LIST OF REFERENCES

## PART A—UNITED STATES REFERENCES


**A-1** ASM
WEAR, FATIGUE, AND FRETTING SURFACE DAMAGE OF MATERIALS
Am. Soc. Met. (Cleveland)
Seven papers on compatibility of metal pairs, subsurface fatigue, pitting of gear teeth, scoring phenomena, fretting and fretting corrosion, and corrosion and sliding characteristics of metals at high temperatures.
Subject Index Nos.—1.2.5, 1.6.1.1, 1.6.2, 1.6.3, 1.10.2.2

**A-2** ASTM
SYMPOSIUM ON ACOUSTICAL FATIGUE—1960
STP, No. 284, 65 pp., March, 1961.
Subject Index No.—1.12.4

**A-3** ASTM
SYMPOSIUM ON FATIGUE OF AIRCRAFT STRUCTURES—1959
STP, No. 274, 138 pp., June, 1960
Subject Index No.—1.12.4

**A-4** Anderson, W. J. and Bisson, E. E.
MATERIALS FOR HIGH, DRY BEARINGS
SAE Journal, Vol. 68, pp. 74–75, June, 1960
Fatigue life of Mo tool steels, Stellites, Fe alloys and Pyroceram in roller element bearings as determined by service testing at temperatures to 1000 F.
Subject Index Nos.—2.2.1, 2.6.1.1, 2.10.2.2, 3.2.1, 3.6.1.1, 3.10.2.2

**A-5** Anonymous
BERYLLIUM DESIGN DATA
Lockheed Missiles and Space Division; LSMD 48472; Prepared under BuWeps Contract NOrd 17017; 1960.
Subject Index No.—8.11

**A-6** Anonymous
CHEMICAL COATINGS CUT METAL FATIGUE
Steel, Vol. 147, p. 109, July 11, 1960.
Subject Index Nos.—2.6, 5.6, 6.6

**A-7** Anonymous
EFFECT OF ORGANIC COMPOUNDS ON METAL FATIGUE
Nat. Bur. Standards (U.S.) Tech. News Bull., Vol. 44, p. 127, Aug., 1960.
Coatings of certain polar organic compounds on specimens of steel, Mg and Cu-Be alloys markedly increase fatigue strength, according to recent National Bureau of Standards experiments. The compounds found most beneficial have a carbon chain of at least 12 with a polar group at one end. Apparently the polar group attaches to a metal surface in such a way that a tightly packed monomolecular film is formed which acts as a barrier to water and oxygen molecules.
Subject Index Nos.—2.4.8, 5.4.8, 6.4.8

**A-8** Anonymous
EVALUATION OF DETECTION TECHNIQUES
Southwest Research Institute, March 17, 1960.
The objective of this program is to provide instrumentation for the nondestructive detection of latent fatigue in metals and alloys. This report summarizes the results obtained with magnetic leakage flux, magneto-absorption, eddy current, and ultrasonic detection techniques using magnetic specimens.
Subject Index No.—1.7.1

**A-9** Anonymous
EVALUATION OF PHYSICAL STRENGTH OF MATERIALS
Mech. World Eng. Rec., Vol. 140, pp. 320–321, Aug., 1960.
Standard tensile test performance and the determination of proof stress in lieu of yield point on nonferrous materials. Creep performance and fatigue life are now better understood phenomena and capable of analysis and empirical determination.
Subject Index No.—1.1.4

**A-10** Anonymous
FATIGUE DATA ON PRECIPITATION-HARDENABLE STAINLESS STEEL
DMIC, Battelle Mem. Inst., OTS PB 161196—DMIC Memorandum 46, March 11, 1960.
A series of memoranda dealing with the fatigue properties of some alloys of current interest to the missile and airframe industry. Steels included in this memorandum are 17-7PH, AM350 and AM355.
Subject Index No.—3.11

**A-11** Anonymous
FATIGUE PROPERTIES OF SOME HIGH-STRENGTH STEELS
Nat. Bur. Standards (U.S.) Tech. News Bull., Vol. 44, p. 174–175, Oct., 1960.
Investigation of fatigue properties of both commercial and experimental steels that had been heat treated to high tensile strengths. Some of the experimental steels containing Cu are found to have superior fatigue strengths. With the exception of high Si steels, maximum strengths are obtained with specimens that have been tempered at 350 or 400 F.
Subject Index Nos.—2.2.1, 2.11, 2.2.6,

**A-12** Anonymous
FATIGUE TESTING OF SANDWICH CONSTRUCTION
Northrop Corporation, Norair Div., NOR 61-18 Interim Report No. 2, 1 Aug., through 31 Oct., 1960.

**A-12** *(continued)*

This report discusses the problems encountered in utilizing the C-100 and Kalidyne electro-mechanical shakers for fatigue testing of honeycomb core by dynamic methods. The major difficulty thus far encountered is balancing the total system so that the loads will be applied in pure tension-compression with no load concentration at the edges. The appendix describes the method as it applies to obtaining both core moduli and core fatigue.

Subject Index No.—1.8

**A-13** Anonymous
INVESTIGATION OF THERMAL EFFECTS ON STRUCTURAL FATIGUE
WADD, Tech. Rept. TR-60-410 Part I, Aug., 1960.

A procedure for design of fatigue resistant structures under an elevated temperature environment is presented. Constant load amplitude, and spectrum fatigue tests were run on notched and unnotched PH 15-7 Mo and AM 355 stainless steel specimens at temperatures up to 800 F. The hydraulic spectrum loader is described. Methods of accounting for non-linear damage propagation and large preloads are developed. A digital computer program is presented based on these methods. The test spectrum fatigue lives are compared with predictions by cumulative damage analyses. These analyses include Miner's linear damage theory as well as several non-linear damage theories.

Subject Index Nos.—3.6.1.1, 3.6.5

**A-14** Anonymous
MALLEABLE IRON, FATIGUE AND IMPACT EFFECTS
Machine Design, Vol. 32, pp. 124–126, Jan. 7, 1960.

Various types of tests and results under various conditions. Tensile strength, fatigue limit, impact strength and notch sensitivities of typical malleable irons.

Subject Index Nos.—2.1.4.3, 2.2.1, 2.11

**A-15** Anonymous
NEW PROCESS UPS FATIGUE STRENGTH OF STEEL
Western Metalworking, Vol. 18, pp. 41–42, Dec., 1960.

Subject Index Nos.—2.2.1.1, 2.4.6, 3.4.6

**A-16** Anonymous
SUMMARY REPORT—CO-OPERATIVE EVALUATION OF ×2020 ALUMINUM ALLOY PROJECT 4-58
Aerospace Res. Test. Comm., ATC Report ARTC-27, Nov. 15, 1960.

An industry wide co-operative test program was initiated to obtain design and processing data, including fatigue data.

Subject Index Nos.—4.2, 4.9.3

**A-17** Atkins, J. H., Bisplinghoff, R. L., Hamm, J. L.; Jackson, E. G.; and Simons, J. C., Jr.
EFFECTS OF SPACE ENVIRONMENT ON MATERIALS
WADD, Tech. Rept. 60-721, PB 171, 294, Dec., 1960.

Subject Index No.—1.6

**A-18** Atkinson, R. J.
AIRCRAFT FATIGUE—A SURVEY OF CURRENT THOUGHT
Aero/Space Eng., p. 102, Jan., 1960; Seventh Anglo-American Aeronautics Conference, New York, October 5–7.

Investigation of structural fatigue in aircraft under all types of operational flying conditions, and discussion of design requirements, loading actions, fatigue data, assessment of fatigue performance, and proving.

Subject Index Nos.—4.9.3, 4.10.3

**A-19** Atterbury, T. J. and Di Boll, W. B., Jr.
THE EFFECT OF PRESETTING HELICAL COMPRESSION SPRINGS
Am. Soc. Mech. Engrs., Series B, Journal of Eng. for Ind., Vol. 82, No. 1, pp. 41–46, Feb., 1960.

A procedure for predicting the increase in fatigue load carrying capacity due to presetting helical springs is developed, based on the actual stress-strain curve of a material. Reasonable correlation with experimental results is obtained. For the cyclic load conditions and the material chosen, an increase in load carrying capacity of 21 per cent was observed. It is expected that an increase of approximately 40 per cent could be realized with slight modification of fabrication techniques.

Subject Index Nos.—2.4.5, 2.4.7, 2.10.2

**A-20** Balicki, M. and Haumann, F. K.
STABILITY OF LEAD AND BISMUTH TELLURIDES ON PULSE HEATING TO SUCCESS—HIGHER TEMPERATURES
Paper from "Reactor Technology Rept. No. 12—Metallurgy," U.S. Atomic Energy Commission, KAPL-20000-9, p. A. 19-A. 36, March, 1960.

Thermal shock tests on thermo-electric materials to determine resistance to thermal cycling, prolonged exposure to high-temperature gradients and rapid heating and cooling rates. P-type and n-type conductivity PbTe and $Bi_2Te_3$ samples are induction heated and water quenched in successive cycles with increasing temperature rise to within 100 C of their respective melting points. Data for thermal stress-strain relations and fracture mechanisms.

Subject Index No. 8.6.5

**A-21** Barish, T.
HOW TO PREDICT OSCILLATION LIFE OF BALL AND ROLLER BEARINGS
Machine Design, Vol. 32, pp. 113–116, Sept. 1, 1960.

Subject Index No.—2.10.2.2

**A-22** Barron, R. F.
LOW TEMPERATURE PROPERTIES OF ENGINEERING MATERIALS
Machine Design, Vol. 32, pp. 189–195, March 17, 1960.

Subject Index Nos.—1.6.1.2, 1.11

**A-23** Baughman, R. A.
EFFECT OF HARDNESS, SURFACE FINISH, AND GRAIN SIZE ON ROLLING-CONTACT FATIGUE LIFE OF M-50 BEARING STEEL
ASME Trans., Series D, Journal of Basic Engineering, Vol. 82, No. 2, pp. 287–294, June, 1960.

Considerable testing on the RC Rig and statistical-treatment methods are included. A mathematical expression relating these variables to life expectancy is presented and the optimization of these variables is discussed.

Subject Index Nos.—2.2.2.1, 2.4.3, 2.10.2.2, 2.8.3

**A-24** Beitscher, S.
FATIGUE TESTS OF FUEL-CELL TUBE-STRUCTURE WELDS
Paper from "Reactor Technology Rept. No. 12—Metallurgy," U.S. Atomic Energy Commission, KAPL-2000-9, pp. B5–B9, March, 1960.

Investigation of fatigue life of notched weldments in wrought Zircaloy-2 tubing (as fabricated into arc-welded angle sections in fuel-cell structures). Specimens are subjected to cyclic, unidirectional stresses at room temperature. From test results and an analysis utilizing a modified Goodman diagram, the variance of the fatigue notch factor with the stress concentration factor is determined.

Subject Index Nos.—1.10.1.3, 8.10.1.3

**A-25** Bendler, H. A. and Wood, W. A.
ELECTRON METALLOGRAPHIC OBSERVATIONS ON THE FORMATION OF FATIGUE CRACKS (LETTER TO THE EDITOR)
Acta Met., Vol. 8, No. 6, pp. 402–403, June, 1960.

Subject Index Nos.—5.1.5, 5.7.1.1, 5.7.2

**A-26** Bingman, R. N.
RESONANT FATIGUE FAILURES ASSOCIATED WITH NOISE
SAE Natl. Aero. Meeting, New York, April 5–8, 1960, Preprint 164B.
Discussion of the extent and diversity of resonant fatigue damage under rapidly fluctuating pressures such as those produced by jet noise. Types of failures, significant noise environments which induce damage, and design criteria and inspection techniques based on experience with USAF weapon systems are surveyed.

Subject Index Nos.—1.6.7, 1.9.3

**A-27** Blackburn, W. S.; Harnby, G.; and Stobo, J. J.
EFFECT OF THERMAL CYCLING ON THE CREEP OF URANIUM
Journal of Nuclear Energy, Pt. A, Vol. 12, pp. 162–171, Aug., 1960.
Effect of thermal cycles of up to 40 above and below 500 C on the creep rate of uranium specimens. Development of theory predicting the effect of thermal cycling on creep. Comparison of predictions of theories with experimental results.

Subject Index No.—8.6.5

**A-28** Bouton, I.
THE STATISTICAL BASIS OF LOADING SPECTRA FOR FATIGUE DESIGN CRITERIA
(USAF Fatigue Aircraft Struc. Symposium, Dayton, Aug. 13, 1959) Aero/Space Eng., Vol. 19, No. 3, pp. 53–57, 64, March, 1960.
Discussion of the requirements for synthesizing loading spectra for new systems and the problems involved in calculating such spectra. It is concluded that there is still a need for a large-scale program to gather statistical data for loading spectra and for devising methods to utilize the statistical data in the design criteria. Statistical data on the eight parameters established for the present eight-channel data recording program form the minimum basis for rational fatigue criteria. The loading spectra usually must establish two functions. First, the past history of an aircraft at any time in its life must be determinable statistically in order to determine the probable strength level (fatigue damage) of the structural elements at all times during the lifetime of the aircraft. Second, the probability of encountering a given magnitude load at any given time in the history of the component must be known in order to compute the probability at any given time. The aircraft probability of failure and its inverse, structural reliability, are the sum total of all the probabilities of failure during the previous history of the aircraft.

Subject Index Nos.—1.7.3, 1.8.3, 1.9.3, 1.12.1

**A-29** Bowman, C. E. and Dolan, T. J.
BIAXIAL FATIGUE STUDIES OF HIGH STRENGTH STEELS CLAD WITH STAINLESS STEEL
U. of Illinois, Dept. of Theoretical and Applied Mechanics, TAM Rept. 164, May, 1960.
Resistance to cyclic mechanical loading of the bond between stainless steel clad to carbon steel backing plate. Bending fatigue and static bend specimens were more sensitive detectors of a poor bond. Bond failures were not developed in well-bonded clad plate; bond failures developed only in plate with faulty bond. There is no correlation between the indication of a sound bond by ultrasonic means and the resistance of the bond to cyclic mechanical loading.

Subject Index Nos.—2.4.8, 2.5.3, 3.5.3

**A-30** Brandes, E. A.
ALUMINIZED AND CHROMIZED COATINGS CHANGE STEEL PROPERTIES
Prod. Engg., Vol. 31, No. 26, pp. 31–33, June 27, 1960.

Subject Index No.—2.4.8.2, 2.6.1.1

**A-31** Bratina, W. J. and Mills, D.
INVESTIGATION OF RESIDUAL STRESS IN FERROMAGNETICS USING ULTRASONICS
Nondestructive Testing, Vol. 18, pp. 110–113, March-April, 1960.
The residual stress in SAE 1020 steel bars, annealed and deformed, can be evaluated quantitatively by employing the changes in absorption of ultrasound. A Sperry ultrasonic attenuation comparator is used. Micro-eddy currents or magnetic mechanisms account for the observed decrease in attenuation.

Subject Index No.—2.4.7

**A-32** Brock, G. W. and Sinclair, G. M.
ELEVATED-TEMPERATURE TENSILE AND FATIGUE BEHAVIOR OF UNALLOYED ARC-CAST MOLYBDENUM
Proc. Am. Soc. Testing Mats., Vol. 60, pp. 530–539, 1960.
Tension and rotating-bending fatigue tests were carried out over a range of temperatures. The fatigue strength/UTS ratio was fairly constant (.65–.72) over the range 75–875 F, and there was evidence of a knee in the S/N curve.

Subject Index Nos.—3.1.4.3, 3.5.4, 3.6.1.1

**A-33** Brosens, P. J.; Hakima, N. A. G.; and Khabbaz, G. R.
DETECTION OF FATIGUE DAMAGE WITH RAYLEIGH WAVES
ARL Tech. Rept. 60–307, Aug., 1960.
Some aspects of the fatigue process in metals are presented which indicate that the detection of fatigue damage by ultrasonic means must be based on concentration of ultrasonic energy at the surface of the examined metal. Rayleigh waves appear to be those of most interest. They offer the possibility of detecting both fatigue damage prior to crack formation and the fatigue cracks present after crack formation. These ultrasonic waves are, therefore, studied theoretically and experimentally. In the experiments, only low frequency waves (2 megacycles) were used hence crack detection was achieved but detection of fatigue damage prior to crack formation was not.

Subject Index No.—1.7.1

**A-34** Browner, R. H.
PROPERTIES AND MODES OF FAILURES OF ALUMINUM LAMINATES IN BENDING FATIGUE
Air Force Inst. of Tech., Wright-Patterson Air Force Base, Ohio, Master's Thesis, Aug., 1960 (Report No. GAE-Mech-60-2).

Laminate and solid sheet cantilever specimens of 1100–H18 aluminum alloy were vibrated in bending slightly below resonance; with failure defined as an increase in dynamic deflection. This method of detecting early fatigue damage proved extremely sensitive. Laminate sheet appeared to be inferior to solid sheet in bending fatigue at stress ranging from 9,000 psi to 15,000 psi. Laminates failed by cracks in plies, which were discontinuous at adhesive layers, rather than by delamination. The foil grain orientation and the number of foil plies (12 or 13) of the laminate have no apparent effect on the fatigue life.

Subject Index No.—4.1.5

**A-35** Burley, C. E.
FATIGUE CHARACTERISTICS OF EC AND 5005 ALLOY ALUMINUM WIRE
Power Systems, No. 51, pp. 789–792, Dec., 1960.

Fatigue testing of Al-O 8 per cent Mg alloy cable using a rotating buckling machine to determine stress-lifetime curves. Fatigue strength, fatigue limit and ratio of fatigue limit to tensile strength are compared for the two types of wire.

Subject Index Nos. 4.1.3.4, 4.2.1, 4.11

**A-36** Campbell, J. E.
NOTES ON MECHANICAL TESTING TECHNIQUES AT VERY LOW TEMPERATURES
DMIC, Battelle Mem. Inst., Memo. No. 43, Feb. 19, 1960.

Discusses hardness tests, impact tests, tensile tests, fatigue tests, torsion tests and strain measurement at low temperatures.

Subject Index Nos.—1.8, 1.6.1.2

**A-37** Campion, D. J. and Morgan, C. J.
THE EFFECT OF ELECTROLESS ("KANIGEN") NICKEL PLATING ON THE FATIGUE STRENGTH OF STEEL
ARDE Memo. No. (MX) 60/60 (suppl. to ARDE Memo. No. (MX) 25/58, AD-159, 409) Oct., 1960.

"Kanigen" nickel deposits heat-treated to give maximum hardness reduced the fatigue strength of S.99 steel by approximately 68 per cent. The use of such coatings on strong steels which have to withstand high fatigue stresses cannot therefore be recommended. The internal stress of the deposits was approximately 7 ton/sq in. (tensile) "as plated" and 5 ton/sq in. (tensile) after heat-treatment.

Subject Index No.—2.4.8.1

**A-38** Carman, C. M.
FATIGUE PROPERTIES OF ULTRA-HIGH-STRENGTH STEELS
Pitman-Dunn Labs, Frankford Arsenal, Rept. No. R-1562, June, 1960.

The rotating beam fatigue properties of 18 ultra-high-strength low-alloy steels were investigated. The results were interpreted in terms of tempering temperature, composition, and fatigue strength-tensile or yield strength ratio. It is concluded that: (1) For steels with less than 0.4 per cent silicon, the maximum fatigue strength was generally obtained at the lowest tempering temperature used, either 350 or 400 F. The fatigue strength of high-silicon steels remained approximately constant for tempering temperatures up to 600 F. (2) All of the steels containing 1.3 per cent copper showed higher maximum fatigue strength than the other steels when all were tempered at 400 F or lower. (3) For steels of similar alloy content, there is a decrease in the fatigue strength-tensile strength ratio with increasing carbon content. (4) Subsurface nucleation of fatigue cracks was prevalent in steels with the best fatigue properties. (5) The fatigue strength-yield strength ratio is greater for steels containing copper as a major constituent. It is recommended that: (a) The factors that contribute to the high fatigue strength of copper bearing steels be investigated more fully for application to non-copper bearing steels having greater ductility; and (b) Efforts be made to improve the ductility of copper bearing steels.

Subject Index Nos.—2.1.4.3, 2.11

**A-39** Carroll, K. D.
BERYLLIUM CRACK PROPAGATION AND RELATED STUDIES
Lockheed Aircraft Corp., SB 60-30: Aug. 24, 1960.

A total of 141 bibliographic references were selected for Be crack propagation studies and are divided into 3 parts, the last being applicable to metals in general. 1. Be Crack Propagation and Fracture Investigations: Fifteen references are concerned with the mechanics of stress origin and development in Be. Effects of structure, processing, surface conditions, temperature and impurities are included. 2. Mechanical Properties of Be Related to Crack or Fracture Tendencies: Forty-two references are concerned with deformation, elasticity, and tensile properties of Be (including single and polycrystalline specimens, alloys and compounds). Effects of impurities, processing and temperature are analyzed. 3. Theory and Analysis of Crack Propagation and Structure: Mathematical and theoretical analyses of metal stresses caused by such factors as heating, loading, processing, corrosion, and impurities are included in 84 references. These references were selected as sources of information potentially applicable to Be alloys.

Subject Index No.—8.7.2

**A-40** Carter, T. L. and Zaretsky, E. V.
ROLLING-CONTACT FATIGUE LIFE OF A CRYSTALLIZED GLASS CERAMIC
NASA, TND-259, p. 35, March, 1960.

The five ball fatigue tester was used to evaluate a crystallized glass ceramic (Pyroceram 9608), a potential high-temperature bearing material, with respect to rolling-contact fatigue life. Controlled variables, included ball loading (contact stress), contact angle, ambient temperature, test lubricant, and specimen fabricator. These tests indicated that the crystallized glass ceramic may be useful in low-load, short-duration applications where an operating temperature above the limits of steels is the paramount design consideration.

Subject Index No.—10.10.2.2

**A-41** Carter, T. L.; Zaretsky, E. V.; and Anderson, W. J.
EFFECT OF HARDNESS AND OTHER MECHANICAL PROPERTIES ON ROLLING-CONTACT FATIGUE LIFE OF FOUR-HIGH-TEMPERATURE BEARING STEELS
NASA TND-270, 51 pp., March, 1960.

Testing of AISI M-1, AISI M-50, Halmo and WB49 alloy steels by means of a fatigue spin rig and five-ball fatigue tester at 800,000 psi maximum compressive stress to determine elastic limit, yield strength, wear and plastic deformation.

Subject Index Nos.—2.10.2.2, 3.2.1, 3.6.1, 3.10.2.2

**A-42** Cers, A. E. and Blatherwick, A. A.
FATIGUE AND STRESS RUPTURE PROPERTIES OF INCONEL 713C, V-57C AND TITANIUM ALLOYS 7Al-3Mo-Ti AND MST 821 (8Al-2Cb-1Ta-Ti)
WADD, Tech. Rept. 60-426, July, 1960.

Fatigue rupture and creep data at various temperatures obtained at various alternating and mean stress combinations are presented for the alloys Inconel 713C, V-57C (modified Super A-286), 7Al-3Mo-Ti and MST 821 (8Al-2Cb-1Ta-Ti). The tests were performed on unnotched specimens and for Inconel 713C also on notched specimens having a theoretical stress concentration factor of 2.9. The data are presented as S-N curves and stress-range diagrams to show the effect of temperature, ratio of alternating-to-mean stress, stress magnitude and specimen notch on the fatigue and rupture properties.

Subject Index Nos.—3.1.4.4, 3.3.4, 3.5.2, 3.6.1, 7.1.4.4, 7.3.4, 7.5.2, 7.6.1

**A-43** Chang, J. C.; Heer, F. J.; and Sweet, J. W.
MODIFIED 4340, HEAT TREATED TO 270,000 TO 300,000 ULTIMATE
Metal Progress, Vol. 78, pp. 104–110, Nov., 1960.

Steels made by three methods—basic electric, vacuum induction and consumable arc—were studied and their longitudinal and transverse properties evaluated as well as their toughness and fatigue resistance both statically and dynamically.

Subject Index Nos.—3.2.3, 3.11

**A-44** Chinn, J. L.
DEVELOPMENT AND APPLICATION OF FATIGUE ANALYSIS TO AIRCRAFT FASTENERS
SAE Natl. Aero. Meeting, Los Angeles, Oct. 5–9, 1960, preprint 108T.

Presentation of the features covered by the final fatigue test specification; test machines, specimen holding fixtures, standard fatigue test nuts, the test set-up, test loads and conditions, test reports, and inspection requirements of fatigue test specimens. A comparative evaluation of alloy titanium and steel fasteners, and new developments in fatigue test methods and equipment are included.

Subject Index Nos.—1.8.1, 1.8.2, 2.10.1.2, 7.10.1.2

**A-45** Chironis, N. P.
55 PER CENT THREAD DEPTH WILL MAKE BERYLLIUM BOLTS PRACTICAL
Prod. Engg., Vol. 31, No. 47, pp. 75–77, Nov. 14, 1960.

Subject Index Nos. 8.3.4, 8.10.1.2

**A-46** Clock, L. S.
MODIFIED GOODMAN DIAGRAMS SIMPLIFY THE ANALYSIS OF FATIGUE STRENGTH
Machine Design, Vol. 31, pp. 167–169, Oct. 15, 1959; Aero/Space Eng., p. 102, Jan., 1960.

How to construct and use modified Goodman diagrams for maximum stress determinations with fluctuation and steady loads.

Subject Index Nos. 1.5.2, 1.9.4

**A-47** Cochardt, A.
DEVELOPMENT OF A FERROMAGNETIC COBALT-BASE HIGH TEMPERATURE ALLOY
Trans. Am. Soc. Metals, Vol. 52, pp. 914–928, 1960.

A number of alloys precipitation hardened with titanium and containing 62 to 88 per cent cobalt were made in an effort to develop a new blade material for turbines and compressors. Material of optimum composition has 22–24 per cent nickel, 1.8–2.0 per cent titanium, 0.15–0.25 per cent aluminum and balance cobalt. At 1200 F the fatigue strength of these alloys was 40,000 psi at $10^8$ cycles as determined on round specimens tested on an electro-dynamic fatigue machine operated at 120 cycles per second. Damping, aging characteristics, creep, and oxidation resistance are also reported.

Subject Index Nos.—3.1.4.2, 3.1.4.4, 3.6.1.1, 3.11

**A-48** Coffin, L. F., Jr.
THE STABILITY OF METALS UNDER CYCLIC PLASTIC STRAIN
Trans. Amer. Soc. Mech. Engrs., Series D, Journal of Basic Engineering, Vol. 82, No. 3, pp. 671–682, Sept., 1960.

It was observed that under certain conditions, materials subjected to cyclic plastic strain showed little stability to simultaneously imposed steady stresses. Describes and interprets some experiments undertaken to learn more about this behavior of real materials.

Subject Index Nos.—1.5.3, 1.6.5

**A-49** Cornet, I. and Gorum, A. E.
THE OBSERVATION OF FATIGUE PROCESSES IN MgO SINGLE CRYSTALS
Trans. Amer. Inst. Mining, Met., Petrol. Engrs., Vol. 218, No. 3, pp. 480–485, June, 1960.

Subject Index Nos.—10.1.2, 10.1.5

**A-50** Cory, W. E.; Owen, T. E.; and Rollwitz, W. I.
DETECTION OF LATENT FATIGUE IN METALS AND ALLOYS
Southwest Research Inst., San Antonio, Texas; ASTIA AD-240 472L; Contract No. as 59-6202-C.

Subject Index No.—1.7.1

**A-51** Cummings, H. N.
SOME QUANTITATIVE ASPECTS OF FATIGUE OF MATERIALS
WADD Tech. Rept. 60-42, July, 1960. PB 171 084.

In this report are given not only the fatigue properties of many structural materials but also the "static" properties and such other supplementary information as was given in the references consulted. The data are in general from room temperature tests, but a few data are given on tests at higher temperatures. The data are presented in tables and on curves, supplemented by brief discussions in the text.

Subject Index Nos.—1.6.1.1, 1.11

**A-52** D'Amato, R.
A STUDY OF THE STRAIN-HARDENING AND CUMULATIVE DAMAGE BEHAVIOR OF 2024-T4 ALUMINUM ALLOY IN THE LOW-CYCLE FATIGUE RANGE
WADD Tech. Rept. 60-175, 108 p., April, 1960.

