NASA PATENT ABSTRACTS
BIBLIOGRAPHY

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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.
TYPICAL CITATION AND ABSTRACT

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.

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# TABLE OF CONTENTS

## Section 1 • Abstracts

### AERONAUTICS

For related information see also Astronautics.

#### 01 AERONAUTICS (GENERAL)

N.A.

#### 02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery. For related information see also 34 Fluid Mechanics and Heat Transfer.

#### 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

N.A.

Includes cockpit and cabin display devices; and flight instruments. For related information see also 19 Spacecraft Instrumentation and 35 Instrumentation and Photography.

#### 07 AIRCRAFT PROPULSION AND POWER

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

N.A.

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)

N.A.

For extraterrestrial exploration see 91 Lunar and Planetary Exploration.

#### 13 ASTRODYNAMICS

N.A.

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

N.A.

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

N.A.

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 ................................................. 7
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 ........................................................................ N.A.
For related information see also 06 Aircraft Instrumentation and 35 Instrumentation and Photography.

20 SPACECRAFT PROPULSION AND POWER ............................................................ 10
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) .......................................................... 10

24 COMPOSITE MATERIALS .................................................................................... 11
Includes physical, chemical, and mechanical properties of laminates and other composite materials. For
ceramic materials see 27 Nonmetallic Materials.

25 INORGANIC AND PHYSICAL CHEMISTRY ............................................................ 14
Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.
For related information see also 77 Thermodynamics and Statistical Physics.

26 METALLIC MATERIALS ....................................................................................... 16
Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

27 NONMETALLIC MATERIALS ................................................................................. 16
Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles,
adesives, and ceramic materials. For composite materials see 24 Composite Materials.

28 PROPELLANTS AND FUELS .................................................................................. 20
Includes rocket propellents, 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 .................................................................................... N.A.
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) .................................................................................... 20
Includes vacuum technology; control engineering; display engineering; cryogenics; and fire prevention.

32 COMMUNICATIONS AND RADAR ................................................................... 22
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 ......................................... 24
Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturi-
ization; and integrated circuitry. For related information see also 60 Computer Operations and Hardware and
76 Solid-State Physics.

34 FLUID MECHANICS AND HEAT TRANSFER ...................................................... 28
Includes boundary layers; hydrodynamics; fluidics; mass transfer and ablation cooling. For related informa-
tion see also 02 Aerodynamics and 77 Thermodynamics and Statistical Physics.

35 INSTRUMENTATION AND PHOTOGRAPHY ..................................................... 29
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 informa-
tion see also 06 Aircraft Instrumentation and 19 Spacecraft Instrumentation.

36 LASERS AND MASERS ....................................................................................... 33
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 

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  CONTRACT NUMBER INDEX
INVENTOR INDEX  NUMBER INDEX
SOURCE 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

An emergency spin recovery parachute is presented that is housed within a centrally mounted housing on the aft end of an aircraft and connected to a ring fitting within the housing. Two selectively latching shackles connected to separate towlines are openly disposed adjacent the ring fitting. The towlines extend in opposite directions from the housing along the aircraft wing to attachment points adjacent the wing-tips where the other end of each towline is secured. Upon pilot command, one of the open shackles latches to the ring fitting to attach the towline connected thereto, and a second command signal deploys the parachute. Suitable break-away straps secure the towlines to the aircraft surface until the parachute is deployed and the resulting force on the towline attached to the parachute overcomes the straps and permits the towline to extend to the point of attachment to exert sufficient drag on the spinning aircraft to permit the pilot to regain control of the aircraft. To employ the parachute as a drag chute to reduce landing speeds, both shackles and their respective towlines are latched to the ring fitting.

OFFICIAL GAZETTE OF THE U.S. PATENT AND TRADEMARK OFFICE

VAPORIZING PARTICLE VELOCIMETER Patent Application

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.

AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

AIRBORNE RESCUE SYSTEM Patent

The airborne rescue system includes a boom with telescoping members for extending a line and collar to a rescue
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.

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.

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

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

Includes aircraft simulation technology.

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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. 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.
14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, e.g., mobile transporters; and simulators.

N91-21175∗ National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.

O-RING GASKET TEST FIXTURE Patent

An apparatus is presented for testing O-ring gaskets under a variety of temperature, pressure, and dynamic loading conditions. Specifically, this apparatus has the ability to simulate a dynamic loading condition where the sealing surface in contact with the O-ring moves both away from and axially along the face of the O-ring.

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

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.

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

Includes passenger and cargo space transportation, e.g., shuttle operations; and space rescue techniques.
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 (NASA-CASE-MSC-21562-1; NAS 1.71:MSC-21562-1; US-PATENT-APPL-SN-658911) Avail: NTIS HC/MF A03 CSCL 22B 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.

NASA

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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.

NASA

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.

N91-21221* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.
OVERCENTER COLLET SPACE STATION TRUSS FASTENER Patent
to advance their forward portions through the body opening and then expand them outwards. 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.

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particles which may damage the impact panels pass between the trailing edge of one panel and the leading edge of the rotationally succeeding panel.

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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 preferentially 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 desirably impact one of the panels and are thereby removed from orbit, while large
SYNCHRONOUSLY DEPLOYABLE DOUBLE FOLD BEAM AND PLANAR TRUSS STRUCTURE Patent

MARVIN D. RHODES, inventor (to NASA) and JOHN M. HEDGEPETH, inventor (to NASA) (Astro Research Corp., Carpinteria, CA.) 21 May 1991 14 p Filed 22 Aug. 1986

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.

