For numerical output of this problem, refer to Vol. II of this report filed in the Document Library of Ballistics Research Laboratories.

D. List of Labels

DECIDE

DX(S) = Eulerian space interval in region S at t = 0

= L(S)/ZØN(S)

H(S) = no. of cells from left boundary through region S

$$= \sum_{L=2}^{S} ZØN(L)$$

B5INIT(S)

RHØ(S) = density at zero pressure in region S

A1,A2,A3 = coefficients in Eq. (4.5)

DV(S) = $v_2(p,T) - v_1(p,T)$

PM = pressure at which the Hugoniot in phase I intercepts the phase boundary

CV1 = C_{v1}

CVMIX = $C_{v,m}$

GAMM1(S) = Γ

EØ = internal energy at the foot of the Hugoniot

TØ = T_o

DPDTMX = $(\partial p/\partial T)_{v,m}$

TAUØ = $1/\tau$, Eq. (5.11)

VP = specific volume in phase I at p = PM = $v_1(pM,T)$

V2 = $v_2(pM,T)$

CSPS = starting value for sound speed

J = index for space grid

V(J) = v_j

U(J) = U_j

Q(J) = q_j

P(J) = p_j

TLIMA(J) = value of Δt_j for next time step

CSP(J) = sound speed in cell J

E(J) = E_j

ENT(J) = s_j

TMP(J) = T_j

NSA(J) = switching index

= 1, phase I

= 2, mixed phase

= 3, phase II

<u>MAIN</u>

X(J) = x_j (Fig. 5.2)

MASS(J) = mass of cell J

JSTAR = cell label just ahead of shock front at which computation stops for each time cycle

TIMES = t

CYCLE = number of times t has been incremented

JCRIT = value of J for which TLIMA is minimum

LAST = switching index for halting program after writing last output.

PPEAK = maximum computed pressure in each cycle

TLIMB = TLIMA(JCRIT)

