.48859	-.032
39.9464	4.2007	15.4119	4.51238	4.51591	-.078
40.3442	4.2265	15.5125	4.54428	4.54128	.066
40.7306	4.2595	15.6239	4.57262	4.56938	.071
41.0221	4.2830	15.7084	4.59379	4.59070	.067
41.3620	4.3096	15.8032	4.61906	4.61463	.096
41.7035	4.3369	15.9005	4.64397	4.63915	.104
42.1498	4.3755	16.0369	4.67462	4.67357	.022
42.3306	4.3935	16.1002	4.68556	4.68955	-.085
42.8425	4.4296	16.2269	4.72574	4.72150	.090
43.4074	4.4708	16.3704	4.76914	4.75771	.240
43.4494	4.4837	16.4154	4.76614	4.76907	-.062
43.8457	4.5125	16.5149	4.79657	4.79418	.050
44.0966	4.5446	16.6253	4.80721	4.82205	-.308
44.6849	4.5791	16.7434	4.85732	4.85184	.113
44.8106	4.5982	16.8086	4.86075	4.86831	-.155
45.2730	4.6346	16.9328	4.89418	4.89966	-.112
45.4763	4.6586	17.0130	4.90443	4.91991	-.315
46.0063	4.6865	17.1068	4.95114	4.94358	.153
46.4676	4.7191	17.2158	4.98641	4.97110	.308

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TABLE E2

SPECIFIC HEAT OF 75A/O GOLD-25A/O SILVER ALLOY

RUN 16

FEBRUARY 10.1969

CTOT (MJ/DEG)	CADD (MJ/DEG)	T**2 (DEG2)	C/T (MJ/M-DEG2)	C/T FIT (MJ/M-DEG2)	PCERROR
4.2057	.9339	1.8697	1.26509	1.27232	-.568
4.4605	.9644	1.9900	1.31030	1.31136	-.081
4.6575	.9886	2.0872	1.34266	1.34290	-.018
4.8812	1.0149	2.1940	1.38008	1.37753	.185
5.1002	1.0409	2.3015	1.41471	1.41241	.163
5.3607	1.0727	2.4347	1.45295	1.45561	-.183
5.6549	1.1034	2.5645	1.50269	1.49771	.333
5.8727	1.1267	2.6644	1.53722	1.53012	.464
6.1004	1.1519	2.7731	1.57111	1.56534	.368
6.3660	1.1808	2.8987	1.61019	1.60607	.257
6.6516	1.2107	3.0294	1.65272	1.64847	.258
6.7807	1.2236	3.0860	1.67252	1.66679	.344
6.9353	1.2401	3.1585	1.69428	1.69030	.235
7.1731	1.2644	3.2658	1.72868	1.72510	.208
7.3916	1.2865	3.3639	1.75989	1.75689	.171
7.7057	1.3192	3.5089	1.80260	1.80388	-.071
7.9335	1.3418	3.6097	1.83432	1.83656	-.122
8.3708	1.3842	3.7987	1.89524	1.89781	-.135
8.5829	1.4047	3.8903	1.92416	1.92747	-.172
8.8280	1.4276	3.9923	1.95821	1.96055	-.119
9.0417	1.4487	4.0866	1.98586	1.99108	-.262
9.2921	1.4725	4.1929	2.01903	2.02553	-.321
9.5253	1.4940	4.2886	2.05044	2.05653	-.296
9.7679	1.5162	4.3877	2.08278	2.08863	-.280
10.0119	1.5379	4.4848	2.11561	2.12007	-.210
10.2155	1.5564	4.5671	2.14224	2.14673	-.209
10.5084	1.5831	4.6857	2.17999	2.18514	-.236
10.7213	1.6024	4.7717	2.20711	2.21298	-.265
10.9974	1.6268	4.8797	2.24281	2.24796	-.229
11.2341	1.6486	4.9766	2.27178	2.27934	-.331
11.5132	1.6714	5.0774	2.30925	2.31197	-.118
11.7601	1.6925	5.1705	2.34087	2.34212	-.053
12.0181	1.7167	5.2774	2.37086	2.37673	-.247
12.2123	1.7332	5.3503	2.39525	2.40033	-.212
12.5257	1.7604	5.4698	2.43366	2.43901	-.219
12.7502	1.7819	5.5643	2.45838	2.46960	-.455
13.0727	1.8059	5.6694	2.50178	2.50361	-.073
13.3208	1.8275	5.7641	2.53103	2.53425	-.127
13.6306	1.8535	5.8778	2.56832	2.57104	-.106
13.8357	1.8709	5.9538	2.59255	2.59563	-.119
14.1269	1.8944	6.0560	2.62810	2.62870	-.023
14.4054	1.9175	6.1563	2.66100	2.66117	-.006
14.6408	1.9393	6.2514	2.68586	2.69193	-.226
14.9343	1.9613	6.3468	2.72258	2.72277	-.007

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TABLE E2 CONTINUED

CTOT (MJ/DEG)	CADD (MJ/DEG)	T**2 (DEG2)	C/T (MJ/M-DEG2)	C/T FIT (MJ/M-DEG2)	PCERROR
15.3242	1.9929	6.4833	2.76817	2.76694	.044
15.5586	2.0103	6.5585	2.79704	2.79127	.207
15.8059	2.0320	6.6521	2.82355	2.82154	.071
16.1062	2.0560	6.7555	2.85806	2.85499	.108
16.3561	2.0757	6.8404	2.88681	2.88243	.152
16.7041	2.1034	6.9593	2.92623	2.92089	.183
17.0526	2.1314	7.0795	2.96496	2.95976	.176
17.2827	2.1496	7.1572	2.99071	2.98488	.195
17.5425	2.1708	7.2479	3.01880	3.01420	.153
17.8600	2.1944	7.3487	3.05535	3.04678	.281
18.1661	2.2173	7.4467	3.09003	3.07846	.376
18.5126	2.2465	7.5710	3.12554	3.11864	.221
18.8859	2.2706	7.6733	3.17129	3.15170	.622
19.0901	2.2906	7.7585	3.18878	3.17924	.300
19.3530	2.3121	7.8497	3.21575	3.20872	.219
19.6652	2.3358	7.9499	3.24953	3.24110	.260
19.9940	2.3611	8.0572	3.28436	3.27576	.262
20.3181	2.3890	8.1750	3.31537	3.31383	.046
20.6400	2.4108	8.2671	3.35203	3.34359	.252
20.9010	2.4339	8.3648	3.37588	3.37515	.022
21.2464	2.4558	8.4570	3.41624	3.40494	.332
21.4703	2.4790	8.5547	3.43297	3.43648	-.102
21.8788	2.5079	8.6763	3.47696	3.47576	.035
22.2124	2.5306	8.7718	3.51347	3.50661	.196
22.6005	2.5601	8.8953	3.55258	3.54649	.172
22.7224	2.5700	8.9371	3.56408	3.55998	.115
23.1212	2.5965	9.0478	3.60765	3.59574	.331
23.4014	2.6202	9.1473	3.63280	3.62784	.137
23.7253	2.6442	9.2474	3.66524	3.66017	.139
24.0757	2.6711	9.3599	3.69905	3.69649	.069
24.3620	2.6902	9.4396	3.72936	3.72223	.192
24.6665	2.7162	9.5478	3.75584	3.75714	-.035
25.0834	2.7414	9.6527	3.80203	3.79102	.290
25.3611	2.7665	9.7571	3.82438	3.82472	-.009
25.7076	2.7923	9.8642	3.85756	3.85928	-.045
26.1454	2.8218	9.9868	3.90211	3.89884	.084
26.4016	2.8427	10.0733	3.92453	3.92673	-.056
26.7389	2.8672	10.1750	3.95671	3.95955	-.072
27.1447	2.8974	10.2996	3.99458	3.99977	-.130
27.4057	2.9170	10.3806	4.01859	4.02588	-.181
27.7344	2.9409	10.4793	4.04939	4.05773	-.206
28.1090	2.9683	10.5921	4.08418	4.09412	-.243
28.3107	2.9821	10.6490	4.10369	4.11248	-.214
28.7186	3.0097	10.7625	4.14327	4.14908	-.140

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TABLE E2 CONTINUED

CTOT (MJ/DEG)	CADD (MJ/DEG)	T**2 (DEG2)	C/T (MJ/M-DEG2)	C/T FIT (MJ/M-DEG2)	PCERROR
29.0199	3.0315	10.8522	4.17098	4.17800	-.168
29.3694	3.0560	10.9525	4.20375	4.21037	-.157
30.0863	3.1091	11.1697	4.26770	4.28039	-.296
30.4307	3.1322	11.2640	4.30041	4.31079	-.241
30.8409	3.1593	11.3746	4.33950	4.34646	-.160
31.1231	3.1814	11.4645	4.36307	4.37545	-.283
31.5329	3.2066	11.5669	4.40352	4.40844	-.112
31.9300	3.2323	11.6712	4.44127	4.44206	-.018
32.2564	3.2566	11.7697	4.46920	4.47380	-.103
32.7085	3.2893	11.9017	4.50864	4.51635	-.171
33.0934	3.3117	11.9921	4.54694	4.54550	.032
33.3598	3.3341	12.0825	4.56702	4.57460	-.166
34.1247	3.3842	12.2834	4.63735	4.63934	-.043
34.4434	3.4086	12.3811	4.66324	4.67082	-.162
34.8703	3.4360	12.4904	4.70255	4.70605	-.074
35.2670	3.4609	12.5896	4.73939	4.73801	.029
35.4893	3.4786	12.6601	4.75658	4.76071	-.087
35.9373	3.5066	12.7713	4.79795	4.79654	.029
36.3990	3.5364	12.8891	4.83958	4.83447	.106
36.6935	3.5592	12.9793	4.86262	4.86350	-.018
37.0891	3.5859	13.0842	4.89700	4.89729	-.006
37.4149	3.6090	13.1749	4.92421	4.92649	-.046
37.7244	3.6311	13.2616	4.94980	4.95443	-.093
38.1231	3.6578	13.3660	4.98424	4.98802	-.076
38.6091	3.6910	13.4952	5.02549	5.02962	-.082
38.9216	3.7143	13.5855	5.05025	5.05869	-.167
39.3340	3.7395	13.6829	5.08759	5.09004	-.048
39.8116	3.7706	13.8031	5.12891	5.12874	.003
40.1560	3.7951	13.8970	5.15694	5.15895	-.039
40.5219	3.8222	14.0011	5.18559	5.19246	-.132
40.8371	3.8428	14.0796	5.21263	5.21772	-.098
41.3715	3.8742	14.1993	5.26117	5.25625	.094
41.7182	3.8977	14.2885	5.28994	5.28494	.095
42.2067	3.9292	14.4076	5.33169	5.32325	.159
42.5283	3.9510	14.4894	5.35825	5.34958	.162
42.8253	3.9769	14.5867	5.37789	5.38087	-.055
43.4203	4.0106	14.7128	5.43216	5.42143	.198
43.7994	4.0356	14.8058	5.46373	5.45135	.227
44.1824	4.0640	14.9112	5.49293	5.48525	.140
44.4490	4.0868	14.9951	5.51084	5.51224	-.025
44.7549	4.1111	15.0848	5.53276	5.54107	-.150
45.3366	4.1438	15.2046	5.58562	5.57961	.108
45.7178	4.1712	15.3047	5.61489	5.61178	.055
46.0828	4.1979	15.4017	5.64275	5.64297	-.004

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TABLE E2 CONTINUED

CTOT (MJ/DEG)	CADD (MJ/DEG)	T**2 (DEG2)	C/T (MJ/M-DEG2)	C/T FIT (MJ/M-DEG2)	PCERROR
46.5556	4.2274	15.5084	5.68281	5.67729	.097
46.8866	4.2539	15.6040	5.70614	5.70800	-.033
47.3304	4.2851	15.7160	5.74081	5.74400	-.056
47.8064	4.3183	15.8342	5.77817	5.78201	-.066
48.3705	4.3509	15.9501	5.82749	5.81926	.142
48.5214	4.3674	16.0085	5.83461	5.83802	-.058
49.0236	4.4030	16.1336	5.87338	5.87822	-.082
49.3931	4.4268	16.2170	5.90364	5.90503	-.024
49.7877	4.4597	16.3321	5.93011	5.94201	-.200
50.4431	4.4908	16.4400	5.99203	5.97667	.257
50.7687	4.5182	16.5347	6.01362	6.00709	.109
51.1422	4.5524	16.6521	6.03634	6.04482	-.140
51.5509	4.5739	16.7257	6.07309	6.06848	.076
52.1752	4.6131	16.8592	6.12436	6.11133	.213
52.3328	4.6332	16.9275	6.12966	6.13326	-.059
53.1447	4.6820	17.0919	6.19768	6.18607	.188
53.1360	4.6855	17.1035	6.19403	6.18980	.068
53.4278	4.7162	17.2061	6.20881	6.22276	-.224

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TABLE E3

SPECIFIC HEAT OF 30A/O GOLD-70A/O SILVER ALLOY

RUN 17

FEBRUARY 24.1969

CTOT (MJ/DEG)	CADD (MJ/DEG)	T**2 (DEG2)	C/T (MJ/M-DEG2)	C/T FIT (MJ/M-DEG2)	pCERROR
3.7051	.9318	1.8618	1.02628	1.03568	-.908
3.8643	.9550	1.9526	1.05131	1.05493	-.342
4.0332	.9802	2.0533	1.07579	1.07627	-.045
4.1917	1.0039	2.1493	1.09796	1.09660	.124
4.3660	1.0294	2.2538	1.12225	1.11874	.313
4.5132	1.0518	2.3470	1.14088	1.13849	.209
4.6862	1.0767	2.4515	1.16406	1.16065	.294
4.8599	1.1020	2.5585	1.18631	1.18334	.251
5.1144	1.1375	2.7108	1.21966	1.21563	.332
5.2853	1.1618	2.8158	1.24083	1.23789	.237
5.4708	1.1865	2.9234	1.26524	1.26071	.359
5.6428	1.2103	3.0274	1.28635	1.28277	.280
5.9391	1.2490	3.1977	1.32437	1.31890	.415
6.0707	1.2680	3.2817	1.33868	1.33672	.147
6.2795	1.2952	3.4024	1.36443	1.36233	.154
6.4529	1.3178	3.5028	1.38540	1.38365	.127
6.7825	1.3611	3.6957	1.42398	1.42459	-.042
6.9333	1.3810	3.7842	1.44123	1.44338	-.149
7.1356	1.4057	3.8946	1.46607	1.46682	-.052
7.3011	1.4276	3.9923	1.48432	1.48757	-.218
7.4749	1.4490	4.0881	1.50487	1.50791	-.201
7.6770	1.4751	4.2045	1.52722	1.53264	-.354
7.8298	1.4932	4.2852	1.54566	1.54978	-.265
8.0453	1.5196	4.4029	1.57037	1.57478	-.280
8.2686	1.5459	4.5203	1.59662	1.59972	-.194
8.4290	1.5655	4.6074	1.61457	1.61824	-.227
8.6311	1.5879	4.7071	1.63920	1.63943	-.014
8.8164	1.6112	4.8108	1.65871	1.66147	-.166
8.9601	1.6278	4.8841	1.67530	1.67704	-.104
9.1150	1.6480	4.9739	1.69057	1.69615	-.329
9.3289	1.6722	5.0811	1.71514	1.71893	-.220
9.5191	1.6944	5.1790	1.73614	1.73975	-.207
9.6917	1.7153	5.2713	1.75423	1.75938	-.293
9.9148	1.7392	5.3768	1.78032	1.78182	-.084
10.1060	1.7612	5.4736	1.80101	1.80240	-.077
10.2938	1.7840	5.5733	1.82015	1.82362	-.191
10.4852	1.8061	5.6702	1.84042	1.84424	-.208
10.6913	1.8303	5.7763	1.86164	1.86682	-.277
10.8932	1.8503	5.8636	1.88566	1.88540	.014
11.0881	1.8741	5.9675	1.90454	1.90752	-.156
11.3053	1.8971	6.0676	1.92858	1.92882	-.012
11.4963	1.9198	6.1664	1.94729	1.94985	-.131
11.6963	1.9424	6.2648	1.96772	1.97079	-.156
11.9176	1.9655	6.3647	1.99188	1.99208	-.010

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TABLE E3 CONTINUED

CTOT (MJ/DEG)	CADD (MJ/DEG)	T**2 (DEG2)	C/T (MJ/M-DEG2)	C/T FIT (MJ/M-DEG2)	PCERROR
12.1244	1.9876	6.4606	2.01373	2.01249	.062
12.3373	2.0100	6.5573	2.03641	2.03309	.163
12.5595	2.0337	6.6597	2.05953	2.05490	.225
12.7082	2.0573	6.7611	2.06832	2.07651	-.394
13.0088	2.0808	6.8624	2.10641	2.09808	.397
13.1844	2.1039	6.9616	2.12054	2.11922	.062
13.4037	2.1263	7.0575	2.14348	2.13967	.178
13.6257	2.1499	7.1585	2.16578	2.16119	.212
13.8383	2.1725	7.2554	2.18686	2.18185	.230
14.0406	2.1939	7.3466	2.20695	2.20128	.257
14.2688	2.2199	7.4577	2.22785	2.22496	.130
14.5015	2.2431	7.5564	2.25174	2.24601	.255
14.7079	2.2658	7.6529	2.27103	2.26660	.195
14.9124	2.2883	7.7487	2.28995	2.28702	.128
15.1729	2.3139	7.8572	2.31640	2.31018	.269
15.3848	2.3362	7.9519	2.33651	2.33037	.263
15.6102	2.3600	8.0526	2.35773	2.35185	.250
15.8238	2.3828	8.1490	2.37749	2.37243	.213
16.0551	2.4082	8.2561	2.39821	2.39529	.122
16.3285	2.4348	8.3687	2.42508	2.41932	.238
16.5178	2.4556	8.4560	2.44181	2.43795	.158
16.7334	2.4785	8.5525	2.46125	2.45855	.110
17.0069	2.5051	8.6643	2.48768	2.48242	.212
17.2044	2.5262	8.7533	2.50511	2.50142	.147
17.4844	2.5535	8.8676	2.53177	2.52582	.236
17.6941	2.5728	8.9487	2.55239	2.54316	.363
17.8710	2.5956	9.0440	2.56480	2.56361	.050
18.1374	2.6201	9.1467	2.59075	2.58543	.206
18.3404	2.6448	9.2501	2.60582	2.60753	-.066
18.6004	2.6684	9.3486	2.63110	2.62857	.096
18.8151	2.6908	9.4422	2.64962	2.64859	.039
19.0431	2.7122	9.5312	2.67102	2.66760	.128
19.2948	2.7398	9.6462	2.69147	2.69218	-.026
19.5325	2.7634	9.7441	2.71255	2.71312	-.021
19.8057	2.7907	9.8576	2.73644	2.73738	-.034
20.0600	2.8127	9.9491	2.76101	2.75694	.148
20.5125	2.8622	10.1542	2.79685	2.80081	-.141
20.7424	2.8853	10.2495	2.81643	2.82120	-.169
21.0103	2.9101	10.3522	2.84057	2.84315	-.091
21.2698	2.9348	10.4543	2.86334	2.86499	-.058
21.5097	2.9595	10.5560	2.88295	2.88477	-.132
21.7414	2.9836	10.6551	2.90164	2.90797	-.218
22.0549	3.0119	10.7714	2.92982	2.93285	-.103
22.3570	3.0430	10.8991	2.95404	2.96020	-.208

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TABLE E3 CONTINUED

CTOT (MJ/DEG)	CADD (MJ/DEG)	T**2 (DEG2)	C/T (MJ/M-DEG2)	C/T FIT (MJ/M-DEG2)	%ERROR
22.5256	3.0595	10.9669	2.96810	2.97470	-.222
22.7745	3.0822	11.0597	2.98994	2.99459	-.155
23.0712	3.1064	11.1588	3.01783	3.01579	.068
23.2868	3.1324	11.2648	3.03214	3.03849	-.209
23.5823	3.1598	11.3766	3.05734	3.06243	-.166
23.8534	3.1850	11.4792	3.08029	3.08440	-.134
24.0199	3.2017	11.5472	3.09345	3.09898	-.178
24.3411	3.2313	11.6673	3.12060	3.12471	-.132
24.6314	3.2583	11.7764	3.14485	3.14809	-.103
24.9513	3.2872	11.8934	3.17194	3.17317	-.039
25.2713	3.3138	12.0008	3.20049	3.19618	.135
25.4611	3.3362	12.0909	3.21286	3.21550	-.082
25.8137	3.3638	12.2018	3.24521	3.23926	.183
25.8720	3.3783	12.2598	3.24384	3.25170	-.242
26.1595	3.4021	12.3553	3.26914	3.27219	-.093
26.4920	3.4324	12.4764	3.29645	3.29814	-.051
26.7582	3.4564	12.5719	3.31839	3.31863	-.007
27.1057	3.4866	12.6918	3.34766	3.34434	.099
27.4028	3.5172	12.8132	3.36936	3.37039	-.030
27.5799	3.5356	12.8862	3.38212	3.38605	-.116
27.8809	3.5622	12.9910	3.40689	3.40853	-.048
28.0744	3.5842	13.0777	3.41952	3.42715	-.223
28.3693	3.6086	13.1732	3.44475	3.44764	-.084
28.7905	3.6448	13.3150	3.47962	3.47807	.045
28.9619	3.6647	13.3926	3.49044	3.49473	-.123
29.2605	3.6881	13.4838	3.51646	3.51431	.061
29.5431	3.7174	13.5975	3.53640	3.53873	-.066
29.8053	3.7442	13.7011	3.55511	3.56098	-.165
30.1073	3.7687	13.7956	3.58065	3.58127	-.017
30.3218	3.7926	13.8876	3.59459	3.60104	-.179
30.6328	3.8231	14.0046	3.61739	3.62616	-.242
30.9720	3.8496	14.1058	3.64643	3.64790	-.040
31.2702	3.8744	14.1998	3.67099	3.66811	.078
31.4193	3.8921	14.2673	3.67984	3.68261	-.075
31.8658	3.9296	14.4089	3.71614	3.71303	.084
32.1510	3.9558	14.5076	3.73780	3.73425	.095
32.6194	3.9950	14.6543	3.77567	3.76580	.262
32.7195	4.0098	14.7096	3.77979	3.77768	.056
33.0634	4.0375	14.8128	3.80809	3.79986	.216
33.2989	4.0644	14.9126	3.82259	3.82132	.033
33.5517	4.0916	15.0130	3.83918	3.84293	-.098
33.8145	4.1134	15.0933	3.86029	3.86018	.003
34.2974	4.1513	15.2320	3.90026	3.89002	.263
34.5160	4.1763	15.3234	3.91357	3.90968	.099

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TABLE E3 CONTINUED

CTOT (MJ/DEG)	CADD (MJ/DEG)	T**2 (DEG2)	C/T (MJ/M-DEG2)	C/T FIT (MJ/M-DEG2)	PCERROR
34.7134	4.1950	15.3910	3.92798	3.92424	.095
35.0082	4.2256	15.5017	3.94780	3.94807	-.007
35.2485	4.2504	15.5914	3.96399	3.96736	-.085
35.5906	4.2795	15.6957	3.99068	3.98982	.021
35.9111	4.3115	15.8102	4.01285	4.01445	-.040
36.2464	4.3436	15.9243	4.03680	4.03903	-.055
36.4802	4.3627	15.9919	4.05536	4.05358	.044
36.8296	4.3958	16.1084	4.08047	4.07868	.044
37.0455	4.4211	16.1974	4.09317	4.09783	-.114
37.4479	4.4528	16.3078	4.12564	4.12162	.097
37.7121	4.4854	16.4213	4.14020	4.14607	-.141
38.0781	4.5164	16.5282	4.16842	4.16910	-.016
38.2831	4.5346	16.5911	4.18365	4.18265	.024
38.6842	4.5754	16.7307	4.21065	4.21273	-.049
38.9889	4.6075	16.8402	4.23048	4.23632	-.138
39.2909	4.6286	16.9118	4.25601	4.25175	.100
39.6176	4.6589	17.0141	4.27948	4.27380	.133
39.9801	4.6923	17.1263	4.30558	4.29800	.176
40.2094	4.7175	17.2106	4.31987	4.31617	.086

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TABLE E4

SPECIFIC HEAT OF 90A/O GOLD-10A/O SILVER ALLOY

RUN 18

MAY 19,1969

CTOT (MJ/DEG)	CADD (MJ/DEG)	T**2 (DEG2)	C/T (MJ/M-DEG2)	C/T FIT (MJ/M-DEG2)	PCERROR
4.5624	.9339	1.8700	1.42015	1.42869	-.598
4.7887	.9584	1.9663	1.46197	1.46653	-.311
4.8094	.9603	1.9736	1.46644	1.46942	-.203
5.0733	.9886	2.0871	1.51330	1.51400	-.046
5.2992	1.0110	2.1780	1.55518	1.54969	.354
5.5801	1.0413	2.3032	1.60067	1.59886	.113
5.8615	1.0697	2.4220	1.64793	1.64549	.148
6.0121	1.0847	2.4852	1.67291	1.67027	.158
6.3016	1.1140	2.6098	1.71866	1.71918	-.030
6.6647	1.1471	2.7523	1.78005	1.77505	.282
6.9495	1.1737	2.8675	1.82557	1.82020	.295
7.0907	1.1869	2.9250	1.84756	1.84277	.260
7.3709	1.2118	3.0341	1.89248	1.88551	.370
7.5235	1.2266	3.0989	1.91451	1.91091	.189
7.7931	1.2508	3.2057	1.95568	1.95275	.150
8.0708	1.2769	3.3211	1.99532	1.99792	-.130
8.2697	1.2923	3.3892	2.02851	2.02460	.193
8.5496	1.3166	3.4975	2.06998	2.06700	.144
8.8079	1.3387	3.5957	2.10819	2.10544	.131
9.0600	1.3609	3.6946	2.14380	2.14413	-.015
9.3214	1.3829	3.7928	2.18167	2.18254	-.040
9.5979	1.4065	3.8980	2.22060	2.22365	-.137
9.8618	1.4287	3.9972	2.25758	2.26244	-.215
10.1536	1.4524	4.1030	2.29910	2.30382	-.205
10.4017	1.4726	4.1933	2.33380	2.33908	-.226
10.6627	1.4944	4.2904	2.36904	2.37703	-.336
10.9559	1.5172	4.3925	2.41038	2.41690	-.269
11.2547	1.5407	4.4969	2.45176	2.45765	-.240
11.5754	1.5661	4.6101	2.49505	2.50187	-.273
11.8018	1.5835	4.6874	2.52605	2.53204	-.237
12.1164	1.6078	4.7956	2.56834	2.57424	-.229
12.4082	1.6294	4.8911	2.60855	2.61151	-.113
12.6894	1.6511	4.9876	2.64538	2.64913	-.141
13.0304	1.6774	5.1038	2.68964	2.69445	-.179
13.2214	1.6924	5.1701	2.71376	2.72029	-.240
13.4801	1.7120	5.2567	2.74714	2.75405	-.251
13.8136	1.7361	5.3628	2.79135	2.79538	-.144
14.1029	1.7574	5.4568	2.82860	2.83198	-.120
14.3603	1.7769	5.5424	2.86074	2.86532	-.160
14.7710	1.8066	5.6727	2.91332	2.91604	-.093
15.0357	1.8258	5.7568	2.94672	2.94878	-.070
15.3443	1.8487	5.8570	2.98459	2.98777	-.106
15.6660	1.8714	5.9557	3.02533	3.02620	-.029
15.9947	1.8956	6.0615	3.06500	3.06732	-.076