STANDARD REMOTE MANIPULATOR SYSTEM DOCKING TARGET AUGMENTATION FOR AUTOMATED DOCKING Patent

RICHARD W. DABNEY, inventor (to NASA), RICHARD T. HOWARD, inventor (to NASA), and THOMAS C. BRYAN, inventor (to NASA) 4 Jun. 1991 12 p Filed 20 Feb. 1990

A docking target is provided for use in automated docking of a first vehicle on which the target is located. The target comprises a pair of laterally extending arm portions lying in substantially the same plane and a central post extending outwardly from the plane of the arm portions. At least three reflectors are located on the target. Two of the reflectors are located at the outboard ends of the arms portions and another reflector is located at the end of the central post. In an important embodiment, the reflectors comprise individual pieces of retroreflective tape. The reflectors, when viewed from the front of the target, are aligned along the longitudinal center line of the target, and can take a number of different shapes including circular or square.

NANO-G RESEARCH LABORATORY FOR A SPACECRAFT Patent

FRIEDRICH O. VONBUN, inventor (to NASA) and OWEN K. GARriott, inventor (to NASA) 4 Jun. 1991 7 p Filed 28 Apr. 1989

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
20 SPACECRAFT PROPULSION AND POWER

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.

NASA

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components, e.g., rocket
engines; and spacecraft auxiliary power sources.

METHOD OF INJECTING FLUID PROPELLANTS INTO A
ROCKET COMBUSTION CHAMBER Patent Application
STEVEN J. SCHNEIDER, inventor (to NASA) 31 May 1991 9 p
(NASA-CASE-LEW-14846-2; NAS 1.71:14846-2; US-PATENT-APPL-
SN-709907) Avail: NTIS HC/MF A02 CSCL 21H

A rocket injector is provided with multiple sets of manifolds
for supplying propellants to injector elements. Sensors transmit
the temperatures of the propellants to a suitable controller which
is operably connected to valves between these manifolds and
propellant storage tanks. Additional valves are opened to furnish
propellants to more of the manifolds when cryogenic propellant
temperatures are sensed. Only a portion of the valves are opened
to furnish propellants to some of the manifolds when lower
temperatures are sensed.

NASA

CHEMISTRY AND MATERIALS (GENERAL)

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 dialsides 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 dihydrazides 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
PREPARING COMPOSITE MATERIALS FROM MATRICES OF PROCESSABLE AROMATIC POLYIMIDE THERMOPLASTIC BLENDS Patent
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. Official Gazette of the U.S. Patent and Trademark Office

METHOD OF APPLYING A THERMAL BARRIER COATING SYSTEM TO A SUBSTRATE Patent Application
A metallic close-out layer is applied to the surface of a thermal barrier coating system to seal the ceramic material in the coating. The close-out layer is glass-bead preened to densify the surface.

HEAT TRANSFER DEVICE Patent Application
Gas derived graphite fibers are generated by the decomposition of an organic gas. These fibers when joined with a suitable binder are used to make a high thermal conductivity composite material. The fibers may be intercalated. The intercalate can be halogen or halide salt, alkaline metal, or any other species which contributes to the electrical conductivity improvement of the graphite fiber. The heat transfer device may also be made of intercalated highly oriented pyrolytic graphite and machined, rather than made of fibers.
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.
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.

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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.

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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 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.

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

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

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 caused 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.

**N91-32196**

National Aeronautics and Space Administration.
Langley Research Center, Hampton, VA.

IGNITABILITY TEST METHOD AND APPARATUS Patent

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.

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

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

High temperature solder device for flat cables includes a microwelder, an anvil which acts as a heat sink and supports a flexible flat ribbon cable that is to be connected to a multiple pin connector. The microwelder is made from a modified commercially available resistance welding machine such as the Split Tip Electrode microwelder by Weltek, which consists of two separate electrode halves with a removable dielectric spacer in between. The microwelder is not used to weld the items together, but to provide a controlled compressive force on, and energy pulse to, a solder preform placed between a pin of the connector and a conductor of the flexible flat ribbon cable. When the microwelder is operated, an electric pulse will flow down on electrode, through the solder preform and back up the other electrode. This pulse of 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.

A high temperature solder device for flat cables includes a microwelder, an anvil which acts as a heat sink and supports a flexible flat ribbon cable that is to be connected to a multiple pin connector. The microwelder is made from a modified commercially available resistance welding machine such as the Split Tip Electrode microwelder by Weltek, which consists of two separate electrode halves with a removable dielectric spacer in between. The microwelder is not used to weld the items together, but to provide a controlled compressive force on, and energy pulse to, a solder preform placed between a pin of the connector and a conductor of the flexible flat ribbon cable. When the microwelder is operated, an electric pulse will flow down on electrode, through the solder preform and back up the other electrode. This pulse of electrical energy will cause the solder preform to heat up and melt, joining the pin and conductor.

High emittance radiator surfaces are produced by arc-texturing. This process produces such a surface on a metal

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

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

by scanning it with a low voltage electric arc from a carbon electrode in an inert environment.

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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.


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.


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.


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.

NASA
MOLECULES WITH ENHANCED ELECTRONIC POLARIZABILITIES BASED ON DEFECT-LIKE STATES IN CONJUGATED POLYMERS Patent
DAVID N. BERATAN, inventor (to NASA) (Jet Propulsion Lab., California Inst. of Tech., Pasadena.) 30 Apr. 1991 22 p
Filed 10 Oct. 1989
(Contract NAS7-918)
Avail: US Patent and Trademark Office CSCL 11C

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.

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


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 arylene 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.

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

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 dlamine, 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 pwt. Y2O3 having a thickness between about four and 15 mils covers the thin ceramic layer.

