NASA

PATENT ABSTRACTS

BIBLIOGRAPHY

A CONTINUING BIBLIOGRAPHY

Section 1 • Abstracts

JULY 1978

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
# ACCESSION NUMBER RANGES

<table>
<thead>
<tr>
<th>Bibliography Number</th>
<th>STAR Accession Numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td>NASA SP-7039(04)</td>
<td>N69-20701–N73-33931</td>
</tr>
<tr>
<td>NASA SP-7039(12)</td>
<td>N74-10001–N77-34042</td>
</tr>
<tr>
<td>NASA SP-7039(13)</td>
<td>N78-10001–N78-22018</td>
</tr>
</tbody>
</table>

This bibliography was prepared by the NASA Scientific and Technical Information Facility operated for the National Aeronautics and Space Administration by Informatics Information Systems Company.
Annotated references to NASA-owned inventions covered by U S patents and applications for patent that were announced in Scientific and Technical Aerospace Reports (STAR) between January 1978 and June 1978.
INTRODUCTION

Several thousand inventions result each year from the aeronautical and space research supported by the National Aeronautics and Space Administration. The inventions having important use in government programs or significant commercial potential are usually patented by NASA. These inventions cover practically all fields of technology and include many that have useful and valuable commercial application.

NASA inventions best serve the interests of the United States when their benefits are available to the public. In many instances, the granting of nonexclusive or exclusive licenses for the practice of these inventions may assist in the accomplishment of this objective. This bibliography is published as a service to companies, firms, and individuals seeking new, licensable products for the commercial market.

The NASA Patent Abstracts Bibliography (NASA PAB) is a semiannual NASA publication containing comprehensive abstracts and indexes of NASA-owned inventions covered by U.S. patents and applications for patent. The citations included in NASA PAB were originally published in NASA's Scientific and Technical Aerospace Reports (STAR) and cover STAR announcements made since May 1969.

For the convenience of the user, each issue of NASA PAB has a separately bound Abstract Section (Section 1) and Index Section (Section 2). Although each Abstract Section covers only the indicated six-month period, the Index Section is cumulative covering all NASA-owned inventions announced in STAR since May 1969. Thus a complete set of NASA PAB would consist of the Abstract Sections of Issue 04 (January 1974) and Issue 12 (January 1978) and the Abstract and Index Sections for this issue.

The 161 citations published in this issue of the Abstract Section cover the period January 1978 through June 1978. The Index Section contains references to the 3386 citations covering the period May 1969 through June 1978.

ABSTRACT SECTION (SECTION 1)

This PAB issue incorporates the 1975 STAR category revisions which include 10 major subdivisions divided into 74 specific categories and one general category/division (See Table of Contents for the scope note of each category under which are grouped appropriate NASA inventions). This new scheme was devised in lieu of the 34 category divisions which were utilized in PAB supplements (01) through (06) covering STAR abstracts from May 1969 through January 1974. Each entry in the Abstract Section consists of a STAR citation accompanied by an abstract and a key illustration taken from the patent or application for patent drawing. Entries are arranged in subject category in order of the ascending NASA Accession Number originally assigned in STAR to the invention. The range of NASA Accession Numbers within each issue is printed on the inside front cover.

Abstract Citation Data Elements Each of the abstract citations has several data elements useful for identification and indexing purposes, as follows:

NASA Accession Number
NASA Case Number
Inventor's Name
Title of Invention
U.S. Patent Application Serial Number
U.S. Patent Number (for issued patents only)
U.S. Patent Office Classification Number(s)
(for issued patents only)

These data elements in the citation of the abstract as depicted in the Typical Citation and Abstract reproduced below and are also used in the several indexes

**TYPICAL CITATION AND ABSTRACT**

NASA SPONSORED DOCUMENT

**SOURCE**

N78-19166# National Aeronautics and Space Administration
Hugh L. Dryden Flight Research Center Edwards Calif

**TITLE**

A PORTABLE DEVICE PARTICULARLY SUITED FOR USE IN STARTING AIR-START UNITS FOR AIRCRAFT

**INVENTOR**

William R. Rosier and George C. Volk inventors (to NASA) Filed 9 Mar 1978 15 p
(Contract NAS4-22722)

**ABSTRACT**

The invention is embodied in a device including (1) a DC circuit having a pair of terminal plugs each plug being characterized by a first, second, and third terminal (2) a pair of manually operable switches for connecting the first terminal of each of the plugs to the positive side of a voltage source (3) a circuit lead connecting the second terminal of each plug to the negative side of said source (4) a pair of electrical cables adapted to connect the first and second terminals of each plug to an air-start unit (5) means for connecting each of the cables between the first terminal of one plug and the third terminal of the other plug of the pair, and (6) a second pair of manually operable switches for selectively connecting the third terminal of each plug to the negative side of the voltage source whereby electrical continuity of each cable of the pair may be examined prior to being connected to an air-start unit

**KEY ILLUSTRATION**
INDEX SECTION (SECTION 2)

The Index Section is divided into five indexes which are cross-indexed and are useful in locating a single invention or groups of inventions.

Each of the five indexes utilizes basic data elements: (1) Subject Category Number, (2) NASA Accession Number, and (3) NASA Case Number, in addition to other specific index terms.

**Subject Index.** Lists all inventions according to appropriate alphabetized technical term and indicates the related NASA Case Number, the Subject Category Number, and the NASA Accession Number.

**Inventor Index.** Lists all inventions according to alphabetized names of inventors and indicates the related NASA Case Number, the Subject Category Number, and the NASA Accession Number.

**Source Index.** Lists all inventions according to alphabetized source of invention (i.e., name of contractor or government installation where invention was made) and indicates the related NASA Case Number, the Subject Category Number, and the NASA Accession Number.

**Number Index.** Lists inventions in order of ascending (1) NASA Case Number, (2) U.S. Patent Application Serial Number, (3) U.S. Patent Classification Number, and (4) U.S. Patent Number and indicates the related Subject Category Number and the NASA Accession Number.

**Accession Number Index.** Lists all inventions in order of ascending NASA Accession Number and indicates the related Subject Category Number, the NASA Case Number, the U.S. Patent Application Serial Number, the U.S. Patent Classification Number, and the U.S. Patent Number.

**HOW TO USE THIS PUBLICATION TO IDENTIFY NASA INVENTIONS**

To identify one or more NASA inventions within a specific technical field or subject, several techniques are possible when using the flexibility incorporated into the *NASA PAB*.

1. **Using Subject Category.** To identify all NASA inventions in any one of the subject categories in this issue of *NASA PAB*, select the desired Subject Category in the Abstract Section (Section 1) and find the inventions abstracted thereunder.

2. **Using Subject Index.** To identify all NASA inventions listed under a desired technical subject index term, (A) turn to the cumulative Subject Index in the Index Section and find the invention(s) listed under the desired technical subject term. (B) Note the indicated Accession Number and the Subject Category Number. (C) Using the indicated Accession Number, turn to the inside front cover of the Index Section to determine which issue of the Abstract Section includes the Accession Number desired. (D) To find the abstract of the particular invention in the issue of the Abstract Section selected, (i) use the Subject Category Number to locate the Subject Category and (ii) use the Accession Number to locate the desired invention within the Subject Category listing.
(3) **Using Patent Classification Index**  To identify all inventions covered by issued NASA patents (does not include applications for patent) within a desired Patent Office Classification, (A) turn to the Patent Classification Number in the Number Index of Section 2 and find the associated inventions(s), and (B) follow the instructions outlined in (2)(B), and (D) above

**PUBLIC AVAILABILITY OF COPIES OF PATENTS AND PATENT APPLICATIONS**

Copies of U.S. patents may be purchased directly from the U.S. Patent Office, Washington, D.C. 20231, for fifty cents a copy. When ordering patents, the U.S. Patent Number should be used, and payment must be remitted in advance, preferably by money order or check payable to the Commissioner of Patents. Prepaid purchase coupons for ordering are also available from the Patent Office.

NASA *patent application specifications* are sold in paper copy by the National Technical Information Service at price code A02 ($4.00 domestic, $8.00 foreign). Microfiche are sold at price code A01 ($3.00 domestic, $4.50 foreign). The U.S-Patent-Appl-SN-number should be used in ordering either paper copy or microfiche from NTIS.

**LICENSES FOR COMMERCIAL USE \ INQUIRIES AND APPLICATIONS FOR LICENSE**

NASA inventions, abstracted in *NASA PAB*, are available for nonexclusive or exclusive licensing in accordance with the NASA Patent Licensing Regulations. It is significant that all licenses for NASA inventions shall be by express written instruments and that no license will be granted or implied in a NASA invention except as provided in the NASA Patent Licensing Regulations.

Inquiries concerning the NASA Patent Licensing Program or the availability of licenses for the commercial use of NASA-owned inventions covered by U.S. patents or pending applications for patent should be forwarded to the NASA Patent Counsel of the NASA installation having cognizance of the specific invention, or the Assistant General Counsel for Patent Matters, Code GP-4, National Aeronautics and Space Administration, Washington, D.C. 20546. Inquiries should refer to the NASA Case Number, the Title of the Invention, and the U.S. Patent Number or the U.S. Application Serial Number assigned to the invention as shown in NASA PAB.

The NASA Patent Counsel having cognizance of the invention is determined by the first three letters or prefix of the NASA Case Number assigned to the invention. The addresses of NASA Patent Counsels are listed alongside the NASA Case Number prefix letters in the following table. Formal application of license must be submitted on the NASA Form, Application for NASA Patent License, which is available upon request from any NASA Patent Counsel.
<table>
<thead>
<tr>
<th>NASA Case Number Prefix Letters</th>
<th>Address of Cognizant NASA Patent Counsel</th>
</tr>
</thead>
<tbody>
<tr>
<td>ARC-xxxxx</td>
<td>Ames Research Center</td>
</tr>
<tr>
<td>XAR-xxxxx</td>
<td>Mail Code 200-11A</td>
</tr>
<tr>
<td></td>
<td>Moffett Field, California 94035</td>
</tr>
<tr>
<td></td>
<td>Telephone (415)965-5104</td>
</tr>
<tr>
<td>ERC-xxxxx</td>
<td>NASA Headquarters</td>
</tr>
<tr>
<td>XER-xxxxx</td>
<td>Mail Code GP-4</td>
</tr>
<tr>
<td>HQN-xxxxx</td>
<td>Washington, D C 20546</td>
</tr>
<tr>
<td>XHQ-xxxxx</td>
<td>Telephone (202)755-3954</td>
</tr>
<tr>
<td>GSC-xxxxx</td>
<td>Goddard Space Flight Center</td>
</tr>
<tr>
<td>XGS-xxxxx</td>
<td>Mail Code 204</td>
</tr>
<tr>
<td></td>
<td>Greenbelt, Maryland 20771</td>
</tr>
<tr>
<td></td>
<td>Telephone (301)982-2351</td>
</tr>
<tr>
<td>KSC-xxxxx</td>
<td>John F Kennedy Space Center</td>
</tr>
<tr>
<td>XKS-xxxxx</td>
<td>Mail Code AA-PAT</td>
</tr>
<tr>
<td></td>
<td>Kennedy Space Center, Florida 32899</td>
</tr>
<tr>
<td></td>
<td>Telephone (305)867-2544</td>
</tr>
<tr>
<td>LAR-xxxxx</td>
<td>Langley Research Center</td>
</tr>
<tr>
<td>XLA-xxxxx</td>
<td>Mail Code 456</td>
</tr>
<tr>
<td></td>
<td>Langley Station</td>
</tr>
<tr>
<td></td>
<td>Hampton, Virginia 23365</td>
</tr>
<tr>
<td></td>
<td>Telephone (804)827-3725</td>
</tr>
<tr>
<td>LEW-xxxxx</td>
<td>Lewis Research Center</td>
</tr>
<tr>
<td>XLE-xxxxx</td>
<td>Mail Code 500-311</td>
</tr>
<tr>
<td></td>
<td>21000 Brookpark Road</td>
</tr>
<tr>
<td></td>
<td>Cleveland, Ohio 44135</td>
</tr>
<tr>
<td></td>
<td>Telephone (216)433-6346</td>
</tr>
<tr>
<td>MSC-xxxxx</td>
<td>Lyndon B Johnson Space Center</td>
</tr>
<tr>
<td>XMS-xxxxx</td>
<td>Mail Code AM</td>
</tr>
<tr>
<td></td>
<td>Houston, Texas 77058</td>
</tr>
<tr>
<td></td>
<td>Telephone (713)483-4871</td>
</tr>
<tr>
<td>MFS-xxxxx</td>
<td>George C Marshall Space Flight Center</td>
</tr>
<tr>
<td>XMF-xxxxx</td>
<td>Mail Code CC01</td>
</tr>
<tr>
<td></td>
<td>Huntsville, Alabama 35812</td>
</tr>
<tr>
<td></td>
<td>Telephone (205)453-0020</td>
</tr>
<tr>
<td>NPO-xxxxx</td>
<td>NASA Resident Legal Office</td>
</tr>
<tr>
<td>XNP-xxxxx</td>
<td>Mail Code 180-601</td>
</tr>
<tr>
<td>FRC-xxxxx</td>
<td>4800 Oak Grove Drive</td>
</tr>
<tr>
<td>XFR-xxxxx</td>
<td>Pasadena, California 91103</td>
</tr>
<tr>
<td>WOO-xxxxx</td>
<td>Telephone (213)354-2700</td>
</tr>
</tbody>
</table>
Title 14—AERONAUTICS AND SPACE

Chapter V—National Aeronautics and Space Administration

PART 1245—PATENTS

Section 1245.202—Patent Licensing Regulations

1. Subpart 2 is revised in its entirety as follows:

Sec. 1245.200 Scope of subpart.
1245.201 Definitions.
1245.202 Basic considerations.
1245.203 Licenses for practical application of inventions.
1245.204 Other licenses.
1245.205 Publication of NASA inventions available for licensing.
1245.206 Application for nonexclusive license.
1245.207 Application for exclusive license.
1245.208 Processing applications for license.
1245.209 Royalties and fees.
1245.210 Reports.
1245.211 Revocation of licenses.
1245.212 Appeals.
1245.213 Litigation.
1245.214 Address of communications.

Authority: The provisions of this Subpart 2 issued under 42 U.S.C. 2457, 2473(b) (3).

§ 1245.200 Scope of subpart.

This Subpart 2 prescribes the terms, conditions, and procedures for licensing inventions covered by U.S. patents and patent applications for which the Administrator of the National Aeronautics and Space Administration holds title on behalf of the United States.

§ 1245.201 Definitions.

For the purpose of this subpart, the following definitions apply:

(a) "Invention" means an invention covered by a U.S. patent or patent application for which the Administrator of NASA holds title on behalf of the United States and which is designated by the Administrator as appropriate for the grant of a license(s) in accordance with this subpart.

(b) "To practice an invention" means to make or have made, use or have used, sell or have sold, or otherwise dispose of, any device, apparatus, composition of matter or chemical substance embodying the invention, and to use or have used the process or method comprising the invention.

(c) "Practical application" means the manufacture in the case of a composition of matter or product, the use in the case of a process, or the operation in the case of a machine, under such conditions as to establish that the invention is being utilized and that its benefits are reasonably accessible to the public.

(d) "Special invention" means any invention designated by the NASA Assistant General Counsel for Patent Matters to be subject to short-form licensing procedures. An invention may be designated as a special invention when a determination is made that:

(1) Practical application has occurred and is likely to continue for the life of the patent and for which an exclusive license is not in force, or

(2) The public interest would be served by the expeditious granting of a nonexclusive license for practice of the invention.

(e) The "Administrator" means the Administrator of the National Aeronautics and Space Administration, or his designee.

(f) "Government" means the Government of the United States of America.

(g) The "Inventions and Contributions Board" means the NASA Inventions and Contributions Board established by the Administrator of NASA within the Administration in accordance with section 305 of the National Aeronautics and Space Act of 1958, as amended (42 U.S.C. 2457).

§ 1245.202 Basic considerations.

(a) Much of the new technology resulting from NASA sponsored research and development in aeronautical and space science and engineering applications and other fieldsNASA has special authority and responsibility under the National Aeronautics and Space Act of 1958, as amended (42 U.S.C. 2451), to provide for the widest practical dissemination and utilization of this new technology. In addition, NASA has been given unique requirements to protect the inventions resulting from NASA activities and to promulgate licensing regulations to encourage commercial use of these inventions.

(b) NASA-owned inventions will best serve the interests of the United States when they are brought to practical application in the shortest time possible. Although NASA encourages the nonexclusive licensing of its inventions to promote competition and achieve their widest possible utilization, the commercial development of certain inventions calls for a substantial capital investment which private manufacturers may be unwilling to risk under a nonexclusive license. It is the policy of NASA to seek exclusive licenses when such licenses would provide a necessary incentive to the licensee to achieve early practical application of the invention.

(c) The Administrator, in determining whether to grant an exclusive license, will evaluate all relevant information submitted by applicants and all other persons and will consider the necessity for further technical and market development of the invention, the capabilities of prospective licensees, their plans to undertake the required research and development, the impact on competitors, and the benefits of the license to the Government and to the public. Preference for exclusive licenses may be given to U.S. citizens or companies who intend to manufacture or use, in the case of a process, the invention in the United States or its territories and possessions. Consideration may also be given to assisting small businesses and minority business enterprises, as well as to economic development, low income and labor surplus areas.

(d) All licenses for inventions shall be by express written instruments. No license shall be granted either expressly or by implication, for a NASA invention except as provided for in §§ 1245.203 and 1245.204, in any existing or future treaty or agreement between the United States and any foreign government.

(e) Licenses for inventions covered by NASA-owned foreign patents and patent applications shall be granted in accordance with the NASA Foreign Patent Licensing Regulations (1245.4).

§ 1245.203 Licensing for practical application of inventions.

(a) General. As an incentive to encourage practical application of inventions, licenses will be granted to responsible applicants according to the circumstances and conditions set forth in this section.

(b) Nonexclusive licenses. (1) Each invention will be made available to responsible applicants for nonexclusive, revocable licenses in accordance with §§ 1245.204, consistent with the provisions of any existing exclusive license.

(2) The duration of the license shall be for a period of five years from the date of issuance.

(3) The license shall require the licensee to achieve the practical application of the invention and to then practice the invention for the duration of the license.

