

# SIGNIFICANT NASA INVENTIONS

Available for Licensing  
in Foreign Countries

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National Aeronautics and Space Administration  
Washington, D.C., U.S.A.

1975

## **PREFACE**

### **NASA FOREIGN PATENT LICENSING PROGRAM**

#### **GENERAL**

The foreign licensing program of the National Aeronautics and Space Administration serves to promote and utilize foreign patent rights vested in the Administration. The objective of this program is to extend the patent coverage on valuable NASA-owned inventions to various foreign countries in order to further the interests of United States industry in foreign commerce, to enhance the economic interests of the United States, and to advance the international relationships of the United States.

#### **WHERE TO DIRECT INQUIRIES REGARDING INVENTIONS**

Listed in this booklet are abstracts of various NASA-owned inventions which are available for foreign licensing in the identified countries in accordance with the NASA Foreign Patent Licensing Regulations, published on August 18, 1966, in 31 Federal Register 10958-10959, now 14 CFR 1245.400 et seq., and are reproduced on page 1. Requests for additional information of the invention or information regarding applications for license for a specific invention should be directed to the NASA field installation address printed on the page on which the invention appears. Please be sure to include the title and NASA Case Number of the invention when making your inquiries. Application for a foreign license should be made by completing NASA Form 1531, "Application For Patent License in Countries Other Than the United States".

#### **NEGOTIATION OF LICENSES**

Licenses will be individually negotiated and may be granted to any applicant, foreign or domestic, on a nonexclusive or exclusive basis for royalties or other considerations and on such other terms and conditions as are deemed appropriate to the interests of the United States. Preference in the granting of foreign license rights will be

shown to those applicants who have previously been granted a license under the corresponding U.S. patent or patent application.

### **TO OBTAIN COPIES OF PATENTS**

This publication includes abstracts of those inventions in which NASA owns the principal or exclusive rights and which have been made available for patent licensing in the countries indicated. The corresponding U.S. patent number is also listed. Copies of the U.S. patents may be purchased directly from the U.S. Patent Office, Washington, D.C. 20231 for fifty cents a copy. Some of these inventions have been licensed by NASA in one or more of the indicated countries.

# CONTENTS

	Page
NASA FOREIGN PATENT LICENSING REGULATIONS ..	1
SYSTEM FOR RECORDING AND REPRODUCING PULSE CODE MODULATED DATA (XGS-01021) .....	3
LIGHT DETECTION SYSTEM (XNP-01059) .....	4
INTERCONNECTION OF SOLAR CELLS (XGS-01475) ...	5
BALANCED BELLOWS SPIROMETER (XAC-01547) .....	6
APPARATUS PROVIDING A DIRECTIVE FIELD PAT- TERN AND ATTITUDE SENSING OF A SPIN- STABILIZED SATELLITE (XGS-02607) .....	7
MAGNETOMOTIVE METAL WORKING DEVICE (XMF-03793) .....	8
FLUID FLOW SENSOR (XMF-04163) .....	9
APPARATUS FOR CONTROLLABLY HEATING FLUID (XMF-04237) .....	10
TIME DIVISION MULTIPLEX SYSTEM (XGS-05918) ....	11
INVERTER WITH MEANS FOR BASE CURRENT SHAPING FOR SWEEPING CHARGE CARRIERS FROM BASE REGION (XGS-06226) .....	12
THERMAL CONTROL PANEL (XLA-07728) .....	13
MICROWAVE FLAW DETECTOR (ARC-10009) .....	14
FIRE RESISTANT COATING COMPOSITION (GSC-10072) .....	15
TRAFFIC CONTROL SYSTEM AND METHOD (GSC-10087-1) .....	16

	Page
POSITION LOCATION SYSTEM AND METHOD (GSC-10087-2) .....	17
TRANSVERSE PIEZORESISTANCE AND PINCH EF- FECT ELECTROMECHANICAL TRANSDUCERS (ERC-10088) .....	18
FIRE RETARDANT FOAMS (ARC-10098) .....	19
INTUMESCENT PAINTS (ARC-10099) .....	20
UNSATURATING SATURABLE CORE TRANSFORMER (ERC-10125) .....	21
METHOD AND APPARATUS FOR MEASURING THE DAMPING CHARACTERISTICS OF A STRUCTURE (ARC-10154) .....	22
CENTRIFUGAL LYOPHOBIC SEPARATOR (LAR- 10194-1) .....	23
METHOD AND APPARATUS FOR TENSILE TESTING OF METAL FOIL (LAR-10208-1) .....	24
METALLIC INTRUSION DETECTOR SYSTEM (ARC- 10265-1) .....	25
MODIFIED POLYISOCYANURATE POLYMER FOAM (ARC-10280) .....	26
POLYMERIC VEHICLES AS CARRIERS FOR SULFONIC ACID SALT OF NITROSUBSTITUTED AROMATIC AMINES (ARC-10325) .....	27
ANTI-GLARE IMPROVEMENT FOR OPTICAL IMAGING SYSTEMS (NPO-10337) .....	28
METHOD FOR THE REPAIR AND MAINTENANCE OF DENTAL ENAMEL (ERC-10338) .....	29

	Page
USE OF UNILLUMINATED SOLAR CELLS AS SHUNT DIODES FOR A SOLAR ARRAY (GSC-10344) .....	30
POTASSIUM SILICATE-ZINC COATINGS (GSC-10361) ..	31
DEPOSITION OF FILMS (LAR-10362) .....	32
HONEYCOMB CORE STRUCTURES OF MINIMAL SURFACE TUBULE SECTIONS (ERC-10363) .....	33
EXPANDABLE SPACE FRAMES (ERC-10365) .....	34
ELECTRON MICROSCOPE APERTURE SYSTEM (ARC- 10448-1) .....	35
INFRARED TURNTABLE LASER (ARC-10463) .....	36
POLYIMIDE FOAM FOR THERMAL INSULATION AND FIRE PROTECTION (ARC-10464-1) .....	37
SHOULDER HARNESS AND LAP BELT RESTRAINT SYSTEM (ARC-10519) .....	38
GRAVITY GRADIENT ATTITUDE CONTROL SYSTEM (GSC-10555) .....	39
AIRFOIL SHAPE FOR FLIGHT AT SUBSONIC SPEEDS (LAR-10585-1) .....	40
WATER PURIFICATION MEMBRANES AND METHOD OF PREPARATION (ARC-10643) .....	41
SUPPRESSION OF FLUTTER (LAR-10682-1) .....	42
IMPROVEMENTS FOR ABATING EXHAUST NOISES IN JET ENGINES (ARC-10712) .....	43
FIBER MODIFIED POLYURETHANE FOAM FOR BALLISTIC PROTECTION (ARC-10714) .....	44

	Page
PROTECTION OF MOISTURE SENSITIVE OPTICAL COMPONENTS (ARC-10749) .....	45
G-LOAD MEASURING AND INDICATOR APPARATUS (ARC-10806-1) .....	46
OPTICAL RADIATION FREQUENCY CONVERTER AND METHOD (HQN-10818) .....	47
TOTALLY CONFINED EXPLOSIVE WELDING (LAR-10941-1) .....	48
BACTERIAL ADENOSINE TRIPHOSPHATE AS A MEASURE OF URINARY TRACT INFECTION (GSC-11092-2) .....	49
STABILIZATION OF PIGMENTS (NPO-11139) .....	50
STORED CHARGE TRANSISTOR (NPO-11156-2) .....	51
GRADED BANDGAP $A_{1-x}Ga_{1-x}As$ -GaAs SOLAR CELL (LAR-11174) .....	52
EXPLOSIVELY WELDED SCARF JOINT (LAR-11211-1) .	53
IMPROVED NARROW BAND FM SYSTEM FOR VOICE COMMUNICATIONS (GSC-11261-1) .....	54
LONG RANGE LASER TRAVERSING SYSTEM (GSC-11262-1) .....	55
DUAL CYCLE AIRCRAFT TURBINE ENGINE (LAR-11310-1) .....	56
AMPLITUDE STEERED ANTENNA ARRAY (GSC-11446) .....	57
RECORDER/PROCESSOR APPARATUS (GSC-11553) ...	58

	Page
MILLIMETER WAVE PUMPED PARAMETRIC AMPLIFIER (GSC-11617) .....	59
ELECTRON BEAM CONTROLLER (LEW-11617-1) .....	60
WINGTIP VORTEX DISSIPATOR FOR AIRCRAFT (LAR-11645) .....	61
VOLTAGE CONTROLLED VARIABLE POWER DIVIDER (GSC-11659) .....	62
TWISTED MULTIFILAMENT SUPERCONDUCTOR (LEW-11726-1) .....	63
DUALLY MODE-LOCKED Nd: YAG LASER (GSC-11746-2) .....	64
DISH ANTENNA HAVING SWITCHABLE BEAMWIDTH (GSC-11760-1) .....	65
TWO-DIMENSIONAL RADIANT ENERGY ARRAY (GSC-11839-1) .....	66
ELECTROSTATICALLY CONTROLLED HEAT SHUTTER (NPO-11942) .....	67
OPHTHALMIC LIQUEFACTION PUMP (LEW-12051) .....	68
CATALYTIC TRIMERIZATION OF AROMATIC NITRILES AND TRIARYL-S-TRIAZINE RING CROSS-LINKED HIGH TEMPERATURE RESISTANT POLYMERS AND COPOLYMERS MADE THEREBY (LEW-12053-1) .....	69
METHOD OF IMPROVING IMPACT RESISTANCE OF CERAMIC BODIES, AND IMPROVED BODIES (LEW-12301) .....	70
ZERO TORQUE GEAR HEAD WRENCH (NPO-13059-1) (NPO-13436-1) .....	71

	Page
RAW LIQUID WASTE TREATMENT SYSTEM AND PROCESS (NPO-13224-1) .....	72
FLOURESCENE DETECTOR FOR MONITORING ATMO- SPHERIC POLLUTANTS (NPO-13231) .....	73
HYDROGEN RICH GAS GENERATOR (NPO-13342) ....	74
A MULTITARGET SEQUENTIAL SPUTTERING AP- PARATUS (NPO-13345-1) .....	75
SMALL, POROUS, POLYACRYLATE BEADS (NPO- 13383) .....	76
COOPERATIVE MULTIAXIS SENSOR FOR TELE- OPERATION OF ARTICLE MANIPULATING AP- PARATUS (NPO-13386-1) .....	77
SYSTEM FOR MINIMIZING INTERNAL COMBUSTION ENGINE POLLUTION EMISSION (NPO-13402) .....	78
COMPUTER INTERFACE SYSTEM (NPO-13428-1) (NPO- 13447-1) .....	79
BRUSHLESS DC MOTOR WITH WOUND ROTOR (NPO-13437-1) .....	80
IMPROVED HYDROGEN-RICH GAS GENERATOR (NPO- 13464-1) .....	81
HIGH VOLTAGE, HIGH CURRENT SCHOTTKY BARRIER SOLAR CELL (NPO-13482-1) .....	82
ANTI-FOG COMPOSITION (MSC-13530-2) .....	83
MODIFICATION OF THE PHYSICAL PROPERTIES OF FREEZE-DRIED RICE (MSC-13540-1) .....	84
HYDROGEN-RICH GAS GENERATOR (NPO-13560-1) (NPO-13561-1) .....	85

	Page
METHOD OF FLUXLESS BRAZING AND DIFFUSION BONDING OF ALUMINUM CONTAINING COMPONENTS (MSC-14435-1) .....	86
AIR CUSHION LIFT PAD (MFS-14685) .....	87
PROCESS AND APPARATUS FOR MAKING DIAMONDS (MFS-20698) .....	88
GRAPHITE-REINFORCED ALUMINUM COMPOSITE AND METHOD OF PREPARING THE SAME (MFS-21077) ...	89
METHOD AND APPARATUS FOR NON-DESTRUCTIVE TESTING (MFS-21233) .....	90
MICROWAVE POWER TRANSMISSION SYSTEM WHEREIN LEVEL OF TRANSMITTED POWER IS CONTROLLED BY REFLECTIONS FROM RECEIVER (MFS-21470-1) .....	91
REFRACTORY PORCELAIN ENAMEL PASSIVE CONTROL COATING FOR HIGH TEMPERATURE ALLOYS (MFS-22324) .....	92
POLYIMIDES OF ETHER-LINKED ARYL TETRACARBOXYLIC DIANHYDRIDES (MFS-22355-1) .....	93
ETHER-LINKED ARYL TETRACARBOXYLIC DIANHYDRIDES (MFS-22356) .....	94
A PANEL FOR SELECTIVELY ABSORBING SOLAR THERMAL ENERGY AND THE METHOD OF PRODUCING SAID PANEL (MFS-22562) .....	95
ANTI-GRAVITY DEVICE (MFS-22758-2) .....	96

# TITLE 14—AERONAUTICS AND SPACE

## Chapter V—National Aeronautics and Space Administration

### PART 1245—PATENTS

#### Subpart 4—Foreign Patent Licensing Regulations

- Sec.  
1245.400 Scope of subpart.  
1245.401 Policy.  
1245.402 Types of licenses and terms and conditions.  
1245.403 Government license.  
1245.404 Enforcement of patent rights.  
1245.405 Procedures.

**AUTHORITY:** The provisions of this Subpart 4 issued under 42 U.S.C. 2457 (g) and (h).

#### § 1245.400 Scope of subpart.

(a) The subpart establishes the policy, terms, conditions, and procedures under which NASA-owned foreign patents and patent applications may be licensed.

(b) The provisions of this subpart apply to all NASA-owned patents granted in countries other than the United States and to NASA-owned patent applications pending in such countries and supplement the provisions of Subpart 2 of this part for foreign patent licensing.

#### § 1245.401 Policy.

The foreign licensing program of the National Aeronautics and Space Administration serves to promote and utilize foreign patent rights vested in the Administration. The objectives of this program are to further the interests of United States industry in foreign commerce, to enhance the economic interests of the United States, and to advance the international relationships of the United States.

#### § 1245.402 Types of licenses and terms and conditions.

Licenses will be individually negotiated and may be granted to any applicant, foreign or domestic, on a nonexclusive or exclusive basis for royalties or other considerations and on such other terms and conditions as are deemed appropriate to the interests of the United States. Preference in the granting of foreign license rights will be shown to those applicants who have previously been granted a license under the corresponding U.S. patent or patent application.

#### § 1245.403 Government license.

There will be reserved from each exclusive license an irrevocable, nonexclusive, nontransferable, royalty-free license for the practice of such invention throughout the world by or on behalf of the United States or any foreign government pursuant to any existing or future treaty or agreement with the United States.

#### § 1245.404 Enforcement of patent rights.

An exclusive licensee will be authorized to enforce the licensed patent and to sue infringers of the patent at its own expense.

#### § 1245.405 Procedures.

(a) NASA will publish in the United States, and elsewhere as may be appropriate, lists of NASA-owned foreign patents or patent applications available for licensing.

(b) NASA will also furnish written notice of the availability for licensing of NASA-owned foreign patents or patent applications to any licensee under the corresponding U.S. patent or patent application.

(c) Applications for license should be addressed to the Administrator, National Aeronautics and Space Administration, Washington, D.C. 20456. The application must fully identify the patent or patent application, and state the type of license requested together with proposed terms and conditions thereof.

(d) The conduct of negotiations with prospective licensees will be the responsibility of the General Counsel, NASA. In the conduct of such negotiations, due regard shall be had for the possible interests of NASA program and staff offices, and their coordination will be obtained as deemed appropriate.

(e) NASA will publish notice in the FEDERAL REGISTER, and elsewhere as may be appropriate, of its intention to grant an exclusive license under an identified patent or patent application. An exclusive license will not be granted until the expiration of 60 days from the date of notice in order to provide a suitable time interval for interested persons or other Government agencies to interpose comment or objection.

(f) All licenses shall become effective upon the written acceptance by the licensee of a license instrument specifying the type of license and terms and conditions thereof.

*Effective date.* The provisions of this Subpart 4 are effective upon publication in the FEDERAL REGISTER.

JAMES E. WEBB,  
*Administrator.*

[F.R. Doc. 66-8920; Filed, Aug. 17, 1966; 8:45 a.m.]

FEDERAL REGISTER, VOL. 31, NO. 160--THURSDAY, AUGUST 18, 1966

# SYSTEM FOR RECORDING AND REPRODUCING PULSE CODE MODULATED DATA

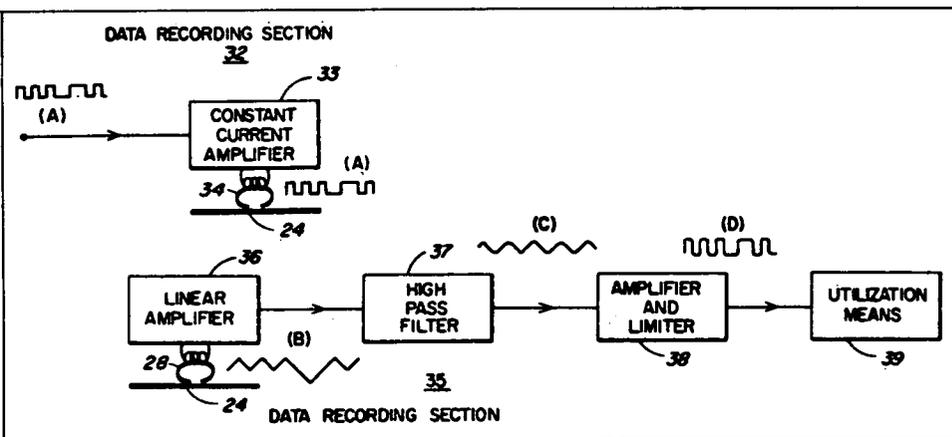
NASA Case No. XGS-01021

Canada

*Address inquiries to:*  
Goddard Space Flight Center  
Attn: Patent Counsel  
Mail Code: 204  
Greenbelt, MD 20771  
U.S.A.

*[Corresponding to U.S. Patent No. 3,277,373]*

In pulse code modulated magnetic tape recording and reproducing (playback) systems, the playback head tends to alter the shape of the recorded signal. Accordingly, the reproducing system must reconstruct the proper signal from the altered one. This invention eliminates the need for this reconstruction function by the design of the playback head in which the head gap is approximately one-half the wave length of the recorded pulse code modulated data at its fundamental pulse repetition frequency. The playback head thus provides an output signal which is an integral of the recorded signal and contains all of the recorded information. The invention also allows a higher packing density of the recorded information on the magnetic tape.



# LIGHT DETECTION SYSTEM

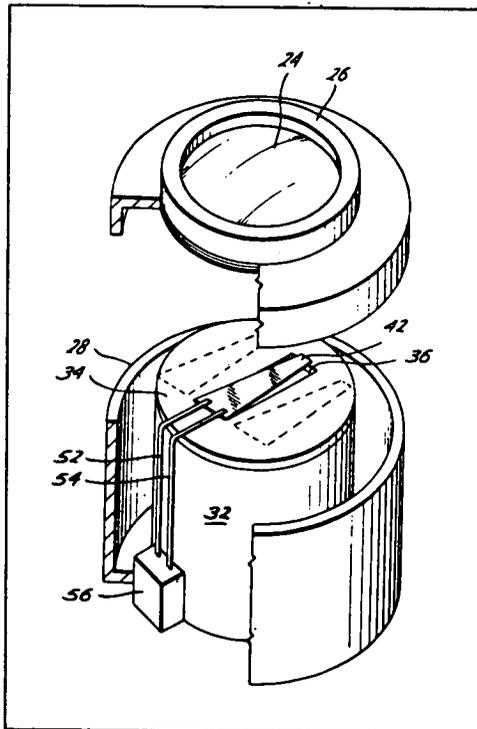
NASA Case No. XNP-01059

Canada

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NASA Pasadena Office  
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Mail Code: 180-601  
4800 Oak Grove Drive  
Pasadena, CA 91103  
U.S.A.

*[Corresponding to U.S. Patent No. 3,354,320]*

A system for determining the position of a light source about two axes of a reference position. The system, originally developed for orienting antenna on the Mariner spacecraft, utilizes a single movable part, a vibrating reed shutter, for alternately blocking and passing light from the source projected onto a photosensitive detector at the position of reference.



# INTERCONNECTION OF SOLAR CELLS

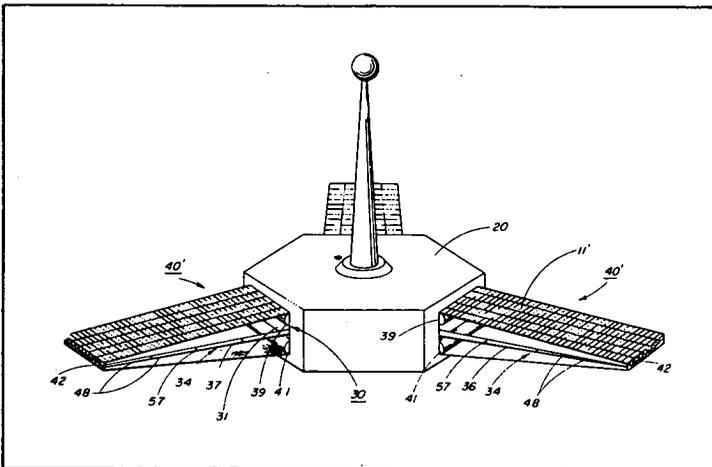
NASA Case No. XGS-01475

Canada

Address inquiries to:  
Goddard Space Flight Center  
Attn: Patent Counsel  
Mail Code: 204  
Greenbelt, MD 20771  
U.S.A.

