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NASA PATENT ABSTRACTS

BIBLIOGRAPHY

A CONTINUING BIBLIOGRAPHY
SECTION 1 ABSTRACTS
This supplement is available from the National Technical Information Service (NTIS), Springfield, Virginia 22161, price code A05.
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 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 Section for all subsequent issues and the Index Section for the most recent issue.

The 181 citations published in this issue of the Abstract Section cover the period July 1991 through December 1991. The Index Section references over 5100 citations covering the period May 1969 through December 1991.

ABSTRACT SECTION (SECTION 1)

This PAB issue includes 10 major subject divisions separated into 76 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 scheme was devised in 1975 and revised in 1987 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, when appropriate, a key illustration taken from the patent or application for patent. Entries are arranged by subject category in order of the ascending NASA Accession Number originally assigned for STAR to the invention. The range of NASA Accession Numbers within each issue is printed on the inside front cover.

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

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

These data elements are identified in the Typical Citation and Abstract and in the indexes.
INDEX SECTION (SECTION 2)

The Index Section is divided into five indexes. These indexes are cross-indexed and are used to locate a single invention or groups of inventions.

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

Accession Number Index: Lists all inventions in order of ascending 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 with 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, (1) use the Subject Category Number to locate the Subject Category and (2) 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 (not including applications for patent) within a desired Patent Classification, (A) turn to the Patent Classification Number in the Number Index of Section 2 and find the associated invention(s), and (B) follow the instructions outlined in (2)(B), and (D) above.
A prosthetic device has been developed for below-the-elbow amputees. The device consists of a cuff, a stem, a housing, two hook-like fingers, an elastic band for holding the fingers together, and a brace. The fingers are pivotally mounted on a housing that is secured to the amputee's upper arm with the brace. The stem, which also contains a cam, is rotationally mounted within the housing and is secured to the cuff, which fits over the amputee's stump. By rotating the cammed stem between the fingers with the lower arm, the amputee can open and close the fingers.
# TABLE OF CONTENTS

## Section 1 • Abstracts

### AERONAUTICS
For related information see also Astronautics.

**01 AERONAUTICS (GENERAL)**

For extraterrestrial exploration see 91 Lunar and Planetary Exploration.

**02 ASTRODYNAMICS**

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.

**03 AIR TRANSPORTATION AND SAFETY**

Includes passenger and cargo air transport operations; and aircraft accidents. For related information see also 16 Space Transportation and 85 Urban Technology and Transportation.

**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 Space Communications, Spacecraft Communications, Command and Tracking and 32 Communications and Radar.

**05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE**

Includes aircraft simulation technology. For related information see also 18 Spacecraft Design, Testing and Performance and 39 Structural Mechanics. For land transportation vehicles see 85 Urban Technology and Transportation.

**06 AIRCRAFT INSTRUMENTATION**

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**

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and onboard 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**

Includes aircraft handling qualities; piloting; flight controls; and autopilots. For related information see also 05 Aircraft Design, Testing and Performance.

**09 RESEARCH AND SUPPORT FACILITIES (AIR)**

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tubes; and aircraft engine test stands. For related information see also 14 Ground Support Systems and Facilities (Space).

### ASTRONAUTICS
For related information see also Aeronautics.

**12 ASTRONAUTICS (GENERAL)**

For extraterrestrial exploration see 91 Lunar and Planetary Exploration.

**13 ASTRODYNAMICS**

Includes powered and free-flight trajectories; and orbital and launching dynamics.

**14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)**

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**

Includes boosters; operating problems of launch/space vehicle systems; and reusable vehicles. For related information see also 20 Spacecraft Propulsion and Power.

**16 SPACE TRANSPORTATION**

Includes passenger and cargo space transportation, e.g., shuttle operations; and space rescue techniques. For related information see also 03 Air Transportation and Safety and 18 Spacecraft Design, Testing and Performance. For space suits see 54 Man/System Technology and Life Support.

**17 SPACE COMMUNICATIONS, SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING**

Includes telemetry; space communications networks; astronavigation and guidance; and radio blackout. For related information see also 04 Aircraft Communications and Navigation and 32 Communications and Radar.

N.A.—no abstracts were assigned to this category for this issue.
18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes satellites; space platforms; space stations; spacecraft systems and components such as thermal and environmental controls; and attitude controls. For life support systems see 54 Man/System Technology and Life Support. For related information see also 05 Aircraft Design, Testing and Performance, 39 Structural Mechanics, and 16 Space Transportation.

19 SPACECRAFT INSTRUMENTATION

For related information see also 06 Aircraft Instrumentation and 35 Instrumentation and Photography.

20 SPACECRAFT PROPULSION AND POWER

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, 44 Energy Production and Conversion, and 15 Launch Vehicles and Space Vehicles.

CHEMISTRY AND MATERIALS

23 CHEMISTRY AND MATERIALS (GENERAL)

24 COMPOSITE MATERIALS

Includes physical, chemical, and mechanical properties of laminates and other composite materials. For ceramic materials see 27 Nonmetallic Materials.

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.

26 METALLIC MATERIALS

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

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials. For composite materials see 24 Composite Materials.

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters and oxidizers; their storage and handling procedures; and aircraft fuels. For related information see also 07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, and 44 Energy Production and Conversion.

29 MATERIALS PROCESSING

Includes space-based development of products and processes for commercial application. For biological materials see 55 Space Biology.

ENGINEERING

For related information see also Physics.

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; cryogenics; and fire prevention.

32 COMMUNICATIONS AND RADAR

Includes radar; land and global communications; communications theory; and optical communications. For related information see also 04 Aircraft Communications and Navigation and 17 Space Communications, Spacecraft Communications, Command and Tracking. For search and rescue see 03 Air Transportation and Safety, and 16 Space Transportation.

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.

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluids; mass transfer and ablation cooling. For related information see also 02 Aerodynamics and 77 Thermodynamics and Statistical Physics.

35 INSTRUMENTATION AND PHOTOGRAPHY

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

36 LASERS AND MASERS

Includes parametric amplifiers. For related information see also 76 Solid-State Physics.
37 MECHANICAL ENGINEERING
Includes auxiliary systems (nonpower); machine elements and processes; and mechanical equipment.

38 QUALITY ASSURANCE AND RELIABILITY
Includes product sampling procedures and techniques; and quality control.

39 STRUCTURAL MECHANICS
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
For related information see also Space Sciences.

42 GEOSCIENCES (GENERAL)

43 EARTH RESOURCES AND REMOTE SENSING
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
Includes specific energy conversion systems, e.g., fuel cells; global sources of energy; geophysical conversion; and windpower. For related information see also 07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, and 28 Propellants and Fuels.

45 ENVIRONMENT POLLUTION
Includes atmospheric, noise, thermal, and water pollution.

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

47 METEOROLOGY AND CLIMATOLOGY
Includes weather forecasting and modification.

48 OCEANOGRAPHY
Includes biological, dynamic, and physical oceanography; and marine resources. For related information see also 43 Earth Resources and Remote Sensing.

LIFE SCIENCES

51 LIFE SCIENCES (GENERAL)

52 AEROSPACE MEDICINE
Includes physiological factors; biological effects of radiation; and effects of weightlessness on man and animals.

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

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT
Includes human engineering; biotechnology; and space suits and protective clothing. For related information see also 16 Space Transportation.

55 SPACE BIOLOGY
Includes exobiology; planetary biology; and extraterrestrial life.

MATHEMATICAL AND COMPUTER SCIENCES

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

60 COMPUTER OPERATIONS AND HARDWARE
Includes hardware for computer graphics, firmware, and data processing. For components see 33 Electronics and Electrical Engineering.

61 COMPUTER PROGRAMMING AND SOFTWARE
Includes computer programs, routines, algorithms, and specific applications, e.g., CAD/CAM.

62 COMPUTER SYSTEMS
Includes computer networks and special application computer systems.
63 CYBERNETICS
Includes feedback and control theory, artificial intelligence, robotics and expert systems. For related information see also 54 Man/System Technology and Life Support.

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

65 STATISTICS AND PROBABILITY
Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

66 SYSTEMS ANALYSIS
Includes mathematical modeling; network analysis; and operations research.

67 THEORETICAL MATHEMATICS
Includes topology and number theory.

PHYSICS
For related information see also Engineering.

70 PHYSICS (GENERAL)
For precision time and time interval (PTTI) see 35 Instrumentation and Photography; for geophysics, astrophysics or solar physics see 46 Geophysics, 90 Astrophysics, or 92 Solar Physics.

71 ACOUSTICS
Includes sound generation, transmission, and attenuation. For noise pollution see 45 Environment Pollution.

72 ATOMIC AND MOLECULAR PHYSICS
Includes atomic structure, electron properties, and molecular spectra.

73 NUCLEAR AND HIGH-ENERGY PHYSICS
Includes elementary and nuclear particles; and reactor theory. For space radiation see 93 Space Radiation.

74 OPTICS
Includes light phenomena and optical devices. For lasers see 36 Lasers and Masers.

75 PLASMA PHYSICS
Includes magnetohydrodynamics and plasma fusion. For ionospheric plasmas see 46 Geophysics. For space plasmas see 90 Astrophysics.

76 SOLID-STATE PHYSICS
Includes superconductivity. For related information see also 33 Electronics and Electrical Engineering and 36 Lasers and Masers.

77 THERMODYNAMICS AND STATISTICAL PHYSICS
Includes quantum mechanics; theoretical physics; and Bose and Fermi statistics. For related information see also 25 Inorganic and Physical Chemistry and 34 Fluid Mechanics and Heat Transfer.

SOCIAL SCIENCES

80 SOCIAL SCIENCES (GENERAL)
Includes educational matters.

81 ADMINISTRATION AND MANAGEMENT
Includes management planning and research.

82 DOCUMENTATION AND INFORMATION SCIENCE
Includes information management; information storage and retrieval technology; technical writing; graphic arts; and micrography. For computer documentation see 61 Computer Programming and Software.

83 ECONOMICS AND COST ANALYSIS
Includes cost effectiveness studies.

84 LAW, POLITICAL SCIENCE AND SPACE POLICY
Includes NASA appropriation hearings; aviation law; space law and policy; international law; international cooperation; and patent policy.

85 URBAN TECHNOLOGY AND TRANSPORTATION
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.
SPACE SCIENCES For related information see also Geosciences.

88 SPACE SCIENCES (GENERAL) ......................................................... N.A.

89 ASTRONOMY ........................................................................ N.A.
Includes radio, gamma-ray, and infrared astronomy; and astrometry.

90 ASTROPHYSICS ..................................................................... N.A.
Includes cosmology; celestial mechanics; space plasmas; and interstellar and interplanetary gases and dust. For related information see also 75 Plasma Physics.

91 LUNAR AND PLANETARY EXPLORATION ................................. N.A.
Includes planetology; and manned and unmanned flights. For spacecraft design or space stations see 18 Spacecraft Design, Testing and Performance.

92 SOLAR PHYSICS ..................................................................... N.A.
Includes solar activity, solar flares, solar radiation and sunspots. For related information see 93 Space Radiation.

93 SPACE RADIATION ................................................................. N.A.
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.

GENERAL
Includes aeronautical, astronautical, and space science related histories, biographies, and pertinent reports too broad for categorization; histories or broad overviews of NASA programs.

99 GENERAL ............................................................................. N.A.

Section 2 • Indexes

SUBJECT INDEX
INVENTOR INDEX
SOURCE INDEX

CONTRACT NUMBER INDEX
NUMBER INDEX
ACCESSION NUMBER INDEX
AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

SELECTABLE TOWLINE SPIN CHUTE SYSTEM Patent


A velocimeter measures flow characteristics of a flow traveling through a chamber in a given direction. Tracer particles are entrained in the flow and a source of radiant energy produces an output stream directed transverse to the chamber and having a sufficient intensity to vaporize the particles as they pass through the output stream. Each of the vaporized particles explodes to produce a shock wave and a hot core, and a flow visualization system tracks the motion of the hot cores and shock waves to thereby measure velocity of each tracer particle, and temperature of the flow around the tracer.

AIRBORNE RESCUE SYSTEM Patent


The airborne rescue system includes a boom with telescoping members for extending a line and collar to a rescue
victim. The boom extends beyond the tip of the helicopter rotor so that the victim may avoid the rotor downwash. The rescue line is played out and reeled in by winch. The line is temporarily retained under the boom. When the boom is extended, the rescue line passes through clips. When the victim dons the collar and the tension in the line reaches a predetermined level, the clips open and release the line from the boom. Then the rescue line can form a straight line between the victim and the winch, and the victim can be lifted to the helicopter. A translator is utilized to push out or pull in the telescoping members. The translator comprises a tape and a rope. Inside the telescoping members the tape is curled around the rope and the tape has a tubelike configuration. The tape and rope are provided from supply spools.

Official Gazette of the U.S. Patent and Trademark Office

The invention is a real-time takeoff and landing performance monitoring system for an aircraft which provides a pilot with graphic and metric information to assist in decisions related to achieving rotation speed within the safe zone of a runway, or stopping the aircraft on the runway after landing or takeoff abort. By comparing the present performance of the aircraft with a predicted nominal performance based upon given conditions, performance deficiencies are detected by the system. The system provides a head-down display and a head-up display. The head-up display is projected onto a partially reflective transparent surface through which the pilot views the runway. Hence, the system supplies the pilot with critical status information while allowing the pilot to continue to view the runway.

Official Gazette of the U.S. Patent and Trademark Office

A device is disclosed for reducing drag and store separation difficulties caused by shallow cavities on aircraft in supersonic flight consisting of a slab of porous material cut to fit precisely inside the cavity. This slab is mounted inside the cavity such that a plenum extends beyond the tip of the helicopter rotor so that the victim may avoid the rotor downwash. The rescue line is played out and reeled in by winch. The line is temporarily retained under the boom. When the boom is extended, the rescue line passes through clips. When the victim dons the collar and the tension in the line reaches a predetermined level, the clips open and release the line from the boom. Then the rescue line can form a straight line between the victim and the winch, and the victim can be lifted to the helicopter. A translator is utilized to push out or pull in the telescoping members. The translator comprises a tape and a rope. Inside the telescoping members the tape is curled around the rope and the tape has a tubelike configuration. The tape and rope are provided from supply spools.

Official Gazette of the U.S. Patent and Trademark Office

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

N91-27156* National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.

PASSIVE VENTING TECHNIQUE FOR SHALLOW CAVITIES Patent

ROBERT L. STALLINGS, JR., inventor (to NASA) and FLOYD J. WILCOX, JR., inventor (to NASA) 28 May 1991 11 p Filed 28 Sep. 1988

(NASA-CASE-LAR-13875-1; US-PATENT-5,018,688; US-PATENT-APPL-SN-250468; US-PATENT-CLASS-244-137.4; US-PATENT-CLASS-244-118.1; US-PATENT-CLASS-244-130; INT-PATENT-CLASS-B64C-7/00; INT-PATENT-CLASS-B64D-1/02)

Avail: US Patent and Trademark Office CSCL 01C

A device is disclosed for reducing drag and store separation difficulties caused by shallow cavities on aircraft in supersonic flight consisting of a slab of porous material cut to fit precisely inside the cavity. This slab is mounted inside the cavity such that a plenum extends beyond the tip of the helicopter rotor so that the victim may avoid the rotor downwash. The rescue line is played out and reeled in by winch. The line is temporarily retained under the boom. When the boom is extended, the rescue line passes through clips. When the victim dons the collar and the tension in the line reaches a predetermined level, the clips open and release the line from the boom. Then the rescue line can form a straight line between the victim and the winch, and the victim can be lifted to the helicopter. A translator is utilized to push out or pull in the telescoping members. The translator comprises a tape and a rope. Inside the telescoping members the tape is curled around the rope and the tape has a tubelike configuration. The tape and rope are provided from supply spools.

Official Gazette of the U.S. Patent and Trademark Office

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

N91-31120* National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.

AIRPLANE TAKEOFF AND LANDING PERFORMANCE MONITORING SYSTEM Patent


Avail: US Patent and Trademark Office CSCL 17G

The invention is a real-time takeoff and landing performance monitoring system for an aircraft which provides a pilot with graphic and metric information to assist in decisions related to achieving rotation speed within the safe zone of a runway, or stopping the aircraft on the runway after landing or takeoff abort. By comparing the present performance of the aircraft with a predicted nominal performance based upon given conditions, performance deficiencies are detected by the system. The system provides a head-down display and a head-up display. The head-up display is projected onto a partially reflective transparent surface through which the pilot views the runway. Hence, the system supplies the pilot with critical status information while allowing the pilot to continue to view the runway.

Official Gazette of the U.S. Patent and Trademark Office

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

N91-31120* National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.

AIRPLANE TAKEOFF AND LANDING PERFORMANCE MONITORING SYSTEM Patent


Avail: US Patent and Trademark Office CSCL 17G

The invention is a real-time takeoff and landing performance monitoring system for an aircraft which provides a pilot with graphic and metric information to assist in decisions related to achieving rotation speed within the safe zone of a runway, or stopping the aircraft on the runway after landing or takeoff abort. By comparing the present performance of the aircraft with a predicted nominal performance based upon given conditions, performance deficiencies are detected by the system. The system provides a head-down display and a head-up display. The head-up display is projected onto a partially reflective transparent surface through which the pilot views the runway. Hence, the system supplies the pilot with critical status information while allowing the pilot to continue to view the runway.