(4) The license may be granted for all or less than all fields of use of the invention available throughout the United States of America, its territories and possessions, Puerto Rico, and the District of Columbia, or in any lesser geographic portion thereof.

(5) The license shall extend to the subsidiaries and affiliates of the licensee and shall not be assignable without approval of the Administrator, NASA, except to the successor of that part of the licensee’s business to which the invention pertains.

(c) Short-form nonexclusive licenses. A nonexclusive, revocable license for a special invention, as defined in §1245.201(d), shall be granted upon written request, to any applicant by the Patent Counsel of the NASA installation having cognizance of the invention.

(d) Exclusive licenses. (1) A limited exclusive license may be granted on an invention available for such licensing provided that:

(i) The Administrator has determined that: (a) The invention has not been brought to practical application by a nonexclusive licensee in the fields of use or geographical locations covered by the application for the exclusive license; (b) practical application of the invention in the fields of use or geographical locations covered by the application for the exclusive license is not likely to be achieved expeditiously by the further funding of the invention by the Government; (c) a nonexclusive license required by any applicant pursuant to these regulations, and (e) the exclusive license will provide the necessary incentive to the licensee to achieve early practical application of the invention, and

(ii) Either a notice pursuant to
(1) The license may be subject to (a) any other reservations as may be in the future treaty or agreement with the United States of America; (b) rights retained by the contractor to achieve practical application of the invention, including the geographical location where the applicant plans to manufacture or use, in the case of a process, the invention; and (c) a statement indicating the minimum term of years the applicant desires to be licensed.

(2) Contents of an application for a short-form nonexclusive license under § 1245.203(c) for a special invention shall include:

(a) Identification of invention for which license is desired, including the NASA patent case number, patent application serial number or patent number, title and date, if known.

(b) Name and address of company or organization applying for license; and

(c) Name and address of representative of applicant to whom correspondence should be sent.

§ 1245.207 Application for exclusive license.

(a) Submission of application An application for exclusive license under § 1245.203(d) may be submitted to NASA at any time. An application for exclusive license shall be addressed to the NASA Assistant General Counsel for Patent Matters.

(b) Contents of an application for exclusive license. In addition to the requirements set forth in § 1245.206(b), the application for an exclusive license shall include:

(1) Applicant's status, if any, in any one or more of the following categories:

(a) Small business firm;

(b) Minority business enterprise;

(c) Location in a surplus labor area;

(d) Location in a low-income urban area; and

(e) Location in an area designated by the Government as economically depressed.

(2) A statement indicating the time, expenditure, and other acts which the applicant considers necessary to achieve practical application of the invention, and the applicant's offer to invest that sum and to perform such acts if the license is granted.

(3) A statement whether the applicant would be willing to accept a license for all or less than all fields of use of the invention throughout the United States of America, its territories and possessions, Puerto Rico, and the District of Columbia, or in any lesser geographic portion thereof.

(4) A statement indicating the amount of royalty fees or other consideration, if any, the applicant would be willing to pay the Government for the exclusive license, and

(5) Any other facts which the applicant believes to show it to be in the interests of the United States of America for the Administrator to grant an exclusive license rather than a nonexclusive li-
PATENT LICENSING REGULATIONS

cense and that such an exclusive license should be granted to the applicant.
§ 1245.208 Processing applications for licenses.
(a) Initial review. Applications for nonexclusive and exclusive licenses under §§ 1245.206 and 1245.207 will be reviewed by the Patent Counsel of the NASA Inventions and Contributions Board. The Administrator will either determine whether to grant the nonexclusive license or exclusive license, or will require that the applicant supply additional information.

(b) Determination of Administrator and grant of nonexclusive licenses. The Administrator shall determine whether to grant a nonexclusive license and shall notify the applicant of the decision. The Administrator shall consider the basic considerations set forth in §§ 1245.202 and 1245.203, or any special terms or conditions of the license.

(c) Determination of Administrator and grant of exclusive licenses. The Administrator shall determine whether to grant an exclusive license and shall notify the applicant of the decision. The Administrator shall consider the basic considerations set forth in §§ 1245.202 and 1245.203, or any special terms or conditions of the license.

§ 1245.209 Royalties and fees.

(a) Normally, a nonexclusive license for the practical application of an invention granted to a U.S. citizen or company will not require the payment of royalties, however, NASA may require other consideration.

(b) An exclusive license for an invention or any sublicense which has been granted.

§ 1245.210 Reports.

A license shall require the licensee to submit periodic reports of his efforts to work the invention. The reports shall contain information within his knowledge, or which he may acquire under normal business practice, pertaining to the commercial use that is being made of the invention, and such other information which the Administrator may determine pertinent to the licensing program and which is specified in the license.

§ 1245.211 Revocation of licenses.

(a) Any license granted pursuant to § 1245.203 may be revoked, either in part or in its entirety, by the Administrator if in his opinion the license is being used in violation of the terms of the license, or if the licensee at any time shall default in making any report required by the license or make any false report, or shall commit any breach of any covenant or agreement therein contained, and shall fail to remedy any such default, breach or omission within 30 days after written notice, or if the patent is deemed unenforceable either by the Attorney General or a final decision of a U.S. court.

(b) Any license granted pursuant to § 1245.204(a) may be revoked, either in part or in its entirety, by the Administrator if in his opinion such revocation is necessary to achieve the earliest practical application of the invention pursuant to an application for exclusive license submitted in accordance with § 1245.207, or the licensee at any time shall breach any covenant or agreement contained in the license, and shall fail to remedy any such breach within 30 days after written notice thereof.

(c) Before revoking any license granted pursuant to this Subpart 2 for any cause, there will be furnished to the licensee a written notice of intention to revoke the license, and the licensee will be afforded 30 days after such notice in which to appeal and request a hearing before the Inventions and Contributions Board on the question of revocation. After a hearing, the Inventions and Contributions Board shall transmit to the Administrator the record of proceedings, its findings of fact and its recommendations whether the license should be revoked either in part or in its entirety. The Administrator shall review the recommendation of the Board and determine whether to revoke the license in part or in its entirety. Revocation of a license shall include revocation of all sublicenses which have been granted.

§ 1245.212 Appeals.

Any person desiring to file an appeal pursuant to § 1245.211(c) shall address the appeal to Chairman, Inventions and Contributions Board Any person filing an appeal shall be afforded an opportunity for such appeal to be heard by the Inventions and Contributions Board, and to offer evidence in support of his appeal. The procedures to be followed in such appeal shall be those prescribed by the Administrator. The Administrator shall make findings of fact and recommendations with respect to disposition of the appeal. The decision on the appeal shall be made by the Administrator, and such decision shall be final and conclusive, except on questions of law, unless determined by a court of competent jurisdiction to have been fraudulent, or capricious, or arbitrary, or so grossly erroneous as necessarily to imply bad faith, or not supported by substantial evidence.

§ 1245.213 Litigation.

An exclusive licensee shall be granted the right to sue at his own expense any party who infringes the rights set forth in his license and comply with the licensed patent. The licensee may join the Government, upon consent of the Attorney General, as a party complainant in such suit. Any suit commenced in response to the Government and the licensee shall pay costs and any final judgment or decree that may be rendered against the Govern-
PATENT LICENSING REGULATIONS

The Government shall also have an absolute right to intervene in any such suit at its own expense. The licensee shall be obligated to promptly furnish to the Government, upon request, copies of all pleadings and other papers filed in any such suit and of evidence adduced in proceedings relating to the licensed patent including, but not limited to, negotiations for settlement and agreements settling claims by a licensee based on the licensed patent, and all other books, documents, papers, and records pertaining to such suit. If, as a result of any such litigation the patent shall be declared invalid, the licensee shall have the right to surrender his license and be relieved from any further obligation thereunder.

§ 1245.214 Address of communications.
(a) Communications to the Assistant General Counsel for Patent Matters in accordance with §§ 1245.206 and 1245.207 and requests for information concerning licenses for NASA inventions should be addressed to the Assistant General Counsel for Patent Matters, Code GP, National Aeronautics and Space Administration, Washington, D.C. 20546

(b) Communications to the Inventions and Contributions Board in accordance with §§ 1245.208, 1245.211, and 1245.212 should be addressed to Chairman, Inventions and Contributions Board, National Aeronautics and Space Administration, Washington, D.C. 20546

Effective date The regulations set forth in this subpart 2 are effective April 1, 1972

JAMES C. FLETCHER,
Administrator.

FOREIGN PATENT LICENSING REGULATIONS

Selected NASA inventions are also available for licensing in countries other than the United States in accordance with the NASA Foreign Patent Licensing Regulation (14 CFR 1245.4), a copy of which is available from any NASA Patent Counsel. For abstracts of NASA-owned inventions available for licensing in countries other than the United States, see NASA SP-7038, "Significant NASA Inventions Available for Licensing in Countries Other Than the United States." A copy of this NASA publication is available from NASA Headquarters, Code GP-4, Washington, D.C., 20546.
TABLE OF CONTENTS
Section 1 • Abstracts

AERONAUTICS
Includes aeronautics (general), aerodynamics, air transportation and safety, aircraft communications and navigation, aircraft design, testing and performance, aircraft instrumentation, aircraft propulsion and power, aircraft stability and control, and research and support facilities (air)
For related information see also Astronautics

<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>AERONAUTICS (GENERAL)</td>
<td>N.A.</td>
</tr>
<tr>
<td>02</td>
<td>AERODYNAMICS</td>
<td>1</td>
</tr>
<tr>
<td>03</td>
<td>AIR TRANSPORTATION AND SAFETY</td>
<td>N.A.</td>
</tr>
<tr>
<td>04</td>
<td>AIRCRAFT COMMUNICATIONS AND NAVIGATION</td>
<td>1</td>
</tr>
<tr>
<td>05</td>
<td>AIRCRAFT DESIGN, TESTING AND PERFORMANCE</td>
<td>2</td>
</tr>
<tr>
<td>06</td>
<td>AIRCRAFT INSTRUMENTATION</td>
<td>N.A.</td>
</tr>
<tr>
<td>07</td>
<td>AIRCRAFT PROPULSION AND POWER</td>
<td>2</td>
</tr>
<tr>
<td>08</td>
<td>AIRCRAFT STABILITY AND CONTROL</td>
<td>4</td>
</tr>
<tr>
<td>09</td>
<td>RESEARCH AND SUPPORT FACILITIES (AIR)</td>
<td>4</td>
</tr>
</tbody>
</table>

ASTRONAUTICS
Includes astronautics (general), astrodynamics, ground support systems and facilities (space), launch vehicles and space vehicles, space transportation, spacecraft communications, command and tracking, spacecraft design, testing and performance, spacecraft instrumentation, and spacecraft propulsion and power
For related information see also Aeronautics

<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td>ASTRONAUTICS (GENERAL)</td>
<td>N.A.</td>
</tr>
<tr>
<td>13</td>
<td>ASTRODYNAMICS</td>
<td>N.A.</td>
</tr>
<tr>
<td>14</td>
<td>GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)</td>
<td>N.A.</td>
</tr>
<tr>
<td>15</td>
<td>LAUNCH VEHICLES AND SPACE VEHICLES</td>
<td>5</td>
</tr>
<tr>
<td>16</td>
<td>SPACE TRANSPORTATION</td>
<td>N.A.</td>
</tr>
<tr>
<td>17</td>
<td>SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING</td>
<td>5</td>
</tr>
<tr>
<td>18</td>
<td>SPACECRAFT DESIGN, TESTING AND PERFORMANCE</td>
<td>N.A.</td>
</tr>
</tbody>
</table>

For extraterrestrial exploration see 91 Lunar and Planetary Exploration
For related information see also 09 Research and Support Facilities (Air)

16 SPACE TRANSPORTATION
Includes passenger and cargo space transportation, e.g., shuttle operations, and rescue techniques
For related information see also 03 Air Transportation and Safety and 85 Urban Technology and Transportation

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING
Includes telemetry, space communications networks, astrodynamics, and radio blackout
For related information see also 04 Aircraft Communications and Navigation and 32 Communications

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE
Includes spacecraft thermal and environmental control, and attitude control
For related information see also 54 Man/System Technology and Life Support For related information see also 05 Aircraft Design, Testing and Performance and 39 Structural Mechanics
19 SPACECRAFT INSTRUMENTATION N.A.
For related information see also 06 Aircraft Instrumentation and 35 Instrumentation and Photography

20 SPACECRAFT PROPULSION AND POWER N.A.
Includes main propulsion systems and components, e.g., rocket engines, and spacecraft auxiliary power sources
For related information see also 07 Aircraft Propulsion and Power, 28 Propellants and Fuels, and 44 Energy Production and Conversion

CHEMISTRY AND MATERIALS
Includes chemistry and materials (general), composite materials, inorganic and physical chemistry, metallic materials, nonmetallic materials, and propellants and fuels

23 CHEMISTRY AND MATERIALS (GENERAL) N.A.
Includes biochemistry and organic chemistry

24 COMPOSITE MATERIALS 5
Includes laminates

25 INORGANIC AND PHYSICAL CHEMISTRY 7
Includes chemical analysis, e.g., chromatography, combustion theory, electrochemistry, and photochemistry
For related information see also 77 Thermodynamics and Statistical Physics

26 METALLIC MATERIALS 9
Includes physical, chemical, and mechanical properties of metals, e.g., corrosion, and metallurgy

27 NONMETALLIC MATERIALS 9
Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials

28 PROPELLANTS AND FUELS 11
Includes rocket propellants, igniters, and oxidizers, storage and handling, and aircraft fuels
For related information see also 07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, and 44 Energy Production and Conversion

ENGINEERING
Includes engineering (general), communications, electronics and electrical engineering, fluid mechanics and heat transfer, instrumentation and photography, lasers and masers, mechanical engineering, quality assurance and reliability, and structural mechanics
For related information see also Physics

31 ENGINEERING (GENERAL) 12
Includes vacuum technology, control engineering, display engineering, and cryogenics

32 COMMUNICATIONS 13
Includes land and global communications, communications theory, and optical communications
For related information see also 04 Aircraft Communications and Navigation and 17 Spacecraft Communications, Command and Tracking

33 ELECTRONICS AND ELECTRICAL ENGINEERING 15
Includes test equipment and maintainability, components, e.g., tunnel diodes and transistors, microminiaturization, and integrated circuitry
For related information see also 60 Computer Operations and Hardware and 76 Solid-State Physics

34 FLUID MECHANICS AND HEAT TRANSFER 18
Includes boundary layers, hydrodynamics, fluidics mass transfer, and ablation cooling
For related information see also 02 Aerodynamics and 77 Thermodynamics and Statistical Physics

35 INSTRUMENTATION AND PHOTOGRAPHY 20
Includes remote sensors, measuring instruments and gages, detectors, cameras and photographic supplies, and holography
For related information see also 06 Aircraft Instrumentation and 19 Spacecraft Instrumentation

36 LASERS AND MASERS 26
Includes parametric amplifiers

37 MECHANICAL ENGINEERING 28
Includes auxiliary systems (non-power), machine elements and processes, and mechanical equipment

38 QUALITY ASSURANCE AND RELIABILITY 32
Includes product sampling procedures and techniques, and quality control

39 STRUCTURAL MECHANICS 32
Includes structural element design and weight analysis, fatigue, and thermal stress
For applications see 05 Aircraft Design, Testing and Performance and 18 Spacecraft Design, Testing and Performance

GEOSCIENCES
Includes geosciences (general), earth resources, energy production and conversion, environment pollution, geophysics, meteorology and climatology, and oceanography
For related information see also Space Sciences