[Corresponding to U.S. Patent No. 3,459,391]

Expanded metal, that is, a thin metal strip which has first had short longitudinal cuts made therein and then been pulled transverse to the cuts to open the cuts into diamond shaped holes, has been used as interconnectors in a solar cell matrix to provide a flexible, somewhat resilient array. The solar cell array can be compactly stored prior to deployment and then deployed into a variety of shapes through the use of a new expandable frame in which telescoping tubes are extended to a desired length and then cemented to form a rigid support structure.



\*Exclusively licensed in Japan.

## BALANCED BELLOWS SPIROMETER

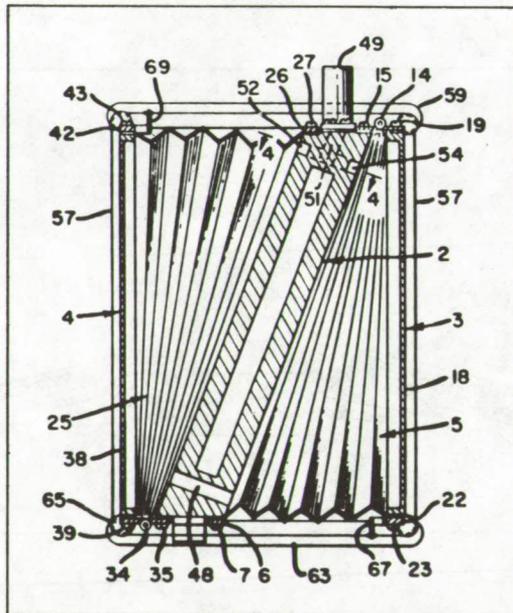
NASA Case No. XAC-01547

Canada

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Ames Research Center  
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Mail Code: 200-11A  
Moffett Field, CA 94035  
U.S.A.

[Corresponding to U.S. Patent No. 3,420,225]

A laboratory instrument for measuring total lung capacity, vital capacity, maximum breathing capacity, tidal volume, functional residual capacity and oxygen uptake of human subjects. The spirometer, which employs two mechanically interconnected bellows, is compact, retains calibration, and is unaffected by acceleration fields along all three coordinate axes.



# APPARATUS PROVIDING A DIRECTIVE FIELD PATTERN AND ATTITUDE SENSING OF A SPIN-STABILIZED SATELLITE

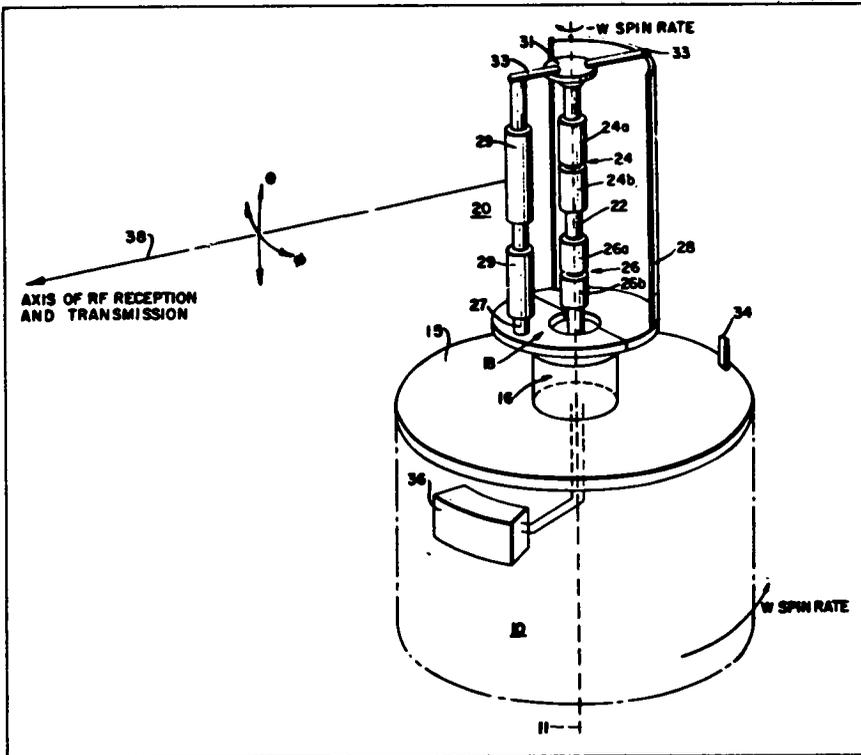
NASA Case No. XGS-02607

Canada, France,  
Netherlands, Japan,  
West Germany, Great Britain

Address inquiries to:  
Goddard Space Flight Center  
Attn: Patent Counsel  
Mail Code: 204  
Greenbelt, MD 20771  
U.S.A.

[Corresponding to U.S. Patent No. 3,341,151]

A satellite, adapted to spin about an axis, having antenna elements for communicating with a remote body and a beam collimator rotatable with respect to the spin axis. The beam collimator is rotated at the same rate and in the opposite direction as the spin of the satellite to provide a directional beam stationary in space. Ejection apparatus enables the collimator to be jettisoned in event of rotational malfunction so that an omnidirectional beam may be provided about the spin axis. Signal processing circuitry operating in conjunction with the antenna elements provides information concerning the attitude of the satellite.



# MAGNETOMOTIVE METAL WORKING DEVICE

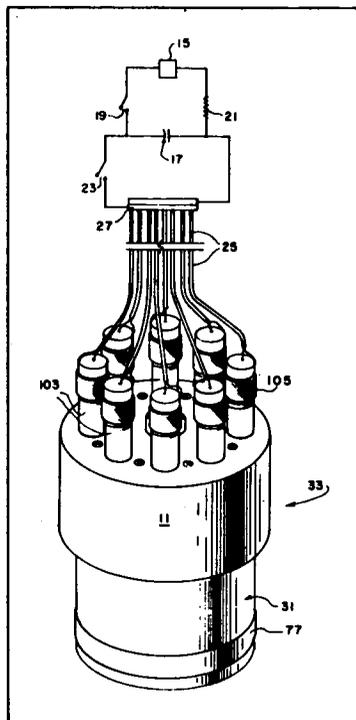
NASA Case No. XMF-03793

Canada

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Marshall Space Flight Center  
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U.S.A.

*[Corresponding to U.S. Patent No. 3,360,972]*

A portable magnetic hammer, a metal working device developed in the course of the Saturn program, wherein energy for manipulating a metal workpiece is acquired by creating a high-intensity magnetic field from a controlled electrical discharge into a conductor coil. This compact, lightweight device performs sizing, blanking, and stress removal functions without surface marring of the metals. It is expected that the magnetic hammer would find use in many environments particularly in removing dents, deformed or depressed surfaces from vehicles, fenders and bodies, tanks, etc.



# FLUID FLOW SENSOR

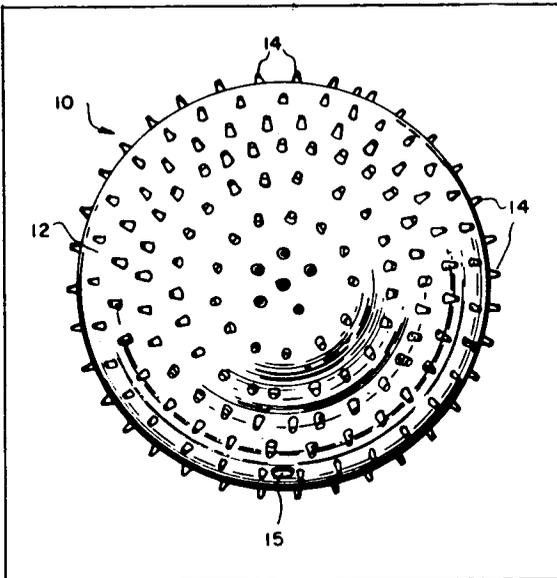
NASA Case No. XMF-04163

Canada

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Huntsville, AL 35812  
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*[Corresponding to U.S. Patent No. 3,340,732]*

A meteorological balloon having superior response and aerodynamic stability characteristics due to provision of a plurality of evenly dispersed protuberances on the balloon surface. These protuberances form a roughened surface to provide a more evenly distributed flow separation area to induce a larger balloon wake, resulting in greater stability in flight.



# APPARATUS FOR CONTROLLABLY HEATING FLUID

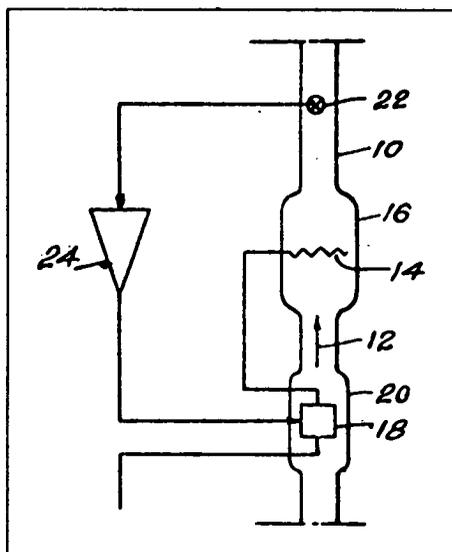
NASA Case No. XMF-04237

Canada

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Marshall Space Flight Center  
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Mail Code: A&PS-PAT  
Huntsville, AL 35812  
U.S.A.

*[Corresponding to U.S. Patent No. 3,517,162]*

This invention is associated with fluid heating devices which operate by circulating fluid past an electronically controlled heater element in a flow conduit. The efficiency of such devices is increased by placing the heater control components in the conduit, upstream from the heater element, thereby utilizing the heat generated in the control components for preheating the fluid anterior to the principal heater element.



# TIME DIVISION MULTIPLEX SYSTEM

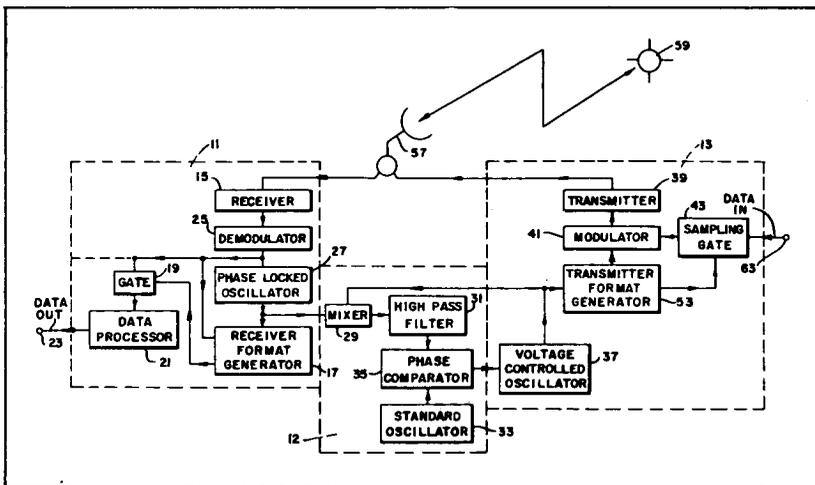
NASA Case No. XGS-05918

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Address inquiries to:  
Goddard Space Flight Center  
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Greenbelt, MD 20771  
U.S.A.

[Corresponding to U.S. Patent No. 3,430,237]

Apparatus for synchronizing a satellite time division multiplex system so that signals can be transmitted or received between any of the stations. The system constantly compensates for Doppler shift so that a medium altitude satellite is always in synchronization. Additionally, a system is provided for centering a slave station in an empty slot in the time division multiplex format.



# INVERTER WITH MEANS FOR BASE CURRENT SHAPING FOR SWEEPING CHARGE CARRIERS FROM BASE REGION

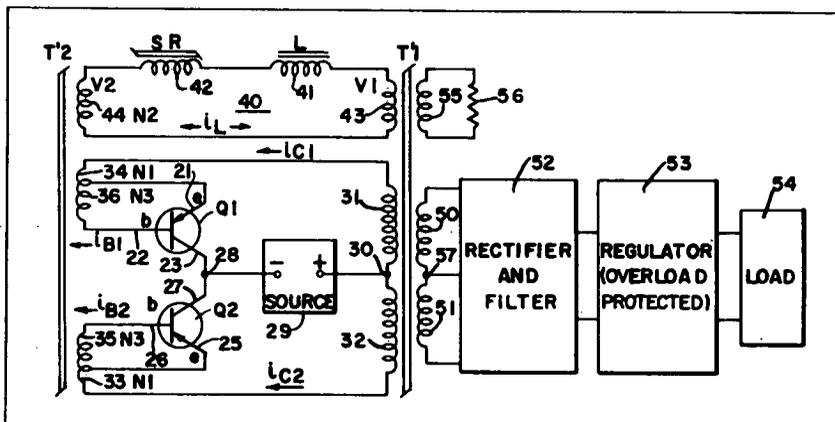
NASA Case No. XGS-06226

Canada

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Goddard Space Flight Center  
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Mail Code: 204  
Greenbelt, MD 20771  
U.S.A.

*[Corresponding to U.S. Patent No. 3,466,570]*

Inverters are utilized for converting a source of direct current to alternating current, or alternately for converting a source of direct current to a first voltage level alternating current and then to a second desired direct current voltage level. The concept employed in the inverters of this invention employs semiconductors and utilizes means for base current shaping for sweeping charge carriers from the base region. More specifically, the provision of both an inductance and a saturable reactor in the frequency determining network of a push-pull transformer coupled oscillator-inverter drastically improves performance. The circuit inhibits abnormal surges, spikes or ripples which are usually present at an energy source output. Short circuit protection is provided and increased reliability and efficiency is obtained by reducing the switching transistor overlap without requiring the application of a high inverse base to emitter voltage. A further feature is the provision of a means for controllably separating the base drive current reduction (switching-off transistor) and base drive current overdrive (switching-on transistor) into two distinct and separate time intervals.



## THERMAL CONTROL PANEL

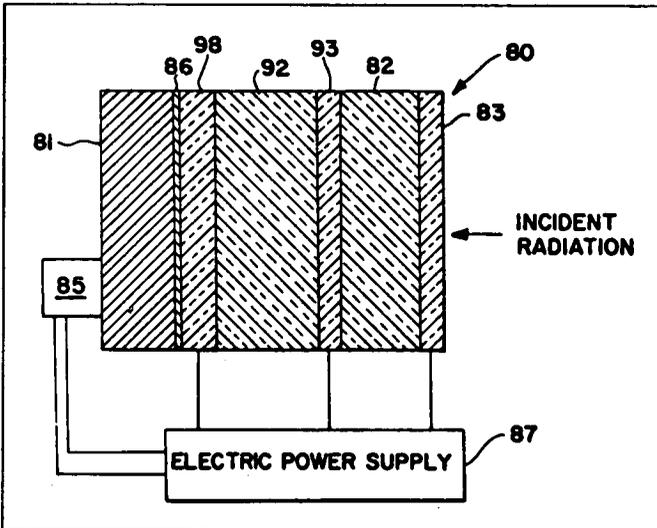
NASA Case No. XLA-07728

Canada

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Langley Station  
Hampton, VA 23665  
U.S.A.

[Corresponding to U.S. Patent No. 3,374,830]

It is necessary to protect the interior of space vehicles from the extreme environmental temperature changes encountered in space missions. For this purpose a thermo-sensitive panel construction has been developed for achieving selectively changeable and controllable surface solar absorptivity/emissivity ratios. The result is obtained by altering the molecular structure of the panel construction through such changes as electroluminescence, semiconductor, photovoltaic effect and electro-optical polarization.



## MICROWAVE FLAW DETECTOR

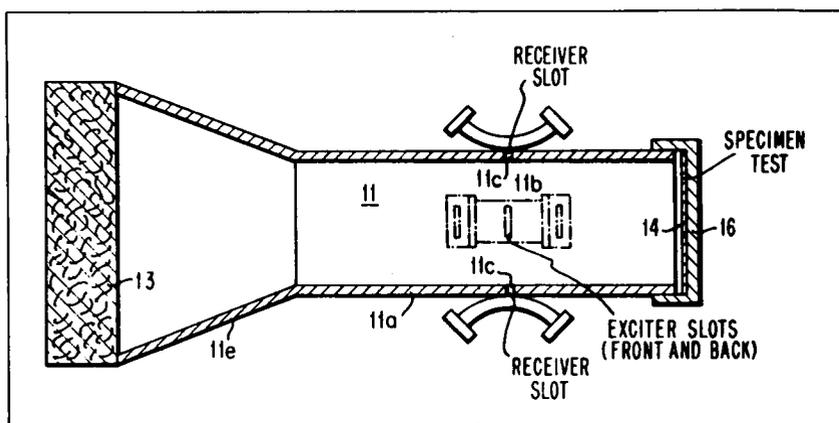
NASA Case No. ARC-10009

Canada

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Moffett Field, CA 94035  
U.S.A.

[Corresponding to U.S. Patent No. 3,532,973]

The basic theory of a microwave metal surface flaw detector is that irradiation of a flawed metal surface by electromagnetic microwave energy results in re-emission of electromagnetic energy from the surface in a pattern of eigenmodes different from those of the original irradiating signal. The incident microwave signal must satisfy the electromagnetic boundary conditions on the surface of the specimen. In accordance with the present invention, there is provided a flaw detection system utilizing microwave energy which is radiated to the test surface and which varies in a cyclic or return-to-zero manner. The test surface modifies the reflected electromagnetic energy, in accordance with the surface condition, so that the reflected energy provides a measure of the surface condition as a function of the cyclic scan angle. This reflected energy is demodulated and then correlated, either with itself or with a reference pattern, to provide an indication of irregularities in the surface.



## **FIRE RESISTANT COATING COMPOSITION**

**NASA Case No. GSC-10072**

**Canada, France,  
Italy, Japan,  
Great Britain, West Germany**

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Greenbelt, MD 20771  
U.S.A.

*[Corresponding to U.S. Patent No. 3,493,401]*

Fire resistant coating compositions intended for high temperature applications, which when dried are flake, crack, craze, and abrasion resistant and of greatly reduced leachability. The compositions, which are combinable with selected conventional pigments and fillers, comprise a combination of a potassium silicate solution, ceric oxide, and/or alkyl trialkoxy silane as rehydration suppressants, and wollastonite as a film builder.

## TRAFFIC CONTROL SYSTEM AND METHOD

NASA Case No. GSC-10087-1

Address inquiries to:

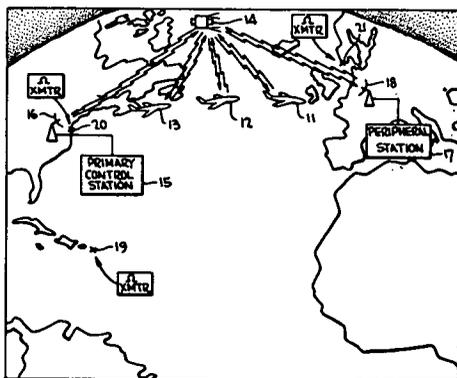
Belgium, Canada,  
France, Italy, Japan,  
Switzerland, Great Britain

Goddard Space Flight Center  
Attn: Patent Counsel  
Mail Code: 204  
Greenbelt, MD 20771  
U.S.A.

*[Corresponding to U.S. Patent No. 3,534,367]*

System and method for position locating, deriving centralized air traffic control, data, and communicating via voice and digital signals between a multiplicity of remote aircraft (including supersonic transports) and a central station, as well as a peripheral ground station(s), through a synchronous satellite relay station. Side tone ranging patterns, as well as digital and voice signals are modulated on a carrier transmitted from the central station and received on all of the supersonic transports. Each aircraft communicates with the ground stations via a different frequency multiplexed spectrum. Supersonic transport position is derived from a computer at the central station and supplied to a local air traffic controller. Position is determined in response to variable phase information imposed on the side tones at the aircraft, and relayed back to the transports. Common to all of the side tone techniques is Doppler compensation for the supersonic transport velocity.

The patent coverage of GSC-10087-1 is directed to transmitting a first side tone spectrum from a first point, transmitting a carrier modulating with a second side tone spectrum from a second point, receiving the first and second spectrums on an aircraft, determining from the phase of the tones the distance of the aircraft relative with the first and second points, determining the distance of the aircraft from the center of the Earth, and then combining the three distances to establish the location of the aircraft.



## POSITION LOCATION SYSTEM AND METHOD

NASA Case No. GSC-10087-2

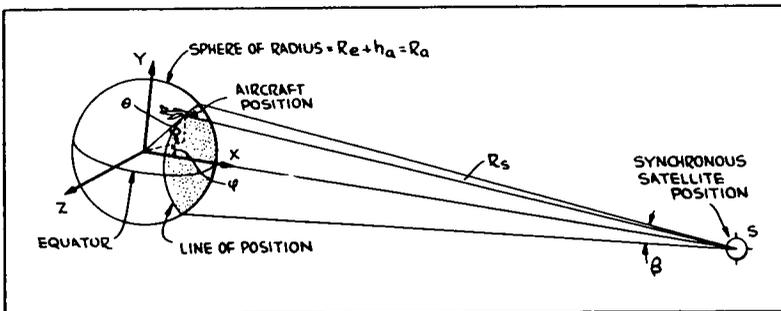
Belgium, Canada, France,  
Great Britain, Switzerland,  
West Germany

Address inquiries to:  
Goddard Space Flight Center  
Attn: Patent Counsel  
Mail Code: 204  
Greenbelt, MD 20771  
U.S.A.