Official Gazette of the U.S. Patent and Trademark Office
chamber is formed between the slab and the floor of the cavity. This device allows air to flow through the chamber opposite to the direction of flow outside the chamber. This results in reduced drag and improved store separation characteristics.

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A multi-heat addition turbine engine (MHATE) incorporates a plurality of heat addition devices to transfer energy to air and a plurality of turbines to extract energy from the air while converting it to work. The MHATE provides dry power and lower fuel consumption or lower combustor exit temperatures.

NASA

The invention is a rotatable, non-circular forebody flow controller. The apparatus comprises a small geometric device located at a nose of a forebody of an aircraft and a non-circular cross-sectional area that extends toward the apex of the aircraft. The device is symmetrical about a reference plane and preferably attaches to an axle which in turn attaches to a rotating motor. The motor rotates the device about an axis of rotation. Preferably, a control unit connected to an aircraft flight control computer signals to the rotating motor the proper rotational positioning of the geometric device.

Official Gazette of the U.S. Patent and Trademark Office

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tubes; and aircraft engine test stands.

N91-21157* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.

HIGH-PRESSURE PROMOTED COMBUSTION CHAMBER Patent
In the preferred embodiment of the promoted combustion chamber disclosed herein, a thick-walled tubular body that is capable of withstanding extreme pressures is arranged with removable upper and lower end closures to provide access to the chamber for dependently supporting a test sample of a material being evaluated in the chamber. To facilitate the real-time analysis of a test sample, several pressure-tight viewing ports capable of withstanding the simulated environmental conditions are arranged in the walls of the tubular body for observing the test sample during the course of the test. A replaceable heat-resistant tubular member and replaceable flame-resistant internal liners are arranged to be fitted inside of the chamber for protecting the interior wall surfaces of the combustion chamber during the evaluation tests. Inlet and outlet ports are provided for admitting high-pressure gases into the chamber as needed for performing dynamic analyses of the test sample during the course of an evaluation test.

Official Gazette of the U.S. Patent and Trademark Office disposed in the enclosure to allow sensing of dynamic and static pressures of the testing apparatus.

A dynamic tester for testing vibration damping seals and bearings is constructed having a hollow shaft extending through the seal or bearing, with the shaft internally supported at each end by fluid bearings on hollow bosses connected to an interior of an enclosure, with no rolling members connected to the shaft is described. A high pressure working fluid is forced through the hollow bosses to operate the bearings. Additionally, the shaft is provided with a reaction turbine that angularly vents a portion of the high pressure working fluid in order to rotate the shaft at high speed, up to 40,000 rpm. The seal or bearing is mounted in a bushing, in turn supported by rods to a shaking device that vibrates the seal or bearing as the shaft is rotated. A plurality of proximity sensors are mounted from outside the enclosure to sense shaft and seal bushing vibrations, and a plurality of pressure ports are disposed in the enclosure to allow sensing of dynamic and static pressures of the testing apparatus.
A description of an insert in a wind tunnel nozzle is presented. The insert has a variable sized passageway that helps create two pressure regions which, in turn, create a diffusion shock wave system and a compression wave system with each system having a plurality of waves. The diffusion shock wave system compresses a flow while the compression wave system turns the flow and is attenuated by the flow itself.

The nozzle diffuser has an inlet in fluid communication with the narrowed inlet of an open test chamber in a conventional wind tunnel. The nozzle diffuser has a passageway extending from its inlet to an outlet in communication with the open test section. The passageway has an internal cross sectional area which increases from its inlet to its outlet and which may be defined by top and bottom isosceles trapezoid walls of a particular flare angle and by isosceles trapezoid side walls of a different flare angle. In addition, a collector having a decreasing internal cross sectional area from inlet to outlet may be provided at the opposite end of the test chamber such that its outlet is in communication with a diffuser located at this outlet.

A low frequency torsional suspension system for testing a space structure uses a plurality of suspension stations attached to the space structure along the length thereof in order to suspend the space structure from an overhead support. Each suspension station includes a disk pivotally mounted to the overhead support, and two cables which have upper ends connected to the disk and lower ends connected to the space structure. The two cables define a parallelogram with the center of gravity of the space structure being vertically beneath the pivot axis of the disk.
vertical distance between the points of attachment of the cables to the disk and the pivot axis of the disk is adjusted to lower the frequency of the suspension system to a level which does not interfere with frequency levels of the space structure, thereby enabling accurate measurement.

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N91-27175* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
FURNACE FOR TENSILE/FATIGUE TESTING Patent
PAMELA K. BRINDLEY, inventor (to NASA) 14 May 1991 11 p
Filed 19 Mar. 1990

Mechanical properties of short test specimens are tested in tension and fatigue using an improved electrical resistance heating furnace having a short length that mounts between the grips of a typical testing machine. The furnace includes a ceramic inner liner having an oval cross section to reduce heat loss at the ends. The furnace is divided into a plurality of individually controlled heating zones. Provision is made to supply an inert gas to the volume around the specimen in the center of the furnace.

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N91-28184*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
SUSPENSION DEVICE FOR LOW-FREQUENCY STRUCTURES Patent Application
MENG-SANG CHEW, inventor (to NASA) (Old Dominion Univ., Norfolk, VA.), JER-NAN JUANG, inventor (to NASA), and LI-FARN YANG, inventor (to NASA) 28 Mar. 1991 19 p

A suspension device is provided for simulating the free-free boundary conditions of space for a low frequency structure. A support cable is connected at one end to the test structure and is vertically guided by a guiding ring. The other end of the cable is connected to a cam having an outer circumference which supports the cable. A drive axle passes through the cam center of rotation and is rotatably journalled in a suitable manner to a rigid structure. Two torsion springs are provided about the drive axle. One end of each spring is connected to a respective face of the cam and the other end is connected to the fixed support. The cam is shaped and the torsion springs selected such that \( W r(t) = T_s(t) \), wherein \( W \) is the weight of the test structure; \( r(t) \) is the instantaneous moment arm defined as the perpendicular distance from the rotational center of the cam to the cable at time \( t \), and \( T_s(t) \) is the total spring torque exerted by the two springs on the cam at time \( t \). The test structure is accordingly vertically suspended by the cable and the instantaneous moment arm compensates for any increased spring torque arising from a vertical displacement of the test structure to simulate space conditions.

N91-24216** National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.
SPACE TRANSPORTATION
Includes passenger and cargo space transportation, e.g., shuttle operations; and space rescue techniques.

N91-24216*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.
LOAD LIMITING, ENERGY ABSORBING, LIGHTWEIGHT DEBRIS CATCHER Patent Application
JON B. KAHN, inventor (to NASA) and WILLIAM C. SCHNEIDER, inventor (to NASA) 22 Feb. 1991 25 p

In the representative embodiment of the invention disclosed a load limiting, energy absorbing net is arranged to overlay a normally-covered vent opening in the rear bulkhead of the space orbiter vehicle. Spatially-disposed flexible retainer straps are extended from the net and respectively secured to bulkhead brackets spaced around the vent opening. The intermediate portions of the straps are doubled over and stitched together in a pattern enabling the doubled-over portions to progressively separate at a predictable load designed to be well below the tensile capability of the straps as the stitches are successively torn apart by the forces imposed on the retainer members whenever the cover plate is explosively separated from the bulkhead and propelled into the net. By arranging these stitches to be successively torn away at a load below the strap strength in response to forces acting on the retainers that are less than the combined strength of the retainers, this tearing action serves as a predictable compact energy absorber for safely halting the cover plate as the retainers are extended as the net is deployed. The invention further includes a block of an energy-absorbing material positioned in the net for receiving loose debris produced by the explosive release of the cover plate.

N91-28186*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.

THERMALLY ACTIVATED RETAINER MEANS Patent Application
MARGARET E. GRIMALDI, inventor (to NASA) and LESLIE S. Hertz, inventor (to NASA) 15 Jul. 1991 15 p
(NASA-CASE-MSC-21793-1; NAS 1.71:MSC-21793-1; US-PATENT-APPL-SN-731829) Avail: NTIS HC/MF A03  CSCL 22B

A retainer member suitable for retaining a gap filler placed in gaps between adjacent tile members is presented. One edge of the retainer member may be attached to the gap filler and another edge may be provided with a plurality of tab members which in an intermediate position do not interfere with placement or removal of the gap filler between tile members. The retainer member may be fabricated from a shape memory alloy which when heated to a specified memory temperature will thermally activate the tab members to predetermined memory positions engaging the tile members to retain the gap filler in the gap. This invention has particular application to the thermal tiles on space vehicles such as the Space Shuttle Orbiter.

N91-21221* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.

OVERCENTER COLLET SPACE STATION TRUSS FASTENER Patent

A quick-connect fastener is arranged with a tubular body that is arranged to be engaged against the exterior surface of a hollow attachment fitting and coincidentally aligned with an opening in the fitting. A collet having normally-contracted fingers with outwardly-enlarged ends is operatively arranged in the body to be advanced forwardly by an expander member mounted in the tubular body for advancing the collet fingers through the opening in the attachment fitting. Biasing means are arranged between the expander member and a toggle linkage in the tubular body which is selectively operated to urge the expander member forcibly into engagement with the collet fingers with an initial biasing force.
to advance their forward portions through the body opening and then expand them outwardly. The biasing means also provide a subsequent biasing force for retaining the collet members in their expanded positions once their enlarged forward end portions are on the opposite side of the body.

An orbital debris sweeper is provided for removing particles from orbit which otherwise may impact and damage an orbiting spacecraft. The debris sweeper includes a central sweeper core which carries a debris monitoring unit, and a plurality of large area impact panels rotatable about a central sweeper rotational axis. In response to information from the debris monitoring unit, a computer determines whether individual monitored particles preferably impact one of the rotating panels or pass between the rotating panels. A control unit extends or retracts one or more booms which interconnect the sweeper core and the panels to change the moment of inertia of the sweeper and thereby the rotational velocity of the rotating panels. According to the method of the present invention, the change in panel rotational velocity increases the frequency of particles which desirelly impact one of the panels and are thereby removed from orbit, while large particles which may damage the impact panels pass between the trailing edge of one panel and the leading edge of the rotationally succeeding panel.

A thermally isolated deployable shield for spacecraft is provided utilizing a plurality of lattice panels stowable generally against the craft and deployable to some fixed distance from the craft. The lattice panels are formed from replaceable shield panels affixed to lattice structures. The lattice panels generally encircle the craft providing 360 degree coverage therearound. Actuation means are provided from translating the shield radially outward from the craft and thermally isolating the shield from the craft. The lattice panels are relatively flexible, allowing the shield to deploy to variable diameters while retaining uniform curvature thereof. Restraining means are provided for holding the shield relatively tight in its stowed configuration. Close-out assemblies provide light sealing and protection of the annular spaces between the deployed shield and the crafts end structure.
SYNCHRONOUSLY DEPLOYABLE DOUBLE FOLD BEAM AND PLANAR TRUSS STRUCTURE Patent

A deployable structure that synchronously deploys in both length and width is disclosed which is suitable for use as a structural component for orbiting space stations or large satellites. The structure is designed with maximum packing efficiency so that large structures may be collapsed and transported in the cargo bay of the Space Shuttle. The synchronous deployment feature allows the structure to be easily deployed in space by two astronauts, without a complex deployment mechanism. The structure is made up of interconnected structural units, each generally in the shape of a parallelepiped. The structural units are constructed of structural members connected with hinged and fixed connections at connection nodes in each corner of the parallelepiped. Diagonal members along each face of the parallelepiped provide structural rigidity and are equipped with mid-length, self-locking hinges to allow the structure to collapse. The structure is designed so that all hinged connections may be made with simple clevis-type hinges requiring only a single degree of freedom, and each hinge pin is located along the centerline of its structural member for increased strength and stiffness.

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STANDARD REMOTE MANIPULATOR SYSTEM DOCKING TARGET AUGMENTATION FOR AUTOMATED DOCKING Patent

An acceleration free research laboratory is provided that is confined within a satellite but free of any physical engagement with the walls of the satellite, wherein the laboratory has adequate power, heating, cooling, and communications services to conduct basic research and development. An inner part containing the laboratory is positioned at the center-of-mass of a satellite within the satellite's outer shell. The satellite is then positioned such that its main axes are in a position parallel to its flight velocity vector or in the direction of the residual acceleration vector. When the satellite is in its desired orbit, the inner part is set free so as to follow that orbit without contacting the inside walls of the outer shell. Sensing means detect the position of the inner part so as to follow that orbit without contacting the inside walls of the outer shell. Sensing means detect the position of the inner part with respect to the outer shell, and activate control rockets to move the outer shell; thereby, the inner part is repositioned such that it is correctly positioned at the center-of-mass of the satellite. As a consequence, all disturbing forces, such as drag forces, act on the outer shell, and the inner part containing the laboratory is shielded and is affected only by gravitational forces. Power is supplied to the inner part and to the laboratory by a balanced microwave/laser link which creates the kind of environment
necessary for basic research to study critical phenomena such as the Lambda transition in helium and crystal growth, and to perform special metals and alloys research, etc.

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**SPECTROSCOPIC WEAR DETECTOR** Patent Application
GEORGE C. MADZSAR, inventor (to NASA) 27 Jun. 1991
12 p
(NASA-CASE-LEW-15200-1; NAS 1.71;LEW-15200-1; US-PATENT-APPL-SN-722446) Avail: NTIS HC/MF A03 CSCL 21H

The elemental composition of a material exposed to hot gases and subjected to wear is determined. Atoms of an elemental species not appearing in this material are implanted in a surface at a depth based on the maximum allowable wear. The exhaust gases are spectroscopically monitored to determine the exposure of these atoms when the maximum allowable wear is reached.

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**POLY(1,3,4-OXADIAZOLES) VIA AROMATIC NUCLEOPHILIC DISPLACEMENT** Patent Application
JOHN W. CONNELL, inventor (to NASA), PAUL M. HERGENROTHER, inventor (to NASA), and PETER WOLF, inventor (to NASA) (Badische Anilin- und Soda-Fabrik A.G., Mogendorf, Germany, F.R.) 22 Jan. 1991 20 p
(NASA-CASE-LAR-14427-1; NAS 1.71;LAR-14427-1; US-PATENT-APPL-SN-645089) Avail: NTIS HC/MF A03 CSCL 07A

Poly(1,3,4-oxadiazoles) (POX) are prepared by the aromatic nucleophilic displacement reaction of di(hydroxyphenyl) 1,3,4-oxadiazole monomers with activated aromatic dihalides or activated aromatic dinitro compounds. The polymerizations are carried out in polar aprotic solvents such as sulfolane or diphenylsulfone using alkali metal bases such as potassium carbonate at elevated temperatures under nitrogen. The di(hydroxyphenyl) 1,3,4-oxadiazole monomers are synthesized by reacting 4-hydroxybenzoic hydrazide with phenyl 4-hydrobenzoate in the melt and also by reacting aromatic diamidrazides with two moles of phenyl 4-hydroxybenzoate in the melt. This synthetic route has provided high molecular weight POX of new chemical
structure, is economically and synthetically more favorable than other routes, and allows for facile chemical structure variation due to the large variety of activated aromatic dihalides which are available.

NASA

N91-25198* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.

SUBSTITUTED

1,1,1-TRIARYL-2,2,2-TRIFLUOROETHANES AND PROCESSES FOR THEIR SYNTHESIS Patent


Synthetic procedures are described for tetraalkyls, tetraacids, and dianhydrides substituted 1,1,1-triaryl-2,2,2-trifluoroethanes which comprises: (1) 1,1-bis(dialkylaryl)-1-aryl-2,2,2-trifluorothane, (2) 1,1-bis(dicarboxyaryl)-1-aryl-2,2,2-trifluoroethanes, or (3) cyclic dihydride or diamine of 1,1-bis(dialkylaryl)-1-aryl-2,2,2-trifluoroethanes. The synthesis of (1) is accomplished by the condensation reaction of an aryl trifluromethyl ketone with a dialkylaryl compound. The synthesis of (2) is accomplished by oxidation of (1). The synthesis of dihydride of (3) is accomplished by the conversion of (2) to its corresponding cyclic dihydride. The synthesis of the diamine is accomplished by the similar reaction of an aryl trifluromethyl ketone with aniline or alkyl substituted or unsubstituted anilines. Also, other derivatives of the above are formed by nucleophilic displacement reactions.

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N91-27220* National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.