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TABLE E4 CONTINUED

CTOT (MJ/DEG)	CADD (MJ/DEG)	T**2 (DEG2)	C/T (MJ/M-DEG2)	C/T FIT (MJ/M-DEG2)	PCERROR
16.2536	1.9133	6.1381	3.09794	3.09712	.026
16.6435	1.9416	6.2613	3.14466	3.14500	-.011
16.9363	1.9629	6.3536	3.17935	3.18091	-.049
17.2778	1.9870	6.4577	3.22050	3.22133	-.026
17.6041	2.0083	6.5499	3.26153	3.25715	.134
17.9444	2.0327	6.6553	3.30114	3.29808	.093
18.2468	2.0544	6.7486	3.33607	3.33432	.052
18.6427	2.0797	6.8574	3.38525	3.37655	.258
18.9880	2.1039	6.9613	3.42503	3.41689	.238
19.2928	2.1254	7.0538	3.45957	3.45277	.197
19.6186	2.1468	7.1454	3.49829	3.48829	.287
19.9808	2.1722	7.2542	3.53888	3.53047	.238
20.2666	2.1925	7.3405	3.57048	3.56395	.183
20.6516	2.2175	7.4473	3.61537	3.60535	.278
21.0537	2.2424	7.5533	3.66338	3.64643	.465
21.3462	2.2627	7.6400	3.69524	3.67999	.414
21.7034	2.2879	7.7468	3.73353	3.72136	.327
22.0771	2.3121	7.8497	3.77575	3.76119	.387
22.4028	2.3363	7.9523	3.80851	3.80094	.199
22.7637	2.3596	8.0510	3.84877	3.83913	.251
23.1279	2.3832	8.1506	3.88903	3.87768	.293
23.4753	2.4053	8.2440	3.92760	3.91379	.353
23.8534	2.4311	8.3529	3.96716	3.95589	.285
24.2845	2.4591	8.4711	4.01351	4.00159	.298
24.6987	2.4872	8.5892	4.05631	4.04725	.224
24.9770	2.5051	8.6643	4.08605	4.07628	.240
25.4193	2.5342	8.7869	4.13204	4.12364	.204
25.7711	2.5582	8.8875	4.16746	4.16246	.120
25.9462	2.5691	8.9334	4.18613	4.18018	.142
26.3383	2.5961	9.0462	4.22491	4.22376	.027
26.7219	2.6217	9.1533	4.26348	4.26507	-.037
27.0840	2.6455	9.2528	4.30001	4.30347	-.081
27.4571	2.6682	9.3476	4.33947	4.34006	-.014
27.8732	2.6965	9.4656	4.37983	4.38555	-.130
28.0963	2.7078	9.5130	4.40563	4.40384	.041
28.6568	2.7453	9.6689	4.46000	4.46392	-.088
28.9146	2.7613	9.7355	4.48619	4.48959	-.076
29.3569	2.7880	9.8464	4.53175	4.53232	-.013
29.7219	2.8136	9.9526	4.56509	4.57322	-.178
30.1259	2.8371	10.0503	4.60709	4.61082	-.081
30.5183	2.8612	10.1498	4.64632	4.64915	-.061
30.9036	2.8855	10.2504	4.68382	4.68786	-.086
31.2245	2.9036	10.3252	4.71725	4.71664	.013
31.6476	2.9334	10.4483	4.75451	4.76399	-.199

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TABLE E4 CONTINUED

CTOT (MJ/DEG)	CADD (MJ/DEG)	T**2 (DEG2)	C/T (MJ/M-DEG2)	C/T FIT (MJ/M-DEG2)	PCERROR
32.1062	2.9606	10.5605	4.80024	4.80713	-.143
32.4859	2.9851	10.6614	4.83569	4.84592	-.211
32.9400	3.0124	10.7736	4.88004	4.88905	-.184
33.2696	3.0348	10.8657	4.90917	4.92447	-.311
33.7054	3.0597	10.9676	4.95274	4.96360	-.219
34.1221	3.0818	11.0584	4.99587	4.99846	-.052
34.5003	3.1081	11.1659	5.02811	5.03976	-.231
34.8697	3.1290	11.2509	5.06471	5.07239	-.152
35.3327	3.1610	11.3814	5.10396	5.12248	-.361
35.8057	3.1860	11.4834	5.15201	5.16159	-.186
36.1814	3.2085	11.5749	5.18715	5.19670	-.184
36.6281	3.2343	11.6792	5.22986	5.23671	-.131
37.0373	3.2600	11.7834	5.26649	5.27664	-.192
37.3919	3.2822	11.8732	5.29815	5.31107	-.243
37.9998	3.3144	12.0032	5.35834	5.36086	-.047
38.2822	3.3334	12.0796	5.38191	5.39014	-.153
38.7566	3.3625	12.1965	5.42432	5.43491	-.195
39.1998	3.3863	12.2919	5.46723	5.47145	-.077
39.6832	3.4142	12.4034	5.51184	5.51412	-.041
40.1524	3.4419	12.5143	5.55417	5.55654	-.043
40.6109	3.4636	12.6006	5.60096	5.58957	.204
40.8085	3.4798	12.6650	5.61399	5.61420	-.004
41.1806	3.5016	12.7514	5.64744	5.64724	.003
41.7162	3.5325	12.8736	5.69585	5.69397	.033
42.0351	3.5534	12.9561	5.72202	5.72550	-.061
42.5560	3.5857	13.0833	5.76643	5.77411	-.133
42.9083	3.6052	13.1601	5.79865	5.80346	-.083
43.4283	3.6339	13.2725	5.84623	5.84638	-.002
43.8684	3.6620	13.3824	5.88247	5.88832	-.099
44.4332	3.6887	13.4860	5.93825	5.92789	.175
44.6475	3.7121	13.5769	5.94608	5.96256	-.276
45.0848	3.7319	13.6536	5.98982	5.99183	-.034
45.6359	3.7686	13.7953	6.03309	6.04590	-.212
46.2689	3.7927	13.8881	6.10036	6.08126	.314
46.6307	3.8222	14.0011	6.12321	6.12437	-.019
47.0134	3.8446	14.0865	6.15601	6.15690	-.015
47.4275	3.8697	14.1823	6.19047	6.19339	-.047
47.9798	3.9003	14.2983	6.23914	6.23760	.025
48.3766	3.9271	14.3994	6.26939	6.27611	-.107
48.9666	3.9569	14.5118	6.32377	6.31889	.077
49.3399	3.9769	14.5868	6.35702	6.34742	.151
49.8975	4.0112	14.7149	6.40229	6.39619	.095
50.4180	4.0427	14.8322	6.44488	6.44081	.063
50.8507	4.0676	14.9244	6.48145	6.47585	.086

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TABLE E4 CONTINUED

CTOT (MJ/DEG)	CADD (MJ/DEG)	T**2 (DEG2)	C/T (MJ/M-DEG2)	C/T FIT (MJ/M-DEG2)	PCERROR
51.2786	4.0930	15.0180	6.51682	6.51145	.082
51.7941	4.1220	15.1247	6.56072	6.55202	.133
52.2002	4.1486	15.2224	6.59170	6.58913	.039
52.5488	4.1731	15.3114	6.61684	6.62297	-.093
53.1061	4.2046	15.4258	6.66391	6.66643	-.038
53.6247	4.2307	15.5203	6.71051	6.70230	.122
54.1346	4.2652	15.6447	6.74810	6.74950	-.021
54.8306	4.3017	15.7753	6.80898	6.79908	.146
55.2289	4.3262	15.8625	6.84048	6.83215	.122
55.6217	4.3496	15.9455	6.87214	6.86367	.123
55.9744	4.3761	16.0391	6.89566	6.89915	-.050
56.6279	4.4114	16.1632	6.95145	6.94619	.076
56.9526	4.4326	16.2373	6.97587	6.97430	.023
57.3907	4.4593	16.3307	7.01038	7.00968	.010
57.9192	4.4950	16.4545	7.04898	7.05657	-.108
58.5354	4.5207	16.5431	7.10778	7.09014	.249
59.1085	4.5637	16.6909	7.14568	7.14611	-.006
59.3978	4.5781	16.7400	7.17117	7.16467	.091
59.8481	4.6083	16.8427	7.20406	7.20355	.007
60.2392	4.6312	16.9205	7.23537	7.23300	.033
60.9063	4.6757	17.0706	7.28415	7.28976	-.077
61.1237	4.6878	17.1112	7.30206	7.30512	-.042
61.6183	4.7169	17.2085	7.34146	7.34190	-.006

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TABLE E5

SPECIFIC HEAT OF PURE GOLD

RUN 19

JUNE 4,1969

CTOT (MJ/DEG)	CADD (MJ/DEG)	T**2 (DEG2)	C/T (MJ/M-DEG2)	C/T FIT (MJ/M-DEG2)	pCERROR
5.6747	.9654	1.9941	1.60720	1.61231	-.317
5.9299	.9377	2.0836	1.65009	1.65310	-.182
6.2268	1.0134	2.1879	1.69865	1.70067	-.118
6.4665	1.0330	2.2688	1.73851	1.73753	.056
6.7210	1.0537	2.3549	1.77983	1.77678	.172
7.0530	1.0808	2.4687	1.83186	1.82857	.180
7.3237	1.1020	2.5585	1.87460	1.86946	.275
7.8597	1.1440	2.7386	1.95578	1.95138	.226
8.1325	1.1651	2.8302	1.99597	1.99300	.149
8.4955	1.1917	2.9460	2.05083	2.04562	.254
8.7424	1.2105	3.0282	2.08598	2.08294	.146
8.9586	1.2259	3.0958	2.11806	2.11366	.208
9.3355	1.2525	3.2131	2.17325	2.16689	.293
9.5782	1.2724	3.3012	2.20311	2.20688	-.171
9.9903	1.2993	3.4203	2.26483	2.26086	.176
10.2514	1.3174	3.5009	2.30117	2.29742	.163
10.5695	1.3401	3.6021	2.34363	2.34325	.016
10.9148	1.3636	3.7066	2.39094	2.39058	.015
11.2383	1.3863	3.8081	2.43310	2.43656	-.142
11.5337	1.4063	3.8973	2.47235	2.47689	-.183
11.8641	1.4279	3.9938	2.51677	2.52054	-.150
12.3111	1.4580	4.1279	2.57444	2.58120	-.262
12.5295	1.4722	4.1913	2.60298	2.60983	-.262
12.8687	1.4940	4.2890	2.64701	2.65398	-.263
13.2269	1.5163	4.3882	2.69422	2.69877	-.169
13.4635	1.5318	4.4575	2.72366	2.73004	-.234
13.8688	1.5572	4.5704	2.77543	2.78102	-.201
14.2742	1.5826	4.6835	2.82636	2.83201	-.199
14.5951	1.6025	4.7719	2.86643	2.87188	-.190
14.9637	1.6263	4.8774	2.91052	2.91940	-.304
15.3260	1.6485	4.9761	2.95497	2.96388	-.301
15.6722	1.6683	5.0636	2.99926	3.00326	-.133
16.0843	1.6931	5.1735	3.04929	3.05270	-.112
16.5013	1.7174	5.2894	3.09757	3.10486	-.235
16.8540	1.7406	5.3828	3.13944	3.14686	-.236
17.1737	1.7588	5.4629	3.17850	3.18286	-.137
17.5801	1.7831	5.5693	3.22604	3.23068	-.144
17.9979	1.8074	5.6760	3.27516	3.27860	-.105
18.3632	1.8288	5.7696	3.31751	3.32058	-.092
18.7719	1.8516	5.8694	3.36593	3.36537	.017
19.1754	1.8767	5.9790	3.40951	3.41454	-.147
19.4287	1.8908	6.0404	3.43904	3.44207	-.088
19.9413	1.9190	6.1630	3.49872	3.49700	.049
20.4552	1.9486	6.2915	3.55587	3.55454	.037

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TABLE E5 CONTINUED

CTOT (MJ/DEG)	CADD (MJ/DEG)	T**2 (DEG2)	C/T (MJ/M-DEG2)	C/T FIT (MJ/M-DEG2)	%ERROR
20.7900	1.9667	6.3698	3.59440	3.58963	.133
21.1747	1.9902	6.4719	3.63437	3.63530	-.026
21.5900	2.0127	6.5690	3.68126	3.67873	.069
21.8944	2.0304	6.6454	3.71363	3.71292	.019
22.4049	2.0574	6.7616	3.77122	3.76483	.170
22.9557	2.0891	6.8981	3.82895	3.82583	.082
23.3317	2.1102	6.9885	3.86881	3.86620	.068
23.8696	2.1356	7.0973	3.93178	3.91473	.435
24.1902	2.1513	7.1795	3.96342	3.95141	.304
24.5566	2.1746	7.2641	4.00222	3.98916	.328
24.9010	2.1947	7.3502	4.03637	4.02752	.220
25.3046	2.2172	7.4462	4.07758	4.07030	.179
25.8173	2.2438	7.5596	4.13208	4.12080	.274
26.2790	2.2679	7.6619	4.18059	4.16637	.341
26.7990	2.2954	7.7786	4.23424	4.21828	.378
27.0519	2.3136	7.8560	4.25367	4.25272	.022
27.4277	2.3318	7.9330	4.29417	4.28694	.169
27.9710	2.3611	8.0572	4.34821	4.34217	.139
28.4259	2.3834	8.1514	4.39605	4.38399	.275
28.8861	2.4077	8.2625	4.43913	4.43336	.130
29.4785	2.4411	8.3952	4.49719	4.49226	.110
29.8478	2.4589	8.4702	4.53546	4.52551	.220
30.3403	2.4853	8.5811	4.58274	4.57470	.176
30.7106	2.5041	8.6601	4.61937	4.60971	.210
31.2963	2.5343	8.7873	4.67619	4.66607	.217
31.7543	2.5583	8.8877	4.71979	4.71053	.197
31.9796	2.5717	8.9439	4.73909	4.73541	.078
32.4125	2.5943	9.0389	4.77988	4.77744	.051
32.9429	2.6208	9.1496	4.83116	4.82642	.098
33.3950	2.6430	9.2426	4.87495	4.86752	.153
33.8590	2.6680	9.3470	4.91687	4.91364	.066
34.4124	2.6977	9.4590	4.97016	4.96314	.141
34.6520	2.7100	9.5222	4.98869	4.99105	-.047
35.4913	2.7505	9.6907	5.06888	5.06540	.069
36.0402	2.7784	9.8068	5.11388	5.11661	.044
36.5691	2.8057	9.9200	5.16636	5.16653	-.004
36.8789	2.8223	9.9889	5.19323	5.19686	-.070
37.4040	2.8468	10.0906	5.24293	5.24166	.024
37.9608	2.8765	10.2135	5.29079	5.29575	-.094
38.2384	2.8928	10.2806	5.31277	5.32531	-.236
38.5768	2.9107	10.3464	5.34417	5.35424	-.188
39.2077	2.9366	10.4614	5.40455	5.40484	-.005
39.8340	2.9698	10.5985	5.45728	5.46509	-.143
40.4012	2.9977	10.7130	5.50746	5.51539	-.144

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TABLE E5 CONTINUED

CTOT (MJ/DEG)	CADD (MJ/DEG)	T**2 (DEG2)	C/T (MJ/M-DEG2)	C/T FIT (MJ/M-DEG2)	%ERROR
40.7016	3.0116	10.7703	5.53487	5.54053	-.102
41.2817	3.0102	10.8876	5.58553	5.59201	-.116
41.7876	3.0684	11.0034	5.62544	5.64285	-.309
42.1167	3.0836	11.0654	5.65515	5.67003	-.262
42.6302	3.1068	11.1603	5.70179	5.71162	-.172
43.1186	3.1304	11.2568	5.74404	5.75393	-.172
43.4435	3.1431	11.3087	5.77559	5.77667	-.019
44.0506	3.1758	11.4416	5.82380	5.83486	-.189
44.6876	3.2056	11.5631	5.87947	5.88800	-.145
45.0676	3.2234	11.6350	5.91217	5.91947	-.123
45.7489	3.2554	11.7646	5.97074	5.97616	-.091
46.2330	3.2800	11.8645	6.00984	6.01979	-.165
46.6725	3.3006	11.9474	6.04735	6.05603	-.143
47.3224	3.3328	12.0772	6.10043	6.11270	-.201
47.7786	3.3536	12.1610	6.13956	6.14925	-.158
48.1525	3.3700	12.2267	6.17232	6.17792	-.091
48.8033	3.3968	12.3339	6.23106	6.22468	.102
49.3630	3.4296	12.4649	6.27018	6.28178	-.185
50.0663	3.4586	12.5805	6.33290	6.33217	.012
50.5574	3.4824	12.6752	6.37246	6.37340	-.015
51.1025	3.5086	12.7792	6.41644	6.41865	-.034
51.4145	3.5279	12.8554	6.43674	6.45181	-.234
52.2339	3.5627	12.9929	6.50748	6.51161	-.063
52.7780	3.5854	13.0823	6.55468	6.55048	.064
53.2484	3.6092	13.1759	6.59065	6.59113	-.007
53.7936	3.6336	13.2713	6.63581	6.63258	.049
54.5473	3.6674	13.4031	6.69789	6.68978	.121
55.0441	3.6938	13.5058	6.73406	6.73434	-.004
55.5513	3.7183	13.6010	6.77351	6.77563	-.031
56.2448	3.7499	13.7233	6.82738	6.82863	.011
56.5990	3.7660	13.7851	6.85797	6.85538	.038
57.4676	3.8063	13.9400	6.92668	6.92246	.061
57.8878	3.8294	14.0284	6.95592	6.96071	-.069
58.3213	3.8504	14.1088	6.98897	6.99552	-.094
59.0272	3.8823	14.2301	7.04525	7.04795	-.038
59.7773	3.9157	14.3678	7.10214	7.10749	-.075
60.2593	3.9395	14.4463	7.14129	7.14141	-.002
60.8905	3.9645	14.5403	7.19478	7.18201	.178
61.6083	4.0307	14.6757	7.24728	7.24043	.095
61.7934	4.0128	14.7208	7.25789	7.25989	-.027
62.2790	4.0344	14.8014	7.29624	7.29463	.022
62.9808	4.0662	14.9191	7.35101	7.34537	.077
63.5430	4.0924	15.0160	7.39390	7.38712	.092
63.9190	4.1130	15.0917	7.41942	7.41975	-.004

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TABLE E5 CONTINUED

CTOT (MJ/DEG)	CADD (MJ/DEG)	T**2 (DEG2)	C/T (MJ/M-DEG2)	C/T FIT (MJ/M-DEG2)	pCERROR
64.6397	4.1456	15.2118	7.47509	7.47145	.049
65.4217	4.1832	15.3483	7.53337	7.53017	.042
65.8762	4.2040	15.4236	7.56818	7.56257	.074
66.3562	4.2286	15.5129	7.60209	7.60095	.015
67.2294	4.2672	15.6516	7.67000	7.66056	.123
67.4314	4.2847	15.7144	7.67709	7.68752	-.136
68.1378	4.3146	15.8212	7.73308	7.73340	-.004
68.9343	4.3488	15.9424	7.79565	7.78542	.131
69.4415	4.3772	16.0430	7.82879	7.82854	.003
69.8766	4.3972	16.1133	7.86152	7.85870	.036
70.3372	4.4276	16.2200	7.88710	7.90443	-.219
71.3375	4.4676	16.3594	7.96785	7.96412	.047
71.9552	4.4972	16.4620	8.01283	8.00806	.060
72.5057	4.5251	16.5582	8.05143	8.04920	.028
73.0664	4.5546	16.6597	8.08958	8.09262	-.038
73.4517	4.5754	16.7307	8.11537	8.12295	-.093
74.0841	4.6047	16.8307	8.16206	8.16569	-.044
74.4665	4.6217	16.8883	8.19096	8.19034	.008
75.3449	4.6618	17.0237	8.25624	8.24816	.098
75.7190	4.6780	17.0782	8.28482	8.27138	.162
75.7744	4.6859	17.1047	8.28392	8.28272	.014
76.4843	4.7171	17.2094	8.33753	8.32738	.122

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TABLE E6

SPECIFIC HEAT OF PURE SILVER

RUN 20

JUNE 20,1969

CTOT (MJ/DEG)	CADD (MJ/DEG)	T**2 (DEG2)	C/T (MJ/M-DEG2)	C/T FIT (MJ/M-DEG2)	PCERROR
3.7795	.9579	1.9642	.97918	.98165	-.252
3.9398	.9845	2.0706	.99887	.99979	-.093
4.1287	1.0151	2.1951	1.02210	1.02102	.105
4.3016	1.0437	2.3131	1.04184	1.04113	.068
4.4408	1.0658	2.4056	1.05833	1.05690	.135
4.5927	1.0893	2.5045	1.07670	1.07377	.274
4.7480	1.1143	2.6110	1.09374	1.09192	.167
4.9237	1.1411	2.7261	1.11424	1.11154	.243
5.0892	1.1668	2.8374	1.13254	1.13051	.179
5.2352	1.1886	2.9324	1.14935	1.14671	.231
5.3883	1.2101	3.0265	1.16812	1.16275	.461
5.5354	1.2340	3.1318	1.18215	1.18071	.122
5.6438	1.2492	3.1985	1.19511	1.19209	.253
5.7962	1.2718	3.2987	1.21158	1.20916	.200
5.9330	1.2918	3.3871	1.22654	1.22425	.187
6.0679	1.3123	3.4782	1.24019	1.23979	.032
6.2252	1.3348	3.5783	1.25740	1.25685	.044
6.3857	1.3580	3.6818	1.27439	1.27450	-.009
6.5585	1.3830	3.7933	1.29241	1.29352	-.086
6.7206	1.4074	3.9020	1.30821	1.31206	-.294
6.8399	1.4239	3.9757	1.32110	1.32463	-.266
7.0492	1.4528	4.1051	1.34340	1.34670	-.245
7.1801	1.4730	4.1951	1.35522	1.36205	-.501
7.3608	1.4965	4.3001	1.37542	1.37996	-.329
7.5327	1.5197	4.4035	1.39365	1.39760	-.283
7.6838	1.5409	4.4977	1.40876	1.41368	-.348
7.8705	1.5655	4.6075	1.42859	1.43241	-.267
8.0308	1.5870	4.7031	1.44815	1.44871	-.246
8.2085	1.6106	4.8079	1.46350	1.46659	-.211
8.3554	1.6309	4.8980	1.47778	1.48197	-.283
8.5407	1.6551	5.0051	1.49693	1.50024	-.220
8.7198	1.6774	5.1041	1.51608	1.51713	-.069
8.8654	1.6998	5.2031	1.52785	1.53402	-.402
9.0244	1.7182	5.2842	1.54583	1.54787	-.132
9.1775	1.7388	5.3749	1.56054	1.56334	-.179
9.3405	1.7594	5.4654	1.57718	1.57878	-.101
9.5255	1.7842	5.5743	1.59471	1.59736	-.166
9.6915	1.8060	5.6698	1.61067	1.61367	-.186
9.8859	1.8262	5.7584	1.63354	1.62879	.292
10.0531	1.8522	5.8722	1.64595	1.64821	-.137
10.2210	1.8742	5.9678	1.66178	1.66453	-.165
10.3897	1.8961	6.0635	1.67761	1.68086	-.194
10.5973	1.9201	6.1680	1.69929	1.69869	.036
10.7779	1.9424	6.2648	1.71686	1.71522	.096

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TABLE E6 CONTINUED

CTOT (MJ/DEG)	CADD (MJ/DEG)	T**2 (DEG2)	C/T (MJ/M*DEG2)	C/T FIT (MJ/M*DEG2)	%ERROR
10.9085	1.9643	6.3595	1.72502	1.73138	-.367
11.1339	1.9885	6.4644	1.74944	1.74929	.009
11.3102	2.0113	6.5628	1.76542	1.76609	-.038
11.5139	2.0350	6.6651	1.78573	1.78355	.122
11.6713	2.0558	6.7547	1.79940	1.79885	.031
11.8674	2.0784	6.8521	1.81881	1.81547	.184
12.0245	2.1019	6.9527	1.83026	1.83265	-.130
12.2714	2.1264	7.0581	1.85724	1.85065	.356
12.4606	2.1504	7.1608	1.87390	1.86818	.306
12.6595	2.1740	7.2619	1.89246	1.88544	.372
12.8074	2.1944	7.3488	1.90411	1.90028	.202
12.9915	2.2177	7.4482	1.92003	1.91724	.145
13.2141	2.2423	7.5529	1.94170	1.93513	.340
13.4088	2.2672	7.6591	1.95803	1.95326	.244
13.5885	2.2893	7.7528	1.97370	1.96927	.225
13.8403	2.3172	7.8712	1.99761	1.98948	.409
13.9725	2.3354	7.9485	2.00752	2.00269	.241
14.1678	2.3582	8.0451	2.02502	2.01919	.289
14.4158	2.3874	8.1684	2.04693	2.04024	.328
14.6110	2.4128	8.2756	2.06234	2.05856	.184
14.7923	2.4311	8.3530	2.08017	2.07178	.405
15.0386	2.4626	8.4856	2.09973	2.09443	.253
15.2048	2.4816	8.5655	2.11438	2.10808	.299
15.3770	2.5039	8.6593	2.12767	2.12410	.168
15.6343	2.5324	8.7792	2.15066	2.14457	.284
15.8552	2.5592	8.8915	2.16868	2.16377	.227
15.9765	2.5768	8.9656	2.17653	2.17643	.005
16.1833	2.5990	9.0586	2.19516	2.19231	.130
16.3582	2.6239	9.1624	2.20681	2.21005	-.147
16.5912	2.6474	9.2608	2.22853	2.22686	.075
16.7705	2.6691	9.3514	2.24278	2.24233	.020
16.9849	2.6949	9.4592	2.25977	2.26077	-.044
17.1777	2.7167	9.5499	2.27594	2.27625	-.013
17.3725	2.7379	9.6382	2.29269	2.29135	.058
17.6153	2.7664	9.7568	2.31207	2.31161	.020
17.7813	2.7885	9.8487	2.32356	2.32731	-.161
17.9959	2.8127	9.9492	2.34115	2.34449	-.143
18.2145	2.8373	10.0510	2.35904	2.36189	-.120
18.3763	2.8568	10.1317	2.37136	2.37569	-.182
18.6602	2.8864	10.2544	2.39575	2.39666	-.038
18.8049	2.9063	10.3366	2.40508	2.41071	-.234
19.0182	2.9278	10.4253	2.42373	2.42586	-.088
19.3485	2.9650	10.5786	2.44994	2.45206	-.086
19.5242	2.9869	10.6687	2.46248	2.46746	-.202

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TABLE E6 CONTINUED

CTOT (MJ/DEG)	CADD (MJ/DEG)	T**2 (DEG2)	C/T (MJ/M-DEG2)	C/T FIT (MJ/M-DEG2)	%ERROR
19.7148	3.0104	10.7656	2.47612	2.48402	-.318
19.9678	3.0339	10.8617	2.49902	2.50046	-.058
20.1425	3.0578	10.9598	2.50998	2.51722	-.288
20.3511	3.0810	11.0547	2.52629	2.53346	-.283
20.5869	3.1063	11.1585	2.54516	2.55119	-.236
20.8050	3.1279	11.2466	2.56367	2.56626	-.101
21.0429	3.1589	11.3731	2.57922	2.58788	-.335
21.2976	3.1853	11.4803	2.59992	2.60621	-.242
21.5294	3.2069	11.5683	2.62007	2.62126	-.046
21.7571	3.2333	11.6752	2.63669	2.63954	-.108
21.9671	3.2576	11.7738	2.65194	2.65641	-.168
22.1885	3.2801	11.8646	2.66988	2.67193	-.077
22.4847	3.3107	11.9883	2.69335	2.69309	.010
22.6437	3.3311	12.0703	2.70361	2.70711	-.129
22.9050	3.3590	12.1823	2.72369	2.72626	-.094
23.2131	3.3862	12.2917	2.75049	2.74497	.201
23.3567	3.4075	12.3769	2.75792	2.75954	-.059
23.6273	3.4313	12.4718	2.78140	2.77577	.203
23.7694	3.4529	12.5580	2.78836	2.79052	-.077
24.0532	3.4812	12.6707	2.81084	2.80979	.037
24.2994	3.5094	12.7824	2.82820	2.82890	-.025
24.5040	3.5316	12.8704	2.84324	2.84395	-.025
24.8134	3.5634	12.9967	2.86694	2.86540	.054
25.0467	3.5931	13.1125	2.88150	2.88538	-.134
25.2512	3.6136	13.1929	2.89735	2.89913	-.062
25.5198	3.6412	13.3009	2.91770	2.91760	.003
25.7570	3.6641	13.3905	2.93639	2.93294	.118
25.8996	3.6873	13.4809	2.94236	2.94840	-.205
26.2255	3.7174	13.5977	2.96871	2.96838	.011
26.5213	3.7446	13.7025	2.99262	2.98632	.211
26.7067	3.7698	13.7998	3.00304	3.00296	.003
26.9852	3.8018	13.9227	3.02189	3.02400	-.070
27.2611	3.8270	14.0195	3.04399	3.04056	.113
27.4635	3.8529	14.1181	3.05619	3.05744	-.041
27.7406	3.8802	14.2218	3.07724	3.07519	.067
27.9737	3.9071	14.3239	3.09276	3.09266	.003
28.2879	3.9360	14.4329	3.11759	3.11130	.202
28.4800	3.9593	14.5209	3.12967	3.12636	.106
28.6613	3.9807	14.6010	3.14142	3.14007	.043
28.8888	4.0069	14.6988	3.15649	3.15682	-.010
29.2191	4.0399	14.8215	3.18095	3.17783	.098
29.3982	4.0675	14.9239	3.18910	3.19534	-.195
29.7011	4.0918	15.0139	3.21449	3.21075	.116
29.9589	4.1160	15.1027	3.23426	3.22596	.257