An experimental fatigue investigation in the range of life between 1 and 10,000 cycles to failure was conducted with a series of round tapered specimens of 2024-T4 aluminum alloy. The specimens had a minimum diameter of 0.356 in. and a maximum diameter of ¾ in. with taper radii of 1½, 0.6 and 0.3 in. Cycling tests were carried out between limits of local strain based upon the change in diameter at the minimum section or strain across the specimen based upon the change in length of the tapered section. Fatigue data for each of the three specimen types can be represented by two straight line segments when range of strain was plotted against cycles to failures on log-log scales. One line segment covered the life range 44 to 1000 cycles and the other above 1000 cycles. When the data for each of the configurations were normalized with respect to its

**A-52** (*continued*)
local strain at failure in a static tensile test, all of the data were represented by the same two straight line segments. Using data from the literature for the endurance range above 10,000 cycles to failure, the entire fatigue range from 1 to 107 cycles to failure was discussed. The fatigue behavior at zero mean strain of the 0.6 inch radius specimens in terms of range of local strain is directly related to that determined by cycling the specimens between fully reversed limits of strain across the specimen. The strain-hardening behavior of the three configurations was compared and effects of mean strain and rate of straining were considered. The relationship between the appearance of the fracture surfaces and the endurance of the specimens was discussed.
Subject Index No.—4.6.5

**A-53** Dinerman, A. E.
CYCLIC STRAIN FATIGUE OF INCONEL AT 75 TO 600 F
U.S. AEC Res. Dev. Rept. KAPL-2084, Aug. 15, 1960.
High-strain, low-cycle fatigue tests were carried out on annealed Inconel rod at 75, 200, 400, and 600 F (25, 95, 205, and 315 C). Fatigue strength increases with temperature up to 400 F and then decreases between 400 and 600 F. The increase in strength is considered to be due to the strain-aging tendency of Inconel. Within the temperature range covered by the tests, a plot of total-strain/cycles-to-failure shows that the strain-fatigue strength of Inconel is in the same order of magnitude as that of AISI-type 347 stainless steel.
Subject Index Nos.—3.6.5, 3.6.1.1, 8.6.1.1, 8.11

**A-54** Dinerman, A. E.
CYCLIC STRAIN FATIGUE OF INCONEL UP TO 600 F
U.S. AEC Res. Dev. Rept., Paper from "Reactor Technology Rept. No. 12—Metallurgy," KAPL-2000-9, pp. B10–B14, March, 1960.
Annealed Inconel rod specimens are cycled in tension and compression at 75–600 F. Fatigue strength and tensile properties are compared with properties of annealed and aged Inconel tubing. An increase in resistance to strain fatigue to 400 F is indicated, this being attributed to strain aging.
Subject Index Nos.—8.6.1.1, 8.11

**A-55** Donkle, L. B.
HOW TO AVOID METAL HOSE FAILURES
Prod. Engg., Vol. 31, No. 30, pp. 43–48, July 25, 1960.
Design considerations for selection of metal hose for high-temperature, high-pressure flexing applications. Failure as influenced by fatigue, corrosion, temperature, internal pressure, external abuse and wall thickess. Physical and mechanical properties of typical hose materials (that is, stainless steel and Cu and Ni alloys).
Subject Index Nos.—1.9.1, 1.10.2, 3.9.3, 5.9.3, 8.9.3

**A-56** Dood, R. A.
TENSILE FATIGUE MACHINE FOR TESTING WIRES AND SINGLE CRYSTALS
Rev. Scientific Instruments, Vol. 31, pp. 69–70, Jan., 1960.
Equipment has a wide frequency range and ability to approach the maximum fatigue stress at any desired rate.
Subject Index No.—1.8.1

**A-57** Evans, U. R.
CORROSION FATIGUE
"The Corrosion and Oxidation of Metals" (book), Ch. 17, pp. 701–730, 1960.
Subject Index Nos.—1.4.5, 1.4.6.2, 1.4.8, 1.6.2

**A-58** Favor, R. J.; Grover, H. J.; and Achbach, W. P.
FATIGUE DATA ON PRECIPITATION-HARDENABLE STAINLESS STEELS
DMIC Memo. 46, Battelle Mem. Inst., PB 161 196, AD-234 805, March 11, 1960.
Semiaustenitic steels constitute one group of commercial precipitation-hardenable stainless steels. Steels of this group have the characteristic of being austenitic in the solution-annealed condition and martensitic after aging and heat treatment. Some commercial alloys of this group for which fatigue data are available are 17-7PH, AM 350, and AM 355. Fatigue notch sensitivity of the 17-7PH appears comparable with corresponding values for some common steels and for some aluminum alloys.
Subject Index Nos.—3.2.1, 3.11

**A-59** Feltner, C. E. and Morrow, J. D.
MICRO-PLASTIC STRAIN HYSTERESIS ENERGY AS A CRITERION FOR FATIGUE FRACTURE
Am. Soc. Mechanical Engrs., Paper No. 60-MET-2, 1960.
An analytical relation existing between stress amplitude and fatigue life is derived and compared with experimental results. The analysis compares well with the S-N curve for 4340 steel.
Subject Index No.—2.1.5

**A-60** Findley, W. N.; Szczepanski, E.; Mathur, P. N.; and Temel, A. O.
ENERGY VERSUS STRESS THEORIES FOR COMBINED STRESS-FATIGUE EXPERIMENT USING A ROTATING DISC
Am. Soc. Mechanical Engrs., Paper No. 60-MET-1, Jan. 25, 1960.
A circular Al disk, loaded along a diameter by pilot pad bearings, is rotated under a constant load to produce fluctuation in stresses at the disk center while maintaining a constant strain energy. Fatigue cracks developing in the region of constant strain energy indicate that a concept of a fluctuating strain energy as a basic theory of failure by fatigue under combined stresses is not tenable.
Subject Index Nos.—4.1.5, 4.5.3

**A-61** Fletcher, E.
SELECTED INFORMATIVE ABSTRACTS ON THERMAL SHOCK AND THERMAL FATIGUE OF COBALT ALLOYS AND CERMETS
Cobalt Info. Center, Battelle Memorial Institute, pp. 1–66, 1960.
Covers the period 1938 to early 1960. Includes a short discussion of the ways in which changes in stress or temperature modify the constant-stress-and-temperature behavior of metals.
Subject Index Nos.—8.6.5, 10.6.5

**A-62** Form, G. W.
A STUDY OF THE RELATIONSHIP BETWEEN STATE OF AGING AND NOTCH-FATIGUE PERFORMANCE OF A HIGH STRENGTH ALUMINUM ALLOY
Trans. Am. Soc. Metals, Vol. 52, pp. 514–529, 1960.
The fatigue performance of notched specimens machined from age-hardenable extruded copper-aluminum alloy rod (Alloy No. 2014) was studied in relation to the state of aging. The tests were made on an axial loading type of vibrator under a nominal stress of 28,500 psi at room temperature and at −110 F. The results obtained indicate that the poor fatigue to tensile strength ratio of high strength aluminum alloys is not invariably associated with overaging taking place during alternating loading. In other words the author's tests show that the relatively low fatigue resistance of high strength aluminum

alloys is primarily attributable to inherent properties of the material before it is subjected to cyclic stressing and not to stress-induced weaknesses of the structure.

Subject Index Nos.—4.1.5, 4.2.6, 4.6.1.2

**A-63** Forney, D. M., Jr.
EXPERIMENTAL TECHNIQUES AND EQUIPMENT FOR ACOUSTICAL FATIGUE RESEARCH AND DEVELOPMENT
Am. Soc. Testing Mats. Spec. Tech. Publ., "Symposium on Acoustical Fatigue", STP No. 284, pp. 54–65, March, 1961.

Review of techniques used for airframe structures, high intensity siren, jet engine or test bed aircraft, cold air jet and air stream modulator.

Subject Index Nos.—1.6.7, 1.8.1, 1.8.2, 4.6.7

**A-64** Forney, D. M., Jr.
ACOUSTICAL FATIGUE TEST PROCEDURES
Noise Control, Vol. 6, No. 1, pp. 11–21, 49, Jan.–Feb., 1960.

Survey of test facilities in which both the direction of propagation of the sound wave can be controlled to some degree and the necessary high sound intensities can be produced. Some of the variations found in equipment design and use, test techniques and objectives, and analysis objectives which characterize the state-of-the-art in the aircraft industry are discussed.

Subject Index Nos.—1.6.7, 1.8.1, 1.8.2

**A-65** Forney, D. M., Jr. and Wang, D. Y.
INVESTIGATION OF THE UNNOTCHED AND NOTCHED FATIGUE BEHAVIOR OF SEVERAL HEAT RESISTANT MATERIALS FOR ENGINE BOLTS
WADD Tech. Rept. 59-25, 59 pp., Feb. 1960, AD-236 684, PB 161 930.

An investigation of the fatigue behavior of $\frac{3}{8}$ in. engine bolts at various temperatures is described for the heat resistant alloys AMS 5735 (A-286), Udimet 500, Inconel 700 and Incoloy 901. Tests were also performed under axial stress on unnotched fatigue specimens and fatigue specimens with a theoretical stress concentration factor of 3.4. The data are presented as S-N diagrams to show the effect on fatigue strength of temperature, stress concentration, stress magnitude and bolt thread rolling. The results of this investigation suggest the possibility of using fatigue test data obtained with single notched specimens to evaluate other heat resistant alloys for possible engine bolt applications thereby reducing the significant expense of fabrication of experimental lots of bolts for test.

Subject Index Nos.—3.3.4, 3.4.5, 3.5.2, 3.6.1.1, 3.10.1.2

**A-66** Forsyth, P. J. E. and Stubbington, C. A.
THE STRUCTURE OF SLIP BAND EXTRUSION REVEALED BY TRANSMISSION ELECTRON MICROSCOPY
Acta Met., Vol. 8, pp. 811–814, Nov., 1960.

Subject Index Nos.—4.1.5

**A-67** Foster, L. R., Jr. and Whaley, R. E.
FATIGUE INVESTIGATION OF FULL-SCALE TRANSPORT-AIRPLANE WINGS-TESTS WITH CONSTANT AMPLITUDE AND VARIABLE-AMPLITUDE LOADING SCHEDULES
NASA TN D-547, 38 pp., Oct., 1960.

Six fatigue tests were conducted on C-46 airplane wings: Two tests at a high constant-amplitude load, two tests with loading schedules based on gust-frequency statistics, and two tests with loading schedules developed from maneuver-loads statistics. The results are presented, discussed, and compared with previously published data from other tests in this series.

Subject Index Nos.—4.7.3.5, 4.10.3

**A-68** Frankel, H. E.; Bennett, J. A.; and Carman, C. M.
FATIGUE PROPERTIES OF SOME HIGH-STRENGTH STEELS
Proc. Am. Soc. Testing Mats., Vol. 60, pp. 501–511, 1960.

Rotating-beam fatigue strengths ($10^5$ cycles) of 18 high-strength low-alloy steels were determined at various hardness levels (UTS 225,000–309,000 psi). Generally the maximum fatigue strength was obtained at the lowest tempering temperature. Best results were given by steels containing 1.3 per cent copper.

Subject Index Nos.—2.2.1.1, 2.2.5.1, 2.2.6

**A-69** Frankel, H. E.; Bennett, J. A.; and Holshouser, W. L.
EFFECT OF OLEOPHOBIC FILMS ON METAL FATIGUE
Journ. Res. Nat. Bur. Stds.—C. Engineering and Instrumentation, Vol. 64 C, No. 2, April–June, 1960.

The fatigue strengths of a low-alloy steel, a magnesium alloy, and a copper-beryllium alloy were increased by coating the specimens with certain polar organic compounds. Also the dispersion of the results was much less for coated specimens of these materials than for clean ones. Similar tests showed no effect with titanium or 6061 aluminum alloy, and only a slight improvement for 17-7 PH stainless steel.

The full beneficial effect of the coatings was found only with compounds having a carbon chain of at least twelve, and this effect was not significantly reduced when the coated specimens were tested in water. Organic solvents (benzene and xylene) had a deleterious effect on the fatigue life of materials that were improved by oleophobic coatings.

It is suggested that the effect of the coatings is principally due to their ability to present a barrier to water and oxygen molecules.

Subject Index Nos.—2.4.8.2, 3.4.8.2, 4.4.8.2, 5.4.8.2, 6.4.8.2, 7.4.8.2

**A-70** Frankel, H. E.; Bennett, J. A.; and Pennington, W. A.
FATIGUE PROPERTIES OF HIGH STRENGTH STEELS
Trans. Am. Soc. Metals, Vol. 52, pp. 257–276, 1960.

The influence of a number of metallurgical variables on the fatigue properties of high strength steels is reported. Four steels—SAE 4340, Toga, Deward and SAE 52100—ranging in carbon content from 0.44 to 1.06 per cent—were used in this investigation. Their fatigue strengths, after a number of quenching and tempering conditions, were determined from tests on rotating beam specimens. To avoid changes in the structure at the surface that might obscure the effects of the variables being studied all specimens were heat treated after final finishing.

Since the authors observed that the fatigue strength was a nearly linear function of hardness up to some limiting value, it was possible to adjust the data to a single hardness value in order to determine the effect of other variables. There was no significant difference between marquenched specimens and those that were direct quenched. The presence of increasing amounts of austenite, up to 10 per cent, lowered the fatigue strength. This deleterious effect was apparently due to the transformation of some of the austenite during fatigue stressing.

Subject Index Nos.—2.1.4, 2.2.2, 2.2.6

**A-71** Freudenthal, A. M.
FATIGUE OF STRUCTURAL METALS UNDER RANDOM LOADING
Am. Soc. Testing Mats. Spec. Tech. Publ., "Symposium on

**A-71** (*continued*)

Acoustical Fatigue," 1960, STP 284, pp. 26–44, March, 1961.

Mainly a theoretical approach to the "interaction" between infrequent high stress amplitudes and the dominant low stress amplitudes, and the development of an "interaction factor" for the evaluation of cumulative damage. Distributions of fatigue lines under random and under constant loading are compared.

Subject Index Nos.—1.7.3, 1.8.3, 1.12.1

**A-72** Freudenthal, A. M.
PREDICTION OF FATIGUE LIFE
J. App. Phys., Vol. 31, pp. 2196–2198, Dec., 1960.

On the basis of the relation between the "reliability-function" and the "risk" of failure (as a function of age), the physical interpretation of the latter can be used to extrapolate the former beyond the range of possible observation. It is shown that the asymptotic distribution of smallest values is compatible with the physical concept of (dynamic or static) fatigue, while the logarithmic-normal distribution is not.

Subject Index Nos.—1.8.3.2, 1.12.1

**A-73** Freudenthal, A. M. and Heller, R. A.
ON STRESS INTERACTION IN FATIGUE AND A CUMULATIVE DAMAGE RULE. II-7075 ALUMINUM ALLOY
WADD, Tech. Rept. 58–69, Part II, 17 pp., Jan., 1960, AD 234,448 PB161, 837.

Investigation to determine the effects of stress interaction, under randomized stress distributions representing gust and maneuver loads on aircraft wings, on the fatigue life of 7075 aluminum alloy specimens. On the basis of numerous rotating bending fatigue tests, it is demonstrated that the linear cumulative damage rule does not provide a safe fatigue life estimate of unnotched specimens. A nonlinear rule representing the test results fairly well is proposed.

Subject Index No.—4.7.3.5

**A-74** Gatewood, B. E.
THE PROBLEM OF STRAIN ACCUMULATION UNDER THERMAL CYCLING
J. Aero/Space Sci., Vol. 27, pp. 461–462, June, 1960.

Presentation of a method to account for strain growth occurring in a beam structure subject to temperature-load cycling. The various aspects of the problem as to criteria for convergence and divergence of the strain accumulation are demonstrated by thermal-cycling one element of a two-element structure.

Subject Index No.—1.6.1, 1.6.5, 1.7.3

**A-75** Gohn, G. R. and Fox, A.
THE R. R. MOORE ROTATING BEAM FATIGUE TEST
Proc. Am. Soc. Testing Mats., Vol. 60, pp. 560–576, 1960.

Rotating-beam fatigue tests were made on two lots of hard-drawn phosphor bronze rod in an investigation of the effect of specimen finish. Little correlation was observed between the surface roughness and the fatigue strength, and the primary source of variation appeared to be associated with the polishing operation.

Subject Index Nos.—5.4.2, 5.4.3

**A-76** Golding, W.
EVALUATION OF BORON TREATED STEELS HEAT TREATED TO HIGH STRENGTH LEVELS
U.S. Naval Air Material Center, Aeronautical Materials Lab., Phila., Pa.; TED AE 4140; Rept. No. NAMC AML AE 1107; AD 239 607; Feb., 1960.

The mechanical metallurgical properties of 98B40 and 81B40 modified boron treated steels heat treated to a strength level in the range 260,000 to 280,000 psi were determined and compared with available published data on conventional AISI 4340 and 4140 grade steels heat treated to the same strength level. In general, except for a slightly lower fatigue strength, the high analysis 98B40 boron steel exhibited mechanical and metallurgical properties comparable to the conventional AISI 4340 steel. The comparison of 81B40 boron steel with AISI 4140 is less conclusive because of the lack of available published data on the latter steel in the strength range investigated.

Subject Index No.—2.11

**A-77** Grosskreutz, J. C.
RESEARCH ON THE MECHANISMS OF FATIGUE
WADD Tech. Rept. 60–313, April, 1960.

Based on a critical appraisal of existing fatigue theory and experimental data, significant research areas have been outlined for the study of fatigue mechanisms. Polycrystalline aluminum and copper and single crystals of aluminum have been used to investigate dislocation densities and configurations during crack initiation and the mechanism by which cracks propagate, both on the surface of a sample and internally. Back reflection X-ray patterns show that an observable increase in dislocation density occurs within the first 0.1 per cent of fatigue life and that a saturation density is reached after only 1 per cent of the life. These dislocations accumulate into stable subgrain boundaries provided either that the stressing is done under a tensile preload or that the amplitude of symmetrical stressing is large enough. For small symmetrical loading (strains $\sim$0.001 for Al) a random dislocation array results with no subgrain formation. These results can be correlated with fatigue hardening behavior and possibly with the shape of the S-N curve. There is no obvious relation between the bulk behavior of fatigue induced dislocations and the formation of the initial fatigue crack which is a highly localized phenomenon.

Subject Index Nos.—4.1.2, 4.1.5, 5.1.5

**A-78** Grosskreutz, J. C. and Gosselin, C. M.
SURFACE DEFORMATION OF ALUMINUM IN FATIGUE
J. App. Phys., Vol. 31, pp. 1127–1128, June, 1960.

Subject Index No.—4.1.5

**A-79** Grover, H. J.
AN OBSERVATION CONCERNING THE CYCLE RATIO IN CUMULATIVE DAMAGE
Am. Soc. Testing Mats. Spec. Tech. Publ., "Symposium on Fatigue of Aircraft Structures—1959," STP No. 274, pp. 120–124, June, 1960.

A cumulative damage hypothesis of damage leading to crack initiation and damage of crack propagation together with Miner's cycle ratio relation provide a life estimate for structural components.

Subject Index Nos.—1.7.2, 1.7.3, 1.12.1

**A-80** Gurney, T. R.
HOW DESIGN CAN EFFECT THE FATIGUE OF WELDED STRUCTURES
Welding Fabrication Design, Vol. 3, pp. 16–20, April, 1960.

Effect of stress concentrations and notches on fatigue strength. Design of structural members to eliminate fatigue cracking.

Subject Index Nos.—1.3.4, 1.10.1.3

**A-81** Hamaker, J. C., Jr. and Vater, E. J.
CARBON:STRENGTH RELATIONSHIPS IN 5 PER CENT CHROMIUM ULTRA-HIGH-STRENGTH STEELS
Proc. Am. Soc. Testing Mats., Vol. 60, pp. 691–720, 1960.

The effects of carbon content and vacuum melting on the mechanical properties of 5.0 per cent chromium, 1.3 per cent molybdenum, 0.5 per cent vanadium ultra-high-strength steel were investigated between minus 320 and plus 1100 F. All compositions exhibited the soft annealed properties, deep air hardenability, high $M_s$ temperatures, and secondary hardening on tempering characteristic of the 0.40 per cent carbon production steel used for several years in the 220,000 to 300,000 psi ultimate strength range.

Vacuum melting resulted in marked improvements in ductility and toughness, surpassing variations in both carbon content and heat-treated strength level in effectiveness. Two potentially useful modifications of the commercial 0.40 per cent carbon steel were studied: a 0.20 per cent carbon grade capable of 260,000 psi ultimate strength with high ductility, hot strength, and potentially good weldability; and a 0.50 per cent carbon grade capable of 330,000 psi ultimate strength, 275,000 psi yield strength, with high fatigue and impact strength.

The importance of secondary hardening for the removal of retained austenite and residual stress, with resulting improvements in fatigue, notch, and transverse ductility properties, is discussed in the light of present trends to higher strength levels.

Subject Index Nos.—2.2.1.1, 2.2.6, 2.4.7, 2.6.1.1, 2.6.1.2

**A-82** Hammel, R. L. and Uhrig, R. E.
CREEP OF TANTALUM UNDER CYCLIC ELEVATED TEMPERATURES
U.S. Atomic Energy Comm., IS-125, 63 pp., April, 1960.

Subject Index No.—8.6.5

**A-83** Hammel, R. L. and Uhrig, R. E.
CREEP OF TANTALUM UNDER CYCLIC ELEVATED TEMPERATURES
U.S. AEC, Ames Lab., Ames, Iowa, IS-125, 62 pp., April, 1960.

An initial study was conducted on the effects of cyclic temperature variations of small amplitudes upon the creep properties of Ta. Results show a marked weakening of the material when a temperature variation of a few degrees is applied in a sinusoidal manner at a rate of one cycle per hour.

Subject Index No.—3.6.5

**A-84** Hanson, R. S.
GYROSCOPIC MACHINE YIELDS BETTER FATIGUE DATA
Prod. Engg., Vol. 31, No. 52, pp. 42–45, Dec. 19, 1960.

New version of rotating-beam tester uses gyroscopic moments to induce bending stress in specimen; eliminates stresses arising from bearing misalignment.

Subject Index No.—1.8.1

**A-85** Hardrath, H. F. and Naumann, E. C.
VARIABLE-AMPLITUDE FATIGUE TESTS OF ALUMINUM-ALLOY SPECIMENS
Am. Soc. Testing Mats. Spec. Tech. Publ., "Symposium on Fatigue of Aircraft Structures—1959", STP No. 274, pp. 125–137, 1960.

Two series of axial load and rotating-beam fatigue tests of 7075-T6 and 2024-T3 Al alloy specimens subjected to constant and varying amplitudes of stress. Data are compared on the basis of the cumulative-damage rule to study effects of sequence, mean stress, spectrum shape and frequency of repeating the load schedule.

Subject Index Nos.—4.5.2, 4.5.4, 4.7.3.5

**A-86** Hilliard, J. K. and Fiala, W. T.
HIGH INTENSITY SOUND
Missile Des. Devel., Vol. 6, pp. 18–21, July, 1960.

Discussion of testing techniques for evaluating the effects of high intensity sonic energy on missile systems, including determination of the nature of the sonic environment for simulation purposes, and equipment for vibration and sonic testing.

Subject Index Nos.—1.6.7, 1.8.1, 1.8.2

**A-87** Jankowsky, E.
EVALUATION OF NATIONAL RESEARCH CORPORATION VACUUM DEPOSITED ALUMINUM COATINGS
U.S. Naval Air Material Center Report No. NAMC-AML-AE 41104.1, Part II, June 15, 1960.

Type H-II tool steel, rotating beam fatigue specimens (260–280 ksi strength level) were tested with vacuum deposited aluminum coatings and after 168 hours exposure to 950 F. Groups of uncoated specimens were also tested before and after 168 hours at 950 F. The decrease in fatigue strength after high temperature exposure was considered due to diffusion of aluminum into the basis metal accompanied by the formation of low strength iron aluminum alloy.

Subject Index Nos.—2.2.6, 2.4.8.2

**A-88** Jankowsky, E.
EVALUATION OF NATIONAL RESEARCH CORPORATION VACUUM DEPOSITED ALUMINUM COATINGS
U.S. Naval Air Material Center Report No. NAMC-AML-1151, Nov. 7, 1960.

Aluminum coated, Type H-II tool steel, rotating beam fatigue specimens were heated at 750 F and 850 F for 168 hours and tested at room temperature. Results of these tests indicated that there was no appreciable decrease in fatigue limit due to 168 hours oxidation at 750 F or 850 F.

Subject Index Nos.—2.2.6, 2.4.8.2

**A-89** Kamperman, G. W. and Allen, C. H.
PERFORMANCE OF INTENSE ACOUSTIC FACILITY FOR FLIGHT VEHICLE AND ELECTRONIC RESEARCH
WADD Tech. Rept. 59-12, p. 42, March, 1960. PB 161 781.

A unique sonic failure research facility has been constructed for testing flight vehicle structures and electronic systems in the presence of high intensity sound. The siren sound source will produce pure tones or narrow bands of noise throughout the frequency range from 50 to 10,000 cps with controlled amplitude modulation from 0 to 50 cps. The maximum acoustic power output is 22,000 w to produce a sound pressure level of approximately 174 db in the 1 ft square progressive-wave test section. This report discusses the performance of the facility.

Subject Index Nos.—1.6.7, 1.8.1, 1.8.2

**A-90** Kaufman, J. G.
FATIGUE PROPERTIES OF BARE AND ALCLAD X2020-T6 SHEET AND EFFECT OF CONDITION OF SURFACE
ALCOA Report No. 9-60-1. Jan. 5, 1960.

The flexural fatigue properties of several lots of bare and alclad X2020-T6 sheet have been determined, with particular emphasis on the effect of surface condition on fatigue strength of the bare sheet. The fatigue strength of X2020-T6 may be

**A-90** (*continued*)

improved significantly, although not consistently, by polishing or machining the surface of the sheet.

Subject Index Nos.—4.4.1, 4.4.2, 4.11

**A-91** Kaufman, J. G. and Nelson, F. G.
AXIAL-STRESS FATIGUE PROPERTIES OF PLAIN AND WELDED 5454, 5086, 5083, AND 5456 PLATE AT ROOM TEMPERATURE AND 320 F
ALCOA Report No. 9-60-24, June 6, 1960.

The axial-stress fatigue strengths of plain and welded plate of several aluminum-magnesium alloys were found to be 10 to 40 per cent higher at −320 F than at room temperature, which is similar to differences in tensile properties.

Subject Index Nos.—4.6.1.2, 4.10.1.3

**A-92** Kee, H. L.
ALLOWABLE STRESSES IN FLASH-WELDED JOINTS
Prod. Engg., Vol. 31, No. 45, pp. 39–42, Oct. 31, 1960.

How to correlate fatigue data with magnetic inspection to give practical values.

Subject Index Nos.—2.9.3, 2.10.1.3

**A-93** Kemsley, D. S.
OBSERVATIONS ON THE WORK HARDENING OF ZINC CRYSTALS IN ALTERNATING TENSION AND COMPRESSION
Acta Met., Vol. 8, pp. 740–743, Oct., 1960.

Subject Index Nos.—8.1.2, 8.1.4

**A-94** Kemsley, D. S. and Paterson, M. S.
THE INFLUENCE OF STRAIN AMPLITUDE ON THE WORK HARDENING OF COPPER CRYSTALS IN ALTERNATING TENSION AND COMPRESSION
Acta Met., Vol. 8, pp. 453–467, July, 1960.

For a given cumulative strain, the work hardening of copper crystals in alternating straining is always less than in a tensile test. At a plastic-strain amplitude of 0.0001, the hardening is very low and nearly the same for all orientations. For larger amplitudes the behavior varies widely with orientation; in general, the rate of work hardening increases steadily with strain amplitude, but for orientations away from [110] there is a sharp increase in hardening rate above a certain amplitude. In this rapid hardening stage, prominent secondary slip is observed, which is otherwise absent.

Subject Index Nos.—5.1.2, 5.1.4, 5.6.5

**A-95** Ketcham, S. J.
ANODIC COATINGS ON MAGNESIUM
U.S. Naval Air Material Center, Phila., Pa., Aeronautical Materials Laboratory Report NAMC AML AE 1113, Jan., 1960.

A study of the properties of anodized coatings applied to a wrought magnesium alloy AZ31B, has been conducted. Results indicate that these coatings increase the resistance of magnesium to corrosion, thermal shock, and wear, and are with one exception, excellent bases for paint. All reduce the fatigue strength of the base metal, reductions ranging from 6–27 per cent.

A similar study of anodized coatings on two magnesium sand alloys, AZ91C and EZ33A is in progress and will be completed in the near future.

Subject Index No.—6.4.8.2

**A-96** Klesnil, M.
FATIGUE BREAKDOWNS IN CARBON STEELS
Metal Treatment and Drop Forging, Vol. 27, pp. 503-610, Dec., 1960.

Use of tensometers to measure the amplitude of deformation and stress. Changes in structure are studied by X-ray diffractography. In the elastically plastic zone hardening is pronounced; in the phenomenologically elastic zone, which covers almost the whole course of the Wohler curve, no hardening is established.

Subject Index Nos.—2.1.5, 2.7.1, 2.8

**A-97** Kropschot, R. H.
THE MECHANICAL PROPERTIES TESTING PROGRAM AT THE NBS-AEC CRYOGENIC ENGINEERING LABORATORY
Paper from "Advances in Cryogenic Engineering," Vol. 1, Plenum Press, pp. 235–241, New York, 1960.

Mechanical tests, including tension, impact, fatigue and hardness, at temperatures down to 20 K, on face-centered-cubic metals and alloys, such as austenitic stainless steels, Ni alloys, Cu and Al alloys.

Subject Index Nos.—2.11, 3.11, 4.11, 5.11

**A-98** Kuguel, R.
THE RELATION BETWEEN THE THEORETICAL STRESS CONCENTRATION FACTOR $K_t$, AND THE FATIGUE NOTCH FACTOR $K_f$, ACCORDING TO THE HIGHLY STRESSED VOLUME APPROACH
TAM Dept. Report No. 184, Univ. Ill., Dec., 1960.

A study was made of the relation between the theoretical stress concentration factor $K_t$, and the fatigue notch factor $K_f$. A relation for $K_f$ is given in terms of $K_t$, the root radii of the notched and unnotched specimens, deduced from the "highly stressed volume" analysis considered in another paper.

A study of available experimental data indicated that the statistical scatter of values of $K_f$ was large. A region based on the proposed relation for $K_f$ and a ±10 per cent scatter band included 78 per cent of the data examined, 112 determinations of $K_f$ from rotating bending experiments. The relation for $K_f$, based on only the geometry of the members, is proposed as a simple adequate relation for use in design.

Subject Index Nos.—1.3.4, 1.12.1

**A-99** Kull, F. R.
WHAT ABOUT FASTENER FATIGUE?
Assembly and Fastener Engineering, Vol. 3, No. 10, p. 55, Oct., 1960.

Article discusses in general terms fatigue of fasteners.

