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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
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.
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 US-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.
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Chapter V—National Aeronautics and Space Administration

PART 1245—PATENTS

Subpart 2—Patent Licensing

§ 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 license(s) in accordance with this subpart.

(b) "Practice an invention" means to make or have made, use or have used, sell or have sold, or otherwise dispose of according to law any machine, article of manufacture or composition of matter physically embodying the invention, or 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-term 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 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 is complicated and may require licenses in other fields. NASA has special authority and responsibility under the National Aeronautics and Space Act of 1958, as amended (42 U.S.C. 2457), 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 a license will provide the 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 capital investment, the impact on competitors, and the benefits of the license to the Government and the public. Preference for exclusive licenses will 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, without 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 Licenses 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 on terms and conditions, and with the provisions, of any existing exclusive license.

(2) The duration of the license shall be for a period as specified in the license.

(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 inventions covered by the United States and foreign patents, as well as for all or any lesser geographic portion thereof.

(5) The license shall extend to the subsidiaries and affiliates of the licensee and shall be nonassignable 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-term nonexclusive licenses. A nonexclusive, revocable license for a special invention, as defined in § 1245.201, 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 in the 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, and (c) a nonexclusive license requested by any applicant pursuant to these regulations, and (c) the exclusive license will provide the necessary incentive to the licensee to achieve practical application of the invention, and

(ii) Either a notice pursuant to
§ 1245.205 listing the invention as available for licensing has been published in the Federal Register for at least 9 months, or a patent covering the invention has been issued for at least 6 months, or a patent covering the invention may be granted prior to the periods specified above if the Administrator determines that the public interest will best be served thereby or by the earlier grant of an exclusive license.

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

(3) The exclusive period of the license shall be negotiated, but shall be for less than the terminal portion of the patent, and shall be related to the period necessary to provide a reasonable incentive to invest the necessary risk capital.

(4) The license shall require the licensor to practice the invention within a period specified in the license and then to cease all practical application of the invention.

(5) The license shall require the licensor to expend a specified minimum sum of money and/or to take other specified actions, during indicated periods following the effective date of the license, in an effort to achieve practical application of the invention.

(6) The license shall be subject to at least an irrevocable royalty-free right of the Government of the United States to practice and have practiced the invention throughout the world by or on behalf of the Government of the United States and on behalf of any foreign government pursuant to any existing or future treaty or agreement with the United States.

(7) The license may be reserved to the Administrator, NASA, under the following circumstances, the right to require the granting of a sublicense to responsible applicant(s) on terms that are consistent with the policies and guidelines set forth by the Administrator, taking into consideration the current royalty rates under similar patents and other factors (i) To the extent the invention is required for public use by Government regulation, or (ii) as may be necessary to fulfill health or safety obligations, or (iii) for other purposes stipulated in the license.

(8) The license may be nontransferable except to the successor of that part of the licensor's business to which the invention pertains.

(9) Subject to the approval of the Administrator, the licensor may grant a limited exclusive sublicense for the practice of such invention, together with the right to grant sublicenses of the same scope to the extent the contractor was legally obligated to do so at the time the contract was awarded. Such licensee and right shall nontransferable except to the successor of that part of the contractor's business to which the invention pertains.

(b) Miscellaneous licenses. Subject to the provisions of this part 2, the Administrator may grant licenses for inventions, when he determines that doing so would provide for an equitable distribution of rights. The following examples of circumstances wherein such licenses may be granted:

(1) In consideration of the settlement of an interference;

(2) In consideration of a release of a claim of infringement;

(3) In exchange for or as part of the consideration for a license under adversely held patent(s).

§ 1245.206 Application for nonexclusive license.

(a) Submission of application. An application for nonexclusive license under § 1245.203(b) or a short-form nonexclusive license for special inventions under § 1245.203(c) shall be addressed to the NASA Patent Counsel of the NASA in installations having cognizance over the NASA invention for which a license is desired or to the NASA Assistant General Counsel for Patent Matters.

(b) Contents of an application for nonexclusive license. An application for nonexclusive license shall include:

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

(i) Small business firm;

(ii) Minority business enterprise;

(iii) Location in a surplus labor area;

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

(v) 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.

(5) Any other facts which the applicant believes to show it to be in the interest 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 license.
(a) Initial review. Applications for nonexclusive and exclusive licenses under §§ 1245 206 and 1245 207 will be reviewed by the Patent Counsel of the Board. The Board may request the Invention and Contributions Board, the NASA Assistant General Counsel for Patent Matters, to determine conformity and appropriateness of the application for license and the availability of the specific invention for the license requested. The Assistant General Counsel for Patent Matters will forward all applications for license conforming to §§ 1245 206(b) and 1245 207(b) to the NASA Inventions and Contributions Board when the invention is available for consideration of the requested license. Prior to forwarding applications for exclusive licenses to the Inventions and Contributions Board, notice in writing will be given to each nonexclusive licensee for the specific invention involved of the application for the exclusive license and providing each nonexclusive licensee with a 30-day period for submitting either evidence that practical application of the invention has occurred or is about to occur, or an application for an exclusive license for the invention.
(b) Recommendations of Inventions and Contributions Board. The Inventions and Contributions Board shall, in accordance with the basic considerations set forth in §§ 1245.202 and 1245 203, evaluate all applications for license forwarded by the Assistant General Counsel for Patent Matters and, based upon the facts presented to the Inventions and Contributions Board in the application and any other facts in its possession, the Inventions and Contributions Board shall recommend to the Administrator—(1) Whether a nonexclusive or exclusive license should be granted, (2) the identity of the licensee, and (3) any special terms or conditions of the license.
(c) Determination of Administrator and grant of nonexclusive licenses. The Administrator shall review the recommendations of the Inventions and Contributions Board and shall determine whether to grant the nonexclusive license recommended by the Board. If the Administrator determines to grant the nonexclusive license, the license will be granted upon the negotiation of the appropriate terms and conditions by the Office of General Counsel.
§ 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 may include a payment of royalties, fees or other consideration when the licensing circumstances and the basic considerations in § 1245 202, considered together, indicate that it is in the public interest to do so.
§ 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 commercial use that is being made of the invention. If the Administrator makes the decision of a U.S. court the licensee at any time shall breach any covenant or agreement therein, and shall fail to remedy any such breach within 30 days after written notice, or if the patent is deemed unenforceable by the Administrator 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 best interest of the United States. A license may be revoked either in part or in its entirety, by the Administrator if in his opinion such revocation is necessary to achieve the best interest of the United States.
(c) Before revoking any license granted pursuant to this Subpart 2, an appeal must be allowed 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 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 to offer evidence in support of his appeal. The procedures to be followed in such appeal shall be determined by the Administrator. The Board 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 necessary 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 court by the licensed patent. The licensee may join the Government, upon consent of the Attorney General, as a party complainant in such suit. The suit may be brought on behalf of 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 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 C.F.R. 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

