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SPACE SYSTEMS INFORMATION BRANCH, GEORGE C. MARSHALL SPACE FLIGHT CENTER

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EARTH COLLECTS MOON DUST BY THE TONS. Dust from the Moon is falling on Earth by the ton each day, according to a theory proposed by Dr. Donald E. Gault of Ames Research Center. If the theory is correct, lunar material might be captured for examination.

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Speaking at a meeting of the American Geophysical Union, Dr. Gault suggested launching rockets with a flytrap mechanism to capture lunar particles just after a meteor shower. Some of the lunar material, he said, might be found by digging into the polar snows, where layers of Moon dust may have been deposited and trapped over the last century.

The conclusions are based on a series of laboratory studies showing how matter traveling at high speed can hit rock and sand, spraying it out at a much higher speed than the projectile's. The same reaction may occur when speeding meteoroids strike the Moon. Thus some of the lunar material might find its way into orbit around the Earth, with a small per cent hitting the Earth either soon after it leaves the Moon or a month or so later.

Gault indicated there would be periods of greater Moon dust enrichment near or on Earth during the great meteor showers, which would have kicked increased amounts of dust off the lunar surface. (Source: The New York Times, April 18, 1963)

A STUDY OF SPECIAL TOOLS FOR SPACE USAGE.

New tools and repair methods for space flight are being developed from a study conducted by Martin Company's Space Systems Division in association with another Baltimore firm, Black and Decker Manufacturing Company. The continuing study by the research engineers shows that emergency repairs can be made in space.

One repair tool, produced experimentally and still being refined, is called a zero reaction space wrench. A basic problem with which space travelers must contend is that of weightlessness. Men may have to live without gravity's pull for flights of many months in future interplanetary travel. As a result, the astronauts of the future will have critical problems with such earthly, simple tasks as turning a monkey wrench. On Earth, you fix the wrench to a bolt and turn or push down the handle.

In weightless space, the astronaut might push on a wrench and the reaction would turn him rather than the tool. That is the problem of torque, which in a general sense deals with the turning and twisting force applied to a body.

Company engineers think they have solved some of the problems for space repairmen with a tool they call the "zero reaction" wrench (Fig. 1) that resembles a pair of clippers or pliers. When the handles are squeezed together, an adjustable gear system turns a socket. Because the forces involved in the squeezing action are applied equally in opposite directions, they neutralize each other, eliminating the undesired torque reaction. The wrench is plugged into the vehicle wall, anchored by pins protruding from the wrench.

Addition of other sources of power is also under study. Powered tools in space would have to be self-contained because the spacecraft's own supply might not be available in time of emergency. A team from the companies is studying the application of such power to a variety of tools far more advanced than the wrench. Some tools possibly could not be used at all. A screw driver, because of its sharp point, may be too dangerous in a delicately pressurized spacecraft.

A conventional hammer loses effectiveness in space because its most important potential, the force of weight, is not present. The engineers instead recommend a spring-loaded impact hammer, similar to a center punch. Conceivably, the spaceman would have to wear a harness similar to that used by window washers when operating tools.

If all this seems difficult, consider it from another angle.

Earthbound repairmen frequently are frustrated because they can't reach an out-of-the-way pipe or bolt. In space, the weightless traveler can stand on his head if necessary. (Source: Data supplied by the Martin Company)

RADIATION: SURVIVAL HAZARD OF MANNED SPACE STATIONS. A recent computer study indicates that proposed manned space stations will face critical radiation hazards. The study, by Robert E. Fortney of Northrop Space Laboratories, predicts extreme danger for a man remaining two days in a space station that is circling the equator at a height of 3200 km (2000 mi). The nuclear scientist used a computer to figure the likely daily dosage of protons, 103 r; the protons are more dangerous than electrons in the lower Van Allen belt, where most manned stations will be. The 3200-km (2000-mi) orbit was picked because proton radiation is strongest at that level.