PLEFT = pressure applied to left boundary

DFNU = mass in cell J+1

XA = $x(t + \Delta t)$

VN = $v(t + \Delta t)$

QA = $Q(t + \Delta t)$

JPMAX = value of J at which p is maximum

ZMIX

FRACT(J) = α_j

XEQ(J) = α_j^{eq}

V1(J) = $v_{1j}(p,T)$

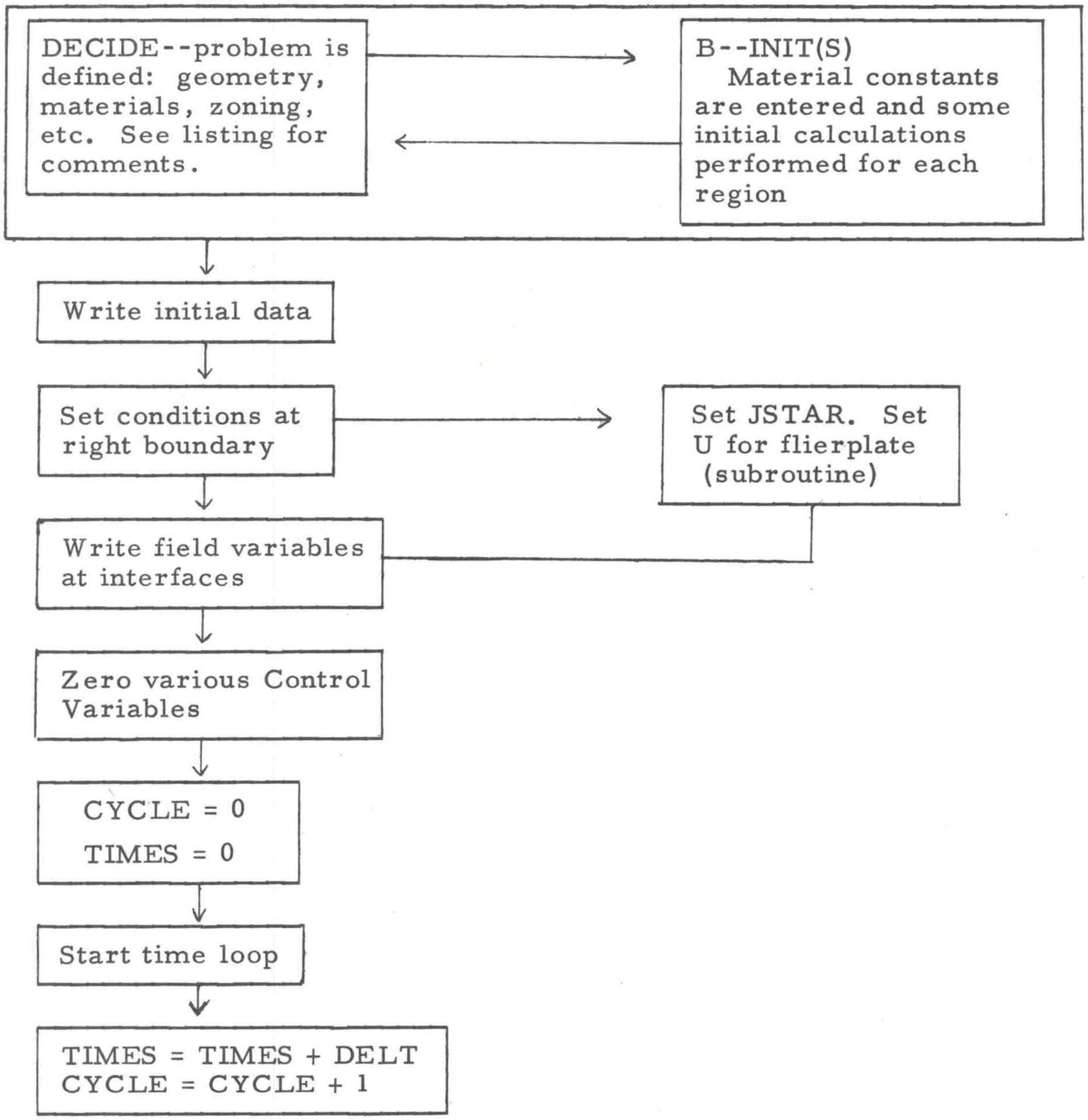

Fig. 1.--FLOW CHART FOR BURN

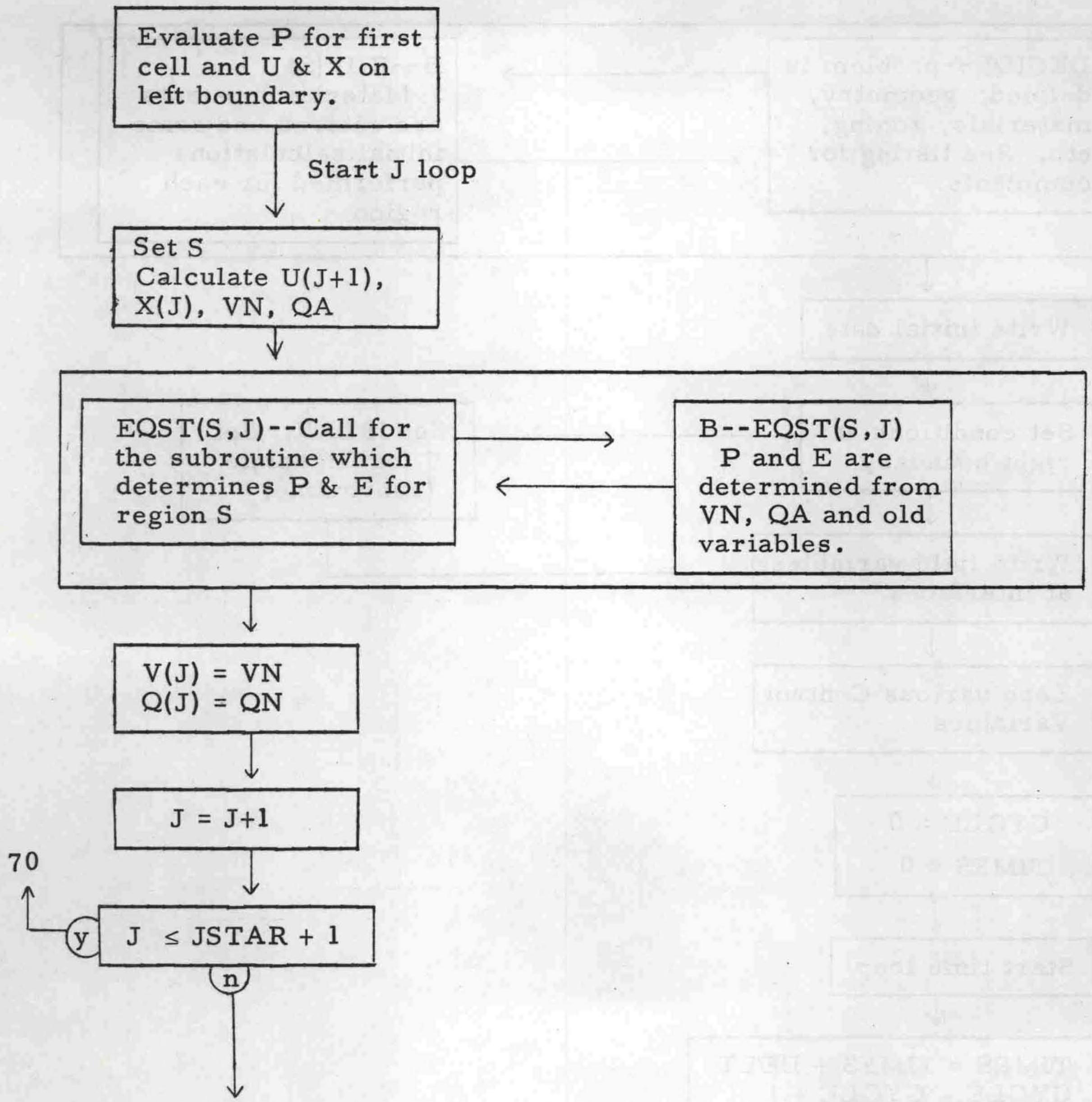
Evaluate P for first cell and U & X on left boundary.
Start J loop
Set S
Calculate U(J+1), X(J), VN, QA
EQST(S,J)--Call for the subroutine which determines P & E for region S
B--EQST(S,J)
P and E are determined from VN, QA and old variables.
V(J) = VN
Q(J) = QN
J = J+1
70
y
J ≤ JSTAR + 1
n