[Corresponding to U.S. Patent No. 3,495,260]

System and method for position locating, deriving centralized air traffic control data, and communicating via voice and digital signals between a multiplicity of remote aircraft (including supersonic transports) and a central station, as well as a peripheral ground station(s), through a synchronous satellite relay station. Side tone ranging patterns, as well as digital and voice signals are modulated on a carrier transmitted from the central station and received on all of the supersonic transports. Each aircraft communicates with the ground stations via a different frequency multiplexed spectrum. Supersonic transport position is derived from a computer at the central station and supplied to a local air traffic controller. Position is determined in response to variable phase information imposed on the side tones at the aircraft, and relayed back to the transports. Common to all of the side tone techniques is Doppler compensation for the supersonic transport velocity.

The claim coverage of GSC-10087-2 varies in at least one respect in that the Doppler frequency shift on the carrier is utilized to provide a determination of the velocity of the object relative to a satellite station.



# TRANSVERSE PIEZORESISTANCE AND PINCH EFFECT ELECTROMECHANICAL TRANSDUCERS

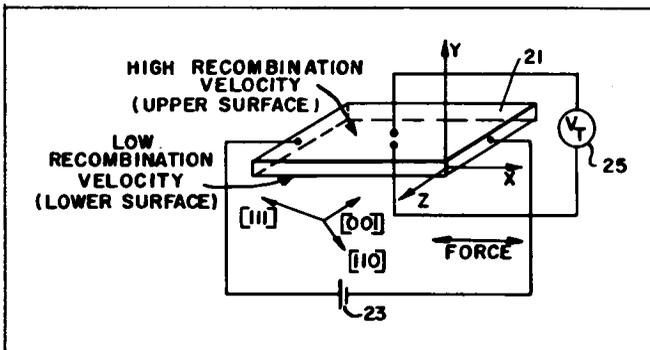
NASA Case No. ERC-10088

Canada

Address inquiries to:  
NASA Headquarters  
Code GP  
Washington, DC 20546  
U.S.A.

[Corresponding U.S. Patent No. 3,537,305]

This invention is a replacement for strain gages and accelerometers. The device may be used in any environment where conventional piezoresistive or strain gage electromechanical transducers can be used. In addition to the foregoing uses, the device can be used in bioelectric sensing due to its small size. The transducer, of anisotropic piezoresistive material, includes a body of semiconductor material having a longitudinal force axis that is skewed with respect to the crystallographic orientation of the body. The material combines the pinch effect with the piezoresistive effect. The device produces a much larger electrical signal for a given stress than presently known in the prior art.



## FIRE RETARDANT FOAMS

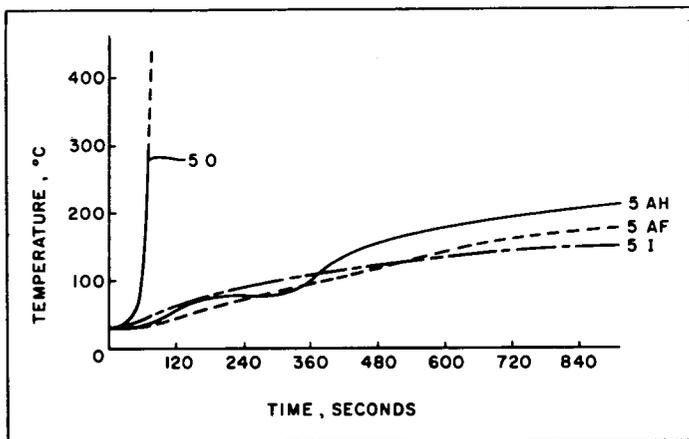
NASA Case No. ARC-10098

\*See address below.

Australia, Belgium, Canada, France,  
Italy, Japan, Sweden, Switzerland,  
Great Britain, West Germany,  
Netherlands

*[Corresponding to U.S. Patent No. 3,549,564]*

This invention improves upon polyurethane foams as fire resistant materials by improving their characteristics and by imparting fire suppressant and fire retardant characteristics. The main structure of the material is a rigid or semi-rigid polyurethane foam, preferably of a highly branched structure, in which are incorporated one or more materials to impart special properties. Modified foams have been developed which provide effective protection for thermally sensitive structures against the destructive action of fuel-fires. The invention relates to the modification of closed cell rigid and semi-rigid polyurethane foams in the density range of from 0.50 to 50 pounds per cubic foot. The modifying agents include three types: a certain class of alkyl halide resins, a certain class of inorganic salts, and encapsulated halogen bearing volatile molecules. The modified foam may then be applied by conventional methods. Outstanding protection against fire has been achieved.



\*Exclusively licensed to Avco Corporation. Please direct inquiries to: Fire Protection Materials, Avco Corporation, Avco Systems Division, Lowell Industrial Park, Lowell, Massachusetts 01851.

## INTUMESCENT PAINTS

NASA Case No. ARC-10099

\*See address below.

Australia, Belgium, Canada, France,  
Italy, Japan, Sweden, Switzerland,  
Great Britain, West Germany,  
Netherlands

*[Corresponding to U.S. Patent No. 3,535,130]*

Intumescent (swelling or expanding) paints useful for fire protection have been produced. Conventional intumescent paints suffer from many disadvantages including sensitivity to water and other solvents, little resistance to scuffing and abrasion, sensitivity to thermal erosion by flames, and limited efficiency in the protection of substrates under thin steel plate or sheet. This paint overcomes these disadvantages and provides outstanding protection. The intumescent material is an aromatic nitroamino compound in the form of its sulfate, either dissolved or dispersed in a vehicle, or prepolymerized, or both. Upon heating, such a paint intumesces, chars and provides a flame resistant coating.

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# UNSATURATING SATURABLE CORE TRANSFORMER

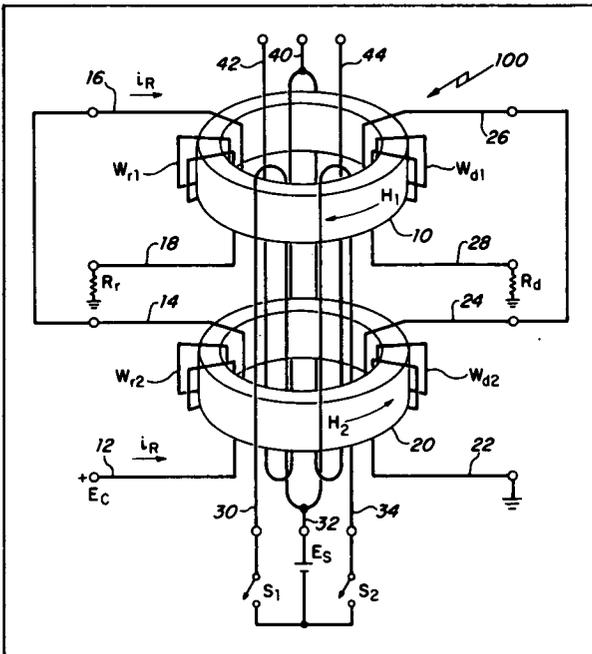
NASA Case No. ERC-10125

Canada, France, Netherlands,  
Italy, Japan, Great Britain,  
West Germany

Address inquiries to:  
NASA Headquarters  
Code GP  
Washington, DC 20546  
U.S.A.

[Corresponding U.S. Patent No. 3,541,428]

The transformer of the present invention will not saturate at any time under any conditions for any length of time. The device includes a pair of stacked, uncut, saturable magnetic cores having a plurality of windings. The cores operate in parallel and provide a means of detecting, warning and suppressing any impending saturation before saturation can occur. Many advantages are gained from the use of this transformer such as: elimination of the main apparent cause of power transistor failure in inverter circuits while enabling existing power transistors to process double or more load current, and, enabling a better utilization of existing components because it reduces the need to derate switching components to a small fraction of their current carrying capacity.



# METHOD AND APPARATUS FOR MEASURING THE DAMPING CHARACTERISTICS OF A STRUCTURE

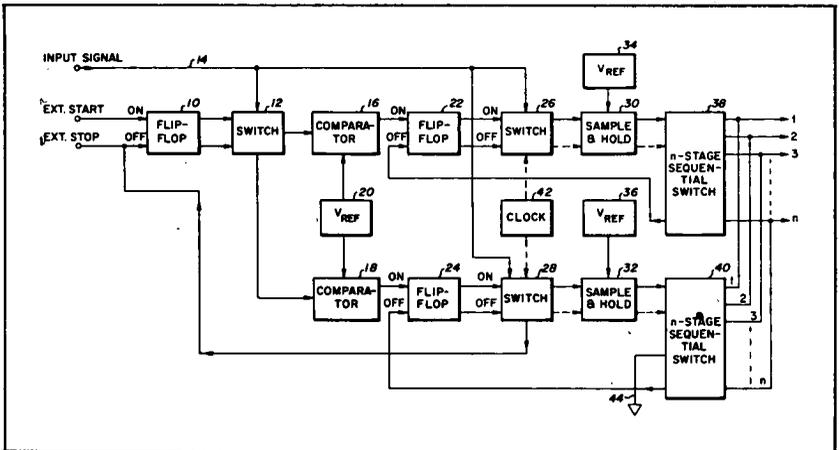
NASA Case No. ARC-10154

Canada, France, Japan,  
Great Britain, West Germany

*Address inquiries to:*  
Ames Research Center  
Attn: Patent Counsel  
Mail Code: 200-11A  
Moffett Field, CA 94035  
U.S.A.

*[Corresponding to U.S. Patent No. 3,620,069]*

Spectral analyzers and correlation computers have been used in the past to provide the most useful damping data heretofore available; however, these types of apparatus either require too much time to obtain accurate values of damping characteristics or can only be used with linear systems. The present invention relates to an automatic on-the-line instrument for measuring the damping characteristics of a structure or system during excitation by random forces or influences. The apparatus is comprised of at least two parallel sampling circuits which perform time sequential sampling operations on predetermined portions of a given input signal. After summing the outputs of the sampling circuits at output terminals, a sampling transient indicative of a point on the damping characteristic of the structure can be obtained.



# CENTRIFUGAL LYOPHOBIC SEPARATOR

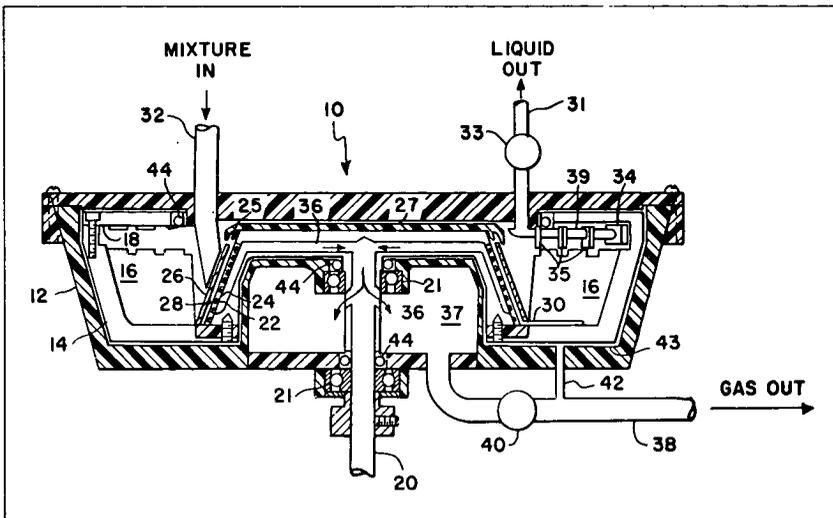
NASA Case No. LAR-10194-1

Canada, Great Britain, France,  
West Germany, Japan, Italy,  
Switzerland

Address inquiries to:  
Langley Research Center  
Attn: Patent Counsel  
Mail Code: 313  
Langley Station  
Hampton, VA 23665  
U.S.A.

*[Corresponding to U.S. Patent No. 3,828,524]*

This is a centrifugal separator for the separation of aerosols from a mixed stream of gas and liquid. The invention utilizes both centrifugal force and a lyophobic filter, the combination of which presents several advantages. This invention relates to a centrifugal separator and more particularly to a separator of aerosols from a mixed stream of gas and liquid utilizing both centrifugal force and a lyophobic filter. The use of lyophobic filters to separate liquid aerosols from a gas stream is known in the art. Using both lyophobic filtration and centrifugal force however, has several advantages over the use of either method of separation by itself.



# METHOD AND APPARATUS FOR TENSILE TESTING OF METAL FOIL

NASA Case No. LAR-10208-1

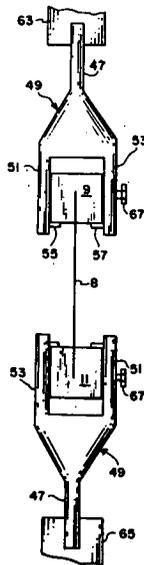
*Address inquiries to:*

Canada, France, Great Britain,  
Japan, Sweden, Switzerland,  
West Germany

Langley Research Center  
Attn: Patent Counsel  
Mail Code: 313  
Hampton, VA 23665  
U.S.A.

*[Corresponding U.S. Patent—Application Pending]*

In the strength of material testing of any specimen the ultimate goal is the acquisition of accurate and reproducible results. This invention is an improved method for the tensile testing of metal foil specimens and to an aligning apparatus for use in the method. Accurate, reproducible results in the tensile testing of thin metal foils are obtained by a method which comprises, before placing the test specimen in a tensile testing machine, working the side edges of the test specimen until the edges are parallel and flaw-free.



# METALLIC INTRUSION DETECTOR SYSTEM

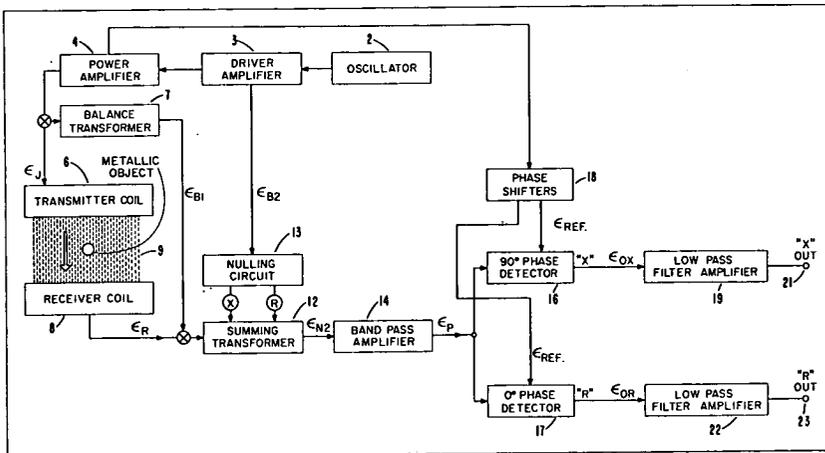
NASA Case No. ARC-10265-1

Great Britain, France, Canada,  
West Germany, Netherlands, Japan

Address inquiries to:  
Ames Research Center  
Attn: Patent Counsel  
Mail Code: 200-11A.  
Moffett Field, CA 94035  
U.S.A.

[Corresponding to U.S. Patent No. 3,676,772]

A system is described for determining the intrusion, relative size, and the physical characteristics of a metallic object in a predetermined space. Transmitter and receiver coil assemblies are arranged to define a space through which a metallic object is expected to pass. The assemblies are adapted to generate an electromagnetic field of predetermined energy per unit volume, with the receiver coil coupled to the energy source to indicate the intrusion of a metallic object into the electromagnetic field, whether the object is ferrous or nonferrous, and the size of the object.



## MODIFIED POLYISOCYANURATE POLYMER FOAM

NASA Case No. ARC-10280

\*See address below.

Canada, France, Italy, Japan,  
Great Britain, West Germany

*[Corresponding to U.S. Patent—Application Pending]*

The subject matter of this invention is directed to a fire retardant polyisocyanurate foam which is resistant to high temperatures and which has exceptional dimensional stability. In general, the present invention is carried out by reacting an organic polyisocyanate in the presence of a blowing agent and catalyst with a low hydroxyl number, high molecular weight linear polyether polyol comprising a condensation product of a multi-functional polyol and propylene oxide with grafted polyacrylonitrile branched side chains. Thus the crux of the present invention is the employment of a polyol having grafted acrylonitrile side chains which cyclize at elevated temperatures to form stable heterocyclic structures. By employing the polyol having a high molecular weight and low hydroxyl number, only small amounts of the isocyanate groups are consumed to form urethane linkages.

\*Exclusively licensed to Avco Corporation. Please direct inquiries to: Fire Protection Materials, Avco Corporation, Avco Systems Division, Lowell Industrial Park, Lowell, Massachusetts 01851.

**POLYMERIC VEHICLES AS CARRIERS FOR  
SULFONIC ACID SALT OF NITROSUBSTITUTED  
AROMATIC AMINES**

NASA Case No. ARC-10325

\*See address below.

**Canada, Japan, West Germany, Great Britain**

*[Corresponding to U.S. Patent No. 3,663,464]*

Intumescent coatings when applied to the surface of an article provide protection from fire and heat. Many applications of the coatings (or paints) are envisioned which include use in schools, homes, office buildings, ships, spacecraft, aircraft, etc. This invention relates to an intumescent agent which contains the ammonium salt of 4-nitroaniline-2-sulfonic acid and a polymer of the mercaptan type which may contain disulfide linkages or polyoxyalkylene linkages. The adhesion and char resistance of such compositions can be further improved by the addition of epoxy resins. The composition exhibits high hydrolytic stability.

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# ANTI-GLARE IMPROVEMENT FOR OPTICAL IMAGING SYSTEMS

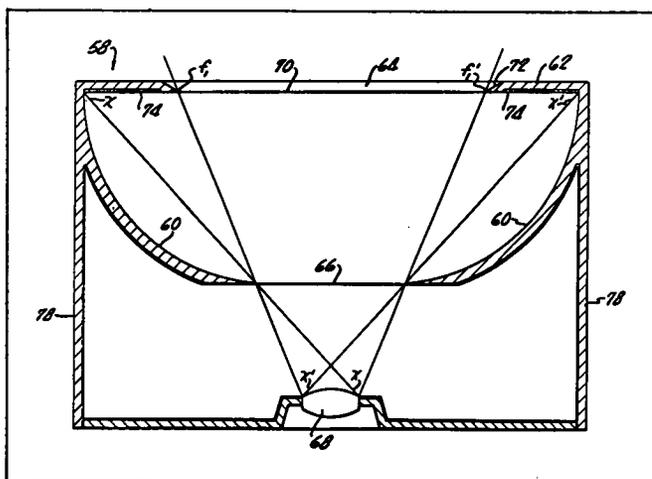
NASA Case No. NPO-10337

Belgium, Canada, France, Great Britain,  
Italy, Japan, West Germany

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NASA Pasadena Office  
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Mail Code: 180-601  
4800 Oak Grove Drive  
Pasadena, CA 91103  
U.S.A.

[Corresponding to U.S. Patent No. 3,488,103]

This invention is directed to an anti-glare baffle for shading rays such as light rays or other radiant energy rays which emanate from outside a desired field of view. The device may find use in sensitive still and movie cameras, light meters, telescopes, radiometers, photometers, electro-optical position sensors, photocell shades, star tracking devices and the like. The anti-glare baffle has a specularly reflective surface formed from an oblate hemispheroid. A shading flange extends inwardly from the upper edge of the hemispheroid and intersects the foci of the oblate hemispheroid. The oblate hemispheroid and flange surround a viewing aperture and spaced ray detecting device.



**METHOD FOR THE REPAIR AND MAINTENANCE  
OF DENTAL ENAMEL**

**NASA Case No. ERC-10338**

**Canada**

*Address inquiries to:*  
Marshall Space Flight Center  
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Mail Code: CC01  
Huntsville, AL 35812  
U.S.A.

*[Corresponding to U.S. Patent No. 3,679,360]*

A process for the preparation of calcium phosphate salts wherein a calcium phosphate salt is deposited from a gel medium onto the surface of a tooth. The use of the gel diffusion process to deposit the constituents of tooth enamel onto the surface of a weak or damaged tooth and thereby effect repair of the tooth is disclosed.

# USE OF UNILLUMINATED SOLAR CELLS AS SHUNT DIODES FOR A SOLAR ARRAY

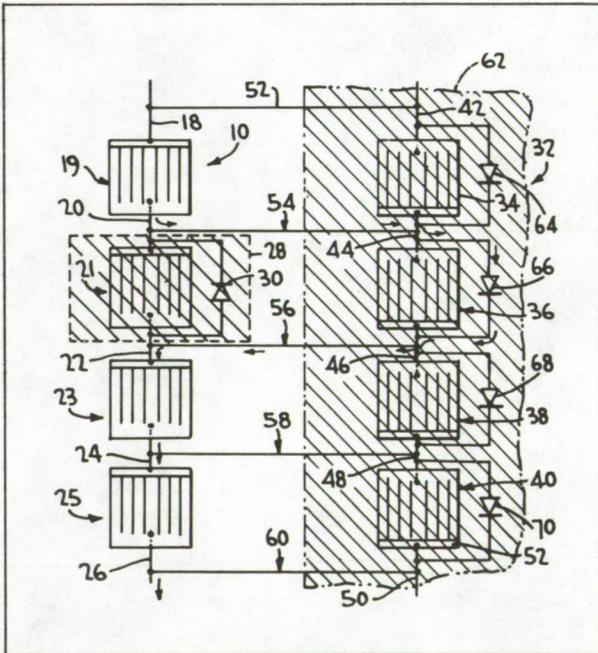
NASA Case No. GSC-10344

Canada, France, Netherlands,  
Italy, Japan, Great Britain,  
West Germany

Address inquiries to:  
Goddard Space Flight Center  
Attn: Patent Counsel  
Mail Code: 204  
Greenbelt, MD 20771  
U.S.A.