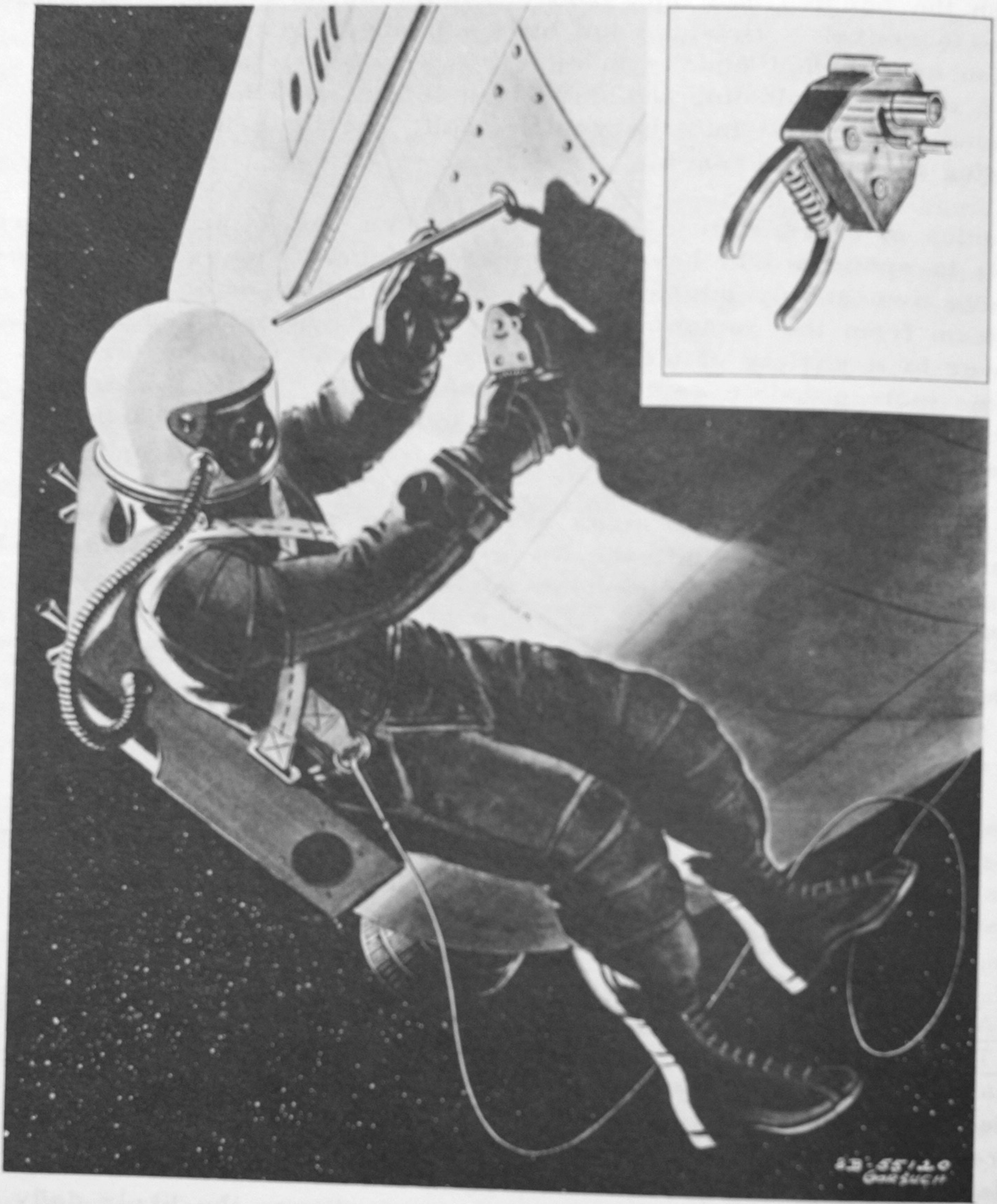


FIG. 1

Fortney's calculations included the shielding effect of a half inch of aluminum, the material probably to be used in future spacecraft. He explained that although other materials or methods of shielding would add protection, they would increase the weight, a critical factor in the orbiting of large objects. Fortney added that orbiting at other levels would decrease the hazard.

The 103 r, more than half the 200-r emergency tolerance limit set by NASA, "would be in the form of high-energy protons capable of penetrating the body to a depth of two or more inches and [of] damaging blood-forming organs," the scientist said. Furthermore, man's skin would stop 200 r in low-energy protons, which is half the emergency skin tolerance limit.

Because radiation is cumulative, a manned spacecraft orbiting in the lower Van Allen belt for any length of time will encounter a serious radiation problem. (Source: The Chattanooga Times, March 25, 1963)

INFRARED COMMUNICATION SYSTEM TO BE TESTED.

Infrared communication between two moving aircraft, which bars unfriendly eavesdropping, gets in-flight evaluation, beginning in May, 1963, Air Force Systems Command (AFSC) has announced. Testing of the ultra-directional air-to-air communication system is slated at AFSC's Aeronautical Systems Division (ASD), Wright-Patterson AFB, Ohio.