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FIGURE 1. VISCOSITY PROFILES OF CAPL-CAPPED ADDITION POLYIMIDES
28 PROPELLANTS AND FUELS

PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers; their storage and handling procedures; and aircraft fuels.

N91-28444* National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.

IMPROVING THE PERFORMANCE OF BLASTING CAPS Patent Application

LAURENCE J. BEMENT, inventor (to NASA), RONNIE B. PERRY, inventor (to NASA), and MORY L. SCHIMMEL, inventor (to NASA) (Schimmel Co., Saint Louis, MO.) 5 Apr. 1991 10 p

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

32

DUAL DIAPHRAGM TANK WITH TELLTALE DRAIN Patent


A fluid storage and expulsion system comprising a tank with an internal flexible diaphragm assembly of dual diaphragms in back-to-back relationship, at least one of which is provided with a patterned surface having fine edges such that the diaphragms are in contact along said edges without mating contact of surface areas to thereby form fluid channels which extend outwardly to the peripheral edges of the diaphragms is described. The interior wall of the tank at the juncture of tank sections is formed with a circumferential annular recess comprising an outer annular recess portion which forms a fluid collection chamber and an inner annular recess portion which accommodates the peripheral edge portions of the diaphragms and a sealing ring in clamped sealing relation therebetween. The sealing ring is perforated with radially extending passages which allow any fluid leaking or diffusing past a diaphragm to flow through the fluid channels between the diaphragms to the fluid collection chamber. Ports connectable to pressure fittings are provided in the tank sections for admission of fluids to opposite sides of the diaphragm assembly. A drain passage through the tank wall to the fluid collection chamber permits detection, analysis and removal of fluids in the collection chamber.

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

APPARATUS FOR JOINING TRUSSES Patent Application

Jeffrey Finckenor, inventor (to NASA) 25 Mar. 1991 11 p

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

N91-25306* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.

ENGINEERING (GENERAL)

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

N91-25305* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.

DUAL DIAPHRAGM TANK WITH TELLTALE DRAIN Patent


A fluid storage and expulsion system comprising a tank
trusses into axial alignment and hold them in that position.

**FLEXIBLE THERMAL APPARATUS FOR MOUNTING OF THERMOELECTRIC COOLER Patent**


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.

**METHOD AND APPARATUS FOR CLEANING RUBBER DEPOSITS FROM AIRPORT RUNWAYS AND ROADWAYS Patent Application**

SANDY M. STUBBS, inventor (to NASA) 3 Apr. 1991 11 p

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.

N91-31476* National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
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.

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

N91-25316* National Aeronautics and Space Administration. Pasadena Office, CA.
DOPPLER-CORRECTED DIFFERENTIAL DETECTION SYSTEM Patent
(Contract NAS7-918)
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 sub 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(sub R) and Q(sub 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(sub R) and Q(sub R) data channels, but to also invert (complement) the I(sub R) and/or Q(sub R) data, or to at least complement the I(sub R) and Q(sub R) data for systems using nontransparent codes that do not have rotation direction ambiguity.

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 are fabricated utilizing porous silicon having pores. A Schottky metal contact is formed in the pores, such as by electroplating. The sensors may be integrated with silicon circuits on the same chip with a high quantum efficiency, which is ideal for IR focal plane array applications due to uniformity and reproducibility.
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.
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.

**METAL CHLORIDE CATHODE FOR A BATTERY Patent**

RATNAMAR V. BUGGA, inventor (to NASA), SALVADOR DISTEFANO, inventor (to NASA), and C. PERRY BANKSTON, inventor (to NASA) (Jet Propulsion Lab., California Inst. of Tech., Pasadena.) 28 May 1991 10 p Filed 30 Mar. 1990


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.

**DIFFERENTIAL CURRENT SOURCE Patent**


A differential, voltage-controlled current source, employing operational amplifiers as the active elements, provides an essentially symmetrical, differential, high impedance drive to a load, the drive being isolated from any circuit common or system ground. Because of the floating differential drive and the identical source impedances of the two outputs, errors from common mode voltage are eliminated.

**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; 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.
A UNIVERSAL COMPUTER CONTROL SYSTEM FOR MOTORS Patent


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.

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HIGH TEMPERATURE, SUPERCONDUCTING OXIDE PHASES ARE FORMED AS A THIN FILM Patent


A ceramic superconductivity part such as a wire is produced through the partial oxidation of a specially formulated copper alloy. This type of wire is formed 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.

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

A passive laminar flow crossflow vorticity control system includes an aerodynamic or hydrodynamic surface having geometric perturbations. The perturbations include peaks and valleys having a predetermined spacing and aligned approximately in a streamline direction to force the formation of crossflow vortices. This minimizes amplification and growth of the vortices, thus delaying transition to turbulence and reducing overall drag.
35 INSTRUMENTATION AND PHOTOGRAPHY

N91-27504* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.

VARIABLE ORIFICE FLOW REGULATOR Patent
ROLLIN C. CHRISTIANSON, inventor (to NASA) (Lockheed Engineering and Sciences Co., Las Cruces, NM.) 4 Jun. 1991
18 p. Filed 11 Apr. 1990

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

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 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.

Official Gazette of the U.S. Patent and Trademark Office
N91-21494* National Aeronautics and Space Administration.
Lyndon B. Johnson Space Center, Houston, TX.
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.
Official Gazette of the U.S. Patent and Trademark Office

N91-21495* National Aeronautics and Space Administration.
Lyndon B. Johnson Space Center, Houston, TX.
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.
Official Gazette of the U.S. Patent and Trademark Office

N91-21496* National Aeronautics and Space Administration.
Marshall Space Flight Center, Huntsville, AL.
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.
Official Gazette of the U.S. Patent and Trademark Office
N91-23460*# National Aeronautics and Space Administration.
Lewis Research Center, Cleveland, OH.