42 GEOSCIENCES (GENERAL) N.A.
<table>
<thead>
<tr>
<th>43 EARTH RESOURCES</th>
<th>34</th>
<th>Includes remote sensing of earth resources by aircraft and spacecraft, photogrammetry, and aerial photography. For instrumentation see 35 Instrumentation and Photography</th>
</tr>
</thead>
<tbody>
<tr>
<td>44 ENERGY PRODUCTION AND CONVERSION</td>
<td>34</td>
<td>Includes specific energy conversion systems, e.g., fuel cells and batteries, global sources of energy, fossil fuels, geophysical conversion, hydroelectric power, and wind power. For related information see also 07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels, and 85 Urban Technology and Transportation</td>
</tr>
<tr>
<td>45 ENVIRONMENT POLLUTION</td>
<td>N.A.</td>
<td>Includes air, noise, thermal and water pollution, environment monitoring, and contamination control</td>
</tr>
<tr>
<td>46 GEOPHYSICS</td>
<td>38</td>
<td>Includes aeronomy, upper and lower atmosphere studies, ionospheric and magnetospheric physics, and geomagnetism. For space radiation see 93 Space Radiation</td>
</tr>
<tr>
<td>47 METEOROLOGY AND CLIMATOLOGY</td>
<td>N.A.</td>
<td>Includes weather forecasting and modification</td>
</tr>
<tr>
<td>48 OCEANOGRAPHY</td>
<td>N.A.</td>
<td>Includes biological, dynamic and physical oceanography, and marine resources</td>
</tr>
<tr>
<td>LIFE SCIENCES</td>
<td></td>
<td>Includes life sciences (general), aerospace medicine, behavioral sciences, man/system technology and life support, and planetary biology</td>
</tr>
<tr>
<td>51 LIFE SCIENCES (GENERAL)</td>
<td>38</td>
<td>Includes genetics</td>
</tr>
<tr>
<td>52 AEROSPACE MEDICINE</td>
<td>38</td>
<td>Includes physiological factors, biological effects of radiation, and weightlessness</td>
</tr>
<tr>
<td>53 BEHAVIORAL SCIENCES</td>
<td>N.A.</td>
<td>Includes psychological factors, individual and group behavior, crew training and evaluation, and psychiatric research</td>
</tr>
<tr>
<td>54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT</td>
<td>40</td>
<td>Includes human engineering, biotechnology, and space suits and protective clothing</td>
</tr>
<tr>
<td>55 PLANETARY BIOLOGY</td>
<td>N.A.</td>
<td>Includes exobiology, and extraterrestrial life</td>
</tr>
<tr>
<td>MATHEMATICAL AND COMPUTER SCIENCES</td>
<td></td>
<td>Includes mathematical and computer sciences (general), computer operations and hardware, computer programming and software, computer systems, cybernetics, numerical analysis, statistics and probability, systems analysis, and theoretical mathematics</td>
</tr>
<tr>
<td>59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)</td>
<td>N.A.</td>
<td></td>
</tr>
<tr>
<td>60 COMPUTER OPERATIONS AND HARDWARE</td>
<td>43</td>
<td>Includes computer graphics and data processing. For components see 33 Electronics and Electrical Engineering</td>
</tr>
<tr>
<td>61 COMPUTER PROGRAMMING AND SOFTWARE</td>
<td>N.A.</td>
<td>Includes computer programs, routines, and algorithms</td>
</tr>
<tr>
<td>62 COMPUTER SYSTEMS</td>
<td>N.A.</td>
<td>Includes computer networks</td>
</tr>
<tr>
<td>63 CYBERNETICS</td>
<td>N.A.</td>
<td>Includes feedback and control theory. For related information see also 54 Man/System Technology and Life Support</td>
</tr>
<tr>
<td>64 NUMERICAL ANALYSIS</td>
<td>N.A.</td>
<td>Includes iteration, difference equations, and numerical approximation</td>
</tr>
<tr>
<td>65 STATISTICS AND PROBABILITY</td>
<td>N.A.</td>
<td>Includes data sampling and smoothing, Monte Carlo method, and stochastic processes</td>
</tr>
<tr>
<td>66 SYSTEMS ANALYSIS</td>
<td>N.A.</td>
<td>Includes mathematical modeling, network analysis, and operations research</td>
</tr>
<tr>
<td>67 THEORETICAL MATHEMATICS</td>
<td>N.A.</td>
<td>Includes topology and number theory</td>
</tr>
<tr>
<td>PHYSICS</td>
<td></td>
<td>Includes physics (general), acoustics, atomic and molecular physics, nuclear and high-energy physics, optics, plasma physics, solid-state physics, and thermodynamics and statistical physics. For related information see also Engineering</td>
</tr>
<tr>
<td>70 PHYSICS (GENERAL)</td>
<td>N.A.</td>
<td>For geophysics see 46 Geophysics. For astrophysics see 90 Astrophysics. For solar physics see 92 Solar Physics</td>
</tr>
<tr>
<td>Section</td>
<td>Title</td>
<td>Notes</td>
</tr>
<tr>
<td>---------</td>
<td>-------</td>
<td>-------</td>
</tr>
<tr>
<td>71</td>
<td>ACOUSTICS</td>
<td>Includes sound generation, transmission, and attenuation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>For noise pollution see 45 Environment Pollution</td>
</tr>
<tr>
<td>72</td>
<td>ATOMIC AND MOLECULAR PHYSICS</td>
<td>Includes atomic structure and molecular spectra</td>
</tr>
<tr>
<td>73</td>
<td>NUCLEAR AND HIGH-ENERGY PHYSICS</td>
<td>Includes elementary and nuclear particles, and reactor theory</td>
</tr>
<tr>
<td></td>
<td></td>
<td>For space radiation see 93 Space Radiation</td>
</tr>
<tr>
<td>74</td>
<td>OPTICS</td>
<td>Includes light phenomena</td>
</tr>
<tr>
<td>75</td>
<td>PLASMA PHYSICS</td>
<td>N.A.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Includes magnetohydrodynamics and plasma fusion</td>
</tr>
<tr>
<td></td>
<td></td>
<td>For ionospheric plasmas see 46 Geophysics For space plasmas see 90 Astrophysics</td>
</tr>
<tr>
<td>76</td>
<td>SOLID-STATE PHYSICS</td>
<td>Includes superconductivity</td>
</tr>
<tr>
<td></td>
<td></td>
<td>For related information see also 33 Electronics and Electrical Engineering and 36 Lasers and Masers</td>
</tr>
<tr>
<td>77</td>
<td>THERMODYNAMICS AND STATISTICAL PHYSICS</td>
<td>N.A.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Includes quantum mechanics, and Bose and Fermi statistics</td>
</tr>
<tr>
<td></td>
<td></td>
<td>For related information see also 25 Inorganic and Physical Chemistry and 34 Fluid Mechanics and Heat Transfer</td>
</tr>
<tr>
<td>SOCIAL SCIENCES</td>
<td>Includes social sciences (general), administration and management, documentation and information science, economics and cost analysis, law and political science, and urban technology and transportation</td>
<td></td>
</tr>
<tr>
<td>80</td>
<td>SOCIAL SCIENCES (GENERAL)</td>
<td>N.A.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Includes educational matters</td>
</tr>
<tr>
<td>81</td>
<td>ADMINISTRATION AND MANAGEMENT</td>
<td>N.A.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Includes management planning and research</td>
</tr>
<tr>
<td>82</td>
<td>DOCUMENTATION AND INFORMATION SCIENCE</td>
<td>N.A.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Includes information storage and retrieval technology, micrography, and library science</td>
</tr>
<tr>
<td></td>
<td></td>
<td>For computer documentation see 61 Computer Programming and Software</td>
</tr>
<tr>
<td>83</td>
<td>ECONOMICS AND COST ANALYSIS</td>
<td>N.A.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Includes cost effectiveness studies</td>
</tr>
<tr>
<td>84</td>
<td>LAW AND POLITICAL SCIENCE</td>
<td>N.A.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Includes space law, international law, international cooperation, and patent policy</td>
</tr>
<tr>
<td>85</td>
<td>URBAN TECHNOLOGY AND TRANSPORTATION</td>
<td>49</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Includes applications of space technology to urban problems, technology transfer, technology assessment, and surface and mass transportation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>For related information see 03 Air Transportation and Safety, 16 Space Transportation, and 44 Energy Production and Conversion</td>
</tr>
<tr>
<td>SPACE SCIENCES</td>
<td>Includes space sciences (general), astronomy, astrophysics, lunar and planetary exploration, solar physics, and space radiation</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>For related information see also Geosciences</td>
</tr>
<tr>
<td>88</td>
<td>SPACE SCIENCES (GENERAL)</td>
<td>N.A.</td>
</tr>
<tr>
<td>89</td>
<td>ASTRONOMY</td>
<td>N.A.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Includes radio and gamma-ray astronomy, celestial mechanics, and astrometry</td>
</tr>
<tr>
<td>90</td>
<td>ASTROPHYSICS</td>
<td>N.A.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Includes cosmology, and interstellar and interplanetary gases and dust</td>
</tr>
<tr>
<td>91</td>
<td>LUNAR AND PLANETARY EXPLORATION</td>
<td>N.A.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Includes planetology, and manned and unmanned flights</td>
</tr>
<tr>
<td></td>
<td></td>
<td>For spacecraft design see 18 Spacecraft Design, Testing and Performance For space stations see 15 Launch Vehicles and Space Vehicles</td>
</tr>
<tr>
<td>92</td>
<td>SOLAR PHYSICS</td>
<td>N.A.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Includes solar activity, solar flares, solar radiation and sunspots</td>
</tr>
<tr>
<td>93</td>
<td>SPACE RADIATION</td>
<td>N.A.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Includes cosmic radiation, and inner and outer earth's radiation belts</td>
</tr>
<tr>
<td></td>
<td></td>
<td>For biological effects of radiation see 52 Aerospace Medicine For theory see 73 Nuclear and High-Energy Physics</td>
</tr>
<tr>
<td>GENERAL</td>
<td>99 GENERAL</td>
<td>N.A.</td>
</tr>
</tbody>
</table>

Note: N.A. means that no abstracts were assigned to this category for this issue.

Section 2 • Indexes

<table>
<thead>
<tr>
<th>Index Type</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>SUBJECT INDEX</td>
<td></td>
</tr>
<tr>
<td>INVENTOR INDEX</td>
<td></td>
</tr>
<tr>
<td>SOURCE INDEX</td>
<td></td>
</tr>
<tr>
<td>NUMBER INDEX</td>
<td></td>
</tr>
<tr>
<td>ACCESSION NUMBER INDEX</td>
<td></td>
</tr>
</tbody>
</table>
02 AERODYNAMICS
Includes aerodynamics of bodies combinations wings rotors and control surfaces and internal flow in ducts and turbomachinery
For related information see also 34 Fluid Mechanics and Heat Transfer

AN ANNULAR WING Patent Application
NTIS HC A02/MF A01 CSCL 01A
An annular wing is described for the purpose of supporting an aircraft in flight without the use of directional stabilizer surfaces. The wing comprises an annular body of substantially uniform symmetrical configuration characterized by an annular positive lifting surface and a chord line. The wing is highly maneuverable, simple in concept, economic to fabricate and characterized by stable horizontal flight properties at subsonic speeds.

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION
Includes digital and voice communication with aircraft air navigation systems (satellite and ground based) and air traffic control
For related information see also 17 Spacecraft Communications Command, and Tracking and 32 Communications

RULER FOR MAKING NAVIGATIONAL COMPUTATIONS Patent
Lawrence Holmes Jr, inventor (to NASA) (TRW Inc Redondo Beach, Calif) Issued 18 Jan 1966 7 p Filed 18 Dec 1961
Sponsored by NASA
US Patent Office CSCL 17G
An extensile ruler used as a computer in navigation to calculate travel time between map points or to calculate ground speed is described. The ruler has a time scale that can be adjusted at length to equal map distances travelled at a designated speed in a time period such as sixty minutes. A means for fixing the length of the ruler is also provided.
05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology

For related information see also 18 Spacecraft Design, Testing and Performance and 39 Structural Mechanics

N78-18045* National Aeronautics and Space Administration Langley Research Center, Langley Station, Va

FUSELAGE STRUCTURE USING ADVANCED TECHNOLOGY METAL MATRIX FIBER REINFORCED COMPOSITES Patent Application
Robert K Robinson (Boeing Commercial Airplane Co Seattle) and Harry M Tomlinson inventors (to NASA) (Boeing Commercial Airplane Co Seattle) Filed 16 Feb 1978 15 p Sponsored by NASA

A fuselage structure in which the skin is comprised of layers of a metal matrix fiber reinforced composite is described. The plies of the composite material are built up so as to take advantage of the unidirectional properties of strength and stiffness of the composite material with alternate plies of material oriented at approximately 45 deg and approximately 315 deg to the fuselage longitudinal axis. The stringers which run longitudinally and support the skin are also reinforced with layers of metal matrix fiber reinforced material oriented at approximately 0 deg relative to the fuselage longitudinal axis. The metal matrix fiber reinforced composite used in the preferred embodiment is borsic aluminum. Borsic aluminum is comprised of silicone coated boron fibers embedded in an aluminum matrix which results in a fuselage structure that is significantly lighter than a similar fuselage of titanium.

N78-10096* National Aeronautics and Space Administration Langley Research Center, Langley Station Va

INDEPENDENT POWER GENERATOR Patent Application
Richard N Young inventor (to NASA) Filed 30 Jul 1976 16 p

A gas turbine powered aircraft auxiliary power system is described. The system is capable of efficiently supplying all aircraft auxiliary services both in flight and on the ground. It is capable also of operating independently of the aircraft main engines. The system employs multiple gas turbine compressor stages and utilizes the aircraft cabin as a plenum chamber between the first and second compressor stages thereby accomplishing cabin pressurization, ventilation and heating.

N78-17055* National Aeronautics and Space Administration Lewis Research Center Cleveland, Ohio

VARIABLE THRUST NOZZLE FOR QUIET TURBOFAN ENGINE AND METHOD OF OPERATING SAME Patent
Arthur P Adamson, inventor (to NASA) (GE Cincinnati Ohio) Issued 17 Jan 1978 7 p Filed 29 May 1975 Sponsored by NASA

An improved method of operating a gas turbine engine is presented wherein engine-generated noise is maintained at a reduced level during reduced thrust operation. Fan speed was maintained at a constant level while fan nozzle area was increased. This maintained high inlet Mach numbers for reduced forward noise propagation and also permitted reduced nozzle exhaust velocity for reduced shear noise. In another embodiment airflow was increased by means of a fan blade pitch change or speed control.
increase while the fan nozzle area was increased, yielding both
net reduction in engine thrust and noise.

Official Gazette of the U.S. Patent Office

GAS TURBINE ENGINE WITH CONVERTIBLE ACCESSORIES Patent
Donald F. Sargisson (GE Cincinnati, Ohio) and Arthur P. Adamson, inventors (to NASA) Issued 17 Jan 1978 6 p Filed 8 Nov 1974 Sponsored by NASA

A design technique, method and apparatus are delineated for controlling the bypass gas stream pressure and varying the bypass ratio of a mixed flow gas turbine engine in order to achieve improved performance. The disclosed embodiments each include a mixing device for combining the core and bypass gas streams. The variable area mixing device permits the static pressures of the core and bypass streams to be balanced prior to mixing at widely varying bypass stream pressure levels. The mixed flow gas turbine engine therefore operates efficiently over a wide range of bypass ratios and the dynamic pressure of the bypass stream is maintained at a level which will keep the engine inlet airflow matched to an optimum design level throughout a wide range of engine thrust settings.

Official Gazette of the U.S. Patent Office
08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities piloting flight controls and autopilots.

N78-17070* National Aeronautics and Space Administration Langley Research Center Langley Station Va
FILTERING TECHNIQUE BASED ON HIGH-FREQUENCY PLANT MODELING FOR HIGH-GAIN CONTROL Patent Application
Frank R. Niesson and John F. Garren Jr inventors (to NASA) Filed 8 Dec 1977 14 p
NTIS HC A02/MF A01 CSCL 01C
An aircraft control system which utilized feedback motion sensors to generate a control signal to control the aircraft is illustrated. The use of a complementary filter permitted a substantial increase in frequency bandwidth due to the simultaneous reduction in noise amplification and control limit cycle tendencies.

N78-19166* National Aeronautics and Space Administration Hugh L. Dryden Flight Research Center Edwards Calif
A PORTABLE DEVICE PARTICULARLY SUITED FOR USE IN STARTING AIR-START UNITS FOR AIRCRAFT Patent Application
William R. Rosier and George C. Volk inventors (to NASA) Filed 9 Mar 1978 15 p
(Contract NAS4-2272)
NTIS HC A02/MF A01 CSCL 01E
The invention is embodied in a device including (1) a DC circuit having a pair of terminal plugs each plug being characterized by a first, second, and third terminal, (2) a pair of manually operable switches for connecting the first terminal of each of the plugs to the positive side of a voltage source, (3) a circuit lead connecting the second terminal of each plug to the negative side of said source, (4) a pair of electrical cables adapted to connect the first and second terminals of each plug to an air-start unit, (5) means for connecting each of the cables between the first terminal of one plug and the third terminal of the other plug of the pair, and (6) a second pair of manually operable switches for selectively connecting the third terminal of each plug to the negative side of the voltage source whereby electrical continuity of each cable of the pair may be examined prior to being connected to an air-start unit.

09 RESEARCH AND SUPPORT FACILITIES (AIR)
Includes airports hangars and runways aircraft repair and overhaul facilities wind tunnels shock tube facilities and engine test blocks.
For related information see also 14 Ground Support Systems and Facilities (Space).

N78-18083* National Aeronautics and Space Administration Ames Research Center Moffett Field Calif
FULL COLOR HYBRID DISPLAY FOR AIRCRAFT SIMULATORS Patent
A full spectrum color monitor connected to the camera and lens system of a television camera supported by a gantry frame over a terrain model simulating an aircraft landing zone projects the monitor image onto a lens or screen visually accessible to a trainee in the simulator. A digital computer produces a pattern corresponding to the lights associated with the landing strip onto a monochromatic display and an optical system projects the calligraphic image onto the same lens so that it is superposed on the video representation of the landing field. The optical system includes a four-color wheel which is rotated between the calligraphic display and the lens, and an apparatus for synchronizing the generation of a calligraphic pattern with the color segments on the color wheel. A servo feedback system responsive to the servo motors on the gantry frame produces an input to the computer so that the calligraphically generated signal corresponds in shape, size and location to the video signal.

N78-19166* National Aeronautics and Space Administration Hugh L. Dryden Flight Research Center Edwards Calif
A PORTABLE DEVICE PARTICULARLY SUITED FOR USE IN STARTING AIR-START UNITS FOR AIRCRAFT Patent Application
William R. Rosier and George C. Volk inventors (to NASA) Filed 9 Mar 1978 15 p
(Contract NAS4-2272)
NTIS HC A02/MF A01 CSCL 01E
The invention is embodied in a device including (1) a DC circuit having a pair of terminal plugs each plug being characterized by a first, second, and third terminal, (2) a pair of manually operable switches for connecting the first terminal of each of the plugs to the positive side of a voltage source, (3) a circuit lead connecting the second terminal of each plug to the negative side of said source, (4) a pair of electrical cables adapted to connect the first and second terminals of each plug to an air-start unit, (5) means for connecting each of the cables between the first terminal of one plug and the third terminal of the other plug of the pair, and (6) a second pair of manually operable switches for selectively connecting the third terminal of each plug to the negative side of the voltage source whereby electrical continuity of each cable of the pair may be examined prior to being connected to an air-start unit.
15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters, manned orbital laboratories, reusable vehicles, and space stations.

N78-13110* National Aeronautics and Space Administration
Ames Research Center, Moffett Field, Calif
FIRE PROTECTION COVERING FOR SMALL DIAMETER MISSILES Patent Application
Salvatore R. Ricciutello and Paul M. Sanko, inventors (to NASA)
Filed 25 Nov 1977 19 p
NTIS HC A02/MF A01 CSCL 16D

Intumescent protection sheeting of unusually uniform thickness was prepared from epoxy polysulfide compositions containing microfibers and the ammonium salt of 1,4-nitroanilino-2-sulfonic acid. An ammonium salt particle size in the order of 5 to 8 microns and a fiber size of about 1/128th inch in length and 3 to 5 microns in diameter was found critical to obtain the required density of 1.46 to 1.50 g/cc. The insulating sheeting was prepared by a continuous process involving vacuum mixing, calendering, and curing under very strict conditions which depend to some extent upon the thickness of the sheet produced. The resulting flexible sheet can be wrapped easily and tightly around small diameter missiles thus affording them for the first time protection from fire for at least 5 minutes. The material is also suited for the protection of other articles with convoluted or contoured surfaces which require covering of highly uniform thickness.

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry, space communications networks, astronavigation, and radio blackouts.

For related information see also 04 Aircraft Communications and Navigation and 32 Communications.

N78-10214* National Aeronautics and Space Administration
Langley Research Center, Langley Station, Va
COMPOSITE SANDWICH LATTICE STRUCTURE Patent
Marvin D. Rhodes, inventor (to NASA) and Martin M. Mikulas Jr
Issued 4 Oct 1977 13 p
(NASA-Case-LAR-11898-1 US-Patent-4052 523

A lattice type structural panel is described. The panel utilizes the unidirectional character of filamentary epoxy impregnated composites. The panels are stiff lightweight structures for use in constructing space satellites and the like.