Pilots can maintain radio contact without being overheard; invisible, infrared "light" beams carry the voice. ASD researchers say the two-way operation is difficult to jam, intercept, or detect. Messages can be picked up only by special instruments directly lined up with the transmitter and beam. Automatic search, acquisition, and lock-on features allow pilots to stay on each other's beam.

A simple push-button system, it is efficient and reliable. It works like this:

Both aircraft must have their units turned on and scanning. The pilot or operator wishing to transmit a message presses a button, triggering the beacon signal. This puts the system in the search mode. The system remains in this mode until the

second aircraft picks up the signal with its search receiver and locks on. At the same time the craft making the reception activates its own beacon. When infrared link is established, both search beacons shut off automatically. Voice communications can then begin at infrared frequencies. Communication is carried over an extremely narrow beam, making the system difficult to jam.

Average power requirements for the systems are extremely low. A small lamp, about the size of a flashlight bulb, beams messages, although the beam is invisible.

Presently two C-131B aircraft are being modified with domes on the tops and bottoms of the fuselages to house the infrared equipment for the evaluation program at ASD. Completion date of the testing program is expected within six months after its start in May. Data reduction and analysis of test results will be performed by ASD laboratory personnel. (Source: AFSC news release No. 31-105-24 (USAF))

LIFE BEGAN WITH A BANG. Another theory of the creation of life on Earth has been formulated by J. J. Gilvarry and A. R. Hochstim of the Space Science Laboratory, General Dynamics/Astronautics, in San Diego, California. The scientists suggest that a collision of mammoth speeding meteorites with Earth produced a shock wave and great temperatures to promote chemical reactions in the primitive atmosphere.

Many scientists now believe the Sun and planets, including the Earth, were formed when clouds of dust and gases condensed into globular masses. The Earth cooled, seas formed, and life somehow began in the warm seas, evolving into all the species, including man. Since the original chemicals were too simple and elemental to be good building blocks for living things, more complex compounds had to be formed in the atmosphere or in the seas.

Gilvarry and Hochstim believe these organic chemicals would have been formed in the air because of the "shooting stars" heating the air and causing the complex compounds. Then when a meteorite plunged into the sea, it could shoot up a hollow column of water and spray, forming a dome-shaped cloud of water

droplets to trap part of the wake of new-formed chemicals. The chemicals would be pulled down, enriching the sea water to provide a kind of chemical soup in which life could have begun. (Source: Nature, March 23, 1963)

FUZZY MOON THEORY PROPOUNDED. Dr. Charles R. Warren has proposed that the Moon is probably covered with a thin layer of openwork fuzz, a concept generated to explain certain oddities in the way the Moon reflects light from the Sun. The most familiar of these oddities is that the limb of the full Moon--the edge as seen from Earth--is just as bright as the Moon's center. Although it has been assumed for many years that the Moon's surface is rough (to account for these observed characteristics), no well-known materials on Earth would produce this effect.

Dr. Warren, a scientist of the United States Geological Survey, has explained that such fragments as gravel, sand, or angular blocks would cast far too little shadow, and dust would not allow for enough open space between particles. His terrain analysis study reported a meshwork only an inch or so deep that may resemble either Tinker-Toy units stuck together in random fashion, snowflakes, or reindeer moss.

This picture of "skeletal fuzz that consists mostly of open space" coincides with an idea expressed recently by Soviet scientists that the Moon has a spongy surface material. (Source: The New York Times, April 12, 1963)

WINGED SLED SPEEDS TESTS AND IS LESS EXPENSIVE. A newly designed rocket-propelled sled at the Air Force Missile Development Center (AFMDC), Holloman AFB, New Mexico, is resulting in greater economy and is speeding up both tests and sleds, Air Force Systems Command has announced. Developed by AFMDC's Field Maintenance Division, the unit consists of a monorail sled mated with a simulated airplane wing to form a dual-rail sled as light and fast as the monorail type. It is the first time such a design has been used for this purpose.

Weight of the sled is 156 kg (342 lb), half that of its dual-rail counterpart. The low-drag, all-metal wing is designed along

aerodynamic lines. Free-sliding metal hooks or slippers anchor the extended wing to the opposite rail to prevent the unit from jumping the rail as it rockets along the 11-km (6.6-mi) track.

Sled runs made to date demonstrated that the winged unit outperforms standard dual-rail sleds. This performance has been attained, with far greater velocities and the same amount of rocket thrust, while carrying weights equally as heavy as those by the monorail type. Thus many sled tests are cut to a fraction of their previous cost.