Subject Index No.—1.10.1.2

**A-100** Lardenoit, V. F.
EFFECTIVE STRESS CONCENTRATION FACTORS FOR FLIGHT VEHICLE MATERIALS UNDER VARIOUS CONDITIONS DURING FATIGUE TESTING
WADD Tech. Rept., 60–419, Oct., 1960.

This report presents in the form of tables and curves, the effective stress concentration factors, $K_f$, for a number of aircraft materials subjected to various conditions during fatigue testing. The influence on $K_f$ is shown for such parameters as temperature, stress ratio, specimen size, direction of testing, test frequency, fabrication of notches, heat treatment, grain size, and for titanium and its alloys, interstitial constituents and hydrogen level.

Because $K_f$ is sensitive to so many variables, no attempt is made to relate it to any of the above listed parameters.

Subject Index Nos.—7.2.1.2, 7.2.2.1, 7.2.6, 7.3.1, 7.3.4, 7.4.1, 7.5.1, 7.5.2, 7.6.1

**A-101** Lehrer, W. M. and Schwartzbart, H.
STATIC AND FATIGUE STRENGTH OF METALS SUBJECTED TO TRIAXIAL STRESSES
Proc. Am. Soc. Testing Mats., Vol. 60, pp. 610–626, 1960.

The objectives of this program were: (1) the determination of the effect of triaxial stresses on fracture in static and dynamic loading and (2) determination of the brittle fracture strength of metal in the absence of any preceding plastic flow. To achieve these objectives, use was made of a composite brazed specimen consisting of a thin disk of soft metal between cylinders of hard metal. When a load is applied to the brazed bars, a triaxial stress condition is created due to the plastic restraint on the metal by the harder steel cylinder interfaces.

The static tensile strength of silver butt brazements in 4340 steel increases with decreasing joint thickness because of increasing triaxiality of stress, reaches a maximum at a joint thickness of $1.5 \times 10^{-4}$ in., and falls to a relatively constant value.

The fatigue life of silver-brazed butt joints in 4340 steel increases continuously with decreasing joint thickness for both fluctuating tension and completely reversed axial loading over the entire range of joint thicknesses investigated. $3 \times 10^{-4}$ in. to $1.8 \times 10^{-2}$ in.

Subject Index No.—2.5.3

**A-102** Lehrer, W. M. and Schwartzbart, H.
STATIC AND FATIGUE STRENGTH OF METALS SUBJECTED TO TRIAXIAL STRESSES
ISA 28th Annual Meeting, N. Y., paper 60-12, Jan. 25–27, 1960.

Quantitative determination of the static and fatigue strength of silver-brazed butt joints subjected to triaxial stresses. Relationships between the appearance of the fracture surfaces and the mechanical properties are drawn, where possible.

Subject Index No.—2.5.3

**A-103** Leybold, H. A.
AXIAL-LOAD FATIGUE TESTS ON 17-7 PH STAINLESS STEEL UNDER CONSTANT-AMPLITUDE LOADING
NASA Tech. Note D-439, p. 17, Oct., 1960.

Investigation conducted at room temperature to determine fatigue properties and notch sensitivity of 17-7 PH stainless steel in condition TH 1050. All specimens are tested under completely reversed axial loading.

Subject Index No.—3.3.4, 3.11

**A-104** Lischer, A. A.
DEVELOPMENT FATIGUE TESTING OF A LARGE HELICOPTER ROTOR BLADE
Am. Soc. Testing Mats. Spec. Tech. Publ., "Symposium on Fatigue of Aircraft Structures," STP No. 274, pp. 79–98, June, 1960.

Laboratory development fatigue test program for a large pressure-jet rotor. Program includes testing in the design stage of components simulating suspected critical design details. Results of a plan for improving bolted connections.

Subject Index Nos.—1.8.1, 1.10.3, 3.10.1.2

**A-105** Liu, H. W. and Corten, H. T.
FATIGUE DAMAGE UNDER VARYING STRESS AMPLITUDES
NASA TN D-647, 68 pp., Nov., 1960.

The influence of complex stress histories on the fatigue life of members was investigated to determine the relationship between fatigue life and the relative number and amplitude of imposed cycles of stress. A physical model of fatigue damage was formulated in terms of the number of damage-nuclei initiated by the highest applied stress and the propagation of damage by all subsequent cycles of stress. Based on this physical model a mathematical equation was derived that related the fatigue life to stress history. Further interpretation of this equation was made by an alternative hypothesis. Aluminum-alloy, hard-drawn-steel, and high-strength-steel music wires were tested and the data statistically analyzed to obtain a measure of mean fatigue life and scatter.

Subject Index Nos.—2.1.5, 4.1.5

**A-106** Lundberg, B. K. O.
HOW SAFE IS FAIL-SAFE?
Aviation News, Issue 270, pp. 14–19, 1960.

Subject Index Nos.—1.9.3, 1.10.3

**A-107** Mains, R. M.
A GENERALIZATION OF CUMULATIVE DATA
Trans. Am. Soc. Mech. Engrs., Series D, Vol. 82, pp. 435–440, June, 1960.

Subject Index Nos.—1.7.3, 1.12.1

**A-108** Mann, J. Y.
THE FATIGUE NOTCH SENSITIVITY OF ANNEALED COPPER
Proc. Am. Soc. Testing Mats., Vol. 60, pp. 602–609, 1960.

Rotating-cantilever fatigue tests are reported on notched annealed copper specimens having $K_t$ values of 1.5, 2.5, 4.0, 5.5, and $>10$.

Contrary to the commonly accepted view, this investigation has shown that annealed copper is not particularly fatigue-notch-sensitive—the maximum $K_t$ found being less than 1.5. There is also evidence that this material is unlikely to exhibit the phenomenon of "non-propagating cracks."

Subject Index Nos.—5.3.4, 5.7.2, 5.8

**A-109** Manson, S. S.
THERMAL STRESSES IN DESIGN: PART 18—WORKING STRESSES FOR DUCTILE MATERIALS
Machine Design, Vol. 32, pp. 153–159, June 23, 1960.

An elastic-strain invariance method, an initial plasticity method and an asymptotic method for determining total strain range in parts subjected to thermal cycling but not to external load. Some consideration must be given to the state of stress—the degree of bi-axiality or tri-axiality of stresses.

Subject Index No.—1.6.5

**A-110** Manson, S. S.
THERMAL STRESSES IN DESIGN, PART 19—CYCLIC LIFE OF DUCTILE MATERIALS
Machine Design, Vol. 32, pp. 139–144, July 7, 1960.

Design relationships and procedure for determining cyclic life directly from strain-range computations.

Subject Index No.—1.6.5

**A-111** Manson, S. S.
THERMAL STRESSES IN DESIGN, PART 20—THERMAL CYCLING WITH STEADY STRESS
Machine Design, Vol. 32, pp. 161–167, July 21, 1960.

This article discusses general design philosophy for cases involving thermal cycling with steady stress. Examples are given for cases with and without strain hardening assumed involving a cycle-by-cycle analysis. The author subsequently describes what he terms an "asymptotic approach" involving further assumptions regarding material behavior.

Subject Index No.—1.6.5

**A-112** Manson, S. S.
THERMAL STRESSES IN DESIGN, PART 21—EFFECT OF MEAN STRESS AND STRAIN ON CYCLIC LIFE
Machine Design, Vol. 32, pp. 129–135, Aug. 4, 1960.
Presentation of a method for estimating the cyclic life in parts which have been subjected to tensile prestrain, considering stress components, multi-axiality, and prestrain in the plastic range.
Subject Index Nos.—1.4.7, 1.5.3, 1.6.5

**A-113** Manson, S. S.
THERMAL STRESSES IN DESIGN, PART 22—CUMULATIVE FATIGUE DAMAGE
Machine Design, Vol. 32, pp. 160–166, Aug. 18, 1960.
Discussion of factors in fatigue damage and of the crack initiation and propagation processes. The applicability aspect is emphasized, and mathematical formulations are included.
Subject Index Nos.—2.3.4, 2.6.5, 2.7.3.1, 3.3.4, 3.6.5, 3.7.3.1

**A-114** Marco, S. M.; Starkey, W. L.; and Hornung, K. G.
A QUANTITATIVE INVESTIGATION OF THE FACTORS WHICH INFLUENCE THE FATIGUE LIFE OF A V-BELT
Am. Soc. Mech. Engrs., Series B, Journal of Engineering for Industry, Vol. 82, No. 1, pp. 47–59, Feb., 1960.
A new design method for V-belts was developed. The new method involves a horsepower-life relationship which was derived on the basis of the results of an experimental program of belt testing involving many hundreds of tests, together with an analysis of these data which introduces several new concepts of stress analysis for rubber-textile structures.
Subject Index Nos.—13.9.3, 13.10.2

**A-115** McCluskey, D.
HALTING RESONANCE TESTS AT FAILURE
Environmental Quart., Vol. 6, pp. 12–14, July, 1960.
Presentation of a simple method of stopping a single frequency fatigue test, run at resonant frequencies, at the moment of failure. Prevention of damage to expensive equipment is one of its advantages.
Subject Index Nos.—1.8.1, 1.8.2

**A-116** McCulloch, A. J.
DEVELOPMENT OF FATIGUE LOADING SPECTRA FOR TESTING AIRCRAFT COMPONENTS AND STRUCTURES
Am. Soc. Testing Mats. Spec. Tech. Publ., "Symposium on Fatigue of Aircraft Structures," STP No. 274, pp. 30–57, June, 1960.
Determination of fatigue strength by the use of a spectra which is constructed as defined operational conditions with detailed load and stress data.
Subject Index Nos.—1.7.3, 1.8.4, 1.10.3

**A-117** McEvily, A. J. Jr. and Illg, W.
A METHOD FOR PREDICTING THE RATE OF FATIGUE-CRACK PROPAGATION
Am. Soc. Testing Mats. Spec. Tech. Publ., "Symposium on Fatigue of Aircraft Structures," STP No. 274, pp. 112–119, June, 1960.
Tests are conducted on 2024T3 and 7075T6 Al alloy sheet to determine fatigue-crack propagation rates. Semiempirical expressions are developed to predict crack rate.
Subject Index Nos.—4.2.1, 4.7.2, 4.9.2

**A-118** Menringer, F. J. and Felgar, R. P.
LOW-CYCLE FATIGUE OF TWO NICKEL-BASE ALLOYS BY THERMAL-STRESS CYCLING
Am. Soc. Mech. Engrs., Series D, Journal of Basic Engineering, Vol. 82, No. 3, pp. 661–670, Sept., 1960.
Cast DCM and cast Udimet 500, two nickel-base alloys, were tested in a thermal-stress-cycling device of the Coffin type. The strains induced by the thermal stresses were analyzed in several ways in an attempt to relate the plastic strains to cyclic life.
Subject Index No.—3.6.5

**A-119** Mittenbergs, A. A.; Williams, D. N.; Jaffee, R. I.; and Grover, H. J.
INVESTIGATION OF THE FATIGUE PROPERTIES OF MOLYBDENUM UNDER VARIOUS CONDITIONS OF TEMPERATURE, COATINGS, AND STRESS CONCENTRATION
WADD Tech. Report 60-427, Oct., 1960.
Fatigue behavior of unalloyed arc-cast molybdenum was investigated in tension-tension fatigue loading on uncoated and coated, unnotched and notched sheet specimens at 1800 F, room temperature, and −40 F. Three oxidation-resistant coatings were evaluated under fatigue loading. Static tensile tests were also conducted on specimens of the four surface conditions at the three temperatures. The fatigue strength of unprotected molybdenum at 1800 F was in the same range as the fatigue strength of some other high-temperature materials at this temperature. At room and low temperatures, the fatigue strength of unprotected specimens was relatively high. The notch sensitivity of unprotected molybdenum was low at 1800 F, but rather high at room and at low temperatures. All coatings lowered the fatigue strength of molybdenum at all three temperatures. The loss of fatigue strength was higher in the notched specimens. The coatings investigated did not prove to be completely reliable for high-temperature applications under continuous fatigue loading. For short-life high-temperature fatigue loading, however, utilization of coated molybdenum appeared to be possible with proper precautions. Further research is suggested on protective coatings and on molybdenum-base alloys.
Subject Index Nos.—3.3.4, 3.4.8.2, 3.6.1.1, 3.6.1.2

**A-120** Moon, D. P.; Van Echo, J. A.; Simmons, W. F.; and Barker, J. F.
STRUCTURAL DAMAGE IN THERMALLY CYCLED RENE' 41 AND ASTROLOY SHEET MATERIALS
DMIC, Battelle Mem. Inst., Rept. No. 126, p. 24, Feb. 29, 1960. PB 151 083.
Stress-Rupture life at 1650 F and tensile properties at room temperature and at 1400 F were used to determine the extent of structural damage in thermally cycled Rene' 41 and Astroloy sheet materials. Solution treated and aged Rene' 41 was tested both in the heat-treated condition and after exposure to 10 or 100 thermal cycles between 1350 F and 1750 or 1875 F. All of the conditions of thermal-cycling exposure caused at least some loss in the strength of this material. Metallographic examination indicated that overaging was primarily responsible for the the damage at 1750 F, and resolution of the $Ni_3(Al, Ti)$ precipitate and depletion of the alloy by surface oxidation were damaging mechanisms at 1875 F. Solution-treated and aged Rene' 41 was tested in the heat-treated condition and after 10 thermal cycles between 1350 F and 1875 F. No loss of strength was incurred by this exposure, but overaging had taken place

and would probably have caused structural damage with further exposure.

Subject Index Nos.—3.1.4.4, 3.6.5, 3.7

**A-121** Munse, W. H.
EVALUATION OF LABORATORY FATIGUE STUDIES FOR WELDED STRUCTURES
Weld. J., Vol. 39, No. 4, pp. 172s–175s, April, 1960.

Welded 12-in. structural beams are tested in a 200,000 lb fatigue testing machine. The data are used to provide the design of welded bridges.

Subject Index Nos.—2.9.3, 2.10.1.3, 2.11

**A-122** Muvdi, B. B.
STRUCTURAL BERYLLIUM
Proc. Am. Soc. Testing Mats., Vol. 60, pp. 812–824, 1960.

An attempt was made to produce beryllium possessing adequate structural characteristics. Specimens of plate beryllium representing five different fabrication methods were compared by metallographic examination, texture analysis, and mechanical tests. From a structural viewpoint, the best combination of uniaxial and biaxial properties was exhibited by commerical grade QMV beryllium powder which had been compacted cold and then upset hot. A further advantage of this process over the other four is the fact that it is relatively simple and economical and yields comparatively good surface finish.

The mechanical tests indicated that, for upset beryllium, plastic deformation before fracture was appreciable in both tension and flexure—and even under biaxial stress conditions. The fatigue strength, measured by the cantilever method, was approximately 45 per cent of the tensile strength at $10^7$ cycles.

Subject Index Nos.—8.2.1.1, 8.2.4, 8.4.3, 8.7.1

**A-123** Newman, M.
NOMOGRAPH SHOWS WHEN CRACKS BECOME DANGEROUS
Prod. Engr., Vol. 31, pp. 56–57, Aug. 29, 1960.

Chart solving the equation for critical size and stress for fast crack growth in sheet metal. Crack extension parameters for Al, Mg and Ti alloys, low-alloy steel and stainless steel.

Subject Index Nos.—2.7.2, 3.7.2, 4.7.2, 5.7.2, 7.7.2

**A-124** Nudelman, H. B. and Sheehan, J. P.
A STUDY OF FATIGUE PROPERTIES OF ULTRA-HIGH STRENGTH STEEL
WADD Tech. Rept. 60-120, 57 pp., June, 1960, PB 171 056.

A temper-resistant, high-strength steel was investigated with reference to fatigue strength. This alloy was prepared by two different melting techniques. The first method consisted of induction melting in air, using standard deoxidation techniques. The second method involved the application of a special deoxidation practice to induction melting; silicon-free steel was deoxidized with C and Al to minimize the presence of silicate inclusions. These alloys were tested in fatigue, using the Prot accelerated method. The results of the samples melted with standard practice indicated that fatigue strength is improved slightly by tempering at elevated temperature. The application of a special melting process showed that a very significant increase in the Prot fracture stress to ultimate tensile strength ratio ($E_p$/UTS) can be obtained by eliminating the presence of Si and deoxidizing with C and Al.

Subject Index Nos.—2.2.3, 2.2.5.1

**A-125** Orner, G. M. and Hartbower, C. E.
NOTCH SENSITIVITY IN HIGH-STRENGTH SHEET MATERIALS
Weld. J., Vol. 39, pp. 147s–159s, April, 1960.

A correlation between Charpy energy, adjusted for sheet thickness, and critical elastic-energy release rate ($G_c$) is demonstrated for tough and moderately tough sheet materials. Correlation is also demonstrated between critical crack length (at the 0.2 per cent yield stress) and Charpy "notch-toughness index," a parameter derived from sheet thickness, yield strength and modulus.

Subject Index Nos.—2.1.4.3, 2.3.4

**A-126** Padlog, J.; Huff, R. D.; and Holloway, G. F.
UNELASTIC BEHAVIOR OF STRUCTURES SUBJECTED TO CYCLIC, THERMAL AND MECHANICAL STRESSING CONDITIONS
WADD, Tech. Rept. 60-271, Dec., 1960.

Subject Index No.—1.10

**A-127** Padlog, J. and Rattinger, I.
LOW-CYCLE FATIGUE STRENGTH OF PRESSURIZED COMPONENTS
Am. Soc. Testing Mats. Spec. Tech. Publ., "Symposium on Fatigue of Aircraft Structures," STP No. 274, pp. 65–76, June, 1960.

Combined experimental and analytical investigation of the low-cycle fatigue strength of pressurized tubes. Fatigue strengths are determined for notched and unnotched, flat, axially loaded 403 stainless steel tubes.

Subject Index Nos.—3.3.4, 3.5.3, 3.6.5, 3.10.2, 3.12.1

**A-128** Paul, D. A. and Wang, D. Y.
FATIGUE BEHAVIOR OF 2014-T6, 7075-T6 AND 7079-T6 ALUMINUM ALLOY REGULAR HAND FORGINGS
WADD Tech. Rept. 59-591, p. 34, Jan., 1960, PB 161 500.

This report presents the test procedures and results of a fatigue investigation on regular hand forgings of the aluminum alloys 2014-T6, 7075-T6 and 7079-T6. The effects of forging direction on fatigue strength are investigated in the unnotched and notched condition. The unnotched fatigue strength of the three alloys ranged from 20,000 psi at $2 \times 10^7$ cycles, with the 7079-T6 alloy being slightly lower than 7075-T6 and about the same as that of the 2014-T6 alloy. The fatigue strength in the short transverse direction is consistently lower than in the longitudinal direction; however, the difference becomes less in the notched condition.

Subject Index Nos.—4.2.1.1, 4.2.2.3, 4.2.4.1, 4.3.4

**A-129** Peaslee, R. L.
THERMAL FATIGUE AND HIGH-TEMPERATURE BRAZEMENTS
Weld. J., Vol. 39, No. 1, pp. 29–33, Jan., 1960.

Nature of thermal fatigue and problems with brazements where sheet metal is jointed to heavier sections. Examples of thermal fatigue cracking in brazed turbine stator blades. Rocket engine components, heat exchanger, honeycomb structures, furnace retorts and electric furnace elements.

Subject Index Nos.—1.6.1.1, 1.10.1.3, 2.6.1.1, 2.6.5, 2.10.1.3,

**A-130** Peckner, D.
WHY METALS BREAK AND WHAT TO DO ABOUT IT
Matls. Design Engr., Vol. 51, No. 4, pp. 127–142, April, 1960.

A summary of knowledge concerning the fracture of metals. Includes a practical discussion of fatigue failures, brittle failures, tensile and stress corrosion failures. Extensive case histories are cited.

Subject Index No.—1.9.1

**A-131** Peterson, R. E.
ANALYTICAL APPROACH TO THE STUDY OF THE EFFECT OF SMALL CAVITIES ON FATIGUE STRENGTH
Nondestructive Testing, Vol. 18, No. 3, pp. 193–194, 202, May–June, 1960.
The main variables to be considered are: shape of cavity, orientation of cavity with respect to stress, proximity of cavities to each other, absolute size of cavity, and material containing the cavity.
Subject Index Nos.—1.2.5, 1.3.4

**A-132** Pinkhusovich, L. L. and Fridman, Z. G.
FATIGUE RESISTANCE OF RAILS CONTAINING ARSENIC
Paper from "Contemporary Problems of Metallurgy," Consultants Bureau Inc., pp. 496–500, New York, 1960.
Effect of 0.123–0.255 per cent As concentration with 0.67–0.81 per cent carbon on fatigue resistance and cracking susceptibility of normalized and nonheat-treated rail steel specimens.
Subject Index Nos.—2.2.1, 2.10.2

**A-133** Radd, F. J.; Crowder, L. H.; and Wolfe, L. H.
EFFECT OF PH IN THE RANGE 6.6–14.0 + ON THE AEROBIC CORROSION FATIGUE OF STEEL
Corrosion, Vol. 16, No. 8, pp. 415t–418t, Aug., 1960.
Subject Index No.—2.6.2

**A-134** Reed, E. C. and Viens, J. A.
THE INFLUENCE OF SURFACE RESIDUAL STRESS ON FATIGUE LIMIT OF TITANIUM
Am. Soc. Mech. Engrs., Series B, Journal of Engineering for Industry, Vol. 82, No. 1, pp. 76–78, Feb., 1960.
Investigation of the effect of surface residual stress on the endurance limit of 6Al-4V-Ti alloy shows that this effect is equal within experimental error to the residual stress divided by a constant. Results can be expressed by a simple equation. A value for the constant is derived.
Subject Index Nos.—7.4.1, 7.4.3, 7.4.7, 7.9.2

**A-135** Rewerts, G. R. and Swanson, P. J.
A METHOD FOR CONTROLLING TIME-VARIABLE AERODYNAMIC HEATING AND LOADS IN STRUCTURAL TESTING
SAE Meeting (Los Angeles), Paper by Convair-Astronautics Div. of General Dynamics Corp., Oct. 10–14, 1960; Society of Automotive Engineers, Inc., Preprint 228A., 8 pp.
Subject Index No.—1.10.3

**A-136** Ross, A. S. and Morrow, J. D.
CYCLE-DEPENDENT STRESS RELAXATION OF A-286 ALLOY
Am. Soc. Mech. Engrs., Series D, Journal of Basic Engineering, Vol. 32, No. 3, pp. 654–660, Sept., 1960.
Tubular fatigue specimens of A-286 alloy were axially tested under conditions of controlled strain, and the cycle-dependent relaxation of mean stress measured. It was found that, in the case of A-286 alloy, most of the relaxation occurred early in the fatigue life.
Subject Index Nos.—3.5.2, 3.6.5

**A-137** Rowland, R. M. and Cronin, J. L.
DYNAMIC EFFECTS IN FATIGUE TESTING
J. Aero/Space Sci., Vol. 27, p. 390, May, 1960.
Study of the problem as to whether the type of force input and the frequency and distribution of these inputs have harmonics that would couple with structural resonances so as to adversely affect the life predictions.
Subject Index No.—1.7.3

**A-138** Rudnick, J. and Friedman, R.
LOADING SYSTEMS FOR CONDUCTING FULL-SCALE AIRCRAFT FATIGUE TESTS
U.S. Naval Air Material Center, Aeronautical Structures Lab., Phila., Pa.; Rept. No. NAMATCEN ASL 1028; AD 240 020; April, 1960.
This report summarizes the equipment and techniques used by the Aeronautical Structures Laboratory for applying loads when conducting fatigue tests of full-scale aircraft structures and component parts.
Subject Index Nos.—1.8.1, 1.10.3

**A-139** Sachs, G.; Gerberich W. W.; Weiss, V.; and Latorre, J. V.
LOW-CYCLE FATIGUE OF PRESSURE-VESSEL MATERIALS
Am. Soc. Testing Mats., Vol. 60, pp. 512–529, 1960.
Low-cycle strain-controlled fatigue tests in tension-compression and in bending were conducted on two pressure-vessel materials (A-302 steel and 5454-0 aluminum alloy) and one additional aluminum alloy (2024-T4). It was found that for tension compression cycling the experimental data are well approximated by the equation $N = [(\epsilon_F - \epsilon_0)/\epsilon_{TR}]^2$. In bend cycling the same general trend is observed; however, the slope of the log e versus log N curves is less than that for tension-compression cycling. The effects of mean strain or prestrain, of biaxiality, and of test temperature have been studied. The effects of prestrain or mean strain (cold working) and of biaxiality fade out rapidly and become insignificant somewhere above 10,000 cycles. In contrast, the effects due to differences in ductility of different materials and due to different test temperatures are retained up to at least 100,000 cycles.
Subject Index Nos.—2.5.2, 2.6.1, 2.7.3, 2.9.2, 4.5.2, 4.6.1, 4.7.3, 4.9.2

**A-140** Sachs, G.; Sell, R.; and Weiss, V.
TENSION, COMPRESSION, AND FATIGUE PROPERTIES OF SEVERAL SAE 52100 AND TOOL STEELS USED FOR BALL BEARINGS
NASA TN D-239, 48 pp. Feb., 1960.
Subject Index Nos.—2.2.1.1, 2.10.2.2

**A-141** Sachs, G. and Sessler, J. G.
EFFECT OF STRESS CONCENTRATION ON THE TENSILE STRENGTH OF HEAT TREATED TITANIUM ALLOY SHEET AT VARIOUS TEMPERATURES
Research Inst., Syracuse U., MET E. 604-608 C; Aug., 1960.
Subject Index No.—7.3.4

**A-142** Sauzedde, R. E.
OPERATIONAL AND FATIGUE FACTORS AFFECT ROLLER CLUTCH DESIGN
SAE Journal, Vol. 68, No. 9, pp. 50–51, Sept., 1960.
Many variables of operation and fatigue affect the design of production roller clutches. This article suggests certain parameters to consider in the design of these clutches and proposes a method for calculating the loads and stresses with which the designer must contend. (Article based on Paper No. 208B SAE)
Subject Index No.—2.9.3

**A-143** Schjelderup, H. C.
PREDICTION OF ACOUSTIC FATIGUE LIFE
Am. Soc. Testing Mats. Spec. Tech. Publ., "Symposium on Acoustical Fatigue—1960," STP No. 284, pp. 19–25, March, 1961.
Current procedures used by the airframe industry for predicting fatigue life of structures loaded by high-energy acoustical noise are reviewed.
Subject Index Nos.—1.6.7, 1.7.3

**A-144** Shaw, S. L. and Stevenson, C. H.
TESTING TECHNIQUES FOR ELEVATED TEMPERATURE STRUCTURES
For presentation at SAE National Aeronautic Meeting, Los Angeles, Douglas Aircraft Co., Oct. 10–14, 1960. Paper No. 228B.
Subject Index Nos.—1.6.1.1, 1.10.3

**A-145** Shoemaker, J. H. and Bidigare, G.
NEW NITRIDING PROCESS FOR INCREASED WEAR AND FATIGUE RESISTANCE
SAE Summer Meeting, Chicago, Preprint 178B, 13 p., June 5–10, 1960.
Description of the Tufftride process which involves the immersion of the specimen in a specially formulated molten salt bath. The process is applicable to low-carbon, alloy, stainless tool steels, heat resistant steels, and grey, alloy, nodular or ductile, malleable and pearlitic irons.
Subject Index No.—2.4.6.2

**A-146** Signorelli, R. A.; Johnston, J. R.; and Waters, W. J.
THERMAL-STRESS FATIGUE CRACKING OF TURBINE BUCKETS OPERATED AT 1700 F IN A TURBOJET ENGINE WITH LONG PERIODS OF OPERATION BETWEEN STARTS
NASA Tech. Note D-272, Feb., 1960.
Factors influencing thermal stress fatigue cracking of Nibase turbine buckets.
Subject Index Nos.—3.2.1.1, 3.6.1.1, 3.6.5, 3.10.2

**A-147** Simkovich, E. A. and Loria, E. A.
EFFECT OF DECARBURIZATION AND GRINDING CONDITIONS ON FATIGUE STRENGTH OF FIVE PER CENT Cr-Mo-V SHEET STEEL
Am. Soc. Met., Preprint No. 185, 1960.
A new method of decarburizing sheet steel uniformly to four depths. Sheets are heat treated to 210,000 psi tensile strength level without further decarburization. Results show a sharp drop in fatigue strength with small amounts of decarburization. Axial tension-tension fatigue test results are correlated with tensile and hardness tests, as well as metallographic analysis, and a method of detecting decarburization based on hardness measurements is evolved.
Subject Index Nos.—2.4.1, 2.4.3, 2.4.9, 2.5.2

**A-148** Smith, C. R.
DESIGN APPLICATIONS FOR IMPROVING FATIGUE RESISTANCE OF AIRPLANE STRUCTURES
Proc. Am. Soc. Testing Mats., Vol. 60, pp. 589–601, 1960.
Fatigue life can be lengthened by lessening the load on the first rows of rivets in joints and by providing interference fits. A method for predicting the effect of interference fits is presented, and good agreement shown with experimental data. 7075-T6 alloy sheet was evaluated.
Subject Index Nos.—4.4.7, 4.10.1.1, 4.10.2

**A-149** Smith, R. W. and Smith, G. T.
THERMAL-FATIGUE CRACK-GROWTH CHARACTERISTICS AND MECHANICAL STRAIN CYCLING BEHAVIOR OF A-286, DISCALOY AND 16-25-6 AUSTENITIC STEELS
NASA Tech. Note D-479, p. 67, Oct., 1960.
Thermal fatigue tests on notched and unnotched disk specimens of A-286, Discaloy, hot-cold worked 16-25-6 and overaged 16-25-6 austenitic steels. Relative thermal-fatigue resistances, duration of microstage and macrostage crack-growth periods and factors affecting fatigue life.
Subject Index Nos.—3.2.1, 3.3.4, 3.6.5., 3.7.2

**A-150** Srawley, J. E. and Beachem, C. D.
CRACK PROPAGATION TESTS OF HIGH-STRENGTH SHEET MATERIALS, PART 4—EFFECT OF WARM PRESTRAINING
U.S. Naval Res. Lab., NRL Rept. No. 5460, 16 p., April 18, 1960, PB 161, 355.
Weakening effects of cracking in steel are mitigated by straining at moderately elevated temperatures, where the mode of fracture is shear, before testing at lower temperatures. Load bearing capacity improves from pre-straining treatment and varies inversely as the testing temperature. Effect is result of blunting of crack fronts by plastic flow and shear cracking.
Subject Index No.—2.7.2

**A-151** Stellabotte, M. L.
EVALUATION OF A1S1 4140 STEEL COLD DRAWN BY LASALLE STEEL COMPANY'S "PROCESS 11"
U.S. Naval Air Material Center, Phila., Pa., Aeronautical Materials Laboratory Rept. NAMC AML 1152, Nov., 1960.
An evaluation was made of A1S1 4140 steel as processed by the LaSalle Steel Company's proprietary "Process 11." This cold finishing, "phase working" process produces a material which has ultra high tensile and yield strengths, comparatively good ductility, increased resistance to fatigue failure and hydrogen embrittlement (as compared to other ultra high strength steel) but a material which is also highly notch sensitive.
Subject Index No.—2.2.4.2

**A-152** Stephens, R. I. and Sinclair, G. M.
A HIGH TEMPERATURE, VACUUM, AXIAL FATIGUE TESTING MACHINE
ASTM Bull., No. 249, pp. 44–48, Oct., 1960.
Equipment developed to test thin-walled refractory metal specimens in a vacuum under repeated axial load at temperatures up to 2500 F. The machine is of the constant displacement type with eccentric and crank mechanism for varying the alternating stress, mean stress and frequency of cycling.
Subject Index Nos.—3.6.1.1, 3.8.1

**A-153** Stern, I. L.; Cordiano, H. V.; and Digiglio, V. A.
COMPARATIVE PROPERTIES OF Al-ALLOY WELDMENTS
Weld. J., Vol. 39, No. 10, pp. 424s–432s, Oct., 1960.
Subject Index Nos.—4.2.1, 4.10.1.3

**A-154** Stickley, G. W.
ADDITIONAL STUDIES OF EFFECTS OF ANODIC COATINGS ON THE FATIGUE STRENGTH OF ALUMINUM ALLOYS
Proc. Am. Soc. Testing Mats., Vol. 60, pp. 577–588, 1960.
Rotating-bending and plane-bending fatigue tests were made on smooth and notched specimens of 7075-T6 alloy with and without anodic coatings. Thicker coating reduced the fatigue

**A-154** (*continued*).
strength, the chromic-acid treatment giving greater sensitivity. Prior surface treatments examined had little effect. Sealing the coatings in boiling water had a harmful effect, regardless of thickness.