24 COMPOSITE MATERIALS

Includes laminates.

N78-17140* National Aeronautics and Space Administration
Washington, D.C.
SYSTEM AND METHOD FOR TRACKING A SIGNAL SOURCE Patent
Louis N. Mogavero, Edwin G. Johnson, John M. Evans Jr, and James S. Albus, inventors (to NASA)
Issued 3 Jan 1978 7 p
Filed 11 Jul 1975
(Supersedes N75-30385 (13 - 21 p 2655))

A system for tracking moving signal sources is disclosed which is particularly adaptable for use in tracking stage performers. A miniature transmitter is attached to the person or object to be tracked and emits a detectable signal of a predetermined frequency. A plurality of detectors positioned in a preset pattern sense the signal and supply output information to a phase detector which applies signals representing the angular orientation of the transmitter to a computer. The computer provides command signals to a servo network which drives a device such as a motor driven mirror reflecting the beam of a spotlight to track the moving transmitter.

Official Gazette of the U.S. Patent Office
A coating which is stable to the environment and to exposure to water and which intumesces at a favorable temperature was developed. The composition comprises a mixture of 4,4'-dinitrosulfanilide as the intumescent agent in a polymer binder mixture of a chlorinated polyolefin, a bisphenol A epoxy resin, and a rubber-like amine hardener.

A honeycomb-laminate composite structure was comprised of (1) a cellular core of a polyquinoxaline foam in a honeycomb structure, and (2) a layer of a noncombustible fibrous material impregnated with a polyimide resin laminated on the cellular core. A process for producing the honeycomb-laminate composite structure and articles containing the honeycomb-laminate composite structure is described.

A process was developed for preparing relatively thick composite laminate structure wherein thin layers of prepreg tapes...
FUEL COMBUSTOR Patent


A fuel combustor comprises a chamber with air and fuel inlets and a combination gas outlet. The fuel is supplied to a vaporization zone and fuel and air are mixed in a pair of mixing chambers, each exemplified by a swirl can. The resultant mixture is directed into a combustion zone within the combustor. Heat pipes are arranged with one end portion substantially in the combustion zone and the other end in the vaporization zone of its appropriate mixing chamber. Some of the heat of combustion is thus carried back upstream into the swirl cans to vaporize the fuel as it enters the vaporization zone in the swirl can, thereby improving vaporization and fuel mixing.

Official Gazette of the U.S. Patent Office

PROCESS OF FORMING CATALYTIC SURFACES FOR WET OXIDATION REACTIONS Patent


A wet oxidation process was developed for oxidizing waste materials comprising dissolved ruthenium salt in a reactant feed stream containing the waste materials. The feed stream is introduced into a reactor and the reactor contents are then raised to an elevated temperature to effect deposition of a catalytic surface of ruthenium black on the interior walls of the reactor. The feed stream is then maintained in the reactor for a period of time sufficient to effect at least partial oxidation of the waste materials.

Official Gazette of the U.S. Patent Office

IMPROVEMENTS IN MICROELECTROPHORETIC APPARATUS AND PROCESS Patent Application

Benjamin W Grunbaum, inventor (to NASA) Filed 10 Nov 1977 32 p

Gel tray and lid assemblies designed for use in conjunction with slotted electrophoretic membranes were developed to take advantage of improved microelectrophoretic accessores which include a multisample applicator capable of applying up to 10 samples consecutively or simultaneously and a temperature control plate for dissipating the heat produced by electrophoresis in a gel. The trays and membranes can be marketed ready for use as electrophoretic media or impregnated with various specific substrates and dyes which can develop the electrophoretic patterns of up to 30 individual protein samples in up to 10 tray or membrane compartments. In addition to greatly simplifying and speeding up electrophoresis, these methods and equipment can contribute to the standardization of processes for clinical forensic and anthropological diagnosis and identification.

Official Gazette of the U.S. Patent Office
AUTOMATIC MULTIPLE-SAMPLE APPLICATOR AND ELECTROPHORESIS APPARATUS Patent
An apparatus for performing electrophoresis and a multiple-sample applicator is described. Electrophoresis is a physical process in which electrically charged molecules and colloidal particles upon the application of a dc current migrate along a gel or a membrane that is wetted with an electrolyte. A multiple-sample applicator is provided which coacts with a novel tank cover to permit an operator either to depress a single button thus causing multiple samples to be deposited on the gel or on the membrane simultaneously or to depress one or more sample applicators separately by means of a separate button for each applicator. Official Gazette of the U.S. Patent Office

THERMOLUMINESCENT AEROSOL ANALYSIS Patent
A method for detecting and measuring trace amounts of aerosols when reacted with ozone in a gaseous environment was examined. A sample aerosol was exposed to a fixed ozone concentration for a fixed period of time and a fluorescer was added to the exposed sample. The sample was heated in a 30 C/mminute linear temperature profile to 200 C. The trace peak was measured and recorded as a function of the test aerosol and the recorded thermoluminescence trace peak of the fluorescer is specific to the aerosol being tested. Official Gazette of the U.S. Patent Office

ELECTROCHEMICAL DATA SIGNAL PROCESS AND DISPLAY Patent Application
An electrochemical detection device for detecting microorganisms is described. A standard pH reference electrode and a platinum cathodic electrode are positioned in a container with suitable nutrient medium for microbial growth plus the sample to be tested. The two electrodes are connected to electronic circuitry including an up/down counter which counts up for the first 80 minutes after a test has been initiated. Then the potential between the two electrodes is tracked by the electronic circuitry and after there is a change of 10 mv a signal is sent to the up/down counter to reverse its count. Thereafter when there is an additional 20 mv change in the potential between the two electrodes another signal is sent to the up/down counter signalling it to stop. The resulting count on the counter is equal to the length of time for the inoculum to begin the production of measurable amounts of H2 after inoculation. This length of time is indicative of a endpoint.
26 METALLIC MATERIALS

Includes physical chemical and mechanical properties of metals e.g. corrosion and metallurgy.

N78-18182 National Aeronautics and Space Administration Lewis Research Center, Cleveland, Ohio TANTALUM MODIFIED FERRITIC IRON BASE ALLOYS Patent

Strong ferritic alloys of the Fe-Cr-Al type containing 0.4% to 2% tantalum were developed. These alloys have improved fabricability without sacrificing high temperature strength and oxidation resistance in the 800 C (1475 F) to 1040 C (1900 F) range. Office Gazette of the U.S. Patent Office

N78-18183 National Aeronautics and Space Administration Lewis Research Center, Cleveland, Ohio DIRECTIONALLY SOLIDIFIED EUTECTIC GAMMA-GAMMA NICKEL-BASE SUPERALLOYS Patent
Melvin R Jackson, inventor (to NASA) Issued 25 Oct 1977 7 p Filed 7 May 1976

A directionally solidified multivariate eutectic gamma-gamma prime nickel-base superalloy casting having improved high temperature properties was developed. The alloy is comprised of a two phase eutectic structure consisting essentially of one a weight percent basis 60 - 90 aluminum, 5 - 17 tantalum, 0-10 cobalt, 0-6 vanadium, 0-8 rhenum, 20-60 tungsten, and the balance being nickel subject to the proviso that the sum of the atomic percentages of aluminum plus tantalum is within the range of from 19-22, and the ratio of atomic percentages of tantalum to aluminum plus tantalum is within the range of from 0.12 to 0.23. Embedded within the gamma nickel-base matrix are aligned eutectic gamma prime phase (primarily nickel-aluminum-tantalum) reinforcing fibers. Office Gazette of the U.S. Patent Office

27 NONMETALLIC MATERIALS

Includes physical chemical, and mechanical properties of plastics elastomers lubricants polymers textiles adhesives and ceramic materials.

N78-10292 National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif. PREPARATION OF HETEROCYCLIC BLOCK COPOLYMER FROM PERFLUOROALKYLENE OXIDE ALPHA, OMEGA-DIAMIDOXIMES Patent Application
(NASA-Case-ARC-11060-1 US-Patent-Appl-SN-843090) Avail NTIS HC A02/MF A01 CSCL 07C

New heat and chemical resistant polymeric materials are prepared by the thermal condensation of diamidoxime monomers to yield larger molecules having 1, 2, 4-oxadiazole linkages. This process of direct intermolecular condensation of amidoxime groups is used for the synthesis of new fluorinated 1, 3, 4-oxadiazole polymers. NASA

N78-11245 National Aeronautics and Space Administration Goddard Space Flight Center, Greenbelt, Md ELECTRICALLY CONDUCTIVE THERMAL CONTROL COATINGS Patent Application
Michael Charles Shai, inventor (to NASA) Filed 21 Oct 1977 16 p

A coating characterized by low thermal absorption high thermal emissivity and high electrical conductivity was developed. The paint composition or coating comprises a fired oxide pigment having a minor amount of aluminum oxide and a major amount of zinc oxide an alkali metal silicate vehicle-binder and sufficient water to provide a mixture suitable for application to a substrate. The fired oxide pigment may further include a minor amount of cobalt oxide. The resulting coating is particularly useful for coating the surfaces of spacecraft and similar objects. NASA

N78-14164 National Aeronautics and Space Administration Pasadena Office Calif DURABLE ANTISTATIC COATING FOR POLY-METHYL METHACRYLATE Patent
Vaclav Hadek (JPL) Robert B Somoano (JPL), and Alan Rembaum, inventors (to NASA) (JPL) Issued 6 Dec 1977 18 p Filed 3 Jun 1976 Supersedes N77-22287 (15 - 13 p 1699)
Sponsored by NASA

A durable antistatic coating is achieved on polymethylmethacrylate plastic without affecting its optical clarity by applying to the surface of the plastic a low molecular weight solvent having a high electron affinity and a high dipole moment, such as acetonitrile or nitrromethane alone or in the presence of photopolymerizable monomer. The treated polymethylmethacrylate plastic dissipates most of the induced electrostatic charge and retains its optical clarity. The antistatic behavior persists after washing rubbing and vacuum treatment. Office Gazette of the U.S. Patent Office

N78-15276 National Aeronautics and Space Administration Lewis Research Center, Cleveland, Ohio TRIMERIZATION OF AROMATIC NITRILES Patent
Li-Chen Hsu, inventor (to NASA) Issued 6 Dec 1977 18 p Filed 10 Oct 1974 Supersedes N74-34579 (12 - 24 p 2914)

Triazine compounds and cross-linked polymer compositions were made by heating aromatic nitriles to a temperature in the range of about 100 C to about 700 C in the presence of a catalyst or mixture of catalysts. Aromatic nitrile-modified (terminated and/or appended) imide benzimidazole imidazopyrrole quinoxaline and other condensation type prepolymers or their precopolymers were made which were tenderized with or without a filler by the aforementioned catalytic trimerization process. Office Gazette of the U.S. Patent Office
**THERMAL SHOCK AND EROSION RESISTANT TANTALUM**


A process was developed for preparing aromatic polyamide acids for use as adhesives by reacting an aromatic diaminehydride to an approximately equimolar amount of an aromatic diamine in a water or lower alkanoic miscible ether solvent. The polyamide acids are converted to polyamides by heating to the temperature range of 200 - 300°C. The polyamides are thermally stable and insoluble in ethers and other organic solvents Official Gazette of the U S Patent Office

**THERMAL SHOCK AND EROSION RESISTANT TANTALUM CARBIDE CERAMIC MATERIAL**


Ceramic tantalum carbide artifacts with high thermal shock and mechanical erosion resistance are provided by incorporating tungsten-rhenium and carbon particles in a tantalum carbide matrix. The mix is sintered by hot pressing to form the ceramic carbide The mix is then sintered to form the ceramic carbide. The tantalum carbide is preferable to a temperature of 200°C. The polyamide acids are thermally stable and insoluble in ethers and other organic solvents Official Gazette of the U S Patent Office

**FLAME RETARDANT SPANDEX TYPE POLYURETHANES**


Flame retardant elastomeric compositions were developed comprised of (1) spandex type polyurethane having incorporated into the polymer main halogen containing polyols (2) conventional spandex type polyurethanes in physical admixture flame retardant additives and (3) fluoroelastomeric resins in physical admixture with flame retardant additives. Methods of preparing fibers of the flame retardant elastomeric materials are presented and articles of manufacture comprised of the elastomeric materials are mentioned Official Gazette of the U S Patent Office

**NUCLEAR ALKYLATED PYRIDINE ALDEHYDE POLYMERS AND CONDUCTIVE COMPOSITIONS THEREOF**


A thermally stable relatively conductive polymer was disclosed. The polymer was synthesized by condensing in the presence of a catalyst a 2, 4, or 6 nuclear alkylated 2, 3, or 4 pyridine aldehyde or quaternary derivatives thereof to form a polymer. The pyridine groups were linked by olefinic groups between 2-4 2-6, 2-3, 3-4 3-6 or 4-6 positions Conductive compositions were prepared by dissolving the quaternary polymer and an organic charge transfer complexing agent such as TCNQ in a mutual solvent such as methanol Official Gazette of the U S Patent Office

**METHOD OF ADHERING BONE TO A RIGID SUBSTRATE USING A GRAPHITE FIBER REINFORCED BONE CEMENT**


A method is described for adhering bone to the surface of a rigid substrate such as a metal or resin prosthesis using an improved surgical bone cement. The bone cement has mechanical properties more nearly matched to those of animal bone and thermal curing characteristics which result in less traumatization of body tissues and comprises a dispersion of short high modulus graphite fibers within a bonder composition including polymer dissolved in reactive monomer such as polymethylmethacrylate dissolved in methylmethacrylate monomer Official Gazette of the U S Patent Office

**POLYIMIDE ADHESIVES**


A process was developed for preparing aromatic polyamide acids for use as adhesives by reacting an aromatic diaminehydride to an approximately equimolar amount of an aromatic diamine in a water or lower alkanoic miscible ether solvent. The polyamide acids are converted to polyamides by heating to the temperature range of 200 - 300°C. The polyamides are thermally stable and insoluble in ethers and other organic solvents Official Gazette of the U S Patent Office

**NUCLEAR ALKYLATED PYRIDINE ALDEHYDE POLYMERS AND CONDUCTIVE COMPOSITIONS THEREOF**


A thermally stable relatively conductive polymer was disclosed. The polymer was synthesized by condensing in the presence of a catalyst a 2, 4, or 6 nuclear alkylated 2, 3, or 4 pyridine aldehyde or quaternary derivatives thereof to form a polymer. The pyridine groups were linked by olefinic groups between 2-4 2-6, 2-3, 3-4 3-6 or 4-6 positions Conductive compositions were prepared by dissolving the quaternary polymer and an organic charge transfer complexing agent such as TCNQ in a mutual solvent such as methanol Official Gazette of the U S Patent Office

**METHOD OF ADHERING BONE TO A RIGID SUBSTRATE USING A GRAPHITE FIBER REINFORCED BONE CEMENT**


A method is described for adhering bone to the surface of a rigid substrate such as a metal or resin prosthesis using an improved surgical bone cement. The bone cement has mechanical properties more nearly matched to those of animal bone and thermal curing characteristics which result in less traumatization of body tissues and comprises a dispersion of short high modulus graphite fibers within a bonder composition including polymer dissolved in reactive monomer such as polymethylmethacrylate dissolved in methylmethacrylate monomer Official Gazette of the U S Patent Office
N78-17217* National Aeronautics and Space Administration
Goddard Space Flight Center Greenbelt, Md
ALKALI-METAL SILICATE BINDERS AND METHODS OF
MANUFACTURE Patent Application
John B Schutt inventor (to NASA) Filed 21 Dec 1977
NTIS HC A02/MF A01 CSCL 11A
Binders were made from alkali metal silicates exhibiting a
high silicon dioxide mol ratio which is important in establishing
a characteristic of high resistance to water solubility. The binders
are stable during manufacture and storage and may be made
with inexpensive components. The process of making these binders
is predictable and repeatable. The process involves mixing a
starter alkali metal silicate solution with silicon dioxide
hydrogel and then with water and silicone. The final product
binder contains silicon dioxide and an alkali metal oxide, water
and silicone. The silicone dioxide is in the form of a hydrogel
sol. The hydrogel sol allows for the high mol ratio (for insolvibility)
and a high inorganic solids content for low porosity. NASA

N78-17219* National Aeronautics and Space Administration
Langley Research Center Langley Station Va
MIXED DIAMINES FOR LOWER MELTING ADDITION
POLYWIDE PREPARATION AND UTILIZATION Patent
Application
Terry L StClair inventor (to NASA) Filed 6 Oct 1977 13 p
NTIS HC A02/MF A01 CSCL 07C
By employing a mixture of methylene diamines as the diamine
portion of the oligomer in an addition polymerization process,
an oligomer is produced that is tacky and nonboardy when used
to form a prepreg. This mixed diamine oligomer melts in the
175-200 C temperature range during processing and requires
only approximately 200 psi molding pressure to fabricate
composite structures having equal or better physical property
characteristics than those produced previously at 1000 psi molding
pressure. Composites prepared from oligomers of this type can
be thermoformed at elevated temperatures after an initial molding
in the 175-200 C temperature range due to this lowered melting
temperature of the mixed diamines. NASA

N78-17302* National Aeronautics and Space Administration
Pasadena Office Calif
HIGH TEMPERATURE RESISTANT CERMET AND CERAMIC
COMPOSITIONS Patent
Wayne M Phillips, inventor (to NASA) (JPL) Issued 7 Feb
1978 10 p Filed 20 Nov 1975 Supersedes N76-13294
(14 - 04. p 0433) Sponsored by NASA
(NASA-Case-NPO-13690-1, US-Patent-4,072,532,
US Patent Office CSCL 11B
High temperature oxidation resistance, high hardness and
high abrasion and wear resistance are properties of cermet
compositions particularly to provide high temperature resistant
refractory coatings on metal substrates, for use as electrical
insulation seals for thermionic converters. The compositions
comprise a sintered body of particles of a high temperature
resistant metal or metal alloy, preferably molybdenum or tungsten
particles, dispersed in and bonded to a solid solution formed of
aluminum oxide and silicon nitride, and particularly a ternary
solid solution formed of a mixture of aluminum oxide, silicon
nitride and aluminum nitride. Ceramic compositions comprising
a sintered solid solution of aluminum oxide, silicon nitride and
aluminum nitride are also described.