LOW DIELECTRIC FLUORINATED POLY(PHENYLENE ETHER KETONE) FILM AND COATING Patent


The present invention relates to film and coating materials prepared from novel fluorinated poly(phenylene ether ketones). A fluorinated poly(phenylene ether ketone) is prepared by reacting a bisphenol with 1,1,1,3,3,3 hexafluoro-2,2-bis 4-[4-(halobenzoyl)] phenyl propane (wherein halo is fluoro or chloro), which is a novel monomer formed as the reaction product of halobenzene (wherein halo is fluoro or chloro) and 1,1,1,3,3,3 hexafluoro-2,2-bis (p-chloro formyl phenyl) propane. Especially beneficial results of this invention are that films and coating materials prepared from the novel fluorinated poly(phenylene ether ketone) are essentially optically transparent/colorless and have a lower dielectric constant than otherwise comparable, commercially available poly(phenylene ether ketones). Moreover, unlike the otherwise comparable commercially available materials, the novel fluorinated poly(phenylene ether ketones) of the present invention can be solution cast or sprayed to produce the films and coatings. Furthermore, the long term thermal stability of the polymers of the present invention is superior to that of the commercially available materials.

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24 COMPOSITE MATERIALS

Includes physical, chemical, and mechanical properties of laminates and other composite materials.

N91-25198* National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.

PROCESS FOR THE MANUFACTURE OF SEAMLESS METAL-CLAD FIBER-REINFORCED ORGANIC MATRIX COMPOSITE STRUCTURES Patent


A process for producing seamless metal-clad composite structures includes providing a hollow, metallic inner member and an outer sleeve to surround the inner member and define an inner space therebetween. A plurality of continuous reinforcing fibers is attached to the distal end of the outer sleeve of the inner member, and the inner member is then introduced, distal end first, into one end of the outer sleeve. The inner member is then moved, distal end first, into the outer sleeve until the inner member is completely enveloped by the outer sleeve. A liquid matrix material is then injected into the space containing the reinforcing fibers between the inner member and the outer sleeve. Next a pressurized heat transfer medium is passed through the inner member to cure the liquid matrix material. Finally, the wall thickness of both the inner member and the outer sleeve are reduced to desired dimensions by chemical etching, which adjusts the thermal expansion coefficient of the metal-clad composite structure to a desired value.

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24 COMPOSITE MATERIALS

Includes physical, chemical, and mechanical properties of laminates and other composite materials.
PREPARING COMPOSITE MATERIALS FROM MATRICES OF PROCESSABLE AROMATIC POLYIMIDE THERMOPLASTIC BLENDS Patent

NORMAN J. JOHNSTON, inventor (to NASA), TERRY L. ST.CLAIR, inventor (to NASA), ROBERT M. BAUCOM, inventor (to NASA), and JOHN R. GLEASON, inventor (to NASA) 2 Apr. 1991

Composite materials with matrices of tough, thermoplastic aromatic polyimides are obtained by blending semi-crystalline polyimide powders with polyamic acid solutions to form slurries, which are used in turn to prepare prepregs, the consolidation of which into finished composites is characterized by excellent melt flow during processing.

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A composition containing 30 to 70 percent chromium carbide, 5 to 20 percent soft noble metal, 5 to 20 percent metal fluorides, and 20 to 60 percent metal binder is used in a powdered metallurgy process for the production of self-lubricating components, such as bearings. The use of the material allows the self-lubricating bearing to maintain its low friction properties over an extended range of operating temperatures.

Fibers having metal-like resistivities are produced and are conceivably useful as electrical conductors.
Composite flexible multilayer insulation systems (MLI) were evaluated for thermal performance and compared with the currently used fibrous silica (baseline) insulation system. The systems described are multilayer insulations consisting of alternating layers of metal foil and scrim ceramic cloth or vacuum metallized polymeric films quilted together using ceramic thread. A silicon carbide thread for use in the quilting and the method of making it are also described. These systems are useful in providing lightweight insulation for a variety of uses, particularly on the surface of aerospace vehicles subject to very high temperatures during flight.

A catalyst for the combination of CO and O2 to form CO2 which includes a platinum group metal, e.g., platinum; a reducible metal oxide having multiple valence states, e.g., SnO2; and a compound which can bind water to its structure, e.g., silica gel. This catalyst is ideally suited for application to high powered, pulsed, CO2 lasers operating in a sealed or closed cycle condition.

A system for prolonging the life of a granulated activated charcoal (GAC) water treatment device is disclosed in which an ultraviolet light transparent material is used to constrain water to

A catalyst for the combination of CO and O2 to form CO2 which includes a platinum group metal, e.g., platinum; a reducible metal oxide having multiple valence states, e.g., SnO2; and a compound which can bind water to its structure, e.g., silica gel. This catalyst is ideally suited for application to high powered, pulsed, CO2 lasers operating in a sealed or closed cycle condition.

A system for prolonging the life of a granulated activated charcoal (GAC) water treatment device is disclosed in which an ultraviolet light transparent material is used to constrain water to
flow over carbon surfaces. It is configured to receive maximum
flux from a UV radiation source, for the purpose of preventing
microbial proliferation on the carbon surfaces, oxidizing organic
contaminants adsorbed from the water onto the carbon surfaces
and from biodegradation of adsorbed microbial forms, disinfecting
water, and oxidizing organic contaminants in the water.

N91-28321* National Aeronautics and Space Administration.
Langley Research Center, Hampton, VA.
ACOUSTOPHORESIS METHOD AND APPARATUS Patent
Application
JOSEPH S. HEYMAN, inventor (to NASA) 17 Dec. 1990 15 p
(NASA-CASE-LAR-13388-1; NAS 1.71:LAR-13388-1;
US-PATENT-APPL-SN-628062) Avail: NTIS HC/MF A03 CSCL
07D

A method and apparatus are provided for
acoustophoresis, i.e., the separation of species via acoustic waves.
An ultrasonic transducer applies an acoustic wave to one end of
a sample container containing at least two species having different
acoustic absorptions. The wave has a frequency tuned to or
harmonized with the point of resonance of the species to be
separated. This wave causes the species to be driven to an
opposite end of the sample container for removal. A second
ultrasonic transducer may be provided to apply a second, oppositely
directed acoustic wave to prevent undesired streaming. In addition,
a radio frequency tuned to the mechanical resonance and coupled
with a magnetic field can serve to identify a species in a medium
comprising species with similar absorption coefficients, whereby
an acoustic wave having a frequency corresponding to this
gyrational rate can then be applied to sweep the identified species
to one end of the container for removal.

N91-31258* National Aeronautics and Space Administration.
Ames Research Center, Moffett Field, CA.
ETCHING METHOD FOR PHOTORESISTS OR
POLYMERS Patent
NARCINDA R. LERNER, inventor (to NASA) and THEODORE
J. WYDEVEN, JR., inventor (to NASA) 16 Apr. 1991 13 p
Filed 4 May 1989 Continuation-in-part of
(NASA-CASE-ARC-11873-2; US-PATENT-5,007,983;
US-PATENT-CLASS-204-192.32;
INT-PATENT-CLASS-H01L-21/306) Avail: US Patent and
Trademark Office CSCL 07D

A method for etching or removing polymers, photoresists,
and organic contaminants from a substrate is disclosed. The
method includes creating a more reactive gas species by producing
a plasma discharge in a reactive gas such as oxygen and contacting
the resulting gas species with a sacrificial solid organic material
such as polyethylene or polyvinyl fluoride, reproducing a highly
reactive gas species, which in turn etches the starting polymer,
organic contaminant, or photoresist. The sample to be etched is
located away from the plasma glow discharge region so as to
avoid damaging the substrate by exposure to high energy particles
and electric fields encountered in that region. Greatly increased
etching rates are obtained. This method is highly effective for
etching polymers such as polyimides and photoresists that are
otherwise difficult or slow to etch downstream from an electric
discharge in a reactive gas.

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N91-32196* National Aeronautics and Space Administration.
Langley Research Center, Hampton, VA.
IGNITABILITY TEST METHOD AND APPARATUS Patent
LAURENCE J. BEMENT, inventor (to NASA), JAMES W.
BAILEY, inventor (to NASA), and MORRY L. SCHIMMEL, inventor
Continuation-in-part of abandoned US-Patent-Apppl-SN-426345, filed
30 Nov. 1989
(NASA-CASE-LAR-14454-1; US-PATENT-5,052,817;
An apparatus for testing ignitability of an initiator includes a body having a central cavity, an initiator holder for holding the initiator over the central cavity of the body, an ignition material holder disposed in the central cavity of the body and having a cavity facing the initiator holder which receives a measured quantity of ignition material to be ignited by the initiator. It contains a chamber in communication with the cavity of the ignition material and the central cavity of the body, and a measuring system for analyzing pressure characteristics generated by ignition of the ignition material by the initiator. The measuring system includes at least one transducer coupled with an oscillograph for recording pressure traces generated by ignition.

Electrical energy will cause the solder preform to heat up and melt, joining the pin and conductor.

An improved lightweight, ablative coating is disclosed that may be spray applied and cured without the development of appreciable shrinkage cracks. The ablative mixture consists essentially of phenolic microballoons, hollow glass spheres, glass fibers, ground cork, a flexibilized resin binder, and an activated colloidal clay.

High emittance radiator surfaces are produced by arc-texturing. This process produces such a surface on a metal.
by scanning it with a low voltage electric arc from a carbon electrode in an inert environment.

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**N91-25298**

National Aeronautics and Space Administration.
Lewis Research Center, Cleveland, OH.

CERAMIC COATINGS ON SMOOTH SURFACES Patent Application
R. A. MILLER, inventor (to NASA), W. J. BRINDLEY, inventor (to NASA), and C. J. ROUGE, inventor (to NASA) 13 May 1991
12 p

A metallic coating is plasma sprayed onto a smooth surface of a metal alloy substitute or on a bond coating. An initial thin ceramic layer is low pressure sprayed onto the smooth surface of the substrate or bond coating. Another ceramic layer is atmospheric plasma sprayed onto the initial ceramic layer.

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**N91-25375**

National Aeronautics and Space Administration.
Lewis Research Center, Cleveland, OH.

OXIDATION RESISTANT COATINGS FOR TITANIUM ALLOYS AND TITANIUM ALLOY MATRIX COMPOSITES Patent Application
WILLIAM J. BRINDLEY, inventor (to NASA), JAMES L. SMIALEK, inventor (to NASA), and CARL J. ROUGE, inventor (to NASA) 1 Apr. 1991 9 p

An oxidation resistant coating for titanium alloys and titanium alloy matrix composites comprises an MCrAlX material. M is a metal selected from nickel, cobalt, and iron. X is an active element selected from Y, Yb, Zr, and Hf.

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**N91-25376**

National Aeronautics and Space Administration.
Lewis Research Center, Cleveland, OH.

METHOD OF PREPARING A THERMAL BARRIER COATING Patent Application
I. ZAPLATYNSKY, inventor (to NASA) 1 Mar. 1991 10 p
(NASA-CASE-LEW-14999-2; NAS 1.71:LEW-14999-2; US-PATENT-APPL-SN-662684) Avail: NTIS HC/MF A02 CSCL 11C

A composite thermal barrier coating is plasma sprayed onto a substrate. This coating has a first layer including a first ceramic material and a second layer including a second ceramic material impregnated with a glass, the glass being a ternary eutectic. The glass may consist of about 14.6 weight percent Al2O3, about 23.3 weight percent CaO, and about 62.1 weight percent SiO2. The first and second ceramic materials may include yttria-stabilized zirconia.
Highly conjugated organic polymers typically have large non-resonant electronic susceptibilities, which give the molecules unusual optical properties. To enhance these properties, defects are introduced into the polymer chain. Examples include light doping of the conjugated polymer and synthesis, conjugated polymers which incorporate either electron donating or accepting groups, and conjugated polymers which contain a photoexcitable species capable of reversibly transferring its electron to an acceptor. Such defects in the chain permit enhancement of the second hyperpolarizability by at least an order of magnitude.

Cadmium oxide is used with a dry solid lubricant on a surface to improve wear resistance. The surface topography is first altered by photochemical etching to a predetermined pattern. Cadmium oxide is then sputtered onto the altered surface to form an intermediate layer to more tightly hold the dry lubricant, such as graphite.

A process for bonding elastomeric material to a metal part includes coating a heat curable adhesive on the surfaces of the metal part to be bonded. The metal part is placed in a mold, a bottom plate and an upper transfer pot of a transfer molding machine is preheated to a predetermined cure temperature. A predetermined quantity of uncured elastomeric material is loaded into the transfer pot. The mold containing the adhesive coated metal part is clamped to the bottom plate, and almost contemporaneously, the uncured elastomeric material is pressed into the mold while maintaining heat and pressure in the mold for a time sufficient to vulcanize and thereby cure the elastomeric material simultaneously with the adhesive, whereby contacting surfaces of the metal part are strongly bonded to the vulcanized elastomeric material.

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27 NONMETALLIC MATERIALS

N91-28425* National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
POLYIMIDES PREPARED FROM 3,5-DIAMINO BENZO
TRIFLUORIDE Patent Application

High performance, thermooxidatively stable polyimides are prepared by reacting aromatic diamines with pendant trifluoromethyl groups and dianhydrides in an amide solvent to form a poly(amic acid), followed by cyclizing the poly(amic acid) to form the corresponding polyimide.

N91-31307* National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
ETHYNYL TERMINATED IMIDOETHIOETERS AND RESINS THEREFROM Patent

Ethynyl terminated imidothioethers (ETIs) are prepared by the reaction of a dimercaptan, such as 4,4'-dimercaptodiphenyl ether, and an ethynyl containing maleimide, such as N-(3-ethynylphenyl)maleimide. Blends of these ETIs and ethynyl terminated polymeric materials, such as ethynyl terminated sulfones and ethynyl terminated arylenes ethers, are also prepared. These resin blends exhibit excellent processability, and the cured blends show excellent fracture toughness and solvent resistance, as well as excellent adhesive and composite properties.

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N91-32230* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
ADDITION POLYIMIDES WITH ENHANCED PROCESSABILITY Patent Application

The present invention is directed to nonplanar polyimides having improved thermo-oxidative stability and enhanced processability. In a preferred embodiment, high molecular weight polyimides (HMW PMRs (polymerization of monomer reactants)) are obtained by reacting a nonplanar polyphenyl amine, a diester or dianhydride of a tetracarboxylic acid, and an end capping compound. A second embodiment involves reacting a diamine with a nonplanar diester, or nonplanar dianhydride, of a tetracarboxylic acid, and an end capping compound. The polyimides of this invention overcome processing difficulties involved with using HMW PMRs through their noncoplanar conformation. For example, the noncoplanar conformation helps reduce the melting temperature and melt viscosity normally required and thereby permits substantially increased resin flow in processing of HMW PMRs. The polyimides of the invention possess excellent thermo-oxidative stability at 343 to 371 C for composite applications. In addition, the polyimides of the invention display a low thermal expansion coefficient and a narrow molecular weight distribution at high molecular weights.

N91-32229* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
CERAMIC COATINGS ON SMOOTH SURFACES Patent Application

A metal substrate or a bond coating having a smooth surface is covered by a thin ceramic layer of ZrO2 - 8 pctl. Y2O3 having a thickness between about four and 15 mils covers the thin ceramic layer.
IMPROVING THE PERFORMANCE OF BLASTING CAPS
Patent Application

Common blasting caps are made from an aluminum shell in the form of a tube which is closed at both ends. One end, which is called the output end, terminates in a principal side or face, and contains a detonating agent which communicates with a means for igniting the detonating agent. The improvement of the present invention is a flat, steel foil bonded to the face in a position which is aligned perpendicularly to the longitudinal axis of the tube.

NASA

DUAL DIAPHRAGM TANK WITH TELLTALE DRAIN
Patent

This invention relates to a joint for holding a pair of trusses together in axial alignment. The joint includes a pair of cylindrical locking elements secured to the ends of the trusses. The locking elements each having a plurality of lands and grooves which lie in parallel planes when the trusses are in axial alignment. A pair of clamps positioned on opposite sides of the trusses are provided with a plurality of lands and grooves which mesh with the lands and grooves on the locking elements, with means being provided for urging the clamps toward each other to bring the...
trusses into axial alignment and hold them in that position.

N91-27385* National Aeronautics and Space Administration. Pasadena Office, CA.

FLEXIBLE THERMAL APPARATUS FOR MOUNTING OF THERMOELECTRIC COOLER Patent
JACK A. JONES, inventor (to NASA), S. WALTER PETRICK, inventor (to NASA), and STEVEN BARD, inventor (to NASA) (Jet Propulsion Lab., California Inst. of Tech., Pasadena.) 16 Jul. 1991 10 p Filed 31 Jul. 1990 (Contract NAS7-918)

A flexible heat transfer apparatus used to flexibly connect and thermally couple a thermoelectric cooler to an object to be cooled is disclosed. The flexible heat transfer apparatus consists of a pair of flexible corrugated sheets made from high thermal conductivity materials such as copper, aluminum, gold, or silver. The ridges of the corrugated sheets are oriented perpendicular to one another and bonded sandwich-fashion between three plates to define an upper section and a lower section. The upper section provides X flexure, the lower section provides Y flexure, and both sections together provide Z flexure.

Official Gazette of the U.S. Patent and Trademark Office

N91-28454* National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.