METHOD OF PRODUCING A PLUG TYPE HEAT FLUX
GAUGE Patent Application
CURT H. LIEBERT, inventor (to NASA) 8 Apr. 1991
13 p
(NASA-CASE-LEW-14967-2; NAS 1.71:LEW-14967-2;
US-PATENT-APPL-SN-685962) Avail: NTIS HC/MF A03 CSCL

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.

N91-23462** National Aeronautics and Space Administration.
Lyndon B. Johnson Space Center, Houston, TX.

TWO DIMENSIONAL VERNIER Patent Application
RICHARD D. JUDAY, inventor (to NASA) 14 Jan. 1991
15 p
(NASA-CASE-MSC-21700-1; NAS 1.71:MSC-21700-1;
US-PATENT-APPL-SN-640775) Avail: NTIS HC/MF A03 CSCL

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.

N91-25388*# National Aeronautics and Space Administration.
Marshall Space Flight Center, Huntsville, AL.

RADIATION SENSITIVE AREA DETECTION DEVICE ANDMETHOD Patent Application
DANIEL C. CARTER, inventor (to NASA), DIANA L. HECHT, inventor (to NASA), and WILLIAM K. WITHEROW, inventor (to NASA) 3 Jun. 1991 24 p
(NASA-CASE-MFS-28563-1; NAS 1.71:MFS-28563-1;
US-PATENT-APPL-SN-710193) Avail: NTIS HC/MF A03 CSCL

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...
35 INSTRUMENTATION AND PHOTOGRAPHY

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.

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 prove 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.

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N91-28546*# National Aeronautics and Space Administration.

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^2. 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

NASA
PLUG-TYPE HEAT FLUX GAUGE Patent

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.

LASERS AND MASERS

includes parametric amplifiers.

BIREFRINGENT FILTER DESIGN Patent Application

A birefringent filter is provided for tuning the wavelength of a broad band emission laser. The filter comprises thin plates of a birefringent material having thicknesses which are non-unity, integral multiples of the difference between the thicknesses of the two thinnest plates. The resulting wavelength selectivity is substantially equivalent to the wavelength selectivity of a conventional filter which has a thinnest plate having a thickness equal to this thickness difference. The present invention obtains 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.

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 strobos 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.
36 LASERS AND MASERS

N91-28557* National Aeronautics and Space Administration.
Goddard Space Flight Center, Greenbelt, MD.
EDGE TECHNIQUE FOR MEASUREMENT OF LASER
FREQUENCY SHIFTS INCLUDING THE DOPPLER SHIFT
Patent Application
LARRY KORB, inventor (to NASA) 20 May 1991 39 p
(NASA-CASE-GSC-13343-1; NAS 1.71:GSC-13343-1;

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.

37 MECHANICAL ENGINEERING

Includes auxiliary systems (nonpower); machine elements and
processes; and mechanical equipment.

N91-21525* National Aeronautics and Space Administration.
Goddard Space Flight Center, Greenbelt, MD.
CONNECTION SPACE REDUCTION MECHANISM
Patent Application
MALCOLM BRUCE MILAM, inventor (to NASA) 31 Dec.
1990 17p
(NASA-CASE-GSC-13220-1; NAS 1.71:GSC-13220-1;
US-PATENT-APPL-SN-636532) Avail: NTIS HC/MF A03 CSCL 131

A connector assembly comprised of two halves, each
respectively including a shell type connector subassembly, one
being an active half and the other being a passive half. The
active half includes an alignment cusp that causes a coupling
motion in response to coming in contact with the outer portion of
the other half which causes the respective connectors within the
two subassemblies to move toward each other into coupling
relationship at twice the rate at which the two subassemblies
come together. Both halves are adapted to rotate about and
translate along respective mutually orthogonal axes to facilitate
an interconnection.

N91-32489* National Aeronautics and Space Administration.
Pasadena Office, CA.
QUANTUM WELL, BEAM DEFLECTING SURFACE
EMITTING LASERS Patent Application
JAE H. KIM, inventor (to NASA) (Jet Propulsion Lab., California Inst.
of Tech., Pasadena.) 5 Jun. 1991 22p
(Contract NAS7-918)
(NASA-CASE-NPO-18243-1-CU; NAS 1.71:NPO-18243-1-CU;

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.
**SINGLE ELEMENT MAGNETIC SUSPENSION ACTUATOR**

Patent


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 \( V_{FC} \). Official Gazette of the U.S. Patent and Trademark Office

**FULLY ARTICULATED FOUR-POINT-BEND LOADING FIXTURE**

Patent


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

**MECHANICAL STRAIN ISOLATOR MOUNT**

Patent


Certain devices such as optical instruments must preserve their alignmental integrity while being subjected to mechanical strain. A mechanical strain isolator mount is provided to preserve the alignmental integrity of an alignment sensitive instrument. An alignment sensitive instrument is mounted on a rectangular base. Flexural legs are connected at their proximal ends to the rectangular base. Flexural legs are also spaced parallel to the sides. Mounting pads are connected to the legs at the distal end and the mechanical strain isolator mount is attached to the substrate by means of threaded bolts. When a mounting pad and its respective leg is subjected to lateral strain in either the X or Y direction via the substrate, the respective leg relieves the strain by bending in the direction of the strain. An axial strain on a mounting pad in the Z direction is relieved by a rotational motion of the legs in the direction of the strain. When the substrate is stress free, the flexural legs return to their original condition and thus preserve the original alignment integrity of the alignment sensitive instrument. Official Gazette of the U.S. Patent and Trademark Office
METHOD AND APPARATUS FOR POSITIONING A ROBOTIC END EFFECTOR Patent


Avail: US Patent and Trademark Office CSCL 131

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.