N78-17330* National Aeronautics and Space Administration
Pasadena Office Calif
HIGH PERFORMANCE AMMONIUM NITRATE PRO-
PELLANT Patent Application
Floyd A Anderson, inventor (to NASA) (JPL) Filed 16 Dec
1977 26 p (Contract NAS7-100)
NTIS HC A03/MF A01 CSCL 211
Propellants having the combustion efficiency and high burning
rates normally only achieved with perchlorates, have now been
formulated with ammonium nitrate as the primary oxidizer and
with powdered metal fuel, all of which permits the use of lesser
amounts of perchlorate oxidizer. These novel formulations
greatly reduce the total hydrogen chloride emissions to the
atmosphere and hence are particularly desirable for the Space
Shuttle propulsion systems. NASA
N78-10328*
National Aeronautics and Space Administration
Goddard Inst for Space Studies, New York
THERMAL COMPENSATOR FOR CLOSED-CYCLE HELIUM REFRIGERATOR Patent Application
Donald E Jennings (NAS-NRC) and John J Hillman inventors (to NASA) Filed 30 Sep 1977 17 p
(NASA-Case-GSC-12168-1, US-Patent-Appl-SN-838337) Avail NTIS HC A02/MF A01 CSCL 13A
The wavelength of an infrared, semiconductor laser diode is maintained substantially constant by maintaining the diode temperature constant. The diode is carried by a cold tip of a closed cycle helium refrigerator. The refrigerator has a tendency to cause the temperature of the cold tip to oscillate. A heater diode and a sensor diode are placed on a thermal heat sink so that the sensing diode and substantially the same temperature as the heater diode and substantially no thermal lag exists between them. The sensor diode is connected in a negative feedback circuit with the heater diode so that the tendency of the laser diode to thermally oscillate is virtually eliminated. NASA

N78-11260*
National Aeronautics and Space Administration
Langley Research Center Langley Station Va
LIQUID HYDROGEN FLASH VAPORIZER Patent Application
A method and device are disclosed for initially reducing the temperature of a stream of LH2 in a fuel distribution line. The device allows some LH2 to escape into and vaporize in a shroud surrounding a length of the line just upstream of the nozzle. The effect of this controlled evaporation is to cool the LH2 in the line to satisfactorily low temperatures before it exits the line. This prevents the immediate vaporization of the fuel as it leaves the line. NASA

N78-17237*
National Aeronautics and Space Administration
Lewis Research Center Cleveland Ohio
CLOSED LOOP SPRAY COOLING APPARATUS Patent
A closed loop apparatus for spraying coolant against the back of a radiation target is described. The coolant was circulated through a closed loop with a bubble of inert gas being maintained around the spray. Mesh material was disposed between the bubble and the surface of the liquid coolant which was below the bubble at a predetermined level. In a second embodiment no inert gas was used; the bubble consisting of a vapor produced when the coolant was sprayed against the target. Official Gazette of the U S Patent Office

N78-17238*
National Aeronautics and Space Administration
Pasadena Office, Calif
PURGING MEANS AND METHOD FOR XENON ARC LAMPS Patent
High pressure Xenon short-arc lamp with two reservoirs which are selectively connectable to the lamp's envelope is described. One reservoir contains an absorbent which will absorb both Xenon and contaminant gases such as CO2 and O2. The absorbent temperature is controlled to evacuate the envelope of both the Xenon and the contaminant gases. The temperature of the absorbent is then raised to desorb only clean Xenon while retaining the contaminant gases thereby clearing the envelope of the contaminant gases. The second reservoir contains a gas whose specific purpose is to remove the objectional metal film which deposits gradually on the interior surface of the lamp envelope during normal arc operation. The origin of the film is metal transferred from the cathode of the arc lamp by sputtering or
A SYSTEM FOR DELIVERING SiCl4 TO A CHEMICAL REACTOR Patent Application
Robert E. Witkowski (Westinghouse Electric, Trafford, Pa.) and Thomas S. Bulischeck, inventors (to NASA) (Westinghouse Electric, Trafford, Pa.) Filed 31 Jan 1978 19 p

A system was developed for delivering SiCl4 to the chemical reactor employed in the production of solar grade silicon. The system is characterized by a supply circuit including a tank comprising a source of high purity SiCl4 and a pressurized delivery loop connected between the source and a reactor for delivering SiCl4 under pressure to the reactor. A gas cover circuit is connected to the supply circuit for introducing an inert dry cover gas into the source of SiCl4 for maintaining purity. A quality control system including an analyzer connected with the supply circuit is used for detecting the presence of by-products of hydrolysis within the supply circuit and an analyzer connected with the cover gas circuit is provided for detecting the presence of moisture in the cover gas. Additionally, a further monitoring system is provided for purposes of extracting quantities of SiCl4 to be examined for metallic chlorides, oxides, and the like.

AZIMUTH CORRELATOR FOR REAL-TIME SYNTHETIC APERTURE RADAR IMAGE PROCESSING Patent Application
Wayne E. Arens, inventor (to NASA) (JPL) Filed 18 Oct 1977 23 p

A number of serial range-line buffer memories are cascaded such that the output stages of all buffer memories together form a complete and unique range bin in the azimuthal dimension at any given time. A range bin is automatically read out of the last stages of the registers in parallel on a range line sample-by-sample basis for subsequent range migration correction and correlation. Range migration correction is performed on the range bins by effectively varying the length of a delay register at the output of each range line buffer memory. The corrected range bin output from the delay registers is then correlated with a Doppler reference function to form an image element on a real-time basis.

ULTRA STABLE FREQUENCY DISTRIBUTION SYSTEM Patent
Richard L. Sydnor (JPL) and John W. MacConnell, inventors (to NASA) (JPL) Issued 6 Dec 1977 9 p

A system is presented for synchronizing a signal at a remotely located slave station with the phase and frequency of a signal generated at a master station. The signal transmitted...
at the master station and received by the slave station provides compensation for the phase shift caused by the transmission path delays between the master and slave station. The slave station transmits a signal to the master station at a frequency that is different from the frequency of the signal being transmitted by the master station. The signal transmitted by the slave station is received by the master station while the master station transmitter is off. The signal transmitted by the master station is received by the slave station while the slave station transmitter is off.

Official Gazette of the U.S. Patent Office

APPARATUS AND METHOD FOR STABILIZED PHASE DETECTION FOR BINARY SIGNAL TRACKING LOOPS Patent Application

An apparatus and method for phase detection in binary signal tracking loops is described. Two bandpass detectors are alternately interchanged between electrical connection with two local code, reference tracking signals in order to cancel any adverse effect of gain imbalance in the bandpass detectors and direct current offset or drift.

CLUTTER FREE SYNTHETIC APERTURE RADAR CORRELATOR Patent Application

A synthetic aperture radar correlation system including a moving diffuser located at the imaging plane of a radar processor is presented. The output of the moving diffuser is supplied to a lens whose impulse response is at least as wide as that of the overall processing system. A significant reduction in clutter results. The novelty of the invention appears to reside in locating a moving diffuser at the imaging plane of the radar processor and reimaging the diffuser with a lens whose impulse response is at least as wide as the impulse response of the radar system.
HEARING AID MALFUNCTION DETECTION SYSTEM Patent
A malfunction detection system for detecting malfunctions in electrical signal processing circuits is disclosed. Malfunctions of a hearing aid in the form of frequency distortion and/or inadequate amplification by the hearing aid amplifier, as well as weakening of the hearing aid power supply are detectable. A test signal is generated and a timed switching circuit periodically applies the test signal to the input of the hearing aid amplifier in place of the input signal from the microphone. The resulting amplifier output is compared with the input test signal used as a reference signal. The hearing aid battery voltage is also periodically compared to a reference voltage. Deviations from the references beyond preset limits cause a warning system to operate.

POWER FACTOR CONTROL SYSTEM FOR AC INDUCTION MOTORS Patent
A power factor control system for use with ac induction motors was designed which samples lines voltage and current through the motor and decreases power input to the motor proportional to the detected phase displacement between current and voltage. This system provides less power to the motor, as it is less loaded.

OVERLOAD PROTECTION SYSTEM FOR POWER INVERTER Patent
An overload protection system for a power inverter utilizes a first circuit for monitoring current to the load from the power inverter to detect an overload and a control circuit to shut off the power inverter, when an overload condition was detected. At the same time, a monitoring current inverter was turned on to deliver current to the load at a very low power level. A second circuit monitored current to the load from the monitoring current inverter, to hold the power inverter off through the control circuit until the overload condition was cleared so that the control circuit may be deactivated in order for the power inverter to be restored after the monitoring current inverter is turned off completely.

OFFICIAL GAZETTE OF THE U.S. PATENT OFFICE
An apparatus for deriving time domain measurements of the phase stability of a test device is described. The amplitude of a dc signal indicative of the phase shift introduced by the tested device was compared with the amplitude of a ramp voltage. Electrical and electronic devices as well as other devices introduce phase shift on signals that are coupled through them. The amount of phase shift is not stable within the same device and there is a drift in phase shift as a function of ambient conditions such as temperature, power supply voltage, etc.

A superconducting microbridge is provided for use in superconducting quantum interference devices wherein a pair of spaced layers of superconductive material are connected by a weak link bridge to establish an electrical junction. The superconductive layers and bridge are coated with a semiconductor material shunting the bridge at room temperatures to prevent the destruction of the device by minute electrical currents while the coating acts as a dielectric permitting normal electrical behavior of the microbridge at cryogenic temperatures.

A current source was designed which is substantially independent of variations of temperature. The current source may be made either to have a linear dependence upon changes of temperature or, by the simple addition of a resistor, may be made substantially independent of temperature variations. Since the current source consists only of transistors of one conductivity type and resistors, it is ideally suited for manufacture in the form of a monolithic integrated circuit.
N78-17296* National Aeronautics and Space Administration
Goddard Space Flight Center, Greenbelt, Md
TRANSFORMER REGULATED SELF-STABILIZING CHOP-PIER Patent
A self-stabilizing voltage regulator is described Direct current voltage regulation employing a series transistor rendered conductive during various portions of a cycle is controlled by saturation of an autotransformer The constant volt-second capacity of the transformer provides conduction time inverse to the input voltage whereby average output voltage is maintained constant Conduction commences in response to short gate signals and resistor feedback for degenerative turn-off of the transistor was after transformer saturation Standard output filters are also included.

N78-17297* National Aeronautics and Space Administration
Goddard Space Flight Center, Greenbelt, Md
SHUNT REGULATION ELECTRIC POWER SYSTEM Patent
A regulated electric power system having load and return bus lines is described A plurality of solar cells interconnected in a power supplying relationship and having a power shunt tap point electrically spaced from the bus lines is provided A power dissipator is connected to the shunt tap point and provides for a controllable dissipation of excess energy supplied by the solar cells A dissipation driver is coupled to the shunt tap point and provides for a controllable dissipation of excess energy supplied by the solar cells A dissipation driver is connected to the power dissipator and controls its conductance and dissipation and is also connected to the solar cells in a power tapping relationship to derive operating power therefrom An error signal generator is coupled to the load bus and to a reference signal generator to provide an error output signal which is representative of the difference between the electric parameters existing at the load bus and the reference signal generator An error amplifier is coupled to the error signal generator and the dissipation driver to provide the driver with controlling signals Official Gazette of the US Patent Office

N78-17297* National Aeronautics and Space Administration
Goddard Space Flight Center, Greenbelt, Md
VOLTAGE FEED THROUGH APPARATUS HAVING REDUCED PARTIAL DISCHARGE Patent Application
Stephan R. Peck (GE, Philadelphia) and Jeffrey W. Benham inventors (to NASA) (GE, Philadelphia) Filed 10 Jan 1978 15 p (NASA-Case-GSC-12347-1, US-Patent-Appl-SN-868249) Avail NTIS HC A02/MF A01 CSCL 09A Voltage feed through apparatuses where the partial discharge occurrences were reduced to a magnitude of not more than five partial discharge occurrences are illustrated Voltage feed through apparatuses were used to properly measure partial discharge occurrences by items under test prior to their use in spacecraft and other hostile environments NASA

N78-18308* National Aeronautics and Space Administration
Hugh L. Dryden Flight Research Center Edwards Calif WINDOW COMPARATOR Patent
of the second operational amplifier to determine when the algebraic difference of the input signal and the setpoint voltage has exceeded a predetermined tolerance after that difference has changed signs. Official Gazette of the U.S. Patent Office

A dichroic plate for microwave energy which includes an array of interlaced crossed slots or dipole elements was developed. Each of the elements included first and second crossed arms that are at approximately right angles to each other and aligned with X and Y axes. The elements were arranged so that the centers were aligned parallel to the X and Y axes to form columns and rows. The interlacing was such that a line between the centers of all adjacent elements had non-zero differently relative to the X and Y axes. In one embodiment the spacing between adjacent arms of different adjacent elements was the same along the X and Y axes, while in a second embodiment, the spacing between similarly directed arms of adjacent elements differed from the spacing between oppositely directed arms of adjacent elements.

A heat dissipating instrument package of a spacecraft, located in a canister having walls in heat transfer relationship with the package, is maintained at a substantially constant temperature. Fixed conductance heat pipes on the canister walls are connected to variable conductance heat pipes, mounted on a radiator structure separated from the canister walls by a thermal blanket. The effective radiating area of the radiator structure is controlled by the variable conductance heat pipes in response to a comparison of a sensed temperature of the instrument package or the canister wall with a set point value. The comparison controls a heater in a gas reservoir containing a non-condensable gas of the variable conductance heat pipe. A thermal radiation shield for the gas reservoir prevents radiant energy from the exterior environment and thermal energy reflected from the spacecraft from overheating the non-condensable gas.

A fluid velocity measuring device portable in a free stream of fluid flow to cause vortices to be created at a frequency proportional to the rate of flow is described. Sensors were utilized to generate signals representative of fluid velocity frequencies proportional to fluid flow speed and the amplitudes of which are indicative of fluid flow direction. The device includes
housing mounted around a spindle fixed at one end to some reference structure. Bearings provide a low friction contact and alignment between the housing and the mounting spindle to measure rotational forces caused by vortex creation and translational drag forces relative to the reference structure. The sensors generate electric signals which are translated into indications of fluid flow speed and direction by additional electric circuitry.

A heat pipe design is offered that utilizes an auxiliary working fluid. The fluid although being less efficient than the main working fluid remains liquid at low heat loads when the main working fluid freezes.

A ferromagnetic or ferrimagnetic element is used to control the temperature and applied magnetic field of the element to cause the state of the element as represented on a temperature-magnetic entropy diagram to repeatedly traverse a loop. The loop may have a first portion of concurrent substantially isothermal or constant temperature and increasing applied magnetic field, a second portion of lowering temperature and constant applied magnetic field, a third portion of isothermal and decreasing applied magnetic field and a fourth portion of increasing temperature and constant applied magnetic field. Other loops may be four-sided, with two isotherms and two adiabats. Preferably, a regenerator is used to enhance desired cooling or heating effects.
34 FLUID MECHANICS AND HEAT TRANSFER

MULTI-CHAMBER CONTROLLABLE HEAT PIPE Patent
Arnold P. Shlosmger inventor (to NASA) (TRW Inc. Redondo Beach Calif) Issued 1 Dec 1970 8 p Filed 14 May 1969
Sponsored by NASA

A temperature controllable heat pipe switching device is reported. It includes separate evaporating and condensing chambers interconnected by separate vapor flow and liquid return conduits. The vapor flow conduit can be opened or closed to the flow of vapor whereas the liquid return conduit blocks vapor flow at all times. When the vapor flow path is open the device has high thermal conductivity and when the vapor flow path is blocked the device has low thermal conductivity.

Official Gazette of the U.S. Patent Office

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors, measuring instruments and gages, detectors, cameras, and photographic supplies and holography. For aerial photography see 43 Earth Resources. For related information see also 06 Aircraft Instrumentation and 19 Spacecraft Instrumentation.

GAS COMPRESSION APPARATUS Patent
Leslie S. Terp, inventor (to NASA) (Garrett Corp, Los Angeles) Issued 4 Oct 1977 8 p Filed 24 Oct 1975

Apparatus for transferring gas from a first container to a second container of higher pressure was devised. A free-piston compressor having a driving piston and cylinder and a smaller diameter driven piston and cylinder, comprise the apparatus. A rod member connecting the driving and driven pistons functions for mutual reciprocation in the respective cylinders. A conduit may be provided for supplying gas to the driven cylinder from the first container. Also provided is apparatus for introducing gas to the driving piston, to compress gas by the driven piston for transfer to the second higher pressure container. The system is useful in transferring spacecraft cabin oxygen into higher pressure containers for use in extravehicular activities.

Official Gazette of the U.S. Patent Office
35 INSTRUMENTATION AND PHOTOGRAPHY

N78-10433# National Aeronautics and Space Administration
Langley Research Center, Langley Station, Va
MAGNETIC SUSPENSION AND POINTING SYSTEM Patent Application
Willard W Anderson and Nelson J Groom inventors (to NASA)
Filed 17 Jun 1977 10 p
NTIS HC A02/MF A01 CSCL 14B

An apparatus is described for providing accurate pointing of instruments on a carrier vehicle and for providing isolation of the instruments from the vehicle's motion disturbances. The apparatus includes two assemblies, with connecting interfaces, each assembly having a separate function. The first assembly is attached to the carrier vehicle and consists of an azimuth gimbal and an elevation gimbal which provide coarse pointing of the instruments by allowing two rotations of the instruments relative to the carrier vehicle. The second or vernier pointing assembly is made up of magnetic suspension and fine pointing actuators, roll motor segments and an instrument mounting plate around which a continuous annular rim is attached which provides appropriate magnetic circuits for the actuators and the roll motor segments. The vernier pointing assembly is attached to the elevation gimbal and provides vernier attitude fine pointing and roll positioning of the instruments as well as six-degree-of-freedom isolation from carrier motion disturbances.