FLUSH MOUNTING OF THIN FILM SENSORS Patent
Application
THOMAS C. MOORE, SR., inventor (to NASA) 6 May 1991 10 p

Flush mounting of a sensor on a surface is provided by first forming a recessed area on the surface. Next an adhesive bonding mixture is introduced into the recessed area. The adhesive bonding mixture is chosen to provide thermal expansion matching with the surface surrounding the recessed area. A strip of high performance polymeric tape is provided, with the sensor attached to the underside thereof, and the tape is positioned over the recessed area so that it acts as a carrier of the sensor. A shim having flexibility so that it will conform to the surface surrounding the recessed area is placed over the tape, and a vacuum pad is placed over the shim. The area above the surface is then evacuated while holding the sensor flush with the surface during curing of the adhesive bonding mixture. After such curing, the pad, shim, and tape are removed from the sensor, electrical connections for the sensor are provided, after which the remaining space in the recessed area is filled with a polymeric foam.

N91-28455* National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.

METHOD AND APPARATUS FOR CLEANING RUBBER DEPOSITS FROM AIRPORT RUNWAYS AND ROADWAYS Patent Application
SANDY M. STUBBS, inventor (to NASA) 3 Apr. 1991

A method and apparatus for cleaning rubber deposits from surfaces such as airport runways and roadways is disclosed. The apparatus includes a large vehicle that has the capacity to be loaded so as to effectively add weight to rubber cleaning tires of the vehicle. In addition, the vehicle has a water tank and sprinkler system so that the surface may be wetted down in front of the tires as the vehicle proceeds across the surface. The cleaning tires of the apparatus are aligned so that they are at a yaw angle to the direction of travel, and the cleaning tire assembly is attached to the underside of the trailer of the vehicle and positioned between a forward and rear water tank. In addition, this tire assembly is
equipped with a means of loading the tires onto the contaminated surface. The method comprises driving such a vehicle at low speeds down the surface as the road is being wet in front of the cleaning tires. The effect of the angled tires is to create a scrubbing action that not only heats the rubber deposits by friction but also causes it to be removed from the surface. The rubber that does not stick to the cleaning tires is then removed from the surface by sweeping.

APPARATUS AND METHOD FOR EXPLOSIVE BONDING TO EDGE OF FLYER PLATE Patent
LAURENCE J. BEMENT, inventor (to NASA) and ANNE C. KUSHNICK, inventor (to NASA) 24 Sep. 1991 11 p Filed 2 Oct. 1990

The invention is an apparatus and a process for the explosive joining of a flyer plate and a base plate. The apparatus consists of a flyer plate positioned over a base plate. The flyer plate has a notch containing a filler material in intimate contact with the flyer plate. An adhesive means holds a ribbon explosive partially overlapping the notch in the flyer plate. A detonating means initiates the ribbon explosive that drives the flyer plate to accomplish a high velocity, angular collision between the mating surfaces. This collision creates surface melts and effacing bonding, resulting in electron sharing linkups between the plates. An unbonded tab fractures at a base of the notch leaving a bond to an edge of the attached flyer plate.

A method is described for forming hollow particles, or shells, of extremely small size. The shell material is heated to a molten temperature in the presence of a gas that is at least moderately soluble in the shell material, to form a solution of the molten shell material and the soluble gas. The solution is atomized to form a multiplicity of separate droplets that are cooled while in free fall. Cooling of a droplet from the outside traps the dissolved gas and forces it to form a gas bubble at the center of the droplet which now forms a gas filled shell. The shell is reheated and then cooled in free fall, in an environment having a lower pressure than the gas pressure in the shell. This causes expansion of the shell and the formation of a shell having a small wall thickness compared to its diameter.

COMMUNICATIONS AND RADAR
Includes radar; land and global communications; communications theory; and optical communications.

DOPPLER-CORRECTED DIFFERENTIAL DETECTION SYSTEM Patent
Doppler in a communication system operating with a multiple differential phase-shift-keyed format (MDPSK) creates an adverse phase shift in an incoming signal. An open loop frequency estimation is derived from a Doppler-contaminated incoming signal. Based upon the recognition that, whereas the change in phase of the received signal over a full symbol contains both the differentially encoded data and the Doppler induced phase shift, the same change in phase over half a symbol (within a given symbol interval) contains only the Doppler induced phase shift, and the Doppler effect can be estimated and removed from the incoming signal. Doppler correction occurs prior to the receiver's final output of decoded data. A multiphase system can operate with two samplings per symbol interval at no penalty in signal-to-noise ratio provided that an ideal low pass pre-detection filter is employed, and two samples, at 1/4 and 3/4 of the symbol interval $T_s$, are taken and summed together prior to incoming signal data detection.

A demodulator for Offset Quaternary Phase Shift Keyed (OQPSK) signals modulated with two words resolves eight possible combinations of phase ambiguity which may produce data error by first processing received $I(R)$ and $Q(R)$ data in an integrated carrier loop/symbol synchronizer using a digital Costas loop with matched filters for correcting four of eight possible phase lock errors, and then the remaining four using a phase ambiguity resolver which detects the words to not only reverse the received $I(R)$ and $Q(R)$ data channels, but also invert (complement) the $I(R)$ and/or $Q(R)$ data, or to at least complement the $I(R)$ and $Q(R)$ data for systems using nontransparent codes that do not have rotation direction ambiguity.

The method and apparatus for fusion of data from optical and radar sensors by error minimization procedure is presented. The method was applied to the problem of shape reconstruction of an unknown surface at a distance. The method involves deriving an incomplete surface model from an optical sensor. The unknown characteristics of the surface are represented by some parameter. The correct value of the parameter is computed by iteratively generating theoretical predictions of the radar cross sections (RCS) of the surface, comparing the predicted and the observed values for the RCS, and improving the surface model from results of the comparison. Theoretical RCS may be computed from the surface model in several ways. One RCS prediction technique is the method of moments. The method of moments can be applied to an unknown surface only if some shape information is available from an independent source. The optical image provides the independent information.
A differential detection technique for multiple phase shift keying (MPSK) signals is provided which uses a multiple symbol observation interval on the basis of which a joint decision is made regarding the phase of the received symbols. In accordance with the invention, a first difference phase is created between first and second received symbols. Next, the first difference phase is correlated with the possible values thereof to provide a first plurality of intermediate output signals. A second difference phase is next created between second and third received symbols. The second difference phase is correlated with plural possible values thereof to provide a second plurality of intermediate output signals. Next, a third difference phase is created between the first and third symbols. The third difference phase is correlated with plural possible values thereof to provide a third plurality of intermediate output signals. Each of the first plurality of intermediate outputs are combined with each of the second plurality of intermediate outputs and each of the third plurality of intermediate outputs to provide a plurality of possible output values. Finally, a joint decision is made by choosing from the plurality of possible output values the value which represents the best combined correlation of the first, second and third difference values with the possible values thereof.

LATERALLY STACKED SCHOTTKY DIODES FOR INFRARED SENSOR APPLICATIONS

A magnetostrictive drive motor is disclosed which has a rotary drive shaft in the form of a drum which is encircled by a plurality of substantially equally spaced roller members in the form of two sets of cones which are in contact with the respective cam surfaces on the inside surface of an outer drive ring. The drive ring is attached to sets of opposing pairs of magnetostrictive rods. Each rod in a pair is mutually positioned end to end within respective energizing coils. When one of the coils in an opposing pair is energized, the energized rod expands while the other rod is caused to contract, causing the drive ring to rock, i.e., rotate slightly in either the clockwise or counterclockwise direction, depending upon which rod in a pair is energized. As the drive ring is activated in repetitive cycles in either direction, one set of drive cones attempts to roll up their respective cam surface but are pinned between the drive shaft drum and the drive ring. As the frictional force preventing sliding builds up, the cones become locked, setting up reaction forces including a tangential component which is imparted to the drive shaft drum to provide a source of motor torque. Simultaneously the other set of cones are disengaged from the drive shaft drum. Upon deactivation of the magnetostrictive drive motor, the cones are disengaged from the drive shaft drum. Upon deactivation of the magnetostrictive drive motor, the cones are disengaged from the drive shaft drum.
rod coils, the force on the drive cones is released, causing the system to return to an initial rest position. By repetitively cycling the energization of the magnetostrictive rods, the drive shaft drum indexes in microradian rotational steps.

A gas/arc electrode is disclosed for use under vacuum conditions where a first housing encloses a second housing, with an end of the second housing extending through an opening in the first housing and having an outlet orifice. Provisions are made for circulating a coolant through the first housing to surround and cool the second housing. An electrical current and a gas, such as argon, as passed through the second housing, with the current flowing through a narrow stream of the ionized gas flowing through the outlet orifice to a workpiece to be treated. The second housing forms a chamber which has a cross sectional area, in a plane perpendicular to the direction of gas flow, of at least ten times the cross sectional area of the outlet orifice such that a gas pressure can be maintained in the chamber to reduce erosion of the chamber walls.

A synchronous demodulator includes a switch which is operated in synchronism with an incoming periodic signal and both divides and amplifies that signal to two signal channels. The two channels each include a network for computing and holding, for a predetermined length of time, the average signal value on that channel and applies those values, in the form of two other signals, to the inputs of a differential amplifier. The networks may be R-C networks. The output of the differential amplifier may or may not form the output of the synchronous detector and may or may not be filtered. The output will not include a periodic signal due to the presence of a dc offset. Additionally, the output will not contain any substantial ripple due to periodic components in the input signal. In a somewhat more complex version, containing twice the structural components of the above synchronous demodulator with a more complex switching mechanism, essentially all ripple due to periodic components in the input signal are eliminated.

The invention disclosed is a digital circuit which emulates a synchro signal in a synchro-resolver follower system for precise control of shaft position and rotation at very low rotational rates. The invention replaces the synchro and drive motor in a synchro-resolver follower system with a digital and analog synchro
emulation circuit for generating the resolver control signal. The
synchro emulation circuit includes amplitude modulation means to
provide relatively high frequency resolver excitation signals for
accurate resolver response even with very low shaft rotation
rates.

N91-27478* National Aeronautics and Space Administration.
Pasadena Office, CA.
METAL CHLORIDE CATHODE FOR A BATTERY Patent
RATNAKUMAR V. BUGGA, inventor (to NASA), SALVADOR
DISTEFANO, inventor (to NASA), and C. PERRY BANKSTON,
inventor (to NASA) (Jet Propulsion Lab., California Inst. of Tech.,
(Contract NAS 7-918)
(NASA-CASE-NPO-17809-1-CU; US-PATENT-5,019,470;
US-PATENT-CLASS-29-623.5; INT-PATENT-CLASS-H01M-4/58;
INT-PATENT-CLASS-H01M-4/04) Avail: US Patent and
Trademark Office CSCL 10C

A method of fabricating a rechargeable battery is
disclosed which includes a positive electrode which contains a
chloride of a selected metal when the electrode is in its active
state. The improvement comprises fabricating the positive electrode by:
providing a porous matrix composed of a metal; providing a
solution of the chloride of the selected metal; and impregnating
the matrix with the chloride from the solution.

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N91-28490** National Aeronautics and Space Administration.
Langley Research Center, Hampton, VA.
METHOD OF PREFORMING AND ASSEMBLING
SUPERCONDUCTING CIRCUIT ELEMENTS Patent Application
GENE H. HAERTLING, inventor (to NASA) (Clemson Univ.,
SC.) and JOHN D. BUCKLEY, inventor (to NASA) 6 Mar. 1991
17 p
(NASA-CASE-LAR-14395-1-CU; NAS 1.71:LAR-14395-1-CU;
US-PATENT-APPL-SN-666536) Avail: NTIS HC/MF A03 CSCL
09A

The invention is a method of preforming and pretesting rigid and discrete superconductor circuit elements to optimize the
superconductivity development of the preformed circuit element prior to its assembly, and encapsulation on a substrate and final
environmental testing of the assembled ceramic superconductive elements.

NASA
A UNIVERSAL COMPUTER CONTROL SYSTEM FOR MOTORS Patent

ZOLTAN F. SZAKALY, inventor (to NASA) 10 Sep. 1991

A control system for a multi-motor system such as a space telerobot, having a remote computational node and a local computational node interconnected with one another by a high speed data link is described. A Universal Computer Control System (UCCS) for the telerobot is located at each node. Each node is provided with a multibus computer system which is characterized by a plurality of processors with all processors being connected to a common bus, and including at least one command processor. The command processor communicates over the bus with a plurality of joint controller cards. A plurality of direct current torque motors, of the type used in telerobot joints and telerobot hand-held controllers, are connected to the controller cards and responds to digital control signals from the command processor. Essential motor operating parameters are sensed by analog sensing circuits and the sensed analog signals are converted to digital signals for storage at the controller cards where such signals can be read during an address read/write cycle of the command processing processor.

EMERGENCY LOCATING TRANSMITTER Patent

PAUL E. WREN, inventor (to NASA) 7 May 1991

A transmitter generates three signals for sequential transmission. These signals are an unmodulated r.f. carrier, a r.f. carrier amplitude modulated by a first audio frequency waveform and a r.f. carrier amplitude modulated by a second audio frequency waveform which is distinguishable from the first and which may be employed as a means for identifying a particular transmitter. The composite, sequentially transmitted signal may be varied in terms of the individual signal transmission sequence, the duration of the individual signals, overall composite signal repetition rate and the frequency of the second audio waveform. Various combinations of signal variations may be employed to transmit different information.

LOW COST, FORMABLE, HIGH T(SUB C) SUPERCONDUCTING WIRE Patent

JAMES L. SMIALEK, inventor (to NASA) 17 Sep. 1991

A ceramic superconductivity part such as a wire is produced through the partial oxidation of a specially formulated copper alloy in the core. The alloys contain low level quantities of rare earth and alkaline earth dopant elements. Upon oxidation at high temperature, superconducting oxide phases are formed as a thin film.
FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

HEAT TUBE DEVICE Patent

The present invention discloses a heat tube device through which a working fluid can be circulated to transfer heat to air in a conventional air conditioning system. The heat tube device is disposable about a conventional cooling coil of the air conditioning system and includes a plurality of substantially U-shaped tubes connected to a support structure. The support structure includes members for allowing the heat tube device to be readily positioned about the cooling coil. An actuatable adjustment device is connected to the U-shaped tubes for allowing, upon actuation thereof, for the heat tubes to be simultaneously rotated relative to the cooling coil for allowing the heat transfer from the heat tube device to air in the air conditioning system to be selectively varied.

PASSIVE LAMINAR FLOW CONTROL OF CROSSFLOW VORTICITY Patent Application

An improved fluid actuating system for imparting motion to a body such as a spacecraft is disclosed. The fluid actuating system consists of a fluid mass that may be controllably accelerated through at least one fluid path whereby an opposite acceleration is experienced by the spacecraft. For full control of the spacecraft’s orientation, the system would include a plurality of fluid paths. The fluid paths may be circular or irregular, and the fluid paths may be located on the interior or exterior of the spacecraft.

FLUID-LOOP REACTION SYSTEM Patent

An improved fluid actuating system for imparting motion to a body such as a spacecraft is disclosed. The fluid actuating system consists of a fluid mass that may be controllably accelerated through at least one fluid path whereby an opposite acceleration is experienced by the spacecraft. For full control of the spacecraft’s orientation, the system would include a plurality of fluid paths. The fluid paths may be circular or irregular, and the fluid paths may be located on the interior or exterior of the spacecraft.
N91-27504* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.

VARIABLE ORIFICE FLOW REGULATOR Patent

A flow regulator for high-pressure fluids at elevated temperatures includes a body having a flow passage extending between inlet and outlet openings. First and second orifice members are arranged in the flow passage so at least one of the orifice members can be moved transversely in relation to the flow passage between one operating position where the two orifice openings are aligned for establishing a maximum flow rate of fluids flowing through the flow passage and at least one other operating position in which the two openings are moderately misaligned with one another for establishing a predetermined reduced flow rate of fluids flowing through the flow passage.

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35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

N91-21493* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.

VOLUMETRIC MEASUREMENT OF TANK VOLUME Patent
RICHARD T. WALTER, inventor (to NASA); PAULD. VANBUSKIRK, inventor (to NASA) (Lockheed Engineering and Sciences Co., Houston, TX.), WILLIAM F. WEBER, inventor (to NASA), and RICHARD C. FROEBEL, inventor (to NASA) 26 Mar. 1991 8 p Filed 28 Dec. 1989 Supersedes N91-13683 (29-5, p 663)

A method is disclosed for determining the volume of compressible gas in a system including incompressible substances in a zero-gravity environment consisting of measuring the change in pressure (delta P) for a known volume change rate (delta V/delta t) in the polytrophic region between isothermal and adiabatic conditions. The measurements are utilized in an idealized formula for determining the change in isothermal pressure (delta P sub iso) for the gas. From the isothermal pressure change (delta iso) the gas volume is obtained. The method is also applicable to determination of gas volume by utilizing work (W) in the compression process. In a passive system, the relationship of specific densities can be obtained.

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N91-31596* National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.