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TABLE E6 CONTINUED

CTOT (MJ/DEG)	CADD (MJ/DEG)	T**2 (DEG2)	C/T (MJ/M-DEG2)	C/T FIT (MJ/M-DEG2)	%ERROR
30.2206	4.1466	15.2150	3.25112	3.24518	.183
30.4627	4.1726	15.3099	3.26790	3.26142	.198
30.6548	4.1996	15.4080	3.27792	3.27822	-.009
30.9597	4.2283	15.5118	3.30106	3.29599	.154
31.1696	4.2559	15.6111	3.31297	3.31300	-.001
31.4512	4.2859	15.7187	3.33248	3.33142	.032
31.7991	4.3176	15.8319	3.35920	3.35079	.251
31.9833	4.3448	15.9284	3.36815	3.36732	.025
32.2352	4.3741	16.0319	3.38429	3.38505	-.022
32.4476	4.3946	16.1043	3.39992	3.39745	.073
32.7396	4.4258	16.2138	3.41993	3.41619	.110
32.9971	4.4566	16.3210	3.43898	3.43455	.041
33.2055	4.4891	16.4340	3.44525	3.45390	-.251
33.5575	4.5232	16.5517	3.47099	3.47406	-.088
33.7382	4.5419	16.6162	3.48355	3.48512	-.045
34.2118	4.5954	16.7989	3.51442	3.51641	-.056
34.4778	4.6230	16.8928	3.53285	3.53249	.010
34.8112	4.6577	17.0099	3.55590	3.55254	.094
35.0358	4.6856	17.1039	3.56923	3.56865	.016
35.0233	4.6900	17.1187	3.56571	3.57118	-.153
35.2225	4.7199	17.2186	3.57520	3.58829	-.365

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TABLE E7

SPECIFIC HEAT OF 20A/O GOLD-80A/O SILVER ALLOY

RUN 21

JULY 8,1969

CTOT (MJ/DEG)	CADD (MJ/DEG)	T**2 (DEG2)	C/T (MJ/M-DEG2)	C/T FIT (MJ/M-DEG2)	PCERROR
3.8420	.9337	1.8688	.99988	1.00937	-.940
4.0047	.9559	1.9564	1.02443	1.02659	-.210
4.1942	.9837	2.0672	1.04948	1.04837	.107
4.3684	1.0098	2.1732	1.07079	1.06922	.147
4.4970	1.0281	2.2483	1.08732	1.08399	.307
4.6686	1.0531	2.3522	1.10794	1.10444	.317
4.7586	1.0667	2.4092	1.11792	1.11564	.204
4.9585	1.0955	2.5309	1.14124	1.13959	.145
5.1257	1.1183	2.6281	1.16178	1.15872	.264
5.2699	1.1387	2.7159	1.17818	1.17599	.186
5.4348	1.1608	2.8114	1.19802	1.19479	.270
5.5542	1.1774	2.8838	1.21132	1.20903	.189
5.5741	1.1794	2.8926	1.21442	1.21076	.302
5.7410	1.2019	2.9906	1.23361	1.23005	.289
5.9288	1.2270	3.1009	1.25487	1.25178	.247
6.0802	1.2468	3.1878	1.27232	1.26889	.270
6.2632	1.2716	3.2977	1.29187	1.29053	.104
6.4407	1.2939	3.3964	1.31254	1.30997	.196
6.5258	1.3078	3.4584	1.31871	1.32217	-.261
6.5844	1.3146	3.4885	1.32606	1.32809	-.153
6.8035	1.3408	3.6049	1.35223	1.35103	.089
6.9500	1.3604	3.6923	1.36717	1.36824	-.078
7.1506	1.3841	3.7983	1.39060	1.38912	.107
7.3467	1.4110	3.9182	1.40933	1.41275	-.242
7.5150	1.4324	4.0138	1.42691	1.43158	-.326
7.7108	1.4549	4.1144	1.44950	1.45141	-.132
7.8634	1.4753	4.2052	1.46408	1.46930	-.355
8.0892	1.5011	4.3205	1.48964	1.49203	-.160
8.2260	1.5187	4.3992	1.50295	1.50755	-.305
8.4043	1.5403	4.4951	1.52159	1.52646	-.319
8.5875	1.5616	4.5903	1.54121	1.54523	-.260
8.7664	1.5842	4.6907	1.55856	1.56502	-.413
8.9496	1.6049	4.7825	1.57846	1.58313	-.295
9.1519	1.6282	4.8862	1.59967	1.60358	-.244
9.3674	1.6524	4.9934	1.62265	1.62473	-.128
9.5400	1.6728	5.0837	1.63989	1.64254	-.162
9.7258	1.6950	5.1819	1.65806	1.66192	-.232
9.9248	1.7175	5.2810	1.67853	1.68147	-.175
10.1120	1.7401	5.3806	1.69628	1.70113	-.285
10.3293	1.7627	5.4801	1.71989	1.72077	-.051
10.5118	1.7856	5.5805	1.73611	1.74058	-.257
10.7074	1.8079	5.6783	1.75526	1.75990	-.264
10.9065	1.8301	5.7756	1.77500	1.77910	-.230
11.1226	1.8529	5.8751	1.79739	1.79875	-.075

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TABLE E7 CONTINUED

CTOT (MJ/DEG)	CADD (MJ/DEG)	T**2 (DEG2)	C/T (MJ/M-DEG2)	C/T FIT (MJ/M-DEG2)	PCERROR
11.3233	1.8754	5.9733	1.81682	1.81814	-.072
11.5286	1.8987	6.0748	1.83630	1.83818	-.102
11.7203	1.9190	6.1630	1.85556	1.85560	-.002
11.9341	1.9425	6.2652	1.87609	1.87579	.016
12.1466	1.9664	6.3685	1.89594	1.89620	-.014
12.3669	1.9893	6.4680	1.91776	1.91586	.099
12.5489	2.0107	6.5602	1.93373	1.93408	-.018
12.8100	2.0368	6.6729	1.96008	1.95635	.191
12.9719	2.0554	6.7532	1.97430	1.97221	.106
13.1958	2.0803	6.8602	1.99456	1.99336	.060
13.4065	2.1036	6.9601	2.01358	2.01312	.023
13.6723	2.1302	7.0742	2.03953	2.03567	.189
13.8698	2.1501	7.1596	2.05853	2.05255	.291
14.0532	2.1710	7.2487	2.07422	2.07017	.196
14.2814	2.1972	7.3607	2.09336	2.09232	.050
14.5550	2.2231	7.4710	2.12045	2.11414	.298
14.7545	2.2446	7.5630	2.13791	2.13233	.262
15.0000	2.2696	7.6691	2.16050	2.15333	.333
15.1947	2.2913	7.7614	2.17681	2.17168	.241
15.4015	2.3137	7.8565	2.19450	2.19040	.187
15.7114	2.3413	7.9734	2.22535	2.21363	.534
15.9898	2.3731	8.1079	2.24753	2.24014	.330
16.0462	2.3789	8.1327	2.25244	2.24505	.329
16.3229	2.4073	8.2524	2.27666	2.26875	.348
16.5512	2.4315	8.3548	2.29584	2.28901	.298
16.7944	2.4565	8.4601	2.31678	2.30987	.299
16.9999	2.4806	8.5615	2.33215	2.32994	.095
17.2418	2.5042	8.6607	2.35363	2.34959	.172
17.4812	2.5300	8.7691	2.37294	2.37106	.079
17.6918	2.5507	8.8562	2.39121	2.38831	.122
17.9194	2.5751	8.9582	2.40948	2.40851	.040
18.2236	2.6025	9.0733	2.43734	2.43131	.248
18.3918	2.6233	9.1600	2.44867	2.44860	.007
18.6143	2.6463	9.2561	2.46674	2.46754	-.033
18.8783	2.6721	9.3641	2.48906	2.48894	.005
19.2494	2.7087	9.5168	2.51996	2.51921	.030
19.5317	2.7367	9.6332	2.54321	2.54228	.036
19.6374	2.7475	9.6784	2.55159	2.55124	.014
19.8811	2.7724	9.7817	2.57096	2.57173	-.030
20.1295	2.7961	9.8802	2.59171	2.59126	.018
20.3619	2.8193	9.9766	2.61027	2.61038	-.004
20.6316	2.8430	10.0746	2.63398	2.62981	.158
20.7970	2.8648	10.1651	2.64341	2.64775	-.164
21.0472	2.8892	10.2659	2.66352	2.66776	-.159

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TABLE E7 CONTINUED

CTOT (MJ/DEG)	CADD (MJ/DEG)	T**2 (DEG2)	C/T (MJ/M-DEG2)	C/T FIT (MJ/M-DEG2)	pCERROR
21.3178	2.9144	10.3698	2.68596	2.68837	*.090
21.5745	2.9371	10.4635	2.70790	2.70697	.035
21.8216	2.9636	10.5729	2.72574	2.72866	-.107
22.0171	2.9875	10.6712	2.73785	2.74817	*.375
22.3163	3.0113	10.7689	2.76484	2.76757	*.099
22.5752	3.0361	10.8711	2.78517	2.78786	*.097
22.8040	3.0589	10.9645	2.80253	2.80638	*.137
23.0156	3.0810	11.0548	2.81785	2.82432	-.229
23.3115	3.1093	11.1707	2.84082	2.84733	-.229
23.6035	3.1349	11.2750	2.86494	2.86805	-.108
23.8751	3.1629	11.3893	2.88445	2.89074	-.218
24.0612	3.1810	11.4628	2.89852	2.90534	*.235
24.3915	3.2093	11.5778	2.92580	2.92820	-.082
24.6572	3.2362	11.6871	2.94490	2.94990	*.170
24.9229	3.2589	11.7790	2.96668	2.96816	*.050
25.1078	3.2802	11.8651	2.97820	2.98528	*.237
25.4348	3.3063	11.9704	3.00597	3.00619	*.007
25.7212	3.3329	12.0774	3.02776	3.02746	.010
26.0563	3.3654	12.2082	3.05219	3.05347	*.042
26.2837	3.3894	12.3044	3.06748	3.07259	-.166
26.5425	3.4102	12.3874	3.08897	3.08909	*.004
26.7982	3.4351	12.4868	3.10736	3.10885	*.048
27.0331	3.4578	12.5776	3.12423	3.12690	*.086
27.3255	3.4822	12.6747	3.14762	3.14621	.045
27.6089	3.5071	12.7732	3.16947	3.16580	.116
27.9451	3.5418	12.9105	3.19199	3.19312	*.035
28.2319	3.5693	13.0191	3.21243	3.21472	*.071
28.5294	3.5948	13.1193	3.23545	3.23465	.025
28.7511	3.6143	13.1959	3.25218	3.24990	.070
29.0109	3.6419	13.3039	3.26888	3.27140	-.077
29.3126	3.6690	13.4095	3.29124	3.29241	-.036
29.5942	3.6930	13.5028	3.31279	3.31098	.055
29.8151	3.7181	13.6001	3.32587	3.33036	-.135
30.1156	3.7482	13.7168	3.34601	3.35357	-.226
30.4265	3.7699	13.8003	3.37245	3.37022	.066
30.7102	3.7995	13.9139	3.39068	3.39283	-.063
31.0227	3.8226	14.0027	3.41625	3.41051	.168
31.2564	3.8502	14.1081	3.42925	3.43150	*.065
31.5393	3.8759	14.2056	3.44953	3.45093	*.041
31.8325	3.9013	14.3021	3.47117	3.47014	.030
32.1648	3.9335	14.4236	3.49365	3.49436	-.020
32.4282	3.9550	14.5046	3.51373	3.51060	.092
32.7841	3.9844	14.6150	3.54057	3.53250	.229
32.9639	4.0099	14.7102	3.54801	3.55147	*.097

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TABLE E7 CONTINUED

CTOT (MJ/DEG)	CADD (MJ/DEG)	T**2 (DEG2)	C/T (MJ/M-DEG2)	C/T FIT (MJ/M-DEG2)	PCERROR
33.4156	4.0421	14.8297	3.58489	3.57530	.268
33.6568	4.0668	14.9212	3.60022	3.59354	.186
33.8916	4.0939	15.0213	3.61339	3.61349	-.003
34.1879	4.1199	15.1171	3.63459	3.63259	.055
34.4242	4.1462	15.2134	3.64837	3.65180	-.094
34.7868	4.1739	15.3145	3.67653	3.67196	.124
35.0424	4.2006	15.4116	3.69233	3.69132	.027
35.3870	4.2320	15.5250	3.71619	3.71393	.061
35.6278	4.2587	15.6210	3.73022	3.73309	-.077
35.9351	4.2880	15.7264	3.75063	3.75411	-.093
36.2592	4.3173	15.8307	3.77310	3.77492	-.048
36.5077	4.3484	15.9411	3.78559	3.79695	-.299
36.8608	4.3741	16.0320	3.81326	3.81511	-.048
37.0771	4.3930	16.0985	3.82852	3.82836	.004
37.4614	4.4260	16.2142	3.85583	3.85147	.113
37.7074	4.4533	16.3096	3.86999	3.87051	-.013
37.9647	4.4791	16.3993	3.88626	3.88842	-.056
38.3350	4.5152	16.5244	3.91015	3.91340	-.083
38.6828	4.5447	16.6258	3.93490	3.93365	.032
39.0228	4.5746	16.7282	3.95847	3.95410	.110
39.2957	4.6026	16.8234	3.97532	3.97312	.055
39.6282	4.6357	16.9358	3.99629	3.99557	.018
39.9537	4.6625	17.0262	4.01970	4.01363	.151
40.1786	4.6896	17.1172	4.03147	4.03181	-.008
40.5375	4.7193	17.2167	4.05709	4.05169	.133

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TABLE E8

SPECIFIC HEAT OF 10A/O GOLD-90A/O SILVER ALLOY

RUN 22

JULY 18,1969

CTOT (MJ/DEG)	CADD (MJ/DEG)	T**2 (DEG2)	C/T (MJ/M-DEG2)	C/T FIT (MJ/M-DEG2)	PCERROR
3.8875	.9644	1.9900	1.00630	1.00681	-.051
4.0373	.9681	2.0851	1.02546	1.02424	.121
4.1713	1.0070	2.1700	1.04181	1.03981	.193
4.3252	1.0330	2.2722	1.05967	1.05853	.108
4.4711	1.0609	2.3830	1.07945	1.07886	.055
4.6566	1.0841	2.4826	1.10096	1.09711	.351
4.8301	1.1100	2.5953	1.12058	1.11777	.251
4.9715	1.1322	2.6880	1.13637	1.13478	.140
5.1269	1.1540	2.7847	1.15524	1.15250	.238
5.3373	1.1855	2.9191	1.17930	1.17715	.182
5.4884	1.2073	3.0145	1.19064	1.19465	.167
5.6744	1.2334	3.1289	1.21843	1.21564	.229
5.8260	1.2562	3.2296	1.23427	1.23411	.013
5.9736	1.2761	3.3175	1.25163	1.25024	.111
6.0887	1.2910	3.3864	1.26509	1.26288	.175
6.2391	1.3120	3.4804	1.28152	1.28012	.109
6.4021	1.3352	3.5802	1.29759	1.29843	.089
6.5887	1.3623	3.7008	1.31947	1.32058	-.159
6.7329	1.3810	3.7844	1.33503	1.33591	-.066
6.9273	1.4081	3.9054	1.35587	1.35812	-.165
7.0645	1.4270	3.9985	1.36773	1.37522	-.544
7.2357	1.4495	4.0892	1.38869	1.39186	-.226
7.3976	1.4727	4.1948	1.40437	1.41125	-.487
7.5814	1.4997	4.2921	1.42581	1.42911	-.231
7.7409	1.5170	4.3715	1.44274	1.44738	-.320
7.9002	1.5373	4.4520	1.45859	1.46398	-.368
8.0846	1.5603	4.5545	1.47878	1.48280	-.271
8.2566	1.5829	4.6649	1.49641	1.50124	-.322
8.4457	1.6054	4.7848	1.51762	1.51959	-.130
8.6211	1.6282	4.8860	1.53533	1.53818	-.186
8.8003	1.6510	4.9870	1.55368	1.55674	-.196
8.9805	1.6727	5.0830	1.57304	1.57439	-.086
9.1355	1.6941	5.1778	1.58708	1.59180	-.297
9.3497	1.7170	5.2877	1.61045	1.61199	-.096
9.4727	1.7359	5.3620	1.62148	1.62565	-.256
9.7041	1.7655	5.4834	1.64567	1.64796	-.139
9.8849	1.7871	5.5871	1.66261	1.66701	-.264
10.0747	1.8077	5.6869	1.68196	1.68536	-.202
10.2455	1.8310	5.7792	1.69867	1.70234	-.215
10.4251	1.8536	5.8782	1.71572	1.72054	-.280
10.6176	1.8757	5.9746	1.73568	1.73825	-.148
10.8305	1.9005	6.0825	1.75722	1.75810	-.050
11.0191	1.9239	6.1843	1.77495	1.77682	-.105
11.2917	1.9525	6.3086	1.80153	1.79968	.269

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TABLE E8 CONTINUED

C(0T (MJ/DEG)	CA00 (MJ/DEG)	T**2 (DEG2)	C/T (MJ/M-DEG2)	C/T FIT (MJ/M-DEG2)	%ERROR
11.4187	1.9710	6.3886	1.81401	1.81438	-.020
11.6294	1.9953	6.4939	1.83377	1.83376	.000
11.8340	2.0186	6.5943	1.85497	1.85224	.148
12.0357	2.0434	6.7013	1.87290	1.87191	.053
12.2451	2.0680	6.8071	1.89303	1.89138	.087
12.3126	2.0760	6.8416	1.89929	1.89773	.082
12.5422	2.1033	6.9588	1.92045	1.91928	.061
12.7499	2.1281	7.0654	1.93930	1.93890	.020
12.9591	2.1518	7.1669	1.95895	1.95759	.070
13.1694	2.1746	7.2642	1.97974	1.97549	.215
13.3492	2.1962	7.3566	1.99557	1.99250	.154
13.6298	2.2256	7.4826	2.02325	2.01569	.375
13.7296	2.2372	7.5398	2.03082	2.02623	.226
13.7800	2.2672	7.6589	2.05502	2.04815	.335
14.1901	2.2903	7.7572	2.07548	2.06626	.349
14.3987	2.3195	7.8591	2.09196	2.08501	.333
14.5969	2.3376	7.9577	2.10905	2.10317	.280
14.8260	2.3620	8.0612	2.13045	2.12224	.387
15.0931	2.3763	8.2002	2.15099	2.14894	.095
15.2210	2.4099	8.2634	2.16203	2.15948	.155
15.4479	2.4336	8.3623	2.18416	2.17769	.297
15.6774	2.4567	8.4606	2.20578	2.19585	.452
15.8586	2.4807	8.5620	2.21878	2.21449	.194
16.0770	2.5042	8.6606	2.23791	2.23265	.236
16.3924	2.5369	8.7980	2.26697	2.25798	.398
16.6505	2.5696	8.9363	2.28705	2.28328	.165
16.6770	2.5730	8.9530	2.28693	2.28655	.017
16.9066	2.5972	9.0591	2.30689	2.30609	.035
17.1508	2.6255	9.1694	2.32794	2.32642	.065
17.3240	2.6453	9.2520	2.34200	2.34165	.015
17.5570	2.6684	9.3487	2.36315	2.35948	.156
17.7871	2.6941	9.4556	2.38201	2.37922	.117
17.9670	2.7175	9.5535	2.39444	2.39724	-.117
18.2314	2.7425	9.6575	2.41681	2.41642	.009
18.4040	2.7632	9.7433	2.43186	2.43225	-.016
18.6855	2.7943	9.8726	2.45462	2.45609	-.060
18.9203	2.8179	9.9687	2.47513	2.47382	.053
19.0833	2.8385	10.0559	2.48611	2.48990	-.152
19.3370	2.8610	10.1518	2.50958	2.50760	.079
19.5408	2.8878	10.2600	2.52310	2.52756	-.176
19.7510	2.9115	10.3579	2.53928	2.54562	-.249
20.0260	2.9375	10.4652	2.56356	2.56543	-.073
20.1847	2.9565	10.5434	2.57492	2.57986	-.191
20.5123	2.9915	10.6877	2.60091	2.60649	-.214

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TABLE E8 CONTINUED

CTOT (MJ/DEG)	CA00 (MJ/DEG)	T**2 (DEG2)	C/T (MJ/M-DEG2)	C/T FIT (MJ/M-DEG2)	%ERROR
20.6776	3.0112	10.7686	2.61268	2.62141	-.333
20.9412	3.0361	10.8709	2.63548	2.64030	-.182
21.1475	3.0571	10.7569	2.65228	2.65617	-.146
21.3916	3.0851	11.0718	2.67002	2.67739	-.275
21.6652	3.1090	11.1696	2.69455	2.69544	-.033
21.8750	3.1330	11.2706	2.70918	2.71410	-.181
22.1113	3.1571	11.3665	2.72652	2.73161	-.113
22.4359	3.1710	11.5037	2.75368	2.75714	-.125
22.6252	3.2123	11.5903	2.76731	2.77313	-.210
22.8278	3.2319	11.6693	2.78422	2.78773	-.126
23.1034	3.2597	11.7823	2.80557	2.80860	-.108
23.3617	3.2860	11.8884	2.82571	2.82820	-.088
23.6328	3.3132	11.9981	2.84692	2.84846	-.054
23.8614	3.3375	12.0962	2.86385	2.86659	-.096
24.0100	3.3570	12.1769	2.87333	2.88150	-.283
24.2996	3.3790	12.2652	2.89694	2.89782	.039
24.6073	3.4097	12.3855	2.92308	2.92005	.104
24.8334	3.4350	12.4865	2.93885	2.93872	.004
24.7937	3.4310	12.5504	2.95114	2.95053	.020
25.3160	3.4837	12.6804	2.97542	2.97456	.029
25.5688	3.5083	12.7780	2.99501	2.99261	.080
25.8313	3.5305	12.8695	3.01377	3.01322	.018
26.0972	3.5594	12.9801	3.03592	3.02995	.197
26.3565	3.5855	13.0820	3.05564	3.04882	.224
26.5647	3.6126	13.1893	3.06709	3.06865	-.051
26.8204	3.6403	13.2974	3.08495	3.08866	-.120
27.0768	3.6655	13.3959	3.10688	3.10688	.000
27.3167	3.6861	13.4760	3.12599	3.12169	.074
27.6002	3.7196	13.6061	3.14191	3.14575	-.122
27.8576	3.7417	13.6917	3.16294	3.16158	.043
28.1273	3.7692	13.7976	3.18268	3.18118	.047
28.3817	3.7951	13.8970	3.20076	3.19958	.037
28.6151	3.8208	13.9956	3.21640	3.21783	-.044
28.9050	3.8482	14.1003	3.23836	3.23719	.037
29.2215	3.8783	14.2150	3.26214	3.25842	.114
29.4702	3.9030	14.3115	3.27975	3.27629	.105
29.7013	3.9293	14.4078	3.29507	3.29412	.029
29.9660	3.9571	14.5134	3.31321	3.31367	-.014
30.2005	3.9848	14.6162	3.33545	3.33269	.083
30.5039	4.0077	14.7101	3.35240	3.35008	.069
30.7051	4.0379	14.8111	3.37045	3.36879	.050
31.0347	4.0653	14.9165	3.38891	3.38821	.021
31.3220	4.0945	15.0236	3.40906	3.40815	.027
31.5271	4.1163	15.1112	3.42181	3.42437	-.075

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TABLE E8 CONTINUED

CTOT (MJ/DEG)	CADD (MJ/DEG)	T**2 (DEG2)	C/T (MJ/M-DEG2)	C/T FIT (MJ/M-DEG2)	PCERROR
31.8906	4.1523	15.2357	3.44877	3.44742	.039
32.1016	4.1764	15.3235	3.46207	3.46370	-.047
32.3982	4.2047	15.4263	3.48363	3.48274	.025
32.7355	4.2425	15.5629	3.50516	3.50804	-.082
32.9066	4.2622	15.6336	3.51584	3.52114	-.150
33.2856	4.2970	15.7582	3.54397	3.54423	-.007
33.6064	4.3261	15.8620	3.56790	3.56347	.124
33.7721	4.3423	15.9194	3.57964	3.57412	.154
34.0202	4.3706	16.0196	3.59581	3.59268	.087
34.2941	4.3978	16.1155	3.61423	3.61045	.105
34.4605	4.4206	16.2233	3.62187	3.63045	-.236
34.7812	4.4506	16.3002	3.64587	3.64470	.032
35.0656	4.4872	16.4275	3.66377	3.66830	-.124
35.3987	4.5153	16.5245	3.68703	3.68628	.020
35.6855	4.5443	16.6244	3.70662	3.70482	.048
35.9415	4.5727	16.7217	3.72283	3.72285	-.001
36.1649	4.6032	16.8267	3.73913	3.74215	-.414
36.4764	4.6312	16.9205	3.75945	3.75974	-.008
36.7208	4.6609	17.0207	3.77129	3.77831	-.186
37.0605	4.6943	17.1001	3.80197	3.79304	.235
37.1473	4.6998	17.1513	3.80233	3.80254	-.006
37.3907	4.7226	17.2276	3.82061	3.81671	.102

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TABLE E9

SPECIFIC HEAT OF 90A/O GOLD-10A/O SILVER ALLOY

RUN 23

SEPTEMBER 26,1969

CTOT (MJ/DEG)	CADD (MJ/DEG)	T**2 (DEG2)	C/T (MJ/M-DEG2)	C/T FIT (MJ/M-DEG2)	pCERROR
4.8578	.9641	1.9869	1.47058	1.47315	-.174
5.0697	.9885	2.0866	1.51269	1.51149	.079
5.2938	1.0129	2.1860	1.55019	1.55052	-.021
5.5133	1.0348	2.2761	1.58932	1.58568	.217
5.7143	1.0585	2.3741	1.61781	1.62434	-.402
5.9967	1.0833	2.4792	1.67073	1.66554	.312
6.2592	1.1102	2.5937	1.71171	1.71046	.073
6.5233	1.1349	2.6998	1.75577	1.75203	.213
6.7631	1.1569	2.7945	1.79552	1.78916	.356
6.9750	1.1787	2.8892	1.82572	1.82628	-.031
7.2224	1.1998	2.9813	1.86747	1.86237	.274
7.5257	1.2271	3.1011	1.91497	1.90929	.298
7.7978	1.2515	3.2090	1.95650	1.95153	.255
8.0310	1.2732	3.3049	1.99018	1.98910	.055
8.2819	1.2945	3.3990	2.02917	2.02590	.161
8.5128	1.3144	3.4877	2.06363	2.06063	.146
8.6229	1.3414	3.6078	2.10882	2.10760	.058
9.0898	1.3649	3.7123	2.14655	2.14851	-.091
9.3535	1.3879	3.8152	2.18337	2.18873	-.245
9.6469	1.4108	3.9173	2.22793	2.22863	-.031
9.8797	1.4307	4.0063	2.25998	2.26343	-.152
10.1241	1.4518	4.1004	2.29295	2.30019	-.315
10.3927	1.4739	4.1992	2.33019	2.33880	-.368
10.6899	1.4968	4.3015	2.37312	2.37875	-.237
10.9046	1.5139	4.3774	2.40306	2.40838	-.221
11.2316	1.5402	4.4950	2.44733	2.45430	-.284
11.5192	1.5621	4.5925	2.48758	2.49236	-.192
11.7775	1.5827	4.6841	2.52195	2.52811	-.243
12.0772	1.6055	4.7854	2.56288	2.56763	-.185
12.3732	1.6281	4.8854	2.60274	2.60665	-.150
12.6454	1.6499	4.9823	2.63736	2.64443	-.267
12.9871	1.6758	5.0966	2.68252	2.68901	-.241
13.2600	1.6965	5.1884	2.71794	2.72479	-.251
13.5531	1.7176	5.2814	2.75729	2.76101	-.134
13.8567	1.7404	5.3818	2.79624	2.80016	-.140
14.1573	1.7640	5.4854	2.83299	2.84058	-.267
14.4992	1.7891	5.5957	2.87670	2.88344	-.234
14.8816	1.8162	5.7145	2.92621	2.92971	-.119
15.1407	1.8363	5.8028	2.95696	2.96407	-.240
15.4513	1.8589	5.9011	2.99583	3.00234	-.217
15.7737	1.8808	5.9969	3.03737	3.03960	-.073
16.1211	1.9047	6.1007	3.08156	3.07997	.051
16.4129	1.9265	6.1955	3.11598	3.11683	-.027
16.6236	1.9413	6.2597	3.14187	3.14181	.002