[Corresponding to U.S. Patent No. 3,672,999]

An improvement has been made in the electrical interconnection of solar cells in an array of solar batteries. Each individual cell of a shaded battery is electrically connected in parallel with a corresponding cell of an illuminated solar battery. The p-n junction solar cell of the shaded battery provides a forward biased diode equivalent in a by-pass conducting path around the corresponding illuminated cell in the event it becomes non-conductive. Thus, uninterrupted current flow is maintained in the event the illuminated cell fails to function.



## POTASSIUM SILICATE-ZINC COATINGS

NASA Case No. GSC-10361

Canada, France, Italy,  
Japan, Great Britain,  
West Germany,

*Address inquiries to:*  
Goddard Space Flight Center  
Attn: Patent Counsel  
Mail Code: 204  
Greenbelt, MD 20771  
U.S.A.

*[Corresponding to U.S. Patent No. 3,620,784]*

Zinc dust coatings which, when dried on a metal surface, are crack, craze, and abrasion resistant. The coatings are formed by combining a potassium silicate solution with zinc dust and, optionally, including an alkyl trialkoxysilane. These compositions of basically inorganic materials are intended primarily for the protection of metals subject to adverse environmental conditions.

## DEPOSITION OF FILMS

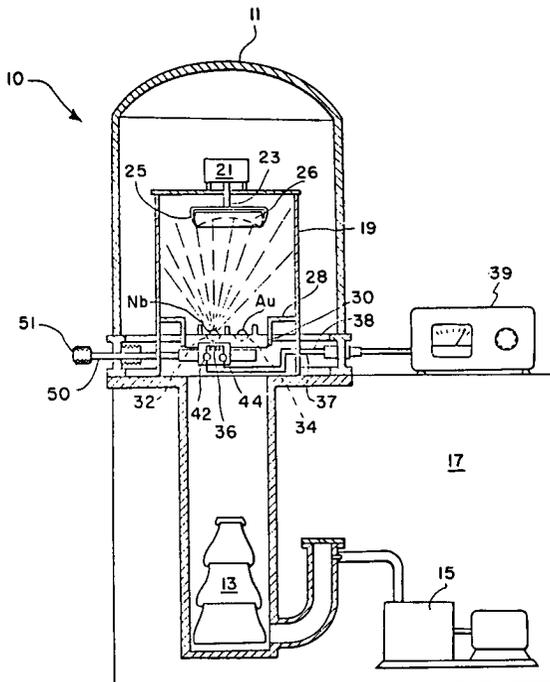
NASA Case No. LAR-10362

Canada, France, Japan,  
Great Britain, West Germany

Address inquiries to:  
Langley Research Center  
Attn: Patent Counsel  
Mail Code: 456  
Langley Station  
Hampton, VA 23665  
U.S.A.

*[Corresponding U.S. Patent – Application Pending]*

A system for depositing multilayer protective coatings on a glass or quartz substrate wherein a single heat source evaporates selective ones of a plurality of vaporizable metal coatings contained in the vacuum chamber with the substrate to be coated. The metal coating materials are contained in an electrically grounded crucible with an electrical potential of approximately 2000 volts being generated between the crucible and a cathode filament and wherein a magnetic field is provided perpendicular to the propagation direction of the electrons generated for bending the electron beam trajectory toward the coating metal contained in the crucible.



# HONEYCOMB CORE STRUCTURES OF MINIMAL SURFACE TUBULE SECTIONS

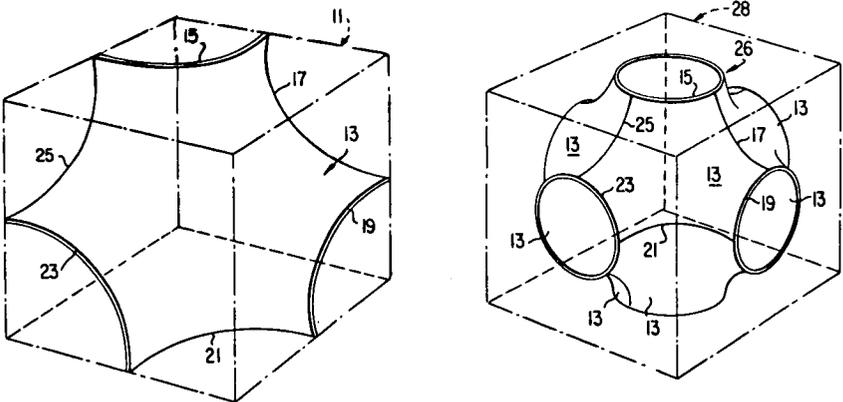
NASA Case No. ERC-10363

Canada, India,  
Great Britain

Address inquiries to:  
Goddard Space Flight Center  
Attn: Patent Counsel  
Mail Code: 204  
Greenbelt, MD 20771  
U.S.A.

[Corresponding to U.S. Patent No. 3,663,346]

Honeycomb cores formed of tubule sections bounded orthogonally by plane facings are described. The tubule sections are defined as being formed of minimal surface elements that orthogonally intersect all of the surfaces of a kaleidoscopic cell at least once. In other words, the tubule sections are broken into elements for definition purposes. The elements are defined as minimal surface elements, i.e., elements that have a mean curvature that is equal to zero at all points on their surface. These elements are further defined inside an imaginary kaleidoscopic cell in that they orthogonally intersect all surfaces of an imaginary kaleidoscopic cell at least once. The tubule sections are smoothly interconnected to form honeycomb core structures that have no internal discontinuities.



## EXPANDABLE SPACE FRAMES

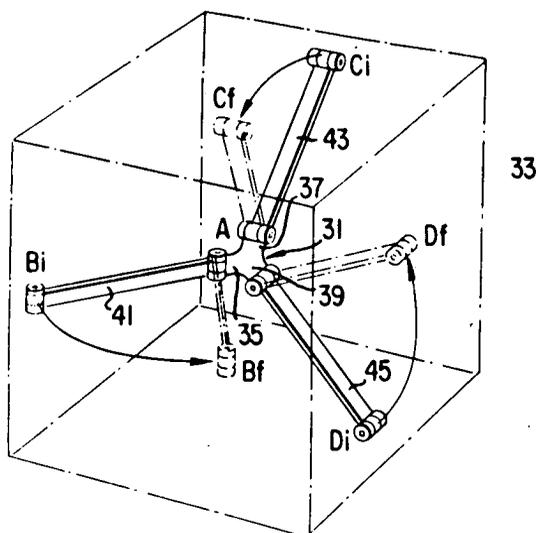
NASA Case No. ERC-10365

Great Britain, West Germany,  
Belgium, Sweden, Japan, Argentina,  
Canada, Netherlands, Mexico,  
Switzerland, France, Italy,  
Australia, India

Address inquiries to:  
NASA Pasadena Office  
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Mail Code: 180-601  
4800 Oak Grove Drive  
Pasadena, CA 91103  
U.S.A.

*[Corresponding to U. S. Patent No. 3,757,476]*

Expandable space-frames formed of a plurality of hinge joint assemblies and struts are reported in this invention. The space-frames are utilized in various types of structures. They can form a basic building structure or can be utilized in a planar manner to form the floors and walls of a structure. They can be utilized in space to define a structure such as a manned orbiting laboratory.



## ELECTRON MICROSCOPE APERTURE SYSTEM

NASA Case No. ARC-10448-1

Canada, France, Japan, Germany,  
Great Britain, Netherlands

*Address inquiries to:*  
Ames Research Center  
Attn: Patent Counsel  
Mail Code: 200-11A  
Moffett Field, CA 94035  
U.S.A.

*[Corresponding to U.S. Patent No. 3,847,689]*

An electron microscope is described, which includes an electron source, a condenser lens having either a circular aperture for focusing a solid cone of electrons onto a specimen or an annular aperture for focusing a hollow cone of electrons onto the specimen, and an objective lens with an annular objective aperture, for focusing electrons passing through the specimen onto an image plane. The invention also entails a method of making the annular objective aperture, using electron imaging, electrolytic deposition, and ion etching techniques.

## INFRARED TUNABLE LASER

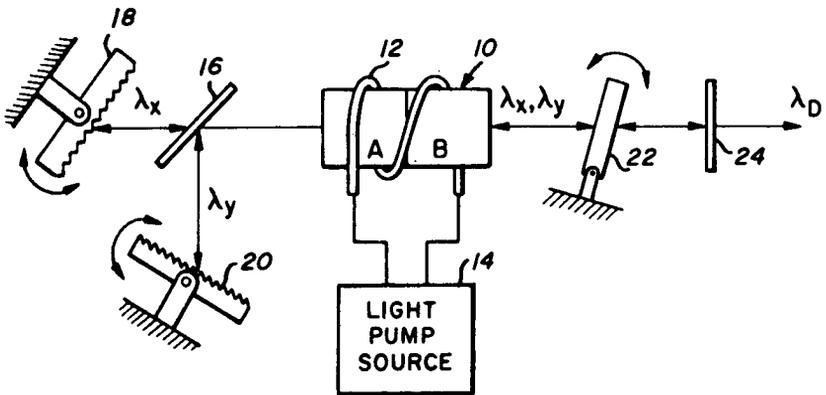
NASA Case No. ARC-10463

Belgium, Canada, France,  
Germany, Japan, Great  
Britain, Netherlands

Address inquiries to:  
Ames Research Center  
Attn: Patent Counsel  
Mail Code: 200-11A  
Moffett Field, CA 94035  
U.S.A.

[Corresponding to U.S. Patent No. 3,753,148]

The invention relates to laser apparatus for providing an intense source of coherent laser radiation which is tunable from the visible wavelengths through the infrared wavelengths. It can be used in absorption spectroscopy and in the detection and monitoring of pollution in the atmosphere. Selected radiation of the tunable laser is passed through the non-linear mixing crystal causing it to develop radiation of a third wavelength which is transmitted out of the optical cavity through the third reflector.



**POLYIMIDE FOAM FOR THERMAL INSULATION  
AND FIRE PROTECTION**

**NASA Case No. ARC-10464-1**

**Canada, Great Britain, France,  
West Germany, Japan, Italy,  
Switzerland**

*Address inquiries to:*  
Ames Research Center  
Attn: Patent Counsel  
Mail Code: 200-11A  
Moffett Field, CA 94035  
U.S.A.

*[Corresponding to U.S. Patent No. 3,772,216]*

In the preparation of polyimide foams by the reaction of polyisocyanates and polyfunctional aromatic acid derivatives, flame retardant foamed products of improved cell quality, friability, and resiliency are obtained by conducting the reaction in the presence of an alkanolamine, such as 1-hydroxyethyl-2-heptadecenyl glyoxalidine. Another aspect of the invention resides in the finding that polyimide foams of reproducible density above 1 lb/cu ft and below 6 lbs/cu ft can be obtained by, employing in the reaction at least 2% by weight of silozane-glycol copolymer as a surfactant which acts as a specific density control agent. A further feature of the invention is the production of polyimide foams into which reinforcing fibers such as silicon dioxide and carbon fibers may be incorporated.

## SHOULDER HARNESS AND LAP BELT RESTRAINT SYSTEM

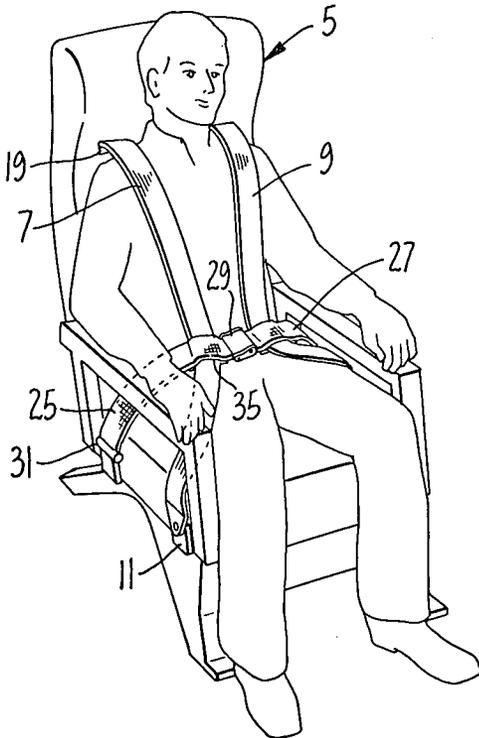
NASA Case No. ARC-10519

Australia, Canada, France,  
Great Britain, Italy, Japan  
Sweden, West Germany

Address inquiries to:  
Ames Research Center  
Attn: Patent Counsel  
Mail Code: 200-11A  
Moffett Field, CA 94035  
U.S.A.

*[Corresponding to U.S. Patent No. 3,887,233]*

The present invention provides a shoulder harness which is held by inertia reels so that the user is not unduly restrained and can freely move about, yet the reels will instantly lock when the user is subjected to deceleration forces. The shoulder straps preferably pass through openings in the seat itself so that they are substantially at shoulder height and there is little chance of the straps slipping off of the shoulders. The combined restraint of the present invention provides for slippage between the lap belt and the shoulder straps so that it readily adapts itself to users of different sizes.



# GRAVITY GRADIENT ATTITUDE CONTROL SYSTEM

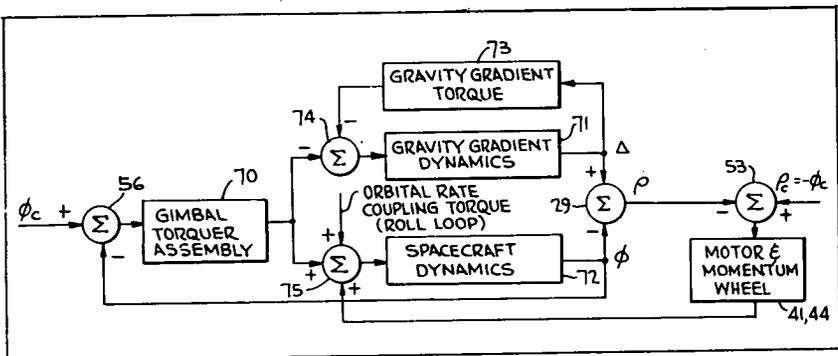
NASA Case No. GSC-10555

Canada, Japan

Address inquiries to:  
Goddard Space Flight Center  
Attn: Patent Counsel  
Mail Code: 204  
Greenbelt, MD 20771  
U.S.A.

*[Corresponding to U.S. Patent No. 3,567,155]*

A system for controlling and stabilizing the attitude of an artificial earth satellite includes a gravity gradient member mounted in a gimbal arrangement to have two degrees of freedom. The angular deviation of the gravity gradient member and the satellite relative to the local vertical and the spacecraft angle command input signal selectively drive a plurality of inertial momentum wheels, one for each of the three spacecraft axes, provided to dampen the gravity gradient member librations. The gravity gradient member is controlled so that the equilibrium position of the longitudinal axis thereof is maintained in alignment with the local vertical in response to signals indicative of the rate of change of movement thereof with respect to the remainder of the satellite and a signal indicative of the angular deviation of the satellite position from the angle command.



## AIRFOIL SHAPE FOR FLIGHT AT SUBSONIC SPEEDS

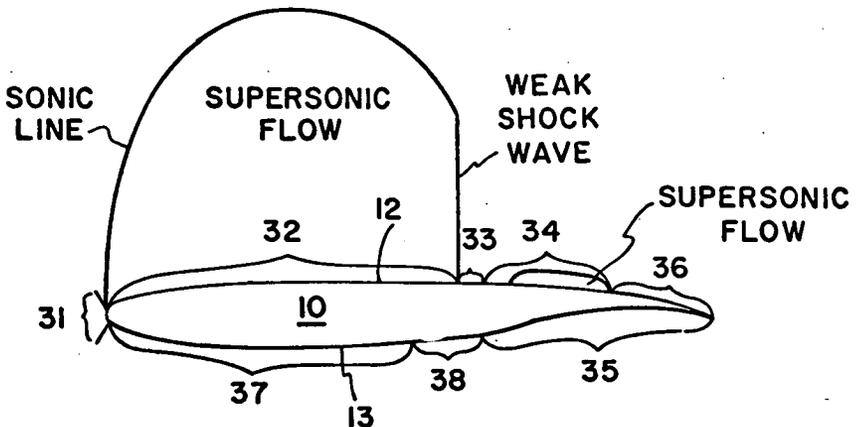
NASA Case No. LAR-10585-1

Canada, France, Germany, Japan,  
Italy, Israel, Sweden, Australia,  
Great Britain, Netherlands

Address inquiries to:  
Langley Research Center  
Attn: Patent Counsel  
Mail Code: 313  
Langley Station  
Hampton, VA 23665  
U.S.A.

*[Corresponding U.S. Patent—Application Pending]*

This invention relates to an airfoil for an aircraft and more particularly to an airfoil with a design Mach number in the range .7 to 1.0 and having an upper surface designed to delay shock wave induced boundary layer separation until high subsonic Mach numbers well above the critical Mach number are reached. The airfoil has an upper surface shaped to control flow accelerations and pressure distribution over the upper surface and prevents separation of the boundary layer due to shock wave formulation at high subsonic speeds well above the critical Mach number. A highly cambered trailing edge section improves overall airfoil lifting efficiency.



# WATER PURIFICATION MEMBRANES AND METHOD OF PREPARATION

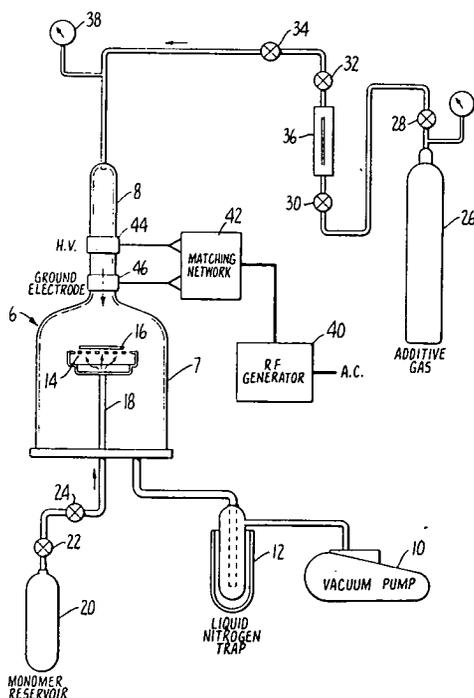
NASA Case No. ARC-10643

Australia, Canada, France,  
Germany, Great Britain,  
Italy, Japan, Israel,  
Netherlands

Address inquiries to:  
Ames Research Center  
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Moffett Field, CA 94035  
U.S.A.

[Corresponding to U.S. Patent No. 3,847,652]

Reverse osmosis membrane technology has grown dramatically in recent years for the production of fresh water and is particularly important in the purification and reuse of water in space missions. The present invention contemplates the fabrication of membranes of allyl amine as thin films in the presence of a plasma discharge. The membranes are superior in that they do not have to be stored in pure H<sub>2</sub>O, demonstrate salt rejection rates of 95% or more, do not compress under use, are formed without pinholes, and in any desired configuration, and, possess high adhesion on a variety of substrates.





# IMPROVEMENTS FOR ABATING EXHAUST NOISES IN JET ENGINES

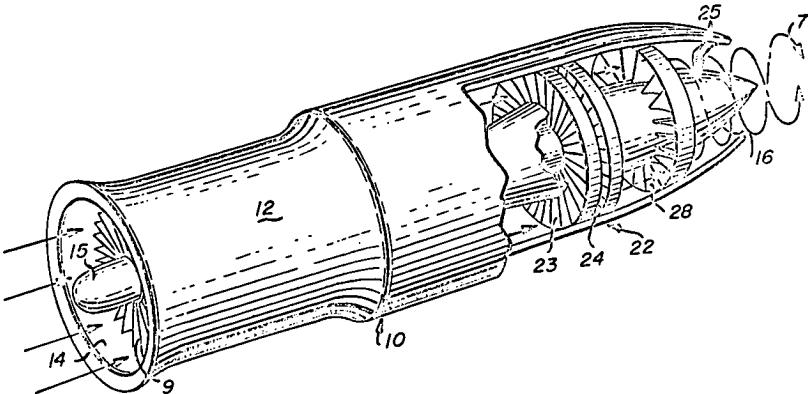
NASA Case No. ARC-10712

Australia, Canada, France,  
Great Britain, Germany,  
Israel, Italy, Japan,  
Sweden

Address inquiries to:  
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Moffett Field, CA 94035

*[Corresponding to U.S. Patent No. 3,830,431]*

A noise abating improvement for jet engines including the provision of apparatus in the primary flow stream of gas turbine engines such as turbojet, turbofan, turboprop, and other jet engines such as ram jets, scram jets and hybrid jet engines, or in either the primary and/or secondary flow streams of turbofan engines or the like, for imparting to the exhaust gases a component rotation or swirl about the engine's longitudinal axis. The rotary component in the exhaust gases has the effect of substantially suppressing the build up on sound energy normally produced by an axial flow exhaust stream.