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<td>03 AIR TRANSPORTATION AND SAFETY</td>
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<tr>
<td>04 AIRCRAFT COMMUNICATIONS AND NAVIGATION</td>
<td>1</td>
</tr>
<tr>
<td>Includes digital and voice communication with aircraft, air navigation systems (satellite and ground based), and air traffic control</td>
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</tr>
<tr>
<td>For related information see also 17 Spacecraft Communications, Command and Tracking and 32 Communications</td>
<td></td>
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</tbody>
</table>

| 05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE | 2 |
| Includes aircraft simulation technology |
| For related information see also 18 Spacecraft Design, Testing and Performance and 39 Structural Mechanics |

| 06 AIRCRAFT INSTRUMENTATION | N.A. |
| Includes cockpit and cabin display devices, and flight instruments |
| For related information see also 19 Spacecraft Instrumentation and 35 Instrumentation and Photography |

| 07 AIRCRAFT PROPULSION AND POWER | 2 |
| Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors, and on-board auxiliary power plants for aircraft |
| For related information see also 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels, and 44 Energy Production and Conversion |

| 08 AIRCRAFT STABILITY AND CONTROL | 4 |
| Includes aircraft handling qualities, piloting, flight controls, and autopilots |

| 09 RESEARCH AND SUPPORT FACILITIES (AIR) | 4 |
| 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) |

### 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

| 12 ASTRONAUTICS (GENERAL) | N.A. |
| For extraterrestrial exploration see 91 Lunar and Planetary Exploration |

| 13 ASTRODYNAMICS | N.A. |
| Includes powered and free-flight trajectories, and orbit and launching dynamics |

| 14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE) | N.A. |
| Includes launch complexes, research and production facilities, ground support equipment, e.g., mobile transporters, and simulators |
| For related information see also 09 Research and Support Facilities (Air) |

| 15 LAUNCH VEHICLES AND SPACE VEHICLES | 5 |
| Includes boosters, manned orbital laboratories, reusable vehicles, and space stations |

| 16 SPACE TRANSPORTATION | N.A. |
| 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 | 5 |
| Includes telemetry, space communications networks, astronavigation, and radio blackout |
| For related information see also 04 Aircraft Communications and Navigation and 32 Communications |

| 18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE | N.A. |
| Includes spacecraft thermal and environmental control, and attitude control |
| For life support systems see 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 50 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.
43 EARTH RESOURCES 34
Includes remote sensing of earth resources by aircraft and spacecraft, photogrammetry, and aerial photography
For instrumentation see 35 Instrumentation and Photography

44 ENERGY PRODUCTION AND CONVERSION 34
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

45 ENVIRONMENT POLLUTION N.A.
Includes air, noise, thermal and water pollution, environment monitoring, and contamination control

46 GEOPHYSICS 38
Includes aeronomy, upper and lower atmosphere studies, ionospheric and magnetospheric physics, and geomagnetism
For space radiation see 93 Space Radiation

47 METEOROLOGY AND CLIMATOLOGY N.A.
Includes weather forecasting and modification

48 OCEANOGRAPHY N.A.
Includes biological, dynamic and physical oceanography, and marine resources

LIFE SCIENCES
Includes life sciences (general), aerospace medicine, behavioral sciences, man/system technology and life support, and planetary biology

51 LIFE SCIENCES (GENERAL) 38
Includes genetics

52 AEROSPACE MEDICINE 38
Includes physiological factors, biological effects of radiation, and weightlessness

53 BEHAVIORAL SCIENCES N.A.
Includes psychological factors, individual and group behavior, crew training and evaluation, and psychiatric research

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT 40
Includes human engineering, biotechnology, and space suits and protective clothing

55 PLANETARY BIOLOGY N.A.
Includes exobiology, and extraterrestrial life

MATHEMATICAL AND COMPUTER SCIENCES
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

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL) N.A.

60 COMPUTER OPERATIONS AND HARDWARE 43
Includes computer graphics and data processing
For components see 33 Electronics and Electrical Engineering

61 COMPUTER PROGRAMMING AND SOFTWARE N.A.
Includes computer programs, routines, and algorithms

62 COMPUTER SYSTEMS N.A.
Includes computer networks

63 CYBERNETICS N.A.
Includes feedback and control theory
For related information see also 54 Man/System Technology and Life Support