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TABLE E9 CONTINUED

CTOT (MJ/DEG)	CADD (MJ/DEG)	T**2 (DEG2)	C/T (MJ/M-DEG2)	C/T FIT (MJ/M-DEG2)	pCERROR
16.9146	1.9604	6.3428	3.17901	3.17410	.155
17.3379	1.9918	6.4787	3.22794	3.22691	.032
17.6789	2.0148	6.5779	3.26988	3.26547	.135
17.9776	2.0360	6.6695	3.30488	3.30104	.116
18.2584	2.0563	6.7570	3.33707	3.33501	.062
18.6466	2.0829	6.8714	3.38301	3.37946	.105
18.9415	2.1038	6.9610	3.41679	3.41422	.075
19.1693	2.1185	7.0241	3.44443	3.43874	.165
19.6411	2.1525	7.1697	3.49685	3.49521	.047
19.9785	2.1740	7.2615	3.53743	3.53082	.187
20.3445	2.1974	7.3618	3.58084	3.56971	.312
20.6346	2.2172	7.4461	3.61354	3.60242	.309
21.0866	2.2460	7.5688	3.66651	3.64997	.453
21.3687	2.2673	7.6594	3.69519	3.68510	.274
21.7223	2.2926	7.7669	3.73260	3.72675	.157
22.1741	2.3184	7.8765	3.78781	3.76920	.494
22.4451	2.3391	7.9642	3.81438	3.80315	.295
22.7816	2.3628	8.0643	3.84961	3.84192	.200
23.1434	2.3852	8.1592	3.89078	3.87864	.313
23.5411	2.4126	8.2750	3.93237	3.92346	.227
23.9109	2.4361	8.3739	3.97314	3.96175	.288
24.3346	2.4664	8.5016	4.01542	4.01114	.107
24.7180	2.4911	8.6058	4.05650	4.05144	.125
25.0546	2.5122	8.6945	4.09305	4.08572	.179
25.3362	2.5308	8.7724	4.12238	4.11584	.159
25.6940	2.5538	8.8691	4.16003	4.15321	.164
26.0070	2.5762	8.9629	4.19019	4.18943	.018
26.4148	2.6000	9.0650	4.23471	4.22887	.138
26.7125	2.6214	9.1523	4.26343	4.26261	.019
27.0977	2.6451	9.2512	4.30429	4.30077	.082
27.4313	2.6677	9.3465	4.33665	4.33758	-.022
27.8199	2.6907	9.4417	4.37847	4.37433	.095
28.1934	2.7159	9.5469	4.41466	4.41487	-.005
28.6141	2.7411	9.6517	4.45875	4.45535	.076
28.9894	2.7651	9.7513	4.49617	4.49374	.054
29.4807	2.7955	9.8775	4.54589	4.54240	.077
29.7627	2.8147	9.9573	4.57221	4.57317	-.021
30.0702	2.8361	10.0460	4.60031	4.60734	-.153
30.4993	2.8611	10.1497	4.64466	4.64729	-.057
30.8465	2.8842	10.2451	4.67719	4.68406	-.147
31.2522	2.9077	10.3506	4.71656	4.72467	-.172
31.7235	2.9355	10.4569	4.76627	4.76563	.014
32.1495	2.9636	10.5729	4.80559	4.81026	-.097
32.6146	2.9913	10.6867	4.85156	4.85407	-.052

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TABLE E9 CONTINUED

CTOT (MJ/DEG)	CADD (MJ/DEG)	T**2 (DEG2)	C/T (MJ/M-DEG2)	C/T FIT (MJ/M-DEG2)	pCERROR
32.9034	3.0103	10.7650	4.87791	4.88418	-.128
33.2636	3.0340	10.8625	4.91062	4.92169	-.225
33.6554	3.0578	10.9600	4.94825	4.95918	-.221
34.1239	3.0840	11.0671	4.99543	5.00036	-.098
34.5193	3.1087	11.1682	5.03216	5.03921	-.140
34.9786	3.1382	11.2888	5.07370	5.08555	-.233
35.4101	3.1622	11.3865	5.11652	5.12311	-.129
35.8115	3.1858	11.4826	5.15476	5.16002	-.102
36.1867	3.2122	11.5898	5.18573	5.20118	-.297
36.6485	3.2361	11.6868	5.23276	5.23840	-.108
37.0996	3.2637	11.7983	5.27398	5.28121	-.137
37.5582	3.2889	11.9004	5.31857	5.32038	-.034
38.0231	3.3154	12.0070	5.36264	5.36129	.025
38.4688	3.3423	12.1152	5.40305	5.40279	.005
38.8112	3.3640	12.2026	5.43282	5.43630	-.064
39.2437	3.3903	12.3079	5.47152	5.47665	-.094
39.6981	3.4151	12.4072	5.51489	5.51471	.003
40.1151	3.4435	12.5204	5.54871	5.55807	-.168
40.7009	3.4744	12.6434	5.60520	5.60520	-.000
41.0432	3.4956	12.7278	5.63474	5.63754	-.050
41.5422	3.5257	12.8469	5.67862	5.68313	-.079
41.7146	3.5352	12.8843	5.69467	5.69745	-.049
42.1167	3.5605	12.9843	5.72867	5.73573	-.123
42.6017	3.5864	13.0860	5.77434	5.77464	-.005
43.1070	3.6148	13.1975	5.82017	5.81729	.050
43.4797	3.6404	13.2979	5.84912	5.85569	-.112
43.9480	3.6651	13.3943	5.89293	5.89254	.007
44.4712	3.6945	13.5088	5.93981	5.93633	.059
44.8512	3.7185	13.6019	5.97113	5.97190	-.013
45.3550	3.7492	13.7206	6.01363	6.01726	-.060
45.7453	3.7726	13.8107	6.04685	6.05165	-.079
46.2896	3.8007	13.9188	6.09740	6.09294	.073
46.6741	3.8250	14.0118	6.12864	6.12846	.003
47.1332	3.8520	14.1148	6.16782	6.16778	.001
47.6163	3.8793	14.2186	6.21027	6.20739	.046
48.0415	3.9060	14.3274	6.24242	6.24689	-.104
48.6139	3.9300	14.4405	6.29439	6.29202	.038
49.0667	3.9665	14.5441	6.33163	6.33152	.002
49.5625	3.9946	14.6530	6.37611	6.37306	.048
49.9999	4.0202	14.7489	6.41007	6.40943	.010
50.6310	4.0534	14.8717	6.46647	6.45639	.156
50.9851	4.0767	14.9582	6.49353	6.48934	.065
51.3430	4.1047	15.0610	6.51685	6.52851	-.179
51.7776	4.1283	15.1478	6.55468	6.56156	-.105

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TABLE E9 CONTINUED

CTOT (MJ/DEG)	CADD (MJ/DEG)	T**2 (DEG2)	C/T (MJ/M-DEG2)	C/T FIT (MJ/M-DEG2)	%ERROR
52.3895	4.1646	15.2805	6.60500	6.61206	-.107
52.5487	4.1729	15.3110	6.61907	6.62365	-.069
53.1335	4.2031	15.4206	6.67109	6.66539	.086
53.5542	4.2291	15.5144	6.70457	6.70107	.052
54.0490	4.2588	15.6216	6.74453	6.74182	.040
54.5715	4.2877	15.7250	6.78896	6.78114	.115
54.8977	4.3071	15.8014	6.81358	6.81019	.050
55.7068	4.3541	15.9615	6.88172	6.87104	.155
56.1421	4.3824	16.0615	6.91463	6.90903	.081
56.5554	4.4066	16.1464	6.94827	6.94130	.100
57.0020	4.4379	16.2561	6.97993	6.98295	-.043
57.3403	4.4590	16.3324	7.00553	7.01192	-.091
57.9254	4.4924	16.4456	7.05431	7.05490	-.008
58.3449	4.5171	16.5309	7.08807	7.08729	.011
58.8064	4.5463	16.6311	7.12344	7.12530	-.026
59.3471	4.5760	16.7396	7.16694	7.16644	.007
59.7403	4.6051	16.8320	7.19500	7.20149	-.090
60.1949	4.6297	16.9154	7.23323	7.23312	.001
60.7178	4.6639	17.0308	7.27209	7.27686	-.066
61.0663	4.6760	17.0802	7.30479	7.29560	.126
61.2972	4.6892	17.1158	7.32571	7.30909	.227
61.7125	4.7203	17.2198	7.35313	7.34847	.063

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TABLE E10

SPECIFIC HEAT OF 82.5A/O GOLD-17.5A/O SILVER ALLOY

RUN 26

JANUARY 8,1970

CTOT (MJ/DEG)	CADD (MJ/DEG)	T**2 (DEG2)	C/T (MJ/M-DEG2)	C/T FIT (MJ/M-DEG2)	PCERROR
4.7061	.9823	1.9818	1.38559	1.38533	.019
4.9224	.9873	2.0806	1.42079	1.42038	.029
5.1406	1.0113	2.1783	1.45708	1.45506	.139
5.3473	1.0342	2.2738	1.48951	1.48897	.036
5.5608	1.0567	2.3632	1.52403	1.52246	.107
5.8473	1.0867	2.4945	1.57024	1.56727	.189
6.0595	1.1086	2.5867	1.60304	1.59997	.192
6.2922	1.1319	2.6866	1.63949	1.63541	.249
6.5107	1.1532	2.7787	1.67374	1.66808	.339
6.7903	1.1817	2.9023	1.71443	1.71189	.149
7.0772	1.2065	3.0198	1.75867	1.75355	.292
7.2810	1.2290	3.1096	1.78722	1.78540	.102
7.5418	1.2527	3.2141	1.82679	1.82244	.239
7.7772	1.2748	3.3118	1.86125	1.85706	.225
8.0922	1.3050	3.4460	1.90398	1.90460	-.033
8.2109	1.3154	3.4921	1.92155	1.92094	.032
8.4165	1.3343	3.5762	1.95026	1.95072	-.023
8.6700	1.3571	3.6776	1.98582	1.98663	-.041
8.9014	1.3791	3.7757	2.01598	2.02138	-.267
9.2239	1.4047	3.8903	2.06444	2.06195	.120
9.4695	1.4304	4.0047	2.09717	2.10249	-.253
9.7155	1.4496	4.0905	2.12831	2.13285	-.213
9.9838	1.4727	4.1947	2.16399	2.16973	-.265
10.2325	1.4946	4.2917	2.19646	2.20404	-.344
10.4934	1.5164	4.3888	2.23147	2.23840	-.310
10.7580	1.5364	4.4868	2.26662	2.27308	-.284
11.0448	1.5618	4.5908	2.30482	2.30988	-.219
11.2806	1.5825	4.6824	2.33395	2.34226	-.355
11.5092	1.6027	4.7727	2.36141	2.37423	-.540
11.8348	1.6262	4.8770	2.40725	2.41111	-.160
12.1150	1.6483	4.9752	2.44363	2.44561	-.089
12.3845	1.6711	5.0762	2.47621	2.48153	-.214
12.6628	1.6933	5.1744	2.51123	2.51623	-.198
13.0339	1.7236	5.3078	2.55653	2.56338	-.267
13.2517	1.7401	5.3805	2.58440	2.58906	-.180
13.5454	1.7645	5.4877	2.61888	2.62696	-.308
13.8413	1.7864	5.5840	2.65659	2.66096	-.164
14.1152	1.8079	5.6784	2.68956	2.69431	-.176
14.4145	1.8305	5.7774	2.72638	2.72926	-.106
14.7132	1.8545	5.8813	2.76122	2.76596	-.171
14.9871	1.8752	5.9726	2.79393	2.79819	-.152
15.2421	1.8946	6.0568	2.82429	2.82794	-.129
15.5652	1.9182	6.1597	2.86343	2.86427	-.029
15.8678	1.9411	6.2589	2.89890	2.89926	-.012

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TABLE E10 CONTINUED

CTOT (MJ/DEG)	CADD (MJ/DEG)	T**2 (DEG2)	C/T (MJ/M-DEG2)	C/T FIT (MJ/M-DEG2)	PCERROR
16.1552	1.9620	6.3495	2.93321	2.93123	.068
16.4906	1.9674	6.4594	2.97166	2.97003	.055
16.7995	2.0107	6.5604	3.00676	3.00565	.037
17.1180	2.0337	6.6602	3.04375	3.04085	.095
17.3838	2.0545	6.7489	3.07283	3.07215	.022
17.6861	2.0772	6.8467	3.10646	3.10661	-.005
18.0350	2.1018	6.9524	3.14680	3.14389	.092
18.3363	2.1230	7.0433	3.18138	3.17595	.171
18.6475	2.1515	7.1645	3.20940	3.21868	-.288
18.9876	2.1704	7.2462	3.25337	3.24745	.182
19.3096	2.1937	7.3458	3.28861	3.28258	.184
19.6637	2.2177	7.4484	3.32887	3.31872	.306
19.9761	2.2399	7.5428	3.36300	3.35197	.329
20.2851	2.2635	7.6431	3.39461	3.38732	.215
20.6376	2.2882	7.7481	3.43287	3.42450	.251
21.0380	2.3147	7.8608	3.47762	3.46397	.374
21.3069	2.3344	7.9443	3.50533	3.49339	.342
21.6304	2.3585	8.0452	3.53829	3.52892	.265
21.9579	2.3811	8.1420	3.57280	3.56297	.276
22.3688	2.4078	8.2545	3.61799	3.60259	.427
22.6626	2.4322	8.3575	3.64419	3.63861	.148
23.0519	2.4601	8.4751	3.68343	3.66022	.087
23.4800	2.4842	8.5765	3.73344	3.71589	.472
23.7353	2.5039	8.6572	3.75781	3.74425	.362
24.0406	2.5287	8.7638	3.78414	3.78177	.063
24.4171	2.5529	8.8654	3.82399	3.81747	.171
24.6938	2.5726	8.9460	3.85104	3.84053	.117
24.9516	2.5923	9.0304	3.87473	3.87551	-.020
25.4268	2.6223	9.1557	3.92472	3.91954	.132
25.7443	2.6466	9.2576	3.95324	3.95536	-.054
26.1223	2.6695	9.3530	3.99348	3.98690	.115
26.4336	2.6907	9.4417	4.02347	4.02007	.094
26.6324	2.7181	9.5559	4.06230	4.06017	.052
27.1910	2.7416	9.6535	4.09786	4.09448	.083
27.5347	2.7647	9.7496	4.13110	4.12823	.070
27.8744	2.7867	9.8493	4.16252	4.16324	-.017
28.2693	2.8149	9.9582	4.19971	4.20149	-.042
28.7240	2.8417	10.0691	4.24723	4.24042	.161
28.9591	2.8621	10.1536	4.26494	4.27007	-.120
29.4159	2.8901	10.2697	4.31044	4.31081	-.009
29.7790	2.9143	10.3694	4.34450	4.34580	-.030
30.1463	2.9379	10.4671	4.37978	4.38011	-.007
30.5047	2.9628	10.5697	4.41157	4.41610	-.103
30.8642	2.9875	10.6714	4.44388	4.45177	-.177

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TABLE E10 CONTINUED

CTOT (MJ/DEG)	CADD (MJ/DEG)	T**2 (DEG2)	C/T (MJ/M-DEG2)	C/T FIT (MJ/M-DEG2)	%ERROR
31.2356	3.0142	10.7808	4.47596	4.49015	-.316
31.6769	3.0417	10.8940	4.51793	4.52982	-.263
32.0355	3.0633	10.9825	4.55263	4.56087	-.181
32.2853	3.0834	11.0646	4.57167	4.58965	-.392
32.8745	3.1176	11.2045	4.62939	4.63869	-.201
33.2716	3.1417	11.3027	4.66702	4.67312	-.131
33.6207	3.1667	11.4049	4.69602	4.70892	-.274
34.0255	3.1909	11.5014	4.73481	4.74272	-.167
34.4209	3.2158	11.6045	4.77029	4.77885	-.179
34.9002	3.2458	11.7258	4.81386	4.82134	-.155
35.2944	3.2684	11.8175	4.85145	4.85345	-.041
35.6617	3.2899	11.9042	4.88595	4.88382	.044
35.9362	3.3110	11.7892	4.90675	4.91357	-.139
36.3447	3.3336	12.0802	4.94601	4.94545	.011
36.6838	3.3570	12.1746	4.97392	4.97846	-.091
37.1673	3.3850	12.2867	5.01886	5.01770	.023
37.5115	3.4083	12.3800	5.04741	5.05035	-.058
37.9404	3.4341	12.4831	5.08592	5.08644	-.010
38.3860	3.4625	12.5962	5.12424	5.12601	-.035
38.7508	3.4836	12.6801	5.15752	5.15536	.042
39.1556	3.5152	12.8054	5.18655	5.19918	-.243
39.5786	3.5365	12.8894	5.22790	5.22856	-.013
40.0263	3.5607	12.9851	5.27009	5.26200	.154
40.3606	3.5863	13.0860	5.29386	5.29730	-.065
40.8241	3.6124	13.1881	5.33605	5.33300	.057
41.2796	3.6404	13.2978	5.37506	5.37132	.070
41.7036	3.6690	13.4096	5.40883	5.41039	-.029
42.0063	3.6900	13.4913	5.43235	5.43895	-.121
42.4660	3.7167	13.5946	5.47235	5.47504	-.040
43.0943	3.7470	13.7120	5.53347	5.51603	.316
43.3806	3.7737	13.8149	5.54919	5.55196	-.050
43.8087	3.8010	13.9220	5.58366	5.58936	-.102
44.4807	3.8297	14.0295	5.65175	5.62690	.442
44.7280	3.8556	14.1285	5.66259	5.66146	.020
45.2024	3.8859	14.2436	5.70093	5.70165	-.013
45.6003	3.9136	14.3484	5.73077	5.73823	-.127
46.0248	3.9370	14.4366	5.76841	5.76901	-.010
46.5880	3.9662	14.5466	5.81946	5.80738	.208
46.9687	3.9933	14.6481	5.84739	5.84276	.079
47.1579	4.0067	14.6980	5.86134	5.86017	.020
47.6519	4.0376	14.8131	5.90116	5.90034	.014
48.1394	4.0676	14.9243	5.94081	5.93912	.028
48.5723	4.0933	15.0192	5.97942	5.97221	.121
48.9994	4.1200	15.1174	6.01073	6.00642	.075

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TABLE E10 CONTINUED

CTOT (MJ/DEG)	CADD (MJ/DLG)	T**2 (DEG2)	C/T (MJ/M-DEG2)	C/T FIT (MJ/M-DEG2)	pCERROR
49.4095	4.1485	15.2218	6.04120	6.04282	-.027
49.9375	4.1750	15.3183	6.08889	6.07644	.205
50.2851	4.2027	15.4198	6.11121	6.11180	-.010
50.6266	4.2307	15.5203	6.13285	6.14682	-.227
51.1314	4.2542	15.6051	6.17960	6.17637	.052
51.6731	4.2883	15.7273	6.22220	6.21894	.052
52.1872	4.3159	15.8259	6.26648	6.25327	.211
52.5774	4.3456	15.9312	6.29275	6.28996	.044
53.0103	4.3763	16.0396	6.32377	6.32769	-.062
53.4388	4.4056	16.1428	6.35526	6.36361	-.131
53.9037	4.4298	16.2276	6.39561	6.39313	.039
54.3400	4.4583	16.3270	6.42866	6.42774	.014
54.8892	4.4911	16.4410	6.47264	6.46740	.081
55.3714	4.5232	16.5519	6.50855	6.50597	.040
55.5308	4.5427	16.6188	6.51407	6.52925	-.232
56.1172	4.5755	16.7310	6.56192	6.56828	-.097
56.6404	4.6067	16.8373	6.60361	6.60524	-.025
56.9871	4.6321	16.9234	6.62745	6.63519	-.117
57.5802	4.6632	17.0286	6.67787	6.67176	.092
58.0132	4.6923	17.1262	6.70964	6.70570	.059
58.3614	4.7205	17.2207	6.73136	6.73854	-.107

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TABLE E11

SPECIFIC HEAT OF 60A/O GOLD-40A/O COPPER ALLOY

RUN 28

JUNE 2,1970

CTOT (MJ/DEG)	CADD (MJ/DEG)	T**2 (DEG2)	C/T (MJ/M-DEG2)	C/T FIT (MJ/M-DEG2)	PCERROR
4.0861	.9662	1.9970	1.14707	1.14303	.354
4.2056	.9868	2.0797	1.15969	1.16193	-.193
4.3680	1.0107	2.1770	1.18223	1.18419	-.165
4.5185	1.0310	2.2605	1.20517	1.20331	.154
4.7440	1.0614	2.3871	1.23841	1.23230	.495
4.9480	1.0923	2.5174	1.26259	1.26217	.033
5.1204	1.1149	2.6137	1.28725	1.28427	.232
5.3114	1.1398	2.7205	1.31408	1.30879	.404
5.4724	1.1619	2.8163	1.33451	1.33078	.280
5.5635	1.1755	2.8753	1.34452	1.34433	.014
5.7220	1.1956	2.9631	1.36620	1.36451	.124
5.7465	1.1981	2.9739	1.37037	1.36700	.247
5.9449	1.2240	3.0878	1.39583	1.39320	.189
6.1240	1.2461	3.1851	1.42007	1.41559	.317
6.3085	1.2708	3.2942	1.44209	1.44071	.096
6.5055	1.2952	3.4024	1.46758	1.46566	.132
6.6351	1.3119	3.4764	1.48334	1.48271	.042
6.7738	1.3269	3.5434	1.50341	1.49815	.351
6.7955	1.3339	3.5745	1.50087	1.50533	-.297
7.0076	1.3567	3.6760	1.53131	1.52876	.166
7.1825	1.3796	3.7778	1.55117	1.55227	-.071
7.3945	1.4072	3.9011	1.57500	1.58074	-.363
7.5968	1.4316	4.0101	1.59958	1.60595	-.396
7.7459	1.4500	4.0925	1.61695	1.62500	-.496
7.9555	1.4735	4.1971	1.64389	1.64923	-.324
8.1191	1.4926	4.2825	1.66369	1.66900	-.318
8.3037	1.5161	4.3875	1.68360	1.69334	-.575
8.5039	1.5381	4.4853	1.70890	1.71600	-.414
8.7954	1.5691	4.6234	1.74612	1.74804	-.110
8.9282	1.5843	4.6910	1.76171	1.76373	-.114
9.1747	1.6135	4.8207	1.78926	1.79386	-.256
9.3382	1.6339	4.9112	1.80626	1.81489	-.476
9.5659	1.6577	5.0167	1.83445	1.83942	-.270
9.7452	1.6748	5.0926	1.85805	1.85709	.052
9.9686	1.7022	5.2135	1.88098	1.88524	-.226
10.1283	1.7180	5.2831	1.90110	1.90144	-.018
10.3288	1.7409	5.3840	1.92295	1.92495	-.104
10.4625	1.7577	5.4581	1.93584	1.94223	-.329
10.6634	1.7820	5.5646	1.95614	1.96708	-.556
10.9166	1.8066	5.6724	1.98734	1.99223	-.246
11.0674	1.8243	5.7501	2.00268	2.01039	-.383
11.3014	1.8478	5.8527	2.03026	2.03436	-.201
11.4843	1.8662	5.9332	2.05154	2.05317	-.079
11.7281	1.8920	6.0457	2.07842	2.07947	-.050

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TABLE E11 CONTINUED

CTOT (MJ/DEG)	CADD (MJ/DEG)	T**2 (DEG2)	C/T (MJ/M-DEG2)	C/T FIT (MJ/M-DEG2)	PCERROR
11.9331	1.9154	6.1475	2.09920	2.10331	-.195
12.1886	1.9410	6.2586	2.12822	2.12933	-.052
12.4182	1.9647	6.3613	2.15340	2.15339	.001
12.5871	1.9814	6.4336	2.17245	2.17034	.097
12.8052	2.0040	6.5313	2.19589	2.19324	.121
13.0270	2.0290	6.6392	2.21765	2.21857	-.041
13.2672	2.0535	6.7447	2.24338	2.24335	.001
13.5557	2.0785	6.8525	2.27797	2.26867	.410
13.7162	2.1051	6.9665	2.28561	2.29547	-.429
14.0108	2.1284	7.0664	2.32241	2.31899	.148
14.1946	2.1455	7.1399	2.34284	2.33627	.281
14.4241	2.1694	7.2420	2.36597	2.36032	.239
14.7020	2.1972	7.3607	2.39472	2.38829	.269
14.9337	2.2200	7.4582	2.41873	2.41128	.309
15.1752	2.2453	7.5660	2.44229	2.43670	.230
15.4736	2.2734	7.6854	2.47389	2.46489	.365
15.6984	2.2957	7.7799	2.49657	2.48719	.377
15.7893	2.3093	7.8378	2.50166	2.50088	.031
16.1056	2.3379	7.9590	2.53552	2.52954	.237
16.3894	2.3657	8.0768	2.56376	2.55739	.249
16.6470	2.3875	8.1690	2.59211	2.57922	.500
16.9146	2.4158	8.2883	2.61658	2.60748	.349
17.2442	2.4469	8.4194	2.64958	2.63856	.418
17.4682	2.4680	8.5085	2.67182	2.65968	.457
17.5844	2.4828	8.5708	2.68007	2.67447	.209
17.8145	2.5104	8.6867	2.69785	2.70196	-.152
18.1345	2.5361	8.7946	2.73281	2.72759	.191
18.3822	2.5604	8.8966	2.75602	2.75183	.152
18.5186	2.5767	8.9650	2.76631	2.76809	-.064
18.7653	2.5981	9.0548	2.79145	2.78947	.071
18.9975	2.6171	9.1343	2.81593	2.80840	.268
19.2445	2.6446	9.2491	2.83592	2.83571	.007
19.5485	2.6707	9.3581	2.86655	2.86168	.170
19.7803	2.6929	9.4506	2.88789	2.88375	.144
20.0560	2.7192	9.5606	2.91314	2.90997	.109
20.3282	2.7413	9.6522	2.94112	2.93184	.316
20.5111	2.7622	9.7395	2.95487	2.95267	.074
20.7917	2.7905	9.8567	2.97900	2.98069	-.057
21.0365	2.8113	9.9434	3.00288	3.00142	.049
21.3086	2.8366	10.0481	3.02766	3.02645	.040
21.5298	2.8625	10.1553	3.04349	3.05210	-.282
21.8393	2.8850	10.2486	3.07617	3.07443	.056
22.0645	2.9105	10.3540	3.09272	3.09969	-.225
22.4079	2.9353	10.4564	3.12872	3.12423	.144

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TABLE E11 CONTINUED

CTOT (MJ/DEG)	CADD (MJ/DEG)	T**2 (DEG2)	C/T (MJ/M-DEG2)	C/T FIT (MJ/M-DEG2)	PCERROR
22.5863	2.9583	10.5509	3.13954	3.14690	-.234
22.8595	2.9809	10.6443	3.16564	3.16930	-.115
23.1338	3.0081	10.7559	3.18832	3.19610	-.243
23.4350	3.0334	10.8599	3.21653	3.22109	-.142
23.7401	3.0589	10.9645	3.24501	3.24624	-.038
23.9835	3.0828	11.0624	3.26491	3.26977	-.149
24.2677	3.1086	11.1680	3.28961	3.29518	-.169
24.5804	3.1328	11.2667	3.31982	3.31896	.026
24.8425	3.1593	11.3747	3.34032	3.34498	-.139
25.0429	3.1778	11.4499	3.35727	3.36311	-.174
25.3486	3.2048	11.5595	3.38390	3.38954	-.166
25.6657	3.2311	11.6666	3.41256	3.41537	-.082
25.9482	3.2592	11.7801	3.43461	3.44278	-.237
26.1938	3.2813	11.8694	3.45537	3.46434	-.259
26.5022	3.3078	11.9764	3.48221	3.49021	-.229
26.8644	3.3356	12.0882	3.51605	3.51726	-.034
27.1623	3.3608	12.1896	3.54197	3.54179	.005
27.4065	3.3853	12.2881	3.56030	3.56563	-.149
27.7356	3.4101	12.3870	3.59098	3.58960	.038
28.0563	3.4374	12.4962	3.61839	3.61606	.065
28.3191	3.4630	12.5980	3.63847	3.64075	-.063
28.6290	3.4905	12.7073	3.66395	3.66727	-.091
29.0166	3.5223	12.8335	3.69748	3.69791	-.012
29.2286	3.5462	12.9278	3.71115	3.72083	-.260
29.3871	3.5582	12.9754	3.72546	3.73240	-.186
29.7517	3.5857	13.0835	3.75846	3.75870	-.006
30.0132	3.6101	13.1791	3.77874	3.78195	-.085
30.3795	3.6411	13.3008	3.80918	3.81156	-.062
30.6730	3.6656	13.3964	3.83376	3.83485	-.029
30.9727	3.6915	13.4970	3.85816	3.85938	-.032
31.3285	3.7170	13.5960	3.89062	3.88352	.183
31.6401	3.7464	13.7099	3.91403	3.91129	.070
31.9408	3.7681	13.7934	3.94119	3.93170	.241
32.2645	3.7966	13.9028	3.96681	3.95840	.212
32.5082	3.8226	14.0026	3.98286	3.98280	.002
32.8432	3.8508	14.1102	4.01007	4.00910	.024
33.0790	3.8745	14.2005	4.02654	4.03120	-.116
33.4407	3.9029	14.3080	4.05717	4.05752	-.008
33.7638	3.9296	14.4089	4.08352	4.08221	.032
34.0190	3.9518	14.4927	4.10350	4.10274	.018
34.3777	3.9804	14.6000	4.13327	4.12906	.102
34.5702	4.0031	14.6845	4.14438	4.14980	-.130
35.0439	4.0411	14.8262	4.18332	4.18457	-.030
35.3574	4.0658	14.9178	4.20931	4.20706	.053