METHOD AND APPARATUS FOR DETECTING LAMINAR FLOW SEPARATION AND REATTACHMENT Patent

The invention is a method and apparatus for simultaneously detecting laminar separation and reattachment of a fluid stream such as an airstream from and to the upper surface of an airfoil by simultaneously sensing and comparing a plurality of output signals. Each signal represents the dynamic shear stress at one of an equal number of sensors spaced along a straight line on the surface of the airfoil that extends parallel to the airstream. The output signals are simultaneously compared to detect the sensors across which a reversal in phase of said output signal occurs, said detected sensors being in the region of laminar separation or reattachment.

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**FLEXIBLE DIAPHRAGM-EXTREME TEMPERATURE USAGE Patent**


A diaphragm suitable for extreme temperature usage, such as encountered in critical aerospace applications, is fabricated by a unique method, and of a unique combination of materials. The materials include multilayered lay-ups of diaphragm materials sandwiched between layers of bleeder fabrics. After being formed in the desired shape on a mold, they are vacuum sealed and then cured under pressure, in a heated autoclave. A bond capable of withstanding extreme temperatures are produced.

**WET ATMOSPHERIC GENERATION APPARATUS Patent**

RICHARD M. HAMNER, inventor (to NASA) (Teledyne Brown Engineering, Huntsville, AL.) and JANICE K. ALLEN, inventor (to NASA) 20 Mar. 1990 7 p Filed 12 Dec. 1988


The invention described relates to an apparatus for providing a selectively humidified gas to a camera canister containing cameras and film used in space. A source of pressurized gas (leak test gas or motive gas) is selected by a valve, regulated to a desired pressure by a regulator, and routed through an ejector (venturi device). A regulated source of water vapor in the form of steam from a heated reservoir is coupled to a low pressure region of the ejector which mixes with high velocity gas flow through the ejector. This mixture is sampled by a dew point sensor to obtain dew point thereof (ratio of water vapor to gas) and the apparatus adjusted by varying gas pressure or water vapor to provide a mixture at a connector having selected humidity content.

**TANK GAUGING APPARATUS AND METHOD Patent**


Apparatus for gauging the amount of liquid in a container and the volume of gas in the container. Gas from the accumulator may be communicated into the container in a similar process as a verification of the gauging of the liquid volume, or as an independent process for determining the volume of liquid in the container.
A method of making a plug-type heat flux gauge in a material specimen in which a thermoplug is integrally formed in the specimen is disclosed. The thermoplug and concentric annulus are formed in the material specimen by electrical discharge machining and trepanning procedures. The thermoplug is surrounded by a concentric annulus through which thermocouple wires are routed. The end of each thermocouple wire is welded to the thermoplug, with each thermocouple wire welded at a different location along the length of the thermoplug.

A two dimensional vernier scale is disclosed utilizing a cartesian grid on one plate member with a polar grid on an overlying transparent plate member. The polar grid has multiple concentric circles at a fractional spacing of the spacing of the cartesian grid lines. By locating the center of the polar grid on a location on the cartesian grid, interpolation can be made of both the X and Y fractional relationship to the cartesian grid by noting which circles coincide with a cartesian grid line for the X and Y direction.

A radiation sensitive area detection device for use in conjunction with an X ray, ultraviolet or other radiation source is provided which comprises a phosphor containing film which releases a stored diffraction pattern image in response to incoming light or other electromagnetic wave. A light source such as a helium-neon laser, an optical fiber capable of directing light from the laser source onto the phosphor film and also capable of channelling the fluoresced light from the phosphor film to an integrating sphere which directs the light to a signal processing means including a light receiving means such as a photomultiplier tube. The signal processing means allows translation of the fluoresced light in order to detect the original pattern caused by the diffraction of the radiation by the original sample. The optical fiber is retained directly in front of the phosphor screen by a thin metal holder which moves up and down across the phosphor screen and which features a replaceable pinhole which allows easy adjustment of the resolution of the light projected onto the phosphor film. The device produces near real time images with high spatial resolution and without the distortion that accompanies
prior art devices employing photomultiplier tubes. A method is also provided for carrying out radiation area detection using the device of the invention.

NASA

N91-27522* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, MD.
VISUAL AID FOR THE HEARING IMPAIRED Patent
MURZBAN D. JHABVALA, inventor (to NASA) and HUNG C. LIN, inventor (to NASA) (Maryland Univ., College Park.) 2 Jul. 1991 14 p Filed 9 Jun. 1989

A multichannel electronic visual aid device which is able to signal to the user whether sound is coming from the left or right, front or back, or both is presented. For the plurality of channels, which may operate in pairs, the sound is picked up by a respective microphone and amplified and rectified into a DC voltage. The DC voltage is next fed to an analog to digital converter and then to a digital encoder. The binary code from the encoder is coupled into a logic circuit where the binary code is decoded to provide a plurality of output levels which are used to drive an indicator which, in turn, provides a visual indication of the sound level received. The binary codes for each pair of channels are also fed into a digital comparator. The output of the comparator is used to enable the logic circuits of the two channels such that if, for example, the signal coming from the right is louder than that coming from the left, the output of the logic unit of the right channel will be enabled and the corresponding indicator activated, indicating the sound source on the right. An indication of the loudness is also provided. One embodiment of the invention may be carried by the hearing impaired or deaf, as a system which is embedded into eye glasses or a cap. Another embodiment of the invention may be integrated with a vehicle to give a hearing impaired or deaf driver a warning, with a directional indication, that an emergency vehicle is in the vicinity. In this second embodiment, the emergency vehicle transmits a radio frequency signal which would be used as an enabling signal for the visual aid device to avoid false alarms from traffic and other sound sources in the vicinity of the driver’s vehicle.

NASA

N91-28546*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
PRESSURE TRANSDUCER AND SYSTEM FOR CRYOGENIC ENVIRONMENTS Patent Application
JOHN J. CHAPMAN, inventor (to NASA) 23 Apr. 1991 31 p

A silicon pressure die is bonded to a borosilicate substrate above the pneumatic port. A Wheatstone bridge circuit is formed on the silicon pressure die and has bridge elements of silicon doped with boron to a deposit density level of approximately 1 x 10(exp 19)-10(exp 21) boron/cm. A current source is provided to excite the Wheatstone bridge circuit. In addition, a temperature sensor is provided to provide temperature readings. An array may be formed of the resulting pressure transducers. This unique solution of materials permits operation of a pressure transducer in cryogenic environments.

NASA
A plug-type heat flux gauge formed in a material specimen and having a thermoplug integrally formed in the material specimen, and a method for making the same are disclosed. The thermoplug is surrounded by a concentric annulus, through which thermocouple wires are routed. The end of each thermocouple wire is welded to the thermoplug, with each thermocouple wire welded at a different location along the length of the thermoplug. The thermoplug and concentric annulus may be formed in the material specimen by electrical discharge machining and trepanning procedures.

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Includes parametric amplifiers.

N91-25392* National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
SYNCHRONOUS STROBE APPARATUS FOR FLOW VISUALIZATION Patent Application
JOHN M. FRANKE, inventor (to NASA), STEPHEN B. JONES, inventor (to NASA), BRADLEY D. LEIGHTY, inventor (to NASA), and DAVID B. RHODES, inventor (to NASA) 6 May 1991 22 p (NASA-CASE-LAR-14556-1; NAS 1.71 :LAR-14556-1; US-PATENT-APPL-SN-699289) Avail: NTIS HC/MF A03 CSCL 20E

The present invention relates generally to flow visualization and, more specifically, to a strobbed laser light curtain used for wind tunnel testing of rotating bodies. A laser produces a continuous beam which is strobbed by a Bragg cell. The strobbed beam is converted into a laser light curtain by an optics package. A synchronizing circuit provides an output signal to a Bragg cell driver which is coupled to the Bragg cell. The synchronizing circuit allows the user to set the pulsed duration of the strobe, the number of strobes per revolution, and the delay. The invention is particularly useful in wind tunnel testing of rotating blades, but could also be used for measuring other periodic motions.

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an acceptable tuning of the wavelength while avoiding a decrease in optical quality associated with conventional filters wherein the respective plate thicknesses are integral multiples of the thinnest plate.
A method is disclosed for determining the frequency shift in a laser system by transmitting an outgoing laser beam. An incoming laser beam having a frequency shift is received. A first signal is acquired by transmitting a portion of the incoming laser beam to an energy monitor detector. A second signal is acquired by transmitting a portion of the incoming laser beam through an edge filter to an edge detector, which derives a first normalized signal which is proportional to the transmission of the edge filter at the frequency of the incoming laser beam. A second normalized signal is acquired which is proportional to the transmission of the edge filter at the frequency of the outgoing laser beam. The frequency shift is determined by processing the first and second normalized signals.

NASA

This invention relates to surface emitting semiconductor lasers (SELs), with integrated 45 deg. beam deflectors. A SEL is formed on a wafer including vertical mirrors and 45 deg. beam deflectors formed in grooves by tilted ion beam etching. A SEL is a lattice matched, or unstrained, AlGaAs/GaAs GRINSCH SQW SEL. An alternate embodiment is shown, in which a SEL is lattice mismatched, strained or pseudomorphic, or InGaAs/AlGaAs GRINSCH SQW SEL which emits radiation at a wavelength to which its substrate is transparent. Both SELs exhibit high output power, low threshold current density, and relatively high efficiency, and each are processing compatible with conventional large scale integration technology. Such SELs may be fabricated in large numbers from single wafers. The novel features of this invention include the use of tilted ion beam etching to form a pair of grooves each including vertical mirrors and 45 deg. beam deflectors. The embodiment provides substantial circuit design flexibility because radiation may be coupled both up and/or down through the substrate.
The invention, a single element magnetic suspension actuator with bidirectional force capability along a single axis, includes an electromagnet and a nonmagnetic suspended element. A permanent magnet mounted on the suspended element interacts with a magnetic field established by the electromagnet to produce bidirectional forces in response to a variable force command voltage $V_{FC}$ applied to the electromagnet. A sensor measures the position of the suspended element on the single axis which is a function of force command voltage $V_{FC}$.

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A fully articulated four-point bend loading fixture for Modulus of Rupture (MOR) and fracture toughness specimens utilizes an upper loading plate in combination with a lower loading plate. The lower plate has a pair of spring loaded ball bearings which seat in V-shaped grooves located in the upper plate. The ball bearings are carried in the arms of the lower plate. A load is applied to the specimen through steel rollers, one large roller and one smaller roller each located on both the upper and lower plates. The large rollers have needle roller bearings which enable a single loading roller to rotate relative to the plate to which it is attached.

Official Gazette of the U.S. Patent and Trademark Office
METHOD AND APPARATUS FOR POSITIONING A ROBOTIC END EFFECTOR Patent


A robotic end effector and operation protocol for a reliable grasp of a target object irrespective of the target's contours is disclosed. A robotic hand includes a plurality of jointed fingers, one of which, like a thumb, is in opposed relation to the other. Each finger is comprised of at least two jointed sections, and provided with reflective proximity sensors, one on the inner surface of each finger section. Each proximity sensor comprises a transmitter of a beam of radiant energy and means for receiving reflections of the transmitted energy when reflected by a target object and for generating electrical signals responsive thereto. On the fingers opposed to the thumb, the proximity sensors on the outermost finger sections are aligned in an outer sensor array and the sensors on the intermediate finger sections and sensors on the innermost finger sections are similarly arranged to form an intermediate sensor array and an inner sensor array, respectively. The invention includes a computer system with software and/or circuitry for a protocol comprising the steps in sequence of: (1) approach axis alignment to maximize the number of outer layer sensors which detect the target; (2) non-contact contour following the target by the robot fingers to minimize target escape potential; and (3) closing to rigidize the target including dynamically re-adjusting the end effector finger alignment to compensate for target motion. A signal conditioning circuit and gain adjustment means are included to maintain the dynamic range of low power reflection signals.

METHOD AND APPARATUS FOR CONFIGURATION CONTROL OF REDUNDANT ROBOTS Patent


A method and apparatus to control a robot or manipulator configuration over the entire motion based on augmentation of...
the manipulator forward kinematics is disclosed. A set of kinematic functions is defined in Cartesian or joint space to reflect the desirable configuration that will be achieved in addition to the specified end-effector motion. The user-defined kinematic functions and the end-effector Cartesian coordinates are combined to form a set of task-related configuration variables as generalized coordinates for the manipulator. A task-based adaptive scheme is then utilized to directly control the configuration variables so as to achieve tracking of some desired reference trajectories throughout the robot motion. This accomplishes the basic task of desired end-effector motion, while utilizing the redundancy to achieve any additional task through the desired time variation of the kinematic functions. The present invention can also be used for optimization of any kinematic objective function, or for satisfaction of a set of kinematic inequality constraints, as in an obstacle avoidance problem. In contrast to pseudoinverse-based methods, the configuration control scheme ensures cyclic motion of the manipulator, which is an essential requirement for repetitive operations. The control law is simple and computationally very fast, and does not require either the complex manipulator dynamic model or the complicated inverse kinematic transformation. The configuration control scheme can alternatively be implemented in joint space.

A sample filter holder is disclosed for use with a microscope for holding the filter in a planar condition on the stage of the microscope so that automatic focusing of the microscope can be performed on particle samples dispersed on the filter. The holder includes a base having a screen positioned on its top surface and secured to the disk at the peripheral edge of the screen. Small bores allow the outer surface of the screen to communicate with the well. The filter is placed on the screen and is held in a flat disposition by the suction forces.

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An electromagnetic attachment mechanism is disclosed for use as an end effector of a remote manipulator system. A pair of electromagnets, each with a U-shaped magnetic core with a pull-in coil and two holding coils are mounted by a spring suspension system on a base plate of the mechanism housing with end pole pieces adapted to move through openings in the base plate when the attractive force of the electromagnets is exerted on a strike plate of a grapple fixture affixed to a target object. The pole pieces are spaced by an air gap from the strike plate when the mechanism first contacts the grapple fixture. An individual control circuit and power source is provided for the pull-in coil and one holding coil of each electromagnet. A back-up control circuit connected to the two power sources and a third power source is provided for the remaining holding coils. When energized, the pull-in coils overcome the suspension system and air gap and are automatically de-energized when the pole pieces move to grapple and impose a preload force across the grapple interface. A battery backup is a redundant power source for each electromagnet in each individual control circuit and is automatically connected upon failure of the primary source. A centerline mounted camera and video monitor are used in cooperation with a target...
A metallic threaded composite fastener, particularly suited for high temperature applications, has a body member made of high temperature resistant composite material with a ceramic coating. The body member has a head portion configured to be installed in a countersunk hole and a shank portion which is noncircular and tapered. One part of the shank may be noncircular and the other part tapered, or the two types of surface could be combined into a frustum of a noncircular cone. A split collar member made of high strength, high temperature tolerant metal alloy is split into two halves and the interior of the halves are configured to engage the shank. The exterior of the collar has a circumferential groove which receives a lock ring to secure the collar halves to the shank. In the assembled condition torque may be transmitted from the body to the split collar by the engaged noncircular portions to install and remove the fastener assembly into or from a threaded aperture and shear loads in the collar threads are transferred to the shank tapered portion as a combination of radial compression and axial tension loads. Thus, tension loads may be applied to the fastener shank without damaging the ceramic coating.
permanently attached by a telescoping assembly to one of the devices; and the structure can be used as a pulling device for removing annular bearings or the like from blind bores.

**METHOD AND APPARATUS FOR RELEASABLY CONNECTING FIRST AND SECOND OBJECTS** Patent Application


The apparatus and method are disclosed for releasably connecting first and second objects, where a magnetic end effector may include at least one elongated pin number, a proximal end of which is connected to the first object and the distal end of which may be inserted into a receiving portion in the second object. Latch members are carried by the pin member for radial movement between retracted and expanded positions for releasing and locking, respectively, first and second objects. A plunger member carried by the pin member is axially moveable between first and second positions. In the first plunger position, the latch members are located in the expanded (locked) position and in the second plunger position the latch members are released for movement to retracted or unlocked position. The magnetic end effector is provided for releasable attachment to the first object and for moving the plunger member to the second position, releasing the first object.

**PRESSURE VESSEL FLEX JOINT** Patent Application


An airtight, flexible joint is disclosed for the interfacing of two pressure vessels such as between the Space Station docking tunnel and the Space Shuttle Orbiter bulkhead adapter. The joint provides for flexibility while still retaining a structural link between the two vessels required due to the loading created by the internal/external pressure differential. The joint design provides for limiting the axial load carried across the joint to a specific value, a function returned in the Orbiter/Station tunnel interface. The flex joint comprises a floating structural segment which is permanently attached to one of the pressure vessels through the use of an inflatable seal. The geometric configuration of the joint causes the tension between the vessels created by the internal gas pressure to compress the inflatable seal. The inflation pressure of the seal is kept at a value above the internal/external pressure differential of the vessels in order to maintain a controlled distance between the floating segment and pressure vessel. The inflatable seal consists of either a hollow torus-shaped flexible bladder or two rolling convoluted diaphragm seals which may be reinforced by a system of straps or fabric anchored to the hard structures. The joint acts as a flexible link to allow both angular motion and lateral displacement while it still contains the internal pressure and holds the axial tension between the vessels.