N78-10434# National Aeronautics and Space Administration
Lyndon B Johnson Space Center, Houston Tex
VARIABLE CONTOUR SECURING SYSTEM Patent Application
Paul P Zebus (Rockwell International Downey, Calif.), Cyrus C Haynie (Rockwell International Downey, Calif.) and Poley N Packer inventors (to NASA) (Rockwell International Downey, Calif.) Filed 27 Sep 1977 14 p
Sponsored by NASA
NTIS HC A02/MF A01 CSCL 14B

A vacuum operated holding fixture for securing parts of variable contour is reported. The retaining mechanism includes a spaced array of adjustable spindles mounted on a housing. Each spindle has a base member support cup at one end thereof. A vacuum source is applied to the cups for seating the member adjacent to the cups. A locking mechanism sets the spindles in a predetermined position once the member has been secured to the spindle support cups.

N78-10435# National Aeronautics and Space Administration
John F Kennedy Space Center, Cocoa Beach, Fla
LIGHTNING CURRENT DETECTOR Patent Application
Stephen F Livermore, inventor (to NASA) Filed 22 Sep 1977 12 p
NTIS HC A02/MF A01 CSCL 14B

An apparatus is outlined for measuring the intensity of current produced in an elongated electrical conductive member by a lightning strike. The apparatus includes an elongated strip of magnetic material that is carried within an elongated tubular housing. A predetermined electrical signal is recorded along the length of the elongated strip of magnetic material. One end of the magnetic material is positioned closely adjacent to the electrically conductive member so that the magnetic field produced by current flowing through the member disturbs a portion of the recorded electrical signal directly proportional to the intensity of the lightning strike.

N78-11370# National Aeronautics and Space Administration
Langley Research Center, Langley Station, Va
AN ELECTRICALLY SCANNED PRESSURE SENSOR MODULE WITH IN SITU CALIBRATION CAPABILITY Patent Application
Chris Gross inventor (to NASA) Filed 27 Sep 1977 17 p
NTIS HC A02/MF A01 CSCL 14B

A high data rate pressure sensor module with an in situ calibration capability to help reduce energy consumption in wind tunnel facilities without loss of measurement accuracy is described. The sensor module allows for nearly a two order of magnitude increase in data rates over conventional electromechanically scanned pressure sampling techniques. The module consists of 16 solid state pressure sensor chips and signal multiplexing electronics integrally mounted to a four position pressure selector switch. One of the four positions of the pressure selector switch allows the in situ calibration of the 16 pressure sensors. The other three positions allow 48 channels (three sets of 16) pressure inputs to be measured by the sensors. The small size of the sensor module allows mounting within many wind tunnel models thus eliminating long tube lengths and their corresponding slow pressure response.
were the cyclic radiation energy received. A transducing system is inclined for converting the pressure variations of the resonant gas into electronic readout signals.

Official Gazette of the U.S. Patent Office

N78-13490* National Aeronautics and Space Administration
Ames Research Center, Moffett Field, Calif

LOW GRAVITY PHASE SEPARATOR Patent

Supersedes N75-32262 (13 - 23, p 2897) Sponsored by NASA


An apparatus is described for phase separating a gas-liquid mixture as might exist in a subcritical cryogenic helium vessel for cooling a superconducting magnet at low gravity such as in planetary orbit permitting conservation of the liquid and extended service life of the superconducting magnet.

Official Gazette of the U.S. Patent Office

N78-14364* National Aeronautics and Space Administration
Ames Research Center, Moffett Field, Calif

FLOW SEPARATION DETECTOR Patent
George C. Mateer and Aviel Brook, inventors (to NASA) (NAS-NRC) issued 6 Dec 1977 6 p. Filed 6 Aug 1976


An arrangement for sensing the fluid separation along a surface which employs a thermally insulating element having a continuous surface blending into and forming a part of the fluid flow surface is described. A sudden decrease in the temperature of the downstream sensor conductor and concomitant increase in the temperature of the upstream sensor conductor is an indication of the separation. When the temperatures are returned to the state achieved during normal flow, the indicator thereby indicates the normal attached fluid flow. The conductors may be, for example, wires or thin films, and should be within the viscous sub-layer of the expected fluid flow. A single heater and several pairs of sensors and corresponding sensor conductors may be used to detect not only the fluid flow and the separation but the direction of the fluid flow over the fluid flow surface.

Official Gazette of the U.S. Patent Office

N78-13400* National Aeronautics and Space Administration
Ames Research Center, Moffett Field, Calif

OPTICALLY SELECTIVE, ACOUSTICALLY RESONANT GAS DETECTING TRANSUCER Patent


A gas analyzer is disclosed which responds to the resonant absorption or emission spectrum of a specific gas by producing an acoustic resonance in a chamber containing a sample of that gas, and which measures the amount of that emission or absorption by measuring the strength of that acoustic resonance, e.g., the maximum periodic pressure, velocity or density achieved. In the preferred embodiment, a light beam is modulated periodically at the acoustical resonance frequency of a closed chamber which contains an optically dense sample of the gas of interest. Periodic heating of the absorbing gas by the light beam causes a cyclic expansion movement and pressure within the gas. An amplitude is reached where the increased losses...
A system for accurately determining the exposure density required for X-ray photography of a particular area of interest is provided. The light received from an X-ray image intensifier is applied to a beam splitting mirror which divides the light between a motion picture film camera and a television film camera. Between the beam splitter and the motion picture film camera, there is positioned another light beam splitter to direct some of the light at a mask having an opening which encloses only the image area of interest. Behind that opening there is positioned a photomultiplier intensity sensor for determining the exposure required and varying X-ray beam intensity accordingly.

---

A projection system for the display of parallax and perspective of a real image from a hologram is presented. A reference beam was projected in a sequence of several projections at selected angles of perspective through the hologram this sequence being rapidly performed. The resulting angular spaced images emitted from the hologram were directed onto a mirror which was coordinately tilted to reflect all of the resulting images to register onto a screen where they appeared as a single three-dimensional image.
35 INSTRUMENTATION AND PHOTOGRAPHY

N78-17395* National Aeronautics and Space Administration
Pasadena Office, Calif
PRESSURE TRANSDUCER Patent
Alan Rembaum inventor (to NASA) (JPL) Issued 8 Feb 1972
4 p Filed 18 Sep 1969 Sponsored by NASA
Patent Office CSCL 14B
A pressure transducer is described in which the sensing
element is a crystal of the monomeric charge transfer complex
of pyrene and tetracyanoethylene A H

N78-18390* National Aeronautics and Space Administration
Marshall Space Flight Center, Huntsville, Ala
SEMICONDUCTOR PROJECTILE IMPACT DETECTOR
Patent
Edward L Shriver, inventor (to NASA) Issued 25 Oct 1977
4 p Filed 11 Mar 1976 Supersedes N76-19405 (14 - 10.
p 1252)
14B
A semiconductor projectile impact detector is described for
use in determining micrometeorite presence as well as its flux
and energy comprising a photovoltaic cell which generates a
voltage according to the light and heat emitted by the mi-
crometeorites upon impact A counter and peak amplitude
measuring device were used to indicate the number of particules
which strike the surface of the cell as well as the kinetic energy
of each of the particles Official Gazette of the U S Patent Office

N78-18391* National Aeronautics and Space Administration
Hugh L Dryden Flight Research Center, Edwards, Calif
ATTACHING OF STRAIN GAGES TO SUBSTRATES Patent
Application
Meyer M Lemcoe (Battelle Columbus Labs, Ohio) and Harry E
Pattee, inventors (to NASA) (Battelle Columbus Labs, Ohio) Filed
16 Feb 1978 10 p
(Contract NAS4-2020)
NTIS HC A02/MF A01 CSCL 14B
A method and apparatus for attaching strain gages to
substrates was developed which is especially useful for field
installation, and especially for materials which experience a drastic
reduction in fatigue strength when heated as in spot welding
A strain gage having a backing plate is attached to a substrate by
using a foil of brazing material between the backing plate and
substrate A pair of electrodes that are connected to a current
source, are applied to opposites sides of backing plate so that
heating of the structure occurs primarily along the relatively
highly conductive foil of brazing material Field installations are
facilitated by utilizing a backing plate with wings extending at
an upward incline from either side of the backing plate, by
attaching the electrodes to the wings to perform the brazing
operation, and by breaking off the wings after the brazing
is completed NASA

An interferometer is described, having several means for
automatically adjusting the angular tilt of a reflecting surface in
one of two paths to maintain the exit beams from the two
paths parallel to each other Three detectors at the output of
the interferometer were disposed on mutually perpendicular axes
which define a plane normal to the nominal exit beam axis
One detector at the origin of the axes was used as a reference
for separate phase difference comparison with the outputs of
the other two detectors on the X and Y axes to develop servo
error signals Official Gazette of the U S Patent Office

N78-18393* National Aeronautics and Space Administration
Pasadena Office, Calif
INTERFEROMETER MIRROR TILT CORRECTING SYSTEM
Patent
Rudolf A Schmdler, inventor (to NASA) (JPL) Issued 11 Oct
p 0581) Sponsored by NASA
(NASA-Case-NPO-13687-1 US-Patent-4,053 231
14B
An interferometer is described, having several means for
automatically adjusting the angular tilt of a reflecting surface in
one of two paths to maintain the exit beams from the two
paths parallel to each other Three detectors at the output of
the interferometer were disposed on mutually perpendicular axes
which define a plane normal to the nominal exit beam axis
One detector at the origin of the axes was used as a reference
for separate phase difference comparison with the outputs of
the other two detectors on the X and Y axes to develop servo
error signals Official Gazette of the U S Patent Office

24
35 INSTRUMENTATION AND PHOTOGRAPHY

N78-18394*# National Aeronautics and Space Administration
Langley Research Center Langley Station Va
SOLAR CELL ANGULAR POSITION TRANSDUCER Patent Application
Maynard C Sandford and David L Gray, inventors (to NASA)
Filed 9 Feb 1978 18 p
NTIS HC A02/MF A01 CSCL 14B

A device that can accurately ascertain the angular position
of an object was developed. It has been used to determine the
position of control surfaces of a wind tunnel scaled model airplane.
The angular position transducer uses a light source directed toward
two photo cells. A control surface shaft is rotated from a zero
null position and one solar cell receives more illumination than
the other, producing a differential voltage between the two cells.
This voltage is directly proportional to the shaft rotational angle.
The voltage is amplified by a high gain surface angular position

N78-18396*# National Aeronautics and Space Administration
Pasadena Office, Calif
OVER-UNDER DOUBLE-PASS INTERFEROMETER Patent Application
Rudolf A Schmidt, inventor (to NASA) (JPL) Filed 8 Dec
1977 12 p
(Contract NAS7-100)
NTIS HC A02/MF A01 CSCL 14B

An over-under double pass interferometer in which the
beamsplitter area and thickness can be reduced to conform only
with optical flatness considerations was achieved by offsetting
the optical center line of one cat s-eye retroreflector relative to
the optical center line of the other in order that one split beam
be folded into a plane distinct from the other folded split beam.
The beamsplitter is made transparent in one area for a first
folded beam to be passed to a mirror for doubling back and is
made totally reflective in another area for the second folded
beam to be reflected to a mirror for doubling back. The two
beams thus doubled back are combined in the central beamsplit-
ting area of the beamsplitting and passed to a detector. This
makes the beamsplitter insensitive to minimum thickness
requirements and selection of material.

N78-18465*# National Aeronautics and Space Administration
Ames Research Center, Moffett Field Calif
APPARATUS FOR MEASURING A SORBATE DISPERSED
IN A FLUID STREAM Patent
Otis L Updike, inventor (to NASA) (Va Univ Charlottesville)
Issued 25 Oct 1977 10 p Filed 19 Sep 1975 Supersedes
N75-32389 (13 - 23 p 2914) Sponsored by NASA
Patent Office CSCL 14B

A sensitive, miniature apparatus was designed for measuring
low concentrations of a sorbate dispersed in a fluid stream. The
device consists of an elongated body having a surface capable
of sorbing an amount of the sorbate proportional to the
concentration in the fluid stream and propagating acoustic energy
along its length. The acoustic energy is converted to an electrical
output signal corresponding to the concentration of sorbate in
the fluid stream. The device can be designed to exhibit high
sensitivity to extremely small amounts of sorbate dispersed in
a fluid stream and to exhibit low sensitivity to large amounts
of sorbate. Another advantage is that the apparatus may be formed
in a microminiature size and at a low cost using bath microiabrica-
tion technology.

Official Gazette of the U S Patent Office
36 LASERS AND MASERS

Includes parametric amplifiers

A LASER APPARATUS Patent Application

A laser apparatus is reported that uses a pump laser device for producing pump laser energy upon being excited. The pump laser device has a resonating cavity for oscillating and amplifying the pump laser energy. A source laser device is energy upon being excited by the pump laser energy, the source laser device having a resonating cavity for oscillating and amplifying the source laser energy. The source laser's resonating cavity is coupled within a portion of the pump laser's resonating cavity. NASA

EXTERNAL BULB VARIABLE VOLUME MASER Patent Application

A maser functioning as a frequency standard that includes a variable volume constant surface area storage bulb is described. The variable volume portion of the bulb exterior to the resonant cavity, has a maximum volume on the same order of magnitude as the fixed volume bulb portion. The cavity has a length to radius ratio of at least 3 so that the operation is attained without the need for a feedback loop. A baffle plate, between the fired and variable volume bulb portions includes apertures for enabling hydrogen atoms to pass between the two bulb...
portions and is an electromagnetic shield that prevents coupling of the electromagnetic field of the cavity into the variable volume bulb portion. The maser is operated so that the zero wall shift frequency can be determined by being operated at first and second accurately controlled temperatures for identical small and large volumes. From the two temperatures and volumes, the zero wall shift frequency was determined as the intersection of two straight lines.

GAS ION LASER CONSTRUCTION FOR ELECTRICALLY ISOLATING THE PRESSURE GAUGE THEREOF

The valve and the pressure gauge of a gas ion laser were electrically insulated from the laser discharge path by connecting them in series with the cathode of the laser. The laser cathode can be grounded and preferably is a cold cathode although a hot cathode may be used instead. The cold cathode was provided with a central aperture to which was connected both the pressure gauge and the gas pressure reservoir through the valve. This will effectively prevent electric discharges from passing either to the pressure gauge or the valve which would otherwise destroy the pressure gauge. Official Gazette of the U.S. Patent Office.

N78-17367
National Aeronautics and Space Administration
Langley Research Center, Langley Station, Va
A VERSATILE LDV BURST SIMULATOR
Patent Application
Otto Youngbluth Jr., inventor (to NASA), Filed 16 Dec 1977
15 p

A device that generates burst signals which were suitable for determining whether or not a laser Doppler velocimeter was operating properly is described. Means are presented for independently varying the information and pedestal frequencies, for adding asymmetry to the generated burst pulses, and for selecting several different combinations of burst signals. NASA

INDEPENDENT GAIN AND BANDWIDTH CONTROL OF A TRAVELING WAVE MASER

An X-band traveling wave maser of the folded-comb type is presented, with two figure-eight coils for gain and bandwidth control. One figure-eight coil covers the full lengths of the comb structure for bandwidth adjustment of an external magnetic field. The other coil covers a central half of the comb structure for independent gain adjustment of the external magnetic field. The half of each figure-eight coil at the turn around end of the comb structure is oriented to aid the external magnetic field, and the half of each coil at the input-output end of the comb structure is oriented to buck the external magnetic field. The maser is pumped in the push-push mode with two different frequencies. Official Gazette of the U.S. Patent Office.
OIL COOLING SYSTEM FOR A GAS TURBINE ENGINE Patent

A gas turbine engine fuel delivery and control system is provided with means to recirculate all fuel in excess of fuel control requirements back to aircraft fuel tank, thereby increasing the fuel pump heat sink and decreasing the pump temperature rise without the addition of valving other than that normally employed. A fuel/oil heat exchanger and associated circuitry is provided to maintain the hot engine oil in heat exchange relationship with the cool engine fuel. Where anti-icing of the fuel filter is required, means are provided to maintain the fuel temperature entering the filter at or above a minimum level to prevent freezing thereof. Fluid circuitry is provided to route hot engine oil through a plurality of heat exchangers disposed within the system to provide for selective cooling of the oil.

METHOD AND TURBINE FOR EXTRACTING KINETIC ENERGY FROM A STREAM OF TWO-PHASE FLUID Patent Application

A turbine is described which comprises a plurality of nozzles for delivering streams of a two-phase fluid along linear paths and a phase separator for responsively separating the vapor and liquid phases. This phase separator is characterized by concentrically related annuli supported for rotation within the paths and having endless channels for confining the liquid under the influence of centrifugal forces. A vapor turbine fan extracts kinetic energy from the vapor and a liquid turbine blade extracts kinetic energy from the liquid. Thus the angular momentum of both the liquid phase and the vapor phase of the fluid is converted to torque.

IMPAKT ABSORBING BLADE MOUNTS FOR VARIABLE PITCH BLADES Patent

A variable pitch blade and blade mount are reported that are suitable for propellers, fans and the like and which have improved impact resistance. Composite fan blades and blade mounting arrangements permit the blades to pivot relative to a turbine hub about an axis generally parallel to the centerline of the engine upon impact of a large foreign object such as a bird. Centrifugal force recovery becomes the principal energy absorbing mechanism and a blade having improved impact strength is obtained.
The operation of the intake valve of hydrazine powered engines is described. The poppet valve uses a pneumatic spring which holds the poppet valve against the piston while the valve is opened and closed. To accomplish this, a poppet valve is slidably mounted in a pneumatic spring chamber which reaches a pressure approaching the gas supply pressure and during the opening of the valve the spring chamber retains enough pressure to hold the poppet valve onto the piston. In addition, the bottom of the poppet valve can have a suction cup type configuration to hold the poppet valve on the piston on the down stroke.

A machine is described for attaching solar cells to a flexible substrate having printed circuitry. The strip is fed through a station where solar cells come into contact with solder pads for the printed circuitry and are simultaneously heated by an infrared lamp. The strip then passes to various stations where flux and solder residue are removed, the electrical performance of the soldered cells is determined, an encapsulating resin is deposited on the cells, and the encapsulated solar cells are examined for electrical performance. At the final station, the resulting array is wound on a take-up drum.
A motion-restraining device for dissipating at a controlled rate the force of a moving body is discussed. The device is characterized by a drive shaft adapted to be driven in rotation by a moving body connected to a tape wound about a reel mounted on the drive shaft, and an elongated pitman link having one end pivotally connected to the crankshaft and the opposite end thereof connected with the mass through an energy-dissipating linkage. A shuttle is disposed within a slot and guided by rectilinear motion between a pair of spaced impact surfaces. Reaction forces applied at impact of the shuttle with the impact surfaces include oppositely projected force components angularly related to the direction of the applied impact forces.