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TABLE E11 CONTINUED

CTOT (MJ/DEG)	CADD (MJ/DEG)	T**2 (DEG2)	C/T (MJ/M-DEG2)	C/T FIT (MJ/M-DEG2)	PCERROR
35.7852	4.0972	15.0337	4.24617	4.23554	.251
35.9763	4.1187	15.1128	4.25770	4.25500	.063
36.2913	4.1462	15.2134	4.28191	4.27973	.051
36.6519	4.1775	15.3275	4.30963	4.30782	.042
36.9443	4.2057	15.4298	4.33028	4.33301	-.063
37.3645	4.2358	15.5386	4.36651	4.35981	.154
37.6266	4.2544	15.6056	4.38914	4.37633	.293
37.8498	4.2827	15.7073	4.40047	4.40141	-.021
38.1475	4.3112	15.8089	4.42148	4.42649	-.113
38.5628	4.3446	15.9278	4.45466	4.45583	-.026
38.9334	4.3713	16.0223	4.48615	4.47917	.156
39.1762	4.4004	16.1245	4.49955	4.50444	-.109
39.4860	4.4239	16.2071	4.52502	4.52488	.003
39.8398	4.4570	16.3227	4.55021	4.55347	-.072
40.2365	4.4868	16.4261	4.58289	4.57907	.083
40.5502	4.5155	16.5251	4.60558	4.60360	.043
40.7941	4.5401	16.6098	4.62178	4.62459	-.061
41.3226	4.5704	16.7137	4.67071	4.65034	.438
41.4738	4.5989	16.8108	4.67276	4.67442	-.036
41.8450	4.6306	16.9185	4.70072	4.70116	-.009
42.0070	4.6571	17.0079	4.70544	4.72336	-.379
42.4142	4.6883	17.1130	4.73818	4.74948	-.238
42.8341	4.7178	17.2117	4.77347	4.77401	-.011

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TABLE E12

SPECIFIC HEAT OF (48A/O AU-32A/O CU-20A/O AG) ALLOY

RUN 29

JUNE 26,1970

CTOT (MJ/DEG)	CADD (MJ/DEG)	T**2 (DEG2)	C/T (MJ/M-DEG2)	C/T FIT (MJ/M-DEG2)	PCERROR
3.8537	.9841	2.0702	1.13775	1.13879	-.091
4.0187	1.0105	2.1761	1.16342	1.16235	.092
4.2103	1.0407	2.3005	1.19229	1.19002	.190
4.3460	1.0620	2.3896	1.21209	1.20987	.180
4.4958	1.0851	2.4870	1.23391	1.23155	.192
4.5718	1.0969	2.5371	1.24466	1.24272	.156
4.7820	1.1289	2.6700	1.27582	1.27234	.274
4.9506	1.1531	2.7780	1.29992	1.29643	.269
5.0691	1.1710	2.8560	1.31598	1.31383	.164
5.2318	1.1948	2.9598	1.33877	1.33700	.132
5.3222	1.2072	3.0139	1.35232	1.34909	.240
5.5259	1.2369	3.1446	1.37989	1.37828	.116
5.6611	1.2563	3.2257	1.39957	1.39640	.228
5.7931	1.2745	3.3106	1.41688	1.41538	.106
5.9686	1.2989	3.4187	1.44091	1.43957	.093
6.1452	1.3232	3.5267	1.46495	1.46373	.083
6.2853	1.3421	3.6110	1.48410	1.48262	.100
6.4134	1.3610	3.6951	1.49956	1.50145	-.126
6.5753	1.3833	3.7947	1.52061	1.52377	-.208
6.7474	1.4077	3.9045	1.54169	1.54837	-.432
6.9257	1.4296	4.0011	1.56763	1.57005	-.154
7.0627	1.4494	4.0852	1.58478	1.58891	-.260
7.2316	1.4716	4.1887	1.60571	1.61215	-.400
7.4080	1.4940	4.2687	1.62931	1.63460	-.324
7.6160	1.5199	4.4044	1.65725	1.66060	-.202
7.7888	1.5436	4.5098	1.67783	1.68430	-.384
7.9438	1.5629	4.5953	1.69816	1.70365	-.322
8.1325	1.5866	4.7008	1.72256	1.72726	-.273
8.3327	1.6114	4.8116	1.74817	1.75222	-.231
8.5241	1.6374	4.9270	1.77059	1.77821	-.428
8.7173	1.6590	5.0226	1.79686	1.79974	-.160
8.8950	1.6808	5.1191	1.81915	1.82150	-.129
9.0938	1.7048	5.2248	1.84430	1.84533	-.056
9.1701	1.7160	5.2744	1.85176	1.85654	-.257
9.3484	1.7370	5.3670	1.87447	1.87742	-.157
9.5725	1.7638	5.4847	1.90232	1.90402	-.089
9.7168	1.7832	5.5698	1.91792	1.92323	-.276
9.9123	1.8056	5.6680	1.94272	1.94544	-.140
10.1004	1.8278	5.7654	1.96565	1.96744	-.091
10.2730	1.8500	5.8624	1.98596	1.98938	-.172
10.4611	1.8727	5.9614	2.00689	2.01179	-.244
10.6648	1.8951	6.0589	2.03315	2.03388	-.036
10.8668	1.9179	6.1583	2.05740	2.05639	.049
11.0368	1.9412	6.2593	2.07421	2.07927	-.243

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TABLE E12 CONTINUED

CTOT (MJ/DEG)	CADD (MJ/DEG)	T**2 (DEG2)	C/T (MJ/M-DEG2)	C/T FIT (MJ/M-DEG2)	PCERROR
11.2290	1.9624	6.3514	2.09779	2.10016	-.113
11.4531	1.9863	6.4548	2.12591	2.12360	.109
11.6510	2.0079	6.5567	2.14814	2.14674	.065
11.8429	2.0330	6.6564	2.16933	2.16937	-.001
12.0313	2.0561	6.7560	2.18956	2.19199	-.111
12.2517	2.0793	6.8557	2.21655	2.21464	.086
12.4434	2.1008	6.9482	2.23859	2.23566	.131
12.6336	2.1246	7.0501	2.25811	2.25883	-.032
12.8492	2.1466	7.1447	2.28442	2.28036	.178
13.0611	2.1719	7.2527	2.30688	2.30495	.084
13.2927	2.1957	7.3544	2.33458	2.32812	.277
13.4939	2.2198	7.4572	2.35545	2.35153	.166
13.7065	2.2423	7.5531	2.37992	2.37339	.275
13.9261	2.2665	7.6560	2.40416	2.39685	.305
14.1275	2.2903	7.7573	2.42479	2.41996	.199
14.3745	2.3141	7.8583	2.45458	2.44302	.473
14.6326	2.3410	7.9720	2.48374	2.46898	.597
14.8135	2.3664	8.0754	2.49920	2.49262	.264
14.9791	2.3844	8.1553	2.51614	2.51099	.205
15.2044	2.4065	8.2449	2.54308	2.53136	.463
15.3781	2.4271	8.3361	2.55918	2.55224	.272
15.6250	2.4528	8.4445	2.58613	2.57704	.353
15.8672	2.4805	8.5609	2.61032	2.60369	.255
15.9884	2.4926	8.6119	2.62379	2.61537	.322
16.4615	2.5458	8.8354	2.67097	2.66661	.163
16.6721	2.5697	8.9356	2.69160	2.68959	.075
16.8962	2.5919	9.0286	2.71606	2.71092	.190
17.1414	2.6179	9.1374	2.74120	2.73591	.194
17.3821	2.6445	9.2487	2.76483	2.76146	.122
17.5477	2.6646	9.3328	2.77950	2.78080	-.047
17.8261	2.6890	9.4343	2.81171	2.80413	.270
18.0674	2.7163	9.5484	2.83435	2.83037	.141
18.2681	2.7374	9.6362	2.85443	2.85056	.136
18.4992	2.7641	9.7472	2.87548	2.87612	-.022
18.7597	2.7913	9.8601	2.90134	2.90214	-.028
18.9799	2.8144	9.9563	2.92294	2.92429	-.046
19.2102	2.8377	10.0527	2.94614	2.94651	-.013
19.4288	2.8615	10.1515	2.96665	2.96930	-.089
19.6772	2.8871	10.2572	2.99101	2.99369	-.090
19.8966	2.9114	10.3576	3.01108	3.01686	-.192
20.1871	2.9373	10.4696	3.04228	3.04158	.023
20.3603	2.9576	10.5483	3.05705	3.06093	-.127
20.6231	2.9830	10.6528	3.08353	3.08507	-.050
20.8473	3.0072	10.7522	3.10404	3.10806	-.129

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TABLE E12 CONTINUED

CTOT (MJ/DEG)	CADD (MJ/DEG)	T**2 (DEG2)	C/T (MJ/M-DEG2)	C/T FIT (MJ/M-DEG2)	PCERROR
21.0589	3.0299	10.8454	3.12340	3.12963	-.199
21.3026	3.0528	10.9396	3.14801	3.15142	-.108
21.5674	3.0807	11.0537	3.17239	3.17783	-.171
21.8248	3.1091	11.1698	3.19494	3.20474	-.306
22.0612	3.1311	11.2598	3.21859	3.22559	-.217
22.3135	3.1553	11.3583	3.24324	3.24844	-.160
22.5079	3.1755	11.4407	3.26091	3.26755	-.203
22.7955	3.2016	11.5466	3.28983	3.29211	-.069
23.0410	3.2283	11.6549	3.31109	3.31726	-.186
23.2253	3.2492	11.7398	3.32629	3.33698	-.320
23.5542	3.2772	11.8529	3.36025	3.36326	-.090
23.8282	3.3078	11.9764	3.38299	3.39199	-.265
24.0696	3.3289	12.0614	3.40726	3.41174	-.131
24.3945	3.3569	12.1741	3.43998	3.43798	.058
24.6535	3.3831	12.2791	3.46315	3.46243	.021
24.8877	3.4062	12.3715	3.48445	3.48394	.015
25.1551	3.4324	12.4761	3.50876	3.50833	.012
25.3496	3.4534	12.5599	3.52496	3.52785	-.082
25.5952	3.4797	12.6644	3.54555	3.55223	-.188
25.9419	3.5114	12.7902	3.57834	3.58157	-.090
26.2431	3.5368	12.8908	3.60815	3.60507	.085
26.4606	3.5595	12.9765	3.62724	3.62507	.060
26.6838	3.5854	13.0824	3.64350	3.64981	-.173
26.9947	3.6115	13.1848	3.67406	3.67376	.008
27.2518	3.6376	13.2869	3.69608	3.69763	-.042
27.5056	3.6667	13.4004	3.72793	3.72418	.101
27.7930	3.6870	13.4797	3.74597	3.74275	.086
28.0471	3.7134	13.5820	3.76709	3.76670	.010
28.3021	3.7379	13.6769	3.79955	3.78894	.016
28.5520	3.7614	13.7675	3.81189	3.81016	.045
28.8529	3.7933	13.8904	3.83614	3.83899	-.074
29.0884	3.8173	13.9824	3.85578	3.86056	-.124
29.4431	3.8474	14.0973	3.88936	3.88753	.047
29.6673	3.8698	14.1827	3.90820	3.90757	.016
29.8951	3.8941	14.2748	3.92630	3.92921	-.074
30.2564	3.9274	14.4007	3.95827	3.95880	-.013
30.5154	3.9514	14.4909	3.98131	3.98001	.033
30.7676	3.9743	14.5771	4.00676	4.00028	.162
31.0027	3.9994	14.6710	4.02223	4.02236	-.003
31.3583	4.0331	14.7965	4.05287	4.05192	.024
31.6451	4.0608	14.8992	4.07718	4.07610	.026
31.9362	4.0863	14.9934	4.10360	4.09829	.127
32.1883	4.1102	15.0814	4.12502	4.11904	.145
32.4412	4.1375	15.1916	4.14442	4.14266	.043

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TABLE E12 CONTINUED

CTOT (MJ/DEG)	CADD (MJ/DEG)	T**2 (DEG2)	C/T (MJ/M-DEG2)	C/T FIT (MJ/M-DEG2)	PCERROR
32.7075	4.1634	15.2760	4.16669	4.16495	.042
32.9657	4.1918	15.3794	4.18610	4.18933	-.077
33.3077	4.2195	15.4797	4.21808	4.21303	.120
33.5755	4.2485	15.5946	4.23837	4.23781	.013
33.9084	4.2781	15.6907	4.26772	4.26287	.114
34.1825	4.3092	15.8018	4.28756	4.28914	-.037
34.4912	4.3379	15.9040	4.31380	4.31333	.011
34.7768	4.3678	16.0098	4.33600	4.33835	-.054
35.0684	4.3985	16.1179	4.35851	4.36395	-.125
35.3650	4.4172	16.1834	4.38920	4.37947	.222
35.5758	4.4483	16.2922	4.39982	4.40524	-.123
35.9756	4.4812	16.4068	4.43609	4.43241	.083
36.2736	4.5139	16.5199	4.45812	4.45924	-.025
36.5198	4.5450	16.6268	4.47386	4.48461	-.240
36.9304	4.5793	16.7442	4.51060	4.51249	-.042
37.2204	4.6056	16.6337	4.53527	4.53375	.034
37.4278	4.6282	16.9103	4.55064	4.55195	-.029
37.7937	4.6645	17.0329	4.57979	4.58109	-.028
38.1132	4.6900	17.1185	4.60897	4.60144	.161
38.4482	4.7253	17.2366	4.63424	4.62953	.102

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TABLE E13

SPECIFIC HEAT OF 95A/O GOLD-5A/O SILVER ALLOY

RUN 30

AUGUST 14,1970

CTOT (MJ/DEG)	CADD (MJ/DEG)	T**2 (DEG2)	C/T (MJ/M-DEG2)	C/T FIT (MJ/M-DEG2)	PCERROR
4.7390	.9274	1.8445	1.47041	1.48053	-.684
5.0172	.9556	1.9549	1.52194	1.52742	-.359
5.3430	.9877	2.0836	1.58079	1.58205	-.080
5.5577	1.0085	2.1679	1.61880	1.61778	.063
5.8865	1.0401	2.2984	1.67485	1.67314	.102
6.1502	1.0646	2.4007	1.71966	1.71651	.184
6.4483	1.0921	2.5165	1.76898	1.76561	.191
6.6927	1.1142	2.6107	1.80887	1.80552	.186
7.0034	1.1415	2.7282	1.85937	1.85526	.221
7.2908	1.1660	2.8342	1.90609	1.90015	.312
7.5188	1.1857	2.9199	1.94177	1.93643	.276
7.6547	1.1971	2.9699	1.96320	1.95756	.288
8.1530	1.2391	3.1542	2.03961	2.03550	.202
8.3013	1.2509	3.2060	2.06299	2.05743	.270
8.5568	1.2720	3.2994	2.10118	2.09691	.204
8.8499	1.2953	3.4029	2.14560	2.14064	.232
9.0478	1.3109	3.4721	2.17538	2.16986	.254
9.4395	1.3427	3.6134	2.23164	2.22951	.095
9.6783	1.3617	3.6982	2.26578	2.26531	.021
9.9755	1.3852	3.8031	2.30783	2.30957	-.075
10.2088	1.4038	3.8858	2.34023	2.34446	-.181
10.5149	1.4274	3.9913	2.38318	2.38893	-.241
10.8170	1.4496	4.0907	2.42651	2.43083	-.178
11.1910	1.4774	4.2149	2.47886	2.48315	-.173
11.4020	1.4936	4.2871	2.50718	2.51357	-.254
11.7017	1.5155	4.3849	2.54856	2.55475	-.242
12.0207	1.5388	4.4885	2.59213	2.59837	-.240
12.3647	1.5635	4.5984	2.63899	2.64461	-.213
12.7218	1.5888	4.7109	2.68738	2.69190	-.168
13.0042	1.6088	4.8000	2.72504	2.72938	-.159
13.3227	1.6330	4.9072	2.76474	2.77444	-.350
13.4673	1.6552	5.0056	2.81294	2.81577	-.101
14.0077	1.6797	5.1142	2.85608	2.86139	-.185
14.3504	1.7033	5.2183	2.90064	2.90511	-.154
14.5712	1.7190	5.2874	2.92837	2.93410	-.195
14.8646	1.7396	5.3781	2.96518	2.97217	-.235
15.1989	1.7620	5.4769	3.00814	3.01360	-.181
15.5311	1.7854	5.5795	3.04884	3.05663	-.255
15.8765	1.8078	5.6778	3.09336	3.09783	-.144
16.2146	1.8314	5.7813	3.13406	3.14121	-.228
16.5115	1.8523	5.8724	3.16936	3.17936	-.315
16.8747	1.8748	5.9706	3.21621	3.22050	-.133
17.2460	1.8992	6.0769	3.26169	3.26498	-.101
17.5888	1.9214	6.1734	3.30371	3.30536	-.050

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TABLE E13 CONTINUED

CTOT (MJ/DEG)	CADD (MJ/DEG)	T**2 (DEG2)	C/T (MJ/M-DEG2)	C/T FIT (MJ/M-DEG2)	PCERROR
17.9159	1.9443	6.2730	3.34101	3.34703	-.180
18.2787	1.9664	6.3688	3.38653	3.38706	-.016
18.6563	1.9903	6.4722	3.43219	3.43031	.055
19.0267	2.0130	6.5701	3.47760	3.47123	.184
19.3848	2.0368	6.6730	3.51848	3.51420	.122
19.7778	2.0616	6.7796	3.56483	3.55869	.172
20.1294	2.0841	6.8766	3.60532	3.59919	.170
20.4416	2.1046	6.9646	3.64036	3.63593	.122
20.8375	2.1284	7.0666	3.68734	3.67848	.241
21.1524	2.1489	7.1543	3.72235	3.71503	.197
21.5080	2.1714	7.2504	3.76241	3.75511	.194
21.8934	2.1953	7.3526	3.80603	3.79770	.219
22.3032	2.2197	7.4566	3.85332	3.84103	.320
22.6881	2.2435	7.5581	3.89620	3.88327	.333
23.0401	2.2667	7.6566	3.93330	3.92430	.229
23.4241	2.2902	7.7567	3.97564	3.96596	.244
23.7928	2.3137	7.8566	4.01482	4.00750	.183
24.2246	2.3382	7.9603	4.06420	4.05064	.335
24.5556	2.3611	8.0573	4.09654	4.09096	.136
24.9392	2.3830	8.1497	4.13964	4.12934	.249
25.3397	2.4077	8.2540	4.18194	4.17268	.222
25.7177	2.4313	8.3537	4.22114	4.21409	.167
26.2087	2.4571	8.4627	4.27765	4.25931	.430
26.5813	2.4822	8.5680	4.31349	4.30301	.244
26.9558	2.5052	8.6649	4.35187	4.34320	.200
27.3617	2.5286	8.7634	4.39505	4.38403	.251
27.7163	2.5510	8.8572	4.43018	4.42292	.164
28.0593	2.5707	8.9400	4.46625	4.45725	.202
28.4189	2.5969	9.0495	4.49725	4.50259	-.119
29.0054	2.6303	9.1897	4.55851	4.56045	-.042
29.3171	2.6470	9.2591	4.59206	4.58938	.059
29.6721	2.6681	9.3473	4.62756	4.62588	.036
30.1112	2.6949	9.4590	4.67041	4.67208	-.036
30.4929	2.7184	9.5569	4.70713	4.71257	-.115
30.9530	2.7422	9.6559	4.75649	4.75351	.063
31.2882	2.7612	9.7352	4.79018	4.78625	.082
31.7326	2.7867	9.8410	4.83433	4.82995	.091
32.2036	2.8142	9.9554	4.88009	4.87721	.059
32.5811	2.8373	10.0509	4.91545	4.91662	-.024
33.0265	2.8632	10.1564	4.95829	4.96100	-.055
33.4687	2.8875	10.2588	5.00235	5.00239	-.001
33.8708	2.9123	10.3611	5.03901	5.04458	-.110
34.2793	2.9363	10.4602	5.07736	5.08543	-.159
34.7855	2.9646	10.5770	5.12624	5.13354	-.142

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TABLE E13 CONTINUED

CTOT (MJ/DEG)	CADD (MJ/DEG)	T**2 (DEG2)	C/T (MJ/M-DEG2)	C/T FIT (MJ/M-DEG2)	PCERROR
35.1304	2.9843	10.6580	5.15891	5.16692	-.155
35.5918	3.0126	10.7745	5.20007	5.21487	-.284
35.9928	3.0352	10.8674	5.23792	5.25312	-.289
36.4892	3.0596	10.9672	5.28873	5.29417	-.103
36.8958	3.0859	11.0751	5.32274	5.33858	-.297
37.3647	3.1112	11.1783	5.36766	5.38097	-.247
37.8330	3.1344	11.2730	5.41451	5.41991	-.100
38.3270	3.1625	11.3876	5.45954	5.46699	-.136
38.7346	3.1855	11.4811	5.49672	5.50541	-.158
39.1361	3.2091	11.5771	5.53208	5.54482	-.230
39.6083	3.2350	11.6821	5.57556	5.58792	-.221
40.1157	3.2601	11.7837	5.62510	5.62958	-.080
40.5337	3.2845	11.8823	5.66155	5.67000	-.149
41.1200	3.3164	12.0111	5.71491	5.72281	-.138
41.5236	3.3354	12.0875	5.75478	5.75411	.012
41.8961	3.3574	12.1761	5.78642	5.79042	-.069
42.3325	3.3817	12.2734	5.82506	5.83028	-.090
42.8391	3.4052	12.3675	5.87485	5.86879	.103
43.2890	3.4325	12.4765	5.91181	5.91339	-.027
43.7906	3.4598	12.5855	5.95618	5.95800	-.031
44.2737	3.4837	12.6806	6.00139	5.99686	.075
44.6657	3.5081	12.7774	6.03248	6.03643	-.066
45.2913	3.5399	12.9032	6.08960	6.08785	.029
45.5480	3.5595	12.9802	6.10601	6.11931	-.217
45.9576	3.5851	13.0812	6.13801	6.16056	-.366
46.6543	3.6141	13.1949	6.20783	6.20695	.014
47.1409	3.6404	13.2979	6.24987	6.24897	.014
47.5044	3.6653	13.3949	6.27567	6.28854	-.205
48.0346	3.6892	13.4881	6.32616	6.32656	-.006
48.5686	3.7176	13.5983	6.37233	6.37146	.014
49.0568	3.7427	13.6956	6.41521	6.41110	.064
49.4797	3.7671	13.7895	6.44954	6.44938	.003
50.1217	3.7987	13.9108	6.50710	6.49877	.128
50.4685	3.8212	13.9970	6.53247	6.53383	-.021
51.0965	3.8510	14.1110	6.58943	6.58023	.140
51.5317	3.8773	14.2109	6.62307	6.62086	.033
52.0729	3.9019	14.3044	6.67294	6.65888	.211
52.5620	3.9321	14.4184	6.70983	6.70520	.069
53.0560	3.9555	14.5066	6.75414	6.74102	.195
53.3295	3.9797	14.5970	6.76738	6.77776	-.153
53.9041	4.0069	14.6989	6.81868	6.81913	-.007
54.5075	4.0407	14.8245	6.86726	6.87009	-.041
55.0313	4.0671	14.9226	6.91210	6.90988	.032
55.5868	4.0955	15.0275	6.95917	6.95242	.097

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TABLE E13 CONTINUED

CTOT (MJ/DEG)	CADD (MJ/DEG)	T**2 (DEG2)	C/T (MJ/M-DEG2)	C/T FIT (MJ/M-DEG2)	PCERROR
56.0785	4.1216	15.1233	6.99983	6.99124	.123
56.4646	4.1467	15.2151	7.02716	7.02846	-.018
57.1659	4.1787	15.3320	7.08988	7.07581	.199
57.4743	4.1965	15.3965	7.11382	7.10191	.168
58.1076	4.2332	15.5293	7.16266	7.15567	.098
58.6343	4.2625	15.6349	7.20431	7.19842	.082
59.0984	4.2916	15.7389	7.23794	7.24047	-.035
59.6777	4.3181	15.8335	7.28905	7.27874	.142
60.0192	4.3448	15.9284	7.30863	7.31709	-.116
60.5968	4.3775	16.0440	7.35354	7.36379	-.139
61.0279	4.4000	16.1232	7.38878	7.39576	-.094
61.4396	4.4267	16.2168	7.41751	7.43356	-.216
61.5356	4.4279	16.2211	7.42887	7.43528	-.086
62.6242	4.4861	16.4238	7.51608	7.51709	-.013
63.1190	4.5124	16.5146	7.55578	7.55374	.027
63.6373	4.5437	16.6222	7.59387	7.59711	-.043
64.2748	4.5750	16.7295	7.64712	7.64036	.088
64.9142	4.6091	16.8457	7.69798	7.68715	.141
65.4162	4.6304	16.9179	7.74277	7.71622	.344
65.8037	4.6631	17.0282	7.76269	7.76065	.026
66.4048	4.6988	17.1481	7.80705	7.80889	-.024
66.7720	4.7241	17.2326	7.83104	7.84288	-.151

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TABLE E14

SPECIFIC HEAT OF (42A/O AU-28A/O CU-30A/O AG) ALLOY

RUN 31

SEPTEMBER 25,1970

CTOT (MJ/DEG)	CADD (MJ/DEG)	T**2 (DEG2)	C/T (MJ/M-DEG2)	C/T FIT (MJ/M-DEG2)	PCERROR
4.0833	.9682	2.0050	1.10023	1.09729	.268
4.2106	.9887	2.0875	1.11523	1.11479	.039
4.3842	1.0147	2.1934	1.13781	1.13723	.051
4.5488	1.0381	2.2899	1.16024	1.15771	.219
4.6526	1.0538	2.3553	1.17273	1.17158	.098
4.9009	1.0880	2.4993	1.20617	1.20215	.335
5.0424	1.1083	2.5857	1.22353	1.22049	.249
5.1946	1.1306	2.6810	1.24130	1.24073	.046
5.3829	1.1550	2.7865	1.26665	1.26315	.277
5.5105	1.1719	2.8598	1.28305	1.27873	.338
5.7258	1.2023	2.9925	1.30775	1.30694	.062
5.9049	1.2249	3.0917	1.33109	1.32805	.229
6.0687	1.2473	3.1904	1.34993	1.34906	.064
6.2542	1.2701	3.2910	1.37400	1.37047	.257
6.4052	1.2926	3.3906	1.38860	1.39168	-.221
6.6221	1.3178	3.5026	1.41743	1.41555	.133
6.7941	1.3403	3.6029	1.43695	1.43692	.002
7.1470	1.3860	3.8066	1.47670	1.48036	-.247
7.3254	1.4084	3.9067	1.49713	1.50172	-.306
7.5021	1.4299	4.0024	1.51792	1.52215	-.278
7.6759	1.4521	4.1016	1.53691	1.54332	-.416
7.8418	1.4729	4.1945	1.55522	1.56317	-.508
8.0516	1.4981	4.3072	1.57921	1.58725	-.507
8.2161	1.5176	4.3940	1.59813	1.60580	-.478
8.3988	1.5383	4.4864	1.61983	1.62556	-.352
8.5946	1.5607	4.5860	1.64265	1.64686	-.256
8.7742	1.5826	4.6834	1.66192	1.66772	-.348
8.9878	1.6062	4.7885	1.68701	1.69020	-.189
9.1606	1.6266	4.8791	1.70575	1.70961	-.226
9.3820	1.6508	4.9860	1.73157	1.73251	-.054
9.5575	1.6724	5.0818	1.74929	1.75303	-.213
9.7525	1.6958	5.1850	1.76950	1.77516	-.319
9.9490	1.7178	5.2821	1.79114	1.79598	-.270
10.1503	1.7400	5.3799	1.81339	1.81697	-.197
10.3493	1.7628	5.4806	1.83428	1.83858	-.234
10.5614	1.7864	5.5842	1.85706	1.86082	-.202
10.9864	1.8326	5.7864	1.90311	1.90425	-.060
11.1861	1.8543	5.8812	1.92440	1.92464	-.013
11.3916	1.8766	5.9786	1.94614	1.94556	.030
11.6048	1.8990	6.0762	1.96916	1.96656	.132
11.8189	1.9228	6.1794	1.99093	1.98877	.109
11.9687	1.9405	6.2564	2.00506	2.00533	-.013
12.3833	1.9851	6.4497	2.04764	2.04696	.033
12.5892	2.0078	6.5477	2.06805	2.06808	-.001

