

C O N T E N T S

Introduction

Part I The Generation of High Magnetic Fields

Section A. Field Analysis and Synthesis

| | | | |
|---|---|--------------------------------|----|
| 1 | Some Concepts for the Design of Superconducting Solenoids | W. F. Gauster and C. E. Parker | 3 |
| 2 | The Method of Zonal Harmonics | M. W. Garrett | 14 |
| 3 | New Solenoid Magnets | F. Gaume | 27 |
| 4 | Network Solution of a System Containing a Force-Free Coil and a Force-Bearing Shell | K. E. Wakefield | 39 |
| 5 | Force-Reduced Toroidal Systems | D. R. Wells and R. G. Mills | 44 |
| 6 | A Method of Controlling Magnetic Flux Path | U. R. Christensen | 48 |
| 7 | High Field Magnetometry | P. Grivet | 54 |

Section B. Continuous Field Magnets and Power Supplies

| | | | |
|----|--|--|-----|
| 8 | Water-Cooled Magnets | F. Bitter | 85 |
| 9 | Cryogenic Coils | C. E. Taylor and R. F. Post | 101 |
| 10 | Optimal Design of Solenoids | C. M. Braams | 109 |
| 11 | Optimal Design of Fuel-Cooled Electromagnets | R. E. Kronauer | 116 |
| 12 | Field Coils for Magnetohydrodynamic Generators | Z. J. J. Stekly, T. A. deWinter and A. ElBindari | 139 |
| 13 | The Cryogenic Magnet Program at Los Alamos | H. L. Laquer | 156 |
| 14 | An Aluminum Magnet Cooled with Liquid Hydrogen | J. R. Purcell | 166 |
| 15 | A Large Liquid-Neon-Cooled Electromagnet | J. C. Laurence and G. V. Brown | 170 |
| 16 | Iron Magnet Design | D. B. Montgomery | 180 |
| 17 | An Efficiency Criterion for Iron-Core Electromagnets | D. deKlerk and C. J. Gorter | 194 |
| 18 | High-Power Solenoid with External Magnetic Circuit | P. P. Cioffi | 202 |
| 19 | The Homopolar Generator as an Electromagnet Power Supply | J. C. Fakan | 210 |
| 20 | The Canberra Homopolar Generator | J. W. Blamey and W. I. B. Smith | 217 |
| 21 | The Graz Homopolar Machine | P. Klaudy | 218 |

Section C. Transient Field Magnets and Energy Supplies

| | | | |
|----|---|--|-----|
| 22 | Pulsed Magnets | H. P. Furth | 235 |
| 23 | Flux Concentration by Stationary Conductors | B. Howland and S. Foner | 249 |
| 24 | Flux Concentration by Hydromagnetic Flow | O. K. Mawardi | 259 |
| 25 | Flux Concentration by Implosion | C. M. Fowler, R. S. Caird, W. B. Garn and D. B. Thomson | 269 |
| 26 | Force-Free Pulsed Coils | Morton A. Levine | 277 |
| 27 | Pulsed Solenoids for Multisecond Pulses | H. Zijlstra | 281 |
| 28 | Pulsed Fields of Long Duration | L. Roeland and F. A. Muller | 287 |
| 29 | Hydrogen-Cooled Pulsed Magnets | J. C. A. van der Sluijs | 290 |
| 30 | Pulsed Bubble Chamber | H. H. Bergmann, J. Gruber, G. Hahn, P. Meyer and K. Mustafa | 292 |
| 31 | Design of 100-KG Pulsed Coils for Phoenix Mirror Machine | S. Skellett | 296 |
| 32 | The Storage and Transfer of Energy | R. Carruthers | 307 |

Section D. Superconducting Magnets

| | | | |
|----|--|--|-----|
| 33 | Pulsed Motor-Generator Sets | C. G. Adams | 319 |
| 34 | Superconducting Magnets | S. H. Autler | 324 |
| 35 | A High-Field Niobium-Zirconium Superconducting Solenoid | J. K. Hulm, M. J. Fraser, H. Riemersma, A. J. Venturino and R. E. Wien | 332 |
| 36 | A 59-Kilogauss Niobium-Zirconium Superconducting Solenoid | R. R. Hake, T. G. Berlincourt and D. H. Leslie | 341 |
| 37 | A Niobium-Tin Superconducting Magnet | L. C. Salter, Jr., S. H. Autler, H. H. Kolm, D. J. Rose and K. Goen | 344 |
| 38 | The Use of Nb-Nb ₃ Sn and Nb-Zr Superconducting Coils on an Iron-Core Magnet | J. O. Betterton and D. S. Easton | 348 |
| 39 | Conception and Design of Large Volumn Superconducting Solenoid | L. J. Donadieu and D. J. Rose | 358 |
| 40 | Magnetic Radiation Shielding | G. Brown | 370 |

Part II High-Magnetic-Field Research Programs

| | | | |
|----|---|---------------------------|-----|
| 41 | High-Magnetic-Field Research at R. R. E. | D. H. Parkinson | 381 |
| 42 | The High-Field Magnets at Oxford | M. Wood | 387 |
| 43 | The Cavendish High-Fields Laboratory | C. J. Adkins | 393 |
| 44 | The National Magnet Laboratory | D. T. Stevenson | 398 |
| 45 | A New Type of Direct-Current Supply for High-Field Solenoids | T. Sugawara and H. Aihara | 403 |
| 46 | High Field Research at Tohoku University | S. Maeda | 406 |
| 47 | The Coil Magnet Installation of the Kamerlingh Onnes Laboratory | D. deKlerk | 412 |
| 48 | Magnetics Research at N. A. S. A. | E. E. Callaghan | 420 |
| 49 | On the Wroclaw Magnet and Related Investigations | R. S. Ingarden | 427 |