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METHOD AND APPARATUS FOR CONFIGURATION CONTROL OF REDUNDANT ROBOTS Patent


Avail: US Patent and Trademark Office CSCL 131

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.

N91-21545* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.

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 well that communicates with 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.

N91-23490* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.

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 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.
pattern on the reflective surface of the strike plate to effect targeting and alignment.

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.

A latching device is disclosed which is lever operated sequentially to actuate a set of collet fingers to provide a radial expansion and to actuate a force mechanism to provide a compressive gripping force for attaching first and second devices to one another. The latching device includes a body member having elongated collet fingers which, in a deactuated condition, are insertable through bores on the first and second devices so that gripping terminal portions on the collet fingers are proximate to the end of the bore of the first device while a spring assembly on the body member is located proximate to the outer surface of a second device. A lever is rotatable through 90 deg to move a latching rod to sequentially actuate and expand collet fingers and to actuate the spring assembly by compressing it. During the first 30 deg of movement of the lever, the collet fingers are actuated by the latching rod to provide a radial expansion and during the last 60 deg of movement of the lever, the spring assembly acts as a force mechanism and is actuated to develop a compressive latching force on the devices. The latching rod and lever are connected by a camming mechanism. The amount of spring force in the spring assembly can be adjusted; the body member can be
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
LEO G. MONFORD, JR., inventor (to NASA) 13 Feb. 1991 20 p
(NASA-CASE-MSC-21517-1; NAS 1.71:MSC-21517-1;
US-PATENT-APPL-SN-654704) Avail: NTIS HC/MF A03 CSCL
13I

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
JON KAHN, inventor (to NASA) 19 Feb. 1991 23 p
(NASA-CASE-MSC-21748-1; NAS 1.71:MSC-21748-1;
US-PATENT-APPL-SN-657598) Avail: NTIS HC/MF A03 CSCL
13K

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
BRUCE WEDDENDORF, inventor (to NASA) 19 Feb. 1991 16 p
(NASA-CASE-MFS-28521-1; NAS 1.71:MFS-28521-1;
US-PATENT-APPL-SN-657586) Avail: NTIS HC/MF A03 CSCL
11A

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.

**HIGH-TEMPERATURE, FLEXIBLE, THERMAL BARRIER SEAL Patent**

PAUL J. SIROCKY, inventor (to NASA) and BRUCE M. STEINETZ, inventor (to NASA) 14 May 1991 13 p Filed 27 Nov. 1989


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.

**QUICK ACTION CLAMP Patent**


A quick release toggle clamp that utilizes a spring that requires a deliberate positive action for disengagement is
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.

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

N91-28579# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, MD.

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.

NASA

N91-28578# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, MD.

IMPROVED SUPERCONDUCTING BEARINGS Patent Application

YURY FLOM, inventor (to NASA) and JAMES D. ROYSTON, inventor (to NASA) 17 Apr. 1991 24 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
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.
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 pin 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.

NASA
TWO FAULT TOLERANT TOGGLE-HOOK RELEASE Patent  
Avail: US Patent and Trademark Office CSCL 13I  
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 latching 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.  
Official Gazette of the U.S. Patent and Trademark Office
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.

A linear mass actuator includes an upper housing and a lower housing connectable to each other and having a central passageway passing axially therethrough a mass linearly movable in the central passageway. Rollers mounted in the upper and lower housings and being in frictional engagement with the mass, translates the mass linearly in the central passageway and drive motors operatively coupled to the roller means, for rotating the rollers and thus driving the mass axially in the central passageway.

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.

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. An actuator is mounted on the body to be manually moved back and forth between spaced positions in an

NASA

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.

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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.

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A system for measuring ocean surface currents from an airborne platform is disclosed. A radar system having two spaced antennas wherein one antenna is driven and return signals from the ocean surface are detected by both antennas is employed to get raw ocean current data which are saved for later processing. There are a pair of global positioning system (GPS) systems including a first antenna carried by the platform at a first location and a second antenna carried by the platform at a second location displaced from the first antenna for determining the position of the antennas from signals from orbiting GPS navigational satellites. Data are also saved for later processing. The saved data are subsequently processed by a ground-based computer system to determine the position, orientation, and velocity of the platform as well as to derive measurements of currents on the ocean surface.

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Topographical terrain models are generated by digitally delineating the boundary of the region under investigation from

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Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.

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Topographical terrain models are generated by digitally delineating the boundary of the region under investigation from
44 ENERGY PRODUCTION AND CONVERSION

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.

N91-23617* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.


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.

N91-27614* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.


A thin, lightweight solar cell that utilizes front contact metallization is presented. Both the front light receiving surface of the solar cell and the facing surface of the cover glass are recessed to accommodate this metallization. This enables the two surfaces to meet flush for an optimum seal.

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A method is disclosed for determining Richardson Number, Ri, or its reciprocal, RRI, for clear air prediction using measured potential temperature and determining the vertical gradient of potential temperature, d(θ)/dz. Wind vector from the aircraft instrumentation versus potential temperature, dW/D(θ), is determined and multiplies by d(θ)/dz to obtain dW/dz. Richardson number or its reciprocal is then determined from the relationship Ri = K(d(θ)/dz divided (dW/dz)squared) 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.

A spiral vane bioreactor of a perfusion type is described in which a vertical chamber, intended for use in a microgravity condition, has a central rotating filter assembly and has flexible membranes disposed to rotate annularly about the filter assembly. The flexible members have end portions disposed angularly with respect to one another. A fluid replenishment medium is input from a closed loop liquid system to a completely liquid filled chamber containing microcarrier beads, cells and a fluid medium. Output of spent medium is to the closed loop. In the closed loop, the output and input parameters are sensed by sensors. A manifold
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.