Subject Index Nos.—4.2.1.1, 4.3.4, 4.4.8.2

**A-155** Stroh, A. N.
SIMPLE MODEL OF A PROPAGATING CRACK
Journal of the Mechanics and Physics of Solids, Vol. 8, pp. 119–122, May, 1960.

Model of a crack in which the surface energy in the Griffith treatment is taken to depend on the temperature and strain rate. Such a crack shows a transition from brittle to ductile behavior as the temperature is raised.

Subject Index Nos.—1.1.5, 1.7.2

**A-156** Taub, A.
FAILURE IN A SHAFT
Metal Prog., Vol. 77, No. 1, pp. 109–110, Jan., 1960.

Fatigue failure suffered in service by a shaft, was investigated and found to be due to improper quenching.

Subject Index No.—2.9.1

**A-157** Taylor, E. R.; Lay, C. R., Jr.; and Mohoney, C. H.
RESONANT-FREQUENCY TESTER: A MACHINE USING MEASUREMENT OF FREQUENCY DECAY FOR QUALITY EVALUATION OF AXIAL-FLOW COMPRESSOR BLADES
U.S. AEC, Oak Ridge Gaseous Diffusion Plant, Tenn., (K-1393), 35 pp., June 30, 1960.

The quality of die-cast, Al alloy, axial-flow compressor-blades was determined by measuring the decay in the natural frequency of the blade vibrating under simulated-service conditions. The results were compared with other methods of routine inspection and found to be economic and to give positive selection between good and defective blades. Inspection is accomplished in $1\frac{1}{2}$–$2\frac{1}{2}$ min per blade. Strain-gage measurements showed that the stress loading of blades in the resonant-frequency machines was comparable with that in conventional Sonntag universal fatigue machines. The principles involved are discussed, and the application of the method and the establishment of test criteria are described. Application of the method to fatigue testing is also discussed and endurance data, including stress loadings, are shown. A manual of instruction for the operation of resonant-frequency machines is included in an appendix.

Subject Index No.—4.8.1

**A-158** Thrall, E. W.
ACOUSTICALLY INDUCED FATIGUE-CAUSE, SOLUTION AND DESIGN ANALYSIS
SAE National Aero. Meeting, New York, April 5–8, 1960. Preprint 164A.

Discussion of the fatigue problem that developed in the empennage area of the Navy A3D aircraft. Details of ground and flight test programs, the test results, and one effective solution to the cracking problem are presented.

Subject Index Nos.—4.6.7, 4.9.1, 4.9.3, 4.10.3

**A-159** Trapp, W. J. and Lazan, B. J.
ROLE OF STRUCTURAL DAMPING IN ACOUSTICAL FATIGUE
WADD, Tech. Rept. 59-304, 26 pp., Jan., 1960. PB 161,742.

Discussion of techniques proposed to reduce or eliminate material fatigue damage due to high-level noise fields of propulsion systems and aerodynamically induced pressure fluctuations. The mechanisms, the significant parameters involved, and the response of materials and structures are studied.

Subject Index No.—1.6.7

**A-160** Trubert, M.; Lu, S. Y.; and Nash, W. A.
EFFECTS OF ELEVATED TEMPERATURES, INITIAL STRESSES AND THERMAL CYCLING ON MECHANICAL PROPERTIES OF 347-2D STAINLESS STEEL
Florida U., Eng. Ind. Exp. Station, Gainesville; Tech. Rept. No. 1; AD 236 452; April, 1960.

The influence of rapidly attained high temperatures on mechanical properties of type 347-2D stainless steel is investigated experimentally. The environments considered are: (a) heating to 2200 F in 15 seconds, then loading in tension at a strain rate of 1.0 in/in/sec, during which phase the effect of various numbers of cycles of heating and cooling prior to loading is also considered; (b) heating to 2200 F at a rate of 200 F per second with various initial stresses present in the specimen; (c) heating to 2200 F in 15 seconds, followed by various lengths of time in which the temperature is held constant prior to loading at a constant strain rate; and (d) thermal cycling between 2200 F and 400 F with various initial stresses present in the specimen.

Subject Index No.—3.6.5

**A-161** Ungar, E. E.
DAMPING TAPES FOR VIBRATION CONTROL
Prod. Engg., Vol. 31, pp. 57–62, Jan. 25, 1960.

Subject Index Nos.—2.9.1, 4.9.1

**A-162** Van Camp, H. W.
STRESS ANALYSIS OF ALUMINUM V-8 DIESEL CYLINDER BLOCK
Society of Automotive Engineers, 12 pp., Preprint No. 255A, 1960.

Subject Index Nos.—4.4.7, 4.10.2

**A-163** Vitovec, F. H.
EFFECT OF RELAXATION ON THE BEHAVIOR OF MATERIALS UNDER COMBINED ALTERNATING AND STATIC STRESS
Trans. Amer. Soc. Mech. Engrs., Series D, Vol. 82, pp. 441–445, June, 1960.

The effect of temperature on the stress range diagram is discussed and the particular characteristics of the curves for unnotched and notched specimens are analyzed. Excluding metallurgical factors from consideration, it is suggested that relaxation is the principal mechanism which influences the behavior of polycrystalline metals under combined alternating and static stress.

Subject Index Nos.—3.3.4, 3.5.2, 3.6.1.1, 3.12.1

**A-164** Vreeland, R. H.
A METHOD FOR SONIC FATIGUE TESTING
Am. Soc. Testing Mats. Spec. Tech. Publ., "Symposium on Fatigue of Aircraft Structures," STP No. 274, pp. 58–64, 1960.

Various aircraft components are tested for crack resistance at high noise levels. Bonded Al honeycomb specimens are found to have the highest sonic fatigue resistance.

Subject Index Nos.—1.6.7, 1.8, 4.6.7, 4.10.1.3, 4.10.1.4

**A-165** Waldron, G. W. J.; Broom, T.; and Summerton, J. M.
RESEARCH ON STRAIN-AGING HARDENING AND SOFTENING OF METALS BY FATIGUE, PART I—FATIGUE OF ALUMINUM-MAGNESIUM ALLOYS, PART II—FATIGUE OF ZINC SINGLE CRYSTALS
Birmingham U.; Office of Scientific Research TR 60-170; Final Aug., 1960.
Subject Index Nos.—4.1.5, 8.1.2

**A-166** Walp, H. O.; Remorenko, R. P.; and Porter, J. V.
ENDURANCE TESTS OF ROLLING CONTACT BEARINGS OF CONVENTIONAL AND HIGH TEMPERATURE STEELS UNDER CONDITIONS SIMULATING AIRCRAFT GAS TURBINE APPLICATIONS
U.S. Dept. of Commerce, OTS Technical Report, PB 161672, 1960.
Tests were conducted at two temperature levels, and at normal and high speeds. To provide means for determining fatigue properties of materials without using complete bearings, simple specimen-testing machines were designed. Results are tabulated and discussed.
Subject Index Nos.—2.5.1, 2.6.1.1, 2.10.2.2

**A-167** Weck, R.
FATIGUE FAILURE—WHY IT OCCURS
Welding Fabrication Design, Vol. 3, pp. 11–15, May, 1960.
Design consideration for fatigue strength in carbon steel and alloy steel structural members. Fatigue failure as a function of stress concentration, with attention to the increase in stress concentration sensitivity occurring with increase in tensile strength.
Subject Index Nos.—2.1.4.3, 2.1.5, 2.3.4

**A-168** Weibull, W.
THE FATIGUE DAMAGING EFFECT OF A RANDOM LOAD
Am. Soc. Testing Mats. Spec. Tech. Publ., "Symposium on Acoustical Fatigue—1960", STP No. 284, pp. 45–53, March, 1961.
Formulae for computing the relevant statistics are deduced, and applied to data obtained from four spectra produced by a low frequency generator at DVL.
Subject Index Nos.—1.7.3.5, 1.8.3.1, 1.8.3.2

**A-169** Weiss, V.; Schaeffer, G. T.; Saule, A.; and Sachs, G.
THERMAL CYCLING UNDER CONSTANT LOAD TO LOW TEMPERATURES OF ALUMINUM AND MAGNESIUM ALLOYS
Am. Soc. Testing Mats. Spec. Tech. Publ., "Symposium on Low-Temperature Properties of High-Strength Aircraft and Missile Materials—1960," STP No. 287, 1961.
Sawtooth-type thermal cycling tests, from −320 F to elevated temperatures, under constant stress, on two aluminum and two magnesium alloys, by resistance heating. N increased with decreasing applied stress; increasing the maximum temperature displaced the curves towards lower stress values. Effect of heating rate was not consistent. Failure could be predicted from Coffin-type equation.
Subject Index Nos.—4.6.5, 6.6.5

**A-170** Whaley, R. E. and Kurzhals, P.
FATIGUE-CRACK PROPAGATION IN ALUMINUM-ALLOY TENSION PANELS
NASA TN D-543, 25 pp., Nov., 1960.
Results are presented of fatigue-crack propagation and stress redistribution in built-up tension panels for which the ratio of skin area to stiffener area was varied over a wide range. The panels were constructed of 2024-T3 and 7075-T6 aluminum alloys. Surveys were made of stress redistribution in the cracked panels and compared with the net area stress.
Subject Index Nos.—4.3.1, 4.3.2, 4.7.2, 4.10.2

**A-171** Whittier, J. S.
RHEOLOGICAL PROPERTIES OF ADHESIVES CONSIDERED FOR INTERFACE DAMPING
WADD Tech. Rept. 60-280, 70 pp., June, 1960. PB 171, 023.
Machines for testing soft adhesives under static compression and shear and under dynamic shear are described. Static creep data in compression and shear are reported for Minnesota Mining and Manufacturing Company's 3M Tape No. 466. At a given compressive load this material deforms, after sufficient time has elapsed, to an "equilibrium" thickness. Dynamic shear data for 3M Tape No. 466 are reported for frequencies from 0.1 to 120 cps and for shear strain amplitudes from zero to unity and greater. Stress history and fatigue effects are also mentioned. This material is found to dissipate large amounts of specific damping energy when undergoing safe dynamic shear strains. Spot checks on the dynamic shear properties of three other materials at 11.5 cps are also presented. The terms used for data presentation are explained in the report by giving data reduction formulas.
Subject Index Nos.—12.1.4.2, 12.5.1

**A-172** Wilkov, A.
NEW OBSERVATIONS RELATING TO THE MECHANISM OF FATIGUE FAILURE
Proc. Am. Soc. Testing Mats., Vol. 60, pp. 540–559, 1960.
This paper contains a discussion of experimental studies of the basic process leading to the formation of a microcrack during fatigue loading. The material studied was 4340 steel. Electron microscope studies were made in combination with carbon-platinum replica during the fatigue process. A theoretical discussion of the results is presented.
Subject Index Nos.—2.1, 2.1.1, 2.1.5, 2.2.2

**A-173** Williams, D. N.; Kohn, M. L.; Evans R. M.; and Jaffee, R. I.
CORROSION—FATIGUE IN TWO HOT WORK DIE STEELS
Modern Castings, Vol. 37, pp. 19–25, Jan., 1960.
Two hot-work die steels H21 and H23, were examined. It was found that sample life in the range of 1100 F to 1400 F was relatively independent of oxidation. Variations in heat treatments, test conditions or other material properties were found to affect sample life in direct proportion to their effect on the plastic strain imposed on the sample during cyclic loading.
Subject Index Nos.—2.2.1.1., 2.2.6, 2.6.1.1, 2.6.2

**A-174** Yokbori, T.
STRESS CRITERION FOR FATIGUE FRACTURE OF STEELS
J. Mech. Phys. Solids, Vol. 8, pp. 81–86, 1960.
Approach to the problem of correlating the macroscopic fatigue strength of steels with microscopic explanations of present dislocation theory.
Subject Index Nos.—1.1.5, 1.2.2, 2.3.4, 2.12.1

**A-175** Zaretsky, E. V. and Anderson, W. J.
RELATION BETWEEN ROLLING-CONTACT FATIGUE LIFE AND MECHANICAL PROPERTIES FOR SEVERAL AIRCRAFT BEARING STEELS
Proc. Am. Soc. Testing Mats., Vol. 60, pp. 627–649, 1960.
Two bench-type fatigue rigs used to determine the room-temperature fatigue lives of M-1, M-50, Halmo and WB-49 tool steel balls, tempered to various hardness levels. 10 per cent life increased continuously with increasing hardness, and correlated with resistance to plastic deformation under rolling contact. Elastic limit and yield strength values showed peaks at intermediate hardness levels.
Subject Index Nos.—2.1.4, 2.2.1.1, 2.2.6, 2.10.2.2

**B-1** Anonymous
A MODEL OF METAL FATIGUE
Nature, Vol. 185, pp. 303–304, Jan. 30, 1960. (England)
Important part played by surface disturbance of a fatigue specimen by to-and-fro slip bands. Subsequent surface movements can cause deep valleys resulting in cracks. A rough model of this process is set up in mathematical form.
Subject Index No.—1.1.5

**B-2** Anonymous
ARTICLES ON FATIGUE FAILURE
Welder, Vol. 24, No. 142, p. 26, April–June, 1960. (England)
Subject Index No.—1.7

**B-3** Anonymous
AXLE-FATIGUE TESTING MACHINE
Railway Gazette (England), Vol. 113, No. 25, p. 714, Dec. 16, 1960.
Subject Index No.—2.8.1

**B-4** Anonymous
BACK-ROOM ALLOYS FOR GAS TURBINES
Gas Oil Power (England), Vol. 55, pp. 9–10, Jan., 1960.
Subject Index No.—3.2.1, 3.6.1.1, 3.6.2

**B-5** Anonymous
COIL SPRING RESEARCH LABORATORY
Engineer (England), Vol. 209, No. 5435, p. 536, March 25, 1960.
Fatigue testing machinery installed at the new laboratories of the Coil Spring Federation Research Organization, is described. The research program includes the study of fatigue-life of heavy-duty springs as a function of type of material, heat treatment and surface finish.
Subject Index Nos.—2.2.6, 2.4.3, 2.8.1, 2.10.2

**B-6** Anonymous
DISCUSSION AT THE SYMPOSIUM ON: FATIGUE OF WELDED STRUCTURES
British Welding J. (England), Vol. 7, pp. 472–481, July, 1960. Vol. 8, pp. 513–529, Aug., 1960. Vol. 9, pp. 577–587, Sept., 1960.
Symposium held at Cambridge University from March 29, to April 1, 1960, jointly organized by the British Welding Research Association and the Engineering Department of the University.
Subject Index Nos.—2.1.4.3, 2.2.5, 2.3.4, 2.10.1.3

**B-7** Anonymous
DESIGN OF EQUIPMENT USED TO TEST AIRCRAFT EQUIPMENT FOR STRENGTH, FATIGUE AND CORROSION RESISTANCE
"Dowty-Rotol Limited" Metal Industry (England), Vol. 97, pp. 262–264, Sept. 23, 1960.
Subject Index No.—1.8.1

**B-8** Anonymous
FATIGUE FAILURE IN METALS
Shipbuild. and Shipp. Rec. (England), Vol. 96, No. 24, p. 763, Dec. 15, 1960.
Subject Index No.—1.12

**B-9** Anonymous
FATIGUE FRACTURE
Metal Treatment and Drop Forging (England), Vol. 27, p. 250, June, 1960.

Specimens of 2 per cent carbon mild steel are tested on a Wholer-type fatigue testing machine and examined to determine hardness, grain size and structure.
Subject Index Nos.—1.1.5, 1.7.2, 1.7.1.2, 1.8, 2.1.4.3, 2.2.2

**B-10** Anonymous
FATIGUE INVESTIGATIONS
BWRA (BRITISH WELDING RESEARCH ASSOC.) 15th Annual Report, 1959–1960.
The influence of defects on the fatigue strength of mild steel butt welds, welded shafts and welded joints in high tensile steels, Al alloys and heat resisting alloys.
Subject Index No.—2.10.1.3

**B-11** Anonymous
FATIGUE OF WELDED STRUCTURES
Commonwealth Engineer (England), Vol. 48, pp. 38–40, Aug. 5, 1960.
Review of tests of steel and Al alloy butt welds, steel fillet welded joints, plastic coated welded beams, stiffeners and plate covers to determine fatigue strength and factors influencing fatigue strength. Effects of notching, joint form and geometry, stress concentration, plastic coatings and other variables.
Subject Index Nos.—2.3.4, 2.4.8.2, 2.10.1.3, 4.3.4, 4.4.8.2, 4.10.1.3

**B-12** Anonymous
FATIGUE OF WELDED STRUCTURES
British Welding J., Vol. 7, pp. 513–529, Aug., 1960.
Discussion of papers presented at a symposium held at Cambridge University by the British Welding Research Assoc. and the Cambridge Engineering Dept. Topics include influence of weld detail on the fatigue strength of welded beams and girders, programmed fatigue testing of full-size welded steel structural assemblies, the fatigue strength of fillet welded joints in steel and a systemization of the fatigue strength values of mild steel welds.
Subject Index No.—2.10.1.3

**B-13** Anonymous
FATIGUE OF WELDED STRUCTURES
British Welding J., Vol. 7, pp. 577–587, Sept., 1960.
Paper on fatigue behavior of welded Al alloy joints as affected by mean stress and heat treatment and discussions of previous papers on weldment fatigue presented at a symposium held at Cambridge University from March 29–April 1, 1960, by the British Department of Cambridge.
Subject Index Nos.—4.5, 4.10.1.3

**B-14** Anonymous
FATIGUE TESTING CO-OPERATION
Metallurgia (England), Vol. 62, No. 374, p. 264, Dec., 1960.
Subject Index No.—1.8

**B-15** Anonymous
INTERNATIONAL TESTS ON METAL FATIGUE
New Scientist (England), Vol. 8, No. 207, p. 1188, Nov. 3, 1960.
Subject Index No.—1.7

**B-16** Anonymous
MAGNESIUM CLADDING
Metal Ind. (England), Vol. 97, pp. 422–424, Nov. 18, 1960.
Subject Index Nos.—6.1.4.4, 6.2.2.1, 6.6.1.1

**B-17** Anonymous
MARINE SHAFT FAILURES
Shipbuild. and Shipp. Rec. (England), Vol. 95, No. 21, p. 667, May 26, 1960.
Subject Index Nos.—2.6.2, 2.6.3, 2.7.2, 2.10.2

**B-18** Anonymous
NATIONAL ENGINEERING LABORATORY—RESEARCH ON MATERIALS AND THEIR FABRICATION
Metallurgia (England), Vol. 62, No. 369, pp. 29–35, July, 1960.
Subject Index Nos.—1.1.4.4, 1.6.1.1, 1.6.3, 1.7.2, 1.8.1, 1.10.1.1, 1.10.1.2, 1.10.3, 2.6.3, 4.6.3

**B-19** Anonymous
ORGANIC COATINGS LESSEN METAL FATIGUE
Engineering (London), p. 2, Vol. 190, July 1, 1960.
An investigation made by the U.S. Bureau of Standards has shown that coatings of long-chain polar substances greatly increase the fatigue strengths of copper-beryllium alloys, steel and magnesium. The polar organic compounds increased the fatigue life of beryllium copper, stressed at 50,000 lb per sq in., by 250 per cent.
Subject Index No.—1.4.7

**B-20** Anonymous
RANDOM SLIP MODEL OF FATIGUE AND COFFIN'S LAW
Nature (England), Vol. 188, No. 4750, pp. 573–574, Nov. 12, 1960.
Subject Index No.—1.1

**B-21** Anonymous
RESONANCE BENDING FOR PIPE FATIGUE TESTS
Canadian Welder (Canada), Vol. 51, p. 16, June, 1960.
Subject Index Nos.—1.8.1, 1.10.2

**B-22** Anonymous
THE EFFECTS OF CONTOUR ETCHING ON THE BENDING FATIGUE PROPERTIES OF ALUMINUM ALLOY SHEETS AND PLATE
Ministry of Aviation (England), 25p. (S and T Memo No. 19/60) Dec., 1960.
A study was made to determine the effects of contour etching (chemical contouring), with and without subsequent treatments, on the bending fatigue characteristics of Al-Cu and Al-Zn alloy sheets and plates. Tests showed that while contour etching resulted in slight deterioration of the fatigue properties of certain of the Al-Cu alloys, post-etching surface treatments, vaporblasting, polishing or grit blasting, in every case restored the fatigue to values comparable to those obtained on the as-received sheets and generally improved them to the same extent as did machining. Contour etching had an adverse effect on the Al-Zn alloys, and although subsequent surface treatments restored the fatigue properties of clad sheets, it was not so effective on the unclad sheets. The best etched results with clad or unclad materials were lower than those obtained on machined materials. Post etching heat treatment was beneficial to all the clad materials but was variable in its effect on unclad materials.
Subject Index Nos.—4.2.6, 4.4.3, 4.4.7

**B-23** Atkinson, M.
THE INFLUENCE OF NON-METALLIC INCLUSIONS ON THE FATIGUE PROPERTIES OF ULTRA-HIGH-TENSILE STEEL
J. Iron Steel Inst. (England), Vol. 195, pp. 64–75, May, 1960.
Investigated relation between fatigue strength and inclusion content for steels heat treated to about 125 tons/in.$^2$. Attempted to develop method of evaluating inclusions on basis of stress concentration. Found a fair correlation between inclusion counts by this method and fatigue properties of eight groups of steels.
Subject Index Nos.—2.1.4.3, 2.2.5.1

**B-24** Atkinson, R. and Jackson, P.
SOME CRANKSHAFT FAILURES: INVESTIGATIONS, CAUSES AND REMEDIES
Trans. Inst. Marine Engrs. (England), Vol. 72, No. 7, pp. 269–304, July, 1960.
Subject Index Nos.—2.2.4.1, 2.3.4, 2.10.2

**B-25** Atkinson, R. J.; Winkworth, W. J.; and Norris, G. M.
BEHAVIOR OF SKIN FATIGUE CRACKS AT THE CORNERS OF WINDOWS IN A COMET I FUSELAGE
Royal Aircraft Establishment Report, Structures 257 (England), June, 1960.
Fatigue tests on a Comet I pressure cabin subjected to operational pressure cycles are described. Cracks at window corners are the main subject of investigation. Results are compared with earlier experiments on other Comet I pressure cabins. Conclusions are reached that appear to have some general significance.
Subject Index Nos.—4.9.1, 4.10.3

**B-26** Baron, H. G.
FATIGUE OF METALS BY THERMAL STRESSES
New Scientist (England), Vol. 7, No. 183, pp. 1287–1289, May 19, 1960.
Subject Index Nos.—2.7.2, 3.3.4, 3.7.2, 8.7.2

**B-27** Baron, H. G.
FATIGUE OF METALS BY THERMAL STRESSES
New Scientist (England), Vol. 8, No. 191, p. 179, July 14, 1960.
Subject Index Nos.—1.6.5, 1.12.1

**B-28** Baron, H. G.
SUMMARY OF ARDE WORK ON THERMAL STRESS FATIGUE
Armament Res. Dev. Establ. (England), ARDE Memo. No. (MX) 18/60; 6 p., (AD 237 337); April, 1960.
Results are outlined of work on the cracking produced in steels and some other metals by the repeated application of thermal stress. Among the subjects discussed are: the effect of different temperature cycles, the effect of repeated phase changes, the effect of stress concentration, interaction of cracks, the effect of surface contamination with low-melting-point metals, the cracking of chromium deposits and the comparative behavior of different steels, heat-resisting alloys and cast iron.
Subject Index Nos.—2.3.4, 2.4.8.1, 2.6.5, 3.3.4, 3.4.8.1, 3.6.5

**B-29** Bates, A. P.
HYPEREUTECTIC ALUMINUM-SILICON ALLOYS, Metallurgia (England), Vol. 61, No. 364, pp. 70–78, Feb. 1960.
Subject Index Nos.—4.2.1.1, 4.6.5

**B-30** Biggs, W. D.
METALLURGICAL ASPECTS OF FUTURE RESEARCH ON FATIGUE OF WELDED STRUCTURES
British Welding J. (England), Vol. 7, No. 3, pp. 212–216, March, 1960. (Paper presented at Symposium on Fatigue of Welded Structures, Cambridge University, March 29 to April 1, 1960).
Discussion of the mechanism of work hardening in relation to fatigue behavior, showing the need for experimental data on the effects of grain size and dispersions. An evaluation of possible heat-affected zone structures, and of their notched fatigue characteristics is also desirable.
Subject Index Nos.—2.2.2.1, 2.3.3, 2.6.1.1, 2.10.1.3

**B-31** Brook, P. E.; Kirby, N.; and Burke, W. T.
THE CREEP AND HIGH TEMPERATURE FATIGUE PROPERTIES OF MAGNESIUM-BASE CANNING ALLOY, MAGNOX A.12
J. Inst. Metals (England), Vol. 88, No. 12, pp. 500–508, Aug., 1960.
A study was made of this alloy, currently used as the canning material in the Calder Hall and Chapelcross reactors. Particular attention was paid to creep behavior in the lower range of reactor temperatures, where this alloy exhibits its minimum ductility and where intergranular cavitation is most prevalent. The effects of temperature, strain rate, and grain size on both ductility and cavitation were investigated. In view of the lack of data on the high-temperature fatigue strength of this alloy, a preliminary survey was made over the range 225–500 C. Detailed studies were carried out at 400 and 450 C., where the fatigue strength attained its lowest value. With the exception of very short-term tests in which general cracking occurred, fatigue failure was attributable to the development of intergranular cavities and their subsequent interlinking. The effect of initial grain size and grain growth during test was studied at 400–500 C. It is shown that grain coarsening gives rise to increased fatigue strength at these temperatures.
Subject Index Nos.—6.2.2.1, 6.4.4, 6.6.1.1, 6.9.3, 6.11

**B-32** Brown, A. F. C. and McClimont, W.
FATIGUE STRENGTH OF FIVE TYPES OF STUD
Engineering, Vol. 189, p. 430, March, 1960.
Subject Index Nos.—2.3.2, 2.3.3, 2.10.1.2

**B-33** Cina, B.
THE CAUSES AND PREVENTION OF SPRING FAILURES
Engineers Digest (England), Vol. 21, No. 4, pp. 91–94, April, 1960.
Service failures of various types of spring are presented and discussed with respect to probable causes. Methods of preventing spring failures are suggested.
Subject Index Nos.—2.9.1, 2.10.2

**B-34** Cina, B.
THE EFFECT OF MODE OF STRESSING IN FATIGUE TESTING
J. Iron and Steel Inst. (England), Vol. 94, pp. 324–336, March, 1960.
Gives results of extensive tests of three alloy steels with varying mean stress. Data can be represented by modified Goodman diagrams. With one steel, definite fatigue failures were obtained in pulsating compression. Metallographic studies showed intrusion and extrusion effects.
Subject Index Nos.—2.1.5, 2.2.1, 2.5.2

**B-35** Cottrell, A. H.
EFFECT OF NUCLEAR RADIATION ON ENGINEERING MATERIALS
Chartered Mechanical Engineer (England), Vol. 7, pp. 105–119, March, 1960.
Subject Index Nos.—2.2.1, 2.6.4, 2.9.3

**B-36** Cox, M. and Glenny, E.
THERMAL FATIGUE INVESTIGATING
Engineer (England), Vol. 210, No. 5457, pp. 346–350, Aug. 26, 1960.
Components which are subjected in service to many abrupt changes in temperature may fail as a result of fatigue induced by cyclic thermal stresses; such conditions occur in the blading of gas turbine engines during starting and shutdown. A description is given of research work in progress at the National Gas Turbine Establishment (England) in which laboratory techniques have been used to investigate temperature transients in turbine blades and to subject materials to simulated service conditions using beds and fluidised solids for heating and cooling test specimens. Results of this work are given to indicate the major factors involved, and their relative importance in governing the thermal fatigue behaviour of creep resistant alloys.
Subject Index Nos.—2.6.5, 2.10.2, 3.6.5, 3.8.2, 3.10.2

**B-37** Derry, L. W. and House, S. R.
A SURVEY OF DATA ON THE FATIGUE STRENGTH OF RIVETED LAP JOINTS IN Al ALLOY SHEET
S and T Memo 4/60 (England) (Min. of Aviation), April, 1960.
Subject Index No.—4.10.1.1

**B-38** Dixon, J. R.
STRESS DISTRIBUTION A CENTRAL CRACK IN A PLATE LOADED IN TENSION; EFFECT OF FINITE WIDTH OF PLATE
J. Roy Aeronaut Soc., (England), pp. 141–145, March, 1960
Investigation of the effect of the finite width of plate on the elastic-stress distribution due to a central crack. Two-dimensional photoelastic tests were carried out on flat-plate specimens. The photoelastic specimens were similar to the 10-in.-wide fatigue specimens used by Frost and Dugdale, with the central crack simulated by a slot bounded by holes of small radii. A theoretical solution of the problem was derived and compared with the present and other photoelastic results.
Subject Index No.—1.3.4

**B-39** Dolan, T. J.
BASIC RESEARCH INTO METAL FATIGUE
Metal Treatment and Drop Forging (England), Vol. 27, No. 173, pp. 50–52, Feb. 1960.
Subject Index No.—1.1, 1.12.1

**B-40** Doyle, W. M.
J. Roy Aeronaut. Soc. (England), Vol. 64, No. 597, pp. 535–548, Sept., 1960.
Subject Index No.—4.1.4.3, 4.6.1.1, 4.9.3, 4.11

**B-41** Dunsby, J. A.
SOME EXPERIMENTS ON THE EFFECT OF TIME ON THE ROOM TEMPERATURE REVERSED BENDING FATIGUE CHARACTERISTICS AND ON THE TENSILE STRENGTH OF 24S–T ALCLAD ALUMINUM ALLOY
National Research Lab., Mech. Engrg. Rept. MS-102, NRC No. 5927 (Canada), Aug. 8, 1960. PB 152 785.