64 NUMERICAL ANALYSIS N.A.
Includes iteration, difference equations, and numerical approximation

65 STATISTICS AND PROBABILITY N.A.
Includes data sampling and smoothing, Monte Carlo method, and stochastic processes

66 SYSTEMS ANALYSIS N.A.
Includes mathematical modeling, network analysis, and operations research

67 THEORETICAL MATHEMATICS N.A.
Includes topology and number theory

PHYSICS
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

70 PHYSICS (GENERAL) N.A.
For geophysics see 46 Geophysics For astrophysics see 90 Astrophysics For solar physics see 92 Solar Physics
<table>
<thead>
<tr>
<th>Code</th>
<th>Subject Area</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>71</td>
<td>ACOUSTICS</td>
<td>Includes sound generation, transmission, and attenuation. 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. For space radiation see 93 Space Radiation</td>
</tr>
<tr>
<td>74</td>
<td>OPTICS</td>
<td>Includes light phenomena</td>
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<td>75</td>
<td>PLASMA PHYSICS</td>
<td>N.A.</td>
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<td>Includes magnetohydrodynamics and plasma fusion. For ionospheric plasmas see 46 Geophysics. For space plasmas see 90 Astrophysics.</td>
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<tr>
<td>76</td>
<td>SOLID-STATE PHYSICS</td>
<td>48</td>
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<tr>
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<td>Includes superconductivity. For related information see also 33 Electronics and Electrical Engineering and 36 Lasers and Masers.</td>
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<tr>
<td>77</td>
<td>THERMODYNAMICS AND STATISTICAL PHYSICS</td>
<td>N.A.</td>
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<td></td>
<td>Includes quantum mechanics, and Bose and Fermi statistics. For related information see also 25 Inorganic and Physical Chemistry and 34 Fluid Mechanics and Heat Transfer.</td>
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<td>78</td>
<td>ECONOMICS AND COST ANALYSIS</td>
<td>N.A.</td>
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<td>Includes cost effectiveness studies</td>
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<td>79</td>
<td>LAW AND POLITICAL SCIENCE</td>
<td>N.A.</td>
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<td></td>
<td></td>
<td>Includes space law, international law, international cooperation, and patent policy.</td>
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<td>80</td>
<td>URBAN TECHNOLOGY AND TRANSPORTATION</td>
<td>49</td>
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<tr>
<td></td>
<td></td>
<td>Includes applications of space technology to urban problems, technology transfer, technology assessment, and surface and mass transportation. For related information see 03 Air Transportation and Safety, 16 Space Transportation, and 44 Energy Production and Conversion.</td>
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<tr>
<td>81</td>
<td>SPACE SCIENCES</td>
<td>N.A.</td>
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<td></td>
<td></td>
<td>Includes space sciences (general), astronomy, astrophysics, lunar and planetary exploration, solar physics, and space radiation. For related information see also Geosciences.</td>
</tr>
<tr>
<td>82</td>
<td>OPTICS</td>
<td>46</td>
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<td></td>
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<td>Includes optical phenomena</td>
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<tr>
<td>83</td>
<td>SOLAR PHYSICS</td>
<td>N.A.</td>
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<tr>
<td></td>
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<td>Includes solar activity, solar flares, solar radiation and sunspots.</td>
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<td>84</td>
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<td>89</td>
<td>ASTRONOMY</td>
<td>N.A.</td>
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<td>Includes radio and gamma-ray astronomy, celestial mechanics, and astrometry.</td>
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<td>90</td>
<td>ASTROPHYSICS</td>
<td>N.A.</td>
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<td>Includes cosmology, and interstellar and interplanetary gases and dust.</td>
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<tr>
<td>91</td>
<td>LUNAR AND PLANETARY EXPLORATION</td>
<td>N.A.</td>
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<td></td>
<td>Includes planetology, and manned and unmanned flights. 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>
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<tr>
<td>93</td>
<td>SPACE RADIATION</td>
<td>N.A.</td>
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<tr>
<td></td>
<td></td>
<td>Includes cosmic radiation, and inner and outer earth's radiation belts. For biological effects of radiation see 52 Aerospace Medicine. For theory see 73 Nuclear and High-Energy Physics.</td>
</tr>
</tbody>
</table>

**GENERAL**

**99 GENERAL**

N.A.

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

N78-19065# National Aeronautics and Space Administration
Hugh L. Dryden Flight Research Center Edwards, Calif
AN ANNULAR WING Patent Application
NASA Case-FRC-11007-1, US-Patent-Appl-SN-880725 Avail 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, economical to fabricate and characterized by stable horizontal flight properties at subsonic speeds. NASA

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.

N78-17031# National Aeronautics and Space Administration
Pasadena Office Calif
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
NASA Case-XNP-01458 US-Patent-3 229 905
An extensive 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.
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 boron silica aluminum. Boron silica 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.

A variable thrust nozzle for a quiet turbofan engine and method of operating same is presented. 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.
increase while the fan nozzle area was increased, yielding both a net reduction in engine thrust and noise.

N78-17056* National Aeronautics and Space Administration Lewis Research Center Cleveland, Ohio
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
US-Patent-4,068,470
US-Patent-Class-60-226R
US-Patent-Class-74-385
US-Patent-Class-74-417
A drive means for connecting a gas turbine engine to its accessories are so constructed as to allow the accessories to be selectively positioned to any one of several predetermined circumferential positions about the perimeter of the engine. This feature permits convenient mounting of the same engine upon vehicles demanding radically different engine mounting arrangements.

N78-18067* National Aeronautics and Space Administration Lewis Research Center Cleveland Ohio
VARIABLE MIXER PROPULSION CYCLE Patent
Dan Joseph Rundell (GE Cleveland), Donald Patrick McHugh (GE Cleveland), Tom Foster (GE Cleveland), and Ralph Harold Brown, inventors (to NASA) issued 24 Jan 1978 10 p. Filed 2 Jun 1975. Sponsored by NASA
US-Patent-4,069,661
US-Patent-Class-60-204
US-Patent-Class-60-262
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.

N78-18068* National Aeronautics and Space Administration Lewis Research Center Cleveland Ohio
INTEGRATED GAS TURBINE ENGINE-NACELLE Patent
US-Patent-4,055,041
US-Patent-Class-60-226R
A nacelle for use with a gas turbine engine is presented. An integral webbed structure resembling a spoked wheel for rigidly interconnecting the nacelle and engine provides lightweight support. The inner surface of the nacelle defines the outer limits of the engine motive fluid flow annulus while the outer surface of the nacelle defines a streamlined envelope for the engine.

07 AIRCRAFT PROPULSION AND POWER
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

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. NASA

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. Official Gazette of the U.S. Patent Office.
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 Ricciello and Paul M Sanko, inventors (to NASA)
Filed 25 Nov 1977 19 p
NTIS HC AO2/ MF AO1 CSCL 16D

Intumescent protection sheeting of unusually uniform thickness was prepared from epoxy polysulfide compositions containing microfibers and the ammonium salt of 1,4-nitroaniline-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 blackout.