---

A technique, method, and apparatus were designed for varying the bypass ratio and modulating the flow of a gas turbine engine in order to achieve improved mission performance. Embodiments include gas flow control system for management of core and bypass stream pressure comprising diverter valve means downstream of the core engine to selectively mix or separate the core and bypass exhaust streams. The flow control system may also include variable geometry means for maintaining the engine inlet airflow at a matched design level at all flight velocities. Earth preferred embodiment thus may be converted from a high specific thrust mixed flow cycle at supersonic velocities to a lower specific thrust separated flow turbofan system at subsonic velocities with a high degree of flow variability in each mode of operation.
the bearing carner rotates, the inclined mounting of the bearing causes the driving gear to perform a wabbling irrotational motion. This wabbling motion causes the contact point between the output gear and the driving gear to traverse around the circumference of the gears once per revolution of the bearing carner.

A R H

**APPARATUS FOR HANDLING MICRON SIZE RANGE PARTICULATE MATERIAL Patent**


An apparatus for handling transporting, or size classifying comminuted material was described in detail. Electrostatic acceleration techniques for classifying particles as to size in the particle range from 0.1 to about 100 microns diameter were employed. Official Gazette of the U S Patent Office

**SHOCK ISOLATOR FOR OPERATING A DIODE LASER AND CLOSED-CYCLE REFRIGERATOR Patent Application**


A diode laser mounted within a helium refrigerator is mounted using a braided copper ground strap which provides good impact shock isolation from the refrigerator cold-tip while also providing a good thermal link to the cold-tip. The diode mount also contains a rigid stand-off assembly consisting of alternate sections of nylon and copper which serve as cold stations to improve thermal isolation from the vacuum housing mounting structure. Included in the mount is a Pb-In alloy wafer inserted between the cold-tip and the diode to damp temperature fluctuations occurring at the cold-tip.

A device was provided through which the angular velocity of a heavy duty shaft was mechanically compared to that of a reference speed shaft, and detected error in the velocity of the heavy duty shaft was eliminated.
38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques and quality control.

N78-17396* National Aeronautics and Space Administration Pasadena Office, Calif

CROSS CORRELATION ANOMALY DETECTION SYSTEM Patent
Ernest Z Micka, inventor (to NASA) (JPL) Issued 23 Sep 1975

This invention provides a method for automatically inspecting the surface of an object, such as an integrated circuit chip, whereby the data obtained by the light reflected from the surface caused by a scanning light beam is automatically compared with data representing acceptable values for each unique surface. A signal output is provided indicative of acceptance or rejection of the chip. Acceptance is based on predetermined statistical confidence intervals calculated from known good regions of the object being tested or their representative values. The method can utilize a known good chip, a photographic mask from which the IC was fabricated, or a computer stored replica of each pattern being tested. Official Gazette of the U.S. Patent Office

A system for automatically inspecting an integrated circuit was developed. A device for shining a scanning narrow light beam at an integrated circuit to be inspected and another light beam at an accepted integrated circuit was included. A pair of photodetectors that receive light reflected from these integrated circuits and a comparing system compares the outputs of the photodetectors. Official Gazette of the U.S. Patent Office

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis, fatigue and thermal stress.


N78-10483* National Aeronautics and Space Administration Pasadena Office, Calif

MACHINE FOR USE IN MONITORING FATIGUE LIFE FOR A PLURALITY OF ELASTOMERIC SPECIMENS Patent
George E Fitzer, inventor (to NASA) (JPL) Issued 21 Jun 1977

An improved machine is described for use in determining the fatigue life for elastomeric specimens. The machine is characterized by a plurality of juxtaposed test stations, specimen support means located at each of the test stations for supporting a plurality of specimens of elastomeric material, and means for subjecting the specimens at each of said stations to sinusoidal strain at a strain rate unique with respect to the strain rate at other stations.
which the specimens at each of the other stations is subjected to sinusoidal strain.

Official Gazette of the U.S. Patent Office

The frequency of the peak and is a measure of the frequency shift.

Official Gazette of the U.S. Patent Office

A CW ultrasonic device is described for measuring frequency shifts of the peak of a mechanical resonance in a body. One application of the device is measuring the strain in a bolt and other applications include measuring the thickness of a body, measuring the depth of a flaw in a body, measuring the elongation of a body and measuring changes in velocity of sound in a body. The body is connected by means of a CW transducer to electrical circuit means including a narrow band RF amplifier to form a closed loop feedback marginal oscillator that frequency locks the device to the peak of a mechanical resonance in the body. When the frequency of this peak changes because of a physical change in the body the frequency of the oscillator changes. The device includes an automatic frequency resonant peak tracker that produces a voltage that is related to a change in frequency of the oscillator. This voltage is applied to the RF amplifier to change the center of its frequency band to include

N78-15512* National Aeronautics and Space Administration
Langley Research Center, Langley Station, Va
CW ULTRASONIC BOLT TENSIONING MONITOR Patent
Joseph S. Heyman, inventor (to NASA) Issued 13 Dec 1977
12 p Filed 23 Dec 1976 Supersedes N77-15236 (15 - 06 p 0735)
(NASA-Case-LAR-12016-1 US-Patent-4 062 227
US Patent Office CSCL 20K

An apparatus is disclosed for monitoring the development and growth of fatigue cracks in a test specimen subjected to a pulsating tensile load. A plurality of television cameras photograph a test specimen which is illuminated at the point of maximum tensile stress. The television cameras have a modified vidicon tube which has an increased persistence time thereby eliminating flicker in the displayed images.

N78-16387* National Aeronautics and Space Administration
Langley Research Center, Langley Station, Va
TV FATIGUE CRACK MONITORING SYSTEM Patent
Reginald J. Exton, inventor (to NASA) Issued 13 Dec 1977
5 p Filed 20 Jul 1976 Supersedes N76-28530 (14 - 19 p 2462)
(NASA-Case-LAR-11490-1 US-Patent-4 063 282
US Patent Office CSCL 20K
43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft photogrammetry, and aerial photography. For instrumentation see 35 Instrumentation and Photography.

N78-10629* National Aeronautics and Space Administration
Goddard Inst for Space Studies, New York
REMOTE SENSING OF VEGETATION AND SOIL USING MICROWAVE ELLIPSOMETRY Patent
Siegfried O. Auer (NAS-NRC) and John B. Schutt, inventors (to NASA) Issued 4 Oct 1977 7 p Filed 15 Apr 1976 Supersedes N76-23671 (14 - 14 p 1814)
(NASA-Case-GSC-11978-1 US-Patent-4 052,666
US Patent Office CSCL 08F

A method is described of determining vegetation height and water content of vegetation from the intensity and state of elliptical polarization of a reflected train of microwaves. The method comprises the steps of reflecting a circularly polarized train of microwaves from vegetation at a predetermined angle of incidence and detecting the reflected train of microwaves. The ratio of the intensities of the electric field vector components is determined, the phase difference of the components is measured, and the refractive index and thickness of the layer of vegetation are computed from a formula. The refractive index is given essentially by the water content of the vegetation.

Official Gazette of the U.S. Patent Office

N78-14452* National Aeronautics and Space Administration
Lewis Research Center, Cleveland, Ohio
PORTABLE LINEAR-FOCUSED SOLAR THERMAL ENERGY COLLECTING SYSTEM Patent
Charles G. Miller (JPL) and Jens G. Pohl, inventors (to NASA) Issued 4 Oct 1977 12 p Filed 28 Apr 1976 Supersedes N76-26690 (14 - 17 p 2218) Sponsored by NASA
(NASA-Case-NPO-13734-1 US-Patent-4,051,834
US-Patent-Class-166-248) Avail
US Patent Office CSCL 08F

A solar heat collection system is provided by utilizing a line-focusing device that is effectively a cylindrically curved concentrator within a protected environment formed by a transparent inflatable casing. A target, such as a fluid or gas carrying conduit is positioned within or near the casing containing the concentrator, at the line focus of the concentrator. The casing can be inflated at the site of use by a low pressure air supply to form a unitary light weight structure. A high energy laser beam is directed into the well and fractures the region of the shale formation. A compressed gas is forced into the well that supports combustion in the flame front ignited by the laser beam, thereby retorting the oil. Gaseous hydrocarbon products are recovered from one of the wells that were not exposed to the laser system.

Official Gazette of the U.S. Patent Office

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems e.g., fuel cells and batteries, global sources of energy, fossil fuels, geophysical conversion, hydroelectric power and wind power.

For related information see also 07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels and 85 Urban Technology and Transportation.

N78-10554* National Aeronautics and Space Administration
Pasadena Office, Calif
IN-SITU LASER RETORTING OF OIL SHALE Patent
Harvey S. Bloomfield, inventor (to NASA) Issued 6 Dec 1977 5 p Filed 28 Jan 1977 Supersedes N77-18429 (14 - 08, p 1176)
(NASA-Case-LEW-12217-1 US-Patent-4,061,190
US-Patent-Class-166-248) Avail
US Patent Office CSCL 08F

Oil shale formations are retorted in situ and gaseous hydrocarbon products are recovered by drilling two or more wells into an oil shale formation underneath the surface of the ground. A high energy laser beam is directed into the well and fractures the region of the shale formation. A compressed gas is forced into the well that supports combustion in the flame front ignited by the laser beam, thereby retorting the oil shale. Gaseous hydrocarbon products which permeate through the fractured region are recovered from one of the wells that were not exposed to the laser system.
A cyclic process for the solar photolysis of water was developed. The process includes a first stage in which water is reduced in the presence of a Eu(III) photo-oxidizable reagent producing hydrogen and spent oxidized Eu(III) reagent. The spent reagent is reduced by means of a transition metal liquid complex reductant RuL(III) in a photoexcited state such as a ruthenium pyridyl complex. Due to competing reactions between the photolysis and regeneration products, the photo-oxidation reaction must be separated from the regeneration in space and time by supporting the reagent and/or the reductant on solid supports and utilizing pH, wavelength, and flow control to maximize hydrogen and oxygen production.

A Schottky barrier solar cell was described, which consists of a layer of wide band gap semiconductor material on top of a layer of narrower band gap semiconductor material, to which one of the cell's contacts may be attached directly or through a substrate. The cell's other contact is a grid structure which is deposited on the thin metal film.

A solar energy conversion device is described, embodied in an improved solar concentrator characterized by elongated supporting members arranged in substantial horizontal parallelism with the axes thereof intersecting a common curve and a tensioned sheet of flexible reflective material disposed in engaging relation with the supporting members for imparting thereto a catenary configuration. The supporting members comprise tensioned wires about which a flexible sheet is drawn. The supporting members comprise rods inserted into tubular receptacles transversely related to a flexible sheet whereby the sheet is tensioned by the weight of the rods. The instant invention provides a simple, economic, and efficient solar energy concentrator particularly suited for use with systems provided for converting solar energy to heat in dwellings and similar structures.

A Schottky barrier solar cell was described, which consists of a layer of wide band gap semiconductor material on top of a layer of narrower band gap semiconductor material, to which one of the cell's contacts may be attached directly or through a substrate. The cell's other contact is a grid structure which is deposited on the thin metal film.
MULTI-CELL BATTERY PROTECTION SYSTEM Patent
Ralph D Thomas and William J Nagle, inventors (to NASA)
Issued 6 Dec 1977 5 p Filed 19 May 1976 Supersedes N76-23713 (14 - 14 p 1820)
A multi-cell battery protection system is described wherein each cell has its own individual protective circuit. The protective circuits consist of a solid state comparator unit and a high current switching device such as a relay. The comparator units each continuously monitor the associated cell and when the cell voltage either exceeds a predetermined high level or falls below a predetermined low level the relay is actuated whereby a bypass circuit is completed across the cell thereby effectively removing the cell from the series of cells.

SOLAR HEATING SYSTEM Patent
A system is disclosed for using solar energy to heat the interior of a structure. The system utilizes a low cost solar collector to heat a recirculating air mass which then flows through a series of interconnected ducts and passageways without the use of exterior fans or blowers. Heat is transferred from the air mass to the structure's interior and the air mass is then reheated.
A method of construction of photovoltaic devices, particularly of multi-cell photovoltaic devices used to form solar cell arrays, was delineated. The first step is to effect in a top surface region of substrate a semiconductive layer by the diffusion of an impurity into the top surface region. Next, by photolithography and etching, the base region is divided into a plurality of base regions and as separated upper active surface regions are created in the top surface region of the base regions by diffusion of the opposite polarity type to that employed in the creation of base regions. Metal contacts are then formed which interconnect between the upper active region of one cell and the lower base region of the adjoining cell in this manner, the cells are connected in series to make their voltages additive.

The energy absorbing properties of solar heating panels are improved by depositing a black chrome coating of controlled thickness on a specially prepared surface of a metal substrate. The surface is prepared by depositing a dull nickel on the substrate, and the black chrome is plated on this low emittance surface to a thickness between 0.5 micron and 2.5 microns.

Carrier lifetimes and bulk diffusion length are qualitatively measured as a means for qualification of a P-N junction photovoltaic solar cell by alternately applying high frequency (blue) monochromatic light pulses and low frequency (red) monochromatic light pulses to the cell while it is irradiated by light from a solar simulator, and synchronously displaying the derivative of the output voltage of the cell on an oscilloscope. This output voltage is a measure of the lifetimes of the minority carriers (holes) in the diffused N layer and majority carriers (electrons).
46 GEOPHYSICS

Includes aeronomy, upper and lower atmosphere studies, ionospheric and magnetospheric physics and geomagnetism.

For space radiation see 93 Space Radiation.

52 AEROSPACE MEDICINE

Includes physiological factors, biological effects of radiation and weightlessness.

N78-10688* National Aeronautics and Space Administration
Ames Research Center Moffett Field Calif.
MECHANICAL ENERGY STORAGE DEVICE FOR HIP DISARTICULATION Patent
Wilbur C. Vallotton, inventor (to NASA) Issued 4 Oct 1977 7 p Filed 30 Jun 1976 Supersedes N76-26871 (14 - 17 p 2241)

An artificial leg including a trunk socket a thigh section hingedly coupled to the trunk socket a leg section hingedly coupled to the thigh section and a foot section hingedly coupled to the leg section is outlined. A mechanical energy storage device is operatively associated with the artificial leg for storage and release of energy during the normal walking stride of the user. Energy is stored in the mechanical energy storage device during a weight-bearing phase of the walking stride when the user's weight is on the artificial leg. Energy is released during a phase of the normal walking stride when the user's weight is removed from the artificial leg. The stored energy is released from the energy storage device to pivot the thigh section forwardly about.
A surgical tissue macerating and removal tool is described which has a rotating rod with a cutting member at one end and which is disposed in a tube which is then contained in an extension of the tool handle. A frusto-conical member extends into the extension at the cutter member end of the rotating rod with its small end engaging the tube. The portion of the frusto-conical member outside of the extension forms a tissue engaging member and may be cut off at an angle to the axis of the rod to form a tissue engaging edge. Apertures are provided in the extension adjacent the frusto-conical member so that treatment fluid supplied in the annular space between the tube and the extension may flow to the operative site. An aperture is provided in the frusto-conical member between the extension and the tube so that fluid may also flow into the tube where it mixes with macerated tissue being directed through an aperture in the tube to a passageway which may have suction applied to help remove macerated material.

The agent contains indomethacin and an H1 or an H2 histamine receptor antagonist in an amount sufficient to reduce gastric distress caused by indomethacin. Usable antagonists include pyrilamine, promethazine, metiamide, and cimetidine.
MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering biotechnology and space suits and protective clothing

IODINE GENERATOR FOR RECLAIMED WATER PURIFICATION Patent

The system disclosed is for controlling the iodine level in a water supply in a spacecraft. It includes an iodine accumulator which stores crystalline iodine in an electrochemical valve to control the input of iodine to the drinking water and an iodine dispenser. A pump dispenses fluid through the iodine dispenser and an iodine sensor to a potable water tankstorage. The iodine sensor electronically detects the iodine level in the water and through electronic means produces a correction current control. The correction current control operates the electro-chemical iodine valve to release iodine from the iodine accumulator into the iodine dispenser. Official Gazette of the US Patent Office

WALKING BOOT ASSEMBLY Patent

A walking boot assembly particularly suited for use with a positively pressurized spacesuit is presented. A bootie adapted to be secured to the foot of a wearer, an hermetically sealed boot for receiving the bootie having a walking sole and an upper portion adapted to be attached to an ankle joint of a spacesuit are also described. Official Gazette of the US Patent Office

WRIST JOINT ASSEMBLY Patent

A wrist joint assembly is provided for use with a mechanical manipulator arm for finely positioning an end-effector carried by the wrist joint on the terminal end of the manipulator arm. The wrist joint assembly is pivotable about a first axis to produce a yaw motion a second axis is to produce a pitch motion, and a third axis to produce a roll motion. The wrist joint assembly includes a disk segment affixed to the terminal end of the manipulator arm and a first housing member and a second housing member and a third housing member. The third housing member and the mechanical end-effector are moved in the yaw, pitch, and roll motion. Drive means are provided for rotating each of the housings about their respective axis which includes a cluster of miniature motors having spur gears carried on the output drive shaft which mesh with a center drive gear affixed on the housing to be rotated. Official Gazette of the US Patent Office

N78-17675 National Aeronautics and Space Administration
Ames Research Center, Moffett Field, Calif

N78-17676 National Aeronautics and Space Administration
Marshall Space Flight Center, Huntsville, Ala

40
N78-17677* National Aeronautics and Space Administration
Lyndon B Johnson Space Center, Houston, Tex
RESTRAINING MECHANISM Patent
John C Hardy inventor (to NASA) (United Aircraft Corp East Hartford Conn) Issued 20 Jan 1970 3 p Filed 6 Oct 1966
Sponsored by NASA
A restraining mechanism restraining a pressurized garment so as to limit its ballooning effect is described. A helically wound spring is bonded at its outer periphery to an elongated flat plate which permits the plate to bend in a single direction. The flat plate is attached to an inflatable glove to the palm side for restraining the glove from ballooning when inflated.