A method and apparatus are disclosed for maintaining continuous, long-term microbial control in the water supply for potable, hygiene, and experimental water for space activities, as well as treatment of water supplies on Earth. The water purification is accomplished by introduction of molecular iodine into the water supply to impart a desired iodine residual. The water is passed through an iodinated anion exchange resin bed. The iodine is bound as $I_n$ at the anion exchange sites and releases $I_2$ into the water stream flowing through the bed. The concentration of $I_2$ in the flowing water gradually decreases and, in the prior art, the ion-exchange bed has had to be replaced. In a preferred embodiment, a bed of iodine crystals is provided with connections for flowing water therethrough to produce a concentrated (substantially saturated) aqueous iodine solution which is passed through the iodinated resin bed to recharge the bed. Novelty resides in the capability of inexpensively and repeatedly regenerating the ion-exchange bed in situ.

The present invention relates to a horizontally rotating bioreactor useful for carrying out cell and tissue culture. For processing of mammalian cells, the system is sterilized and fresh fluid medium, microcarrier beads, and cells are admitted to completely fill the cell culture vessel. An oxygen containing gas is admitted to the interior of the permeable membrane which prevents air bubbles from being introduced into the medium. The cylinder is rotated at a low speed within an incubator so that the circular motion of the fluid medium uniformly suspends the microbeads throughout the cylinder during the cell growth period. The unique design of this cell and tissue culture device was initially driven by two requirements imposed by its intended use for feasibility studies for three dimensional culture of living cells and tissues in space by JSC. They were compatible with microgravity and simulation of microgravity in one G. The vessels are designed to approximate the extremely quiescent low shear environment obtainable in space.
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 surface 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 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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A compliant walker is provided for humans having limited use of their legs and lower back. It includes an upright wheel frame which at least partially surrounds an upright user wearing a partial body harness. It is attached to the frame by means of cable compliant apparatus consisting of sets of cable segments and angle bracket members connected between opposite side members of the frame and adjacent side portions of the harness. Novelty is believed to exist in the combination of a wheeled frame including a side support structure, a body harness, and compliance means connecting the body harness to the side support structure.
54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

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.

53 BEHAVIORAL SCIENCES

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

AN ACCELERATED TRAINING METHOD FOR BACK PROPAGATION NETWORKS Patent Application

ROBERT O. SHELTON, Inventor (to NASA) 17 Jun. 1991

Includes human engineering; biotechnology; and space suits and protective clothing.

WILLIAM E. THORNTON, JR., Inventor (to NASA) and HENRY B. WHITEMORE, Inventor (to NASA) 9 Apr. 1991

Division of US-Patent-App1-SN-035401, filed 7 Apr. 1987

(51) 54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

N91-28730*# National Aeronautics and Space Administration.

Lyndon B. Johnson Space Center, Houston, TX.

METHOD AND APPARATUS FOR WASTE COLLECTION AND STORAGE Patent

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 with the lower arm, the amputee can open and close the fingers.
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**

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.

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**N91-32805** National Aeronautics and Space Administration. Pasadena Office, CA.
**HIGHLY PARALLEL COMPUTER ARCHITECTURE FOR ROBOTIC COMPUTATION Patent Application**

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 cycle clock, 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.

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**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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62 COMPUTER SYSTEMS

Includes computer networks and special application computer systems.

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 overhead 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.

N91-32852* National Aeronautics and Space Administration. Pasadena Office, CA.
ANALOG HARDWARE FOR LEARNING NEURAL NETWORKS Patent

This is a recurrent or feedforward analog neural network processor having a multi-level neuron array and a synaptic matrix for storing weighted analog values of synaptic connection strengths which is characterized by temporarily changing one connection strength at a time to determine its effect on system output relative to the desired target. That connection strength is then adjusted based on the effect, whereby the processor is taught the correct response to training examples connection by connection.

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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.

**N91-28785** National Aeronautics and Space Administration.
Goddard Space Flight Center, Greenbelt, MD.

**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.

**N91-31885** National Aeronautics and Space Administration.
Pasadena Office, CA.

**SYNCHRONIZED COMPUTATIONAL ARCHITECTURE FOR GENERALIZED BILATERAL CONTROL OF ROBOT ARMS**
Patent
Filed 28 Oct. 1988 Continuation-in-part of abandoned
NASA-CASE-NPO-17401-1-CU; US-PATENT-5,038,089;
US-PATENT-CLASS-364-513; INT-PATENT-CLASS-G05B-19/24;
INT-PATENT-CLASS-G06F-15/46) Avail: US Patent and
Trademark Office CSCL 09B

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.

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

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An apparatus is disclosed for reducing acoustic transmission from mechanical or acoustic sources by means of a double wall partition, within which an acoustic pressure field is generated by at least one secondary acoustic source. The secondary acoustic source is advantageously placed within the partition, around its edges, or it may be an integral part of a wall of the partition.

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The invention is a method of and apparatus for characterizing the amplitudes of a sequence of reflected pulses R1, R2, and R3 by converting them into corresponding electric signals E1, E2, and E3 to substantially the same value during each sequence thereby restoring the reflected pulses R1, R2, and R3 to their initial reflection values by timing means, an exponential generator, and a time gain compensator. Envelope and baseline reject circuits permit the display and accurate location of the time spaced sequence of electric signals having substantially the same amplitude on a measurement scale on a suitable video display or oscilloscope.