Fig. 1. (b)

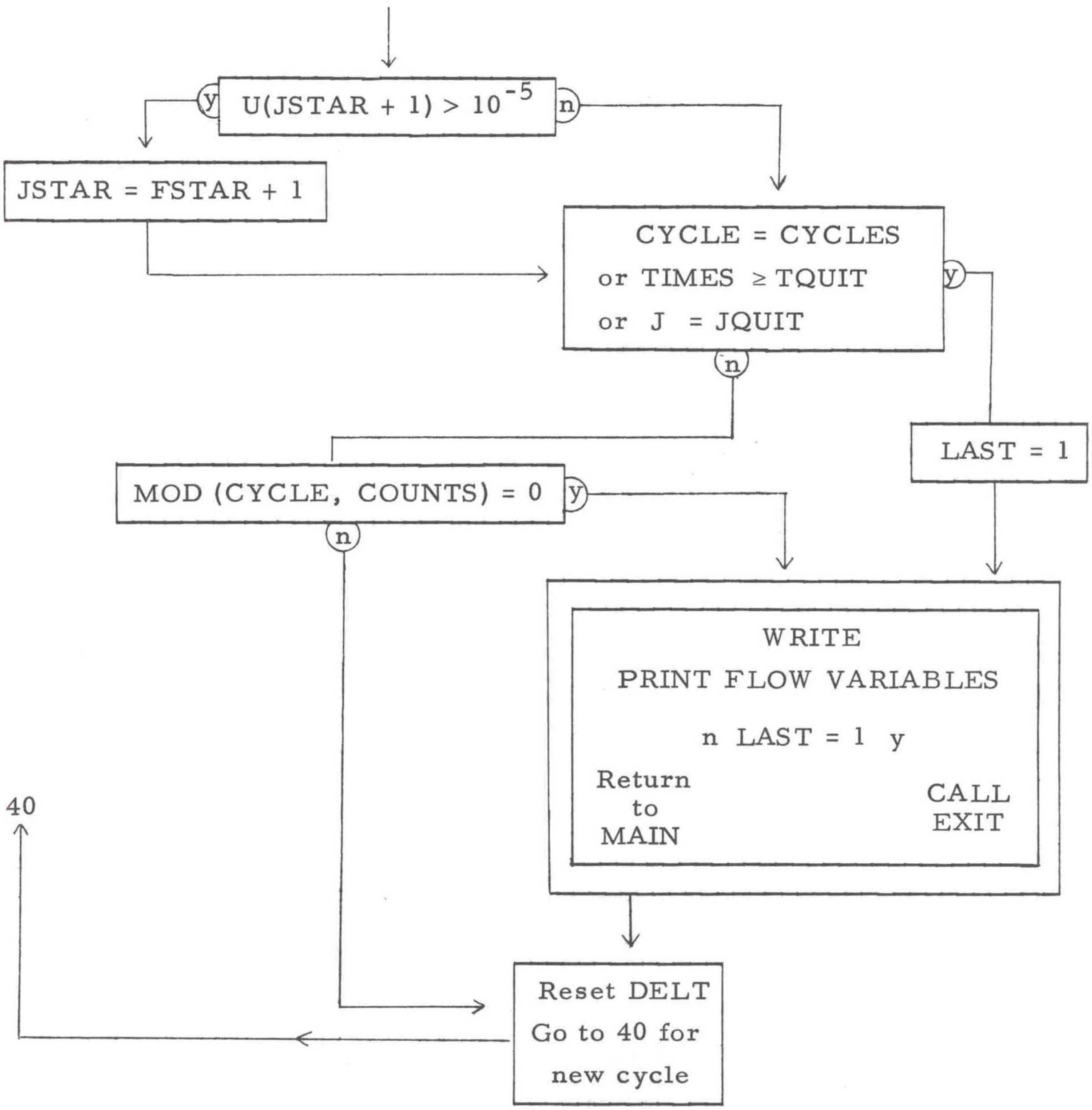
U(JSTAR + 1) > 10^-5
y
n
JSTAR = FSTAR + 1
CYCLE = CYCLES
or TIMES ≥ TQUIT
or J = JQUIT
y
n
LAST = 1
MOD (CYCLE, COUNTS) = 0
y
n
WRITE
PRINT FLOW VARIABLES
n LAST = 1 y
Return to MAIN
CALL EXIT
40
Reset DELT
Go to 40 for
new cycle