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TABLE E14 CONTINUED

CTOT (MJ/DEG)	CADD (MJ/DEG)	T**2 (DEG2)	C/T (MJ/M-DEG2)	C/T FIT (MJ/M-DEG2)	PCERROR
12.8342	2.0330	6.6565	2.09369	2.09152	.103
13.0264	2.0553	6.7527	2.11142	2.11227	-.040
13.2911	2.0818	6.8666	2.13930	2.13684	.115
13.4766	2.1024	6.9548	2.15697	2.15587	.051
13.7009	2.1272	7.0613	2.17819	2.17886	-.031
13.9339	2.1479	7.1501	2.20432	2.19802	.287
14.1540	2.1725	7.2554	2.22456	2.22076	.171
14.3989	2.1965	7.3576	2.24980	2.24285	.310
14.6160	2.2190	7.4537	2.27088	2.26362	.321
14.8612	2.2455	7.5666	2.29365	2.28804	.245
15.0981	2.2684	7.6643	2.31762	2.30917	.366
15.3112	2.2920	7.7645	2.33664	2.33085	.248
15.5347	2.3139	7.8572	2.35878	2.35092	.334
15.7598	2.3378	7.9587	2.37936	2.37290	.272
16.0119	2.3623	8.0623	2.40412	2.39535	.366
16.2062	2.3842	8.1550	2.42059	2.41544	.213
16.4936	2.4115	8.2704	2.44887	2.44046	.345
16.7165	2.4353	8.3705	2.46862	2.46216	.262
16.9471	2.4595	8.4727	2.48915	2.48433	.194
17.1851	2.4827	8.5704	2.51160	2.50554	.242
17.4462	2.5067	8.6713	2.53721	2.52745	.386
17.6374	2.5296	8.7675	2.55168	2.54835	.131
17.8616	2.5512	8.8583	2.57261	2.56807	.177
18.0801	2.5752	8.9586	2.59069	2.58986	.032
18.2964	2.5968	9.0491	2.61008	2.60954	.021
18.5659	2.6218	9.1538	2.63551	2.63232	.121
18.8008	2.6448	9.2501	2.65660	2.65326	.126
19.0310	2.6692	9.3520	2.67572	2.67545	.010
19.2796	2.6934	9.4527	2.69795	2.69738	.021
19.5539	2.7178	9.5545	2.72396	2.71955	.162
19.7780	2.7407	9.6499	2.74287	2.74032	.093
20.0006	2.7654	9.7528	2.76004	2.76276	-.098
20.2456	2.7902	9.8556	2.78070	2.78517	-.160
20.5291	2.8147	9.9573	2.80750	2.80735	.005
20.7620	2.8384	10.0556	2.82675	2.82880	-.073
21.0152	2.8616	10.1519	2.84940	2.84982	-.015
21.2494	2.8854	10.2501	2.86858	2.87128	-.094
21.5436	2.9106	10.3543	2.89592	2.89402	.066
21.7796	2.9365	10.4612	2.91358	2.91738	-.130
22.0307	2.9623	10.5677	2.93352	2.94066	-.243
22.3130	2.9863	10.6662	2.95951	2.96220	-.091
22.5901	3.0146	10.7828	2.98134	2.98772	-.213
22.8448	3.0381	10.8790	3.00320	3.00876	-.185
23.0655	3.0607	10.9718	3.02037	3.02908	-.287

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TABLE E14 CONTINUED

CTOT (MJ/DEG)	CADD (MJ/DEG)	T**2 (DEG2)	C/T (MJ/M-DEG2)	C/T FIT (MJ/M-DEG2)	PCERROR
23.3625	3.0843	11.0685	3.04825	3.05026	-.066
23.6624	3.1118	11.1809	3.07362	3.07489	-.041
23.8854	3.1357	11.2783	3.08998	3.09623	-.202
24.1240	3.1599	11.3769	3.10834	3.11786	-.305
24.3556	3.1791	11.4554	3.12905	3.13507	-.192
24.6047	3.2032	11.5531	3.14890	3.15650	-.241
24.9835	3.2367	11.6889	3.18107	3.18631	-.164
25.2309	3.2590	11.7793	3.20164	3.20615	-.141
25.5135	3.2801	11.8646	3.22809	3.22489	.099
25.6915	3.2981	11.9374	3.24138	3.24087	.016
26.0861	3.3337	12.0806	3.27377	3.27235	.043
26.3337	3.3583	12.1795	3.29241	3.29409	-.051
26.6509	3.3862	12.2916	3.31861	3.31876	-.004
26.8659	3.4096	12.3850	3.33332	3.33930	-.179
27.1889	3.4350	12.4867	3.36182	3.36170	.003
27.4242	3.4611	12.5908	3.37739	3.38461	-.213
27.6887	3.4831	12.6780	3.39982	3.40382	-.118
27.9639	3.5086	12.7790	3.42129	3.42608	-.140
28.2744	3.5337	12.8786	3.44779	3.44803	-.007
28.6439	3.5617	12.9890	3.48050	3.47238	.234
28.8747	3.5858	13.0838	3.49645	3.49329	.090
29.1698	3.6131	13.1912	3.51906	3.51697	.060
29.4129	3.6398	13.2954	3.53494	3.53997	-.142
29.7317	3.6676	13.4040	3.56033	3.56396	-.102
30.0244	3.6916	13.4975	3.58455	3.58463	-.002
30.2968	3.7176	13.5983	3.60466	3.60690	-.062
30.5842	3.7422	13.6935	3.62762	3.62793	-.009
30.8595	3.7701	13.8009	3.64678	3.65170	-.135
31.1764	3.7990	13.9123	3.67077	3.67633	-.151
31.4684	3.8211	13.9968	3.69576	3.69503	.020
31.8282	3.8514	14.1126	3.72442	3.72066	.101
32.1067	3.8789	14.2171	3.74400	3.74382	.005
32.4072	3.9044	14.3137	3.76770	3.76521	.066
32.6683	3.9354	14.4307	3.78269	3.79115	-.223
33.0956	3.9616	14.5292	3.82248	3.81298	.249
33.2636	3.9854	14.6185	3.82964	3.83279	-.082
33.6840	4.0128	14.7211	3.86749	3.85555	.310
33.9716	4.0442	14.8378	3.88551	3.88146	.104
34.2310	4.0692	14.9305	3.90377	3.90204	.044
34.4889	4.0918	15.0139	3.92328	3.92056	.069
34.7549	4.1160	15.1029	3.94283	3.94033	.063
35.0963	4.1448	15.2084	3.96921	3.96378	.137
35.3595	4.1714	15.3055	3.98684	3.98537	.037
35.8102	4.2027	15.4191	4.02556	4.01063	.372

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TABLE E14 CONTINUED

CTOT (MJ/DEG)	CADD (MJ/DEG)	T**2 (DEG2)	C/T (MJ/M-DEG2)	C/T FIT (MJ/M-DEG2)	PCERROR
35.9578	4.2302	15.5184	4.02789	4.03274	-.120
36.3084	4.2580	15.6187	4.05578	4.05506	.018
36.6649	4.2847	15.7144	4.08503	4.07636	.213
36.9492	4.3136	15.8177	4.10379	4.09936	.108
37.3149	4.3458	15.9319	4.13084	4.12480	.146
37.5062	4.3693	16.0152	4.14105	4.14338	-.056
37.8207	4.3982	16.1169	4.16353	4.16606	-.061
38.0846	4.4245	16.2090	4.18122	4.18659	-.128
38.4433	4.4539	16.3119	4.20876	4.20956	-.019
38.7141	4.4875	16.4284	4.22310	4.23555	-.294
39.1204	4.5141	16.5206	4.25801	4.25614	.044
39.3017	4.5438	16.6225	4.26354	4.27891	-.359
39.7072	4.5732	16.7233	4.29667	4.30142	-.110
40.0238	4.6033	16.8257	4.31850	4.32432	-.135
40.4556	4.6310	16.9198	4.35561	4.34534	.236
40.7020	4.6620	17.0245	4.36829	4.36878	-.011
41.1414	4.6953	17.1363	4.40308	4.39379	.211
41.3488	4.7207	17.2211	4.41417	4.41278	.032

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TABLE E15

SPECIFIC HEAT OF (54A/O AU-36A/O CU-10A/O AG) ALLOY

RUN 32

OCTOBER 7,1970

CTOT (MJ/DEG)	CADD (MJ/DEG)	T**2 (DEG2)	C/T (MJ/M-DEG2)	C/T FIT (MJ/M-DEG2)	PCERROR
3.8725	.9414	1.8991	1.11492	1.12035	-.485
4.0235	.9627	1.9834	1.13920	1.13976	-.050
4.1959	.9884	2.0863	1.16400	1.16346	.046
4.3633	1.0121	2.1828	1.18896	1.18570	.275
4.5496	1.0394	2.2953	1.21450	1.21164	.236
4.6576	1.0548	2.3593	1.22952	1.22639	.255
4.8264	1.0787	2.4599	1.25251	1.24963	.231
5.0232	1.1057	2.5743	1.27988	1.27604	.301
5.2506	1.1367	2.7072	1.31060	1.30675	.295
5.4569	1.1648	2.8287	1.33770	1.33485	.214
5.6481	1.1898	2.9379	1.36342	1.36011	.243
5.8430	1.2148	3.0473	1.38974	1.38544	.311
5.9189	1.2246	3.0904	1.39970	1.39542	.307
6.0811	1.2459	3.1841	1.42035	1.41712	.228
6.2826	1.2723	3.3007	1.44557	1.44415	.098
6.4998	1.2992	3.4199	1.47412	1.47179	.159
6.6816	1.3229	3.5256	1.49596	1.49631	-.023
6.8216	1.3398	3.6007	1.51427	1.51376	.034
6.9576	1.3598	3.6898	1.52754	1.53445	-.450
7.1929	1.3854	3.8040	1.56080	1.56098	-.011
7.3467	1.4051	3.8921	1.57867	1.58146	-.177
7.5451	1.4304	4.0048	1.60163	1.60769	-.377
7.7423	1.4532	4.1069	1.62671	1.63144	-.290
7.9005	1.4729	4.1948	1.64501	1.65193	-.419
8.0876	1.4943	4.2902	1.66855	1.67416	-.335
8.3128	1.5212	4.4099	1.69528	1.70206	-.398
8.5264	1.5445	4.5137	1.72261	1.72628	-.213
8.7405	1.5684	4.6204	1.74900	1.75117	-.124
8.8674	1.5847	4.6929	1.76218	1.76809	-.334
9.0250	1.6023	4.7709	1.78132	1.78632	-.280
9.2339	1.6268	4.8797	1.80512	1.81174	-.366
9.4408	1.6491	4.9785	1.83046	1.83485	-.239
9.6530	1.6721	5.0806	1.85600	1.85872	-.147
9.8376	1.6929	5.1725	1.87717	1.88024	-.163
10.0449	1.7170	5.2789	1.89995	1.90515	-.273
10.2509	1.7389	5.3754	1.92444	1.92776	-.172
10.4668	1.7618	5.4759	1.94995	1.95132	-.070
10.6482	1.7837	5.5722	1.96843	1.97391	-.278
10.8726	1.8072	5.6750	1.99473	1.99803	-.165
11.0552	1.8277	5.7652	2.01444	2.01919	-.235
11.2755	1.8513	5.8680	2.03929	2.04335	-.199
11.4695	1.8737	5.9658	2.05935	2.06632	-.337
11.6938	1.8961	6.0634	2.08567	2.08929	-.173
11.9280	1.9197	6.1660	2.11271	2.11341	-.033

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TABLE E15 CONTINUED

CTOT (MJ/DEG)	CADD (MJ/DEG)	T**2 (DEG2)	C/T (MJ/M-DEG2)	C/T FIT (MJ/M-DEG2)	PCERROR
12.1378	1.9433	6.2685	2.13434	2.13753	-.149
12.3630	1.9650	6.3625	2.16082	2.15966	.054
12.6254	1.9913	6.4766	2.19031	2.18656	.171
12.8423	2.0133	6.5716	2.21427	2.20894	.241
13.0702	2.0384	6.6797	2.23743	2.23445	.133
13.2919	2.0609	6.7767	2.26148	2.25733	.184
13.4970	2.0814	6.8648	2.28385	2.27812	.252
13.7181	2.1045	6.9639	2.30687	2.30153	.232
13.9324	2.1272	7.0615	2.32864	2.32461	.173
14.1434	2.1472	7.1472	2.35209	2.34486	.308
14.3572	2.1705	7.2466	2.37302	2.36837	.196
14.6218	2.1953	7.3528	2.40216	2.39351	.361
14.8455	2.2183	7.4506	2.42489	2.41666	.341
15.0650	2.2411	7.5480	2.44672	2.43973	.287
15.2880	2.2655	7.6516	2.46773	2.46430	.139
15.5430	2.2888	7.7506	2.49555	2.48777	.313
15.7655	2.3132	7.8544	2.51605	2.51240	.145
15.9764	2.3333	7.9397	2.53800	2.53264	.212
16.2191	2.3590	8.0485	2.56086	2.55848	.093
16.4649	2.3821	8.1462	2.58637	2.58169	.181
16.7234	2.4069	8.2507	2.61260	2.60654	.232
16.9676	2.4293	8.3455	2.63794	2.62910	.336
17.2252	2.4564	8.4596	2.66164	2.65624	.203
17.4447	2.4790	8.5548	2.68208	2.67891	.119
17.6963	2.5010	8.6472	2.70864	2.70093	.286
17.9214	2.5243	8.7450	2.72924	2.72423	.184
18.1827	2.5489	8.8486	2.75492	2.74892	.218
18.4420	2.5717	8.9442	2.78159	2.77175	.355
18.6620	2.5960	9.0458	2.80003	2.79600	.144
18.9461	2.6243	9.1644	2.82616	2.82432	.065
19.1757	2.6477	9.2622	2.84670	2.84770	-.035
19.4631	2.6717	9.3622	2.87658	2.87160	.173
19.6866	2.6969	9.4674	2.89435	2.89675	-.083
19.9231	2.7182	9.5563	2.91733	2.91804	-.024
20.2236	2.7435	9.6617	2.94780	2.94326	.154
20.4098	2.7646	9.7494	2.96223	2.96427	-.069
20.7208	2.7918	9.8623	2.99258	2.99133	.042
20.9123	2.8124	9.9477	3.00814	3.01180	-.122
21.1776	2.8354	10.0433	3.03385	3.03474	-.029
21.4404	2.8602	10.1459	3.05762	3.05938	-.057
21.7316	2.8862	10.2533	3.08499	3.08517	-.006
21.9129	2.9095	10.3497	3.09634	3.10833	-.386
22.2312	2.9356	10.4575	3.12769	3.13423	-.209
22.4664	2.9569	10.5453	3.14917	3.15535	-.196

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TABLE E15 CONTINUED

CTOT (MJ/DEG)	CADD (MJ/DEG)	T**2 (DEG2)	C/T (MJ/M-DEG2)	C/T FIT (MJ/M-DEG2)	PCERROR
22.7904	2.9839	10.6564	3.18040	3.18209	-.053
23.0754	3.0100	10.7639	3.20585	3.20795	-.066
23.2872	3.0324	10.8557	3.22240	3.23007	-.238
23.5589	3.0565	10.9546	3.24704	3.25390	-.211
23.8466	3.0829	11.0629	3.27228	3.28001	-.236
24.1802	3.1081	11.1657	3.30556	3.30482	.022
24.4465	3.1352	11.2765	3.32662	3.33156	-.148
24.6626	3.1555	11.3593	3.34492	3.35156	-.198
24.9587	3.1831	11.4713	3.37012	3.37862	-.251
25.3170	3.2085	11.5749	3.40628	3.40366	.077
25.4969	3.2314	11.6677	3.41679	3.42610	-.272
25.7903	3.2554	11.7648	3.44385	3.44959	-.166
26.0425	3.2782	11.8569	3.46537	3.47189	-.188
26.3899	3.3056	11.9674	3.49783	3.49865	-.024
26.6980	3.3336	12.0802	3.52381	3.52599	-.062
26.9036	3.3517	12.1531	3.54131	3.54366	-.066
27.2879	3.3855	12.2886	3.57413	3.57652	-.067
27.5997	3.4129	12.3984	3.60061	3.60318	-.071
27.8805	3.4349	12.4862	3.62631	3.62451	.050
28.1552	3.4626	12.5965	3.64687	3.65131	-.121
28.4865	3.4870	12.6935	3.67806	3.67488	.087
28.7789	3.5143	12.8019	3.70130	3.70124	.002
29.1103	3.5429	12.9150	3.72921	3.72876	.012
29.2852	3.5573	12.9717	3.74444	3.74255	.050
29.7113	3.5958	13.1232	3.77884	3.77946	-.016
29.9486	3.6153	13.1995	3.79933	3.79805	.034
30.2328	3.6427	13.3070	3.82084	3.82427	-.089
30.5155	3.6657	13.3965	3.84527	3.84609	-.021
30.8110	3.6892	13.4879	3.87104	3.86840	.068
31.1253	3.7174	13.5975	3.89606	3.89516	.023
31.4219	3.7465	13.7100	3.91792	3.92263	-.120
31.7057	3.7698	13.8000	3.94187	3.94462	-.070
32.0104	3.7970	13.9045	3.96605	3.97018	-.104
32.3480	3.8251	14.0122	3.99411	3.99652	-.060
32.7649	3.8565	14.1317	4.03095	4.02579	.128
33.0089	3.8779	14.2135	4.05028	4.04580	.111
33.3086	3.9044	14.3135	4.07396	4.07032	.089
33.5511	3.9293	14.4077	4.09068	4.09340	-.066
33.8871	3.9565	14.5100	4.11872	4.11850	.005
34.2515	3.9812	14.6028	4.15221	4.14126	.264
34.6294	4.0133	14.7227	4.18250	4.17071	.283
34.8836	4.0383	14.8160	4.20053	4.19360	.165
35.1646	4.0664	14.9200	4.22017	4.21917	.024
35.4648	4.0905	15.0091	4.24498	4.24108	.092

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TABLE E15 CONTINUED

CTOT (MJ/DEG)	CADD (MJ/DEG)	T**2 (DEG2)	C/T (MJ/M-DEG2)	C/T FIT (MJ/M-DEG2)	PCERROR
35.8060	4.1193	15.1148	4.27224	4.26707	.121
36.0815	4.1457	15.2114	4.29214	4.29085	.030
36.3872	4.1682	15.2936	4.31855	4.31108	.173
36.6129	4.1949	15.3909	4.33145	4.33506	-.083
36.9221	4.2228	15.4920	4.35477	4.35995	-.119
37.2633	4.2520	15.5971	4.38148	4.38587	-.100
37.6634	4.2838	15.7112	4.41426	4.41401	.006
37.9225	4.3051	15.7873	4.43496	4.43281	.048
38.2960	4.3426	15.9204	4.46052	4.46568	-.115
38.7230	4.3749	16.0349	4.49625	4.49395	.051
38.9045	4.3931	16.0990	4.50862	4.50979	-.026
39.2569	4.4249	16.2104	4.53484	4.53735	-.055
39.6000	4.4548	16.3150	4.56092	4.56322	-.051
39.9402	4.4814	16.4072	4.58868	4.58605	.057
40.2846	4.5093	16.5038	4.61606	4.60997	.132
40.5609	4.5388	16.6053	4.63368	4.63513	-.031
40.9027	4.5695	16.7108	4.65892	4.66127	-.051
41.2367	4.5955	16.7992	4.68604	4.68320	.060
41.5413	4.6295	16.9146	4.70452	4.71183	-.155
41.9455	4.6598	17.0170	4.73785	4.73725	.013
42.2957	4.6893	17.1161	4.76474	4.76187	.060
42.5377	4.7155	17.2040	4.77982	4.78371	-.081

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TABLE E16

SPECIFIC HEAT OF (30A/O AU-20A/O CU-50A/O AG) ALLOY

RUN 33

OCTOBER 15,1970

CTOT (MJ/DEG)	CADD (MJ/DEG)	T**2 (DEG2)	C/T (MJ/M-DEG2)	C/T FIT (MJ/M-DEG2)	PCERROR
3.8556	.9622	1.9811	1.04628	1.04647	-.018
3.9697	.9803	2.0537	1.06169	1.06052	.110
4.1262	1.0055	2.1557	1.08177	1.08025	.141
4.5321	1.0687	2.4176	1.13371	1.13091	.247
4.6779	1.0903	2.5090	1.15273	1.14862	.358
4.8280	1.1135	2.6076	1.17078	1.16769	.264
5.2020	1.1684	2.8446	1.21720	1.21360	.297
5.3929	1.1967	2.9681	1.23964	1.23754	.170
5.4669	1.2063	3.0101	1.24987	1.24566	.338
5.6024	1.2260	3.0966	1.26576	1.26244	.263
5.7859	1.2523	3.2124	1.28737	1.28490	.193
5.9363	1.2735	3.3061	1.30519	1.30305	.165
6.1574	1.3043	3.4427	1.33123	1.32955	.126
6.2510	1.3174	3.5010	1.34200	1.34087	.084
6.4285	1.3417	3.6091	1.36280	1.36184	.071
6.5910	1.3646	3.7113	1.38076	1.38168	-.066
6.7551	1.3859	3.8061	1.40073	1.40009	.045
6.9232	1.4101	3.9143	1.41824	1.42109	-.201
7.0835	1.4315	4.0099	1.43653	1.43967	-.218
7.2697	1.4573	4.1252	1.45651	1.46206	-.380
7.4229	1.4779	4.2167	1.47349	1.47986	-.430
7.5925	1.5006	4.3183	1.49204	1.49959	-.504
7.7673	1.5223	4.4149	1.51270	1.51838	-.374
7.9045	1.5394	4.4913	1.52860	1.53324	-.303
8.0595	1.5597	4.5816	1.54552	1.55081	-.341
8.2572	1.5848	4.6933	1.56758	1.57252	-.315
8.4284	1.6058	4.7868	1.58709	1.59073	-.228
8.6108	1.6287	4.8882	1.60729	1.61045	-.197
8.7886	1.6516	4.9897	1.62616	1.63021	-.249
8.9568	1.6730	5.0844	1.64408	1.64865	-.277
9.1335	1.6944	5.1792	1.66368	1.66713	-.207
9.3291	1.7183	5.2845	1.68506	1.68763	-.152
9.4967	1.7404	5.3818	1.70167	1.70660	-.289
9.6717	1.7628	5.4803	1.71949	1.72579	-.365
9.8951	1.7887	5.5941	1.74441	1.74797	-.204
10.0900	1.8126	5.6987	1.76477	1.76838	-.204
10.2706	1.8344	5.7941	1.78378	1.78697	-.179
10.4707	1.8584	5.8992	1.80470	1.80748	-.154
10.6513	1.8805	5.9955	1.82310	1.82627	-.173
10.8361	1.9037	6.0965	1.84122	1.84599	-.259
11.0167	1.9228	6.1794	1.86193	1.86216	-.012
11.1662	1.9420	6.2628	1.87598	1.87844	-.131
11.3725	1.9656	6.3653	1.89765	1.89848	-.043
11.5642	1.9871	6.4584	1.91801	1.91666	.071

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TABLE E16 CONTINUED

CTOT (MJ/DEG)	CADD (MJ/DEG)	T**2 (DEG2)	C/T (MJ/M-DEG2)	C/T FIT (MJ/M-DEG2)	PCERROR
11.7780	2.0130	6.5700	1.93899	1.93846	.027
11.9762	2.0361	6.6700	1.95888	1.95800	.045
12.1787	2.0593	6.7700	1.97944	1.97754	.096
12.3739	2.0808	6.8623	1.99982	1.99560	.212
12.5643	2.1030	6.9577	2.01853	2.01425	.212
12.7664	2.1275	7.0626	2.03749	2.03478	.133
12.9296	2.1454	7.1392	2.05423	2.04975	.218
13.1859	2.1750	7.2659	2.07902	2.07456	.215
13.3865	2.1981	7.3648	2.09830	2.09390	.210
13.5852	2.2206	7.4608	2.11758	2.11270	.231
13.7960	2.2446	7.5629	2.13782	2.13271	.240
13.9991	2.2687	7.6655	2.15636	2.15280	.165
14.2135	2.2916	7.7628	2.17780	2.17186	.273
14.4211	2.3135	7.8554	2.19867	2.19000	.396
14.6370	2.3387	7.9622	2.21826	2.21094	.331
14.8405	2.3626	8.0636	2.23645	2.23082	.252
15.0471	2.3849	8.1579	2.25633	2.24931	.312
15.2853	2.4120	8.2724	2.27800	2.27178	.274
15.5038	2.4362	8.3746	2.29825	2.29182	.281
15.7464	2.4631	8.4880	2.32052	2.31407	.279
15.9002	2.4811	8.5636	2.33386	2.32892	.212
16.1514	2.5092	8.6817	2.35648	2.35211	.186
16.3796	2.5348	8.7892	2.37681	2.37321	.152
16.5778	2.5566	8.8808	2.39464	2.39121	.143
16.7628	2.5776	8.9686	2.41076	2.40846	.096
16.9550	2.5970	9.0499	2.42914	2.42444	.194
17.1704	2.6231	9.1591	2.44647	2.44590	.023
17.4011	2.6468	9.2581	2.46798	2.46536	.106
17.5438	2.6639	9.3296	2.47942	2.47942	-.000
17.8316	2.6943	9.4565	2.50534	2.50438	.038
18.0570	2.7178	9.5547	2.52567	2.52369	.079
18.2690	2.7429	9.6591	2.54258	2.54424	-.065
18.4786	2.7660	9.7551	2.56044	2.56312	-.105
18.7796	2.7907	9.8579	2.59183	2.58337	.328
18.8999	2.8150	9.9584	2.59422	2.60316	-.344
19.1874	2.8401	10.0626	2.62285	2.62368	-.032
19.3686	2.8597	10.1438	2.63816	2.63967	-.057
19.6303	2.8891	10.2653	2.65941	2.66361	-.158
19.8302	2.9115	10.3581	2.67553	2.68190	-.238
20.1096	2.9358	10.4584	2.70282	2.70167	.042
20.3221	2.9626	10.5686	2.71777	2.72339	-.206
20.5241	2.9858	10.6643	2.73340	2.74227	-.323
20.8651	3.0102	10.7645	2.76977	2.76204	.280
21.0079	3.0350	10.8666	2.77493	2.78219	-.261

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TABLE E16 CONTINUED

CTOT (MJ/DEG)	CADD (MJ/DEG)	T**2 (DEG2)	C/T (MJ/M-DEG2)	C/T FIT (MJ/M-DEG2)	PCERROR
21.2416	3.0594	10.9663	2.79448	2.80186	-.263
21.5504	3.0861	11.0757	2.82377	2.82346	.011
21.7600	3.1105	11.1756	2.83932	2.84318	-.136
21.9950	3.1346	11.2739	2.85887	2.86260	-.130
22.2594	3.1612	11.3822	2.88113	2.88400	-.100
22.5413	3.1911	11.5039	2.90367	2.90804	-.150
22.7868	3.2110	11.5847	2.92724	2.92402	.110
23.0745	3.2422	11.7114	2.94953	2.94905	.016
23.2170	3.2614	11.7892	2.95804	2.96445	-.216
23.5043	3.2886	11.8989	2.98275	2.98614	-.114
23.7979	3.3170	12.0135	3.00743	3.00881	-.046
23.9441	3.3345	12.0840	3.01750	3.02275	-.174
24.2785	3.3637	12.2012	3.04745	3.04595	.049
24.4821	3.3879	12.2983	3.06143	3.06517	-.122
24.7120	3.4121	12.3953	3.07915	3.08439	-.170
24.9861	3.4365	12.4924	3.10313	3.10361	-.015
25.1890	3.4607	12.5888	3.11685	3.12271	-.188
25.4559	3.4847	12.6843	3.13981	3.14164	-.058
25.7593	3.5101	12.7849	3.16700	3.16157	.172
25.9640	3.5361	12.8878	3.17967	3.18197	-.072
26.2635	3.5621	12.9908	3.20566	3.20238	.102
26.5402	3.5927	13.1108	3.22555	3.22618	-.020
26.8086	3.6180	13.2102	3.24744	3.24589	.048
27.0646	3.6438	13.3113	3.26719	3.26595	.038
27.2976	3.6725	13.4233	3.28189	3.28818	-.191
27.5734	3.6905	13.4932	3.30912	3.30205	.214
27.7992	3.7187	13.6027	3.32303	3.32380	-.023
28.0763	3.7462	13.7089	3.34445	3.34490	-.013
28.3181	3.7709	13.8041	3.36264	3.36380	-.034
28.6542	3.8036	13.9297	3.38883	3.38874	.003
28.8544	3.8261	14.0158	3.40256	3.40586	-.097
29.1368	3.8485	14.1015	3.42743	3.42289	.133
29.4304	3.8780	14.2137	3.44954	3.44520	.126
29.6638	3.9025	14.3066	3.46642	3.46368	.079
29.9624	3.9358	14.4322	3.48685	3.48866	-.052
30.1434	3.9499	14.4855	3.50275	3.49926	.100
30.4612	3.9818	14.6050	3.52647	3.52305	.097
30.6390	4.0041	14.6885	3.53707	3.53966	-.073
31.0217	4.0349	14.8033	3.56989	3.56251	.207
31.2947	4.0696	14.9316	3.58591	3.58807	-.060
31.5282	4.0897	15.0061	3.60502	3.60290	.059
31.8716	4.1219	15.1245	3.63161	3.62649	.141
32.1434	4.1464	15.2143	3.65314	3.64439	.240
32.3794	4.1752	15.3193	3.66755	3.66532	.061