Experiments are described in which specimens of 24S–T aluminum alloy were held at temperatures of 400 F or 300 F for periods ranging from $1\frac{1}{2}$ to 100 hours prior to conducting room temperature reversed bending fatigue or tensile tests. The physical properties of the material change radically with such treatments and it is shown that these changes can be correlated for varying times and temperatures by the use of the Larson-Miller parameter. The results of the tensile tests are in good agreement with previously reported tests provided that proper allowance is made for the initial condition of the material. It is shown that these earlier tests can be used to determine the effects of time at temperature on the tensile strength on a given sample of this material provided that the initial yield strength is known.

Subject Index Nos.—4.1.4.3, 4.2.6

**B-42** Fenner, A. J. and Field, J. E.
A STUDY OF THE ONSET OF FATIGUE DAMAGE DUE TO FRETTING
Trans. N.E. Coast Inst. of Engrs. and Shipbuilders (England), Vol. 76, pp. 183–197, Feb., 1960.

Fretting action was introduced at the surfaces of direct-stress fatigue test-pieces of the Al alloy B.S.L. 65 by use of pads of the same material. The pads were removed at different stages in the tests and the state of damage was studied by a subsequent static tensile test of the specimen. Most of the tests were carried out in air, but one series was undertaken with the fretting process applied in vacuo. Fatigue damage due to fretting was fully developed after $\sim\frac{1}{5}\times$ the total life, but significant damage could be developed in much fewer cycles. The mean stress applied to the test piece during initial fretting had an important effect on the rate at which damage was produced. Microscopical examination failed to reveal damage in the very early stages, but after fretting for $<10^5$ cycles small cracks were detected. Both the initiation of fretting-fatigue cracks and their propagation are assisted by atmospheric corrosion.

Subject Index Nos.—4.5.2, 4.6.3, 4.7.1

**B-43** Fisher, W. A. P.
FATIGUE TESTS ON NOTCH EXTRUDED ALUMINUM ALLOY HAVING A THEORETICAL STRESS CONCENTRATION FACTOR OF 3.65
Min. of Aviation, A.R.C., C.P. No. 460, 1960. Also available as Aeronautical Research Council (England) RAE Tech. Note structures 266, June, 1959.

Fatigue tests were made in axial tension at ratios of mean to alternating stress of 1.1, 2, and 3 and at fixed mean stresses of 8800, 14,000 and 18,000 lb/sq in. The tests provide data on the fatigue of alloy DTD 364B (now L65) with a comparatively high stress concentration and also on the notch sensitivity of this material.

Subject Index Nos.—4.3.4, 4.5.2

**B-44** Fisher, W. A. P.
PROGRAM FATIGUE TESTS ON NOTCHED BARS TO A GUST LOAD SPECTRUM
J. Royal Aeronaut. Soc. (England), Vol. 64, No. 599, p. 713, Nov., 1960. Aero. Res. Conc. Lond. Curr. Paper 498 (England), 19pp., 1960. (Appl. Mechanics Rev. (U.S.A.) Vol. 14, No. 1, p. 30, Jan., 1961.)

A series of programme fatigue tests in axial loading was made on notched bars machined from extruded alloy to DTD 363A. The load spectrum represented a simplified truncated gust spectrum.

Subject Index Nos.—4.3.4, 4.7.3.5, 4.8.4

**B-45** Fisher, W. A. P.
SOME FATIGUE TESTS ON NOTCHED SPECIMENS WITH PROGRAMME LOADING FOR A "GROUND-ATTACK" AIRCRAFT
J. Royal Aeronaut Soc. (England), Vol. 64, No. 599, p. 713, Nov., 1960. Aero. Res. Conc. Lond. Curr. Paper 497 (England), 16 pp., 1960. (Appl. Mechanics Rev. (U.S.A.) Vol. 14, No. 1, p. 30, Jan., 1961.)

A series of programme loading tests was made in a hydraulic fatigue testing machine to check the validity of the Miner Cumulative Damage Hypothesis for a structural light alloy notched specimen in axial tension.

Subject Index Nos.—4.3.3, 4.3.4, 4.7.3, 4.8.4

**B-46** Forsyth, P. J. E. and Ryder, D. A.
FATIGUE FRACTURE
Aircraft Engineering (England), Vol. 32, No. 374, pp. 96–99, April, 1960.

The nature of the fine fracture striations is discussed. Their use in the diagnosis of fatigue failures is described and it is shown how they may be used to obtain quantitative information. It is intended to demonstrate the possibilities of the techniques described rather than to present any new information on the mechanism of the fatigue process.

Subject Index Nos.—4.7.3, 4.10.1.1

**B-47** Frost, N. E.
CORRELATION OF THE ALTERNATING STRESSES REQUIRED TO INITIATE AND PROPAGATE A FATIGUE CRACK IN MILD STEEL
Nature (England), Vol. 187, No. 4733, pp. 233–234, July 16, 1960.

Subject Index Nos.—2.3.4, 2.5.2, 2.7.2

**B-48** Frost, N. E.
EFFECT OF COLD WORK ON THE FATIGUE PROPERTIES OF TWO STEELS
Metallurgia (England), Vol. 62, No. 371, pp. 85–90, Sept., 1960.

Fatigue tests on blanks of typical mild and Ni-Cr steels after various amounts of cold work to determine maximum possible increase in fatigue strength resulting solely from cold work. An appreciable increase in fatigue limit can be achieved by cold working mild steel, there being an optimum value for the amount of prior strain. There is some indication that the fatigue limit of a $2\frac{1}{2}$ per cent nickel-chromium alloy steel may be slightly increased by cold work.

Subject Index Nos.—2.2.1.1, 2.2.1.4, 2.2.4, 2.4.5

**B-49** Frost, N. E.
NOTCH EFFECTS AND THE CRITICAL ALTERNATING STRESS REQUIRED TO PROPAGATE A CRACK IN AN ALUMINUM ALLOY SUBJECT TO FATIGUE LOADING
J. Mech. Eng. Science (England), Vol. 2, No. 2, pp. 109–119, June, 1960.
Fatigue tests at zero mean load on Al alloy (BS.L65) specimens containing edge cracks of various lengths show relationship between crack lengths and critical alternating propagating stress. Fatigue tests are made on notched specimens and the occurrence of nonpropagating cracks are discussed in terms of the above relationship.
Subject Index Nos.—4.1.5., 4.3.3., 4.5.4., 4.7.2

**B-50** Frost, N. E.
RELATION BETWEEN CRITICAL ALTERNATING PROPAGATION STRESS AND CRACK LENGTH FOR MILD STEEL
Engineers Digest (England), Vol. 21, pp. 121–123, Jan., 1960.
Subject Index Nos.—2.3.3., 2.5.4., 2.7.2

**B-51** Gilde, W.
INCREASING THE FATIGUE STRENGTH OF BUTT-WELDED JOINTS
British Weld. J. (England), Vol. 7, No. 3, pp. 208–211, March, 1960.
Paper presented at Symposium on Fatigue of Welded Structures, Cambridge University, March 29, April 1, 1960.
The fatigue strength of butt-welded joints depends on the surface of the weld bend and on the surrounding medium, whether liquid or gas. Transverse butt-welded joints of rimmed low-carbon steel plate were tested in plane bending, and the effect of a plastic coating applied to the weld bead and heat-affected zone was studied. The fatigue strength was increased about 75 per cent. Notched specimens with plastic coatings gave even higher increases.
Subject Index Nos.—2.4.8.2., 2.6.2., 2.9.4., 2.10.1.3

**B-52** Glenny, E.
A STUDY OF THE THERMAL FATIGUE BEHAVIOR OF METALS: THE EFFECT OF TEST CONDITIONS ON NICKEL-BASE HIGH-TEMPERATURE ALLOYS
National Gas Turbine Establishment (England), NGTE R. 239, Jan., 1960.
An attempt has been made to identify the significant factors governing the thermal fatigue behavior of nickel-base high-temperature alloys, mainly using a laboratory technique with hot and cold fluidized beds as the heating and cooling media. A succession of heating shocks was found to be generally more damaging than a succession of cooling shocks between the same temperature limits. The duration of the heating shock and the top temperature of the cycle are dominant factors. The thermal fatigue cracks are initiated at the surface and are intercrystalline in origin and propagation. Surface oxidation, which is intergranular in nature for nickel-base alloys, has a significant effect on thermal fatigue life.
Subject Index No.—3.6.5

**B-53** Glenny, E. and Taylor, T. A.
A STUDY OF THE THERMAL-FATIGUE BEHAVIOR OF METALS
J. Inst. of Metals (England), Vol. 88, No. 11, pp. 449–461, July, 1960.
Subject Index Nos.—3.3.2., 3.3.1., 3.6.1.1., 3.6.1.2., 3.2.2.1., 3.6.5., 3.7.2., 3.8.1., 3.11

**B-54** Gunn, K. W. and McLester, R.
EFFECT OF MEAN STRESS ON FATIGUE PROPERTIES OF ALUMINUM ALLOY BUTT-WELDED JOINTS
British Welding J. (England), Vol. 7, No. 3, pp. 201–208, March, 1960.
Axial-load fatigue tests were made on butt-welded plate joints of three corrosion-resistant aluminum alloys in an Amsler Vibrophore machine at 12,000 cpm. Weld reinforcement was not removed. All three alloys gave very similar welded fatigue strengths. As the mean stress was increased, the stress range decreased until about 9,000 psi mean stress, above which it remained constant (maximum mean stress studied was 15,700 psi). The effects of weld porosity, offset between plates, and shape of weld bead are discussed.
Subject Index Nos.—4.2.1., 4.5.2., 4.8.3.1., 4.10.1.3

**B-55** Gurney, T. R.
FATIGUE STRENGTH OF BEAMS WITH STIFFENERS WELDED TO THE TENSION FLANGE
British Welding J. (England), Vol. 7, No. 9, pp. 569–576, Sept., 1960.
Uni-directional plane bending fatigue tests were carried out on 7 by 7-in. steel beams with web stiffeners welded to the tension flange, both transversely and longitudinally. Transverse welding could give the better results, but was more susceptible to scatter. Tests on plates with welded attachments similar to those used on beams gave comparable results to those of the beam tests. Hence, future investigations can be simplified.
Subject Index No.—2.10.2

**B-56** Gurney, T. R.
FATIGUE STRENGTH OF FILLET WELDED JOINTS IN STEEL
British Welding J. (England), Vol. 7, No. 3, pp. 178–187, March, 1960. (Paper presented at Symposium on Fatigue of Welded Structures, Cambridge University, March 29 to April 1, 1960.)
Current design specifications (U.K., U.S.A., U.S.S.R. and West Germany) are compared with experimental results for transverse and longitudinal fillet welds of the load-carrying and non-load-carrying type. It appears that in certain cases the European specifications have no factor of safety for cyclic loading. Factors affecting the fatigue strength, in particular the stress concentration effects, are discussed, and it is pointed out that high tensile steel joints have about the same fatigue strength as mild steel joints. The benefits to be derived from residual stresses induced by spot heating or local compression are evaluated.
Subject Index Nos.—2.3.4., 2.9.3., 2.10.1.3

**B-57** Gurney, T. R.
INFLUENCE OF RESIDUAL STRESSES ON FATIGUE STRENGTH OF PLATES WITH FILLET WELDED ATTACHMENTS
British Welding J. (England), Vol. No. 6, Vol. No. 7, pp. 415–431, June, 1960.
The report contains details of various fatigue tests carried out to confirm that the increase in strength obtainable by spot heating certain types of notched specimen is due to the residual stresses so induced. It has also been shown that similar in-

**B-57** (*continued*).

creases in strength can be obtained by inducing residual stresses by mechanical means.

Subject Index Nos.—2.3.4., 2.4.5., 2.4.7., 2.7.3.1., 2.10.1.3., 4.3.4., 4.4.5., 4.4.7., 4.7.3., 4.10.1.3

**B-58** Hammond, R. A. F. and Williams, C.
THE EFFECT OF ELECTROPLATING ON FATIGUE STRENGTH
Metallurgical Rev. (England), Vol. 5, No. 18, pp. 165–223, 1960.

The fundamental limitation of Ni and Cr coatings is their relatively low intrinsic fatigue strength relative to the high-strength steels to which they are frequently applied (aggravated by tensile internal stress). A need exists, therefore, for investigating the possibilities of electrodepositing stronger coatings. In the case of Ni, this is clearly feasible by the use of organic addition agents in the plating bath, which could have the added advantage of imparting compressive internal stress to the electrodeposit. The prospects of applying a similar remedy for Cr deposits are far less promising, however.

Subject Index Nos.—2.4.5., 2.4.6., 2.4.8.1., 2.4.6.2., 2.6.2., 2.7.2

**B-59** Harries, D. R.
RADIATION DAMAGE IN IRON AND STEEL
Nuclear Power (England), Vol. 5, No. 47, pp. 97–99, March, 1960; No. 48, pp. 142–145, April, 1960.

Subject Index Nos.—2.1.4.3., 2.3.4., 2.6.4

**B-60** Havard, D. G.
THE FATIGUE LIFE OF THE LEAD SHEATH OF A WATER-COOLED CABLE SYSTEM
Ontario Hydro Research News (Canada), Vol. 12, No. 3, pp. 7–11, July–Sept., 1960.

The results of the investigation show that the sheath of a water-cooled cable would definitely be more highly strained than that of an earth-cooled cable, but present knowledge of the behaviour of lead cable-sheathing materials is such that a fatigue life cannot be estimated from the strain values obtained. It is probable that the sheath of a water-cooled cable would fail before that of an earth-cooled cable. But if an endurance limit does exist for lead subject to daily fatigue cycles, failure would possibly never occur, since the strain magnitudes recorded were low.

Lead alloys have been developed which are far more fatigue-resistant than the alloy used in the experimental cable. The use of such alloys for cable sheath might enable the cable to last for the design life of 40 years even under the higher strains encountered in the water-cooled cable system. Hence it is apparent that further studies of lead (and lead alloy) properties are required if cable-sheath life is to be predicted with any accuracy. Also if cable systems of new designs are to be evaluated, measurement and analysis of the sheath strains will be required to give an indication of fatigue life.

Subject Index Nos.—8.3.4., 8.6.2

**B-61** Heywood, R. B.
LONGER FATIGUE LIFE FOR NUTS AND BOLTS
Engineering (England), Vol. 189, p. 494, April 8, 1960.

Subject Index Nos.—2.3.2., 2.3.4., 2.10.1.2

**B-62** Holfelder, O.
TESTING HEAVILY LOADED PLAIN BEARINGS
Engineer (England), Vol. 210, pp. 504–507, Sept. 23, 1960.

Subject Index Nos.—1.8.1., 1.10.2.2

**B-63** Johnson, R. F. and Sewell, J. F.
THE BEARING PROPERTIES OF 1 PER CENT C-Cr STEEL AS INFLUENCED BY STEEL-MAKING PRACTICE
J. Iron and Steel Inst. (England), Vol. 196, pp. 414–444, Dec., 1960.

A fatigue rig, which simulates in simple form the conditions applying in the case of bearing endurance tests and produces the same type of failures, has been developed. Tests have been carried out on standard 1 per cent C-Cr quality steel to explore the effect of different steelmaking procedures and, in the case of basic electric arc steels, the effect of deoxidation practice on the performance of the material. The rig test results are compared with data obtained from rotary bending tests and standard bearing tests. Considerable success has been achieved in correlating rig test performance with the inclusion content of the material, provided that a special counting technique is used; no indication of the performance, however, is obtained from standard methods.

Subject Index Nos.—1.8.1., 2.2.3., 2.2.5.1., 2.10.2.2

**B-64** Kennedy, A. J. and Sollars, A. R.
ALUMINUM AND AIRCRAFT ENGINEERING
Aircraft Eng. (England), Vol. 32, No. 374, pp. 100–105, April, 1960.
Fatigue resistance of the following alloys:
Al-5.5Zn-2.6Mg(DTD 5024)
Al-4Cu-0.7Mg-0.7Si-1Fe-0.5Mn(L 65)
Al-5Mg-4.1Zn
Al-2.5Cu-1.5Mg-1.2Ni-1Fe-0.1Ti, under prolonged heating in the range 100–150 C, is discussed.

Subject Index Nos.—4.7.3., 4.10.1.1

**B-65** Kenneford, A. S. and Nichols, R. W.
THE FATIGUE PROPERTIES AT LOW TEMPERATURES OF A LOW CARBON AND AN ALLOY STEEL
J. Iron and Steel Inst. (England), Vol. 194, No. 1, pp. 13–18, Jan., 1960.

The ratio of fatigue limit to tensile strength remained constant down to liquid air temperature.

Subject Index Nos.—2.2.2.1., 2.3.4., 2.5.3., 2.6.1.2

**B-66** Kuun, T. C. de K.
FATIGUE STRENGTH OF CHROMIUM PLATED STEEL
African Mech. Eng. (South Africa), pp. 139–144, Jan., 1960.

Plating, heat treating and testing of 0.03 per cent carbon steel; relationship of deposit and treatment to fatigue strength. 7 refs.

Subject Index Nos.—2.4.8.1., 2.11

**B-67** Landau, C. S.
LOW FREQUENCY FATIGUE OF NIMONIC 90
National Gas Turbine Establishment (England), R. 243, Sept., 1960.

An alloy of Nimonic 90 type has been tested under cyclic loads at temperatures of 800, 850, and 900 C. Graham's descriptive theory of deformation has been applied to these test conditions and shown to provide a satisfactory description of the experimental results. (1) The variation of cumulative strain with number of cycles is described by an equation exactly similar to the already established creep equation, that is, by the sum of powers of cycle number $n^{1/3}$, n, $n^3$, and $n^9$. (2) The effect of variation of maximum stress/cycle can be described by the sum of power terms whose exponents are taken from the Graham-Walles standard series. (3) Within the scatter of observation, the variation of cumulative deformation with time and the total time to fracture are independent of the frequency. (4) There is qualitative agreement between the observed and the predicted stress/strain loops.

Subject Index Nos.—3.1.5., 3.6.1., 3.7.3

**B-68** Lewis, E. M.
FUTURE RESEARCH-ENGINEERING ASPECTS
British Welding J. (England), Vol. 7, No. 4, pp. 265–271, April, 1960.

Present maintenance and future design of welded structures are discussed. Maintenance involves problems of inspection and repair of fatigue-cracked members. For future designs, the use of locked-in stresses, automatic instead of manual welding, and careful location of welds, are proposed. The benefits to be derived from full-scale testing are pointed out.

Subject Index Nos.—2.9.3., 2.10.1.3

**B-69** Lowe, W. M. and Squirrell, F.
FATIGUE OF METALS BY THERMAL STRESSES
New Scientist (England), Vol. 7, No. 188, p. 1622, June 23, 1960.

Subject Index Nos.—1.6.1.1., 1.6.1.2., 1.6.5

**B-70** Lunberg, B. K. O. and Eggwertz, S.
A STATISTICAL METHOD FOR FAIL-SAFE DESIGN WITH RESPECT TO AIRCRAFT FATIGUE
Aircraft Eng. (England), Vol. 32, p. 336, Nov., 1960.

As a fatigue crack propagates in a fail-safe aircraft structure, the strength of the structure decreases and the probability of collapse due to a heavy gust or maneuver load increases with time. It is possible to limit the probability of collapse to a required low level by regular inspections.

A method of calculating the probability of collapse for a diffuse wing structure was given in the paper, taking into account crack propagation, inspection frequency and the growing probability with service time of crack initiation. The method developed, presupposes knowledge of: (a) the fatigue and crack propagation characteristics of the structure, in particular a diffuse structure, under the spectrum of loads assumed to occur in reference operational conditions, and (b) the spectrum of heavy gust loads in average thunderstorm turbulence.

Subject Index Nos.—4.7.3., 4.8.3., 4.9.3., 4.12.1

**B-71** Mann, J. Y.
A NOTE ON THE FATIGUE PROPERTIES OF WELDED LOW ALLOY STRUCTURAL STEELS
Australian Dept. of Supply, Aeronaut. Research Labs. (Australia) Tech Memo ARL/SM87.

Subject Index Nos.—2.2.1.1., 2.5.2., 2.10.1.3

**B-72** May, A. N.
A MODEL OF METAL FATIGUE
Nature (England), Vol. 185, No. 4709, pp. 303–304, Jan. 30, 1960.

Subject Index No.—1.12.1

**B-73** Mee, J. W.
TREATMENT OF A 1 PER CENT CARBON SPRING STEEL
Metal Treatment and Drop Forging (England), Vol. 27, pp. 45–49, Feb., 1960.

Subject Index Nos.—2.4.5., 2.4.9

**B-74** Meleka, A. H. and Dunn, G. B.
FATIGUE-INDUCED AFTER-EFFECT IN ZINC SINGLE CRYSTALS
J. Inst. Metals (England), Vol. 88, pp. 407–410, May, 1960.

The superposition of a fatigue stress in a creep experiment results in a sudden increase in the creep rate, which decreases with time, the strain following a (time) $\frac{2}{3}$ law. If the fatigue stress is removed, it is observed that the resulting creep rate is even less than the original static rate. This hardening, too, follows the (time) $\frac{2}{3}$ law. A model based on the increased mobility of an oscillating dislocation is proposed to explain the softening due to fatigue. The subsequent hardening is attributed to the effect of vacancies produced by the fatigue stress.

Subject Index Nos.—1.1.4.4., 1.1.5., 8.1.2., 8.1.4.4., 8.2.2., 8.12.1

**B-75** Meleka, A. H. and Evershed, A. V.
THE DEPENDENCE OF CREEP BEHAVIOR ON THE DURATION OF A SUPERIMPOSED FATIGUE STRESS
J. Inst. Metals (England), Vol. 88, pp. 411–414, May, 1960.

Subject Index Nos.—1.8.1., 5.1.4.4

**B-76** Mitchell, K. W.; King, H.; and Brandes, E. A.
THE EFFECT OF PROTECTIVE COATINGS ON THE PROPERTIES OF FERRITIC STEEL AT 650 C.
Metallurgia (England), Vol. 61, No. 363, pp. 15–23, Jan., 1960.

The effect of surface coatings on tensile, creep and fatigue properties of mild steel and three low alloy steels in sheet form were studied. The coatings were hot dipped aluminum, aluminized, and chromized. Fatigue tests were made at 650 C in a special constant-deflection flexure machine. Aluminizing increased the endurance at low stresses for mild steel and Mo-B steel, and at all stresses for Mo-V steel. Chromizing was beneficial for mild steel, but detrimental to the alloy steels. The hot-dipped coating was beneficial for steels with poor oxidation resistance (mild steel, Mo-B and Mo-V steels), but detrimental to the Cr-Mo-V-W steel.

Subject Index Nos.—2.2.1., 2.4.8.2., 2.6.1.1

**B-77** Modlen, G. F. and Smith, G. C.
CHANGES OCCURRING IN THE SURFACE OF MILD-STEEL SPECIMENS DURING FATIGUE STRESSING
J. Iron and Steel Inst. (England), Vol. 194, p. 459, April, 1960.

Results of experiments on the effects of surface removal and intermediate annealing lead the authors to believe that microcracks form early in fatigue life and that removal of the cracks removes fatigue damage. Metallographic observations in support of this view are presented.

Subject Index Nos.—2.1.5., 2.2.6., 2.7.1

**B-78** Modlen, G. F. and Smith, G. C.
SOME CHANGES IN THE MECHANICAL PROPERTIES OF MILD STEEL CAUSED BY FATIGUE STRESSING
J. Iron and Steel Inst. (England), Vol. 194, Pt. 2, pp. 154–159, Feb., 1960.

Changes in the stress-strain curve and hardness were followed during the fatigue of strain-aged mild steel. Initially the hardness falls, and if the specimen temperature does not rise, the hardness continues to fall until fracture. If the specimen is allowed to become hot, the hardness increases over a comparatively short number of cycles, and then remains roughly constant until fracture occurs. A tentative dislocation model is advanced to explain these results.

Subject Index Nos.—2.1.4.3., 2.12.1

**B-79** Morgan, W. and Buhr, R.
THE NOTCHED FATIGUE PROPERTIES OF HIGH TENSILE STEELS
Aircraft Eng. (England), Vol. 32, No. 381, p. 334, Nov., 1960.

Notched and unnotched fatigue tests were described, which have been carried out on several ultra-high strength alloy steels in the as-quenched condition and after tempering at progressively higher temperatures. The effect of residual quenching stress and secondary hardening on the notch sensitivity of the steels was also evaluated. Minimum notch sensitivity was found in the as-quenched condition and after tempering at the peak of secondary hardening. The mechanism of failure was discussed in terms of the effect of residual stresses and metallurgical structure on the relief of applied peak stresses.

Subject Index Nos.—2.2.6., 2.3.4

**B-80** Morrison, J. L. M.; Crossland, B.; and Parry, J. S. C.
STRENGTH OF THICK CYLINDERS SUBJECTED TO REPEATED INTERNAL PRESSURE
Proc. Inst. Mech. Engrs. (England), Vol. 174, No. 2, pp. 95–117, 1960.

Subject Index Nos.—2.4.6.2., 2.5.3., 2.10., 3.4.6.2., 3.5.3., 3.10., 4.4.6.2., 4.5.3., 4.10., 7.4.6.2., 7.5.3., 7.10

**B-81** Munse, W. H. and Stallmeyer, J. E.
INFLUENCE OF WELD DETAILS ON FATIGUE OF WELDED BEAMS AND GIRDERS
British Welding J. (England), Vol. 7, No. 3, pp. 188–200, March, 1960. (Paper presented at Symposium on Fatigue of Welded Structures, Cambridge University, March 29 to April 1, 1960.)

Fatigue tests were carried out on welded beams of structural steels A7 and A373, mainly under zero-to-maximum bending loading at 180 cpm. Beams were up to 16 in. deep by 8 ft long and the effect of details such as splices, stiffeners, cover plates and attachments were studied. All the details examined reduced the fatigue strength of the welded beam, but sound design, positioning and fabrication were shown to keep the reduction to a satisfactory point. Only the partial-length cover plate produced a major reduction, and must therefore, be terminated at points of reduced stress.

Subject Index Nos.—2.3.4., 2.8.1., 2.9.3., 2.10.3., 2.10.1.3

**B-82** Neumann, A.
A SYSTEMATIZATION OF FATIGUE STRENGTH VALUES OF MILD STEEL WELDS
British Welding J. (England), Vol. 7, No. 3, pp. 162–168, March, 1960. (Paper presented at Symposium on Fatigue of Welded Structures, Cambridge University, March 29 to April 1, 1960.)