**DOUBLE FACE SEALING DEVICE** Patent Application


A double face sealing device is disclosed for mounting between two surfaces to provide an air-tight and fluid-tight seal between a closure member bearing one of the surfaces and a structure or housing bearing the other surface which extends around the opening or hatchway to be closed. The double face sealing device includes a plurality of sections or segments mounted to one of the surfaces, each having a main body portion, a pair of outwardly extending and diverging, cantilever, spring arms, and a pair of inwardly extending and diverging, cantilever, spring arms,
an elastomeric cover on the distal, free ends of the outwardly extending and diverging spring arms, and an elastomeric cover on the distal, free, ends of the outwardly extending and diverging spring arms, and an elastomeric cover on the distal, free ends of the inwardly extending and diverging spring arms. The double face sealing device has application or use in all environments requiring a seal, but is particularly useful to seal openings or hatchways between compartments of spacecraft or aircraft.

A hand hold utilizes joining means which comprises two different mounting brackets that are permanently fastened to a supporting structure. An alignment/capture bracket is disposed at one end of the hand rail or hand hold which mates with one of the mounting brackets. A securing bracket is disposed at the opposite end of the hand rail/hand hold which connects with the other mounting bracket by means of a locking device. The alignment/capture bracket has a central tapered tongue with two matching slots disposed on each side.

This device seals the sliding interfaces between structural panels that are roughly perpendicular to each other or whose edges are butted against one another. The nonuniformity of the gap between the panels requires significant flexibility along the seal length. The seal is mounted in a rectangular groove in a movable structural panel. A plurality of particles or balls is densely packed in an outer sheathing. The balls are laterally preloaded to maintain sealing contact with the adjacent wall using a pressurized linear bellows. Distortions in the adjacent panel are accommodated by rearrangement of the particles within the outer sheathing. Leakage through the seal is minimized by densely compacting the internal particles and by maintaining positive preload along the back side of the seal. The braid architecture of the outer sheathing is selected to minimize leakage through the seal and to resist mechanical abrasion.
presented. The clamp has a sliding bolt that provides a latching mechanism. The bolt is moved by a handle that tends to remain in an engaged position while under tension.

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WET SPINNING OF SOLID POLYAMIC ACID FIBERS Patent
WILLIAM E. DOROGY, JR., inventor (to NASA) and ANNE K. ST.CLAIR, inventor (to NASA) 11 Jun. 1991 9 p Filed 26 Jun. 1990

The invention is a process for the production of solid aromatic polyamic acid and polyimide fibers from a wet gel or coagulation bath gel using N,N-dimethylacetamide (DMAc) solutions of the polyamic acid derived from aromatic dianhydrides such as 3,3',4,4' benzophenonetetra carboxylic dianhydride (BTDA) and aromatic diamines such as 4,4'-oxydianiline (4,4'-ODA). By utilizing the relationship among coagulation medium and concentration, resin inherent viscosity, resin percent solids, filament diameter, and fiber void content, it is possible to make improved polyamic acid fibers. Solid polyimide fibers, obtained by the thermal cyclization of the polyamic acid precursor, have increased tensile properties compared to fibers containing macro pores from the same resin system.

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IMPROVED SUPERCONDUCTING BEARINGS Patent Application
YURY FLOM, inventor (to NASA) and JAMES D. ROYSTON, inventor (to NASA) 17 Apr. 1991 24 p

An improved superconducting bearing is presented. Rotor is confined within two superconducting circular bearing structures, each of which has a number of embedded heating elements, and will levitate rotor which has embedded magnets in its end. Heating elements are connected to a feedback control unit, as are rotor position sensors. The temperature profiles of each circular bearing structure is then adjusted according to the information on rotor position provided to control unit by position sensors. Novelty is believed to reside in providing a superconducting circular bearing structure allowing for a control of the levitating forces.

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ROLLER LOCKING BRAKE Patent Application
JOHN M. VRANISH, inventor (to NASA) 28 Mar. 1991 17 p

A roller locking brake structure includes a roller locking/lifting ring, a housing, a set of conical locking rollers, a striker ring, and a drive disc. The roller locking/lifting ring includes respective V-shaped locking cam surface segments for each locking roller which is in the form of a truncated cone and provides a force and torque reaction surface for forces and torques generated in the braking process as well as providing a channel for a magnetic coil and flux return path of a magnetic circuit used to release a conical roller when the brake is off. The locking conical rollers couple the ring to the rim surfaces of the drive disc which provides another cam surface. The striker ring is located adjacent the rollers and is pulled down against the small end of the rollers by an
electromagnetic coil when energized to decouple the locking rollers from the drive disc and thus cease the braking action.

A rolling joint is provided for obtaining slewing maneuvers for various apparatus including space structures, space vehicles, robotic manipulators and simulators. Two noncircular cylinders, namely a drive and a driven cylinder, are provided in driving contact with one another. This contact is maintained by two pairs of generally S-shaped bands, each pair forming a generally 8-shaped coupling tightly about the circumferential periphery of the noncircular drive and driven cylinders. A stationarily fixed arm extends between and is rotably journaled with a drive axle and a spindle axle respectively extending through selected rotational points of the drive cylinder and of the driven cylinder. The noncircular cylinders are profiled to obtain the desired varying gear ratio. The novelty of the present invention resides in using specifically profiled noncircular cylinders to obtain a desired varying gear ratio.

The invention consists of a locking spline payload fastener comprised of a spring-loaded male spline nut located at the tip of a threaded male positioning member that is affixed to a body being fastened. A complimentary female type spline fitting adapted to engage the spline nut is located at the lower end of a female conical receiving member which is affixed to a receiving body to which the payload body is being fastened. During a fastening guidance and mating procedure, the male nut and female spline fitting are aligned in a soft docking phase which is followed by a forward movement of the spline nut against and into the female spline fitting. This is then followed by a rotation of the male spline nut into a locking arrangement with the female spline fitting. To release the fastener, the process is reversed. Novelty is believed to reside in the concept of a self aligning spline system including a threaded male spline nut which upon engaging a female spline fitting, travels up a driven threaded shank to effect a locking operation.

The primary object of the present invention is to provide a simple, reliable, and lightweight coupling that will also have an efficient thermal interface. A further object of the invention is to provide a coupling that is capable of blind mate with little or no insertion forces. Another object of the invention is to provide a coupling that acts as a thermal regulator to maintain a constant temperature on one side of the coupling. A still further object of the invention is to increase the available surface area of a coupling thus providing a larger area for the conduction of heat across the thermal interface. Another object of the invention is to provide a
fluidic coupling that has no fluid passing across the interface, thus reducing the likelihood of leaks and contamination. The foregoing objects are achieved by utilizing, as in the prior art, a hot area (at an elevated temperature as compared to a cold area) with a need to remove excess heat from the hot area to a cold area. In this device, the thermal interface will occur not on a planar horizontal surface, but along a non-planar vertical surface, which will reduce the reaction forces and increase the thermal conductivity of the device. One non-planar surface is a surface on a cold pin extending from the cold area and the other non-planar surface is a surface on a hot pin extending from the hot area. The cold pin is fixed and does not move while the hot pin is a flexible member and its movement towards the cold pin will bring the two non-planar surfaces together forming the thermal interface. The actuating member for my device is a shape-memory actuation wire which is attached through an aperture to the hot pin and through another aperture to an actuation wire retainer. By properly programming the actuation wire, heat from the hot area will cause the actuation wire to bend the hot wire towards the cold pin forming the coupling and desired thermal interface. The shape-memory actuation wire is made of a shape-memory-effect alloy such as Nitinol.
A coupling device is disclosed which is mechanically two fault tolerant for release. The device comprises a fastener plate and fastener body, each of which is attachable to a different one of a pair of structures to be joined. The fastener plate and body are coupled by an elongate toggle mounted at one end in a socket on the fastener plate for universal pivotal movement thereon. The other end of the toggle is received in an opening in the fastener body and adapted for limited pivotal movement therein. The toggle is adapted to be restrained by three latch hooks arranged in symmetrical equiangular spacing about the axis of the toggle, each hook being mounted on the fastener body for pivotal movement between an unlatching non-contact position with respect to the toggle and a latching position in engagement with a latching surface of the toggle. The device includes releasable lock means for locking each latch hook in its latching position whereby the toggle couples the fastener plate to the fastener body and means for releasing the lock means to unlock each said latch hook from the latch position whereby the unlocking of at least one of the latch hooks from its latching position results in the decoupling of the fastener plate from the fastener body.

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interface by pretested complex tasks sequences based on sequences of parameterized task primitives combined with further teleoperation and run-time binding of parameters based on task context.

37 MECHANICAL ENGINEERING

N91-32510* National Aeronautics and Space Administration. Pasadena Office, CA.
A GENERALIZED COMPLIANT MOTION PRIMITIVE
Patent Application
(Contract NAS7-918)

This invention relates to a general primitive for controlling a telerobot with a set of input parameters. The primitive includes a trajectory generator; a teleoperation sensor; a joint limit generator; a force setpoint generator; a dither function generator, which produces telerobot motion inputs in a common coordinate frame for simultaneous combination in sensor summers. Virtual return spring motion input is provided by a restoration spring subsystem. The novel features of this invention include use of a single general motion primitive at a remote site to permit the shared and supervisory control of the robot manipulator to perform tasks via a remotely transferred input parameter set.

N91-32514* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.
BIDIRECTIONAL DRIVE AND BRAKE MECHANISM
Patent

A space transport vehicle is disclosed as including a body which is arranged to be movably mounted on an elongated guide member disposed in outer space and driven therealong. A drive wheel is mounted on a drive shaft and arranged to be positioned in rolling engagement with the elongated guide carrying the vehicle. A brake member is arranged on the drive shaft for movement into and out of engagement with an adjacent surface of the drive wheel. An actuator is mounted on the body to be manually moved back and forth between spaced positions in an...
arc of movement. A ratchet-and-pawl mechanism is arranged to operate upon movements of the actuator in one direction between first and second positions for coupling the actuator to the drive wheel to incrementally rotate the wheel in one rotational direction and to operate upon movements of the actuator in the opposite direction for uncoupling the actuator from the wheel. The brake member is threadedly coupled to the drive shaft in order that the brake member will be operated only when the actuator is moved on beyond its first and second positions for shifting the brake member along the drive shaft and into frictional engagement with the adjacent surface on the drive wheel.

A gamma ray collimator including a housing having first and second sections is disclosed. The first section encloses a first section of depleted uranium which is disposed for receiving and supporting a radiation emitting component such as cobalt 60. The second section encloses a depleted uranium member which is provided with a conical cut out focusing portion disposed in communication with the radiation emitting element for focusing the emitted radiation to the target.

Topographical terrain models are generated by digitally delineating the boundary of the region under investigation from
the data obtained from an airborne synthetic aperture radar image and surface elevation data concurrently acquired either from an airborne instrument or at ground level. A set of coregistered boundary maps thus generated are then digitally combined in three dimensional space with the acquired surface elevation data by means of image processing software stored in a digital computer.

The method is particularly applicable for generating terrain models of flooded regions covered entirely or in part by foliage.

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A plurality of heat pipes in a shell receive concentrated solar energy and transfer the energy to a heat activated system. To provide for even distribution of the energy despite uneven impingement of solar energy on the heat pipes, absence of solar energy at times, or failure of one or more of the heat pipes, energy storage means are disposed on the heat pipes which extend through a heat pipe thermal coupling means into the heat activated device. To enhance energy transfer to the heat activated device, the heat pipe coupling cavity means may be provided with extensions into the device. For use with a Stirling engine having passages for working gas, heat transfer members may be positioned to contact the gas and the heat pipes. The shell may be divided into sections by transverse walls. To prevent cavity working fluid from collecting in the extensions, a porous body is positioned in the cavity.

NASA
A method is disclosed for determining Richardson Number, $R_i$, or its reciprocal, $R_{1i}$, for clear air prediction using measured potential temperature and determining the vertical gradient of potential temperature, $d(\theta)/dz$. Wind vector from the aircraft instrumentation versus potential temperature, $dW/d(\theta)$, is determined and multiplies by $d(\theta)/dz$ to obtain $dW/dz$. Richardson number or its reciprocal is then determined from the relationship $R_i = K(d(\theta)/dz \div (dW/dz)^2)$ for use in detecting a trend toward a threshold value for the purpose of predicting clear air turbulence. Other equations for this basic relationship are disclosed together with the combination of other atmospheric observables using multiple regression techniques.
permits recharging of the nutrients and pH adjustment. Oxygen is supplied and carbon dioxide and bubbles are removed and the system is monitored and controlled by a microprocessor.

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inexpensively and repeatedly regenerating the ion-exchange bed in situ.
BIOFILM MONITORING COUPON SYSTEM AND METHOD OF USE Patent

An apparatus and method is disclosed for biofilm monitoring of a water distribution system which includes the mounting of at least one fitting in a wall port of a manifold in the water distribution system with a passage through the fitting in communication. The insertion of a biofilm sampling member is through the fitting with planar sampling surfaces of different surfaces. Treatment provided on linearly arrayed sample coupons of the sampling member disposed in the flow stream in edge-on parallel relation to the direction of the flow stream of the manifold under fluid-tight sealed conditions. The sampling member is adapted to be aseptically removed from or inserted in the fitting and manifold under fluid-tight sealed conditions. The sampling member is adapted to be aseptically removed from or inserted in the fitting and manifold under a positive pressure condition and the fitting passage sealed immediately thereafter by appropriate closure means so as to preclude contamination of the water distribution system through the fitting. The apparatus includes means for clamping the sampling member and for establishing electrical continuity between the sampling surfaces and the system for minimizing electropotential effects. The apparatus may also include a plurality of fittings and sampling members mounted on the manifold to permit extraction of the sampling members in a timed sequence throughout the monitoring period.

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ANOMIC ORGANS Patent Application

A device is disclosed for removing foreign objects from anatomic organs such as the ear canal or throat. It has a housing shaped like a flashlight, an electrical power source such as a battery or AC power from a wall socket, and a tip extending from the housing. The tip has at least one wire loop made from a shape-memory-effect alloy such as Nitinol switchably connected to the electrical power source such that when electric current flows through the wire loop the wire loop heats up and returns to a previously programmed shape such as a curet or tweezers so as to facilitate removal of the foreign object.
for flexibility holding and supporting a person in a substantially upright position when the user sags in the frame when taking weight off the lower extremities.

The principal objective is to provide a training procedure for a feed forward, back propagation neural network which greatly accelerates the training process. A set of orthogonal singular vectors are determined from the input matrix such that the standard deviations of the projections of the input vectors along these singular vectors, as a set, are substantially maximized, thus providing an optimal means of presenting the input data. Novelty exists in the method of extracting from the set of input data, a set of features which can serve to represent the input data in a simplified manner, thus greatly reducing the time/expense to training the system.
A method and apparatus are disclosed for collection of fecal matter designed to operate efficiently in zero gravity environment. The system comprises a waste collection area within a body having a seat opening. Low pressure within a waste collection area directs fecal matter away from the user's buttocks and prevents the escape of undesirable gases. The user actuates a piston covered with an absorbent pad that sweeps through the waste collection area, press the waste against an end of the waste collection area and retracts, leaving the used pad. Multiple pads are provided on the piston to accommodate multiple uses of the system. Also a valve allows air to be drawn through the body, which valve will not be plugged with fecal matter. A sheet feeder feeds fresh sheets of absorbent pad to a face of the piston with each actuation.

A prosthetic device has been developed for below-the-elbow amputees. The device consists of a cuff, a stem, a housing, two hook-like fingers, an elastic band for holding the fingers together, and a brace. The fingers are pivotally mounted on a housing that is secured to the amputee's upper arm with the brace. The stem, which also contains a cam, is rotationally mounted within the housing and is secured to the cuff, which fits over the amputee's stump. By rotating the cammed stem between the fingers with the lower arm, the amputee can open and close the fingers.

A life support system is disclosed for human habitation (cabin) which has a bioregenerative capability through the use of a plant habitat (greenhouse) whereby oxygen-rich air from the greenhouse is processed and used in the cabin and carbon dioxide-rich air from the cabin is used in the greenhouse. Moisture from the air of both cabin and greenhouse is processed and reused in both. Wash water from the cabin is processed and reused in the cabin as hygiene water, and urine from the cabin is processed and used in the greenhouse. Spent water from the greenhouse is processed and reused in the greenhouse. Portions of the processing cycles are separated between cabin and greenhouse in order to reduce to a minimum cross contamination of the two habitat systems. Other portions of the processing cycles are common to both cabin and greenhouse. The use of bioregenerative techniques permits a substantial reduction of the total consumables used by the life support system.
60 COMPUTER OPERATIONS AND HARDWARE

Includes hardware for computer graphics, firmware, and data processing.

N91-23724** National Aeronautics and Space Administration.
Lyndon B. Johnson Space Center, Houston, TX.