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

N78-101214* National Aeronautics and Space Administration
Langley Research Center, Langley Station, Va

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 1977 13 p
Filed 14 Sep 1976 Supersedes N77-15103 (15 - 06 p 0715)
(NASA-Case-LAR-11898-1 US-Patent-4.052 523

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 polyamide 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...
are assembled these thin layers are cut into strips that are partially cured and stacked into the desired thickness with uncured prepreg disposed between each layer of strips. The formed laminate is finally cured and thereafter machined to the desired final dimensions. Official Gazette of the U.S. Patent Office.

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography, combustion theory, electrochemistry, and photochemistry. For related information see also 77 Thermodynamics and Statistical Physics.

N78-10225* National Aeronautics and Space Administration
Lyndon B Johnson Space Center Houston, Tex
FUEL COMBUSTOR Patent

A fuel combustor comprises a chamber with air and fuel inlets and a combustion 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.

N78-11216* National Aeronautics and Space Administration
Ames Research Center Moffett Field, Calif.
IMPROVEMENTS IN MICROELECTROPHORETIC APPARATUS AND PROCESS Patent Application

Gel tray and lid assemblies designed for use in conjunction with slotted electrophoretic membranes were developed to take advantage of improved microelectrophoretic accessories 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. NASA.
AUTOMATIC MULTIPLE-SAMPLE APPLICATOR AND ELECTROPHORESIS APPARATUS Patent

Benjamin W. Grunbaum, inventor (to NASA) (Calif. Univ. Berkeley)

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.

THERMOLUMINESCENT AEROSOL ANALYSIS Patent

Robert S. Rogowski and Edward R. Long, Jr., inventors (to NASA)

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 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.

ELECTROCHEMICAL DATA SIGNAL PROCESS AND DISPLAY Patent Application

Judd R. Wilkins and Richard N. Young, inventors (to NASA)

An electrochemical detection device for detecting microorganisms is described. A standard ph reference electrode and a platinum cathodic electrode are positioned in a counter containing a 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 cause it 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 signifying 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 (1472°F) to 1040°C (1900°F) range. Official 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.

N78-18183* 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 multivariant 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 on a weight percent basis 60-90 aluminum, 5-17 tantalum, 0-10 cobalt, 0-6 vanadium, 0-6 rhodium, 2.0 to 6.0 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. Official Gazette of the U.S. Patent Office.

N78-14184* National Aeronautics and Space Administration
Pasadena Office Calif
DURABLE ANTISTATIC COATING FOR POLY-METHYLMETHACRYLATE Patent
Vaclav Hadek (JPL) Robert B Somoano (JPL), and Alan Rembaum, inventors (to NASA) (JPL) Issued 6 Dec 1977 4 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. Official 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 trimerized with or without a filler by the aforementioned catalytic trimerization process. Official Gazette of the U.S. Patent Office.
27 NONMETALLIC MATERIALS

N78-17206* National Aeronautics and Space Administration Langley Research Center Langley Station Va
POLYIMIDE ADHESIVES Patent
Douglas J Proger, Vernon L Bell, and Terry L StClair inventors (to NASA) Issued 27 Dec 1977 5 p Filed 22 Oct 1976

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

N78-17206* National Aeronautics and Space Administration Langley Research Center Langley Station, Va THERMAL SHOCK AND EROSION RESISTANT TANTALUM CARBIDE CERAMIC MATERIAL Patent

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 article which has a high fracture strength relative to its elastic modulus and thus has an improved thermal shock and mechanical erosion resistance. The tantalum carbide is preferable less than minus 100 mesh the carbon particles are preferable less than minus 100 mesh, and the tungsten-rhenium particles are preferable elongate, having a length to thickness ratio of at least 2/1. Tungsten-rhenium wire pieces are suitable as well as graphite particles.
Official Gazette of U S Patent Office

N78-17213* National Aeronautics and Space Administration Lyndon B Johnson Space Center Houston, Tex FLAME RETARDANT SPANDEX TYPE POLYURETHANES Patent

Flame retardant elastomeric compositions were developed comprising of (1) spandex type polyurethane having incorporated into the polymer chain 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

N78-17214* National Aeronautics and Space Administration Pasadena Office Calif NUCLEAR ALKYLATED PYRIDINE ALDEHYDE POLYMERS AND CONDUCTIVE COMPOSITIONS THEREOF Patent

A thermally stable relatively conductive polymer was disclosed. The polymer was synthesized by condensing in the presence of 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

N78-17215* National Aeronautics and Space Administration Pasadena Office Calif
METHOD OF ADHERING BONE TO A RIGID SUBSTRATE USING A GRAPHITE FIBER REINFORCED BONE CEMENT Patent

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 poly vinylmethyl methacrylate dissolved in methyl methacrylate monomer.
Official Gazette of the U S Patent Office

![Graphite Filled vs Unfilled](attachment:image.png)
**ALKALI-METAL SILICATE BINDERS AND METHODS OF MANUFACTURE**  
Patent Application  
John B Schutt inventor (to NASA)  
Filed 21 Dec 1977  
15 p  
(NASA-Case-GSC-12303-1 US-Patent-App-862880) Avail NTIS HC A02/MF A01 CSCCL J1A

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 insolubility) and a high inorganic solids content for low porosity.

**HIGH PERFORMANCE AMMONIUM NITRATE PROPELLANT**  
Patent Application  
Floyd A Anderson, inventor (to NASA)  
Filed 16 Dec 1977  
26 p  
(Contract NAS7-100)  

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.
N78-10326# 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
Albert M Momently inventor (to NASA) (Boeing Commercial Airplane Co, Seattle) Filed 21 Oct 1977 9 p Sponsored by NASA

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. The coolant was disposed between the bubble and the bubble had a slightly larger bubble 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 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...
other gas transfer processes

Official Gazette of the U.S. Patent Office

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**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

Contracts NAS7-100 JPL-95488


NTIS HC A02/MF A01 CSCL 13H

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 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.