Fig. 1. (c)

Unclassified
Security Classification

DOCUMENT CONTROL DATA - R & D

(Security classification of title, body of abstract and indexing annotation must be entered when the overall report is classified)

1. ORIGINATING ACTIVITY (Corporate author) Washington State University Department of Physics, Shock Dynamics Laboratory Pullman, Washington 99163	2a. REPORT SECURITY CLASSIFICATION UNCLASSIFIED 2b. GROUP
3. REPORT TITLE EQUATIONS OF STATE IN SOLIDS (U)	
4. DESCRIPTIVE NOTES (Type of report and inclusive dates) Technical Summary Report No. 1 February 1967	
5. AUTHOR(S) (First name, middle initial, last name) Duvall, George E., Fowles, G. Richard, Horie, Yasuyuki	

6. REPORT DATE	7a. TOTAL NO. OF PAGES	7b. NO. OF REFS
February 1967		49

8a. CONTRACT OR GRANT NO. DA-04-200-AMC-1702(X)	9a. ORIGINATOR'S REPORT NUMBER(S) SDL 67-01
b. PROJECT NO.	
c.	9b. OTHER REPORT NO(S) (Any other numbers that may be assigned this report)
d.	

10. DISTRIBUTION STATEMENT

This document has been approved for public release and sale; its distribution is unlimited.

11. SUPPLEMENTARY NOTES	12. SPONSORING MILITARY ACTIVITY
	U.S. Army Ballistics Research Laboratories Aberdeen Proving Ground, Maryland

13. ABSTRACT

A procedure is described for developing simple approximate equations of state of liquids from Hugoniot P-V relations determined in shock wave measurements. This is applied to a number of liquids and a table of coefficients is given.

The formalism of irreversible thermodynamics is applied to time-dependent phase transitions in iron and an approximate set of constitutive relations is obtained in a form suitable for numerical integration with the equations of continuum dynamics. These are applied in an approximate form to study the development of the two-wave structure in iron caused by the α-ε phase transition.

Finite strain theory is applied to the analysis of shock wave data for quartz, and the results supply enough information to estimate some of the fourth-order elastic constants.

DD FORM 1 NOV 65 1473

Unclassified
Security Classification

Security Classification

14. KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
shock waves equations of state quartz--elastic constants liquids--equations of state phase transitions solids--phase transitions pressure induced phase transitions phase-transitions--effects on shock waves phase transitions--kinetics kinetics of phase transitions						

Security Classification