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TABLE E16 CONTINUED

CTOT (MJ/DEG)	CADD (MJ/DEG)	T**2 (DEG2)	C/T (MJ/M-DEG2)	C/T FIT (MJ/M-DEG2)	PCERROR
32.5889	4.2032	15.4207	3.67901	3.68553	-.177
32.8483	4.2259	15.5030	3.69981	3.70194	-.058
33.1986	4.2580	15.6188	3.72705	3.72503	.054
33.4904	4.2854	15.7170	3.74934	3.74462	.126
33.7584	4.3165	15.8280	3.76647	3.76678	-.008
34.1200	4.3468	15.9355	3.79598	3.78823	.204
34.4027	4.3769	16.0421	3.81545	3.80950	.156
34.5737	4.4002	16.1241	3.82446	3.82588	-.037
34.8663	4.4292	16.2255	3.84580	3.84613	-.009
35.1757	4.4612	16.3371	3.86758	3.86843	-.022
35.3676	4.4939	16.4505	3.87420	3.89108	-.434
35.7681	4.5183	16.5349	3.91137	3.90795	.088
36.0210	4.5437	16.6224	3.92945	3.92546	.102
36.2844	4.5737	16.7249	3.94645	3.94594	.013
36.6337	4.6160	16.8691	3.96759	3.97477	-.181
36.8442	4.6339	16.9296	3.98431	3.98689	-.065
37.1359	4.6640	17.0312	4.00468	4.00721	-.063
37.4382	4.6958	17.1380	4.02544	4.02858	-.078

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TABLE E17

SPECIFIC HEAT OF (36A/O AU-24A/O CU-40A/O AG) ALLOY

RUN 35

NOVEMBER 3,1970

CTOT (MJ/DEG)	CADD (MJ/DEG)	T**2 (DEG2)	C/T (MJ/M-DEG2)	C/T FIT (MJ/M-DEG2)	PCERROR
3.8701	.9592	1.9692	1.06802	1.06690	.104
4.0486	.9881	2.0849	1.09130	1.09041	.081
4.1835	1.0102	2.1748	1.10791	1.10868	-.069
4.3443	1.0335	2.2710	1.13115	1.12824	.258
4.4943	1.0569	2.3682	1.15006	1.14801	.179
4.6758	1.0825	2.4758	1.17582	1.16989	.507
4.8548	1.1094	2.5901	1.19823	1.19313	.427
5.0106	1.1345	2.6980	1.21496	1.21510	-.011
5.1458	1.1530	2.7776	1.23354	1.23130	.182
5.3228	1.1773	2.8832	1.25702	1.25280	.336
5.4887	1.2005	2.9845	1.27803	1.27343	.361
5.6489	1.2235	3.0854	1.29716	1.29400	.244
5.8810	1.2560	3.2285	1.32529	1.32315	.162
5.9897	1.2700	3.2906	1.33960	1.33582	.283
6.1734	1.2948	3.4003	1.36219	1.35819	.294
6.3182	1.3167	3.4976	1.37694	1.37804	-.080
6.4667	1.3385	3.5949	1.39255	1.39789	-.382
6.7496	1.3759	3.7615	1.42656	1.43189	-.372
6.8312	1.3849	3.8016	1.43821	1.44006	-.129
6.9991	1.4072	3.9014	1.45760	1.46045	-.196
7.1517	1.4277	3.9928	1.47487	1.47912	-.288
7.3151	1.4482	4.0845	1.49462	1.49785	-.216
7.4973	1.4733	4.1966	1.51403	1.52075	-.442
7.6927	1.4990	4.3113	1.53582	1.54419	-.542
7.8798	1.5219	4.4131	1.55825	1.56502	-.433
8.0784	1.5446	4.5145	1.58327	1.58575	-.156
8.2494	1.5678	4.6177	1.60089	1.60686	-.372
8.4126	1.5904	4.7163	1.61707	1.62744	-.637
8.5655	1.6057	4.7862	1.63795	1.64135	-.207
8.7266	1.6265	4.8785	1.65507	1.66025	-.312
8.9220	1.6509	4.9865	1.67649	1.68237	-.349
9.1055	1.6731	5.0849	1.69701	1.70252	-.324
9.3126	1.6957	5.1846	1.72233	1.72295	-.036
9.5030	1.7175	5.2808	1.74435	1.74266	.097
9.6674	1.7403	5.3812	1.75944	1.76325	-.216
9.8271	1.7618	5.4759	1.77455	1.78266	-.455
10.0441	1.7850	5.5777	1.80055	1.80353	-.165
10.2250	1.8075	5.6764	1.81904	1.82379	-.260
10.4319	1.8311	5.7800	1.84193	1.84504	-.169
10.6223	1.8534	5.8773	1.86231	1.86502	-.146
10.8332	1.8762	5.9767	1.88636	1.88544	.049
11.0158	1.8980	6.0718	1.90514	1.90496	.009
11.2092	1.9212	6.1728	1.92476	1.92572	-.050
11.4111	1.9444	6.2735	1.94597	1.94641	-.023

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TABLE E17 CONTINUED

CTOT (MJ/DEG)	CADD (MJ/DEG)	T**2 (DEG2)	C/T (MJ/M-DEG2)	C/T FIT (MJ/M-DEG2)	PCERROR
11.6379	1.9686	6.3780	1.97130	1.96789	.173
11.7677	1.9857	6.4522	1.98276	1.98313	-.019
11.9400	2.0063	6.5413	1.99975	2.00146	-.086
12.1686	2.0292	6.6403	2.02588	2.02182	.200
12.3507	2.0515	6.7364	2.04308	2.04159	.073
12.5730	2.0764	6.8432	2.06593	2.06358	.114
12.7588	2.0979	6.9359	2.08419	2.08266	.073
13.0006	2.1287	7.0680	2.10549	2.10987	-.208
13.4034	2.1679	7.2356	2.15056	2.14439	.288
13.6042	2.1907	7.3332	2.17003	2.16451	.255
13.8339	2.2162	7.4417	2.19271	2.18688	.267
14.0422	2.2391	7.5395	2.21319	2.20704	.279
14.2660	2.2633	7.6422	2.23547	2.22821	.326
14.5124	2.2913	7.7615	2.25855	2.25284	.254
14.7094	2.3136	7.8559	2.27707	2.27230	.210
14.9267	2.3360	7.9511	2.29896	2.29197	.305
15.1255	2.3590	8.0483	2.31695	2.31203	.213
15.3760	2.3831	8.1502	2.34326	2.33307	.437
15.5747	2.4069	8.2510	2.36023	2.35390	.269
15.8121	2.4303	8.3496	2.38441	2.37427	.427
16.0638	2.4572	8.4628	2.40818	2.39768	.438
16.2631	2.4805	8.5610	2.42530	2.41798	.303
16.4859	2.5022	8.6525	2.44763	2.43690	.440
16.6849	2.5263	8.7555	2.46391	2.45780	.249
16.8968	2.5499	8.8528	2.48264	2.47834	.173
17.1295	2.5758	8.9614	2.50311	2.50082	.092
17.3591	2.6005	9.0649	2.52381	2.52224	.062
17.5976	2.6258	9.1706	2.54548	2.54413	.053
17.7721	2.6427	9.2411	2.56246	2.55874	.145
18.0219	2.6706	9.3576	2.58381	2.58287	.037
18.2422	2.6953	9.4607	2.60243	2.60425	-.070
18.5372	2.7191	9.5599	2.63404	2.62481	.352
18.6953	2.7442	9.6645	2.64178	2.64650	-.179
18.9429	2.7653	9.7520	2.66725	2.66465	.097
19.1716	2.7908	9.8581	2.68617	2.68666	-.018
19.3927	2.8134	9.9519	2.70589	2.70613	-.009
19.6364	2.8359	10.0454	2.72918	2.72554	.133
19.8790	2.8639	10.1614	2.74824	2.74961	-.050
20.1204	2.8892	10.2660	2.76892	2.77135	-.088
20.3187	2.9121	10.3606	2.78432	2.79098	-.239
20.5725	2.9372	10.4642	2.80690	2.81251	-.200
20.7819	2.9617	10.5649	2.82277	2.83346	-.377
21.1121	2.9861	10.6655	2.85764	2.85437	.114
21.3111	3.0084	10.7573	2.87316	2.87346	-.011

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TABLE E17 CONTINUED

CTOT (MJ/DEG)	CADD (MJ/DEG)	T**2 (DEG2)	C/T (MJ/M-DEG2)	C/T FIT (MJ/M-DEG2)	PCERROR
21.5313	3.0338	10.8613	2.88981	2.89511	-.183
21.7548	3.0589	10.9643	2.90705	2.91653	-.325
22.0696	3.0862	11.0762	2.93680	2.93982	-.103
22.2611	3.1098	11.1727	2.94995	2.95992	-.337
22.5756	3.1351	11.2760	2.98076	2.98142	-.022
22.7360	3.1584	11.3709	2.98922	3.00120	-.399
23.0515	3.1848	11.4785	3.01912	3.02360	-.148
23.3061	3.2060	11.5647	3.04318	3.04158	.053
23.5646	3.2334	11.6758	3.06349	3.06474	-.041
23.7859	3.2595	11.7813	3.07901	3.08675	-.251
24.0582	3.2840	11.8806	3.10313	3.10745	-.139
24.3442	3.3093	11.9825	3.12870	3.12871	-.000
24.5813	3.3348	12.0850	3.14674	3.15011	-.107
25.0777	3.3854	12.2883	3.18608	3.19254	-.202
25.3788	3.4107	12.3897	3.21336	3.21372	-.011
25.5787	3.4332	12.4793	3.22765	3.23245	-.149
25.9123	3.4624	12.5957	3.25687	3.25677	.003
26.1852	3.4909	12.7089	3.27763	3.28043	-.086
26.4692	3.5161	12.8090	3.30202	3.30138	.019
26.7252	3.5418	12.9106	3.32200	3.32262	-.019
26.9183	3.5638	12.9975	3.33531	3.34079	-.164
27.2375	3.5902	13.1013	3.36371	3.36252	.036
27.4763	3.6148	13.1978	3.38176	3.38272	-.028
27.7346	3.6401	13.2967	3.40206	3.40342	-.040
28.0502	3.6669	13.4011	3.42940	3.42529	.120
28.2515	3.6922	13.4999	3.44149	3.44599	-.131
28.5781	3.7194	13.6053	3.46992	3.46807	.053
28.9019	3.7493	13.7210	3.49611	3.49232	.108
29.0866	3.7711	13.8048	3.50807	3.50990	-.052
29.3691	3.7991	13.9126	3.52958	3.53249	-.083
29.6607	3.8248	14.0110	3.55375	3.55313	.017
30.0210	3.8549	14.1256	3.58453	3.57718	.205
30.1849	3.8760	14.2061	3.59387	3.59407	-.006
30.6199	3.9092	14.3318	3.63271	3.62047	.338
30.8174	3.9383	14.4418	3.64167	3.64356	-.052
31.0434	3.9584	14.5172	3.66003	3.65940	.017
31.3490	3.9860	14.6206	3.68449	3.68113	.091
31.6183	4.0130	14.7217	3.70434	3.70237	.053
31.9382	4.0433	14.8344	3.72895	3.72606	.078
32.1439	4.0682	14.9267	3.74149	3.74546	-.106
32.3875	4.0901	15.0074	3.76088	3.76245	-.042
32.7817	4.1217	15.1238	3.79459	3.78693	.197
33.0451	4.1460	15.2126	3.81487	3.80561	.243
33.2927	4.1747	15.3174	3.83058	3.82768	.076

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TABLE E17 CONTINUED

CTOT (MJ/DEG)	CADD (MJ/DEG)	T**2 (DEG2)	C/T (MJ/M-DEG2)	C/T FIT (MJ/M-DEG2)	PCERROR
33.6438	4.2065	15.4329	3.85808	3.85198	.158
33.8900	4.2328	15.5279	3.87500	3.87199	.078
34.0872	4.2581	15.6188	3.88609	3.89115	-.130
34.4356	4.2873	15.7256	3.91458	3.91322	.035
34.7349	4.3173	15.8307	3.93615	3.93580	.009
34.9971	4.3458	15.9320	3.95376	3.95715	-.086
35.3660	4.3761	16.0389	3.98410	3.97970	.110
35.5674	4.4033	16.1347	3.99457	3.99991	-.134
35.8749	4.4260	16.2142	4.02118	4.01669	.112
36.1969	4.4596	16.3315	4.04346	4.04144	.050
36.4773	4.4919	16.4439	4.06112	4.06516	-.099
36.7314	4.5177	16.5327	4.07911	4.08392	-.118
37.0075	4.5453	16.6277	4.09882	4.10399	-.126
37.3552	4.5754	16.7309	4.12613	4.12579	.008
37.6000	4.6060	16.8352	4.14021	4.14782	-.183
37.9653	4.6352	16.9342	4.17014	4.16875	.033
38.3200	4.6626	17.0264	4.19967	4.18825	.273
38.5140	4.6949	17.1350	4.20646	4.21121	-.113
38.7757	4.7214	17.2234	4.22483	4.22992	-.120

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TABLE E18

SPECIFIC HEAT OF (18A/O AU-12A/O CU-70A/O AG) ALLOY

RUN 36

NOVEMBER 18,1970

CTOT (MJ/DEG)	CADD (MJ/DEG)	T**2 (DEG2)	C/T (MJ/M-DEG2)	C/T FIT (MJ/M-DEG2)	PCERROR
3.6313	.9632	1.9854	1.02086	1.02173	-.086
3.7725	.9874	2.0823	1.04052	1.03947	.101
3.9047	1.0109	2.1776	1.05723	1.05692	.030
4.0453	1.0343	2.2743	1.07641	1.07461	.167
4.1900	1.0585	2.3748	1.09553	1.09302	.230
4.3603	1.0874	2.4965	1.11677	1.11530	.132
4.6481	1.1338	2.6948	1.15416	1.15164	.219
4.7897	1.1562	2.7914	1.17248	1.16934	.268
4.9512	1.1816	2.9022	1.19293	1.18964	.277
5.1270	1.2091	3.0222	1.21503	1.21163	.280
5.2538	1.2293	3.1109	1.23017	1.22789	.185
5.3976	1.2516	3.2092	1.24773	1.24591	.146
5.5483	1.2745	3.3105	1.26634	1.26450	.146
5.7388	1.3023	3.4340	1.29068	1.28715	.275
5.9051	1.3289	3.5522	1.30902	1.30882	.015
6.0257	1.3464	3.6298	1.32414	1.32307	.080
6.1688	1.3684	3.7262	1.34034	1.34111	-.058
6.3287	1.3921	3.8338	1.35925	1.36050	-.092
6.4344	1.4080	3.9049	1.37131	1.37355	-.163
6.5763	1.4292	3.9993	1.38761	1.39088	-.235
6.7281	1.4520	4.1013	1.40456	1.40960	-.358
6.8752	1.4724	4.1923	1.42258	1.42633	-.262
7.0266	1.4948	4.2925	1.43947	1.44472	-.364
7.1748	1.5162	4.3877	1.45641	1.46221	-.397
7.3077	1.5347	4.4705	1.47201	1.47742	-.366
7.4941	1.5611	4.5877	1.49337	1.49896	-.373
7.8125	1.6040	4.7788	1.53114	1.53409	-.192
7.9693	1.6258	4.8752	1.54892	1.55180	-.185
8.1399	1.6501	4.9833	1.56732	1.57168	-.278
8.3001	1.6717	5.0786	1.58572	1.58919	-.218
8.4745	1.6960	5.1860	1.60475	1.60896	-.262
8.6416	1.7181	5.2836	1.62386	1.62691	-.187
8.7971	1.7397	5.3766	1.64060	1.64439	-.230
8.9586	1.7617	5.4758	1.65809	1.66227	-.251
9.1256	1.7829	5.5688	1.67750	1.67938	-.112
9.3057	1.8076	5.6769	1.69662	1.69928	-.156
9.4662	1.8302	5.7757	1.71298	1.71748	-.262
9.6479	1.8528	5.8747	1.73387	1.73571	-.106
9.8223	1.8757	5.9748	1.75270	1.75413	-.082
9.9965	1.8994	6.0778	1.77069	1.77311	-.137
10.1759	1.9228	6.1794	1.78994	1.79182	-.105
10.3502	1.9448	6.2749	1.80903	1.80941	-.021
10.5093	1.9662	6.3679	1.82519	1.82655	-.074
10.6953	1.9908	6.4741	1.84435	1.84613	-.097

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TABLE E18 CONTINUED

CTOT (MJ/DEG)	CADD (MJ/DEG)	T**2 (DEG2)	C/T (MJ/M-DEG2)	C/T FIT (MJ/M-DEG2)	PCERROR
10.8864	2.0139	6.5740	1.86562	1.86454	.058
11.0591	2.0371	6.6740	1.88279	1.88298	-.010
11.1830	2.0522	6.7390	1.89628	1.89497	.069
11.4100	2.0806	6.8615	1.92012	1.91755	.134
11.5540	2.0986	6.9389	1.93517	1.93183	.173
11.7392	2.1225	7.0414	1.95382	1.95073	.158
11.9363	2.1468	7.1455	1.97440	1.96993	.227
12.1382	2.1725	7.2555	1.99462	1.99023	.220
12.3306	2.1962	7.3567	2.01438	2.00891	.273
12.4793	2.2134	7.4301	2.03042	2.02246	.394
12.7185	2.2441	7.5608	2.05368	2.04659	.346
12.8705	2.2648	7.6487	2.06745	2.06281	.225
13.0952	2.2915	7.7624	2.09055	2.08382	.323
13.2509	2.3116	7.8474	2.10531	2.09951	.276
13.4666	2.3392	7.9645	2.12570	2.12114	.215
13.6729	2.3626	8.0634	2.14736	2.13942	.371
13.8033	2.3825	8.1476	2.15711	2.15498	.099
14.0199	2.4074	8.2529	2.17926	2.17444	.222
14.2338	2.4345	8.3671	2.19916	2.19554	.165
14.3856	2.4548	8.4529	2.21234	2.21141	.042
14.6441	2.4842	8.5765	2.23853	2.23426	.191
14.8083	2.5043	8.6612	2.25396	2.24993	.179
15.0210	2.5278	8.7599	2.27569	2.26819	.331
15.1799	2.5509	8.8567	2.28783	2.28609	.076
15.3857	2.5741	8.9541	2.30823	2.30411	.179
15.6156	2.6000	9.0625	2.33093	2.32417	.291
15.7786	2.6236	9.1613	2.34315	2.34246	.029
15.9881	2.6510	9.2759	2.36088	2.36366	-.118
16.1943	2.6739	9.3717	2.38104	2.38139	-.015
16.3885	2.6963	9.4650	2.39939	2.39868	.029
16.5668	2.7173	9.5524	2.41582	2.41486	.040
16.7895	2.7435	9.6617	2.43620	2.43511	.045
16.9554	2.7688	9.7607	2.44733	2.45456	-.295
17.2503	2.7955	9.8775	2.47957	2.47509	.181
17.4009	2.8171	9.9674	2.49040	2.49175	-.054
17.6058	2.8401	10.0625	2.50951	2.50937	.006
17.8321	2.8639	10.1612	2.53155	2.52766	.154
18.2278	2.9142	10.3689	2.56389	2.56619	-.090
18.4071	2.9406	10.4782	2.57594	2.58645	-.406
18.7050	2.9711	10.6035	2.60496	2.60970	-.182
18.8566	2.9875	10.6711	2.61571	2.62223	-.249
19.0669	3.0133	10.7774	2.63635	2.64196	-.212
19.3000	3.0390	10.8830	2.65742	2.66156	-.155
19.5026	3.0611	10.9734	2.67583	2.67834	-.094

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TABLE E18 CONTINUED

CTOT (MJ/DEG)	CADD (MJ/DEG)	T**2 (DEG2)	C/T (MJ/M-DEG2)	C/T FIT (MJ/M-DEG2)	PCERROR
19.6575	3.0814	11.0566	2.68757	2.69378	-.231
19.9331	3.1115	11.1790	2.71243	2.71650	-.150
20.1433	3.1377	11.2865	2.72898	2.73647	-.274
20.3237	3.1590	11.3733	2.74398	2.75259	-.313
20.5542	3.1843	11.4763	2.76430	2.77171	-.267
20.8196	3.2091	11.5770	2.79038	2.79042	-.001
21.0316	3.2372	11.6910	2.80575	2.81160	-.208
21.3296	3.2621	11.7918	2.83660	2.83033	.222
21.4727	3.2822	11.8731	2.84610	2.84545	.023
21.6928	3.3090	11.9812	2.86334	2.86555	-.077
21.9294	3.3358	12.0890	2.88308	2.88559	-.087
22.1890	3.3609	12.1901	2.90731	2.90439	.101
22.4271	3.3893	12.3041	2.92603	2.92559	.015
22.6298	3.4141	12.4031	2.94158	2.94400	-.082
22.8614	3.4366	12.4932	2.96283	2.96076	.070
23.0584	3.4653	12.6071	2.97498	2.98196	-.234
23.3753	3.4919	12.7129	3.00646	3.00166	.160
23.4944	3.5135	12.7985	3.01111	3.01758	-.214
23.8528	3.5466	12.9293	3.04460	3.04194	.087
24.0310	3.5657	13.0046	3.05955	3.05596	.118
24.2059	3.5906	13.1027	3.07043	3.07422	-.123
24.4958	3.6193	13.2153	3.09605	3.09519	.028
24.7559	3.6458	13.3191	3.11847	3.11453	.126
24.9825	3.6734	13.4207	3.13522	3.13457	.021
25.2448	3.6996	13.5287	3.15799	3.15358	.140
25.3128	3.7157	13.5909	3.15833	3.16519	-.216
25.5971	3.7357	13.6685	3.18791	3.17964	.260
25.8538	3.7694	13.7984	3.20523	3.20386	.043
26.1394	3.8015	13.9218	3.22761	3.22687	.023
26.3299	3.8231	14.0043	3.24243	3.24226	.005
26.6046	3.8522	14.1154	3.26489	3.26298	.058
26.8130	3.8755	14.2041	3.28116	3.27952	.050
27.0288	3.8993	14.2944	3.29815	3.29637	.054
27.2915	3.9318	14.4173	3.31675	3.31931	-.077
27.5948	3.9600	14.5233	3.34355	3.33909	.134
27.6990	3.9792	14.5954	3.34728	3.35254	-.157
28.0976	4.0093	14.7079	3.38625	3.37354	.377
28.3508	4.0424	14.8308	3.40300	3.39650	.191
28.5248	4.0679	14.9256	3.41289	3.41419	-.038
28.7820	4.0931	15.0184	3.43462	3.43153	.090
28.9998	4.1181	15.1104	3.45090	3.44871	.063
29.2593	4.1450	15.2089	3.47184	3.46712	.136
29.4663	4.1723	15.3085	3.48529	3.48573	-.013
29.7370	4.2003	15.4105	3.50706	3.50480	.065

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TABLE E18 CONTINUED

CTOT (MJ/DEG)	CADD (MJ/DEG)	T**2 (DEG2)	C/T (MJ/M-DEG2)	C/T FIT (MJ/M-DEG2)	PCERROR
30.0587	4.2271	15.5072	3.53648	3.52287	.386
30.2098	4.2595	15.6239	3.53944	3.54469	-.148
30.4760	4.2848	15.7147	3.56196	3.56167	.008
30.7412	4.3146	15.8211	3.58187	3.58157	.009
30.9756	4.3460	15.9328	3.59672	3.60245	-.159
31.2378	4.3733	16.0293	3.61751	3.62049	-.082
31.5011	4.4039	16.1371	3.63663	3.64067	-.111
31.7251	4.4275	16.2197	3.65418	3.65614	-.054
31.9817	4.4580	16.3259	3.67245	3.67601	-.097
32.1974	4.4861	16.4238	3.68645	3.69433	-.213
32.5505	4.5216	16.5464	3.71485	3.71728	-.065
32.6701	4.5387	16.6050	3.72187	3.72825	-.171
33.0759	4.5749	16.7293	3.75673	3.75153	.139
33.3652	4.6087	16.8441	3.77747	3.77303	.118
33.4974	4.6335	16.9282	3.78216	3.78878	-.175
33.8299	4.6650	17.0347	3.80961	3.80875	.023
34.0819	4.6903	17.1195	3.82971	3.82464	.133
34.3004	4.7219	17.2254	3.84220	3.84448	-.059

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TABLE E19

SPECIFIC HEAT OF (6A/O AU-4A/O CU-90A/O AG) ALLOY

RUN 37

DECEMBER 7,1970

CTOT (MJ/DEG)	CADD (MJ/DEG)	T**2 (DEG2)	C/T (MJ/M-DEG2)	C/T FIT (MJ/M-DEG2)	PCERROR
3.7245	.9628	1.9838	.99606	.99614	-.009
3.7625	.9702	2.0133	.99969	1.00134	-.164
3.8686	.9886	2.0871	1.01269	1.01438	-.166
4.0020	1.0104	2.1758	1.03029	1.03003	.026
4.1544	1.0359	2.2806	1.04906	1.04853	.051
4.2983	1.0589	2.3766	1.06744	1.06548	.184
4.4813	1.0886	2.5017	1.08966	1.08758	.191
4.6069	1.1089	2.5879	1.10461	1.10280	.164
4.7443	1.1311	2.6834	1.12050	1.11967	.074
4.9269	1.1574	2.7966	1.14507	1.13966	.474
5.0729	1.1791	2.8910	1.16337	1.15633	.609
5.2569	1.2100	3.0262	1.18179	1.18021	.134
5.3880	1.2288	3.1088	1.19831	1.19482	.292
5.5470	1.2529	3.2150	1.21661	1.21356	.251
5.7043	1.2767	3.3203	1.23435	1.23218	.177
5.8861	1.3031	3.4373	1.25576	1.25285	.232
5.9775	1.3164	3.4963	1.26633	1.26329	.241
6.0832	1.3344	3.5767	1.27556	1.27749	-.151
6.2212	1.3555	3.6705	1.29018	1.29406	-.299
6.4120	1.3810	3.7843	1.31378	1.31418	-.030
6.5756	1.4049	3.8909	1.33164	1.33302	-.103
6.7304	1.4283	3.9956	1.34746	1.35152	-.301
6.8638	1.4472	4.0800	1.36224	1.36645	-.308
7.0421	1.4723	4.1920	1.38193	1.38625	-.312
7.1972	1.4942	4.2897	1.39878	1.40353	-.339
7.3462	1.5156	4.3853	1.41440	1.42042	-.424
7.5251	1.5390	4.4894	1.43520	1.43883	-.253
7.6856	1.5619	4.5916	1.45176	1.45691	-.354
7.8480	1.5832	4.6860	1.47017	1.47361	-.234
8.0266	1.6055	4.7853	1.49113	1.49117	-.002
8.1796	1.6285	4.8875	1.50532	1.50926	-.261
8.3423	1.6507	4.9857	1.52240	1.52661	-.276
8.5165	1.6740	5.0887	1.54090	1.54484	-.255
8.6722	1.6944	5.1788	1.55764	1.56078	-.202
8.8419	1.7172	5.2796	1.57516	1.57863	-.219
9.0388	1.7435	5.3954	1.59549	1.59910	-.226
9.1942	1.7646	5.4885	1.61100	1.61558	-.283
9.3896	1.7887	5.5941	1.63252	1.63428	-.107
9.5726	1.8119	5.6958	1.65190	1.65227	-.022
9.7385	1.8340	5.7925	1.66842	1.66938	-.057
9.9042	1.8576	5.8955	1.68352	1.68761	-.243
10.1127	1.8852	6.0160	1.70401	1.70895	-.289
10.2849	1.9048	6.1011	1.72350	1.72402	-.030
10.4525	1.9283	6.2033	1.73861	1.74211	-.201

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TABLE E19 CONTINUED

CTOT (MJ/DEG)	CADD (MJ/DEG)	T**2 (DEG2)	C/T (MJ/M-DEG2)	C/T FIT (MJ/M-DEG2)	PCERROR
10.5880	1.9446	6.2741	1.75294	1.75465	-.097
10.7479	1.9646	6.3609	1.76913	1.77002	-.051
10.9359	1.9895	6.4687	1.78690	1.78910	-.123
11.1269	2.0117	6.5645	1.80730	1.80607	.068
11.3195	2.0367	6.6724	1.82557	1.82519	.021
11.5148	2.0597	6.7717	1.84576	1.84277	.163
11.6755	2.0817	6.8662	1.85990	1.85952	.021
11.8695	2.1040	6.9617	1.88018	1.87643	.200
12.0618	2.1274	7.0623	1.89903	1.89425	.252
12.2267	2.1489	7.1542	1.91403	1.91052	.184
12.4190	2.1722	7.2540	1.93269	1.92821	.232
12.6260	2.1965	7.3577	1.95323	1.94660	.341
12.8224	2.2213	7.4636	1.97125	1.96535	.300
13.0028	2.2439	7.5600	1.98778	1.98244	.269
13.1855	2.2656	7.6523	2.00533	1.99879	.327
13.3902	2.2904	7.7576	2.02449	2.01746	.348
13.5378	2.3124	7.8510	2.03516	2.03403	.055
13.7646	2.3387	7.9624	2.05698	2.05377	.156
13.9921	2.3639	8.0690	2.07953	2.07266	.331
14.1586	2.3875	8.1690	2.09215	2.09040	.084
14.3450	2.4086	8.2578	2.11010	2.10614	.188
14.5242	2.4309	8.3519	2.12576	2.12283	.138
14.7821	2.4609	8.4786	2.14957	2.14529	.199
14.9586	2.4830	8.5716	2.16467	2.16178	.134
15.1733	2.5098	8.6841	2.18301	2.18174	.058
15.4127	2.5330	8.7817	2.20789	2.19906	.401
15.6076	2.5557	8.8771	2.22535	2.21598	.423
15.7101	2.5740	8.9535	2.23015	2.22954	.027
15.9895	2.6039	9.0791	2.25671	2.25182	.217
16.1243	2.6235	9.1610	2.26594	2.26635	-.018
16.3294	2.6472	9.2598	2.28411	2.28389	.010
16.5241	2.6683	9.3480	2.30216	2.29953	.114
16.7275	2.6925	9.4491	2.31941	2.31748	.083
16.9197	2.7139	9.5383	2.33665	2.33330	.144
17.1885	2.7461	9.6724	2.35903	2.35710	.082
17.4064	2.7749	9.7922	2.37524	2.37837	-.131
17.6718	2.7993	9.8936	2.40196	2.39636	.234
17.8383	2.8218	9.9867	2.41391	2.41289	.042
18.0284	2.8449	10.0827	2.42910	2.42993	-.034
18.2670	2.8735	10.2009	2.44838	2.45093	-.104
18.4422	2.8944	10.2875	2.46249	2.46631	-.155
18.5697	2.9102	10.3528	2.47236	2.47789	-.223
18.8199	2.9352	10.4557	2.49553	2.49618	-.026
19.0475	2.9618	10.5654	2.51396	2.51565	-.067