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**ULTRA STABLE FREQUENCY DISTRIBUTION SYSTEM**

**Patent**

Richard L. Sydnor (JPL) and John W. McConnell, inventors (to NASA) (JPL) Issued 6 Dec 1977 9 p Filed 21 Jun 1976

Supersedes N76-31373 (14 - 22 p 2851) Sponsored by NASA

(NASA-Case-NPO-13836-1 US-Patent-4,061,974


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.

**APPARATUS AND METHOD FOR STABILIZED PHASE DETECTION FOR BINARY SIGNAL TRACKING LOOPS**


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.

**LOW PROFILE CIRCULARLY POLARIZED ANTENNA**


A low profile antenna assembly for communicating electromagnetic radiation is described. In particular, an embodiment shown, a microstrip assembly is formed with an antenna element provided in the shape of an elliptical lamina. The location of the feed point of the antenna element relative to a semimajor axis determines the polarization of radiation able to be transmitted or received by the antenna assembly as well as the antenna input impedance. The polarization is generally elliptical, with right or left circularly polarized radiation communicable by placement of the feed point along a radial line oriented at a 45-degree azimuthal angle relative to a semimajor axis.

**CLUTTER FREE SYNTHETIC APERTURE RADAR CORRELATOR**


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.
33 ELECTRONICS AND ELECTRICAL ENGINEERING

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.

Hearing Aid Malfunction Detection System

Patent


Supersedes N77-13335 (15-04, p 0465) Sponsored by NASA

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


Supersedes N77-17359 (15-08, p 1025) Sponsored by NASA

A power factor control system for a power inverter utilized 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.

Official Gazette of the U.S. Patent Office

Official Gazette of the U.S. Patent Office
TRANSFORMER REGULATED SELF-STABILIZING CHOPPER 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 commenced 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.

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 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 U.S. Patent Office.

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-SN-868249) Avail NTIS HC A02/MF A01 CSCl 09A

Voltage feed through apparatuses where 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

WINDOW COMPARATOR Patent

A window comparator is described, comprising two operational amplifiers one with two feedback circuits each feedback circuit having a diode connected to the amplifier output and poled for forward current conduction of opposite polarity to provide an algebraic difference between an input signal and a selected set-point voltage. Differential input terminals of the second operational amplifier were connected to the separate feedback circuits of the first operational amplifier one input terminal to the output of one diode, and the other to the output of the other diode. A selected window-width voltage was connected through a coupling resistor to one of the input terminals.

N78-17297* National Aeronautics and Space Administration Goddard Space Flight Center, Greenbelt, Md VOLTAGE FEED THROUGH APPARATUS HAVING REDUCED PARTIAL DISCHARGE Patent Application

Voltage feed through apparatuses where 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 Goddard Space Flight Center, Greenbelt, Md WINDOW COMPARATOR Patent

A window comparator is described, comprising two operational amplifiers one with two feedback circuits each feedback circuit having a diode connected to the amplifier output and poled for forward current conduction of opposite polarity to provide an algebraic difference between an input signal and a selected set-point voltage. Differential input terminals of the second operational amplifier were connected to the separate feedback circuits of the first operational amplifier one input terminal to the output of one diode, and the other to the output of the other diode. A selected window-width voltage was connected through a coupling resistor to one of the input terminals.
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

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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, differing components 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.

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A fluid velocity measuring device possonable in a freestream 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 that are proportional to fluid flow speed and the amplitudes of which are indicative of fluid flow direction. The device includes a...
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 electronic circuitry.
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

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

PHOTOELECTRON SPECTROMETER WITH MEANS FOR STABILIZING SAMPLE SURFACE POTENTIAL Patent

An improved X-ray photoelectron spectrometer is disclosed, which includes circuit means to determine the surface potential of a sample, e.g., an insulator. The circuit means comprise an electron gun whose potential is modulated at a preselected frequency above and below a selected potential with respect to the spectrometer common potential, e.g., ground. The beam of electrons is directed to the sample surface. The sample's surface potential is offset by an offset power supply with respect to the spectrometer common potential, e.g., ground. The beam of electrons is directed to the sample surface. The sample's surface potential is offset by an offset power supply with respect to the spectrometer common potential until the ac current which flows through the sample reaches a peak amplitude. A lock-in amplifier is included to measure the ac current in phase with the modulating frequency.

Official Gazette of the U.S. Patent Office
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 ring 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.

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.

An apparatus is described 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.

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 integrated 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 three other 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.
35 INSTRUMENTATION AND PHOTOGRAPHY

N78-12390* National Aeronautics and Space Administration
Lyndon B Johnson Space Center, Houston, Tex
LOW GRAVITY PHASE SEPARATOR Patent
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
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 TRANSDUCER 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 and movement and pressure within the gas. An amplitude is reached where the increased losses 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
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.

Official Gazette of the U.S. Patent Office

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 emitting 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.

Official Gazette of the U.S. Patent Office

A reed is vibrated by the minute vibrations of a base frame which, in turn, is vibrated by a driver mechanism. The vibration of the reed is picked off and fed back to the driver means causing the base frame to be vibrated at the resonant frequency of the reed. A counter is connected to the feedback loop to measure the frequency of the reed oscillations. By adding the mass to be weighed to the reed, the resonant frequency of the reed will be changed which will in turn change the reading at the counter by an amount which is proportional to the added mass.

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

N78-17359* 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
(NASA-Case-NPO-11150, US-Patent-3,641,470,
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

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.

N78-18390* National Aeronautics and Space Administration
Marshall Space Flight Center, Huntsville, Ala
SEMICONDUCTOR PROJECTILE IMPACT DETECTOR Patent
4 p Filed 11 Mar 1976 Supersedes N76-19405 (14-10.
p 1252)
(NASA-Case-MFS-23009-1, US-Patent-4,055,089,
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.

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 opposite 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.