Stussi's theory of fatigue strength has been extended to welded mild steel on the assumption that a linear relationship exists between the fatigue strength diagrams of notched and unnotched specimens. Making certain other assumptions, and using existing data, the author computed analytically sets of fatigue strength curves for St37 and St52 for varying mean stress and stress concentration factor. From these curves permissible cyclic stresses were derived for a wide range of welded connections under different loading conditions.

Subject Index Nos.—2.9.3., 2.10.1.3

**B-83** Newman, R. P.
FATIGUE STRENGTH OF BUTT WELDS IN MILD STEEL
British Welding J. (England), Vol. 7, No. 3, pp. 169–178, March, 1960. (Paper presented at Symposium on Fatigue of Welded Structures, Cambridge University, March 29 to April 1, 1960.)

Factors affecting the fatigue strength of transverse butt welds, welded from one or both sides, and of longitudinal butt welds, are considered and the results of tests presented. Wide variations in fatigue strength, depending on joint form, are noted. Typical data are discussed with respect to present design requirements incorporated in British specifications.

Subject Index Nos.—2.3.2., 2.7.2., 2.8.3.2., 2.10.1.3

**B-84** Newman, R. P.
FATIGUE—THE PROBLEM IN RELATION TO WELDED STRUCTURES, PART I
Welder (England), Vol. 29, No. 142, pp. 27–33, April–June, 1960.

Conditions likely to give rise to fatigue failure; appearance of fatigue fractures; principal factors in the fatigue problem.

Subject Index Nos.—1.10.1.3., 2.5.2., 2.10.1.3

**B-85** Newman, R. P.
FATIGUE—THE PROBLEM IN RELATION TO WELDED STRUCTURES, PART II
Welder (England), Vol. 29, No. 143, pp. 54–60, July–Sept., 1960.

Linear stress-endurance and stress-long endurance curves for mild steel plate under alternating axial stress or axial repeated tension stress are compared with fatigue test results on mild steel butt welds.

Subject Index Nos.—1.10.1.3., 2.10.1.3

**B-86** Owen, M. E.
THE PROBABILITY OF FATIGUE FAILURE OF AIRCRAFT IF THE FATIGUE LIFE IS EXCEEDED
Royal Aircraft Establishment (England), Tech. Note No. 287, Structures Aug., 1960.

This note gives a method of answering each of the following questions: (a) What is the probability of failure of an aircraft which exceeds the fatigue life by a known amount; (b) What is the risk taken if a number of aircraft are permitted to exceed the fatigue life by a known amount; (c) By how much can a number of aircraft exceed the fatigue life if the risk of at least one failure is to be less than a known amount; (d) If a number of aircraft reach or exceed the fatigue life by varying amounts, what is the probability of failure of at least one aircraft? Questions (a) to (c) are answered by deriving formulae, which are applied to selected numbers and the results given in tabular form. Formulae are given in answer to question (d) which may be applied to small and large numbers of aircraft; examples of the application are given.

Subject Index Nos.—1.9.3., 1.10.3

**B-87** Parker, J. and Levy, J. C.
THE FATIGUE CURVES OF COPPER
J. Inst. of Metals (England), Vol. 89, No. 3, pp. 86–89, Nov., 1960.

Subject Index Nos.—5.1.5., 5.7.2

**B-88** Parkes, E. W.
EFFECTS OF REPEATED THERMAL LOADING
Aircraft Engineering (England), Vol. 32, No. 378, pp. 222–229, Aug., 1960.

A very simple redundant structure is subjected to temperature cycling, primarily to determine the influence of the yield stress or temperature relation on its behaviour: the range and periodic time of the temperature cycle are included as sub-

sidiary variables. It is found that improving the strength of the material at elevated temperatures may have the undesirable effect of hastening incremental collapse of the structure, and that the most rapid incremental collapse is not necessarily associated with maximum values for the range and periodic time of the temperature cycle. It is also found that the common assumption that the strength of the material is independent of temperature may in some circumstances be ambiguous, since there may be a sudden discontinuity in behaviour between a structure made from a material having a slight negative strength or temperature gradient and one made from a material having a slight positive gradient.
Subject Index Nos.—2.6.5., 3.6.5., 4.6.5., 7.6.5., 8.6.5

**B-89** Pemperton, H. N. and Smedley, G. P.
AN ANALYSIS OF RECENT SCREWSHAFT CASUALTIES
Shipbuilding and Shipp. Rec. (England), Vol. 95, No. 14, pp. 447–448, April 7, 1960.
Subject Index Nos.—2.6.3., 2.9.1., 2.10.2.2

**B-90** Phillips, J.
FORMULAE FOR USE WITH THE FATIGUE LOAD METER IN THE ASSESSMENT OF WING FATIGUE LIFE
Royal Aircraft Establishment (England), RAE Tech. Note No. 279, Structures, p. 39, April, 1960.
Derivation of suitable constants which, when multiplied by the readings recorded at each appropriate acceleration level on a fatigue load meter and then added together, give directly the proportion of fatigue life used up in the wing. It is suggested that when the estimated proportion is of order 80 per cent, then a more detailed assessment of fatigue life should be made.
Subject Index No.—1.7

**B-91** Porter, J. and Levy, J. C.
THE FATIGUE CURVES OF COPPER
J. Inst. Met. (England), Vol. 89, pp. 86–89, Nov., 1960.
An investigation has been carried out to determine the precise shape and significance of the fatigue (S/N) curve of copper. The fatigue tests were conducted on a rotating cantilever machine and the specimens were of electrolytic tough-pitch copper, annealed for 1 hr at 500 C in vacuum before testing. The S/N curve, determined from a substantial number of tests, showed a hitherto unsuspected discontinuity at a stress amplitude of $\sim$21,500 psi. It was confirmed by metallographic observation that this discontinuity (termed the Intermodal Transition Point) corresponded to a change in the mode of fatigue failure. Below 21,500 psi the crack initiated within a slip band, and its subsequent path showed a marked dependence upon the slip-band pattern. At stresses above 21,500 psi the crack usually started at an L- or Z-shaped nucleus, and the crack path was random in character, going both across and between grains. Even when it traversed a grain, the path was not obviously slip-dependent.
Subject Index Nos.—5.1.3., 5.1.4., 5.1.5

**B-92** Richards, E. J.; Bull, M. K.; and Willis, J. L.
BOUNDARY LAYER NOISE RESEARCH IN THE U.S.A. AND CANADA; A CRITICAL REVIEW
U. Southhampton Dept. Aeron. and Astron. Rept. 131 (England) p. 65, Feb., 1960.
Review of experimental and theoretical boundary-layer noise research in the U.S. and a collection of existing experimental data. Existing data tend to indicate that, for flight at Mach numbers up to 5, rms pressure fluctuation levels are not likely to exceed 150 db. It is concluded that the problem of structural fatigue from boundary-layer noise in this flight regime is to be particularly serious. However, such pressures are likely to provide a serious internal noise problem inside supersonic transports and near delicate electronic apparatus.
Subject Index No.—1.6.7

**B-93** Riddihough, M.
THERMAL CRACKING TEST FOR STEELS AND ALLOYS
Metallurgia (England), Vol. 62, pp. 53–57, Aug., 1960.
Subject Index Nos.—2.6.5., 2.8.1., 3.6.5., 3.8.1

**B-94** Roberts, E. and Honeycombe, R. W. K.
MOVEMENT OF POINT DEFECTS DURING FATIGUE OF ALLUMINUM CRYSTALS
Phil. Mag. (England), Vol. 5, Series 8, pp. 1147–1149, Nov., 1960.
The dynamic stress-strain behavior of Al crystals fatigued in a push-pull machine at 13 cycles per sec is outlined.
Subject Index Nos.—4.1.2., 4.1.5., 4.6.1.2

**B-95** Robins, D. A.
CONTINUOUSLY CAST ALUMINUM-TIN BEARINGS
Tin and Its Uses (England), No. 50, pp. 3–6, 1960.
Subject Index Nos.—4.2.1.1., 4.2.3., 4.8.1

**B-96** Russell, A. E.
FAIL SAFE PRINCIPLES OF AIRCRAFT DESIGN
Min. of Aviation, War Office (England), Symposium on Reliability of Service Equipment, Nov., 1960.
The possible causes of structural damage are considered and divided into three main headings: fatigue damage, accidental damage, and battle damage. The statistics of air safety are considered in relation to structural reliability; aeroelasticity effects as well as structural strength being discussed. Design principles are discussed. Importance of inspection is emphasized.
Subject Index Nos.—1.9.3., 1.10.3

**B-97** Salokangas, J. and Lehto, P.
THE FATIGUE STRENGTH OF SPRAYED-COPPER COATINGS
Engineer's Digest (England), Vol. 21, No. 1, pp. 105–106, Jan. 21, 1960. (Translated from Acta Polytechnical Scandinavica, Mechanical Engineering Series, No. 6, 1959).
Rotating bending fatigue tests were made on copper-sprayed steel specimens using various wire feed rates and spraying distances. If the feed rate is increased, the melting capacity of the flame is strained to the utmost, and may result in a coarse spray of macroparticles of Cu; conversely, when the feed rate is reduced, better atomization is obtained, producing a more homogeneous layer better able to fill cavities in the base metal, resulting in a higher fatigue strength.
Subject Index No.—2.4.8.2

**B-98** Schijve, J.
FATIGUE CRACK PROPAGATION IN LIGHT ALLOY SHEET MATERIAL AND STRUCTURES
Aircraft Eng. (England), Vol. 32, No. 381, p. 334, Nov., 1960.
The paper described an experimental programme which investigated the effects of structural size, frequency and varying the stress amplitude on fatigue crack propagation. All tests were performed at a positive mean stress.

**B-98** (*continued*).
Various size specimens from small components to full scale structures were compared.
The frequency effect was examined by studying the results of low (20 cpm) and high (2,000 cpm) frequency tests.
Subject Index Nos.—4.3.1., 4.5.1., 4.5.2., 4.7.2

**B-99** Smith, C. R.
FATIGUE RESISTANCE
Aircraft Eng. (England), Vol. 32, No. 375, pp. 142–144, May, 1960.
Contrary to the general conception of adding weight for fatigue resistance it is sometimes possible to reduce the fatigue hazard by removing weight. The theory of having bearing area, tear-out area, and tension area sufficient to develop the full shear strength of a rivet is not necessarily sound when fatigue life is considered. Accordingly, marked improvements in fatigue resistance can be achieved by reducing the underlying areas to such an extent that they are incapable of inducing loads causing fatigue failures of the main structure. Results of tests involving fatigue failure are given, and seven basic considerations in the design of fatigue resistant structures are listed.
Subject Index Nos.—4.1.3.4., 4.3.4., 4.9.3., 4.10.1.1., 4.10.1.2

**B-100** Stallmeyer, J. E. and Munse, W. H.
FATIGUE OF WELDED JOINTS IN HIGH-STRENGTH STEELS
British Welding J. (England), Vol. 7, No. 4, pp. 281–287, April, 1960.
The results of fatigue tests on various types of welded joint in alloy structural steels (75,000–150,000 psi, UTS) are presented and discussed. Little superiority over carbon steels was apparent, except at higher mean stresses. Removing weld reinforcement may give no improvement if significant weld defects remain. To make the best use of alloy steels, greater control of weld defects is necessary than for ordinary structural steels.
Subject Index Nos.—2.2.1.1., 2.10.1.3., 12.2.1.1., 12.10.1.3

**B-101** Stubbington, C. A.
THE EFFECT OF FATIGUE DEFORMATION ON THE DISPERSION OF SUBSEQUENT PRECIPITATION IN ALUMINUM ALLOYS
J. Inst. Metals (England), Vol. 38, pp. 227–232, Jan., 1960.
Metallographic and quantitative comparisons have been made between the hardening produced by unidirectional strain and that produced by cyclic strain, and their effects on the subsequent aging of aluminium-12.5 per cent magnesium alloy. Some metallographic observations on the influence of cyclic strain on the subsequent precipitation occurring in aluminium-30 per cent zinc alloy and in a commercial high-strength alloy (DTD 683) are also included. The mechanism by which precipitation is modified is discussed.
Subject Index Nos.—4.1.4., 4.1.5., 4.5.2., 4.2.2., 4.2.6

**B-102** Suzuki, M.
EFFECT OF THE GRAIN ORIENTATION OF THE UNDERLYING METAL ON FLEEKING IN COPPER ELECTRODEPOSITS SUBJECTED TO CYCLIC STRESS
J. Inst. Metals (England), Vol. 88, p. 319, March, 1960.
Subject Index No.—1.4.8.1

**B-103** Teed, P. L.
FRETTING AND FRETTING CORROSION
New Scientist (England), Vol. 8, pp. 776–779, Sept. 22, 1960.
Mechanism of fretting corrosion. Influence of gripping pad material and pressure on the fretting fatigue strength of RC130B Ti alloy. Data for fretting corrosion resistance of several cladding base metal combinations involving steel, cast iron, Al and other metals.
Subject Index Nos.—2.4.3., 2.6.3., 4.4.3., 4.6.3., 7.4.3., 7.6.3

**B-104** Tomlinson, J. E. and Wood, J. L.
FACTORS INFLUENCING THE FATIGUE BEHAVIOR OF WELDED ALUMINUM
British Welding J. (England), Vol. 7, No. 4, pp. 250–264, April, 1960.
Study of the fatigue behavior of aluminum alloys used in welded construction and of the behavior of welded connections. It is shown that for a given material the performance of as-welded joints depends mainly on configuration and bead profile, and that internal defects are of importance in butts where reinforcement is removed. Methods of improving fatigue performance are also discussed.
Subject Index Nos.—4.2.5., 4.3.4., 4.10.1.3., 4.11, 12.2.5., 12.3.4., 12.10.1.3

**B-105** Troughton, A. J.
RELATIONSHIP BETWEEN THEORY AND PRACTICE IN AIRCRAFT STRUCTURAL PROBLEMS
J. Royal Aeronaut. Soc. (England), Vol. 64, No. 599, pp. 653–667, Nov., 1960
When designing an aircraft structure, the structural engineer has to achieve given standards of airworthiness in respect to strength, stiffness and fatigue life while ensuring that the final weight is as low as possible to give operating economy or flexibility.
Stressing for fatigue has three basic rules: (a) evaluate fatigue stress levels spectra for mean operational conditions—never work to conventional ultimate strength reserve factors; (b) select design stresses based on the best test data available and add one's personal factor; and (c) have rigid design office rules to obviate the detail errors which prevent one reaching the typical life normally obtained at that stress level.
In the fatigue field there are many quite small features which may lead to premature failure such as inadequate radiusing of holes or sharp edges, rapid changes of cross-section, rough finish, eccentricities and high die-away loads. It is the sensitivity of fatigue life to these features and the tremendous number of components to check in one aircraft that leads to fail safe design and/or full scale testing.
Subject Index No.—1.12

**B-106** Weck, R.
SYMPOSIUM ON FATIGUE OF WELDED STRUCTURES—CAMBRIDGE UNIVERSITY, MARCH 29, 1960 TO APRIL 1, 1960.
British Welding J. (England), Vol. 7, No. 3, p. 161, March, 1960.
Subject Index Nos.—1.10.1.3., 1.12

**B-107** Whitman, J. G. and Alder, J. F.
PROGRAMMED FATIGUE TESTING OF FULL SIZE WELDED STEEL STRUCTURAL ASSEMBLIES
British Welding J. (England), Vol. 7, No. 4, pp. 272–280, April, 1960.
A fatigue machine for testing full-size bridge panels under constant or variable loading is described. The results of tests under constant loads, under constant loads preceded by a single high load, and using a mixture of load amplitudes are presented

**B-107** (*continued*).
for welded steel panels. An initial overload ($\frac{2}{3}$-yield strength) gave a slight but significant increase in the subsequent fatigue life. The programmed tests gave cumulative damage ratios varying from 0.75 to 2.8. The rate of crack propagation was slow.

Subject Index Nos.—2.8.1., 2.8.4., 2.10.3., 2.10.1.3

**B-108** Williams, D.
A SCHEME FOR PREVENTING STRUCTURAL DAMAGE BY JET EFFLUX
Royal Aircraft Establishment (England), RAE Tech. Note 290, Structures, 18 pp., Oct., 1960.

In this note the problem of structural damage from jet efflux is approached from a new angle. According to the scheme here put forward the vulnerable surfaces, instead of being designed to withstand the incident pressures by virtue of their own inherent strength, are insulated from direct contact with these pressures by a close-fitting protective sheath. This consists of a thin light-alloy sheet whose insulating properties depend on its own inertia and is therefore itself largely unstressed.

Subject Index Nos.—1.9.3., 1.10.3

**B-109** Williams, T. R. G. and Hughes, D. H.
PROBLEMS INVOLVED IN THE DEVELOPMENT OF PROGRAMMED FATIGUE TESTING
Engineer (England), Vol. 210, No. 5466, pp. 703–705, Oct. 28, 1960.

The problems involved in developing programme loading tests to simulate variable loading conditions in fatigue are reviewed. Results show that the load sequence pattern adopted in programme testing has an important effect on Miner's $\Sigma(\eta/N)$ ratio, but contradictory results are obtained in tests on aluminum alloys and mild steel. Comparison of the relationship between random fatigue loading and the programme loading pattern recommended by Gassner shows that for aluminium alloys, the programme test is a conservative estimation of the fatigue life in variable loading. Tests on aluminium alloys reveal a discontinuity in the S/N curve and this change in the mechanism of fatigue damage in aluminium may explain some of the contradictory results obtained between mild steel and aluminium alloys.

Subject Index Nos.—2.7.3.5., 2.8.4., 4.7.3.5., 4.8.4

**B-110** Williams, T. R. G. and Hughes, D. H.
THE PROBLEMS OF CUMULATIVE FATIGUE DAMAGE IN SHEET
Sheet Metal Ind. (England), Vol. 37, No. 401, pp. 653–659, Sept., 1960.

Subject Index Nos.—1.5.2., 1.7.3.5., 1.12.1., 4.7.3.5

**B-111** Wise, S.; Lindsay, D.; and Duncan, I. G. T.
THE STRENGTH OF RAILS WITH PARTICULAR REFERENCE TO RAIL JOINTS
Proc. Inst. Mech. Engrs. (England), Vol. 174, No. 9, pp. 371–407, Sept., 1960.

Subject Index Nos.—2.6.2., 2.10.1.2

**B-112** Wolf, H.
WELDING AS A MEANS OF IMPROVING NOTCH FATIGUE STRENGTH
Engineer's Digest (England), Vol. 21, No. 3, pp. 92–94, March, 1960.

Rotating-bending tests were made on notched steel samples (88,000 psi, UTS) having austenitic and bronze weld deposits. The notch (a fillet or transverse hole) was made in the deposit. The increases obtained in the fatigue strength at $2 \times 10^6$ cycles ranged from 20 to 35 per cent, as compared with unwelded samples, and depended upon the ratio of the elastic modulus values and the fatigue strength of the deposit. The location of the fatigue crack also changed.

Subject Index Nos.—2.3.4., 2.4.9

**B-113** Wood, J. L.
FLEXURAL FATIGUE STRENGTH OF BUTT WELDS IN NP-5/6-TYPE ALUMINUM ALLOY
British Welding J. (England), Vol. 7, No. 5, pp. 365–380, May, 1960.

3-$\frac{1}{2}$in. long specimens of $\frac{1}{4}$ in. BA.28 plate, unwelded and welded by the inert-gas metal-arc process, were tested in plane bending. The fatigue strength was reduced 50 per cent by welding; approx. half the reduction was due to the annealed material adjacent to the weld, and half to the weld bead stress-raiser. Dressing the bead flush with the plate restored the fatigue strength to that of annealed plate. Scattered fine porosity rendered this treatment ineffective, but had no effect on as-welded fatigue strength.

Subject Index Nos.—4.2.5.2., 4.3.4., 4.10.1.3

# Part C—Western European Countries

**C-1** Altmeyer, G. and Peiter, A.
INVESTIGATIONS OF DEFORMATIONS IN FATIGUE SPECIMENS BY MEASURING RESIDUAL STRESSES
Materialprüfung (Germany), Vol. 2, pp. 198–207, June, 1960.
Subject Index Nos.—2.1.5., 2.4.7., 2.5.4

**C-2** Anonymous
STAINLESS STEEL MARINE SCREW PROPELLERS
Acciaio Inossidabile (Italy), Vol. 27, pp. 481–483, July–Aug., 1960.
Subject Index Nos.—3.2.1., 3.6.2., 3.10.2

**C-3** Azzolini, A. and Gogito, G.
ALUMINUM BRONZE
Fonderia Ital. (Italy), Vol. 9, pp. 27–29, Jan., 1960.
Yield and fatigue strengths and fatigue limit are equal to those of some stainless steels. Mechanical properties are improved by the use of Fe, Ni and Mn alloy additions. Applications.
Subject Index Nos.—5.1.4.3., 5.2.1.1., 5.11

**C-4** Bourceau, G.
SOME PRACTICAL ENDURANCE EXAMPLES AND STABILITY OF VARIOUS PARTS AND ASSEMBLIES
Rev. Mecanique (France), Vol. 6, No. 4, pp. 193–208, 1960.
Subject Index Nos.—2.9.1., 2.10.2

**C-5** Broom, T.
CROSS-SLIP AS A SIGNIFICANT MECHANISM IN THE FATIGUE OF METALS
Acta Cryst. (Denmark), Vol. 13, Part 12, p. 1123, Dec. 10, 1960. (Paper presented at the Fifth General Assembly and International Congress of the International Union of Crystallography, Cambridge, England, Aug. 15–24, 1960.)
An essential condition for fatigue failure is continuing reversed slip in local regions. The common manifestation of this is the production of slip "striations."
The fatigue softening of work-hardened copper single crystals is shown to be dependent on the production of striations. The chief criterion for their formation is that the fatigue stress should exceed a value which is close to that necessary for cross-slip as indicated by the end of stage 2 in tensile tests.
Striations are prolific in aluminum single crystals because of the ease of cross-slip and their suppression in dilute aluminum-magnesium alloy crystals can be associated with increasing difficulty of cross-slip.
Subject Index Nos.—4.1.2., 4.1.5., 5.1.2., 5.1.5

**C-6** Cardona, S.
ULTRASONICS AND FATIGUE FAILURES
Rivista Di Meccanica (Italy), Vol. 11, pp. 19–23, Sept. 26, 1960.
Subject Index Nos.—2.7.1.2., 2.10.2

**C-7** Chatter-Jee-Fischer, R. and Schaaber, O.
EXPERIENCES IN TESTING BENDING FATIGUE STRENGTH OF THIN CASE-HARDENED SPECIMENS OF HIGH STRENGTH
Harterei-Technische Mitteilungen (Germany), Vol. 15, No. 1, p. 31, 1960.
Bending fatigue specimens of conventional shape are useless for very thin sheets. Two new specimen shapes are developed which guarantee a small bending angle and fracture at the proper location.
Subject Index No.—2.4.6

**C-8** Cornelius, E.
INVESTIGATING THE STRENGTH OF SEAMLESS AND WELDED TUBES UNDER ALTERNATING APPLIED TORSIONAL STRESS
VDI Zeitschrift (Germany), Vol. 102, No. 16, pp. 645–650, June 1, 1960 (in German).
Comparative tests indicated the welded tubes were stronger than the seamless ones. This is attributable to the greater notch influence of the surfaces and greater variations in wall thickness. No cracks occurred in the welded seam.
Subject Index Nos.—2.3, 2.10.1.3., 2.10.2

**C-9** Corradini, R.
FATIGUE TEST ON ROLL-FORMED ALUMINIUM CHANNEL SECTIONS (ESSAIS DE FATIGUE DE CHENAUX ANCAISSES EN ALUMINIUM)
Revue de l'Aluminium (France), Vol. 37, No. 273, pp. 209–211, Feb., 1960.
Gutters made of A5 Al with braze-welded joints withstood cyclic thermal expansion and contraction very well. Shape of gutter and thickness of Al sheep play role in fatigue resistance. (Q7; Al-b, 4-53, 7-52)
Subject Index Nos.—4.3.1., 4.3.2., 4.6.5., 4.8.3.1., 4.10.1.3., 4.10.2

**C-10** Coustenoble, A.
CORROSION FATIGUE DURING THE ANODIC PEROXYDATION OF LEAD
Metaux (Corrosion-Inds.) (France), Vol. 35, pp. 379–394, Oct., 1960.
Subject Index No.—8.6.2

**C-11** Daubertes, C.; Beuret, J.; Renout, M.; and Cazaud, R.
APPLICATION OF L. LOCATI'S METHOD FOR CHECKING THE FATIGUE LIMITS OF AUTOMOBILE PARTS
Mem. Sci. Rev. Met. (France), Vol. 57, No. 4, pp. 337–346, April, 1960.
Demonstration of validity and precision of a method which uses only one test piece from a lot. Examples of application to crankshafts, axles, wheels and journals. Fatigue limit given by this method does not differ appreciably from that of classic long-time test of 5 million cycles.
Subject Index Nos.—2.8.3.2., 2.9.3., 2.9.4., 2.10.2

**C-12** de Fouquet, J.
EFFECT OF THE ORIGINAL STATE ON THE STRUCTURAL CHANGES OF SOFT BASIC BESSEMER STEEL DURING HIGH TEMPERATURE FATIGUE TESTING
Mem. Sci. Rev. Met. (France), Vol. 57, No. 3, pp. 232–240, March, 1960.
Subject Index Nos.—2.1.5., 2.6.5., 2.7.3.1

**C-13** de Fouquet, J.
ON THE PECULIAR BEHAVIOR OF EXTRA-MILD STEEL UNDER FATIGUE STRESSING BETWEEN ROOM TEMPERATURE AND 500 C.
Mem. Sci. Rev. Met. (France), Vol. 57, No. 8, pp. 603–608, Aug., 1960.
Micrographic study of specimen surface, internal stresses, tensile stress curves and Vickers hardness reveals temperature dependent change in arrangement of carbon and nitrogen in mild steel and alpha Fe under effects of alternating-stress torsion fatigue tests.
Subject Index Nos.—2.1.4.2., 2.1.4.3., 2.1.5., 2.2.5.1., 2.6.1.1

**C-14** de Fouquet, J.; Jaquesson, R.; and Laurent, P.
A NEW FATIGUE MACHINE FOR ALTERNATING TORSION TESTS AT HIGH TEMPERATURE "IN VACUO" OR IN A CONTROLLED ATMOSPHERE
Mem. Sci. Rev. Met. (France), Vol. 57, No. 1, pp. 62–66, Jan., 1960.
The oxidation of metal which takes place in normal atmospheres prevented high-temperature fatigue observations. For this purpose a new testing machine has been devised. Equipment permits the observation of fractures of 18-8 steel from room temperature up to 1000 C.
Subject Index Nos.—1.6.1., 1.6.1.1., 1.8.1., 3.6.1.1., 3.8.1

**C-15** de Leiris, H.
FATIGUE AND WELDING
Rev. Mecanique (France), Vol. 6, No. 4, pp. 178–192, 1960.
Subject Index Nos.—2.9.1., 2.10.1.3

**C-16** de Leiris, H.
MEANS FOR INCREASING THE FATIGUE RESISTANCE OF WELDED NAVAL STRUCTURES
Ass. Tech. Marit. Bull. (France), pp. 441–456, 1960.
Subject Index Nos.—2.4.5., 2.10.1.3

**C-17** de Leiris, H.
ON MEANS OF RAISING THE FATIGUE STRENGTH OF CERTAIN WELDED ASSEMBLIES USED IN SHIPBUILDING
Assn. Tech. Marit. (France), Paper, 1960 Mtg.
Subject Index Nos.—2.4.5., 2.4.7., 2.10.1.3

**C-18** de Leiris, H. and Granjon, H.
STUDY OF THE FATIGUE OF PARTS REPAIRED BY BUILDING-UP TECHNIQUES
Soudage et Tech. Connexes (France), Vol. 14, pp. 85–102, March–April, 1960.
Results of cyclic torsion tests on 50-mm diam steel bars to which built-up deposits are applied either by arc welding or metallizing. Analysis of influence of thickness and width of deposits and welding conditions in the one case, and of various types of surface preparation in the other. Test specimens are of open-hearth steel of type used in France for rotating shafts in merchant vessels.
Subject Index Nos.—2.4.8.2., 2.10.1.3

**C-19** Finnern, B.
INFLUENCE OF LIQUID NITRIDING ON WEAR AND FATIGUE STRENGTH
Schweiz. Arch. Angew. Wiss. Tech. (Germany), Vol. 26, pp. 347–355, Sept., 1960.
Nitriding of machine parts of unalloyed and Cr-alloyed steel and cast iron at 570 C and subsequent water quenching or cooling in air. Influence of nitriding time on hardness and case thickness. Removal of wear effects by grinding.
Subject Index Nos.—2.4.1., 2.4.6.2

**C-20** Finnern, B. and Schaaber, O.
EFFECT OF SALT BATH NITRIDING ON THE FATIGUE STRENGTH OF CARBON STEELS
Harterei-Tech. Mitteilungen (Germany), Vol. 15, No. 2, pp. 63–72, 1960.
Subject Index Nos.—2.2.1., 2.4.6.2

**C-21** Franke, E. A.
TESTING OF WIRE ROPE
Draht (Germany), Vol. 11, pp. 56–59, Feb., 1960.
Suggestions are made for the design of fatigue-testing equipment.
Subject Index Nos.—2.8.1., 2.11