**FIBER MODIFIED POLYURETHANE FOAM  
FOR BALLISTIC PROTECTION**

NASA Case No. ARC-10714

Canada, France, Germany,  
Great Britain, Italy, Japan,  
Netherlands

\*See address below.

*[Corresponding U.S. Patent – Application Pending]*

The closed cell, semi-rigid, fiber-loaded self-extinguishing foam of the present invention has properties of retarding penetration of incendiary ballistics, prevention of fire in the void spaces of the aircraft, providing support for the fuel cell, and strengthening the aircraft frame. The foam is based on a polyurethane resin and is filled with fibers and contains a fire retardant material. It does not produce noxious fumes when heated and the strength of the foam is enhanced by the fibers being oriented parallel to the surface of the substrate on which the foam is sprayed.

\*Exclusively licensed to AVCO Corporation. Please direct inquiries to: Fire Protection Materials, AVCO Corporation, AVCO Systems Division, Lowell Industrial Park, Lowell, Massachusetts, 01851, U.S.A.

# PROTECTION OF MOISTURE SENSITIVE OPTICAL COMPONENTS

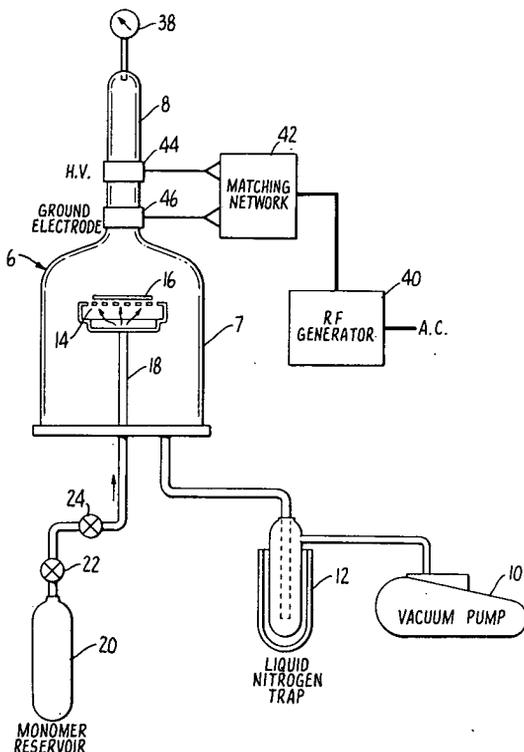
NASA Case No. ARC-10749

Canada, France, Italy,  
Japan, Sweden, Germany,  
Great Britain, Netherlands

Address inquiries to:  
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Moffett Field, CA 94035  
U.S.A.

*[Corresponding U.S. Patent – Application pending]*

Salt crystals used in IR spectroscopy required they be preserved in areas that are not dehumidified. If moisture forms on the crystal, etching results which destroys the effectiveness of the crystal. This invention contemplates coating the crystal with a perfluorinated polymer which not only prevents attack by moisture, but often has the added advantage of acting as an anti-reflective coating so that transmission is increased in nearly all regions of the IR spectrum.



# G-LOAD MEASURING AND INDICATOR APPARATUS

NASA Case No. ARC-10806-1

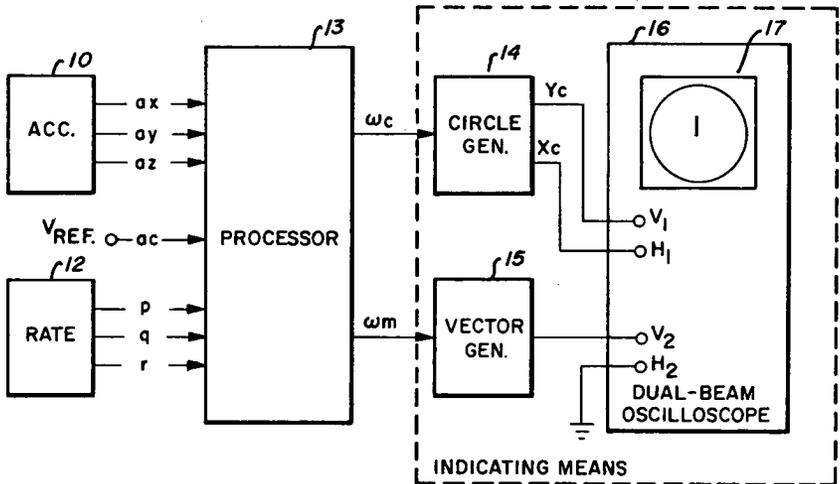
Address inquiries to:

Canada, France, Great Britain,  
Italy, Japan, Sweden, West  
Germany

Ames Research Center  
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Mail Code: 200-11A  
Moffett Field, CA 94035  
U.S.A.

*[Corresponding U.S. Patent—Application Pending]*

Although there are many critical loads that must not be exceeded on an aircraft, in the past no attempt has been made to measure all of these loads during flight. In a piloted aircraft, the pilot is subject to the same acceleration loads as the aircraft, and he automatically attempts to regulate them. However, in a remotely-piloted vehicle, the remote pilot is unable to sense the acceleration loads being experienced by the aircraft, and can inadvertently cause the aircraft to exceed its g-load limits thereby causing severe damage and even destruction of the airframe.



# OPTICAL RADIATION FREQUENCY CONVERTER AND METHOD

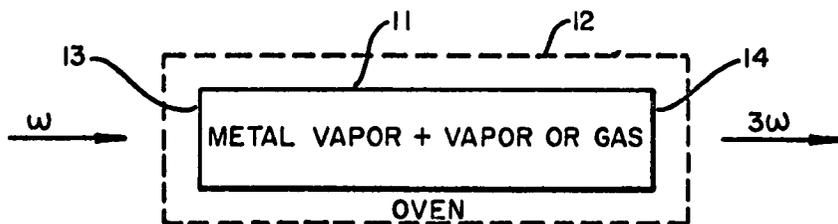
NASA Case No. HQN-10818

Canada, France, Germany,  
Great Britain, Japan,  
Netherlands

*Address inquiries to:*  
NASA Headquarters  
Attn: Patent Counsel  
Mail Code: GP  
Washington, D.C. 20546  
U.S.A.

*[Corresponding U.S. Patent—Application Pending]*

This invention is an Optical Radiation Frequency Converter employing metal vapor which is useful in the ultraviolet region of the spectrum. The invention comprises a cell for retaining the metal vapor or gas which is surrounded by an oven. Monochromatic radiation passes through windows in the cell and oven. In the preferred embodiment, the metal vapor for accomplishing third harmonics is one which has its fundamental harmonic frequencies resonance in the spectral region between the fundamental frequencies and the third harmonic. The metal vapor must have a suitable refractive index to provide for phase matching.



## TOTALLY CONFINED EXPLOSIVE WELDING

NASA Case No. LAR-10941-1

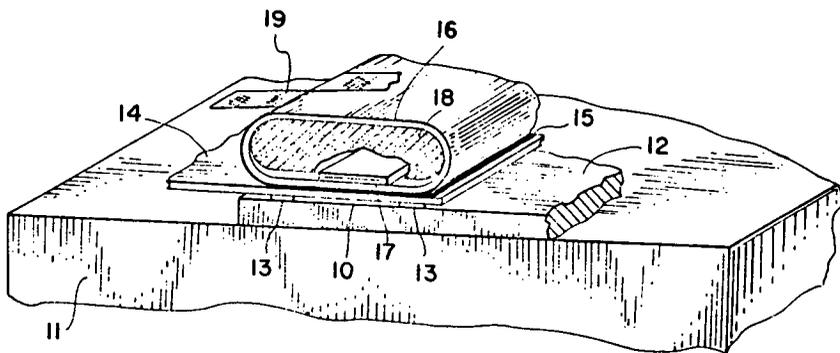
Japan, Germany, Canada,  
Switzerland, Great Britain,  
Australia

*Address inquiries to:*  
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Langley Station  
Hampton, VA 23665  
U.S.A.

*[Corresponding to U. S. Patent No. 3,797,098]*

The invention illustrates and describes a method and apparatus for eliminating the noise and debris of explosive welding techniques. This is accomplished by placing the explosive in a complete enclosure so that both the sound and debris of the explosion are contained in the enclosure. The welding is accomplished by the explosive pressure applied through the wall of the enclosure to the pieces to be joined.

The novelty of the invention is in eliminating the safety hazards and detrimental psychological effects of the loud noises and scattering of debris which result from use of unconfined explosive welding while maintaining the inherent simplicity of the technique.



**BACTERIAL ADENOSINE TRIPHOSPHATE AS A  
MEASURE OF URINARY TRACT INFECTION**

**NASA Case No. GSC-11092-2**

**Great Britain, France, Canada,  
West Germany, Japan**

*Address inquiries to:*  
Goddard Space Flight Center  
Attn: Patent Counsel  
Mail Code: 204  
Greenbelt, MD 20771  
U.S.A.

*[Corresponding U.S. Patent—Application Pending]*

A method is provided for determining bacterial levels in urine samples, which method depends on the quantitative determination of bacterial adenosine triphosphate (ATP) in the presence of non-bacterial adenosine triphosphate. After the removal of non-bacterial ATP, the bacterial ATP is released by cell rupture and is measured by an enzymatic bioluminescent assay using an enzyme obtained from the firefly.

## STABILIZATION OF PIGMENTS

NASA Case No. NPO-11139

Great Britain, Canada, France,  
West Germany, Japan, Italy

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4800 Oak Grove Drive  
Pasadena, CA 91103  
U.S.A.

*[Corresponding U.S. Patent--Application Pending] \**

A method of coating pigment particles is described for preventing degradation and discoloration by ultraviolet light. The chemical species utilized serve as recombination sites for the electrons and holes produced by the radiation. The chemical species selected for a particular pigment should be one equivalent such that stable oxidation stages are formed differing by one electronic charge. Zinc oxide pigments coated with ferri- and ferrocyanide are discussed as an example.

\*Patent rights in the United States are held by Stanford Research Institute. Foreign patent rights are available for licensing from NASA.

## STORED CHARGE TRANSISTOR

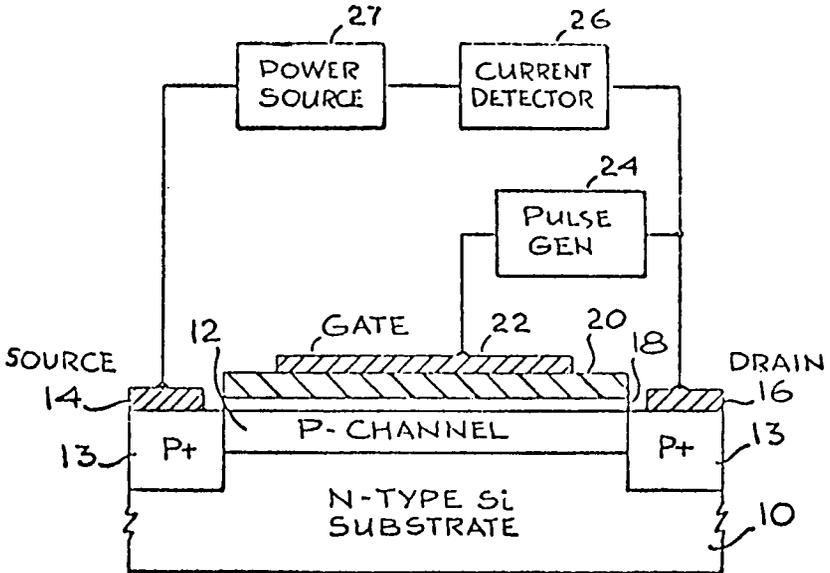
NASA Case No. NPO-11156-2

Canada, Japan

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4800 Oak Grove Drive  
Pasadena, CA 91103  
U.S.A.

[Corresponding U.S. Patent – Application Pending]

A stored charge device of the general type designated as an MNOS field-effect transistor, has its operation improved by embedding a thin metal layer between two insulating films used in the transistor. The embedded metal layer technique is also used to provide a two-terminal thin-film stored charge device, consisting of a "metal-insulator-embedded metal-insulator-metal", sandwich structure which can be used in high-density memory arrays.



# GRADED BANDGAP $\text{Al}_x\text{Ga}_{1-x}\text{As}$ -GaAs SOLAR CELL

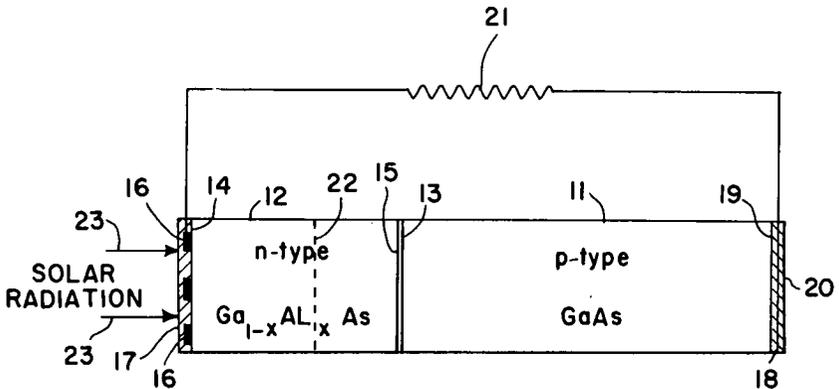
NASA Case No. LAR-11174

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Attn: Patent Counsel  
Mail Code: 313  
Langley Station  
Hampton, VA 23665  
U.S.A.

Canada, France, Japan,  
Great Britain, Germany,  
Italy, Netherlands

*[Corresponding U.S. Patent – Application Pending]*

This invention describes an improved solar cell of increased efficiency. The invention comprises a p-type GaAs crystal adjoining an n-type  $\text{Ga}_{1-x}\text{Al}_x\text{As}$  crystal to form a p-n junction. The value of  $x$  varies linearly in the n-type crystal from  $x=0$  at the junction of the two crystals to  $x = .7$  at the opposite surface of the n-type crystal. Hence, when the said opposite surface of the n-type crystal is exposed to solar radiation, energy is delivered by the p-n junction more efficiently than it is delivered by prior p-n junction type solar cells.



## EXPLOSIVELY WELDED SCARF JOINT

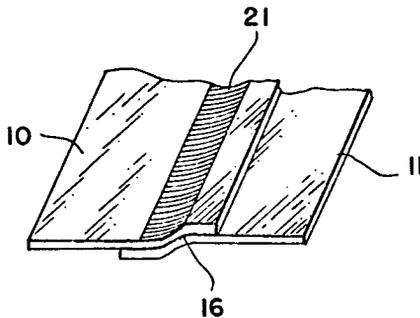
NASA Case No. LAR-11211-1

Japan, Germany, Canada,  
Switzerland, Great Britain,  
Australia

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Langley Research Center  
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Langley Station  
Hampton, VA 23365  
U.S.A.

*[Corresponding to U.S. Patent No. 3,842,485]*

This invention relates to a method for welding thin sheet metal members by the simultaneous bonding and shaping into an essentially planar configuration without the addition of a bonding material. This is accomplished by explosively welding overlapped sheets while simultaneously bending them such that the major portions of the two sheets are left in a single plane. The method furnishes a simple and economical method of welding thin sheet aluminum and titanium with bonds which exhibit the strength of the parent metal.



# IMPROVED NARROW BAND FM SYSTEM FOR VOICE COMMUNICATIONS

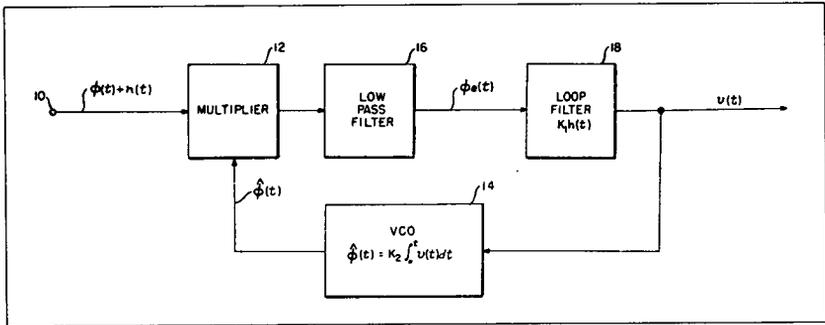
NASA Case No. GSC-11261-1

Canada, Great Britain, France,  
West Germany, Japan, Australia,  
Italy

Address inquiries to:  
Goddard Space Flight Center  
Attn: Patent Counsel  
Mail Code: 204  
Greenbelt, MD 20771  
U.S.A.

*[Corresponding U.S. Patent—Application Pending]*

The Narrow Band FM transmitter transmits voice signals on a FM carrier signal. The transmitter includes preemphasis for flattening the frequency spectrum. The receiver includes a demodulator for demodulating the FM carrier with decreasing band width as a function of the carrier strength. Limiting means are employed for decreasing the carrier strength as the incoming carrier-to-noise ratio decreases and a deemphasis circuit for restoring the frequency spectrum of the original voice signal.



## LONG RANGE LASER TRAVERSING SYSTEM

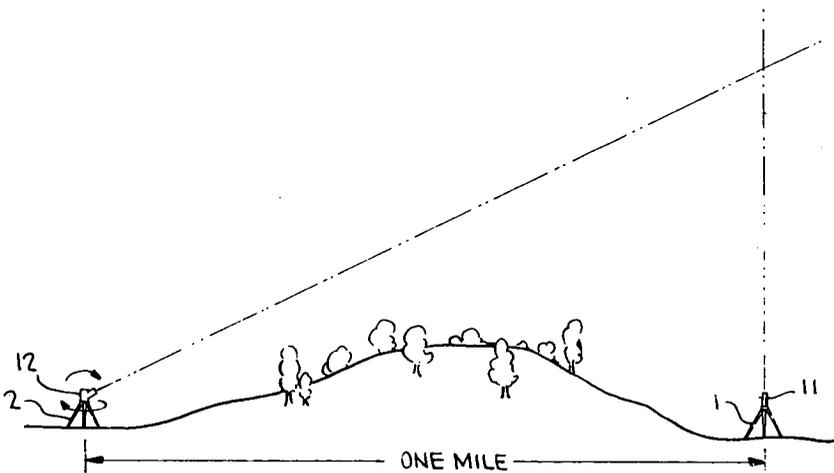
NASA Case No. GSC-11262-1

Canada, Great Britain, France;  
West Germany, Japan, Australia,  
Sweden

*Address inquiries to:*  
Goddard Space Flight Center  
Attn: Patent Counsel  
Mail Code: 204  
Greenbelt, MD 20771  
U.S.A.

*[Corresponding to U. S. Patent No. 3,804,525]*

The relative azimuth bearing between first and second space terrestrial points (which may be obscured from each other by intervening terrain) is measured by placing at one of the points a laser source for projecting a collimated beam upward in the vertical plane. The collimated laser beam is detected at the second point by positioning the optical axis of a receiving instrument for the laser beam in such a manner that the beam intercepts the optical axis. In response to the optical axis intercepting the beam, the beam is deflected into two different ray paths by a beam splitter having an apex located on the optical axis. The energy in the ray paths is detected by separate photoresponsive elements that drive logic networks.



# DUAL CYCLE AIRCRAFT TURBINE ENGINE

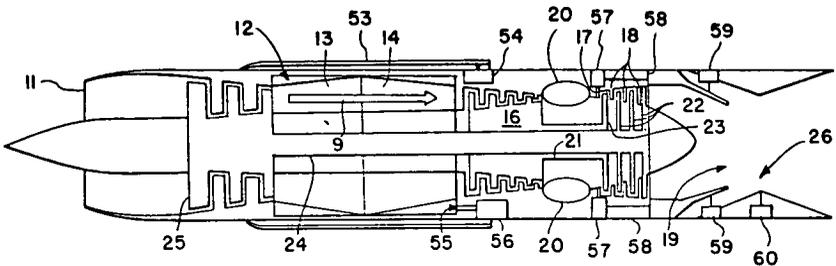
NASA Case No. LAR-11310-1

Canada, France, Germany,  
Great Britain, Italy,  
Japan

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Hampton, VA 23665  
U.S.A.

*[Corresponding U.S. Patent – Application Pending]*

This invention describes a method and apparatus applicable to jet engines for improving operating efficiency over broad ranges of flight conditions and for reducing engine noise output in take-off and landing by controlling the airflow entering and exiting the engines. A turbojet engine apparatus is described which operates efficiently at both subsonic and supersonic speeds and a method is described which enables a turbofan with an associated satellite turbojet or turbofan to operate more efficiently at both subsonic and supersonic speeds. In both cases, take-off and landing noise is reduced substantially. The apparatus consists essentially of arranging for two separate portions of an engine to act upon one airstream or, alternately, to operate on independent airstreams.



# AMPLITUDE STEERED ANTENNA ARRAY

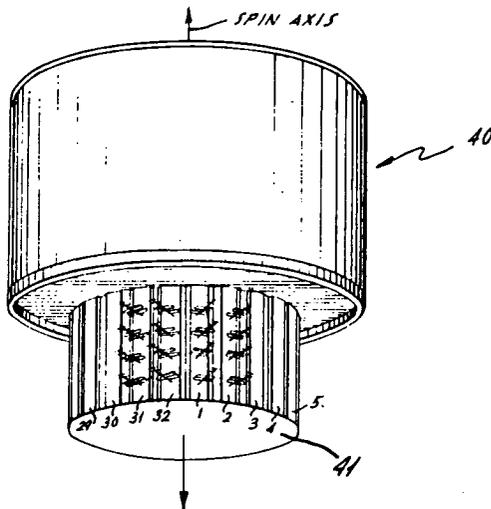
NASA Case No. GSC-11446

Canada, France, Germany,  
Great Britain, Japan,  
Netherlands

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Attn: Patent Counsel  
Mail Code: 204  
Greenbelt, MD 20771  
U.S.A.