N78-18392* National Aeronautics and Space Administration
Pasadena Office, Calif
INTERFEROMETER MIRROR TILT CORRECTING SYSTEM Patent
Rudolf A. Schindler, inventor (to NASA) (JPL) Issued 11 Oct
1977 8 p Filed 18 Dec 1975 Supersedes N76-14433 (14 -
05, p 0581) Sponsored by NASA
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.
35 INSTRUMENTATION AND PHOTOGRAPHY

N78-18396* 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

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 batch microfabrication technology.

Official Gazette of the U.S. Patent Office
AUTOMATIC FLUID DISPENSER Patent
Fluid automatically flows to individual dispensing units at predetermined times from a fluid supply and is available only for a predetermined interval of time after which an automatic control causes the fluid to drain from the individual dispensing units Fluid deprivation continues until the beginning of a new cycle when the fluid is once again automatically made available at the individual dispensing units
Official Gazette of the U S Patent Office

Laser energy. The source laser's resonating cavity is coupled within a portion of the pump laser's resonating cavity NASA

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

A drift compensated and intensity averaged extensometer for measuring the diameter or other properties of a substantially cylindrical sample based upon the shadow of the sample is described A beam of laser light is shaped to provide a beam with a uniform intensity along an axis normal to the sample After passing the sample the portion of the beam not striking said sample is divided by a beam splitter into a reference signal and a measurement signal Both of these beams are then chopped by a light chopper to fall upon two photodiode detectors The resulting ac currents are rectified and then divided into one another with the final output being proportional to the size of the sample shadow Official Gazette of the U S Patent Office

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 1 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

LASERS AND MASERS
Includes parametric amplifiers
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.

**N78-17366** National Aeronautics and Space Administration
Marshall Space Flight Center, Huntsville, Ala.

**GAS ION LASER CONSTRUCTION FOR ELECTRICALLY ISOLATING THE PRESSURE GAUGE THEREOF** Patent
Charles E Wood (TRW Inc, Redondo Beach, Calif.) and Robert S Witte, inventors (to NASA) Issued 6 May 1975 5 p Filed 10 Sep 1973 Sponsored by NASA

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

**N78-18410** National Aeronautics and Space Administration
Pasadena Office, Calif.

**INDEPENDENT GAIN AND BANDWIDTH CONTROL OF A TRAVELING WAVE MASER** Patent

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
George A Coffinberry (GE Cincinnati) and Howard B Kast, inventors (to NASA) (GE Cincinnati) Issued 16 Aug 1977
10 p Filed 17 Jul 1975 Sponsored by NASA
(NASA-Case-LEW-12321-1 US-Patent-4,041,697

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
David G Elliott inventor (to NASA) (JPL) Filed 31 Oct 1977
20 p (Contract NAS7-100)

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.

Richard Ravenhall (GE Cincinnati), Charles T Salesseme (GE Cincinnati), and Arthur P Adamson inventors (to NASA) (GE Cincinnati) Issued 13 Sep 1977 6 p Filed 29 May 1975 Sponsored by NASA
(NASA-Case-LEW-12313-1 US-Patent-4,047,840

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.
RECIPIROCATING ENGINES Patent Application
James W Akkerman inventor (to NASA) Filed 31 Oct 1977
17 p
(NASA-Case-MSC-16239-1 US-Patent-Appl-SN-847276) Avail NTIS HC A02/MF A01 CSCL 20A

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.

METHOD OF FORMING METAL HYDRIDE FILMS Patent
Robert Steinberg Donald L Alger and Dale W Cooper inventors (to NASA) Issued 25 Oct 1977 5 p Filed 20 Feb Supersedes N76-18262 (14 - 09 p 1100)

The substrate to be coated (which may be of metal glass or the like) is cleaned, both chemically and by off-sputtering in a vacuum chamber. In an ultra-high vacuum system vapor deposition by a sublimator or vaporizer coats a cooled shroud disposed around the substrate with a thin film of hydride forming metal which getters any contaminant gas molecules. A shutter is then opened to allow hydride forming metal to be deposited as a film or coating on the substrate. After the hydride forming metal coating is formed, deuterium or other hydrogen isotopes are bled into the vacuum system and diffused into the metal film or coating to form a hydride of metal film. Higher substrate temperatures and pressures may be used if various parameters are appropriately adjusted.

MACHINE FOR FORMING A SOLAR ARRAY STRIP Patent Application
Robert L Mueller (JPL), Robert Y Yasui (JPL), Fred J Cairo (JPL), Jerry K Person (JPL), Ernest N Costogue (JPL), Roy G Downing (JPL), and Orwin Middleton inventors (to NASA) (JPL) Filed 4 Nov 1977 27 p (Contract NAS7-100)

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 shutter 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.

PLASMA IGNITER FOR INTERNAL COMBUSTION ENGINE Patent Application
Dennis J Fitzgerald (JPL) and Robert R Breshears inventors (to NASA) (JPL) Filed 1 Apr 1976 13 p (Contract NAS7-100)
(NASA-Case-NPO-13828-1 US-Patent-Appl-SN-672636) Avail NTIS HC A03/MF A01 CSCL 20A

An igniter for the fuel-air mixture used in the cylinders of an internal combustion engine uses a conventional spark to initiate the discharge of a large amount of energy stored in the capacitor. The high current discharge of the energy in the capacitor switched on by a spark discharge produces a plasma and a magnetic field. The resultant combined electromagnetic current field forces the plasma deep into the combustion chamber thus providing an improved ignition of the fuel-air mixture in the chamber.

N78-13440* National Aeronautics and Space Administration Pasadena Office, Calif
PLASMA IGNITER FOR INTERNAL COMBUSTION ENGINE Patent Application
Dennis J Fitzgerald (JPL) and Robert R Breshears inventors (to NASA) (JPL) Filed 1 Apr 1976 13 p (Contract NAS7-100)
(NASA-Case-NPO-13828-1 US-Patent-Appl-SN-672636) Avail NTIS HC A03/MF A01 CSCL 20A

An igniter for the fuel-air mixture used in the cylinders of an internal combustion engine uses a conventional spark to initiate the discharge of a large amount of energy stored in the capacitor. A high current discharge of the energy in the capacitor switched on by a spark discharge produces a plasma and a magnetic field. The resultant combined electromagnetic current field forces the plasma deep into the combustion chamber thus providing an improved ignition of the fuel-air mixture in the chamber.