**C-22** Fugita, F. E.
DISLOCATION THEORY OF THE EXTRUSION, INTRUSION AND FATIGUE CRACK
Acta Cryst. (Denmark), Vol. 13, Part 12, p. 1123, Dec. 10, 1960. (Paper presented at the Fifth General Assembly and International Congress of the International Union of Crystallography, Cambridge, England, Aug. 15–24, 1960.)
The most interesting and important outcome of recent works concerning fatigue phenomena may be the observation of extrusion and intrusion in slip bands. However, whether or not they play the main role in fatigue is not certain at present. The theory first treats a dislocation mechanism of extrusion and intrusion; the proposed mechanism is somewhat similar to those by Cottrell, and Hull and Thompson, in such point that a latent slip system causes the disturbance of the main slip system, but more general one. In the second, the theory treats the oxidation process which would take place in active slip bands during fatigue: By to-and-fro motion of dislocations in a slip band during stress cycles of period of the order of $10^{-3}$ sec., a step with new metallic surface appears in every first half cycle and disappears in the second half cycle. Applying the theory of the initial rapid oxidation developed by Mott *et al.*, the rate of oxidation of such surface can be estimated. The result shows that oxygen atoms may be supplied at this step, be transported or diffused into the slip band, and finally form oxide layers or inclusions at the depth of several microns from the crystal surface, which would become the strong obstacles for dislocations to generate a fatigue crack even in absence of intrusions. Such oxidation mechanism can explain not only microscopic observations, such that the incipient crack does not always occur in the region where extrusions and intrusions are frequently observed, but also the effects of temperature, stress, atmosphere, and speed of testing on fatigue life. Oxidation may take place at the inner surface of intrusions too, and would cause the crack generation there, especially at higher temperature.
Subject Index No.—1.1.5

**C-23** Gabner, E.
BASIC ASPECTS TO IMPROVE THE ACCURACY OF ONE-STEP AND MULTI-STEP FATIGUE TESTS, PART I—ONE-STEP FATIGUE TESTS
Materialprüfung (Germany) Vol. 2, pp. 121–128, April 20, 1960.
One-step fatigue tests (Wohler tests) give a basis for evaluating repeatedly stressed components; multi-step tests (pro-

**C-23** (*continued*).
grammed fatigue tests) offer a possibility for evaluating limited life components. (Q7).
Subject Index No.—1.8.4

**C-24** Gianola, C.
THE FATIGUE STRENGTH OF METALS
Rivista Meccanica (Italy), Vol. 11, pp. 55–63, Aug. 29, 1960.
Fatigue strength under rotary bending of carbon, structural, stainless and alloy steels and of Cu, Ni, Mg, and Al alloys in a variety of heat treat conditions as reported in the literature.
Subject Index Nos.—1.3.4., 1.11., 1.12., 2.2.6., 2.3.4., 2.11., 3.2.6., 3.11

**C-25** Gianola, C.
THE FATIGUE STRENGTH OF METALS—PART 3
Rivista Meccanica (Italy), Vol. 11, pp. 27–33, Oct., 1960.
Subject Index Nos.—1.3.4., 1.5.4

**C-26** Gillemot, L. and Tomory, M.
INFLUENCE OF SURFACE TREATMENT ON FATIGUE AND BRITTLENESS
Freiberger Forschungsh (Germany), Vol. 50, pp. 123–135, 1960.
Rotary alternating bending of nitrided CrAlMo steel and case hardened steel after varying surface hardening treatments. Notched and notchless specimens are used. Susceptibility to brittle fracturing is measured in relation to surface hardening.
Subject Index Nos.—2.3.4., 2.4.6.1., 2.4.6.2

**C-27** Grosskreutz, J. C.
THE MECHANISM OF FATIGUE CRACK PROPAGATION IN ALUMINUM SINGLE CRYSTALS
Acta Cryst. (Denmark), Vol. 13, Part 12, p. 1124, Dec. 10, 1960. (Paper presented at the Fifth General Assembly and International Congress of the International Union of Crystallography, Cambridge, England, Aug. 15–24, 1960.)
Aluminum single crystals grown by strain-anneal have stressed at ~400 cps in pulsating tension and the initiation and propagation of fatigue cracks observed continuously under 300 × magnification. Motion photomicrographs have been taken under controlled conditions of illumination and exposure. Playback of the film under accelerated speeds allows the surface mechanism of crack initiation and propagation to be studied at leisure. In all cases, cracks were observed to initiate in surface slip bands; two or three neighboring bands may develop simultaneously and independently and later joined by cross-slip to form the main failure crack. Propagation occurs strictly along crystallographic slip systems, usually 1110. The direction of propagation is as nearly perpendicular to the tensile axis as is possible with the available slip systems. Even while maintaining a steady course, the crack frequently jumps from one parallel slip band to another by means of cross-slip. The primary mechanism of propagation appears to be a series of re-initiations in persistent slip bands at the tip of the advancing crack. Large grain (~5 mm) samples were grown to study the effect of grain boundaries. The effect depends in large measure on the relative orientation of the two grains. Examples were shown and discussed.
A model for crack propagation is proposed based on three observations and the evidence obtained from the motion photomicrographs.
Subject Index Nos.—1.8.2., 4.1.2., 4.1.5., 4.7.2

**C-28** Guillemin, J.
THE SE210 CARAVELLE JETLINER. III—SPECIAL MANUFACTURING TECHNIQUES
Revue de L'Aluminium (France), Vol. 37, No. 272, pp. 77–95, Jan., 1960.
Subject Index Nos.—4.8.4., 4.9.3., 4.10.3

**C-29** Hempel, M.
INFLUENCE OF MELTING AND ALLOYING ADDITIONS ON FATIGUE STRENGTH OF STEELS WITH SPECIAL REFERENCE TO SPRING STEELS
Draht (Germany), Vol. 11, pp. 429–437, Aug., 1960.
Effect of basic and acid melting processes; oxidizing or reducing conditions, casting and deoxidation phenomena and residual and alloying elements (S, P, C, Pb, Si, Be, Ti, W, Mn, Mo, Al, V, Co, Cr) on fatigue strength and other mechanical properties.
Subject Index Nos.—2.2.1.1., 2.2.3

**C-30** Hempel, M.
INVESTIGATION OF THE PHYSICAL AND METALLURGICAL PROPERTIES DURING FATIGUE TESTS
Draht (Germany), Vol. 11, pp. 151–157, April, 1960.
Effect of cycling on hardness, yield tensile, impact and fatigue strengths of carbon steel. Changes of damping properties, temperature, electrical conductivity, magnetic induction and structure with the number of cycles.
In order to extend the S/N curve and obtain information about incipient plastic flow, damage, disruption, and cracking routine fatigue tests are supplemented by electronic and magnetic measurements, X-ray and metallographic examination, and chemical analyses. The changes in structure and properties occurring at different stress levels are reviewed in the light of published results on the changes in mechanical properties, damping, generation of heat, magnetic induction, electronic resistance, and microstructure. Theories of the mechanism of fatigue failure are discussed.
Subject Index Nos.—1.1.3., 1.2.3., 2.1.3., 2.1.4.2., 2.1.4.3., 2.1.5

**C-31** Hempel, M.
INVESTIGATIONS OF S-N AND DAMAGE CURVES FOR STEEL WIRES
Arch. Eisenhüttenw. (Germany), Vol. 31, No. 6, pp. 373–383, June, 1960.
Investigations were conducted in rotating bending on variously processed steel wires of several kinds, 1 to 4 mm diameter, and 106 to 353 $kg/mm^2$ ultimate tensile strength. S-N and damage curves were determined by the Wöhler and French methods, respectively. The endurance limits increased with the ultimate tensile strength and were found to be between ±27.5 and ±60.0 $kg/mm^2$. The fatigue ratio varied between 0.25 and 0.35. In determining the damage, the overloads were taken between 10 and 100 per cent above the endurance limits. The ratio of cycles to damage versus cycles to failure decreased as the overloads increased. It was found that coaxing can increase the fatigue strength of steel wires.
Subject Index Nos.—2.1.4.3., 2.2.1., 2.7.1.1., 2.7.3.4

**C-32** Hempel, M.
TECHNOLOGICAL INFLUENCES ON FATIGUE STRENGTH OF STEELS
Draht (Germany), Vol. 11, pp. 589–600, Sept., 1960.
Effect of degree of deformation in working, microstructure

resulting from heat treatments and surface condition on fatigue strength of alloyed and unalloyed steels.
Subject Index Nos.—2.2.1.1., 2.2.4., 2.2.6., 2.4

**C-33** Hirsch, P. B. and Segall, R. L.
THE TEMPERATURE DEPENDENCE OF FATIGUE LIFE
Acta Cryst. (Denmark), Vol. 13, Part 12, p. 1123, Dec. 10, 1960. (Paper presented at Fifth General Assembly and International Congress of the International Union of Crystallography, Cambridge, England, Aug. 15–24, 1960.)
The temperature dependence of the fatigue life of aluminum single crystals has been studied in the temperature range 4.2 to 293 K. The specimens were fatigued in push-pull and the stress necessary to cause failure in $10^6$ cycles was determined. The results are interpreted in terms of a process of thermally activated cross slip.
Subject Index Nos.—4.1.2., 4.1.3.2., 4.6.1.2

**C-34** Hofmann, W. and Vibrans, G.
EFFECT OF HYDROGEN ON THE FATIGUE STRENGTH OF STEEL WELDS
Schweissen u. Schneiden (Germany), Vol. 12, pp. 95–101, March, 1960.
Subject Index Nos.—2.2.1.2., 2.10.1.3

**C-35** Hofmann, W.; Von Malotki, H.; and Wehr, P.
TENSION-COMPRESSION TESTING OF THE FATIGUE STRENGTH AND FORMABILITY OF LEAD AND LEAD ALLOYS FOR CABLE SHEATHING
Metall. (Germany), Vol. 14, No. 8, pp. 763–769, Aug., 1960.
From unalloyed Pb and Pb with small additions of Cu and Te, tubes are extruded and subjected to alternating tensile and compressive loads to determine fatigue strength and deformability.
Subject Index Nos.—8.5.4., 8.8.1., 8.8.2., 8.11

**C-36** Isken, H.
SG-CAST IRON
Industry-Anzeiger (Germany), Vol. 82, pp. 371–372, March 25, 1960.
Strength properties of ferritic, pearlitic and austenitic SG iron. Effect of the cast cross section on shape of the graphite and damping and strength properties. Increase of alternate bend strength by nitriding. Temperatures for relief annealing (620–680 C) and soft annealing (950–1040 C). Elimination of growing and dimensional changes at 500 C by heat treatment at 870 C (2 hr) and furnace cooling to 540 C.
Subject Index Nos.—2.3.2., 2.4.6.2

**C-37** Klesnil, M.
WORK HARDENING AND STRUCTURE CHANGES IN STEEL UNDER ALTERNATING STRESSES
Freiberger Forschungsh (Germany), Vol. 50, pp. 102–112, 1960.
Subject Index Nos.—2.1.4., 2.1.5., 2.7.1

**C-38** Kloppel, K. and Roos, E.
MECHANICAL TESTING AND FATIGUE INVESTIGATION TO EVALUATE DIMENSIONS OF FLAT SHEETS IN ORTHOTROPIC PLATES
Stahlbau (Germany), Vol. 29, pp. 361–373, Dec. 1960.
Tests to evaluate maximum carrying load, deflection and fatigue strength of 4.26 mm thick ST37 steel plates under varying load distributions and degrees of prestressing.
Subject Index Nos.—2.5.4., 2.7.3.1., 2.11

**C-39** Kochendorfer, A.
STRENGTH AND DEFORMATION PROPERTIES OF METALS AT LOW TEMPERATURES
Z. Metallk (Germany), Vol. 51, pp. 73–80, Feb., 1960.
Al, Cu, and Al-Mg alloy, an Al-Zn-Mg alloy, and various low-alloy steels mechanically tested at temperatures ranging from −225 to 225 C. Effect of temperature on tensile strength, yield strength elongation. Fatigue strength of straight and notched samples.
Subject Index Nos.—2.3.4., 2.6.1.2., 2.11, 4.3.4., 4.6.1.2., 4.11., 5.3.4., 5.6.1.2., 5.11., 6.3.4., 6.6.1.2., 6.11

**C-40** Massonet, C.
SOME FUNDAMENTAL PROGRESS ON FATIGUE
Rev. Mecanique (France), Vol. 6, No. 4, pp. 166–167, 1960.
Subject Index Nos.—4.1.5., 4.7.2

**C-41** Mori, L.
THE INFLUENCE OF TESTING TEMPERATURE ON THE MECHANICAL PROPERTIES IN FATIGUE OF Pe 50 ALLOY
Alluminio (Italy), Vol. 29, No. 2, pp. 65–69, Feb., 1960.
Subject Index Nos.—4.6.1.1., 4.8.2., 4.11

**C-42** Morri, D.
FEATURES OF FATIGUE FAILURE DURING ROTARY BENDING TESTS ON NOTCHED SPECIMENS OF AVIONAL 22 TN
Alluminio (Italy), Vol. 29, No. 6, pp. 283–289, June, 1960.
Three basic types of fracture corresponding to short, average and long endurance limits. Fractures at average endurance have a particularly ragged surface and occur only in the area of the "knee-shaped" discontinuity of the F-N curve. Relationship between this type of fracture and discontinuity of the curve could be attributed to the slackening of the rate of propagation of the principal crack, accompanied by the formation of secondary lateral cracks.
Subject Index Nos.—4.1.5., 4.3.4., 4.7.2., 4.11

**C-43** Mossoux, R. and Collin, J.
INFLUENCE OF SURFACE FINISH ON FATIGUE RESISTANCE
Rev. Mecanique (France), Vol. 6, No. 4, pp. 209–210, 1960.
Subject Index Nos.—2.4.1., 2.4.2

**C-44** Müller, P. and Macherauch, E.
X-RAY INVESTIGATION ON PROGRESSIVE DAMAGE OF STEEL SPECIMENS BY AXIAL (TENSION-COMPRESSION) FATIGUE LOADING, PART I
Arch Eisenhüttenw. (Germany), Vol. 31, No. 3, pp. 161–171, March, 1960.
An X-ray method is described that permits investigation of the damage processes under static and dynamic tension-compression loading, and enables a complete analysis of the state of lattice strains at the surface layers in multicrystals. The test procedures are discussed and examples are given on determination of lattice constants from the state of lattice strains. The applicability and limitations of the method are discussed.
Subject Index Nos.—2.1.5., 2.4.7., 2.7.1.1

**C-45** Müller, P. and Macherauch, E.
X-RAY INVESTIGATION ON PROGRESSIVE DAMAGE OF STEEL SPECIMENS BY AXIAL, (TENSION-COMPRESSION) FATIGUE LOADING, PART II
Arch. Eisenhüttenw. (Germany), Vol. 31, No. 4, pp. 259–270, April, 1960.

**C-45** (*continued*).

The lattice strain conditions were determined by X-ray techniques in surface layers of 25 Cr-4 Mo steel specimens loaded in uniaxial tension-compression static and fatigue loadings. The method employed and the measuring technique used enabled determination of lattice constants (and their changes): modulus of elasticity E and Poisson's ratio $\nu$ (or the elastic constants $\frac{1}{2}$ $S_1$ and $S_2$), the stress ratio of transverse stress $\sigma_2$ to principal stress $\sigma_1$, and the internal surface residual stresses $\sigma_{1E}$ and $\sigma_{2E}$.

Subject Index Nos.—2.1.5., 2.4.7., 2.7.1.1

**C-46** Muller-Vogt, G.
AMPLITUDE DEPENDENT DAMPING OF STEEL; CAUSE AND CORRELATION TO BRITTLE FRACTURE SUSCEPTIBILITY
VDI Zeit. (Germany), Vol. 102, p. 1204, Sept. 1, 1960.

Alternate torsion stressing of 0.69 per cent carbon steel with optical recording at frequencies from 20–400 Hz from −8 to +40 C. Interpretation of results in terms of dislocation theory.

Subject Index Nos.—2.1.4.2., 2.1.5., 2.6.1.2

**C-47** Oschatz, H.
CONSIDERATIONS ABOUT THE DEVELOPMENT OF FATIGUE TESTING MACHINES
Materialprüfung (Germany), Vol. 2, pp. 129–134, April 20, 1960.

Efficiency, accuracy of measuring techniques, costs of various types of equipment.

Subject Index No.—1.8.1

**C-48** Paganelli, M.
SOME METALLOGRAPHIC ASPECTS OBSERVED ON LIGHT ALLOY SPECIMENS SUBMITTED TO FATIGUE STRESS
Alluminio (Italy), Vol. 29, No. 11, pp. 511–519, Nov., 1960.

Subject Index Nos.—4.1.3., 4.2.2

**C-49** Panseri, C.; Leoni, M.; and Mori, L.
FATIGUE RESISTANCE AND CORROSION FATIGUE UNDER ROTARY BENDING LOAD OF ALUMINUM BRONZES OF THE XANTAL B AND XM TYPE
Alluminio (Italy), Vol. 29, No. 3, pp. 113–119, March, 1960.

The fatigue limits and corrosion fatigue of two complex aluminum bronzes, Xantal B (aluminum 11.0, iron 4.0, nickel 4.0–0/0, balance copper) and XM (aluminum 8.0, manganese 12.0, iron 3.0, nickel 2.0–0/0, balance copper) under rotary bending load was studied. The fatigue limit was 34 kg/mm$^2$ and 25.5 kg/mm$^2$ for Xantal B and 25.5 kg/mm$^2$ and 14 kg/mm$^2$ for XM alloy in air and 3–0/0 sodium chloride solution respectively.

Subject Index Nos.—5.2.1.1., 5.6.2., 5.7.2., 5.8.1., 5.8.3.1., 5.11

**C-50** Panseri, C. and Mori, L.
INFLUENCE OF HEAT TREATMENT ON THE FATIGUE FAILURE CURVE UNDER ROTARY BENDING LOAD
Alluminio (Italy), Vol. 29, pp. 563–566, Dec., 1960.

Curves obtained during bending fatigue tests on Avional 22 in a tempered and age hardened state (TN) and in a tempered and artificially aged state (TA). Hypotheses concerning the anomaly observed in the curve, a "knee" occurring in the TN curve but not observed in the TA curve.

Subject Index Nos.—4.2.6., 4.11

**C-51** Partridge, P. G. and Segall, R. L.
THE DISLOCATION DISTRIBUTION IN FATIGUE-FACE-CENTERED-CUBIC METALS
Acta Cryst. (Denmark), Vol. 13, Part 12, p. 1123, Dec. 10, 1960. (Paper presented at the Fifth General Assembly and International Congress of the International Union of Crystallography, Cambridge, England, Aug. 15–24, 1960.)

Transmission electron microscope observations have been carried out on fatigued polycrystalline copper, nickel and gold. Some experiments have also been done on copper single crystals. The dislocation arrangement found in these metals can be compared with that found in previous experiments on aluminum and austenitic stainless steel (18/8 type).

The dislocation arrangement in fatigued copper, nickel and gold is quite unlike that found after undirectional deformation. There is no tendency to form subgrains after fatigue. The dislocations are arranged in regions of very high density ($\sim 10^{10}$ to $10^{11}$ cm$^{-2}$) surrounded by less dense regions ($\sim 10^8$ cm$^{-2}$). There are many small dislocation loops, up to about 200 A in diameter. In addition, there are many large elongated dislocation loops. Experiments on copper single crystals have shown that the elongated loops have their long axis normal to the operative Burger's vector and in the slip plane. It is suggested that these loops are formed from multiple jogs on screw dislocations.

Subject Index Nos.—5.1.2., 5.1.5., 8.1.5

**C-52** Pasetti, A.
FATIGUE TESTS AND TENSIOMETRIC RECORDS ON CRANKSHAFT MODELS SUBJECTED TO TORSIONAL STRESSES
Fiat Stabilimento Grandi Motori (Italy), Vol. 12, pp. 49–61, April–June, 1960.

Subject Index No.—2.10.2

**C-53** Puchner, O.
IMPROVEMENT OF THE FATIGUE STRENGTH OF PLATES AND GIRDERS WITH WELDED GUSSETS BY LOCAL HEATING
Rev. Soudure (Belgium), Vol. 16, pp. 27–34, Jan., 1960.

Fatigue strength of gussets can be increased to around 90 per cent of that of base metal having a tensile strength of 38 kg per sq mm, and favorable results can also be obtained with steels having a tensile strength up to 55 kg per sq mm. Residual stresses produced have a generally favorable effect; mechanical properties of assembly are not impaired.

Subject Index Nos.—2.2.6., 2.10.2.3

**C-54** Puchner, O.
INCREASING THE FATIGUE STRENGTH OF BARS AND BEAMS WITH WELDED GUSSETS BY LOCAL HEATING
Soudure et Tech. Connexes (France), Vol. 14, p. 27, Jan.–Feb., 1960.

Subject Index Nos.—2.4.7., 2.10.1.3

**C-55** Rossetti, U. and Luboz, G.
THE EFFECT OF OVERSTRESSING IN FATIGUE TESTS CARRIED OUT WITH DECREASING LOADS
Ing. Meccanica (Italy), Vol. 11, pp. 49–55, Dec., 1960.

Subject Index No.—2.7.3.3

**C-56** Rubo, E.
TESTING STEELS AS TO THEIR BRITTLE FRACTURE SENSITIVITY BY MEANS OF THE FATIGUE BENDING TEST
VDI Zeit. (Germany), Vol. 98, pp. 913–919, June, 1956. Trans. No. MCL-562, Nov. 3, 1960.
Various aspects of this problem are discussed and literature references are grouped under the following headings: Comparison of Various Methods of Testing the Brittle Fracture Sensitivity Fundamentals; Characteristics of the Notch Impact-Bending Test; Peculiarities of the Bending Tests on Build-Up Welded Joints; Advantages and Suitability of the Fatigue Bending Test; Fatigue Bending Tests on Thick Cross-Sections; Bending Fracture Resistance; Coarseness of Grain in the Fracture Cross-Section; Sharpness and the Development of the Crack; and Operational Aspects.
Subject Index No.—2.7.1, 2.7.2, 2.8

**C-57** Schenck, H.; Schmidtmann, E.; and Kettler, H.
EFFECT OF STRAIN AGING ON THE BEHAVIOR OF STEEL UNDER FATIGUE LOADING
Arch. Eisenhüttenw. (Germany), Vol. 31, No. 11, pp. 659–669, Nov., 1960.
The behavior of an unalloyed, 0.22 per cent carbon steel was investigated in rotating-beam fatigue loading. The specimens were subjected to various load levels, test periods, rest periods at temperatures up to 180 C, and annealing treatments. Changes in modulus of elasticity and in damping were studied. Dislocation theory was employed to explain results. Strain aging was found to have a considerable effect on steel under fatigue loading. Coaxing was thought to be caused by strain aging.
Subject Index Nos.—2.1.4.2., 2.2.6., 2.7.3.2

**C-58** Schulz, H.
INCREASING THE BENDING FATIGUE STRENGTH OF DIESEL ENGINE
M.T.Z. (Germany), Vol. 21, p. 189, May, 1960.
Subject Index Nos.—2.4.5., 2.4.6.2., 2.10.2

**C-59** Tauscher, H.
INFLUENCE OF PHOSPHATIZING ON FATIGUE STRENGTH OF STEEL
Draht (Germany), Vol. 11, pp. 442–448, Aug., 1960.
Fatigue testing of phosphatized and untreated samples of K30SiMnCr4 steel and K40NiCrMo6 steel rods. Influence of other surface treatments such as Zn and Cd plating, degreasing, pickling, waxing and lacquering.
Subject Index Nos.—2.4.8.1., 2.4.8.2

**C-60** Thompson, N.
FATIGUE
Acta Cryst. (Denmark), Vol. 13, Part 12, p. 1123, Dec. 10, 1960. (Paper presented at the Fifth General Assembly and International Congress of the International Union of Crystallography, Cambridge, England, Aug. 15–24, 1960.)
An attempt is made to survey recent work relating to the production of vacant lattice sites, and other point defects, by the action of an alternating stress on a metal. The relevance of such defects to the process of fatigue fracture is discussed. Phenomena more directly attributable to dislocations are also considered in a similar way.
Subject Index Nos.—1.1.5., 1.12.1

**C-61** Tomory-Ronay, M.
CORROSION RESISTANCE WITH EMPHASIS ON CORROSION-FATIGUE OF GAS-NITRIDED TITANIUM STEELS
Metalloberfläche (Germany), Vol 14, pp. 360–365, Dec., 1960.
Subject Index No.—3.6.2

**C-62** Volk, K. E. and Franklin, A. W.
IMPROVEMENT OF THE ENDURANCE PROPERTIES OF HEAT RESISTING NICKEL ALLOYS CAUSED BY SMALL ADDITIONS OF BORON AND ZIRCONIUM
Z. Metallk. (Germany), Vol. 51, pp. 172–179, March, 1960.
Three types of Ni-Cr and Ni-Cr-Co alloys with additions of Al and Ti to obtain precipitation hardening (Nimonic 80, Nimonic 90, Nimonic 95). The quasi-ternary system $Ni_3$ Cr-$Ni_3$ Al-$Ni_3$ Ti (isothermal section at 750 C); influence of B and Zr additions on creep resistance; microstructure.
Subject Index No.—3.2.1.1

**C-63** Von Burg, E.
MECHANICAL STRENGTH CHARACTERISTICS OF ALUMINUM AND ITS ALLOYS AT LOW TEMPERATURES
Schweiz. Arch. angew. Wiss. Tech. (Switzerland), Vol. 26, No. 3, pp. 110–114, March, 1960.
Subject Index Nos.—4.3.4., 4.6.1.2., 4.10.1.3., 4.11

**C-64** Wellinger, K. and Gimmel, P.
THE EFFECTS OF WELDED OR SPRAYED METAL DEPOSITS ON FATIGUE STRENGTH OF SHAFTS
Werkstatt u. Betrieb (Germany), Vol. 50, No. 5, pp. 269–273, May, 1960. (Engineer's Digest) (England), Vol. 21, No. 7, pp. 93–94, July, 1960.)
Rotating bending tests on 50 $kg/mm^2$ steel samples, 45 mm diameter, with various deposits. Welded deposit reduced the fatigue strength to 7 $kg/mm^2$ from 23 $kg/mm^2$; stress-relieving raised it to 8–13 $kg/mm^2$; a sprayed deposit gave 12 $kg/mm^2$, and fracture originated at the original surface due to roughening procedure.
Subject Index Nos.—2.4.8.2., 2.9.1., 2.10.1.3., 2.10.2

**C-65** Weibull, W.
SIZE EFFECTS ON FATIGUE CRACK INITIATION AND PROPAGATION IN ALUMINUM SHEET SPECIMENS SUBJECTED TO STRESSES OF NEARLY CONSTANT AMPLITUDE
Aeronaut. Res. Inst. Sweden (Sweden), pp. 5–29, June, 1960.
Subject Index Nos.—4.3.1., 4.7.2

**C-66** Wiegand, H. and Illgner, K. H.
INFLUENCE OF VARIATION IN TEMPERATURE DURING ENDURANCE STRESSES ON THE CREEP BEHAVIOR OF TITANIUM ALLOYS
Metall. (Germany), Vol. 14, pp. 868–878, Sept., 1960.
Single and cyclic temperature changes (350–450 C) of three heat treated Ti alloys (Ti6Al4V, Ti9Al3V and Ti5Al2.5Sn) during endurance testing at constant strain in a specially developed testing apparatus.
Subject Index No.—7.6.1

**C-67** Winter, H. and Meckelburg, H.
DYNAMIC TESTING OF ADHESIVE BONDING METAL JOINTS
Aluminum (Germany), Vol. 36, No. 1, pp. 17–25, Jan., 1960.
Subject Index Nos.—1.8.1., 12.10.1.4

**C-68** Wintergerst, S.
DYNAMIC BEHAVIOR OF RIGID PVC
Kunststoffe (Germany), Vol. 50, pp. 277–280, May, 1960.
By means of rotary flexing tests carried out on rigid PVC rods over a temperature range of −30 to 50 C, its creep strength was determined by Wöhler curves. Utilizing the temperature increase within the rods caused by repeated flexing, the internal damping of the material was determined. Examination of the fractured surfaces enables certain conclusions to be drawn regarding the fracture mechanism. Dynamisches Verhalten von Hart-PVC.
Subject Index Nos.—9.1.4.2., 9.1.5., 9.6.1.1., 9.6.1.2

**C-69** Wolf, H.
FATIGUE TESTS ON NOTCHED SPECIMENS WITH FILLED NOTCHES
Schweissen u. Schneiden (Germany), Vol. 12, pp. 10–14, Jan., 1960.
Notch effect: possibilities of reducing the notch effect; stress distribution; repeated bend tests.
Subject Index Nos.—2.3.3., 2.3.4

## Part D—Eastern European Countries

**D-1** Agurtsov, K. I.
STRESS WAVES IN ELASTIC PLATES
Priklad Mat. i Mekhan (Russia), pp. 438–446, May–June, 1960.
Subject Index No.—1.1

**D-2** Balalaev, Y. F.
CHANGES IN STRUCTURE AND STRENGTH OF METALS DURING HIGH-FREQUENCY CYCLIC LOADING
Metalloved i Termichesk. Obrabotka Metallov., Sbornik Statei (Russia), pp. 41–47, April, 1960.
Subject Index No.—1.5.1

**D-3** Buyko, V. M. and Terminasov, Yu S.
X-RAY STUDY OF THE FATIGUE MECHANISM OF 35KhNM ALLOY STEEL
Izves. VUZ-Chernaya Met. (Russia), pp. 73–77, March, 1960.
Subject Index Nos.—2.1.5., 2.7.1

**D-4** Chaevskii, M. I.
SURFACE LAYER PROCESSES IN STEEL DURING CYCLIC DEFORMATION IN LOW-MELTING METALS
Doklady Akad. Nauk SSSR (Russia), Vol. 134, pp. 1399–1402, June, 1960.
Subject Index Nos.—2.6.1.1., 2.6.2