[Corresponding to U.S. Patent No. 3,806,932]

A spin stabilized satellite has an electronically despun antenna array comprising a multiplicity of peripheral antenna elements. A high gain energy beam is established by connecting a suitable fraction or array of the elements in phase. The beam is steered or caused to scan by switching elements in sequence into one end of the array as elements at the other end of the array are switched out. The switching transients normally associated with such steering are avoided by an amplitude control system. Instead of abruptly switching from one element to the next, a fixed value of power is gradually transferred from the element at the trailing edge of the array to the element next to the leading edge. Thus as the satellite rotates, power is reduced on one element and power is increased on the other element thereby avoiding switching transients and maintaining constant total array power at all times.



# RECORDER/PROCESSOR APPARATUS

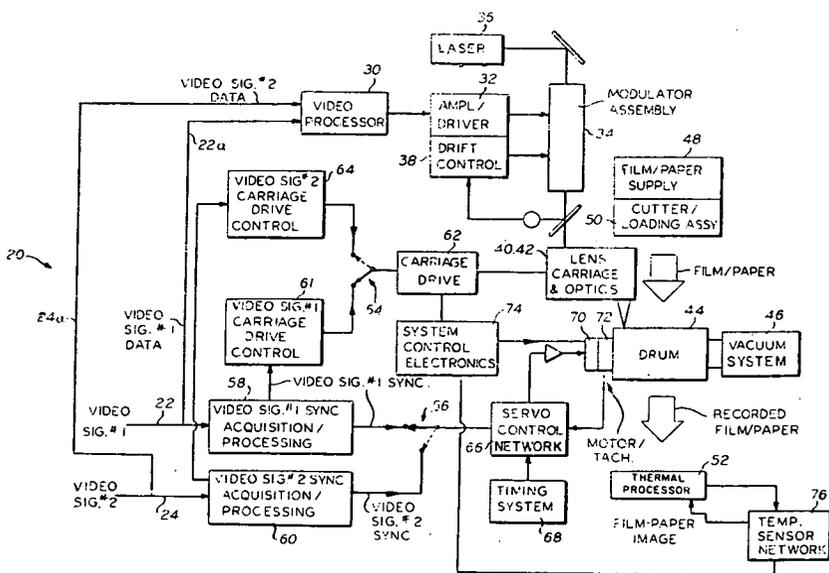
NASA Case No. GSC-11553

Address inquiries to:  
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Attn: Patent Counsel  
Mail Code: 204  
Greenbelt, MD 20771  
U.S.A.

Japan

*[Corresponding to U.S. Patent No. 3,781,902]*

This is an apparatus for recording and thermally processing data. A laser beam, modulated by a video signal generates a raster so as to expose a latent image of the input information on a storage medium. A rotating drum in conjunction with an incrementally driven lens carriage associated with the laser optical system provides the raster generation. The drum is automatically loaded with the storage medium from a supply means and automatically unloaded to a thermal processor upon completion of recording. The latent image is processed by the controlled application of heat so as to produce an actual displayable image corresponding to the data input at the output of the apparatus.



# MILLIMETER WAVE PUMPED PARAMETRIC AMPLIFIER

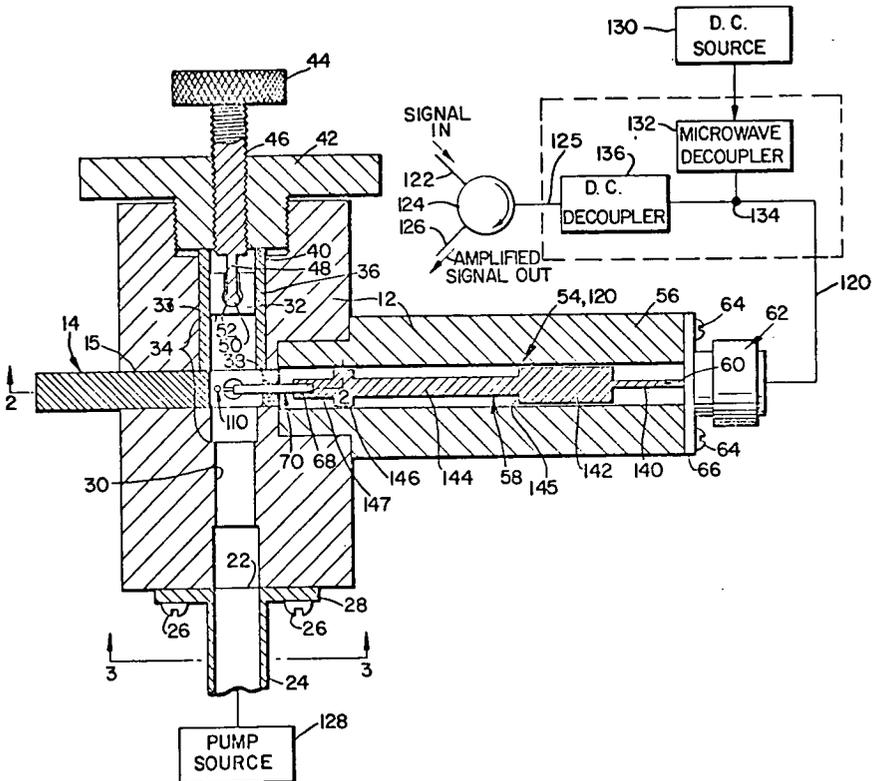
NASA Case No. GSC-11617

Canada, France, Germany,  
Great Britain, Japan,  
Netherlands

Address inquiries to:  
Goddard Space Flight Center  
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Mail Code: 204  
Greenbelt, MD 20771  
U.S.A.

[Corresponding to U.S. Patent No. 3,833,857]

The present invention is directed to a new parametric amplifier structure which exhibits a large gain-bandwidth product and low noise characteristics without cryogenic cooling. In addition, higher idler frequencies are attained and which are easily adjustable in resonant frequency. The amplifier includes a stacked pair of uncased varactor diode chips within a waveguide channel, which chips are stacked in a predetermined direction.



# ELECTRON BEAM CONTROLLER

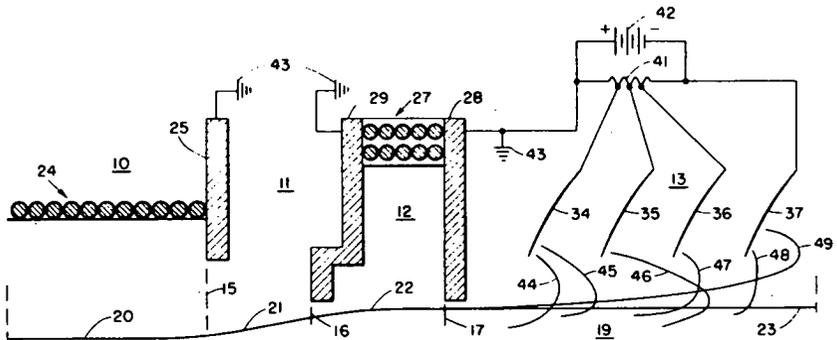
NASA Case No. LEW-11617-1

Australia, Canada, Belgium,  
France, Great Britain,  
Germany, Japan, Italy,  
Netherlands

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21000 Brookpark Road  
Cleveland, OH 44135  
U.S.A.

[Corresponding to U.S. Patent No. 3,764,850]

A magnet applies a magnetic field of predetermined intensity and shape to a spent electron beam over an axial distance having a predetermined relationship to the frequency of operation of a utilization device which has extracted energy from the electron beam and at a predetermined axial distance after the beam has left the magnetic field of the utilization device and entered the beam expansion region and beam stabilization region. The stabilizing magnetic field is terminated abruptly before the electron beam enters a collector apparatus.



# WINGTIP VORTEX DISSIPATOR FOR AIRCRAFT

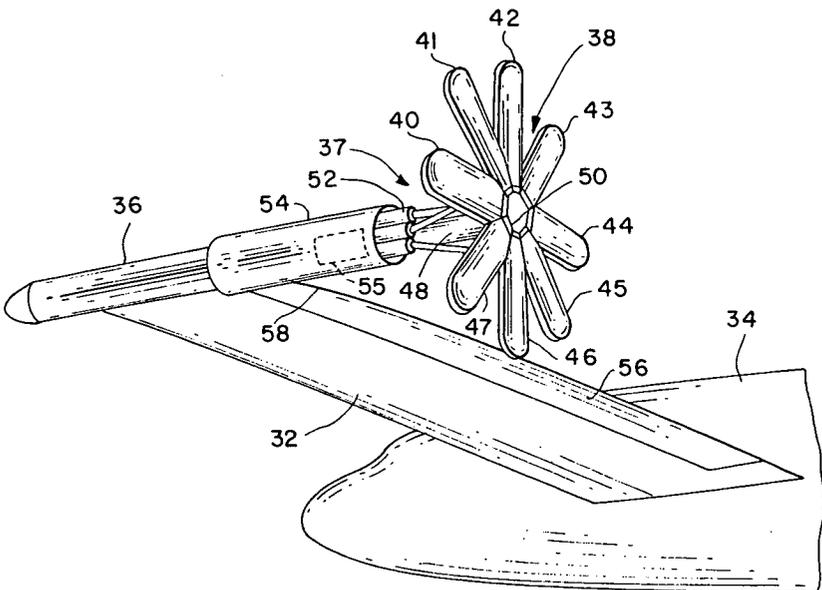
NASA Case No. LAR-11645

Canada, Japan, Germany

Address inquiries to:  
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Hampton, VA 23665  
U.S.A.

*[Corresponding U.S. Patent – Application Pending]*

The lift-induced wingtip vortex associated with large jet aircraft has become a major problem to the air traffic controller as well as an unseen hazard to smaller aircraft. In this invention, a means for attenuating this potentially dangerous wingtip vortex is disclosed which consists of a drogue device attached downstream of the wingtip which creates a positive pressure gradient just downstream from the wing. The positive pressure forces a break up of the rotational air flow of the vortex.



# VOLTAGE CONTROLLED VARIABLE POWER DIVIDER

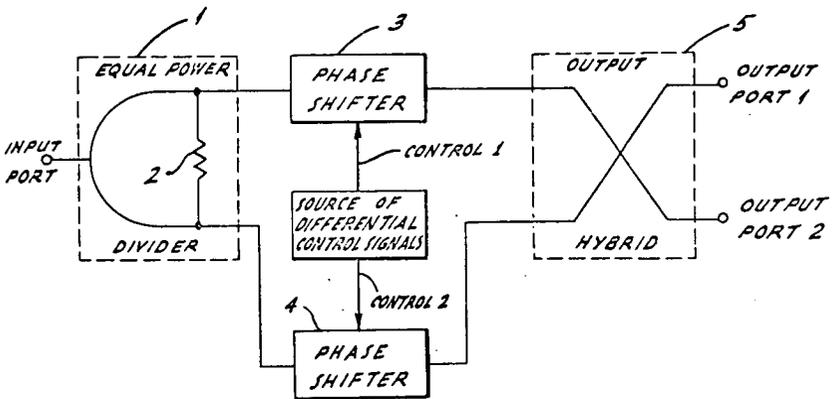
NASA Case No. GSC-11659

Canada, Great Britain,  
France, Germany, Japan,  
Netherlands

Address inquiries to:  
Goddard Space Flight Center  
Attn: Patent Counsel  
Mail Code: 204  
Greenbelt, MD 20771  
U.S.A.

[Corresponding to U.S. Patent No. 3,769,610]

In the voltage controlled variable power divider of the invention, the total output power equals the input power and both outputs have constant and equal phase. The applied power is split into two channels, each of which contains a variable phase shifter. The channels are combined in a 90-degree hybrid coupler so that the relative amplitude in the hybrid outputs is a function of the phase of the hybrid input signals. The phase shifters are voltage driven in opposition so that constant phase is achieved for all output power division ratios.



## TWISTED MULTIFILAMENT SUPERCONDUCTOR

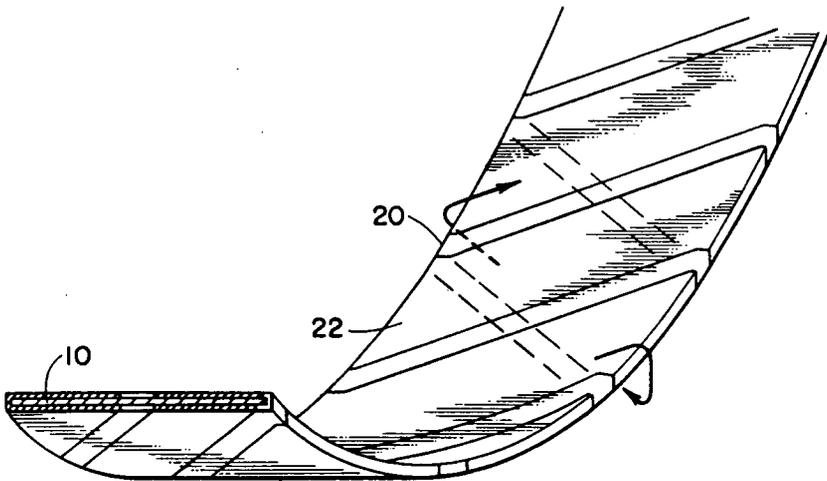
NASA Case No. LEW-11726-1

Canada, France, Japan,  
Great Britain, Germany,  
Netherlands

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21000 Brookpark Road  
Cleveland, OH 44135  
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*[Corresponding to U.S. Patent No. 3,737,824]*

Masking selected portions of a ribbon and forming an inter-metallic compounds on the unmasked portions by a controlled diffusion reaction produces a twisted filamentary structure. The masking material prohibits the formation of superconductive material on predetermined areas of the substrate.



## DUALLY MODE-LOCKED Nd:YAG LASER

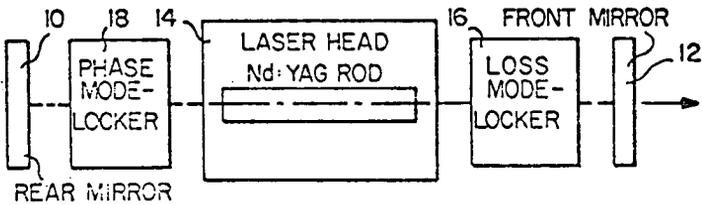
NASA Case No. GSC-11746-1

Canada, France, Germany,  
Great Britain, Japan,  
Netherlands

Address inquiries to:  
Goddard Space Flight Center  
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Mail Code: 204  
Greenbelt, MD 20771  
U.S.A.

*[Corresponding to U.S. Patent No. 3,869,680]*

A need exists in laser technology whereby stable mode-locking can be achieved for a pulsed laser system which is simple and which avoids other known disadvantages. The present invention meets these requirements and includes a pair of partially reflecting mirrors forming the laser cavity. The dual mode-locking elements will pass timed pulses without being extinguished.



# DISH ANTENNA HAVING SWITCHABLE BEAMWIDTH

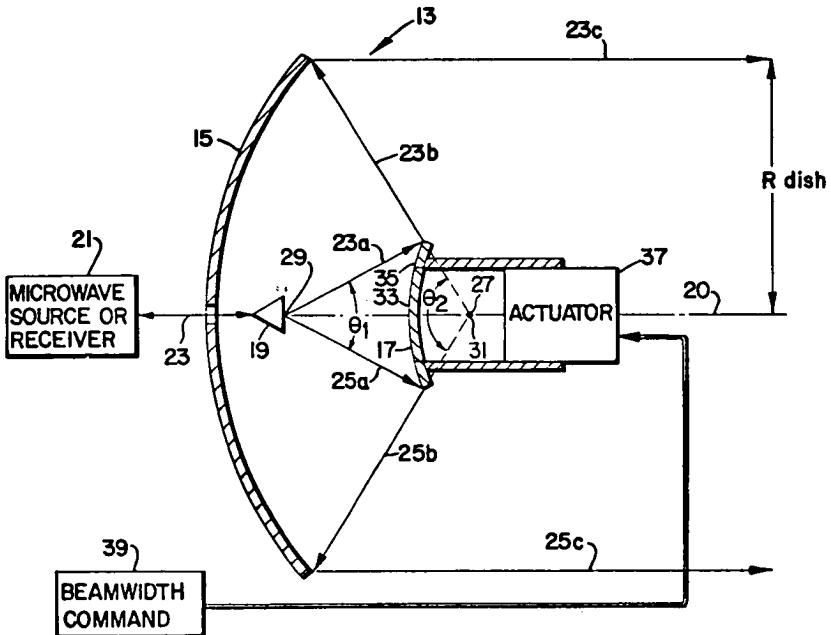
NASA Case No. GSC-11760-1

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Greenbelt, MD 20771  
U.S.A.

Canada, France, Germany,  
Great Britain, Japan,  
Netherlands

[Corresponding to U.S. Patent No. 3,866,233]

The need frequently arises to augment narrow beamwidth transmitting and/or receiving antennas with a wide beamwidth "acquisition" mode. The present invention is a switchable beamwidth antenna employing a common main reflecting dish operable in at least two different beamwidth modes. It includes a concave parabolic main reflecting dish with a central circular region and a surrounding coaxial annular region. The central region of the main dish can be excited for wide beamwidth or the entire dish for narrow beamwidth.



## TWO-DIMENSIONAL RADIANT ENERGY ARRAY

NASA Case No. GSC-11839-1

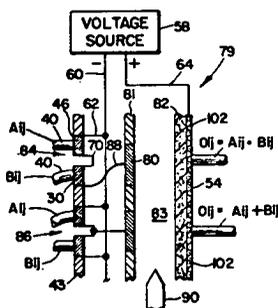
Address inquiries to:

France, Japan, West Germany

Goddard Space Flight Center  
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Mail Code: 204  
Greenbelt, MD 20771  
U.S.A.

[Corresponding U.S. Patent—Application Pending]

Conventional digital computers are composed of devices which perform logical operations on one-dimensional electrical binary signals. Such conventional digital computers are used to process large two-dimensional image or array data only with great difficulty since, in general, point-by-point scanning or interrogation of the images or arrays is required to convert the image data to a serial data stream suitable for digital computer processing. In this invention two-dimensional radiant energy gate devices receive two input arrays and provide an output array having digital states dependent only on the digital states of the signal elements of the two input arrays at corresponding row and column positions. The logic devices include an array of photoconductors responsive to at least one of the input arrays for either selectively accelerating electrons to a phosphor output surface, applying potentials to an electro-luminescent output layer, exciting an array of discrete radiant energy sources, or exciting a liquid crystal to influence crystal transparency or reflectivity.



# ELECTROSTATICALLY CONTROLLED HEAT SHUTTER

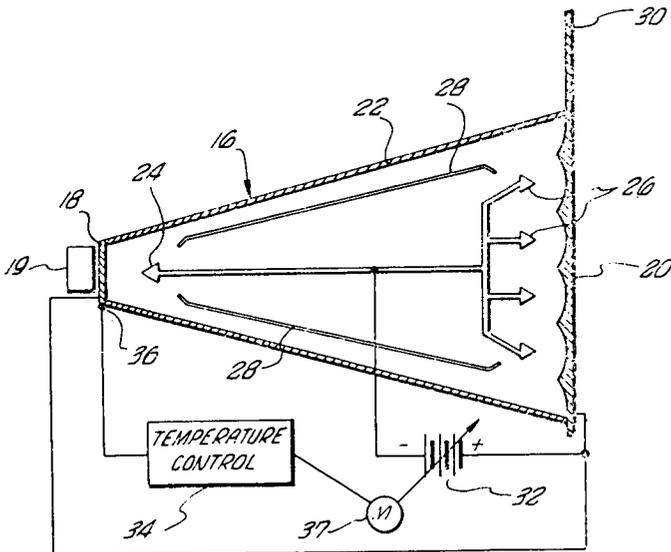
NASA CASE No. NPO-11942

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Pasadena, CA 91103

Australia, Canada, France,  
Germany, Great Britain,  
Belgium, Italy, Japan,  
Netherlands

[Corresponding to U.S. Patent No. 3,763, 928]

A heat transfer assembly for conducting thermal energy includes a hermetically sealed container enclosing a quantity of inert gas such as nitrogen. Two opposed walls of the container have high thermal conducting characteristics while the connecting walls have low thermal conducting characteristics. Electrodes are positioned adjacent the high thermal conducting walls and biased relative to the conducting walls to a corona potential for creating an ionic gas wind which must contact the conducting walls to be neutralized. The contact of the gas molecules permits the maximum thermal energy transfer between the walls. Baffles can be positioned adjacent the electrodes to regulate gas flow between the high thermal conducting surfaces.