N78-13441* National Aeronautics and Space Administration Pasadena Office, Calif
MACHINE FOR FORMING A SOLAR ARRAY STRIP Patent Application
Robert L Mueller (JPL), Robert Y Yasui (JPL), Fred J Cairo (JPL), Jerry K Person (JPL), Ernest N Costogue (JPL), Roy G Downing (JPL), and Orwin Middleton inventors (to NASA) (JPL) Filed 4 Nov 1977 27 p (Contract NAS7-100)

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 shutter 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.

N78-13438* National Aeronautics and Space Administration Lewis Research Center, Cleveland, Ohio
METHOD OF FORMING METAL HYDRIDE FILMS Patent
Robert Steinberg Donald L Alger and Dale W Cooper inventors (to NASA) Issued 25 Oct 1977 5 p Filed 20 Feb Supersedes N76-18262 (14 - 09 p 1100)

The substrate to be coated (which may be of metal glass or the like) is cleaned, both chemically and by off-sputtering in a vacuum chamber. In an ultra-high vacuum system vapor deposition by a sublimator or vaporizer coats a cooled shroud disposed around the substrate with a thin film of hydride forming metal which getters any contaminant gas molecules. A shutter is then opened to allow hydride forming metal to be deposited as a film or coating on the substrate. After the hydride forming metal coating is formed, deuterium or other hydrogen isotopes are bled into the vacuum system and diffused into the metal film or coating to form a hydride of metal film. Higher substrate temperatures and pressures may be used if various parameters are appropriately adjusted.

Official Gazette of the US Patent Office

N78-11399* National Aeronautics and Space Administration Lyndon B Johnson Space Center, Houston Tex
RECIPIROCATING ENGINES Patent Application
James W Akkerman inventor (to NASA) Filed 31 Oct 1977
17 p
(NASA-Case-MSC-16239-1 US-Patent-Appl-SN-847276) Avail NTIS HC A02/MF A01 CSCL 20A

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.

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 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.
the bearing carrier 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 carrier. A R H

N78-17391* National Aeronautics and Space Administration Pasadena Office, Calif
A SPEED CONTROL DEVICE FOR A HEAVY DUTY SHAFT Patent Application
Allen G. Ford, inventor (to NASA) (JPL) Filed 13 Dec 1977 16 p
NTIS HC A02/MF A01 CSCL 13E
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 NASA

N78-17388* National Aeronautics and Space Administration Pasadena Office, Calif
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

N78-19815* National Aeronautics and Space Administration Goddard Space Flight Center, Greenbelt, Md
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 NASA
38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques and quality control.

CROSS CORRELATION ANOMALY DETECTION SYSTEM Patent
Ernest Z Micka, inventor (to NASA) (JPL) Issued 23 Sep 1975
13 p Filed 27 Feb 1973 Sponsored by NASA
(NASA-Case-NPO-13283 US-Patent-3,908,118,

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.

AUTOMATIC VISUAL INSPECTION SYSTEM FOR MICRO-ELECTRONICS Patent
Ernest Z Micka, inventor (to NASA) (JPL) Issued 30 Sep 1975
13 p Filed 27 Sep 1973 Sponsored by NASA
(NASA-Case-NPO-13731 US-Patent-4,030,348,

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.
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
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 ELLIPSOLOGY Patent

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.

N78-14452* National Aeronautics and Space Administration
Lewis Research Center Cleveland Ohio
IN-SITU LASER RETORTING OF OIL SHALE Patent
Harvey S Bloomfield inventor (to NASA) Issued 4 Oct 1977 12 p Filed 28 Apr 1976 Supersedes N76-26690 (14 - 17 p 2218) Sponsored by NASA

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 inflatable casing can be inflated at the site of use by a low pressure air supply to form a unitary light weight structure. The collector including the concentrator and target, is readily transportable and can be used either at ground level or on rooftops. The inflatable concentrator can be replaced with a rigid metal or other concentrator while maintaining the novel advantages of the whole 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(IV) 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.
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)
(NASA-Case-LEW-12039-1 US-Patent-4061 955
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.

LOW COST SOLAR ENERGY COLLECTION SYSTEM Patent
Charles G Miller (JPL) and James B Stephens, inventors (to NASA) (JPL) Issued 27 Dec 1977 26 p Filed 24 Jul 1975 Supersedes N75-28519 (13 - 19, p 2406) Sponsored by NASA
A fixed linear ground-based primary reflector having an extended curved sawtooth contoured surface covered with a metallized polymeric reflecting material reflected solar energy to a movably supported collector that was kept at the concentrated line focus of the reflector primary. Efficient utilization leading to high temperatures from the reflected solar energy was obtained by cylindrical shaped secondary reflectors that directed off-angle energy to the absorber pipe.

SOLAR HEATING SYSTEM Patent
(NASA-Case-LAR-12009-1 US-Patent-4,062 347
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
METHOD OF CONSTRUCTION OF A MULTI-CELL SOLAR ARRAY Patent Application

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 a 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.

SELECTIVE COATING FOR SOLAR PANELS Patent

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. Official Gazette of the U.S. Patent Office

METHOD AND APPARATUS FOR MEASURING MINORITY CARRIER LIFETIMES AND BULK DIFFUSION LENGTH IN P-N JUNCTION SOLAR CELLS Patent Application
Oldwig VonRoos, inventor (to NASA) (JPL) Filed 16 Dec 1977 20 p (Contract NAS7-100) (NASA-Case-NPO-14100-1 US-Patent-App-SN-861391) Avail NTIS HC A02/AF A01 CSCL 10A

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.