A forerunner of the winged sled got its first practical use when it was picked to support an Army research program to simulate the flight of a wire-dispensing antitank missile that released wire from a reel in the missile. A reel was attached to an outrigger so that the wire would trail free of the track and clear of the booster blast.

During testing the outrigger, an open framework of tubular steel, buckled. This led to the designing of a covered airfoil as a low-drag, load-bearing wing capable of being fired at faster speeds by its monorail sled. A new sled is under development for other types of tests requiring payloads up to 900 kg (2000 lb) at higher speeds. The unit consists of two monorail sleds fitted together by a wing supporting a payload above the tracks. (Source: AFSC news release No. 32-3-22 (USAF))

METER TRANSMITTER MEASURES FLOW RATES AND TRANSMITS TO REMOTE STATIONS. An improved electrical area meter transmitter that measures and transmits to distant points liquid rates of flow is now available from Bailey Meter Company. The unit (Fig. 2) mounts directly in horizontal pipe lines up to 10 cm (4 in.) in diam and can transmit flow-rate measurements of water, kerosene, gasoline, oil, chemicals, distillates, and refrigerants. Flow is indicated at the point of measurement; hence the unit provides a quick check of system performance and permits a check of the transmitting system without affecting the measuring mechanism.

The meter transmitter is installed like a valve, directly in the main flow line, with no need for primary elements and connecting piping. A spring-loaded measuring mechanism is sensitive to both

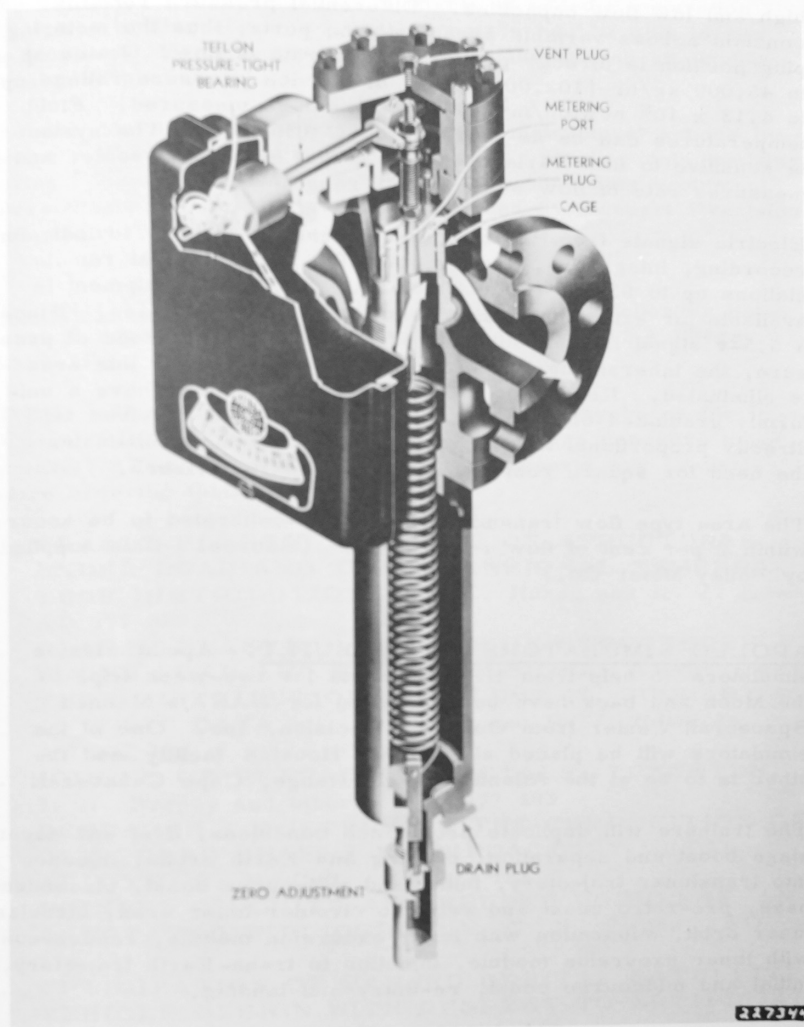


FIG. 2

high and low flow capacities. Differential pressure remains constant across variable area metering ports, thus the metering plug position is directly proportional to rate of flow. Rates up to 45,000 kg/hr (102,000 lb/hr) at service pressure ratings up to 4.13×10^6 newton/m² (600 psig) can be measured. Fluid temperatures can be as high as 180°C (350°F). The system is sensitive to flow variations of 0.25 per cent of full scale, and it measures rate of flow over a 50:1 range.