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TABLE E19 CONTINUED

CTOT (MJ/DEG)	CADD (MJ/DEG)	T**2 (DEG2)	C/T (MJ/M-DEG2)	C/T FIT (MJ/M-DEG2)	PCERROR
19.2760	2.9887	10.6763	2.53221	2.53536	-.124
19.5075	3.0114	10.7696	2.55353	2.55193	.062
19.6912	3.0344	10.8640	2.56719	2.56870	-.059
19.9776	3.0648	10.9886	2.59183	2.59083	.039
20.1064	3.0815	11.0570	2.60092	2.60298	-.079
20.3216	3.1102	11.1742	2.61559	2.62381	-.313
20.5252	3.1327	11.2661	2.63232	2.64013	-.296
20.8102	3.1601	11.3780	2.65811	2.66003	-.072
21.0167	3.1862	11.4839	2.67288	2.67885	-.223
21.2210	3.2089	11.5765	2.68928	2.69530	-.223
21.4690	3.2338	11.6773	2.71082	2.71321	-.088
21.6900	3.2625	11.7935	2.72588	2.73387	-.292
21.8881	3.2798	11.8634	2.74450	2.74630	-.066
22.1480	3.3110	11.9892	2.76363	2.76866	-.182
22.4169	3.3382	12.0988	2.78638	2.78814	-.063
22.5993	3.3616	12.1930	2.79871	2.80490	-.221
22.8729	3.3890	12.3027	2.82187	2.82441	-.090
23.0923	3.4120	12.3948	2.83969	2.84079	-.039
23.3484	3.4396	12.5050	2.85999	2.86037	-.013
23.6416	3.4670	12.6140	2.88563	2.87977	.204
23.8182	3.4905	12.7073	2.89683	2.89636	.016
24.0184	3.5116	12.7910	2.91278	2.91124	.053
24.1992	3.5330	12.8759	2.92572	2.92635	-.021
24.4569	3.5635	12.9963	2.94415	2.94777	-.123
24.6745	3.5864	13.0861	2.96139	2.96375	-.079
24.9472	3.6130	13.1907	2.98404	2.98236	.056
25.1744	3.6408	13.2994	2.99958	3.00171	-.071
25.4645	3.6690	13.4096	3.02356	3.02132	.074
25.6600	3.6896	13.4898	3.03876	3.03559	.104
25.8561	3.7183	13.6010	3.04938	3.05538	-.196
26.0854	3.7394	13.6826	3.06885	3.06991	-.035
26.3177	3.7679	13.7927	3.08446	3.08951	-.163
26.6564	3.7991	13.9126	3.11303	3.11085	.070
26.8542	3.8220	14.0001	3.12703	3.12643	.019
27.0716	3.8473	14.0970	3.14226	3.14367	-.045
27.3602	3.8749	14.2018	3.16582	3.16235	.110
27.5519	3.8994	14.2948	3.17797	3.17890	-.029
27.8726	3.9321	14.4185	3.20283	3.20093	.059
28.0892	3.9599	14.5230	3.21647	3.21954	-.095
28.3143	3.9807	14.6011	3.23500	3.23345	.048
28.6054	4.0158	14.7320	3.25448	3.25678	-.070
28.9073	4.0426	14.8319	3.27978	3.27457	.159
29.1336	4.0670	14.9223	3.29638	3.29068	.173
29.3583	4.0940	15.0217	3.31138	3.30839	.098

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TABLE E19 CONTINUED

CTOT (MJ/DEG)	CADD (MJ/DEG)	T**2 (DEG2)	C/T (MJ/M-DEG2)	C/T FIT (MJ/M-DEG2)	PCERROR
29.5655	4.1174	15.1078	3.32597	3.32372	.068
29.8145	4.1450	15.2090	3.34372	3.34175	.059
30.1219	4.1814	15.3419	3.36434	3.36544	-.033
30.3304	4.1996	15.4077	3.38178	3.37717	.136
30.5634	4.2293	15.5152	3.39626	3.39633	-.002
30.8761	4.2533	15.6017	3.42397	3.41174	.358
31.0385	4.2868	15.7217	3.42738	3.43314	-.168
31.3048	4.3132	15.8162	3.44778	3.44997	-.064
31.6448	4.3437	15.9245	3.47542	3.46929	.177
31.9045	4.3749	16.0350	3.49242	3.48898	.099
32.1205	4.3980	16.1161	3.50803	3.50345	.130
32.3343	4.4267	16.2167	3.52048	3.52139	-.026
32.6191	4.4583	16.3271	3.54039	3.54108	-.019
32.8559	4.4905	16.4387	3.55400	3.56098	-.196
33.1786	4.5236	16.5530	3.57787	3.58136	-.098
33.2956	4.5426	16.6185	3.58301	3.59305	-.279
33.6759	4.5759	16.7326	3.61387	3.61340	.013
33.9214	4.6020	16.8213	3.63150	3.62923	.068
34.1516	4.6302	16.9170	3.64617	3.64630	-.004
34.4703	4.6646	17.0331	3.66872	3.66701	.047
34.8201	4.7044	17.1669	3.69239	3.69088	.041

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TABLE E20

SPECIFIC HEAT OF (36A/O AU-14A/O CU-50A/O AG) ALLOY

RUN 38

FEBRUARY 19,1971

CTOT (MJ/DEG)	CADD (MJ/DEG)	T**2 (DEG2)	C/T (MJ/M-DEG2)	C/T FIT (MJ/M-DEG2)	PCERROR
3.6879	.9413	1.8989	1.06120	1.06659	-.506
3.8027	.9585	1.9666	1.07982	1.08122	-.130
4.0177	.9919	2.1005	1.11156	1.11011	.130
4.1497	1.0130	2.1862	1.12950	1.12863	.077
4.3425	1.0421	2.3065	1.15705	1.15461	.212
4.4996	1.0659	2.4058	1.17866	1.17607	.220
4.7376	1.1011	2.5547	1.21136	1.20824	.258
4.8501	1.1177	2.6256	1.22639	1.22358	.229
4.9868	1.1373	2.7098	1.24508	1.24178	.266
5.0806	1.1506	2.7675	1.25776	1.25425	.280
5.2972	1.1806	2.8976	1.28757	1.28240	.403
5.4631	1.2048	3.0032	1.30827	1.30524	.232
5.6056	1.2248	3.0910	1.32664	1.32423	.182
5.7807	1.2482	3.1943	1.35022	1.34658	.270
5.9475	1.2714	3.2969	1.37111	1.36880	.169
6.1246	1.2954	3.4032	1.39375	1.39181	.139
6.2685	1.3142	3.4868	1.41261	1.40991	.192
6.4439	1.3379	3.5921	1.43438	1.43272	.116
6.6164	1.3611	3.6957	1.45545	1.45516	.020
6.8175	1.3874	3.8128	1.48061	1.48054	.004
6.9637	1.4074	3.9022	1.49756	1.49991	-.156
7.1273	1.4296	4.0013	1.51653	1.52139	-.320
7.2916	1.4506	4.0950	1.53680	1.54171	-.319
7.4660	1.4729	4.1945	1.55798	1.56329	-.339
7.6179	1.4919	4.2793	1.57669	1.58168	-.316
7.8450	1.5210	4.4093	1.60346	1.60988	-.399
8.0336	1.5442	4.5127	1.62644	1.63232	-.360
8.1834	1.5629	4.5959	1.64421	1.65038	-.374
8.3989	1.5888	4.7110	1.67053	1.67536	-.289
8.5661	1.6093	4.8019	1.69028	1.69511	-.285
8.7155	1.6281	4.8857	1.70716	1.71331	-.359
8.8875	1.6490	4.9781	1.72731	1.73338	-.350
9.0699	1.6708	5.0746	1.74876	1.75435	-.319
9.2688	1.6924	5.1702	1.77404	1.77511	-.060
9.4667	1.7166	5.2768	1.79628	1.79829	-.112
9.6409	1.7381	5.3716	1.81545	1.81890	-.190
9.8211	1.7603	5.4695	1.83508	1.84018	-.277
10.0205	1.7834	5.5710	1.85804	1.86227	-.227
10.2135	1.8055	5.6678	1.88035	1.88332	-.157
10.4029	1.8279	5.7657	1.90136	1.90462	-.172
10.6005	1.8506	5.8649	1.92367	1.92621	-.132
10.7803	1.8733	5.9642	1.94183	1.94782	-.308
10.9932	1.8960	6.0632	1.96704	1.96936	-.118
11.2288	1.9224	6.1779	1.99349	1.99435	-.043

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TABLE E20 CONTINUED

CTOT (MJ/DEG)	CADD (MJ/DEG)	T**2 (DEG2)	C/T (MJ/M-DEG2)	C/T FIT (MJ/M-DEG2)	PCERROR
11.4817	1.9473	6.2859	2.02471	2.01787	.339
11.6487	1.9700	6.3842	2.03949	2.03928	.010
11.8281	1.9886	6.4647	2.06042	2.05682	.175
12.0325	2.0143	6.5759	2.08000	2.08107	-.052
12.2586	2.0368	6.6730	2.10678	2.10222	.217
12.4370	2.0593	6.7696	2.12362	2.12329	.016
12.6384	2.0801	6.8594	2.14637	2.14288	.163
12.8391	2.1028	6.9566	2.16726	2.16408	.147
13.0577	2.1262	7.0569	2.19092	2.18597	.227
13.2212	2.1469	7.1459	2.20568	2.20537	.014
13.4600	2.1710	7.2490	2.23239	2.22788	.202
13.6553	2.1947	7.3502	2.25066	2.24997	.031
13.8732	2.2173	7.4466	2.27415	2.27101	.138
14.0881	2.2420	7.5516	2.29515	2.29395	.052
14.2952	2.2644	7.6471	2.31634	2.31480	.067
14.5211	2.2883	7.7485	2.33976	2.33696	.120
14.7618	2.3115	7.8470	2.36638	2.35849	.334
14.9604	2.3350	7.9468	2.38453	2.38030	.178
15.1850	2.3597	8.0513	2.40650	2.40316	.139
15.3732	2.3821	8.1461	2.42341	2.42386	-.019
15.6274	2.4045	8.2407	2.45243	2.44457	.321
15.8697	2.4283	8.3411	2.47790	2.46654	.461
16.0797	2.4530	8.4452	2.49655	2.48929	.291
16.3239	2.4782	8.5514	2.52087	2.51254	.331
16.5522	2.5011	8.6478	2.54396	2.53365	.407
16.7550	2.5254	8.7500	2.56119	2.55601	.203
16.9536	2.5489	8.8485	2.57824	2.57759	.025
17.2018	2.5709	8.9407	2.60518	2.59779	.285
17.3886	2.5941	9.0380	2.62009	2.61910	.038
17.6331	2.6186	9.1404	2.64413	2.64153	.099
17.8600	2.6415	9.2362	2.66611	2.66253	.134
18.0443	2.6626	9.3243	2.68195	2.68185	.004
18.5976	2.7166	9.5496	2.73613	2.73124	.179
18.7993	2.7359	9.6299	2.75602	2.74884	.261
19.0778	2.7668	9.7586	2.77997	2.77708	.104
19.2806	2.7911	9.8596	2.79596	2.79924	-.117
19.5175	2.8142	9.9551	2.81860	2.82021	-.057
19.7515	2.8408	10.0654	2.83793	2.84442	-.228
20.2144	2.8844	10.2459	2.88256	2.88405	-.052
20.6447	2.9297	10.4331	2.92004	2.92518	-.176
20.9818	2.9647	10.5772	2.94955	2.95685	-.247
21.1479	2.9808	10.6437	2.96479	2.97145	-.224
21.4480	3.0076	10.7539	2.99393	2.99569	-.059
21.6738	3.0309	10.8495	3.01344	3.01671	-.108

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TABLE E20 CONTINUED

CTOT (MJ/DEG)	CADD (MJ/DEG)	T**2 (DEG2)	C/T (MJ/M-DEG2)	C/T FIT (MJ/M-DEG2)	PCERROR
22.1660	3.0824	11.0605	3.05512	3.06313	-.261
22.3978	3.1035	11.1468	3.07687	3.08211	-.170
22.6530	3.1262	11.2395	3.10107	3.10251	-.046
22.9485	3.1576	11.3677	3.12525	3.13072	-.175
23.1627	3.1780	11.4509	3.14435	3.14904	-.149
23.4321	3.2026	11.5508	3.16908	3.17104	-.062
23.6733	3.2291	11.6584	3.18789	3.19475	-.215
24.1967	3.2786	11.8587	3.23413	3.23887	-.147
24.5193	3.3067	11.9720	3.26411	3.26385	.008
24.7221	3.3294	12.0636	3.27930	3.28404	-.144
25.0243	3.3545	12.1642	3.30802	3.30622	.054
25.2758	3.3815	12.2726	3.32748	3.33012	-.079
25.5196	3.4031	12.3590	3.34950	3.34918	.010
25.7998	3.4298	12.4660	3.37330	3.37279	.015
26.3181	3.4837	12.6806	3.41407	3.42015	-.178
26.6349	3.5102	12.7853	3.44331	3.44327	.001
26.8946	3.5345	12.8816	3.46533	3.46452	.023
27.1621	3.5668	13.0093	3.48299	3.49272	-.279
27.5072	3.5908	13.1037	3.51764	3.51358	.116
27.7573	3.6147	13.1974	3.53829	3.53429	.113
28.0256	3.6443	13.3133	3.55769	3.55990	-.062
28.5716	3.6963	13.5158	3.60247	3.60466	-.061
28.7695	3.7160	13.5920	3.61810	3.62152	-.094
29.0076	3.7366	13.6717	3.63887	3.63913	-.007
29.2948	3.7669	13.7886	3.66025	3.66500	-.130
29.6604	3.8004	13.9174	3.69066	3.69351	-.077
29.8801	3.8205	13.9946	3.70885	3.71060	-.047
30.1389	3.8481	14.0999	3.72778	3.73390	-.164
30.4473	3.8736	14.1969	3.75499	3.75537	-.010
31.0397	3.9297	14.4095	3.80241	3.80246	-.001
31.3721	3.9566	14.5104	3.83187	3.82482	.184
31.5263	3.9767	14.5860	3.84062	3.84157	-.025
31.9467	4.0086	14.7051	3.87897	3.86797	.284
32.2780	4.0390	14.8185	3.90573	3.89309	.325
32.5440	4.0628	14.9066	3.92757	3.91263	.382
32.7228	4.0915	15.0126	3.93430	3.93614	-.047
32.9882	4.1149	15.0989	3.95619	3.95528	.023
33.5892	4.1681	15.2935	4.00552	3.99846	.176
33.9675	4.2075	15.4365	4.03285	4.03021	.066
34.1739	4.2266	15.5056	4.04919	4.04554	.090
34.5013	4.2575	15.6169	4.07466	4.07027	.108
34.7272	4.2821	15.7052	4.09024	4.08986	.009
35.0707	4.3138	15.8181	4.11736	4.11495	.059
35.4132	4.3439	15.9252	4.14518	4.13875	.155

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TABLE E20 CONTINUED

CTOT (MJ/DEG)	CADD (MJ/DEG)	T**2 (DEG2)	C/T (MJ/M-DEG2)	C/T FIT (MJ/M-DEG2)	PCERROR
35.6665	4.3730	16.0280	4.16168	4.16159	.002
36.2863	4.4341	16.2428	4.20787	4.20935	-.035
36.6460	4.4699	16.3673	4.23447	4.23702	-.060
36.7575	4.4860	16.4234	4.23975	4.24951	-.230
37.1362	4.5090	16.5027	4.27619	4.26715	.212
37.2519	4.5369	16.5990	4.27523	4.28857	-.311
37.7117	4.5700	16.7125	4.31626	4.31384	.056
37.9609	4.6028	16.8241	4.33002	4.33867	-.200
38.2278	4.6284	16.9112	4.35009	4.35806	-.183
38.6644	4.6633	17.0289	4.38687	4.38426	.059
38.9418	4.6944	17.1333	4.40516	4.40752	-.053
39.2809	4.7235	17.2305	4.43248	4.42918	.074

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TABLE E21

SPECIFIC HEAT OF (42A/O AU-8A/O CU-50A/O AG) ALLOY

RUN 39

FEBRUARY 24,1971

CTOT (MJ/DEG)	CADD (MJ/DEG)	T**2 (DEG2)	C/T (MJ/M-DEG2)	C/T FIT (MJ/M-DEG2)	PCERROR
4.0001	.9559	1.9564	1.11552	1.11917	-.326
4.0598	.9640	1.9883	1.12532	1.12673	-.125
4.2236	.9875	2.0827	1.14935	1.14912	.019
4.4096	1.0135	2.1884	1.17669	1.17422	.211
4.5863	1.0387	2.2925	1.20096	1.19893	.169
4.7638	1.0631	2.3943	1.22586	1.22311	.225
4.8645	1.0772	2.4535	1.23929	1.23718	.170
4.8884	1.0807	2.4681	1.24229	1.24065	.133
5.0768	1.1059	2.5752	1.26834	1.26608	.179
5.2744	1.1311	2.6834	1.29644	1.29179	.360
5.4281	1.1521	2.7739	1.31593	1.31331	.200
5.6200	1.1768	2.8812	1.34168	1.33881	.215
5.7570	1.1945	2.9584	1.35960	1.35718	.179
5.8158	1.2020	2.9912	1.36734	1.36498	.173
6.0018	1.2252	3.0928	1.39216	1.38915	.217
6.1740	1.2486	3.1961	1.41213	1.41371	-.111
6.3662	1.2703	3.2918	1.43962	1.43649	.218
6.5572	1.2940	3.3972	1.46363	1.46156	.141
6.7133	1.3134	3.4829	1.48308	1.48198	.074
6.8128	1.3253	3.5359	1.49581	1.49458	.082
6.9312	1.3392	3.5980	1.51106	1.50937	.112
7.1137	1.3623	3.7008	1.53240	1.53385	-.094
7.3464	1.3894	3.8219	1.56182	1.56269	-.056
7.4649	1.4047	3.8900	1.57491	1.57893	-.255
7.6667	1.4277	3.9927	1.60038	1.60341	-.189
7.8578	1.4512	4.0978	1.62217	1.62844	-.385
8.0516	1.4726	4.1935	1.64670	1.65126	-.276
8.2345	1.4940	4.2890	1.66823	1.67404	-.347
8.4387	1.5175	4.3937	1.69244	1.69901	-.386
8.6992	1.5449	4.5157	1.72564	1.72811	-.143
8.8065	1.5597	4.5814	1.73536	1.74381	-.484
8.9618	1.5767	4.6572	1.75405	1.76188	-.444
9.2210	1.6046	4.7815	1.78529	1.79155	-.349
9.4205	1.6258	4.8752	1.80948	1.81391	-.245
9.6355	1.6504	4.9843	1.83327	1.83997	-.364
9.8362	1.6713	5.0771	1.85733	1.86214	-.258
10.0280	1.6918	5.1678	1.87957	1.88380	-.224
10.2381	1.7133	5.2626	1.90471	1.90646	-.092
10.4551	1.7370	5.3671	1.92884	1.93143	-.134
10.6680	1.7593	5.4648	1.95332	1.95480	-.076
10.8911	1.7833	5.5703	1.97797	1.98002	-.104
11.0678	1.8046	5.6639	1.99501	2.00241	-.370
11.2781	1.8263	5.7586	2.01884	2.02507	-.308
11.5085	1.8510	5.8668	2.04366	2.05095	-.355

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TABLE E21 CONTINUED

CTOT (MJ/DEG)	CADD (MJ/DEG)	T**2 (DEG2)	C/T (MJ/M-DEG2)	C/T FIT (MJ/M-DEG2)	PCERROR
11.7400	1.8725	5.9607	2.07157	2.07343	-.090
11.9464	1.8949	6.0584	2.09312	2.09679	-.175
12.2117	1.9208	6.1711	2.12331	2.12378	-.022
12.4342	1.9419	6.2626	2.14900	2.14571	.153
12.6688	1.9654	6.3643	2.17465	2.17006	.212
12.9089	1.9909	6.4749	2.19922	2.19656	.121
13.1295	2.0131	6.5707	2.22282	2.21950	.150
13.3512	2.0368	6.6728	2.24502	2.24398	.046
13.6117	2.0609	6.7766	2.27432	2.26887	.240
13.8339	2.0829	6.8714	2.29773	2.29158	.268
14.2470	2.1240	7.0475	2.34066	2.33383	.293
14.4752	2.1475	7.1485	2.36331	2.35805	.223
14.6976	2.1702	7.2455	2.38546	2.38134	.173
14.9335	2.1930	7.3430	2.40986	2.40474	.213
15.1641	2.2171	7.4455	2.43203	2.42935	.110
15.4273	2.2404	7.5449	2.46070	2.45322	.305
15.6698	2.2619	7.6363	2.48693	2.47517	.475
15.9015	2.2861	7.7391	2.50859	2.49986	.350
16.1728	2.3136	7.8562	2.53439	2.52800	.253
16.4045	2.3343	7.9437	2.55878	2.54903	.383
16.6214	2.3556	8.0339	2.57974	2.57072	.351
16.8469	2.3796	8.1354	2.59982	2.59510	.182
17.1433	2.4038	8.2377	2.63224	2.61971	.478
17.3712	2.4268	8.3348	2.65323	2.64308	.384
17.5534	2.4509	8.4366	2.66506	2.66755	-.093
17.9250	2.4822	8.5681	2.70415	2.69919	.184
18.1117	2.5000	8.6431	2.72182	2.71726	.168
18.3495	2.5230	8.7398	2.74396	2.74053	.125
18.6494	2.5470	8.8407	2.77583	2.76481	.398
18.8291	2.5724	8.9469	2.78573	2.79041	-.168
19.1194	2.5971	9.0506	2.81498	2.81538	-.014
19.3834	2.6207	9.1492	2.84053	2.83913	.049
19.6323	2.6435	9.2445	2.86396	2.86210	.065
19.8625	2.6663	9.3399	2.88406	2.88510	-.036
20.1258	2.6887	9.4331	2.91000	2.90757	.083
20.4026	2.7138	9.5379	2.93574	2.93283	.099
20.6847	2.7393	9.6443	2.96184	2.95849	.113
20.9005	2.7616	9.7370	2.97948	2.98087	-.047
21.1789	2.7846	9.8323	3.00677	3.00386	.097
21.4483	2.8107	9.9409	3.02986	3.03007	-.007
21.6763	2.8324	10.0307	3.04965	3.05175	-.069
21.9393	2.8569	10.1323	3.07273	3.07627	-.115
22.2117	2.8809	10.2315	3.09758	3.10025	-.086
22.4781	2.9057	10.3342	3.12068	3.12504	-.140

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TABLE E21 CONTINUED

CTOT (MJ/DEG)	CADD (MJ/DEG)	T**2 (DEG2)	C/T (MJ/M-DEG2)	C/T FIT (MJ/M-DEG2)	PCERROR
22.7768	2.9311	10.4389	3.14835	3.15035	-.063
23.0806	2.9600	10.5581	3.17389	3.17914	-.165
23.2705	2.9783	10.6333	3.18963	3.19732	-.241
23.5999	3.0063	10.7486	3.21959	3.22520	-.174
23.8455	3.0294	10.8436	3.24010	3.24816	-.248
24.1013	3.0522	10.9370	3.26234	3.27075	-.257
24.3823	3.0757	11.0331	3.28784	3.29400	-.187
24.6917	3.1049	11.1527	3.31316	3.32294	-.294
24.9503	3.1298	11.2543	3.33387	3.34754	-.408
25.3362	3.1558	11.3606	3.37297	3.37326	-.008
25.5059	3.1758	11.4416	3.38370	3.39289	-.271
25.8161	3.2002	11.5412	3.41219	3.41699	-.141
26.0983	3.2264	11.6474	3.43505	3.44272	-.223
26.4062	3.2554	11.7647	3.45956	3.47114	-.334
26.6879	3.2766	11.8504	3.48582	3.49190	-.174
27.0588	3.3040	11.9611	3.52056	3.51873	.052
27.3409	3.3281	12.0581	3.54446	3.54224	.063
27.6446	3.3577	12.1771	3.56734	3.57111	-.106
28.0002	3.3794	12.2642	3.60352	3.59223	.314
28.2923	3.4126	12.3973	3.62182	3.62451	-.074
28.5234	3.4329	12.4782	3.64064	3.64416	-.097
28.8728	3.4616	12.5926	3.67038	3.67193	-.042
29.1161	3.4800	12.6659	3.69213	3.68972	.066
29.2890	3.5047	12.7637	3.69924	3.71345	-.383
29.8178	3.5370	12.8914	3.75175	3.74447	.194
30.0093	3.5572	12.9712	3.76456	3.76386	.019
30.2804	3.5826	13.0711	3.78498	3.78813	-.083
30.6088	3.6065	13.1650	3.81448	3.81094	.093
30.9369	3.6360	13.2809	3.83979	3.83910	.018
31.2379	3.6636	13.3884	3.86264	3.86526	-.068
31.5698	3.6840	13.4677	3.89476	3.88453	.264
31.8109	3.7123	13.5777	3.90854	3.91129	-.070
32.2460	3.7427	13.6954	3.94776	3.93992	.199
32.4455	3.7634	13.7751	3.96103	3.95930	.044
32.7735	3.7947	13.8955	3.98463	3.98861	-.100
33.0728	3.8168	13.9802	4.01054	4.00923	.033
33.4063	3.8455	14.0901	4.03649	4.03597	.013
33.7773	3.8764	14.2077	4.06598	4.06463	.033
34.0427	3.9002	14.2977	4.08593	4.08654	-.015
34.3751	3.9305	14.4124	4.11042	4.11448	-.099
34.6411	3.9513	14.4908	4.13231	4.13358	-.031
35.0736	3.9767	14.5860	4.17343	4.15680	.400
35.3078	4.0078	14.7023	4.18403	4.18515	-.027
35.7178	4.0379	14.8144	4.21877	4.21248	.149

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TABLE E21 CONTINUED

CTOT (MJ/DEG)	CADD (MJ/DEG)	T**2 (DEG2)	C/T (MJ/M-DEG2)	C/T FIT (MJ/M-DEG2)	PCERROR
36.0028	4.0629	14.9069	4.24018	4.23505	.121
36.2822	4.0845	14.9867	4.26301	4.25451	.200
36.6433	4.1133	15.0929	4.29183	4.28041	.267
36.8418	4.1384	15.1849	4.30161	4.30287	-.029
37.2033	4.1675	15.2912	4.33021	4.32882	.032
37.5526	4.1983	15.4031	4.35603	4.35614	-.002
37.8343	4.2220	15.4887	4.37759	4.37704	.013
38.1543	4.2496	15.5885	4.40151	4.40141	.002
38.5200	4.2802	15.6983	4.42946	4.42822	.028
38.8506	4.3097	15.8036	4.45348	4.45397	-.011
39.1417	4.3374	15.9022	4.47351	4.47807	-.102
39.6163	4.3711	16.0215	4.51330	4.50721	.135
39.8592	4.4002	16.1239	4.52623	4.53226	-.133
40.1151	4.4190	16.1897	4.54722	4.54836	-.025
40.4805	4.4507	16.3005	4.57409	4.57546	-.030
40.8642	4.4841	16.4165	4.60223	4.60384	-.035
41.2158	4.5151	16.5240	4.62766	4.63014	-.053
41.4756	4.5378	16.6019	4.64662	4.64920	-.056
41.8815	4.5683	16.7066	4.67910	4.67484	.091
42.2988	4.6042	16.8289	4.70973	4.70479	.105
42.4216	4.6243	16.8971	4.71301	4.72149	-.180
42.8801	4.6582	17.0117	4.74988	4.74957	.007
43.5572	4.7212	17.2229	4.79651	4.80132	-.100

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