Part III Solid-State and Low-Temperature Physics in High Magnetic Fields

Section A. Resonance and Oscillatory Phenomena

| | | | |
|----|--|-----------------|-----|
| 50 | Magneto spectroscopy in Solids | B. Lax | 437 |
| 51 | Spin Resonance in High Fields | N. Bloembergen | 454 |
| 52 | Cyclotron Resonance | J. K. Galt | 464 |
| 53 | Oscillatory Phenomena | A. H. Kahn | 476 |
| 54 | Pulsed-Field Resonance Measurements | S. Foner | 485 |
| 55 | The De Hass-van Alphen Effect in Pulsed Fields | M. G. Priestley | 499 |

Section B. Magnetism and Transport Phenomena

| | | | |
|----|--|--|-----|
| 56 | High Magnetic Fields and Low Temperature Physics | Nicholas Kurti | 505 |
| 57 | Galvano-Thermo-Magnetic Effects | I. M. Templeton and D. K. C. MacDonald | 513 |
| 58 | Peltier Cooling Below 4°K | F. J. Blatt | 518 |
| 59 | Pulsed Field Magnetoresistance Measurements in Metals | P. Cotti, B. Lüthi and J. L. Olsen | 523 |
| 60 | High Field Magnetoresistance Measurements at Room Temperature in Indium Antimonide | C. H. Champness | 528 |
| 61 | Magnetoresistance of Bismuth Metal and Bismuth-Antimony Alloy Single Crystals | S. Tanuma | 534 |
| 62 | Size Effects in High Magnetic Fields | P. Cotti | 539 |
| 63 | Pulsed Field Susceptibility Measurements | R. Stevenson | 544 |

| | | | |
|----|---|------------------------------|-----|
| 64 | Pulsed Field Magnetization Measurements in Compounds | I. S. Jacobs | 549 |
| 65 | Susceptibility and Magnetization of Rare Earths | Warren E. Henry | 552 |
| 66 | Measurements of Magnetisation of Gadolinium Near the Curie Point in High-Pulsed Fields | C. S. Gaskell and H. Motz | 561 |
| 67 | Field-Induced Phase Transitions in MnAs in a Miniature Pulsed Coil | R. W. DeBlois | 568 |

Section C. Superconducting Materials

| | | | |
|----|--|--|-----|
| 68 | Superconductivity in High Magnetic Fields at High Current Densities | J. E. Kunzler | 574 |
| 69 | The Resistive Transition in Nb ₃ Sn | D. Cline, R. H. Kropschot, V. Arp and J. H. Wilson | 580 |
| 70 | Superconducting Critical Current of Nb ₃ Sn in Pulsed Magnetic Fields | H. R. Hart, Jr., I. S. Jacobs, C. L. Kolbe and P. E. Lawrence | 584 |
| 71 | Preparation and Superconductive Properties of Nb ₃ Sn-Coated Niobium Samples | E. J. Saur and J. P. Wurm | 589 |
| 72 | Some Physical Properties of Deposited Nb ₃ Sn | J. J. Hanak, G. D. Cody, P. R. Aron and H. C. Hitchcock | 592 |
| 73 | Effect of Heat Treatment on Nb-Zr Superconducting Alloys | R. G. Treuting, J. H. Wernick and F. S. L. Hsu | 597 |
| 74 | Increased Critical Currents in Nb-Zr Superconductors from Precipitation- Induced Defects | G. D. Kneip, Jr., J. O. Betterton, Jr., D. S. Easton and J. O. Scarbrough | 603 |
| 75 | Evidence for a Critical Magnetic Field in Excess of 500 Kilogauss in the Superconducting V-Ga System | J. H. Wernick, F. J. Morin, F. S. L. Hsu, D. Dorsi, J. P. Maita and J. E. Kunzler | 609 |

Part IV Plasma and Fusion Physics in High Magnetic Fields

Section A. Plasma Physics

| | | | |
|----|--|-----------------|-----|
| 76 | Diffusion of Ions and Electrons | B. Lehnert | 617 |
| 77 | Ion Resonance in a Plasma | S. J. Buchsbaum | 641 |
| 78 | High-Field Effects in Magnetohydrodynamics | W. R. Sears | 652 |
| 79 | Laboratory Experiments in Geophysics | W. H. Bennett | 659 |

Section B. Fusion Physics

| | | | |
|----|--|--------------------------------|-----|
| 80 | The Stellarator | R. G. Mills | 662 |
| 81 | Plasma Confinement in Magnetic Mirror Fields | F. H. Coensgen | 670 |
| 82 | Cusped Geometries | D. C. Hagerman | 681 |
| 83 | Injection | J. Marshall | 688 |
| 84 | A Pulsed-Field Plasma Experiment -- Pharos | A. C. Kolb and W. H. Lupton | 693 |
| 85 | A Review of Fusion Research in the United Kingdom | R. Carruthers | 701 |

Section C. Particle Physics

| | | | |
|----|---|---|-----|
| 86 | The Index of Refraction of a Magnetic Field | T. Erber | 706 |
| 87 | High Fields for High Energy Particle Analysis | Y. B. Kim, E. D. Platner, and S. Kaneko | 719 |
| 88 | Nuclear Research Magnets | V. Z. Peterson | 726 |

| | | | |
|----------------------|--|--|-----|
| List of Participants | | | 737 |
|----------------------|--|--|-----|