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

An apparatus is disclosed for reducing acoustic transmission from mechanical or acoustic sources by means of a double wall partition, within which an acoustic pressure field is generated by at least one secondary acoustic source. The secondary acoustic source is advantageously placed within the partition, around its edges, or it may be an integral part of a wall of the partition.

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

Includes sound generation, transmission, and attenuation.

N91-27914* National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.

METHOD AND APPARATUS FOR CHARACTERIZING REFLECTED ULTRASONIC PULSES Patent


Avail: US Patent and Trademark Office CSCL 20A

The invention is a method of and apparatus for characterizing the amplitudes of a sequence of reflected pulses R1, R2, and R3 by converting them into corresponding electric signals E1, E2, and E3 to substantially the same value during each sequence thereby restoring the reflected pulses R1, R2, and R3 to their initial reflection values by timing means, an exponential generator, and a time gain compensator. Envelope and baseline reject circuits permit the display and accurate location of the time spaced sequence of electric signals having substantially the same amplitude on a measurement scale on a suitable video display or oscilloscope.

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71 ACOUSTICS

Includes sound generation, transmission, and attenuation.
OPTICS

ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure, electron properties, and molecular spectra.

N91-27935* National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.

SLOW POSITRON BEAM GENERATOR FOR LIFETIME STUDIES Patent


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.

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.

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**

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**N91-23890**

National Aeronautics and Space Administration. Pasadena Office, CA.

REAL TIME PRE-DETECTION DYNAMIC RANGE COMPRESSION Patent Application

HUAI-KUANG LIU, inventor (to NASA) (Jet Propulsion Lab., California Inst. of Tech., Pasadena.) 5 Dec. 1990 15 p

(Contract NAS7-918)


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**

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**91-24878**

National Aeronautics and Space Administration. Pasadena Office, CA.

STEREOSCOPIC CAMERA AND VIEWING SYSTEMS WITH UNDISTORTED DEPTH PRESENTATION AND REDUCED OR ELIMINATED ERRONEOUS ACCELERATION AND DECELERATION PERCEPTIONS, OR WITH PERCEPTIONS PRODUCED OR ENHANCED FOR SPECIAL EFFECTS Patent Application

DANIEL B. DINER, inventor (to NASA) (Jet Propulsion Lab., California Inst. of Tech., Pasadena.) 2 Nov. 1990 42 p

(Contract NAS7-918)


Methods for providing stereoscopic image presentation and stereoscopic configurations using stereoscopic viewing systems having converged or parallel cameras may be set up to reduce or eliminate erroneously perceived accelerations and decelerations by proper selection of parameters, such as an image magnification factor, q, and intercamera distance, 2w. For converged cameras, q is selected to be equal to Ve - qlw = 0, where V is the camera distance, e is half the interocular distance of an observer, w is half the intercamera distance, and l is the actual distance from the first nodal point of each camera to the convergence point, and for parallel cameras, q is selected to be equal to e/w. While converged cameras cannot be set up to provide fully undistorted three-dimensional views, they can be set up to provide a linear relationship between real and apparent depth and thus minimize erroneously perceived accelerations and decelerations for three sagittal planes, x = -w, x = 0, and x = +w which are indicated to the observer. Parallel cameras can be set up to provide fully undistorted three-dimensional views by controlling the location of the observer and by magnification and shifting of left and right images. In addition, the teachings of this disclosure can be used to provide methods of stereoscopic image presentation and stereoscopic camera configurations to produce a nonlinear relation between perceived and real depth, and erroneously produce of enhance perceived accelerations and decelerations in order to provide special effects for entertainment, training, or educational purposes.

**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.

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

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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.

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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

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N91-25840* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.

OPTICAL JOINT CORRELATOR FOR REAL-TIME IMAGE TRACKING AND RETINAL SURGERY Patent


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N91-25841* National Aeronautics and Space Administration. Pasadena Office, CA.

HIGH-GAIN ALGAAS/GAAS DOUBLE HETEROJUNCTION DARLINGTON PHOTOTRANSISTORS FOR OPTICAL NEURAL NETWORKS Patent


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N91-26918* National Aeronautics and Space Administration. Pasadena Office, CA.

METHOD AND APPARATUS FOR SECOND-RANK TENSOR GENERATION Patent


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N91-26918* National Aeronautics and Space Administration. Pasadena Office, CA.
opposite direction from the pumping beam. The conjugate beam thus separated is the tensor output \( \text{xy} (\sup T) \).

A reference frequency distribution system is disclosed for transmitting a reference frequency from a reference unit to a remote unit while keeping the reference frequency at the reference unit and the remote unit in phase. A fiber optic cable connects the reference unit to the remote unit. A frequency source at the reference unit produces a reference frequency having an adjustable phase. A fiber optic transmitter at the reference unit modulates a light beam with the reference frequency and transmits the light beam into the fiber optic cable. A 50/50 reflector at the remote unit reflects a first portion of the light beam from the reference unit back into the fiber optic cable to the reference unit. A first fiber optic receiver disposed at the remote unit receives a second portion of the light beam and demodulates the reference frequency to be used at the remote unit. A second fiber optic receiver disposed at the reference unit receives the first portion of the light beam and demodulates a reference frequency component. A phase conjugator is connected to the frequency source for comparing the phase of the reference frequency component to the phase of the reference frequency modulating the light beam 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.
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.

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.

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.
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 nonlinearity 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.
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.

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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.
The 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.