# OPHTHALMIC LIQUEFACTION PUMP

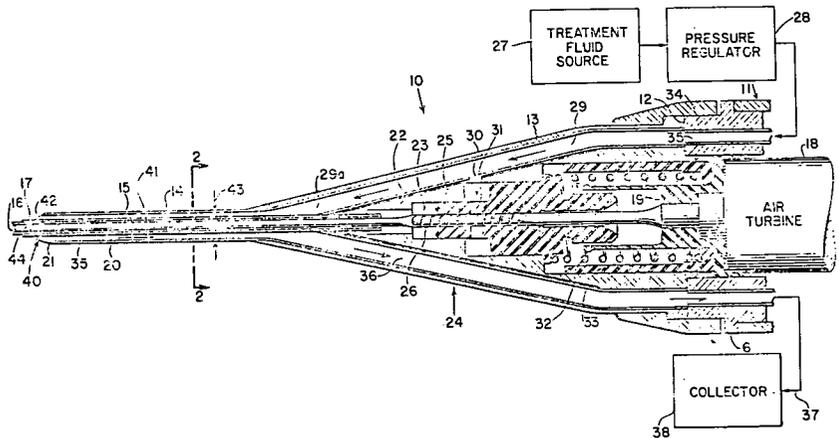
NASA Case No. LEW-12051

Belgium, Canada, Italy,  
Great Britain, Japan, Sweden,  
Netherlands, Germany, India,  
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Address inquiries to:  
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21000 Brookpark Road  
Cleveland, OH 44135  
U.S.A.

*[Corresponding U.S. Patent – Application Pending]*

A surgical tissue macerating and removal tool is disclosed wherein a rotating member having a cutting tip is utilized. When the instrument is to be used in an eye, a treatment fluid is supplied to the operative site and a first pump is provided to evacuate macerated material and treatment fluid from the eye. A second pump means is provided on the rotating member to provide a counter flow of treatment fluid into the space between the rotating member and the support tube. The second pump may provide additional support for the rotating member. Means is also provided for axially positioning rotating member to increase or decrease cutting action.



**CATALYTIC TRIMERIZATION OF AROMATIC NITRILES  
AND TRIARYL-S-TRIAZINE RING CROSS-LINKED HIGH  
TEMPERATURE RESISTANT POLYMERS AND COPOLYMERS  
MADE THEREBY**

NASA Case No. LEW-12053-1

*Address inquiries to:*

Canada, France, Great Britain,  
Japan, Sweden, West Germany

Lewis Research Center  
Attn: Patent Counsel  
Mail Code: 500-113  
21000 Brookpark Road  
Cleveland, OH 44135

*[Corresponding U.S. Patent—Application Pending]*

Prior trimerization methods are unsuitable for processing the aromatic nitrile-modified (terminated and/or appended) condensation-type prepolymers into s-triazine ring cross-linked high temperature resistant matrix resins for fiber reinforced composites. With this invention, aromatic nitriles such as p-cyanobenzoic acid and its esters, etc. can be directly trimerized to their corresponding triaryl-s-triazines at moderate temperature and pressure. Also, with this invention, the norborene groups on the addition-type polyimides are replaced by aromatic nitrile groups, or part of the monomeric reactants (aromatic diamines and tetracarboxylic acid dianhydride or their derivatives) of those soluble high molecular weight polyimides having relatively low thermal stability were replaced by nitrile appended aromatic diamines and aromatic tetracarboxylic acid dianhydrides or their derivatives. These terminating and/or appending aromatic nitrile groups are then catalytically trimerized to produce new triaryl-s-triazine ring containing or cross-linked polyimides which possess the outstanding thermal stability of both polyimides and aryl-s-triazines for continuous use at temperatures above 315°C.

## METHOD OF IMPROVING IMPACT RESISTANCE OF CERAMIC BODIES, AND IMPROVED BODIES

NASA Case No. LEW-12301

*Address inquiries to:*

Canada, France, Great Britain,  
Japan, Sweden, West Germany

Lewis Research Center  
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Cleveland, OH 44135

*[Corresponding U.S. Patent—Application Pending]*

A difficulty with the proposed uses of ceramic materials for such high temperature applications as the stator vanes in aircraft and stationary gas turbines, and rotating parts in automotive gas turbines is their relatively low impact resistance. This invention is a method of improving the impact resistance of bodies of polycrystalline ceramic such as alumina, silicon nitride and silicon carbide, and bodies produced by the method. The body is provided with a layer of a low elastic modulus polycrystalline ceramic material which has microcracks therein, formed by such factors as thermal expansion coefficient anisotropy, differences in thermal expansion coefficients between phases of the material, and by changes in volume during phase transformations in the material. The layer can be applied by preforming the layer and then applying, or by hot pressing the material of the layer onto the body.

## ZERO TORQUE GEAR HEAD WRENCH

NASA Case Nos. NPO-13059-1  
NPO-13436-1

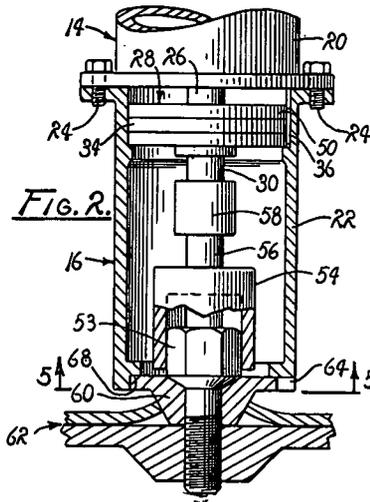
*Address inquiries to:*

Australia, Canada, France,  
Great Britain, Italy, Japan,  
Sweden, West Germany

NASA Pasadena Office  
Attn: Patent Counsel  
Mail Code: 180-601  
4800 Oak Grove Drive  
Pasadena, CA 91103  
U.S.A.

*[Corresponding U.S. Patent—Application Pending]*

Difficulties are often encountered in spacecraft assembly operations because of the existence of torsional stresses induced as a consequence of the tightening of certain bolts employed during such assembly operations. The present invention is a gear head wrench for applying torque to bolts without transferring torsional stresses to bolt-receiving structures. The wrench has an outer housing adapted to be coupled with a spacer interposed between the bolt head and the juxtaposed surface of the bolt-receiving structure for applying a balancing counter-torque to the spacer as torque is applied to the bolt head whereby the bolt-receiving structure is substantially isolated from torsional stress.



# RAW LIQUID WASTE TREATMENT— SYSTEM AND PROCESS

NASA Case No. NPO-13224-2

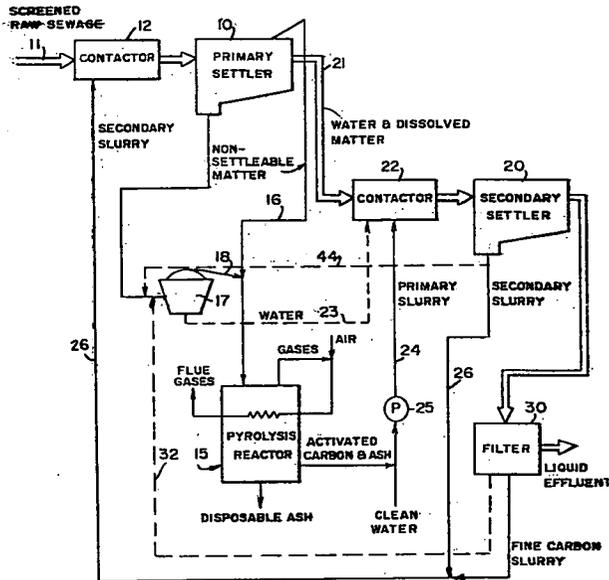
*Address inquiries to:*

Australia, Canada, France,  
Great Britain, Italy, Japan,  
Sweden, West Germany

NASA Pasadena Office  
Attn: Patent Counsel  
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4800 Oak Grove Drive  
Pasadena, CA 91103  
U.S.A.

*[Corresponding to U.S. Patent—Application Pending]*

Raw sewage treatment plants using conventional processes are finding it difficult to dispose of sludge solids. This invention utilizes a series of steps wherein the amount of final product is vastly reduced. The non-dissolved material is pyrolyzed to form an activated carbon and ash material. This carbon and ash is added to the sewer water and absorbs the organic matter and heavy metal ions dissolved in the water. Constant recycling of the carbon and ash reduce the amount of residual material to be disposed.





## HYDROGEN RICH GAS GENERATOR

NASA Case No. NPO-13342

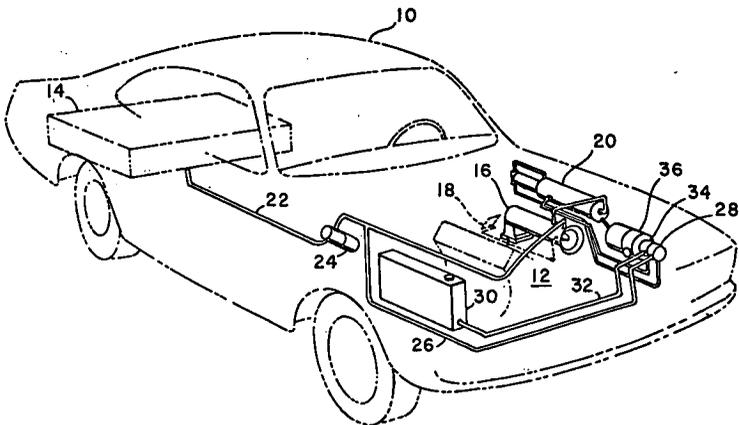
Address inquiries to:

Australia, Canada, France,  
Great Britain, Italy,  
Sweden, West Germany

NASA Pasadena Office  
Attn: Patent Counsel  
Mail Code: 180-601  
4800 Oak Grove Drive  
Pasadena, CA 91103

*[Corresponding U.S. Patent—Application Pending]*

This invention is a generator for generating a hydrogen rich gas to be mixed with a hydrocarbon fuel for use in an internal combustion engine. Such a mixture considerably lowers the pollutants emitted by an internal combustion engine. The hydrogen rich gas is generated in a cylindrically shaped chamber by injecting air and hydrocarbon fuel at one end of said chamber, igniting the mixture of said air and hydrocarbon fuel to provide very hot combustion gases, by partial oxidation of the hydrocarbon. These gases move away from said ignition region to another region where water is injected to be turned into steam by the hot combustion gases. Either simultaneously with the injection of water or subsequently thereto, more hydrocarbon fuel is injected. The steam which is formed mixes with the hot gases present to yield a uniform hot gas whereby a steam reforming reaction with the hydrocarbon fuel takes place to produce a hydrogen rich gas.



# A MULTITARGET SEQUENTIAL SPUTTERING APPARATUS

NASA Case No. NPO-13345-1

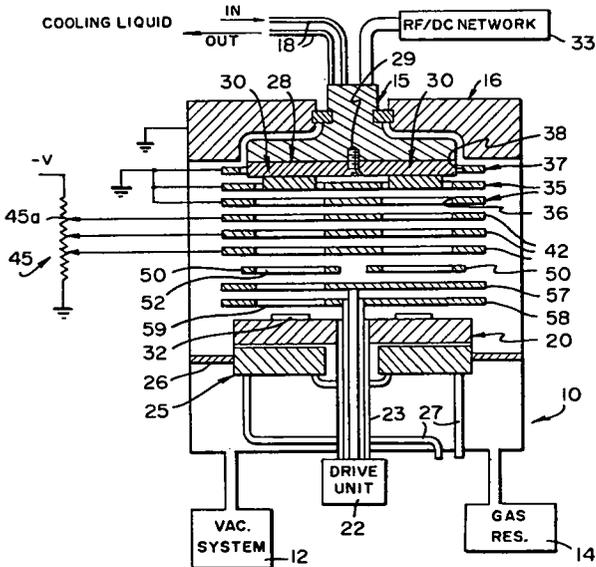
*Address inquiries to:*

Canada, Great Britain,  
Japan, Germany, France

NASA Pasadena Office  
Attn: Patent Counsel  
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4800 Oak Grove Drive  
Pasadena, CA 91103  
U.S.A.

*[Corresponding to U.S. Patent No. 3,864,239]*

Sputter desposition is a process for depositing atoms on a substrate to be used in an electronic device. With this invention it is possible to produce a multilayer structure of different materials in which each layer is of very precise thickness and the interface between layers is absolutely free of contamination. This apparatus includes a stationary cathode, a rotatable anode, different target materials on the cathode, elements bearing apertures to expose the targets, and power means to control the electrical potentials of the system.



## SMALL, POROUS, POLYACRYLATE BEADS

NASA Case No. NPO-13383

*Address inquiries to:*

Australia, Canada, France  
Great Britain, Italy, Japan,  
Netherlands, Sweden, West  
Germany

NASA Pasadena Office  
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Pasadena, CA 91103  
U.S.A.

*[Corresponding U.S. Patent—Application Pending]*

The invention is a method for making uniformly-shaped, porous, round beads. The beads may be used as adsorbents in chromatography and as markers for studies of cell surface receptors. The beads are prepared by the co-polymerization of an acrylic monomer and a cross-linking agent in the presence of 0.05 to 5% by weight of an aqueous soluble polymer such as polyethylene oxide. Cross-linking proceeds at high temperature above about 50°C or at a lower temperature with irradiation. Beads of even shape and even size distribution of less than 2 micron diameter are formed. The beads will find use as adsorbents in chromatography and as markers for studies of cell surface receptors.

# COOPERATIVE MULTIAXIS SENSOR FOR TELEOPERATION OF ARTICLE MANIPULATING APPARATUS

NASA Case No. NPO-13386-1

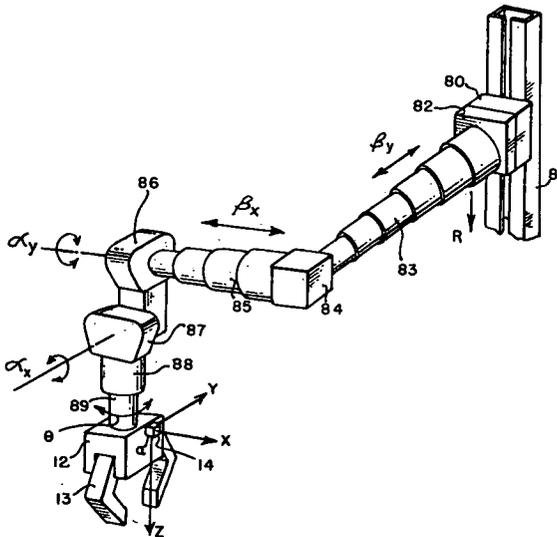
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Pasadena, CA 91103  
U.S.A.

[Corresponding to U.S. Patent No. 3,888,362]

There are numerous tasks involving the manipulation of an article from a remote location under the control of an operator who can place the grasping element in the proximity of the article, but cannot make the final positioning and orientation of the grasping element to successfully grasp the element. The present invention relates to a device which can make the final positioning and orientation to grasp the element. The invention incorporates a corner retroreflector, plane mirrors, photodetectors and a pulsed light source to derive signals to achieve the final steps of grasping the element.



# SYSTEM FOR MINIMIZING INTERNAL COMBUSTION ENGINE POLLUTION EMISSION

NASA Case No. NPO-13402

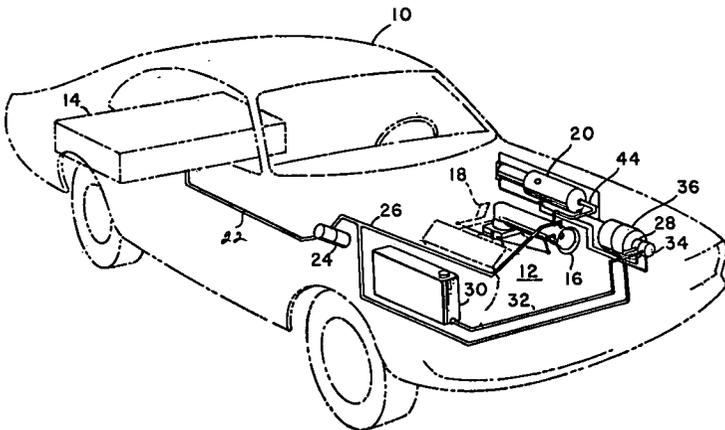
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4800 Oak Grove Drive  
Pasadena, CA 91103  
U.S.A.

*[Corresponding U.S. Patent—Application Pending]*

It is well known that the emitted pollutants of an internal combustion engine are considerably reduced as the fuel-to-air ratio is reduced. However, as the fuel-to-air ratio is reduced, a point is soon reached where the mixture is no longer flammable. It has been found, though, that an ultra lean mixture can be made flammable if mixed with a hydrogen rich gas. This invention is a mixing device which simultaneously atomizes liquid fuel, mixes this fuel with an optimal quantity of hydrogen and combines this mixture with a prescribed quantity of air. A throttling mechanism controls the fuel delivery to the engine and also limits the fuel to air equivalence ratio to a predetermined upper boundary to inhibit the production of air pollutants and to a lower boundry which is above the lean flammability of the mixture.



# COMPUTER INTERFACE SYSTEM

NASA Case No. NPO-13428-1  
NPO-13447-1

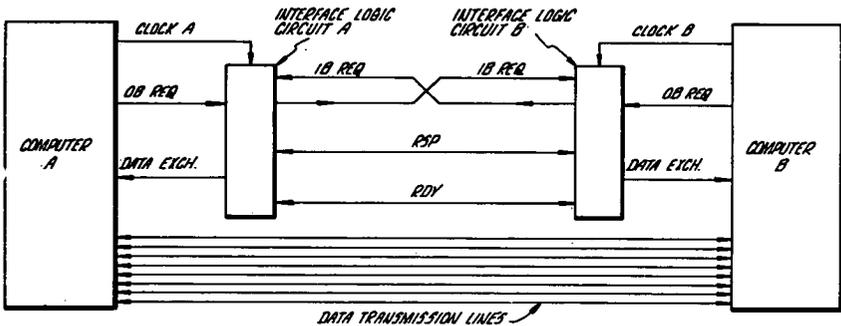
France, Great Britain,  
Japan, West Germany

Address inquiries to:

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4800 Oak Grove Drive  
Pasadena, CA 91103  
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*[Corresponding U.S. Patent—Application Pending]*

Computers and related equipment must be synchronized with one another in order to successfully transmit and receive control signals and data. If the computers are asynchronous, special means are required to transfer data and this invention relates to an interface logic system which, with a minimum of components and inter-connecting lines, verifies that valid information transfer control signals exist and assures proper completion of a data strobe pulse. Thus, data transfer is effected without the requirement of both computers being on a master clock.



# BRUSHLESS DC MOTOR WITH WOUND ROTOR

NASA Case No. NPO-13437-1

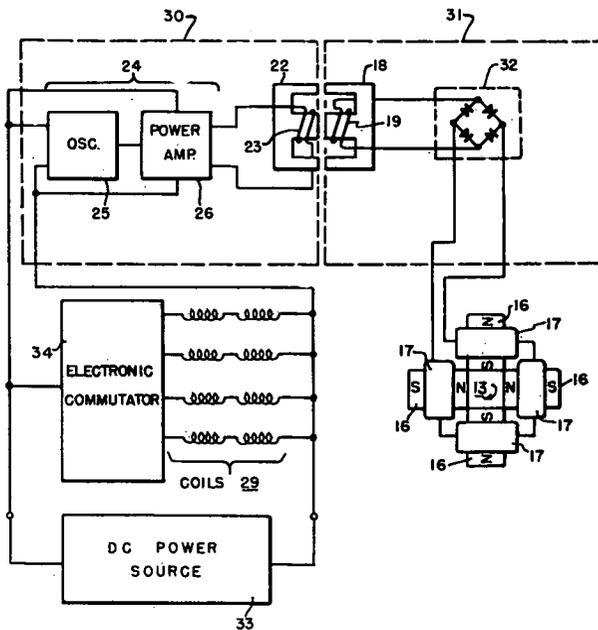
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U.S.A.

*[Corresponding U.S. Patent—Application Pending]*

Brushless dc motors are gradually becoming competitive with the conventional dc motor. In this invention the rotor is an electromagnet energized through a transformer having its primary winding stationary on the stator, and its secondary winding mounted on the rotor. Controlled dc current applied to the motor is converted to ac current for inductive coupling to the rotating secondary winding. The ac current in the secondary winding is rectified to provide dc current to the rotor field coil.



# IMPROVED HYDROGEN-RICH GAS GENERATOR

NASA Case No. NPO-13464-1

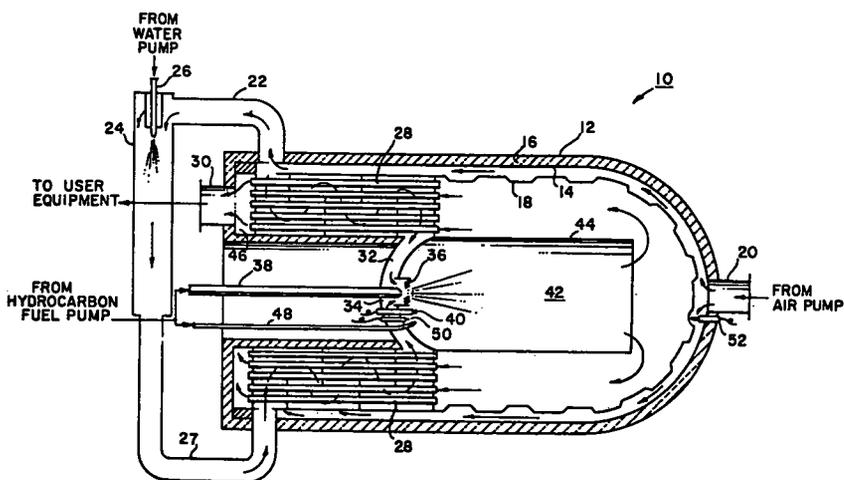
Address inquiries to:

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Great Britain, Italy,  
Sweden, West Germany

NASA Pasadena Office  
Attn: Patent Counsel  
Mail Code: 180-601  
4800 Oak Grove Drive  
Pasadena, CA 91103

*[Corresponding U.S. Patent—Application Pending]*

While the invention of NASA Case No. NPO-13342 does provide hydrogen rich gases, it also has a tendency to form carbon. Since one of the purposes of the hydrogen generator is to provide hydrogen gas to be used in an internal combustion engine, the presence of the carbon which is generated is undesirable since it tends to clog up the induction system of the internal combustion engine. This invention minimizes the carbon output of a hydrogen rich generator by preheating the input air, then injecting atomized water into the preheated air stream and after some more preheating, the resulting steam-air mixture is introduced into the flame zone. An alternate method is to atomize the water and introduce it directly into the flame zone.