PROGRAMMABLE REMAPPER FOR IMAGE PROCESSING Patent Application
TIM E. FISHER, inventor (to NASA), RICHARD D. JUDAY, inventor (to NASA), and JEFFREY B. SAMPSELL, inventor (to NASA) (Texas Instruments, Inc., Dallas.) 30 Mar. 1989 45 p

A video-rate coordinate remapper includes a memory for storing a plurality of transformations on look-up tables for remapping input images from one coordinate system to another. Such transformations are operator selectable. The remapper includes a collective processor by which certain input pixels of an input image are transformed to a portion of the output image in a many-to-one relationship. The remapper includes an interpolative processor by which the remaining input pixels of the input image are transformed to another portion of the output image in a one-to-many relationship. The invention includes certain specific transforms for creating output images useful for certain defects of visually impaired people. The invention also includes means for shifting input pixels and means for scrolling the output matrix.

N91-3205** National Aeronautics and Space Administration.
Pasadena Office, CA.

HIGHLY PARALLEL COMPUTER ARCHITECTURE FOR ROBOTIC COMPUTATION Patent Application
AMIR FIJANY, inventor (to NASA) and ANTA K. BEJCZY, inventor (to NASA) (Jet Propulsion Lab., California Inst. of Tech., Pasadena.) 10 Jun. 1991 28 p
(Contract NAS 7-918)

In a computer having a large number of single instruction multiple data (SIMD) processors, each of the SIMD processors has two sets of three individual processor elements controlled by a master control unit and interconnected among a plurality of register file units where data is stored. The register files input and output data in synchronism with a minor cycle clock under control of two slave control units controlling the register file units connected to respective ones of the two sets of processor elements. Depending upon which ones of the register file units are enabled to store or transmit data during a particular minor clock cycle, the processor elements within an SIMD processor are connected in rings or in pipeline arrays, and may exchange data with the internal bus or with neighboring SIMD processors through interface units controlled by respective ones of the two slave control units.

N91-31810* National Aeronautics and Space Administration.
Pasadena Office, CA.

ASYMMETRIC SOFT-ERROR RESISTANT MEMORY Patent

A memory system is provided, of the type that includes an error-correcting circuit that detects and corrects, that more efficiently utilizes the capacity of a memory formed of groups of binary cells whose states can be inadvertently switched by ionizing radiation. Each memory cell has an asymmetric geometry, so that ionizing radiation causes a significantly greater probability of errors in one state than in the opposite state (e.g., an erroneous switch from '1' to '0' is far more likely than a switch from '0' to '1'. An asymmetric error correcting coding circuit can be used with the asymmetric memory cells, which requires fewer bits than an efficient symmetric error correcting code.

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N91-25693* National Aeronautics and Space Administration. Pasadena Office, CA.

DYNAMIC RESOURCE ALLOCATION SCHEME FOR DISTRIBUTED HETEROGENEOUS COMPUTER SYSTEMS

Patent

This invention relates to a resource allocation in computer systems, and more particularly, to a method and associated apparatus for shortening response time and improving efficiency of a heterogeneous distributed networked computer system by reallocating the jobs queued up for busy nodes to idle, or less-busy nodes. In accordance with the algorithm (SIDA for short), the load-sharing is initiated by the server device in a manner such that extra overload in not imposed on the system during heavily-loaded conditions. The algorithm employed in the present invention uses a dual-mode, server-initiated approach. Jobs are transferred from heavily burdened nodes (i.e., over a high threshold limit) to low burdened nodes at the initiation of the receiving node when: (1) a job finishes at a node which is burdened below a pre-established threshold level, or (2) a node is idle for a period of time as established by a wakeup timer at the node. The invention uses a combination of the local queue length and the local service rate ratio at each node as the workload indicator.

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63 CYBERNETICS

Includes feedback and control theory, artificial intelligence, robotics and expert systems.

N91-23783* National Aeronautics and Space Administration. Pasadena Office, CA.

OBSTACLE AVOIDANCE FOR REDUNDANT ROBOTS USING CONFIGURATION CONTROL Patent Application

A redundant robot control scheme is provided for avoiding
obstacles in a workspace during the motion of an end effector along a preselected trajectory by stopping motion of the critical point on the robot closest to the obstacle when the distance between is reduced to a predetermined sphere of influence surrounding the obstacle. Algorithms are provided for conveniently determining the critical point and critical distance.

**DRIVEN SHIELDING CAPACITIVE PROXIMITY SENSOR**

Patent Application

JOHN M. VRANISH, inventor (to NASA) and ROBERT L. MCCONNELL, inventor (to NASA) 6 Jun. 1991 12 p

A capacitive proximity sensing element, backed by a reflector driven at the same voltage as and in phase with the sensor, is used to reflect the field lines away from a grounded robot arm towards an intruding object, thus dramatically increasing the sensor's range and sensitivity.

**SYNCHRONIZED COMPUTATIONAL ARCHITECTURE FOR GENERALIZED BILATERAL CONTROL OF ROBOT ARMS**

Patent


A master six degree of freedom Force Reflecting Hand Controller (FRHC) is available at a master site where a received image displays, in essentially real time, a remote robotic manipulator which is being controlled in the corresponding six degree freedom by command signals which are transmitted to the remote site in accordance with the movement of the FRHC at the master site. Software is user-initiated at the master site in order to establish the basic system conditions, and then a physical movement of the FRHC in Cartesian space is reflected at the master site by six absolute numbers that are sensed, translated and computed as a difference signal relative to the earlier position. The change in position is then transmitted in that differential signal form over a high speed synchronized bilateral communication channel which simultaneously returns robot-sensed response information to the master site as forces applied to the FRHC so that the FRHC reflects the feel of what is taking place at the remote site. A system wide clock rate is selected at a sufficiently high rate that the operator at the master site experiences the Force Reflecting operation in real time.

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The invention is a permanent magnet flux-biased magnetic actuator with flux feedback for adjustably suspending an element on a single axis. The magnetic actuator includes a pair of opposing electromagnets and provides bi-directional forces along the single axis to the suspended element. Permanent magnets in flux feedback loops from the opposing electromagnets establish a reference permanent magnet flux-bias to linearize the force characteristics of the electromagnets to extend the linear range of the actuator without the need for continuous bias currents in the electromagnets.

71 ACOUSTICS

Includes sound generation, transmission, and attenuation.

SOUND ATTENUATION APPARATUS Patent

An apparatus is disclosed for reducing acoustic transmission from mechanical or acoustic sources by means of a double wall partition, around its edges, or it may be an integral part of a wall of the partition.
ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure, electron properties, and molecular spectra.

N91-27936* National Aeronautics and Space Administration.
Langley Research Center, Hampton, VA.

SLOW POSITRON BEAM GENERATOR FOR LIFETIME STUDIES Patent

JAG J. SINGH, inventor (to NASA), ABE EFTEKHARI, inventor (to NASA), and TERRY L. ST.CLAIR, inventor (to NASA)
14 May 1991 21 p Filed 31 May 1990

A slow positron beam generator uses a conductive source residing between two test films. Moderator pieces are placed next to the test film on the opposite side of the conductive source. A voltage potential is applied between the moderator pieces and the conductive source. Incident energetic positrons: (1) are emitted from the conductive source; (2) are passed through test film; and (3) isotropically strike moderator pieces before diffusing out of the moderator pieces as slow positrons, respectively. The slow positrons diffusing out of moderator pieces are attracted to the conductive source which is held at an appropriate potential below the moderator pieces. The slow positrons have to pass through the test films before reaching the conductive source. A voltage is adjusted so that the potential difference between the moderator pieces and the conductive source forces the positrons to stop in the test films. Measurable annihilation radiation is emitted from the test film when positrons annihilate (combine) with electrons in the test film.

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FIBER OPTIC SENSING SYSTEM Patent


A fiber optic interferometer utilizes a low coherence light emitting diode (LED) laser as a light source which is filtered and driven at two RF frequencies, high and low, that are specific to the initial length of the resonator chamber. A displacement of a reflecting mirror changes the length traveled by the nonreferencing signal. The low frequency light undergoes destructive interference which reduces the average intensity of the wave while the high frequency light undergoes constructive interference which increases the average intensity of the wave. The ratio of these two intensity measurements is proportional to the displacement incurred.

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NON-MECHANICAL OPTICAL PATH SWITCHING AND ITS APPLICATION TO DUAL BEAM SPECTROSCOPY INCLUDING GAS FILTER CORRELATION RADIOMETRY Patent Application

GLEN W. SACHSE, inventor (to NASA) and LIANG-GUO WANG, inventor (to NASA) (College of William and Mary, Hampton, VA.) 11 Feb. 1991 19 p

A non-mechanical optical switch is provided for alternately switching a monochromatic or quasi-monochromatic light beam along two optical paths. A polarizer polarizes light into a single, e.g., vertical component which is then rapidly modulated into vertical and horizontal components by a polarization modulator. A polarization beam splitter then reflects one of these components along one path and transmits the other along the second path. In the specific application of gas filter correlation radiometry, one

74 OPTICS

Includes light phenomena; and optical devices.

N91-21871* National Aeronautics and Space Administration.
Lewis Research Center, Cleveland, OH.
path is directed through a vacuum cell and one path is directed through a gas correlation cell containing a desired gas. Reflecting mirrors cause these two paths to intersect at a second polarization beam splitter which reflects one component and transmits the other to recombine them into a polarization modulated beam which can be detected by an appropriate single sensor.

NASA

A real time, pre-detection optical dynamic range compression system uses a photorefractive crystal, such as BaTiO3 or LiNbO3, in which light induced scattering from crystal inhomogeneities of the optical input occurs as a nonlinear function of the input intensity. The greater the intensity, the faster random interference gratings are created to scatter the incident light. The unscattered portion of the optical signal is therefore reduced in dynamic range over time. The amount or range of dynamic range compression may be controlled by adjusting the time of application of the unscattered crystal output to the photodetector with regard to the time of application of the optical input to the crystal.

NASA
A method for tracking an object in a sequence of images is described. Such sequence of images may, for example, be a sequence of television frames. The object in the current frame is correlated with the object in the previous frame to obtain the relative location of the object in the two frames. An optical joint transform correlator apparatus is provided to carry out the process. Such joint transform correlator apparatus forms the basis for laser eye surgical apparatus where an image of the fundus of an eyeball is stabilized and forms the basis for the correlator apparatus to track the position of the eyeball caused by involuntary movement. With knowledge of the eyeball position, a surgical laser can be precisely pointed toward a position on the retina.

High-gain MOCVD-grown (metal-organic chemical vapor deposition) AlGaAs/GaAs/AlGaAs n-p-n double heterojunction bipolar transistors (DHBTs) and Darlington phototransistor pairs are provided for use in optical neural networks and other optoelectronic integrated circuit applications. The reduced base doping level used results in effective blockage of Zn out-diffusion, enabling a current gain of 500, higher than most previously reported values for Zn-diffused-base DHBTs. Darlington phototransistor pairs of this material can achieve a current gain of over 6000, which satisfies the gain requirement for optical neural network designs, which advantageously may employ neurons comprising the Darlington phototransistor pairs in series with a light source.

A method and apparatus are disclosed for generation of second-rank tensors using a photorefractive crystal to perform the outer-product between two vectors via four-wave mixing, thereby taking 2n input data to a control n squared output data points. Two orthogonal amplitude modulated coherent vector beams x and y are expanded and then parallel sides of the photorefractive crystal in exact opposition. A beamsplitter is used to direct a coherent pumping beam onto the crystal at an appropriate angle so as to produce a conjugate beam that is the matrix product of the vector beam that propagates in the exact
opposite direction from the pumping beam. The conjugate beam thus separated is the tensor output $xy^*$ (sup T).

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where virtually no phase difference exists between the phase of the reference frequency component and the phase of the reference frequency modulating the light beam.

Official Gazette of the U.S. Patent and Trademark Office
THREE DIMENSIONAL MOIRE PATTERN ALIGNMENT

Patent

RICHARD D. JUDAY, inventor (to NASA) 1 Oct. 1991

An apparatus is disclosed for determining three dimensional positioning relative to a predetermined point utilizing moire interference patterns such that the patterns are complementary when viewed on axis from the predetermined distance. Further, the invention includes means for determining rotational positioning in addition to three dimensional translational positioning.

METHOD AND APPARATUS FOR PHASING SEGMENTED MIRROR ARRAYS Patent Application


The sensitivity model of a complex optical system obtained by linear ray tracing is used to compute a control gain matrix by imposing the mathematical condition for minimizing the total wavefront error at the optical system's exit pupil. The most recent deformations or error states of the controlled segments or optical surfaces of the system are then assembled as an error vector, and the error vector is transformed by the control gain matrix to produce the exact control variables which will minimize the total wavefront error at the exit pupil of the optical system. These exact control variables are then applied to the actuators controlling the various optical surfaces in the system, causing the immediate reduction in total wavefront error observed at the exit pupil of the optical system.

FEEDBACK CONTROLLED OPTICS WITH WAVEFRONT COMPENSATION Patent Application

WILLIAM C. BRECKENRIDGE, inventor (to NASA) and DAVID C. REDDING, inventor (to NASA) (Jet Propulsion Lab., California Inst. of Tech., Pasadena.) 13 May 1991

A method and apparatus are disclosed for edge phasing an array of segments in a segmented primary telescope mirror using white light from a far field source and starting with the inner edge of each segment in the first ring of segments. The segments are individually phased for zero piston and tilt error with respect to the edge of a reference surface in the open center position of the telescope mirror, and proceeding from ring to ring by edge phasing one edge of each segment in each subsequent ring with an edge phased. After edge phasing of all segments in the telescope mirror array has been completed, full surface phasing can be achieved by using a conventional Shack-Hartmann technique followed by finding the RMS best fit for each segment of the mirror array.
An associative optical memory including an input spatial light modulator (SLM) in the form of an edge enhanced liquid crystal light valve (LCLV) and a pair of memory SLMs in the form of liquid crystal televisions (LCTVs) forms a matrix array of an input image which is cross correlated with a matrix array of stored images. The correlation product is detected and non-linearly amplified to illuminate a replica of the stored image array to select the stored image correlating with the input image. The LCLV is edge enhanced by reducing the bias frequency and voltage and rotating its orientation. The edge enhancement and non-linearity of the photodetection improves the orthogonality of the stored image. The illumination of the replicate stored image provides a clean stored image, uncontaminated by the image comparison process.

A spectral imaging system having an integrated filter and photodetector array is disclosed. The filter has narrow transmission bands which vary in frequency along the photodetector array. The frequency variation of the transmission bands is matched to, and aligned with, the frequency variation of a received spectral image. The filter is deposited directly on the photodetector array by a low temperature deposition process. By depositing the filter directly on the photodetector array, permanent alignment is achieved for all temperatures, spectral crosstalk is substantially eliminated, and a high signal to noise ratio is achieved.

A spectral imaging system having an integrated filter and photodetector array is disclosed. The filter has narrow transmission bands which vary in frequency along the photodetector array. The frequency variation of the transmission bands is matched to, and aligned with, the frequency variation of a received spectral image. The filter is deposited directly on the photodetector array by a low temperature deposition process. By depositing the filter directly on the photodetector array, permanent alignment is achieved for all temperatures, spectral crosstalk is substantially eliminated, and a high signal to noise ratio is achieved.

N91-25875* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
PLASMA GUN WITH COAXIAL POWDER FEED AND ADJUSTABLE CATHODE Patent

An improved plasma gun coaxially injects particles of ceramic materials having high melting temperatures into the central portion of a plasma jet. This results in a more uniform and higher temperature and velocity distribution of the sprayed particles. The position of the cathode is adjustable to facilitate optimization of the performance of the gun wherein grains of the ceramic material are melted at lower power input levels.

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N91-32925* National Aeronautics and Space Administration. Pasadena Office, CA.
INTEGRATED FILTER AND DETECTOR ARRAY FOR SPECTRAL IMAGING Patent Application

A spectral imaging system having an integrated filter and photodetector array is disclosed. The filter has narrow transmission bands which vary in frequency along the photodetector array. The frequency variation of the transmission bands is matched to, and aligned with, the frequency variation of a received spectral image. The filter is deposited directly on the photodetector array by a low temperature deposition process. By depositing the filter directly on the photodetector array, permanent alignment is achieved for
Hydrocarbon polymer coatings used in microelectronic manufacturing processes are anisotropically etched by hyperthermal atomic oxygen beams (translational energies of 0.2 to 20 eV, preferably 1 to 10 eV). Etching with hyperthermal oxygen atom species obtains highly anisotropic etching with sharp boundaries between etched and mask protected areas.

N91-2393³# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.
PROTEIN CRYSTAL GROWTH TRAY ASSEMBLY Patent Application

A protein crystal growth tray assembly includes a tray that has a plurality of individual crystal growth chambers. Each chamber has a movable pedestal which carries a protein crystal growth compartment at an upper end. The several pedestals for each tray assembly are ganged together for concurrent movement so that the solutions in the various pedestal growth compartments can be separated from the solutions in the tray's growth chambers until the experiment is to be activated.
PROCESS FOR THE CONTROLLED GROWTH OF SINGLE-CRYSTAL FILMS OF SILICON CARBIDE POLYTYPES ON SILICON CARBIDE WAFERS Patent Application
J. ANTHONY POWELL, inventor (to NASA) 12 Jun. 1991 20 p

This invention is a method for the controlled growth of single-crystal semiconductor device quality films of SiC polytypes on vicinal (0001) SiC wafers with low tilt angles. Both homoepitaxial and heteroepitaxial SiC films can be produced on the same wafer. In particular, 3C-SiC and 6H-SiC films can be produced within selected areas of the same 6H-SiC wafer.