**D-5** Chernyak, M. I.
FATIGUE STRENGTH CHARACTERISTICS AS INFLUENCED BY PREVIOUS STRESSING
Dopoyidi Akad. Nauk Akr. RSR (Ukraine), pp. 1492–1494, Nov., 1960.
Heat treated structural steels are subjected to minor plastic deformation by tensile stressing, bending or torsion. Changes of the fatigue limit as a function of degree of deformation.
Subject Index Nos.—2.2.7., 2.4.7

**D-6** Elenevskii, D. S. and Schneerson, L. M.
FATIGUE STRENGTH OF CHEMICALLY HEAT TREATED MACHINE PARTS
Vestnik Mashinostroeniia (Russia), pp. 17–22, Oct., 1960.
Bend and torsion tests with asymmetric cyclic loading of 40KhNMA and 12Kh2H4A steel samples that have been subjected to cementation or nitriding. Distribution of stresses in the surface layer and core. Electropolishing increases fatigue strength of cemented parts.
Subject Index Nos.—2.4.2., 2.4.6.1., 2.4.6.2., 2.5.2

**D-7** Eminger, Z. and Pokorny, R.
HEAT RESISTANT STEELS FOR STEAM TURBINES
Strojirenstvi (Czecholsovakia), pp. 365–373, May, 1960.
Effect of high temperature and exposure time on the structure, mechanical properties, fatigue and creep strengths and relaxation of heat treated forged TBW 50, CrWV, Skoda T56, CrMoWV, Skoda T58 and Cr12WV steels and some cast alloy steels. Effect of composition on temper brittleness.
Subject Index No.—3.6.1.1

**D-8** Evgrafov, G. K. and Osipov, V. O.
USE OF RESIDUAL STRESSES FOR INCREASING FATIGUE STRENGTH OF WELDING CONSTRUCTIONS
Svarochnoe Proisvadstvo (Russia), pp. 8–10, Oct., 1960.
Local heating of welded structural units, such as railroad bridges, tensile stress concentrations and tendency to fatigue failure. Heating to 300–550 C by oxy-acetylene flame burner creates residual compression stresses, thus "transferring" tensile stresses to less critical sections of the unit.
Subject Index Nos.—2.4.7., 2.10.3

**D-9** Fridman, Ya B. and Egorov, V. I.
EFFECT OF PLASTIC DEFORMATION ON THERMAL FATIGUE RESISTANCE
Metalloved. i Termichesk. Obrabotka Metallov, Sbornik Statei (Russia), pp. 27–30, July, 1960.
Thermal fatigue strength and mechanical properties of cold worked and heat treated 1Kh18n9T Cr-Ni steel subjected to cyclic heating 800 $\leftrightarrows$ 20 C and cooling. Reduction of plasticity due to separation of carbide phases during heating and formation of microcracks are observed with the increase of heating cycles.
Subject Index Nos.—3.6.5., 3.7.3.1

**D-10** Fridman, Ya B.; Sobolev, N. D.; and Egorov, V. I.
MECHANICAL METHODS OF TESTING: ON THERMAL FATIGUE TESTS UNDER PURE-SHEER STRESS CONDITIONS
Zavodskaia Labortoriia (Russia), Vol. 26, No. 4, pp. 467–472, April, 1960. (Indust. Laboratory (U.S.A.), Vol. 26, No. 4, pp. 504–508, Dec., 1960 (Translation).)
Subject Index Nos.—1.1.3.2., 1.6.5

**D-11** Galan, P. and Jozefini, P.
ROTATIONAL BEND TESTING OF BUTT WELDED CYLINDRICAL SAMPLES
Zvaranie (Czechoslovakia), Vol. 9, pp. 266–269, Sept., 1960.
Tubes of carbon steel are assembled end to end by fitting a circumferential V-joint by resistance welding, flash welding or pressure gas welding. Data for fatigue and structural tests on completed weldments.
Subject Index No.—2.10.1.3

**D-12** Garf, M. E.
FATIGUE RESISTANCE FOR CYCLIC STRESS CURVES OF A COMPLEX FORM
Zavodskaia Labortoriia (Russia), Vol. 26, No. 1, pp. 94–98, Jan., 1960. (Indust. Laboratory (U.S.A.), Vol. 26, No. 1, pp. 97–101, Nov., 1960 (Translation).)
Subject Index No.—1.6.5

**D-13** Golovin, S. A.
FATIGUE STRENGTH OF SOME CARBON STEELS
Izvest. VUZ-Chernaya Met. (Russia), pp. 146–149, May, 1960.
Torsion, bend and hardness tests of quenched and tempered 50A, U7A and U10A steels used for production of springs which operate under vibration loads. Values for fatigue limits at vari-

**D-13** (*continued*).
ous temperatures. Selection of adequate heat treatment for these steels to provide favorable fatigue properties.
Subject Index Nos.—2.2.6., 2.6.1.1., 2.11

**D-14** Ivanova, V. S.
A NEW CHARACTERISTIC OF THE FATIGUE FAILURE OF METALS
Sov. Phys.-Dokl. (Russia), pp. 875–878, Feb., 1960.
Discussion of the fatigue constant of the metal as a characteristic of fatigue failure induced by symmetrically cyclic stresses beyond the fatigue limit. The fatigue constant is defined as the difference between the stress which causes fatigue failure after a given number of cycles and the stress at which, after the same number of cycles, submicroscopic cracks begin to form.
Subject Index No.—1.12.1

**D-15** Ivanova, V. S.
MECHANISM OF PLASTIC DEFORMATION CAUSED BY CYCLIC LOADING
Metalloved. i Termichesk. Obrabotka Metallov, Sbornik Statei (Russia), pp. 30–37, April, 1960.
Subject Index No.—1.1.5

**D-16** Ivanova, V. S.
RAPID DETERMINATION OF FATIGUE STRENGTH FROM CRITICAL FATIGUE STRESS
Zavodskaia Labortoriia (Russia), Vol. 26, pp. 593–598, May, 1960.
Relationship between the fatigue strength and the critical number of cycles at which lasting distortions form on one side and the latent melting heat, mean specific heat, absolute melting temperature, shear modulus, modulus of elasticity, mechanical heat equivalent and density on the other side.
Subject Index Nos.—1.1.3., 1.1.4

**D-17** Izdinsky, O.
EFFECT OF HEAT TREATMENT ON FATIGUE STRENGTH OF WELDMENTS
Zvaranie (Czechoslovakia), Vol. 9, pp. 168–171, June, 1960.
Electroslag welding of 15110 steel using the electrode Boi special and the flux VUS34Mn. Some of the welded samples are annealed at 650 C, others are normalized at 960 C and subsequently heat treated at 660 C, then fatigue tested.
Subject Index Nos.—2.2.6., 2.10.1.3

**D-18** Karpenko, G. V.
EFFECT OF SCALE FACTOR ON CORROSION FATIGUE
Zavodskaia Labortoriia (Russia), Vol. 26, pp. 1134–1135, Sept., 1960.
Subject Index Nos.—2.3.1., 2.4., 2.6.2

**D-19** Katz, S. N.
THE EFFECT OF ADDITIONAL AXIAL STRESSES ON THE FATIGUE STRENGTH OF BOILER PIPES
Teploenergetika (Russia), No. 5, pp. 12–16, Dec. 16, 1960.
Subject Index Nos.—2.5.3., 2.10.2

**D-20** Klesnil, M.
FATIGUE FAILURE OF STEELS WITH VARYING CARBON CONTENT
Hutnicke Listy (Czechoslovakia), Vol. 15, pp. 120–125, Feb., 1960.
Investigation by fatigue tests, microradiography and electron microscopy. Strain hardening phenomenon and development of submicroscopic flaws studied.
Subject Index No.—2.1.5

**D-21** Kruglikov, S. S.
A STUDY OF THE FATIGUE OF TOOL STEELS HAVING A SURFACE COATING
Ekspress-Informatiya, Metalloved i Termichesk. Obrabotka Metal. (Russia), Abstracts 61–68, No. 10, 4 pp., March, 1960. (Trans. No. MCL-790, Jan. 17, 1961.)
The fatigue strength of chrome tool steel is substantially reduced as a result of applying a metallic coating by spraying, dipping, or electrolysis. The decrease occurs before and after holding the steel at an elevated temperature. Shot-peening or nitriding the surface of steel prior to application of a coating considerably increases the fatigue strength of the coated specimens. This effect also occurs after holding the coated specimens at elevated temperatures. Aluminum-silicon paint does not substantially affect the fatigue of steel. (Author)
Subject Index No.—2.4.8.2

**D-22** Kudryautsev, I. V. and Naumova, T. V.
FATIGUE STRENGTH OF AUSTENITIC STEEL PIPE WELDS
Energo-Mashinostronie (Russia), pp. 35–42, Aug., 1960.
Effect of welding conditions and heat treatment on crack formation in Ei257 steel pipe welds. Fatigue strength of welds during cyclic loading at 20 and 580 C.
Subject Index Nos.—2.2.6., 2.6.1.1., 2.10.1.3

**D-23** Kudryautsev, I. V.; Savvina, N. M.; and Rozenman, L. M.
REDUCTION OF FATIGUE STRENGTH OF STEEL PARTS IN CONTACT AREAS
Metalloved. i Termichesk. Obrabotka Metallov Sbornik Statei (Russia), pp. 3–7, July, 1960.
Stress concentration due to cyclic loads, fretting corrosion and friction as factors causing wear and fracture of machine parts in contact. Material used as intermediate layer in contact areas.
Subject Index Nos.—2.3.4., 2.6.2., 2.6.3., 2.10.2

**D-24** Laptev, A. E.
BREAKDOWN OF MACHINE PARTS EXPOSED TO CYCLIC LOADS
Vestnik Mashinostroeniia (Russia), pp. 3–6, July, 1960.
Important factors involved in initiation of fatigue defects of steel machine parts. Nature of rupture and cracks caused by cyclic stresses and certain operating conditions.
Subject Index Nos.—2.9.1., 2.10.2

**D-25** Nadasan, St.; Bernath, A.; and Lovitiu, E.
A STUDY OF THE FATIGUE BEHAVIOR OF HIGH QUALITY CARBON STEELS PRODUCED IN THE RUMANIAN POPULAR REPUBLIC. I. STANDARDIZED STEELS
Acad. Rep. Populare Romine, Baza Cercetai Atiint. Timisoara, Studii Cercet Saritiint., Series I, Rumania, Vol. 7, Nos. 1–2, pp. 7–26, Jan.–June, 1960.
Fatigue limits during rotating bending tests according to a symmetric cycle were determined for carbon steels OLC 35, OLC 45, and OLC 60. A statistical study was made of the results obtained on specimens prepared from 21 different casts from each type in order to determine their probable fracture limit.
Subject Index Nos.—2.2.2.1, 2.8.3.2

**D-26** Navrotsky, D. I. and Saveliev, V. N.
INFLUENCE OF RESIDUAL STRESSES ON FATIGUE STRENGTH OF TRANSVERSE WELDED SEAMS
Svarochnoe Proisvadstvo (Russia), pp. 15–17, May, 1960.
Determination of the residual stresses in transverse welds of samples of M16C steel. Comparison of fatigue strength of the annealed samples with nonannealed specimens.
Subject Index Nos.—2.2.6, 2.3.4, 2.4.7, 2.10.1.3

**D-27** Oding, I. A.
SCALE FACTOR IN CYCLIC LOADING
Zavodskaia Labortoriia (Russia), Vol. 26, pp. 1106–1107, Sept., 1960.
Effect of sample dimensions, heat treatment, grain size and stress heterogeneity on the strength of specimens during impact, tensile and bend testing under cyclic loading.
Subject Index Nos.—1.1.4, 1.2.2.1, 1.2.6, 1.3.1

**D-28** Oding, I. A. and Kostochkin, Yu. V.
DEFORMATION AND RUPTURE DURING THERMAL FATIGUE
Metalloved. i Termichesk. Obrabotka Metallov Sbornik Statei (Russia), p. 26, April, 1960.
Subject Index Nos.—2.1.3, 2.1.4, 2.2.1.1, 2.6.5

**D-29** Pavlov, P. A.; Paromenskii, A. A.; and Lifshifts, I. I.
INSTRUMENT FOR THE COMBINED TORSION FATIGUE-TENSILE TEST
Zavodskaia Labortoriia (Russia), Vol. 26, pp. 762–764, June, 1960.
Subject Index No. 1.8.1

**D-30** Przegalinski, S.; Bak, R.; and Wojnarowski, J.
EFFECT OF NICKEL ON THE FATIGUE STRENGTH OF STRUCTURAL STEELS
Prace Instytutow Hutniczych (Poland), Vol. 12, pp. 219–222, May, 1960.
Subject Index Nos.—2.2.1, 2.3.4, 2.5.4

**D-31** Shkol'nik, L. M.
FACTORS CAUSING CAVITIES AND TRANSVERSAL CRACKS IN RAIL HEADS
Stal' (Russia), pp. 555–558, June, 1960.
Cavities and cracks in rail heads as influenced by accumulation of nonmetallic inclusions in the metal, which causes laminations and reduction of fatigue strength. Improvement of steel purity by heat treatment and alloying, with decarburizing depth not exceeding 20–25 mm, eliminates these defects.
Subject Index No.—2.2.5.1

**D-32** Silin, L. L.; Kuznetsov, V. A.; and El'Iasheva, M. A.
STRENGTH OF ALUMINUM ALLOY JOINTS IN ULTRASONIC WELDING
Svarochnoe Proisvadstvo (Russia), No. 7, pp. 5–8, July, 1960.
The static strength of joints made of D16M and AMg3M welded by ultrasonic method, during cutting and shearing and at elevated temperature, does not exceed the strength of joints obtained by contact welding. Increasing the testing temperature to 150 C decreases the strength by 20–25 per cent and to 250 C by 40–45 per cent. The vibrational strength of binding joints welded by ultrasounds is very high and higher by 30 per cent than in the case of contact welding.
Subject Index No.—4.10.1

**D-33** Silvesterov, A. V.
FATIGUE FRACTURE OF ALUMINUM ALLOY AMg-6
Zavodskaia Labortoriia (Russia), Vol. 25, pp. 605–607, May, 1960.
Samples are manufactured from rolled and extruded sections and subjected to cyclic tensile loading. The ruptured surface shows a portion of ductile and one of brittle fracture the size of which depends on the minimum load causing rupture.
Subject Index Nos.—4.1.5, 4.2.4, 4.5.2

**D-34** Silvesterov, A. V.
FATIGUE STRENGTH OF WELDED JOINTS OF AMg6 ALLOY
Svarochnoe Proisvadstvo (Russia), pp. 15–17, July, 1960.
Fatigue strength of AMg6 alloy (Al-Mg type) joints is found to be similar to that of the base metal, although it is reduced by an increase of the number of beads. Application of the argon-arc welding process is shown to be favorable for structural elements exposed to dynamic loading.
Subject Index Nos.—4.10.1.3, 4.11

**D-35** Vagapov, P. D.
GENERAL THEORY ON THE SCALE EFFECT IN CYCLIC LOADING
Zavodslaia Labortoriia (Russia), Vol. 26, pp. 1108–1116, Sept., 1960.
Subject Index Nos.—2.3.1, 2.3.2, 2.7.2

**D-36** Zubov, V. Y. and Hrachev, S. V.
IMPROVING THE QUALITY OF SPRING STEEL STRIP
Stal' (Russia), Vol. 20, pp. 849–851, Sept., 1960.
Elimination of austenite grain formations in spring strip by gradual tempering and additional water cooling. Resistance to fatigue and relaxation; comparison with strip with no water cooling.
Subject Index Nos.—2.2.2, 2.2.6

**E-1** Akizono, K.
FORMATION AND PROPAGATION OF FATIGUE CRACKS—S-N CURVES OF IMPACT FATIGUE
J. J.S.M.E. (Japan), Vol. 24, pp. 226–229, Dec., 1960.
Tests on annealed 0.2–0.3 per cent carbon steel specimens using Matsumura's impact fatigue testing machine. Correlation of crack length and propagation velocity with number of blows for fracture and tensile, compressive and tensile-compressive stresses in the specimen notch.
Subject Index Nos.—2.3.4, 2.7.2

**E-2** Anonymous
DIMENSIONAL EFFECTS ON THE FATIGUE PROPERTIES OF STEEL MATERIALS
J. J.S.M.E. (Japan), Vol. 63, pp. 1525–1539, Nov., 1960.
Subject Index Nos.—2.2.1, 2.3.1, 2.5.4

**E-3** Awatani, J.
FATIGUE TESTS OF METALS AT ULTRASONIC FREQUENCY
Trans. J.S.M.E. (Japan), Vol. 26, pp. 1382–1386, Oct., 1960.
S-N curves are obtained for bearing steel and Cu specimens as a function of ultrasonically induced stress concentration at the midportion, which is contracted. Analysis is made of the vibration of the contracted test piece of resonance conditions.
Subject Index Nos.—2.5.1, 2.11, 5.5.1, 5.11

**E-4** Endo, K.
EFFECT OF ATMOSPHERE ON FATIGUE STRENGTH OF CARBON STEEL AT ELEVATED TEMPERATURE
Bull. J.S.M.E. (Japan), Vol. 3, pp. 76–80, 1960.
Fatigue tests of carbon steel at 550 C, under rotating bending and repeated torsion. Atmosphere used was town gas, nitrogen, argon and vacuum.
Subject Index Nos.—2.5.4, 2.6.1.1, 2.6.2, 2.11

**E-5** Hukai, S. and Takeuchi, K.
AN EXPERIMENTAL STUDY OF THE EFFECTS OF ENVIRONMENTS ON THE FATIGUE STRENGTH OF SOME COPPER ALLOYS
Sumitomo Light Metal Tech. Reports (Japan), Vol. 1, pp. 18–23, April, 1960.
Subject Index Nos.—5.2.1.1, 5.6.2

**E-6** Hukai, S. and Takeuchi, K.
Sumitomo Light Metal Tech. Reports (Japan), Vol. 1, 45–54, Jan., 1960.
Rotary bending fatigue test on high strength, corrosion-resistant and heat-resistant Al alloys. Effects of extrusion, forging, rolling, annealing and notch sharpness on stress concentration, notch sensitivity and fatigue strength.
Subject Index Nos.—4.2.1, 4.2.4, 4.2.6, 4.3.4, 4.11

**E-7** Kawade, Y.; Sekido, Y.; and Sasaki, S.
SOME EXPERIMENTS ON THE FATIGUE LIFE UNDER DOUBLE AND TRIPLE STRESSES
Bull. J.S.M.E. (Japan), Vol. 3, No. 10, pp. 275–281, May, 1960.
Effect of cumulative stresses on the fatigue life of 0.07 per cent, 0.25 per cent and 0.47 per cent carbon steel is investigated by rotating bending fatigue test.
Subject Index Nos.—2.2.1, 2.5.2, 2.7.3.5

**E-8** Kawamoto, M. and Kimura, K.
NON-PROPAGATING CRACKS IN FATIGUE OF METALS
Bull. J.S.M.E. (Japan), Vol. 3, pp. 41–47, 1960.
Testing of medium carbon steel (0.34 per cent C) for fatigue strength by superimposing higher stress levels on repeated lower ones. Investigation of the influence of the cycle ratios of the primary stress and the secondary (higher) stress level. Interpretation of the results by cycle ratio-damage (D-R) curves.
Subject Index Nos.—2.7.2, 2.7.3.3, 2.7.3.4, 2.12.1

**E-9** Kawamoto, M.; Nakagawa, T.; and Kohama, H.
FATIGUE STRENGTH UNDER MULTIPLE REPEATED STRESS
Bull. J.S.M.E. (Japan), Vol. 3, pp. 425–431, Nov., 1960.
Subject Index No.—2.7.3.5

**E-10** Kawamoto, M.; Takai, H.; and Kisimato, H.
FATIGUE BAUSCHINGER EFFECT
Trans. J.S.M.E. (Japan), Vol. 26, pp. 1333–1339, Oct., 1960.
Deformation behavior of 0.34 per cent carbon steel under cyclic loading pulsating torsional stress applied in one direction and successively in the reverse direction. A "Fatigue Bauschinger Effect" is observed at stress slightly below the yield stress, corresponding to the conventional Bauschinger Effect observed in static loading.
Subject Index No.—2.1.5

**E-11** Kori, T. and Sasaki, S.
A STUDY ON THE FATIGUE STRENGTH OF CARBON STEELS UNDER MULTIPLE REPEATED STRESSES
Bull. J.S.M.E. (Japan), Vol. 3, No. 10, pp. 281–286, May, 1960.
Prediction of fatigue strength of carbon steels subjected to multiple repeated stresses from results of ordinary fatigue tests. The new relation is based on the already reported equation derived from the assumption that fatigue is caused by accumulation of the distortion of atom lattice. Effects of the excess ratio of stresses, cycle ratio and carbon content of materials. An equation expressing the relation between rotary bending stresses and number of stress repetitions under multiple repeated stress on two stress levels.
Subject Index Nos.—2.7.3.5, 2.9.3

**E-12** Kukai, S. and Takeuchi, K.
EFFECT OF DIFFERENCE IN GRAIN STRUCTURE IN THE FATIGUE PROPERTIES OF ALUMINUM ALLOYS
Sumitomo Light Metals Tech. Repts. (Japan), Vol. 1, pp. 235–245, Oct., 1960.
Notch and unnotched fatigue strengths of coarse and fine grain structures of extruded 61S, 17S and 75S and forged 14S Al alloys are examined through rotating beam tests. Crack initiation under cyclic stressing and static tensile and plastic

properties are also studied as a function of grain size, structure and direction.
Subject Index Nos.—4.2.1, 4.2.2.1, 4.3.4, 4.11

E-13 Nakamura, H.
INDUCTION HARDENING AND FATIGUE STRENGTH
Quart. Rep., Railway Tech. Res. Inst., JNR (Japan), Vol. 1, pp. 17–27, Dec., 1960.
Strength tests and stress measurements were made on carbon steel to determine the effect of induction hardening on fatigue strength. Results indicate improved fatigue properties are dependent on carbon content and pretreatment.
Subject Index Nos.—2.2.1, 2.2.6

E-14 Nakamura, H. and Veda, S.
PLAIN BENDING FATIGUE STRENGTH OF WELDED JOINTS
Trans. J.S.M.E. (Japan), Vol. 26, pp. 1361–1368, Oct., 1960.
Bending fatigue tests on model weldments used in the design and manufacture of truck frames, axles and wheels. Effect of postweld operations such as shot-peening, grinding and annealing on fatigue strength and crack propagation. Relation of notch sensitivity to weldment surface defects.
Subject Index Nos.—2.4.5, 2.7.2, 2.10.1.3

E-15 Ramamritham, S. and Kumar, S.
AN EXPERIMENTAL DETERMINATION OF AXIAL LOAD FATIGUE STRENGTH OF TWO COMMONLY USED AIRCRAFT SPECIFICATION ALUMINUM ALLOYS 24S-T3 AND L-72
J. Aeronaut. Soc. India (India), Vol. 12, pp. 26–39, May, 1960.
Alclad 24S-T3 and L-72 Al alloy sheets undergo static tensile testing, fatigue testing and visual examination of fractured surfaces.
Subject Index Nos.—4.5.2, 4.11

E-16 Shinoda, G.; Sakurai, T.; Sano, T.; Kawasaki, T.; and Izumi, H.
FATIGUE STRENGTH OF AUSTENITIC STEEL AT ELEVATED TEMPERATURES
J. J. Inst. Met. (Japan), Vol. 24, pp. 645–649, Oct., 1960.
Rotating beam fatigue tests on plain and notched austenitic stainless steel specimens, including 304, 316, 347 and 321 stainless at 460–700 C. Fatigue strength at high temperatures is determined as a function of endurance limit and enhancement by carbon content and carbide precipitation.
Subject Index Nos.—3.2.1.1, 3.3.4, 3.6.1.1, 3.11

E-17 Shiota, N. and Imabayashi, M.
CORROSION FATIGUE AND CAVITATION EROSION OF CORROSION RESISTANT ALUMINUM CASTING ALLOYS
J. J. Inst. Met., (Japan), Vol. 24, pp. 304–308, May, 1960.
Subject Index No.—4.6.2

E-18 Sines, G.
THE PREDICTION OF FATIGUE FRACTURE UNDER COMBINED STRESSES AT STRESS CONCENTRATION
Trans. J.S.M.E. (Japan), Vol. 26, pp. 1340–1347, Oct., 1960.
Fatigue failure criteria for unnotched specimens under a combination of alternating and static stress are proposed and examined in fatigue tests to obtain a general failure criterion, especially applicable to notched specimens with stress concentrations. Data are reviewed for various carbon and alloy steels, malleable iron and Cu and Al alloys, after heat treatment and working.
Subject Index Nos.—1.3.4, 1.5.3, 2.3.4, 2.5.2, 4.3.4, 4.5.3, 5.3.4, 5.5.3

E-19 Taira, S. and Honda, K.
X-RAY STUDY OF FATIGUE DAMAGE IN METALLIC MATERIALS
J. J. Inst. Met. (Japan), Vol. 24, pp. 331–335, June, 1960.
Subject Index Nos.—2.1.5, 2.7.1.1

E-20 Taira, S. and Koterazawa, R.
DYNAMIC CREEP AND FATIGUE OF 13 Cr STEEL AT ELEVATED TEMPERATURE
Trans. J.S.M.E. (Japan), Vol. 20, pp. 1356–1360, Oct., 1960.
Data for dynamic creep and fatigue tests at 450 C are correlated with static creep rupture and reversed stress fatigue test data to predict high temperature strength.
Subject Index Nos.—3.1.4.4, 3.6.1.1, 3.11

E-21 Taira, S. and Koterazawa, R.
INFLUENCE OF FREQUENCY OF STRESS CYCLES ON FATIGUE AT ELEVATED TEMPERATURES
Bull. J.S.M.E. (Japan), Vol. 3, No. 10, pp. 235–241, 1960.
Rotating bending fatigue tests were made on 0.55 per cent carbon steel and 13 per cent Cr steel from 450–600 C and stress cycle frequencies of 170 and 1500 cpm. Fatigue strength was determined as a function of strain amplitude, stress cycle frequency and temperature.
Subject Index Nos.—2.2.1.1, 2.5.1, 2.6.1.1, 3.5.1, 3.6.1.1

E-22 Taira, S.; Murakami, Y.; and Koterazawa, R.
INFLUENCE OF REST IN STRESS ALTERNATION ON THE FATIGUE PROPERTIES OF A LOW-CARBON STEEL AT ELEVATED TEMPERATURES
Bull. J.S.M.E. (Japan), Vol. 3, No. 10, pp. 242–246, 1960.
Subject Index Nos.—2.6.1.1, 2.7.3.2

E-23 Takenaka, Y.
FATIGUE OF METALS UNDER REPEATED FINITE STRAIN
Bull. J.S.M.E. (Japan), Vol. 3, pp. 419–424, Nov., 1960.
Measurement of the fatigue characteristics and tensile strength of mild steel and brass tubes subjected to repeated plastic strain in a combined tension-compression and torsion testing machine. Observations on strain hardening, strain softening and the relations between saturated stresses, strain amplitudes and the number of cycles required for fracture.
Subject Index Nos.—2.1.1, 2.1.4, 2.1.5, 2.5.3, 5.1.4, 5.1.5, 5.5.3, 5.11

E-24 Tokuda, A.
MICROFRACTOGRAPHY OF FATIGUE FRACTURE SURFACES OF METALS: PART II, ELECTRON MICROSCOPIC OBSERVATIONS OF THE FATIGUE FRACTURE SURFACES OF LOW ALLOY STEELS AND HIGH CARBON STEELS
J. J. Inst. Met. (Japan), Vol. 24, pp. 665–668, Oct., 1960.
Subject Index Nos.—2.1.5, 2.2.1.1, 2.2.6

E-25 Tokuda, A.
OBSERVATION OF THE FATIGUE FRACTURE SURFACE OF SOME CARBON STEELS BY ELECTRON MICROSCOPE; PART I, MICROFRACTOGRAPHY OF FATIGUE FRACTURE SURFACE OF METALS
Microfractograph with carbon replica by direct evaporation.

**E-25** (*continued*).
The carbon replica was stripped off the specimen surface by electrolyzing or by immersing in alcoholic acid solution. Specimens were made from steel bars with carbon content 0.3 per cent or less and fractured with a rotating beam-fatigue tester at stress levels ranging from 44.8 to 16.3 kg per sq mm. Patterns observed on the fatigue fracture surface can be classified into five types.
Subject Index No.—2.1.5

**E-26** Uchiyama, I.; Hoshino, A.; and Ueno, M.
FATIGUE OF BALL BEARING STEELS
Trans. Nat. Res. Inst. Met. (Tokyo) (Japan), Vol. 2, No. 1, pp. 6–12, 1960.
Tests show that at first a crack nucleates and then propagates to flaking in a very short time. Therefore, it is deduced that the durability of ball bearing steels does not depend on the propagation of the crack, but on the nucleation of it. The size and distribution of carbide and the affinity between carbide and matrix may largely affect the nucleation of crack.
Subject Index Nos.—2.2.2, 2.7.1.1, 2.7.1.2, 2.10.2.2

**E-27** Yamamoto, M. and Watanabe, J.
FATIGUE PROPERTIES OF ZINC SINGLE CRYSTALS AND POLYCRYSTALS
J. Phys. Soc. Japan (Japan), Vol. 15, p. 2099, Nov., 1960.
Zn crystals are subjected to cantilever rotating fatigue tests at 20 C to determine alternating bending stress as a function of number of cycles to fracture.
Subject Index Nos.—8.1.2, 8.1.5