# HIGH VOLTAGE, HIGH CURRENT SCHOTTKY BARRIER SOLAR CELL

NASA Case No. NPO-13482-1

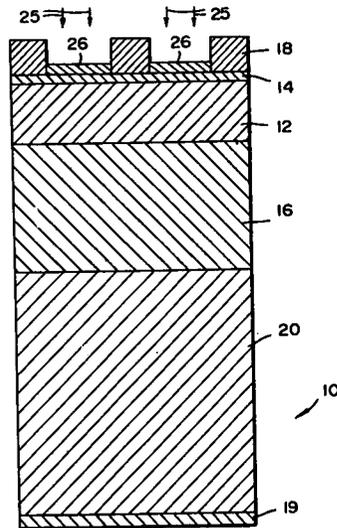
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4800 Oak Grove Drive  
Pasadena, CA 91103  
U.S.A.

*[Corresponding U.S. Patent—Application Pending]*

Extensive research is being conducted to find more efficient solar cells. One such effort is the use of GaAs and this invention is a Schottky barrier solar cell consisting of a layer of wide band gap semiconductor material such as AlGaAs on which a very thin film of semi-transparent metal is deposited to form a Schottky barrier. The layer of the wide band gap semiconductor material is on top of a layer of narrow band gap semiconductor material. The first layer is very efficient for converting the energy of high energy photons and the second layer is efficient in converting the energy of the lower energy photons.



## ANTI-FOG COMPOSITION

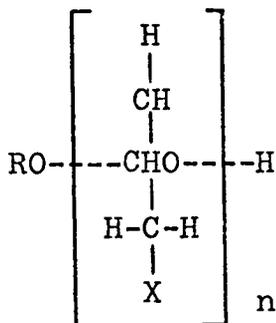
NASA Case No. MSC-13530-2

Australia, Belgium, Canada,  
France, Germany, Great Britain,  
Netherlands, Italy, Japan,  
Sweden, Switzerland

Address inquiries to:  
Johnson Space Center  
Attn: Patent Counsel  
Mail Code: AM  
Houston, TX 77058  
U.S.A.

*[Corresponding to U.S. Patent No. 3,856,534]*

The development and chemical composition of a substance to prevent fogging of windows, mirrors, glasses, space suit visors, and similar optical equipment are discussed. The materials consists of an alkyl glycerol sulfonate, water, and a time extender in the form of an oil. The materials is expected to prevent fogging of visual surfaces for periods of five hours or more during maximum metabolic loads.



**MODIFICATION OF THE PHYSICAL PROPERTIES  
OF FREEZE-DRIED RICE**

**NASA Case No. MSC-13540-1**

**Great Britain, France, Canada,  
Japan, Australia, Switzerland,  
India, Korea**

*Address inquiries to:*  
Johnson Space Center  
Attn: Patent Counsel  
Mail Code: AM  
Houston, TX 77058  
U.S.A.

*[Corresponding to U.S. Patent No. 3,692,533]*

The method steps include first cooking rice over a low simmering heat until it is tender and edible. Then it is frozen and thawed for two complete cycles. Thereafter, the rice is again frozen and freeze dried in a vacuum sufficient to remove water from the rice by sublimation. Rehydration is accomplished by placing the rice in water at an elevated temperature and normally requires only a minute or so. The cycle of first freezing and then thawing appears to change grain porosity and permits easy and rapid sublimation of the water vapor.

# HYDROGEN-RICH GAS GENERATOR

NASA Case No. NPO-13560-1  
NPO-13561-1

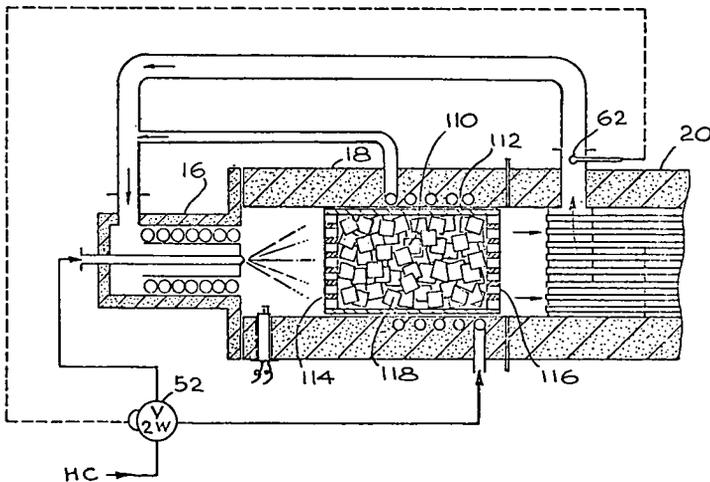
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Great Britain, Italy, Japan,  
Sweden, West Germany

NASA Pasadena Office  
Attn: Patent Counsel  
Mail Code: 180-601  
4800 Oak Grove Drive  
Pasadena, CA 91103  
U.S.A.

*[Corresponding U.S. Patent—Application Pending]*

The inventions of NASA Case Nos. NPO-13342, NPO-13402 and NPO-13464 all require pure water and a consequent water tank. The inherent problems of maintaining a water tank in an automobile, such as finding sources of pure water and preventing freezing of the water, can be obviated with this invention which is a means for generating a soot-free hydrogen-rich gas from liquid hydrocarbon fuel. In this invention, the hydrocarbon fuel is vaporized and is then mixed with preheated air. Thereafter, the mixture is ignited and partial oxidation is permitted. Finally, the products of the combustion chamber in the hydrogen reactor are passed through a nickel catalyst bed where flameless partial oxidation of the fuel takes place on the surface of the catalyst to produce a hydrogen-rich gas.



**METHOD OF FLUXLESS BRAZING AND DIFFUSION  
BONDING OF ALUMINUM CONTAINING COMPONENTS**

**NASA Case No. MSC-14435-1**

*Address inquiries to:*

**Canada, France, Great Britain,  
Sweden, West Germany, Japan**

**Johnson Space Center  
Attn: Patent Counsel  
Mail Code: AM  
Houston, TX 77058  
U.S.A.**

*[Corresponding U.S. Patent—Application Pending]*

Aluminum and its alloys are extremely attractive for fabrication into certain components. Among these is the fabrication of radiator panels for use in orbiting satellites. This invention discloses a new welding technique for aluminum alloys namely diffusion bonding or brazing. The salient step of the invention is the use of a polymeric sealer which is applied to clean the surface and which leaves no residue when thermally removed.

## AIR CUSHION LIFT PAD

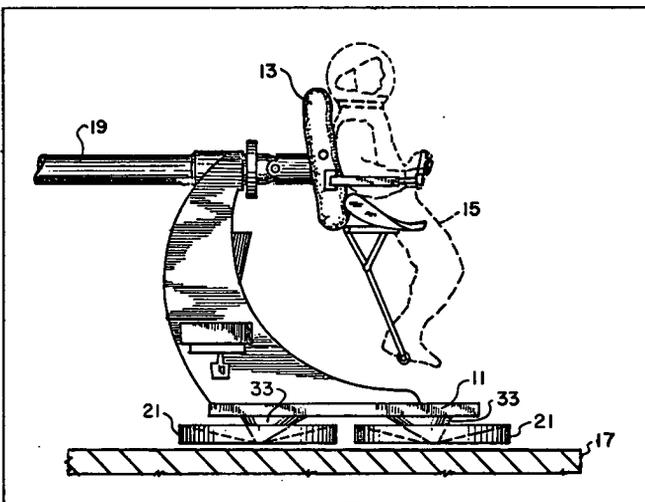
NASA Case No. MFS-14685

Canada

Address inquiries to:  
Marshall Space Flight Center  
Attn: Patent Counsel  
Mail Code: CC01  
Huntsville, AL 35812  
U.S.A.

*[Corresponding to U. S. Patent No. 3,534,826]*

An air cushion lift pad has been developed which utilizes an air cushion of pressurized air to support a device above a surface. The pad includes an upper wall which slopes upwardly from a center portion. Should the pad tend to tilt, the vertical lift force component acting on the inner wall will tend to decrease on the high side and increase on the low side, thereby producing a torque tending to stabilize the pad along the horizontal. A plurality of pads may be used and the design achieves a very stable device with no flutter, vibration, heaving or pitching. The lift pad may be employed to support an object, vehicle, etc. above a surface. Although the surface may be rough or unprepared, stability is achieved.



# PROCESS AND APPARATUS FOR MAKING DIAMONDS

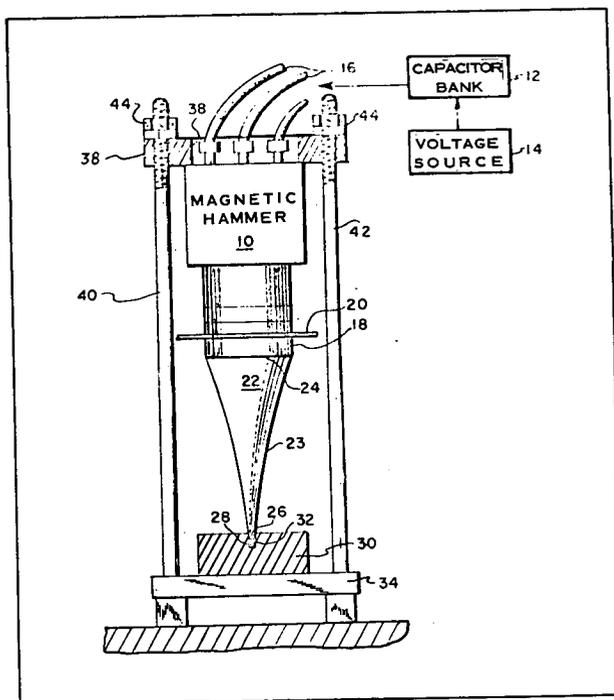
NASA Case No. MFS-20698

Canada, France,  
Japan, Great Britain,  
West Germany

Address inquiries to:  
Marshall Space Flight Center  
Attn: Patent Counsel  
Mail Code: CC01  
Huntsville, AL 35812  
U.S.A.

[Corresponding to U.S. Patent No. 3,632,242]

Diamonds of industrial grade may be fabricated from graphite by this simple but effective apparatus. An exponential horn is vertically positioned with its small end in a graphite receiving pocket. A magnetic hammer above the horn, generates a shock wave in the exponential horn and due to the horn geometry, the velocity of the shock wave is amplified and the shock wave energy concentrated so that all of the energy arrives simultaneously at the small end of the horn. This energy is transferred to the graphite in the anvil pocket and results in pressure and temperature levels that causes the graphite to be transformed, in part, to diamonds.



# GRAPHITE-REINFORCED ALUMINUM COMPOSITE AND METHOD OF PREPARING THE SAME

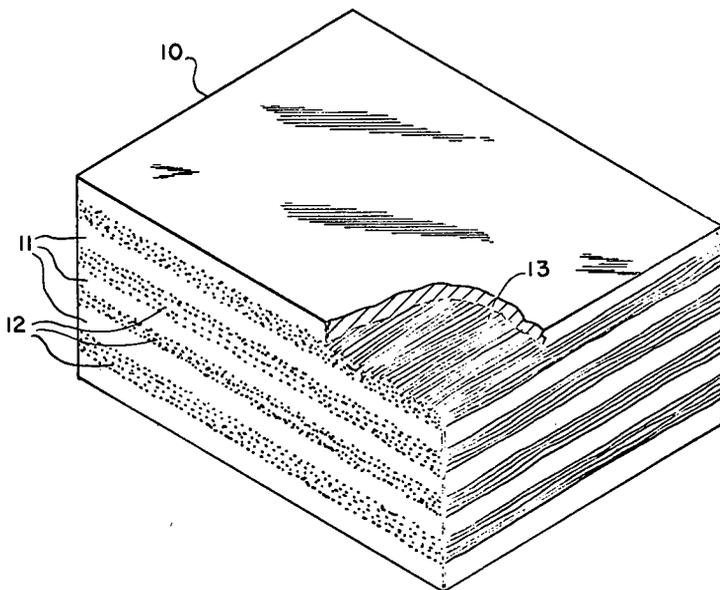
NASA Case No. MFS-21077

Canada, France,  
West Germany,  
Great Britain,  
Italy, Japan

*Address inquiries to:*  
Marshall Space Flight Center  
Attn: Patent Counsel  
Mail Code: CC01  
Huntsville, AL 35812  
U.S.A.

*[Corresponding to U.S. Patent No. 3,894,677]*

Graphite-reinforced aluminum composite material is prepared by coating high strength, high modulus, and low density graphite fiber with nickel, aligning the coated fibers between and in contact with aluminum sheets in a stacked array, and bonding the array into an integral body by application of heat and pressure. The resulting diffusion-bonded composite shows favorable mechanical properties, the graphite fibers remaining intact during the preparation process. Damaging reactions at the graphite surface are prevented by the protective nickel coating. The graphite-reinforced material prepared by the above method can be subjected to shaping or forming operations without breaking the fibers.



# METHOD AND APPARATUS FOR NON-DESTRUCTIVE TESTING

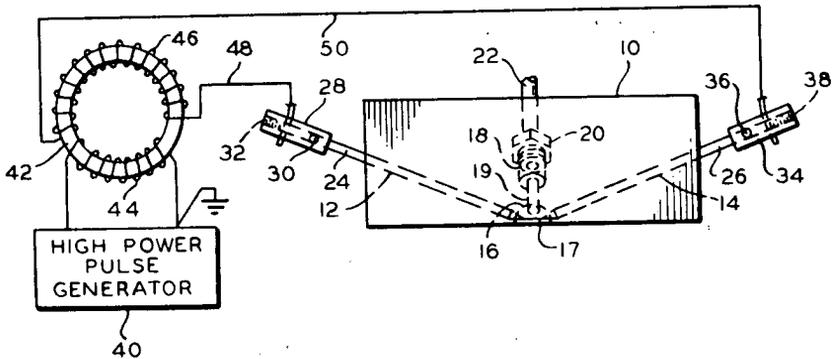
NASA Case No. MFS-21233

Australia, Belgium, Canada,  
France, Great Britain,  
Germany, Italy, Japan,  
Sweden, Netherlands,  
Switzerland

Address inquiries to:  
Marshall Space Flight Center  
Attn: Patent Counsel  
Mail Code: CC01  
Huntsville, AL 35812  
U.S.A.

[Corresponding to U.S. Patent No. 3,782,177]

A high voltage is applied to an arc gap adjacent to a test specimen to develop a succession of high-frequency arc discharges. Those high frequency arc discharges generate pulses of ultrasonic energy within the test specimen without requiring the arc discharges to contact that test specimen and without requiring a coupling medium between those arc discharges and that test specimen. Those pulses can be used for detection of flaws, for measurement of certain properties of the test specimen, and for measurement of stresses within that test specimen.





**REFRACTORY PORCELAIN ENAMEL PASSIVE  
CONTROL COATING FOR HIGH TEMPERATURE ALLOYS**

**NASA Case No. MFS-22324**

**Australia, Canada, France,  
Germany, Great Britain,  
Japan, Italy, Israel,  
Netherlands**

*Address inquiries to:*  
Marshall Space Flight Center  
Attn: Patent Counsel  
Mail Code: CC01  
Huntsville, AL 35812  
U.S.A.

*[Corresponding to U.S. Patent No. 3,891,452]*

Many coating materials have been developed in the space program. This coating is an excellent thermal coating for exposed surfaces. These coatings have low solar absorptance and a high emittance to provide effective protection from solar radiation, reentry heating, dust, salt spray, etc. The coating of this invention meets these requirements and is easily cleanable and will maintain its physical integrity after severe thermal cycling. It is made up of a high-refractory-content boroaluminum silicate glass frit containing zirconium oxide, lithium fluoride, alkali metal and alkaline earth oxide-flux, zinc oxide and a submicron disperse phase of cubic-stabilized zirconium oxide.

**POLYIMIDES OF ETHER-LINKED ARYL  
TETRACARBOXYLIC DIANHYDRIDES**

**NASA Case No. MFS-22355-1**

*Address inquiries to:*

**Canada, France, Great Britain,  
Italy, Japan, Sweden, West  
Germany**

**Marshall Space Flight Center  
Attn: Patent Counsel  
Mail Code: CC01  
Huntsville, AL 35812  
U.S.A.**

*[Corresponding U.S. Patent—Application Pending]*

This invention is used as fuel tank sealant. It is composed of a polyimide. This sealant exhibits excellent thermal, oxidative and hydrolytic stability; high tensile strength and elongation during extreme temperature exposures; improved fuel resistance; and lowered glass transition temperature.

## ETHER-LINKED ARYL TETRACARBOXYLIC DIANHYDRIDES

NASA Case No. MFS-22356

*Address inquiries to:*

Canada, France, Great Britain,  
Italy, Japan; Sweden, West  
Germany

Marshall Space Flight Center  
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Huntsville, AL 35812  
U.S.A.

*[Corresponding to U.S. Patent No. 3,753,148]*

This invention is used as a fuel tank sealant. It is composed of tetracarboxylic acid and dianhydride. This sealant exhibits excellent thermal, oxidative, and hydrolytic stability; high tensile strength and elongation during extreme temperature exposures; improved fuel resistance; and lowered glass transition temperature.

# A PANEL FOR SELECTIVELY ABSORBING SOLAR THERMAL ENERGY AND THE METHOD OF PRODUCING SAID PANEL

NASA Case No. MFS-22562

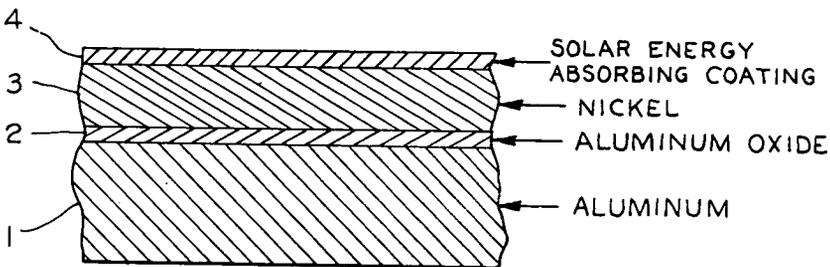
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Germany, Great Britain, India,  
Israel, Italy, Japan, Netherlands,  
Switzerland

Marshall Space Flight Center  
Attn: Patent Counsel  
Mail Code: CC01  
Huntsville, AL 35812  
U.S.A.,

*[Corresponding U.S. Patent—Application Pending]*

Metal bodies having requisite absorptance to emittance ratios can be fabricated so that the heat absorbed is transferred to tubes carried in the metal body for subsequent use in heating and cooling operations. This invention is a panel for selectively absorbing solar thermal energy comprising a metallic substrate, and a solar thermal energy absorbing coating carried on the bright metallic material. A layer of zinc is interposed between the metal substrate and the layer of bright material or the metallic substrate can be anodized for receiving the layer of bright metallic material. Also disclosed is the method for producing the coating which selectively absorbs solar thermal energy.



## ANTI-GRAVITY DEVICE

NASA Case No. MFS-22758-2

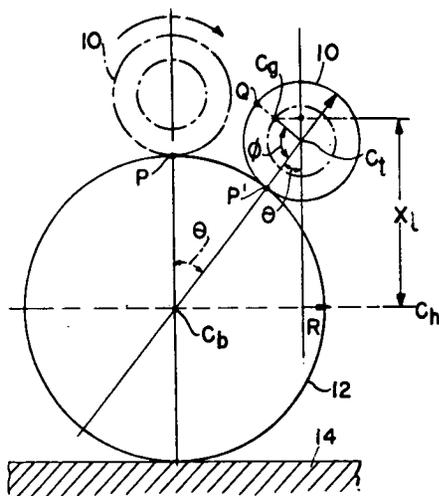
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West Germany

Marshall Space Flight Center  
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U.S.A.

*[Corresponding U.S. Patent—Application Pending]*

The invention consists of two spheres, one sphere having the capability of resting on top of the other sphere without falling off, even when either of the spheres is jiggled. The spheres are not fastened together in any way. The center of gravity of the top sphere is displaced from its geometrical center by a certain distance. The top sphere can rest on the bottom sphere with its center of gravity on the vertical line segment joining the geometrical centers of the spheres. Also, the top sphere can rest on the bottom sphere such that the line joining the centers of the two spheres is inclined to the vertical. In both positions, the top sphere can be rolled up and down on the surface of the bottom sphere to a predetermined maximum angle and, when released, will return to its original position atop the bottom sphere.







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