N78-17529 # National Aeronautics and Space Administration
Pasadena Office Calif
SYSTEM FOR NEAR REAL-TIME CRUSTAL DEFORMATION MONITORING Patent Application
Peter F. MacDoran inventor (to NASA) JPL Filed 21 Dec 1977 21 p
(Contract NAS7-100)
NTIS HC A02/MF A01 CSCL 08G

Near real-time crustal deformation monitoring can be achieved by independent stations which receive S-band radio signals from an Apollo Lunar Surface Experiment Package (ALSEP). The received signals are time tagged by a digital code or L-band signals from the Global Positioning System (GPS) using synchronized atomic clocks at the two stations and then transmitted to a cross-correlation station through telephone lines. The time tags permit the phone line delays to be determined in order for any differences to be compensated before cross correlating the signals. The fringe frequency observation from ALSEP or delay from GPS are obtained by cross correlation and used to estimate base lines for crustal deformation monitoring. The novelty of the invention resides in the use of an artificial radio signal source of narrow bandwidth for transmission over conventional telephone lines.

N78-10686* 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)

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 phase of the normal 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

52 AEROSPACE MEDICINE

Includes physiological factors, biological effects of radiation, and weightlessness.
the hinged coupling to the trunk socket

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distress caused by indomethacin. Usable antagonists include pyrilamine, promethazine, metiamide, and cimetidine. NASA

The agent contains indomethacin and an H1 or an H2 histamine receptor antagonist in an amount sufficient to reduce gastric distress.
54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering biotechnology and space suits and protective clothing

N78-14784* National Aeronautics and Space Administration
Lyndon B Johnson Space Center Houston Tex
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 as an evaporative vessel 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 tank storage 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

N78-17676* National Aeronautics and Space Administration
Lyndon B Johnson Space Center Houston Tex
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 as an evaporative vessel 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 tank storage 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

N78-17678* National Aeronautics and Space Administration
Lyndon B Johnson Space Center Houston Tex
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 as an evaporative vessel 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 tank storage 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

N78-17679* National Aeronautics and Space Administration
Lyndon B Johnson Space Center Houston Tex
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 as an evaporative vessel 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 tank storage 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
**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 flat 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.

**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.

**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.

**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 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.
lightweight, inconspicuous, easily transferable from shoe to shoe, and may be worn with bare feet

NASA

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 parallel 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 differently 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.

NASA

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.

NASA
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.

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A binary coded input signal is converted to a binary coded decimal signal having N decades by employing N four-bit shift registers. The bits of the input signal are sequentially supplied, in order to the least significant position of the register for the units decade, with the most significant bit of the input signal being applied to the units register first. Each of the registers includes a right shift-parallel load mode control input terminal. In response to the sum of the values stored in each register and the binary value 0011 being less than the binary value 1000, the mode control input terminal is activated to shift the register contents one bit to the right. In response to the sum being greater than 1000, the mode control input terminal is activated to load the sum into the register.

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A memory device for two-dimensional radiant energy array computers was developed, in which the memory device stores digital information in an input array of radiant energy digital signals that are characterized by ordered rows and columns. The memory device contains a radiant energy logic storing device having a pair of input surface locations for receiving a pair of separate radiant energy digital signal arrays and an output surface location adapted to transmit a radiant energy digital signal array. A regenerative feedback device that couples one of the input surface locations to the output surface location in a manner for causing regenerative feedback is also included.
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 the 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.

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.

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.

The acuity of an acoustic mirror and microphone system is increased in order to precisely detect the location of a noise source such as that created by an airframe in a wind tunnel, or by machinery. The apparatus which includes mirror which reflects sound from a source to a microphone, can be shifted until the noise detected by microphone is loudest, to determine the precise location from which the sound originates. An enclosure is positioned around the mirror and is filled with a heavy gas such as Freon. The sound waves move slower in the heavy gas than in air, so the wavelength of sound waves is shorter, and the mirror can more accurately focus the sound waves onto the microphone. A pair of thin sheets in front of the mirror is pressed apart by slightly pressed air between them so that all light rays pass perpendicular to the interface between the air in front of the wall and the Freon gas behind wall and are not refracted by the Freon gas.

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 gas-filled 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.

74 OPTICS

Includes light phenomena

N78-13874* National Aeronautics and Space Administration
Goddard Space Flight Center, Greenbelt, Md
THE 2 DEG/90 DEG LABORATORY SCATTERING PHOTOMETER Patent
William R McCluney inventor (to NASA) Issued 11 Oct 1977
6 p Filed 13 Jan 1976 Supersedes N76-17369 (14 - 08 p 0976)
(NASA-Case-GSC-12088-1 US-Patent-4 053 229

A scattering photometer for measuring the light scattered by particles in a hydrosol at substantially 2 deg and 90 deg simultaneously is described. Light from a source is directed by a first optical system into a scattering cell containing the hydrosol under study. Light scattered at substantially 90 deg to the incident beam is focused onto a first photoelectric detector to generate an electrical signal indicative of the amount of scattered light at substantially 90 deg. Light scattered at substantially 2 deg to the incident beam is directed through an annular aperture symmetrically located about the axis of the illuminating beam which is linearly transmitted undeviated through the hydrosol and focused onto a second photodetector to generate an electrical signal indicative of the amount of light scattered at substantially 2 deg.

N78-15879* National Aeronautics and Space Administration
Langley Research Center, Langley Station, Va
TRANSMITTING AND REFLECTING DIFFUSER Patent
(NASA-Case-LAR-10385-3 US-Patent-4 062 996

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 LAMBERTIAN PATTERN
An apparatus was designed for measuring the resolution and efficiency of a glancing-incidence mirror system having an even number of coaxial and confocal reflecting surfaces for use in an X-ray telescope. A collimated beam of X-rays is generated by an X-ray laser and directed along the axis of the system so that the beam is incident on the reflecting surfaces and illuminates a predetermined area. An X-ray detector such as a photographic film is located at the common focus of the surfaces so that the image produced by the X-rays may be compared with a test pattern interposed between the laser and the system.
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.

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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 B 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.

Official Gazette of the U.S. Patent Office

N78-13917* National Aeronautics and Space Administration
Pasadena Office Calif.
HIGH RESOLUTION THRESHOLD PHOTOELECTRON
SPECTROSCOPY BY ELECTRON ATTACHMENT
Patent Application
Ara Chutjian (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 photoion-
ization. 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

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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 for 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.

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 acid 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.
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