PROCESS FOR THE HOMOEPIТАXIAL GROWTH OF SINGLE-CRYSTAL SILICON CARBIDE FILMS ON SILICON CARBIDE WAFERS Patent Application
J. ANTHONY POWELL, inventor (to NASA) 12 Jun. 1991 20 p

The invention is a method for growing homoepitaxial films of SiC on low tilt angle vicinal (0001) SiC wafers. The invention proposes and teaches a new theoretical model for the homoepitaxial growth of SiC films on (0001) SiC substrates. The inventive method consists of (1) preparing the growth surface of SiC wafers slightly off-axis (from less the 0.1 to 6 deg) from the (0001) plane, (2) subjecting the growth surface to a suitable etch, and then (3) growing the homoepitaxial film using conventional SiC growth techniques.

CRYSTAL GROWTH IN A MICROGRAVITY ENVIRONMENT Patent Application
ROGER L. KROES, inventor (to NASA), DONALD A. REISS, inventor (to NASA), and SANDOR L. LEHOCZKY, inventor (to NASA) 19 Jun. 1991 15 p

Gravitational phenomena, including convection, sedimentation, and interactions of materials with their containers all affect the crystal growth process. If they are not taken into consideration they can have adverse effects on the quantity and quality of crystals produced. As a practical matter, convection, and sedimentation can be completely eliminated only under conditions of low gravity attained during orbital flight. There is, then, an advantage to effecting crystallization in space. In the absence of convection in a microgravity environment cooling proceeds by thermal diffusion from the walls to the center of the solution chamber. This renders control of nucleation difficult. Accordingly, there is a need for a new improved nucleation process in space. Crystals are nucleated by creating a small localized region of high relative supersaturation in a host solution at a lower degree of supersaturation.
Voids in aluminum metallization conductors on a chip are avoided or healed after the chip is subjected to thermal treatment at a high temperature sufficient to allow diffusion of silicon by rapidly cooling the chip, preferably by immersion of the chip in liquid nitrogen.

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Copies of U.S. patents may be purchased directly from the U.S. Patent and Trademark Office, Washington, D.C. 20231 at $1.50 per 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 and Trademarks. Prepaid purchase coupons for ordering are also available from the Patent and Trademark Office.

NASA patent application specifications are sold in paper copy and microfiche by the National Technical Information Service. 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 Associate General Counsel for Intellectual Property, code GP, 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.

STANDING ORDER SUBSCRIPTIONS

NASA SP-7039, Section 1 and its supplements are available from the National Technical Information Service (NTIS) on standing order subscription as PB 92-911100 at the price of $15.00 domestic and $30.00 foreign. Standing order subscriptions do not terminate at the end of a year, as do regular subscriptions, but continue indefinitely unless specifically terminated by the subscriber.
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PATENT LICENSING REGULATIONS

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

14 CFR Part 1245

Licensing of NASA Inventions

AGENCY: National Aeronautics and Space Administration

ACTION: Interim regulation with comments requested.

SUMMARY: The National Aeronautics and Space Administration (NASA) is revising its patent licensing regulations to conform with Pub. L. 96-517. This interim regulation provides policies and procedures applicable to the licensing of federally owned inventions in the custody of the National Aeronautics and Space Administration, and implements Pub. L. 96-517. The object of this subpart is to use the patent system to promote the utilization of inventions arising from NASA supported research and development.

EFFECTIVE DATE: July 1, 1981. Comments must be received in writing by December 2, 1981. Unless a notice is published in the Federal Register after the comment period indicating changes to be made, this interim regulation shall become a final regulation.

ADDRESS: Mr. John G. Mannix, Director of Patent Licensing, GP-4, NASA, Washington, D.C. 20546

FOR FURTHER INFORMATION CONTACT: Mr. John G. Mannix, (202) 755-3954.

SUPPLEMENTARY INFORMATION:

PART 1245—PATENTS AND OTHER INTELLECTUAL PROPERTY RIGHTS

Subpart 2 of Part 1245 is revised to read as follows:

Subpart 2—Licensing of NASA Inventions

Sec. 1245.200 Scope of subpart.
1245.201 Policy and objective.
1245.202 Definitions.
1245.203 Authority to grant licenses.

Restrictions and Conditions
1245.204 All licenses granted under this subpart.

Types of Licenses
1245.205 Nonexclusive licenses.
1245.206 Exclusive and partially exclusive licenses.

Procedures
1245.207 Application for a license.
1245.208 Processing applications.
1245.209 Notice to Attorney General.
1245.210 Modification and termination of licenses.
1245.211 Appeals.
1245.212 Protection and administration of inventions.
1245.213 Transfer of custody.
1245.214 Confidentiality of information.

Authority: 35 U.S.C. Section 207 and 208.94 Stat 3023 and 3024.

Subpart 2—Licensing of NASA Inventions

§ 1245.200 Scope of subpart.

This subpart prescribes the terms, conditions and procedures upon which a NASA invention may be licensed. It does not affect licenses which (a) were in effect prior to July 1, 1981; (b) may exist at the time of the Government’s acquisition of title to the invention, including those resulting from the allocation of rights to inventions made under Government research and development contracts; (c) are the result of an authorized exchange of rights in the settlement of patent disputes; or (d) are otherwise authorized by law or treaty.

§ 1245.201 Policy and objective.

It is the policy and objective of this subpart to use the patent system to promote the utilization of inventions arising from NASA supported research and development.

§ 1245.202 Definitions

(a) "Federal agency" means an executive department, military department, Government corporation, or independent establishment, except the Tennessee Valley Authority, which has custody of a Federally owned invention.

(b) "Federal agency" means an executive department, military department, Government corporation, or independent establishment, except the Tennessee Valley Authority, which has custody of a Federally owned invention.

(c) "NASA Invention" means a Federally owned invention with respect to which NASA maintains custody and administration, in whole or in part, of the right, title or interest in such invention on behalf of the United States Government.

(d) "Small business firm" means a small business concern as defined at section 2 of Pub. L. 85-536 (15 U.S.C. 632) and implementing regulations of the Administrator of the Small Business Administration. For the purpose of these regulations, the size standard for small business concerns involved in Government procurement contained in 13 CFR 121.3-12, and in subcontracting, contained in 13 CFR 121.3-12, will be used.

(e) "Practical application" means to manufacture in the case of a composition or product, to practice in the case of a process or method, or to operate in the case of a machine or system; and, in each case, under such condition, as to establish that the invention is being utilized and that its benefits are to the extent permitted by law or Government regulations available to the public on reasonable terms.

(f) "United States" means the United States of America, its territories and possessions, the District of Columbia, and the Commonwealth of Puerto Rico.

§ 1245.203 Authority to grant licenses.

NASA inventions shall be made available for licensing as deemed appropriate in the public interest. NASA may grant nonexclusive, partially exclusive, or exclusive licenses thereto under this subpart on inventions in its custody.

Restrictions and Conditions

§ 1245.204 All licenses granted under this subpart.

(a) Restrictions. (1) A license may be granted only if the applicant has supplied NASA with a satisfactory plan for development or marketing of the invention, or both, and with information about the applicant’s capability to fulfill the plan.

(2) A license granting rights to use or sell under a NASA invention in the United States shall normally be granted only to a licensee who agrees that any products embodying the invention or produced through the use of the invention will be manufactured substantially in the United States.

(b) Conditions. Licenses shall contain such terms and conditions as NASA determines are appropriate for the protection of the interests of the Federal Government and the public and are not in conflict with law or this subpart. The following terms and conditions apply to any license:

(1) The duration of the license shall be for a period specified in the license agreement, unless sooner terminated in accordance with this subpart.

(2) The license may be granted for all or less than all fields of use of the invention or in specified geographical areas, or both.

(3) The license may extend to subsidiaries of the licensee or other parties if provided for in the license but shall be nonassignable without approval of NASA, except to the successor of that part of the licensee’s business to which the invention pertains.

(4) The license may provide the licensee the right to grant sublicenses under the license, subject to the approval of NASA. Each sublicense shall make reference to the license, including the rights retained by the Government, and a copy of such sublicense shall be furnished to NASA.

(5) The license shall require the licensee to carry out the plan for development or marketing of the invention, or both, to bring the invention to practical application within a period specified in the license, and to continue to make the benefits of the invention reasonably accessible to the public.
PATENT LICENSING REGULATIONS

(6) The license shall require the licensee to report periodically on the utilization or efforts at obtaining utilization that are being made by the licensee, with particular reference to the plan submitted.

(7) All licenses shall normally require royalties or other consideration.

(8) Where an agreement is obtained pursuant to §1245.204(a)(2) that any products embodying the invention or produced through use of the invention will be manufactured substantially in the United States, the license shall recite such agreement.

(9) The license shall provide for the right of NASA to terminate the license, in whole or in part, if:

(i) NASA determines that the licensee is not executing the plan submitted with its request for a license and the licensee cannot otherwise demonstrate to the satisfaction of NASA that it has taken or can be expected to take within a reasonable time effective steps to achieve practical application of the invention;

(ii) NASA determines that such action is necessary to meet requirements for public use specified by Federal regulations issued after the date of the license and such requirements are not reasonably satisfied by the licensee;

(iii) The licensee has willfully made a false statement or willfully omitted a material fact in the license application or in any report required by the license agreement; or

(iv) The licensee commits a substantial breach of a covenant or agreement contained in the license.

(10) The license may be modified or terminated, consistent with this subpart, upon mutual agreement of NASA and the licensee.

(11) Nothing relating to the grant of a license, nor the grant itself, shall be construed to confer upon any person any immunity from or defenses under the antitrust laws or from a charge of patent misuse, and the acquisition and use of rights pursuant to this subpart shall not be immunized from the operation of state or Federal law by reason of the source of the grant.

Types of Licenses

§ 1245.205 Nonexclusive licenses.

(a) Availability of licenses. Nonexclusive licenses may be granted on NASA inventions without publication of availability or notice of a prospective license.

(b) Conditions. In addition to the provisions of §1245.204, the nonexclusive license may also provide that, after termination of a period specified in the license agreement, NASA may restrict the license to the fields of use or geographic areas, or both, in which the licensee has brought the invention to practical application and continues to make the benefits of the invention reasonably accessible to the public. However, such restriction shall be made only in order to grant an exclusive or partially exclusive license in accordance with this subpart.

§ 1245.206 Exclusive and partially exclusive licenses.

(a) Domestic licenses.

(1) Availability of licenses. Exclusive or partially exclusive licenses may be granted on NASA inventions: (i) 3 months after notice of the invention's availability has been announced in the Federal Register; or (ii) without such notice where NASA determines that expeditious granting of such a license will best serve the interests of the Federal Government and the public; and (iii) in either situation, specified in (a)(1)(i) or (ii) of this section only if:

(A) Notice of a prospective license, identifying the invention and the prospective licensee, has been published in the Federal Register, providing opportunity for filing written objections within a 60-day period;

(B) After expiration of the period in §1245.206(a)(1)(iii)(A) and consideration of any written objections received during the period, NASA has determined that:

(1) The interests of the Federal Government and the public will be best served by the proposed license, in view of the applicant's intentions, plans, and ability to bring the invention to practical application or otherwise promote the invention's utilization by the public;

(2) The desired practical application has not been achieved, or is not likely expeditiously to be achieved, under any nonexclusive license which has been granted, or which may be granted, on the invention;

(3) Exclusive or partially exclusive licensing is a reasonable and necessary incentive to call forth the investment of risk capital and expenditures to bring the invention to practical application or otherwise promote the invention's utilization by the public; and

(4) The proposed terms and scope of exclusivity are not greater than reasonably necessary to provide the incentive for bringing the invention to practical application or otherwise promote the invention's utilization by the public;

(C) NASA has not determined that the grant of such license will tend substantially to lessen competition or result in undue concentration in any section of the country in any line of commerce to which the technology to be licensed relates, or to create or maintain other situations inconsistent with antitrust laws; and

(D) NASA has given first preference to any small business firms submitting plans that are determined by the agency to be within the capabilities of the firms and as equally likely, if executed, to bring the invention to practical application as any plans submitted by applicants that are not small business firms.

(ii) NASA determines that such action is necessary to meet requirements for public use specified by Federal regulations issued after the date of the license and such requirements are not reasonably satisfied by the licensee;

(iii) The licensee has willfully made a false statement or willfully omitted a material fact in the license application or in any report required by the license agreement; or

(iv) The licensee commits a substantial breach of a covenant or agreement contained in the license.

(10) The license may be modified or terminated, consistent with this subpart, upon mutual agreement of NASA and the licensee.

(11) Nothing relating to the grant of a license, nor the grant itself, shall be construed to confer upon any person any immunity from or defenses under the antitrust laws or from a charge of patent misuse, and the acquisition and use of rights pursuant to this subpart shall not be immunized from the operation of state or Federal law by reason of the source of the grant.

(2) Conditions. In addition to the provisions of §1245.204, the following terms and conditions apply to domestic exclusive and partially exclusive licenses:

(i) The license shall be subject to the irrevocable, royalty-free right of the Government of the United States to practice and have practiced the invention on behalf of the United States and on behalf of any foreign government or international organization pursuant to any existing or future treaty or agreement with the United States.

(ii) The license shall reserve to NASA the right to require the licensee to grant sublicenses to responsible applicants, on reasonable terms, when necessary to fulfill health or safety needs.

(iii) The license shall be subject to any licenses in force at the time of the grant of the exclusive or partially exclusive license.

(iv) The license may grant the licensee the right of enforcement of the licensed patent pursuant to the provisions of Chapter 29 of Title 35, United States Code, or other statutes, as determined appropriate in the public interest.

(b) Foreign licenses.

(1) Availability of licenses. Exclusive or partially exclusive licenses may be granted on a NASA invention covered by a foreign patent, patent application, or other form of protection, provided that:

(i) Notice of a prospective license, identifying the invention and prospective licensee, has been published in the Federal Register, providing opportunity for filing written objections within a 60-day period and following consideration of such objections;

(ii) NASA has considered whether the interests of the Federal Government or United States industry in foreign commerce will be enhanced; and

(iii) NASA has determined that the grant of such license will tend substantially to lessen competition or result in undue concentration in any section of the United States in any line of commerce to which the technology to be licensed relates, or to create or maintain other situations inconsistent with antitrust laws.

(ii) The license shall be subject to the irrevocable, royalty-free right of the Government of the United States to practice and have practiced the invention on behalf of the United States and on behalf of any foreign government or international organization pursuant to any existing or future treaty or agreement with the United States.

(iii) The license shall be subject to any licenses in force at the time of the grant of the exclusive or partially exclusive license.

(iii) The license may grant the licensee the right to take any suitable and necessary actions to protect the licensed property, on behalf of the Federal Government.

(c) Record of determinations. NASA shall maintain a record of determinations to grant exclusive or partially exclusive licenses.

Procedures

§ 1245.207 Application for a license.

An application for a license should be addressed to the Patent Counsel at the NASA installation having responsibility for the invention and shall normally include:

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

(b) Identification of the type of license for which the application is submitted;

(c) Name and address of the person, company, or organization applying for the license and the citizenship or place of incorporation of the applicant;

(d) Name, address, and telephone number of representative of applicant to whom correspondence should be sent;
§ 1245.211 Appeals.

(a) The following parties may appeal to the NASA Administrator or designee any decision or determination concerning the grant, denial, interpretation, modification, or termination of a license or show cause why the license should not be modified or terminated.

(b) Written notice of appeal must be filed within 30 days (or such other time as may be authorized for good cause shown) after receiving notice of the adverse decision or determination; including, an adverse decision following the request for reconsideration under §1245.208(c). The notice of appeal, along with all supporting documentation should be addressed to the Administrator, National Aeronautics and Space Administration, Washington, DC 20546. Should the appeal raise a genuine dispute over material facts, fact-finding will be conducted by the NASA Inventions and Contributions Board. The person filing the appeal shall be afforded an opportunity to be heard and to offer evidence in support of the appeal. The Chairperson of the Inventions and Contributions Board shall prepare written findings of fact and transmit them to the Administrator or designee. There is no further right of administrative appeal from the decision of the Administrator or designee.

§ 1245.212 Protection and administration of inventions.

NASA may take any suitable and necessary steps to protect and administer rights to NASA inventions, either directly or through contract.

§ 1245.213 Transfer of custody.

NASA having custody of certain Federally owned inventions may transfer custody and administration in whole or in part, to another Federal agency, of the right, title, or interest in any such invention.

§ 1245.214 Confidentiality of information.

Title 35, United States Code, section 209, provides that any plan submitted pursuant to §1245.207(b) and any report required by §1245.204(b)(6) may be treated by NASA as commercial and financial information obtained from a person and privileged and confidential and not subject to disclosure under section 552 of Title 5 of the United States Code.

James M. Beggs,
Administrator.

October 15, 1981.

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