N78-17678* National Aeronautics and Space Administration
Lyndon B Johnson Space Center, Houston, Tex
HELMET LATCHING AND ATTACHING RING Patent
Edward W Chase (United Aircraft Corp, East Hartford, Conn) and Seppo J Vikinsalo, inventors (to NASA) (United Aircraft Corp, East Hartford, Conn) Issued 13 Jan 1970 5 p Filed 17 Mar 1966
Sponsored by NASA
A neck ring releasably secured to a pressurized garment carries an open-ended ring normally in the engagement position fitted into an annular groove and adapted to fit into a complementary annular groove formed in a helmet. Camming means formed on the inner surface at the end of the helmet engages the open-ended ring to retract the same and allow for one motion donning even when the garment is pressurized. A projection on the end of the split ring is engageable to physically retract the split ring. Official Gazette of the U.S. Patent Office

N78-17679* National Aeronautics and Space Administration
Lyndon B Johnson Space Center, Houston, Tex
PROTECTIVE GARMENT VENTILATION SYSTEM Patent
Ronald Lang, inventor (to NASA) (United Aircraft Corp East Hartford, Conn) Issued 6 Jan 1970 8 p Filed 6 Oct 1966
Sponsored by NASA
A method and apparatus for ventilating a protective garment space suit system and/or pressure suits to maintain a comfortable and nontoxic atmosphere within is described. The direction of flow of a ventilating and purging gas in portions of the garment may be reversed in order to compensate for changes in environment and activity of the wearer. The entire flow of the ventilating gas can also be directed first to the helmet associated with the garment.

N78-17680* National Aeronautics and Space Administration
Lyndon B Johnson Space Center, Houston, Tex
HELMET FEEDPORT Patent
Ewald Kothe, inventor (to NASA) (United Aircraft Corp East Hartford Conn) Issued 26 Dec 1967 3 p Filed 30 Mar 1966
Sponsored by NASA
A helmet design is described which encapsulates the head of the wearer and is capable of being pressurized and provides a means for gaining internal access for the purpose of eating. A mechanically actuated valve that combines the purging of carbon dioxide and feeding operations by a simple movement of a mechanical lever obviates problems that are attendant in the type of feed and purge ports previously incorporated in pressurized helmets.

BLP
A frusto-conically shaped distensible component is described which inflates to encircle a portion of the wearer's head and carries a collapsible member which automatically extends over the remaining portion of the head. A pulley arrangement secured between the walls of the distensible component automatically extends and retracts the collapsible member. When deflated the unit is carried on the back of the wearer so as to provide an automatic emergency space suit helmet.

Official Gazette of the U.S. Patent Office

A spacesuit is presented having a waist joint, shoulder joints, elbow joints, hip joints, and ankle joints. Each of the joints includes at least one pair of annuli supported for pivotal displacement about paralleling axes and a flexible, substantially impermeable diaphragm of a tubular configuration spanning the distance between the annuli and connected thereto in a hermetically sealed relationship. The diaphragm includes at least one rolling convolution having a crown disposed in a fixed relation with an axis about which one of the annuli pivots. The knee joint is constructed slightly different from the other joints. A curved tubular shell is disposed between two circular bellows. Cables are secured to the rings, shell, and bellows. The cables limit the motion of the bellows when the suit is pressurized.

A drop foot corrective device to alleviate a plurality of difficulties encountered in walking by a victim suffering from a drop foot condition is presented. The invention consists essentially of an apparatus including a legband positionable to girdle the afflicted leg of the victim above the calf and below the knee, retaining and supporting the joint with a flexible ligament affixed to and extending from a toe of the foot or the toe of a shoe worn on the foot to the legband where it is anchored. The novel feature of the device appears to lie in its unique structure which alleviates the problem of drop foot by providing the support needed and the flexibility required and furthermore is inexpensive.
A lightweight structure adapted for gripping objects of a variety of sizes and shapes with uniform tightness was designed for a mechanical manipulator arm of a space vehicle or other remote manipulator. The end effector device includes a pair of movable jaws in opposed relation for gripping an object. Each jaw has laterally spaced gripping fingers in the form of flat plates. Each finger has a gripping face in which a notch is formed. The gripping fingers of one of the jaws are carried alternately offset with respect to the fingers of the opposed jaw to permit the fingers to intermesh and provide a variably closed channel for gripping objects of various sizes and shapes. The jaws are connected to an adapter mechanism by couplings which include a pair of spaced pivots on which a pair of linkage bars are mounted. Each jaw is connected to its coupling through a flexible cartilage which prevents shearing of connecting rods and pins and provides for more effective gripping action. The adapter mechanism is in turn connected to a mechanical wrist joint of a manipulator arm.
71 ACOUSTICS

Includes sound generation, transmission and attenuation.

For noise pollution see 45 Environment Pollution.

N78-10837* National Aeronautics and Space Administration
Pasadena Office Calif

ACOUSTIC ENERGY SHAPING Patent

A suspended mass is shaped by melting all or a selected portion of the mass and applying acoustic energy in varying amounts to different portions of the mass. In one technique for forming an optical waveguide slug a mass of oval section is suspended and only a portion along the middle of the cross-section is heated to a largely fluid consistency. Acoustic energy is applied to opposite edges of the oval mass to press the unheated opposite edge portions together so as to form bulges at the middle of the mass. In another technique for forming a ribbon of silicon for constructing solar cells a cylindrical thread of silicon is drawn from a molten mass of silicon and acoustic energy is applied to opposite sides of the molten thread to flatten it into a ribbon.

Official Gazette of the U S Patent Office

OFFICIAL GAZETTE OF THE UNITED STATES PATENT OFFICE

N78-14867* National Aeronautics and Space Administration
Langley Research Center Langley Station Va

DIFFERENTIAL SOUND LEVEL METER Patent

Small differences between relatively high sound pressure levels at two different microphone sites are measured by a device which provides electrical insertion voltages (pilot voltages) as a means for continuously monitoring the gains of two acoustical channels. The difference between two pilot voltages is utilized to force the gain of one channel to track the other channel.

Official Gazette of the U S Patent Office

N78-17821* National Aeronautics and Space Administration
Langley Research Center Langley Station Va

PSEUDO CONTINUOUS WAVE ACOUSTIC INSTRUMENT Patent Application

A device for measuring acoustic properties and their changes in a sample of liquid, gas, plasma or solid is described. A variable frequency source is applied to the sample by means of a transducer to produce sound waves within the sample. The application of the variable frequency source to the sample is periodically interrupted for a short duration. Means are connected to the transducer for receiving the resulting acoustic signals during the interruptions for producing a control signal indicative of a difference in the frequency of the output of the variable frequency source and the frequency of a mechanical resonant peak in the sample.
The control signal is applied to the variable frequency source to maintain its output frequency at the frequency of the mechanical resonant peak. The change in frequency of the variable frequency source is indicative of the shift in frequency of the mechanical resonant peak and the amplitude of the acoustic signals is indicative of the attenuation of the acoustic signals in the sample.

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra

N78-19907 National Aeronautics and Space Administration
Lewis Research Center Cleveland, Ohio

ATOMIC HYDROGEN STORAGE METHOD AND APPARATUS Patent Application
John A Woolam, inventor to (NASA) Filed 29 Sep 1977

Atomic hydrogen for use as a fuel or as an explosive, is stored in the presence of a strong magnetic field in exfoliated layered compounds such as molybdenum disulfide or an elemental layer material such as graphite. The compound is maintained at liquid helium temperatures and the atomic hydrogen is collected on the surfaces of the layered compound which are exposed during delamination (exfoliation). The strong magnetic field and the low temperature combine to prevent the atoms of hydrogen from recombining to form molecules.

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles, and reactor theory

For space radiation see 93 Space Radiation

N78-19920 National Aeronautics and Space Administration
Washington D.C.

NON-EQUILIBRIUM RADIATION NUCLEAR REACTOR Patent
Kartheinz Thom and Richard T Schneider, inventors (to NASA)
(Fla Univ, Gainesville) Issued 21 Feb 1978 8p Filed 21 Mar 1975 Supersedes N75-22108 (13-13p 1574)
(NASA-Case-HQN-10841-1-US-Patent-4075 057

An externally moderated thermal nuclear reactor is disclosed which is designed to provide output power in the form of electromagnetic radiation. The reactor is a gaseous fueled nuclear cavity reactor device which can operate over wide ranges of temperature and pressure and which includes the capability of processing and recycling waste products such as long-lived
transuranium actinides. The primary output of the device may be in the form of coherent radiation, so that the reactor may be utilized as a self-critical nuclear pumped laser.

FIBER OPTIC MULTIPLE OPTICAL TRANSMISSION SYSTEM Patent
Charles H Bell inventor (to NASA) Issued 6 Dec 1977 8 p Filed 18 Aug 1976 Supersedes N77-15826 (15 - 06 p 0813)

A multiple optical transmission system which minimizes external interference while simultaneously receiving and transmitting video digital data, and audio signals is described. Signals are received into subgroup mixers for blocking into respective frequency ranges. The outputs of these mixers are in turn fed to a master mixer which produces a composite electrical signal. An optical transmitter connected to the master mixer converts the composite signal into an optical signal and transmits it over a fiber optic cable to an optical receiver which receives the signal and converts it back to a composite electrical signal. A de-multiplexer is coupled to the output of the receiver for separating the composite signal back into composite video, digital data and audio signals. A programmable optic patch board is interposed in the fiber optic cables for selectively connecting the optical signals to various receivers and transmitters.

TRANSMITTING AND REFLECTING DIFFUSER Patent

An ultraviolet grade fused silica substrate is coated with vaporized fused silica. The coating thickness is controlled one thickness causing ultraviolet light to diffuse and another thickness causing ultraviolet light to reflect a near Lambertian pattern.

DIFFUSER
A device was disclosed for measuring the distance from a reference plane to a flat or cylindrical surface. The device contains a rotatable measuring scale which is sighted with an optical instrument to make the measurement. Readings are taken at various points along the surface to establish an elevation curve which is used to align the surface with the reference plane.
then moves on to the next selected point and repeats this transmit
and receive operation. It fills the need for a system that permits
a laser velocimeter to rapidly scan across a constantly changing
flow field in an aerodynamic test facility.

**N78-17867** National Aeronautics and Space Administration
Pasadena Office Calif

DIFFERENTIAL OPTOACOUSTIC ABSORPTION DETECTOR

Patent

Michael S. Shumate, inventor (to NASA) (JPL). Issued 10 Jan
1978. 8 p. Filed 27 Aug. 1976. Supersedes N77-11363 (15 -
02 p. 0194). Sponsored by NASA

(NASA-Case-NPO-13759-1, US-Patent-4,067,653,
Patent Office CSCL 20F

A differential optoacoustic absorption detector employed two
tapered cells in tandem or in parallel. When operated in tandem
two mirrors were used at one end remote from the source of
the beam of light directed into one cell back through the other,
and a lens to focus the light beam into the one cell at a principal
focus half way between the reflecting mirror. Each cell was
tapered to conform to the shape of the beam so that the
volume of one was the same as for the other, and the volume
of each received maximum illumination. The axes of the cells
were placed as close to each other as possible in order to
connect a differential pressure detector to the cells with connecting
passages of minimum length. An alternative arrangement
employed a beam splitter and two lenses to operate the cells in
parallel.

**N78-18905** National Aeronautics and Space Administration
Goddard Space Flight Center, Greenbelt, Md

MAGNIFYING IMAGE INTENSIFIER Patent

James Vine, inventor (to NASA) (Westinghouse Electric Corp.,

(NASA-Case-GSC-12010-1, US-Patent-4,070,574,
Patent Office CSCL 20F

A magnetically focused image intensifier was improved to
increase the usable range of magnification without degradation
of image quality. The power requirements of the focusing coils
are minimal. The arrangement of the focusing coils reverses the
direction of the axial magnetic field distribution between the
planes of the photocathode and the phosphor screen.

**N78-13917** National Aeronautics and Space Administration
Pasadena Office Calif

HIGH RESOLUTION THRESHOLD PHOTOELECTRON
SPECTROSCOPY BY ELECTRON ATTACHMENT Patent

Application

Ara Chuhtyan (JPL) and Joseph M. Ajello, inventors (to NASA)
(JPL). Filed 30 Nov. 1977. 13 p. (Contract NAS7-100)

NTIS HC A02/MF A01 CSCL 20L

The stable energy levels of a species ion of an atomic
molecular or radical type are determined by application of a
predetermined level of ionizing energy such as through photoioni-
zation. A trapping gas is added to the gaseous species to provide
a technique for detection of the energy levels. The electrons
emitted from ionized species are captured by the trapping gas,
only if the electrons have substantially zero kinetic energy. If
the electrons have nearly zero energy, they are absorbed by the
trapping gas to produce negative ions of the trapping gas that
can be detected by a mass spectrometer. The light frequencies
at which large quantities of trapping gas ions are detected are the stable energy levels of the positive ion of the species SF6 and CFC13 have the narrowest acceptance bands so that when they are used as the trapping gas, they bind electrons (to form negative ions) only when the electrons have very close to zero kinetic energy

N78-15954* \( ^{+} \) National Aeronautics and Space Administration Lyndon B Johnson Space Center, Houston Tex


A process is described for simultaneously removing sulfur dioxide from stack gases and purifying waste water derived from domestic sewage a portion of the gas stream and a portion of the waste water the latter containing dissolved iron and having an acidic pH are contacted in a closed loop gas-liquid scrubbing zone to effect absorption of the sulfur dioxide into the waste water. A second portion of both the gas stream and the waste water containing less iron are controlled in an open loop gas-liquid scrubbing zone. Contract in the open loop scrubbing zone is sufficient to acidify the waste water which is then treated to remove solids originally present
This bibliography is issued in two sections: Section 1 - Abstracts, and Section 2 - Indexes. This issue of the Abstract Section cites 161 patents and applications for patent introduced into the NASA scientific and technical information system during the period of January 1978 through June 1978. Each entry of the Abstract Section consists of a citation, an abstract, and in most cases, a key illustration selected from the patent or application for patent. This issue of the Index Section contains entries for 3386 patent and application for patent citations covering the period May 1969 through June 1978. The Index Section contains five indexes --- subject, inventor, source, number, and accession number.
PUBLIC COLLECTIONS OF NASA DOCUMENTS

DOMESTIC

NASA distributes its technical documents and bibliographic tools to ten special libraries located in the organizations listed below. Each library is prepared to furnish the public such services as reference assistance, interlibrary loans, photocopy service, and assistance in obtaining copies of NASA documents for retention.

**CALIFORNIA**
University of California, Berkeley

**COLORADO**
University of Colorado, Boulder

**DISTRICT OF COLUMBIA**
Library of Congress

**GEORGIA**
Georgia Institute of Technology, Atlanta

**ILLINOIS**
The John Crerar Library, Chicago

**MASSACHUSETTS**
Massachusetts Institute of Technology, Cambridge

**MISSOURI**
Linda Hall Library, Kansas City

**NEW YORK**
Columbia University, New York

**PENNSYLVANIA**
Carnegie Library of Pittsburgh

**WASHINGTON**
University of Washington, Seattle

NASA publications (those indicated by an "*" following the accession number) are also received by the following public and free libraries:

**CALIFORNIA**
Los Angeles Public Library
San Diego Public Library

**COLORADO**
Denver Public Library

**CONNECTICUT**
Hartford Public Library

**MARYLAND**
Enoch Pratt Free Library, Baltimore

**MASSACHUSETTS**
Boston Public Library

**MICHIGAN**
Detroit Public Library

**MINNESOTA**
Minneapolis Public Library

**MISSOURI**
Kansas City Public Library
St. Louis Public Library

**NEW JERSEY**
Trenton Public Library

**NEW YORK**
Brooklyn Public Library
Buffalo and Erie County Public Library
Rochester Public Library
New York Public Library

**OHIO**
Akron Public Library
Cincinnati Public Library
Cleveland Public Library
Dayton Public Library
Toledo Public Library

**OKLAHOMA**
Oklahoma County Libraries, Oklahoma City

**TENNESSEE**
Memphis Public Library

**TEXAS**
Dallas Public Library
Fort Worth Public Library

**WASHINGTON**
Seattle Public Library

**WISCONSIN**
Milwaukee Public Library

An extensive collection of NASA and NASA-sponsored documents and aerospace publications available to the public for reference purposes is maintained by the American Institute of Aeronautics and Astronautics, Technical Information Service, 750 Third Avenue, New York, New York, 10017

EUROPEAN

An extensive collection of NASA and NASA-sponsored publications is maintained by the British Library Lending Division, Boston Spa, Wetherby, Yorkshire, England. By virtue of arrangements other than with NASA, the British Library Lending Division also has available many of the non-NASA publications cited in STAR. European requesters may purchase facsimile copy or microfiche of NASA and NASA-sponsored documents, those identified by both the symbols "#" and "*", from ESRO/ELDO Space Documentation Service, European Space Research Organization, 114, av Charles de Gaulle, 92-Neuilly-sur-Seine, France.
# NASA Continuing Bibliography Series

<table>
<thead>
<tr>
<th>Number</th>
<th>Title</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>NASA SP-7011</td>
<td>Aerospace Medicine and Biology</td>
<td>Monthly</td>
</tr>
<tr>
<td></td>
<td>Aviation medicine, space medicine, and space biology</td>
<td></td>
</tr>
<tr>
<td>NASA SP-7037</td>
<td>Aeronautical Engineering</td>
<td>Monthly</td>
</tr>
<tr>
<td></td>
<td>Engineering, design, and operation of aircraft and aircraft components</td>
<td></td>
</tr>
<tr>
<td>NASA SP-7039</td>
<td>NASA Patent Abstracts Bibliography</td>
<td>Semiannually</td>
</tr>
<tr>
<td></td>
<td>NASA patents and applications for patent</td>
<td></td>
</tr>
<tr>
<td>NASA SP-7041</td>
<td>Earth Resources</td>
<td>Quarterly</td>
</tr>
<tr>
<td></td>
<td>Remote sensing of earth resources by aircraft and spacecraft</td>
<td></td>
</tr>
<tr>
<td>NASA SP-7043</td>
<td>Energy</td>
<td>Quarterly</td>
</tr>
<tr>
<td></td>
<td>Energy sources, solar energy, energy conversion, transport, and storage</td>
<td></td>
</tr>
<tr>
<td>NASA SP-7500</td>
<td>Management</td>
<td>Annually</td>
</tr>
<tr>
<td></td>
<td>Program, contract, and personnel management, and management techniques</td>
<td></td>
</tr>
</tbody>
</table>

Details on the availability of these publications may be obtained from:

Scientific and Technical Information Office

National Aeronautics and Space Administration

Washington, D.C. 20546