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 than 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.
A process is disclosed for x-ray registration and differencing which results in more efficient compression. Differencing of registered modeled subject image with a modeled reference image forms a differenced image for compression with conventional compression algorithms. Obtention of a modeled reference image includes modeling a relatively unrelated standard reference image upon a three-dimensional model, which three-dimensional model is also used to model the subject image for obtaining the modeled subject image. The registration process of the modeled subject image and modeled reference image translationally correlates such modeled images for resulting correlation thereof in spatial and spectral dimensions. Prior to compression, a portion of the image falling outside a designated area of interest may be eliminated, for subsequent replenishment with a standard reference image. The compressed differenced image may be subsequently transmitted and/or stored, for subsequent decompression and addition to a standard reference image so as to form a reconstituted or approximated subject image at either a remote location and/or at a later moment in time. Overall effective compression ratios of 100:1 are possible for thoracic x-ray digital images.
PUBLIC AVAILABILITY OF COPIES OF PATENTS AND PATENT APPLICATIONS

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.

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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.

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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) "Federally owned invention" means an invention, plant, or design which is covered by a patent, or patent application in the United States, or a patent, patent application, plant variety protection, or other form of protection, in a foreign country, title to which has been assigned to or otherwise vested in the United States Government.

(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 121.3-8, 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 of or willfully omitted a material fact in the license application or in any report required by the license agreement;

(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 under 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 at any time after notice of the invention's availability has been published 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 best be 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 allow for 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) Protection. NASA shall protect the licensed invention from unauthorized use, 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.

(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) 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 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.

(2) Conditions. In addition to the provisions of §1245.204, the following terms and conditions apply to foreign 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 may grant the licensee the right to manufacture products embodying the invention or produced through use of the invention.

(iii) 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.

(iv) The license may grant the licensee the right to manufacture products embodying the invention or produced through use of the invention.

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

§ 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, 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;
§ 1245.210 Modification and termination of licenses.

Before modifying or terminating a license, other than by mutual agreement, NASA shall furnish the licensee and any sublicensee of record a written notice of the proposed change. The notice shall be delivered by registered or certified mail, return receipt requested, and shall be allowed 30 days after such notice to remedy any breach of the license or show cause why the license should not be modified or terminated.

§ 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:

1. A person whose application for a license has been denied;
2. A licensee whose license has been modified or terminated, in whole or in part; or
3. A person who timely filed a written objection in response to the notice required by §§ 1245.206(a)(1)(iii)(A) or 1245.206(b)(1)(i) and who can demonstrate to the satisfaction of NASA that such person may be damaged by the Agency action.

(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. The decision on the appeal shall be made by the NASA 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.

[FR Doc. 81-31609 Filed 10-30-81; 8:45 am]
BILLING CODE 7510-01-M

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(e) Nature and type of applicant's business, identifying products or services which the applicant has successfully commercialized, and approximate number of applicant's employees;

(f) Source of information concerning the availability of a license on the invention;

(g) A statement indicating whether applicant is a small business firm as defined in § 1245.202(c);

(h) A detailed description of applicant's plan for development or marketing of the invention, or both, which should include:

1. A statement of the time, nature and amount of anticipated investment of capital and other resources which applicant believes will be required to bring the invention to practical application;

2. A statement as to applicant's capability and intention to fulfill the plan, including information regarding manufacturing, marketing, financial, and technical resources;

3. A statement of the fields of use for which applicant intends to practice the invention; and

4. A statement of the geographic areas in which applicant intends to manufacture any products embodying the invention and geographic areas where applicant intends to use or sell the invention, or both;

(i) Identification of licenses previously granted to applicant under Federally owned inventions;

(j) A statement containing applicant's best knowledge of the extent to which the invention is being practiced by private industry or Government, or both, or is otherwise available commercially; and

(k) Any other information which applicant believes will support a determination to grant the license to applicant.

§ 1245.208 Processing applications.

(a) Applications for licenses will be initially reviewed by the Patent Counsel of the NASA installation having responsibility for the invention. The Patent Counsel shall make a preliminary recommendation to the Director of Licensing, NASA Headquarters, whether to: (1) grant the license as requested, (2) grant the license with modification after negotiation with the licensee, or (3) deny the license. The Director of Licensing shall review the preliminary recommendation of the Patent Counsel and make a final recommendation to the NASA Assistant General Counsel for Patent Matters. Such review and final recommendation may include, and be based on, any additional information obtained from applicant and other sources that the Patent Counsel and the Director of Licensing deem relevant to the license requested. The determination to grant or deny the license shall be made by the Assistant General Counsel for Patent Matters based on the final recommendation of the Director of Licensing.

(b) When notice of a prospective exclusive or partially exclusive license is published in the Federal Register in accordance with § 1245.206(a)(1)(iii)(A) or § 1245.206(b)(1)(i), any written objections received in response thereto will be considered by the Director of Licensing in making the final recommendation to the Assistant General Counsel for Patent Matters.

(c) If the requested license, including any negotiated modifications, is denied by the Assistant General Counsel for Patent Matters, the applicant may request reconsideration by filing a written request for reconsideration within 30 days after receiving notice of denial. This 30-day period may be extended for good cause.

(d) In addition to, or in lieu of requesting reconsideration, the applicant may also appeal the denial of the license in accordance with § 1245.211.

§ 1245.209 Notice to Attorney General.

A copy of the notice provided for in §§ 1245.206(a)(1)(iii)(A), and 1245.206(b)(1)(i) will be sent to the Attorney General.

§ 1245.210 Modification and termination of licenses.

Before modifying or terminating a license, other than by mutual agreement, NASA shall furnish the licensee and any sublicensee of record a written notice of intention to modify or terminate the license, and the licensee and any sublicensee shall be allowed 30 days after such notice to remedy any breach of the license or show cause why the license should not be modified or terminated.

§ 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:
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### Keywords (Suggested by Author(s))
- Bibliographies
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NASA-Langley, 1992