Electric signals from the unit are transmitted directly to indicating, recording, integrating, and/or controlling equipment at remote stations up to 930 m (3000 ft) away. Additional equipment is available for extending transmission to greater distances. Since a 5.5-v signal is transmitted to the control room instead of pressure, the inherent danger of high pressure piping in this area is eliminated. Receivers used with this transmitter have a uniformly graduated chart or scale since the signal received is directly proportional to rate of flow. This feature eliminates the need for square root extractors or characterizers.

The area type flow transmitter is factory-calibrated to be accurate within 2 per cent of flow range span. (Source: Data supplied by Bailey Meter Co.)

APOLLO SIMULATORS TO BE BUILT. Apollo mission simulators to help train US astronauts for two-week trips to the Moon and back have been ordered for NASA's Manned Spacecraft Center from General Precision, Inc. One of the simulators will be placed at NASA's Houston facility and the other is to be at the Atlantic Missile Range, Cape Canaveral.

The trainers will duplicate pre-launch conditions, first and second stage boost and separation, parking and Earth orbits, injection into translunar trajectory, initial and midcourse coast, circumlunar pass, pre-retro coast and retro to circular lunar orbit, circular lunar orbit, separation with lunar excursion module, rendezvous with lunar excursion module, injection to trans-Earth trajectory, initial and midcourse coast, re-entry and landing.

The trainers will not simulate space conditions such as zero gravity (weightlessness) or G forces.

The simulator will provide sound effects of booster separation and space lighting effects so that astronauts will be able to see the Moon and Earth in proper relation to the spacecraft during all mission phases.

The computers will respond to crew and instructors' actions by solving mathematical and logical problems, providing data exchange, storing information, making decisions, and simulating equipment failure diagnosis. (Source: Data supplied by General Precision, Inc., April 30, 1963)

TECHNICAL REPORTS AVAILABLE. The following listed technical reports can be requested through the NASA library, M-MS-IPL, Bldg. 4481.

NOTE: Those reports with an AD number may be on file in the local DDC branch in Bldg. 4484. Readers can save time by calling 876-6088 and inquiring if such reports are available before ordering them through NASA.

1. ELASTO-PLASTIC ANALYSIS OF STRUCTURES UNDER LOAD AND TWO-DIMENSIONAL TEMPERATURE DISTRIBUTIONS, P. C. Huang and R. J. Edwards. AD 277 029
2. ELASTO-PLASTIC ANALYSIS OF STRUCTURES UNDER LOAD AND TWO-DIMENSIONAL TEMPERATURE DISTRIBUTIONS. VOLUME II, SUMMARY OF TEST DATA, P. C. Huang and R. J. Edwards. AD 277 178
3. JOINING OF REFRACTORY METALS--TUNGSTEN, J. H. Brophy and others. AD 277 403
4. RESEARCH TO DETERMINE THE COMPOSITION OF DISPERSED PHASES IN REFRACTORY METAL ALLOYS, F. B. Cuff. AD 277 152
5. PRINTED CIRCUITS AND WELDED MODULES: AN ANNOTATED BIBLIOGRAPHY, G. E. Owens. AD 278 631
6. OPTIMIZATION OF MANNED ORBITAL SATELLITE VEHICLE DESIGN WITH RESPECT TO ARTIFICIAL GRAVITY, B. J. Loret. AD 277 446
7. IMPACT STUDIES ON LUNAR DUST MODELS AT VARIOUS VACUUMS, R. L. Greer. AD 273 604

8. ELECTROSTATIC SHIELDING OF HIGH ENERGY PROTONS, T. W. Bailey. AD 277 955
9. FAST REACTOR ROCKET ENGINES--CRITICALITY, R. S. Cooper. LA 2707
10. FAST REACTOR ROCKET ENGINES--HEAT TRANSFER, R. S. Cooper. LA 2746
11. PRELIMINARY INVESTIGATION OF EFFECT OF HYDROGEN ON STRESS-RUPTURE AND FATIGUE PROPERTIES OF AN IRON--A NICKEL--AND A COBALT-BASE ALLOY, S. J. Klima, A. J. Nachtigall, and C. A. Hoffman. NASA N63-10898
12. CORRELATION OF PLATE CREEP BUCKLING THEORY WITH EXPERIMENTS ON LONG PLATES OF ALUMINUM ALLOY 2024-0 AT 500° F, Ralph Papirno and George Gerard. AD 291 795
13. PATENT ABSTRACT SERIES. PB 181 473
14. ELECTRODELESS MHD GENERATOR RESEARCH, PART 1, THEORETICAL ANALYSIS. AD 291 713