

flying faster than the speed of sound, the other for flying more slowly. Patent 3,155,344.

A tactile communication system for sensing coded vibrations with the fingers. Patent 3,157,853.

An electric arc that produces a ball of plasma, or ionized gas, that is hotter than the sun's surface for use as solar simulator in environmental test chambers. Patent 3,136,915.

A high-speed surgical drill powered by a tiny gas turbine engine that can be used by dentists, or by surgeons operating on the heart and brain. Patent 3,128,079.

A method of launching rockets that uses a rocket sled zooming on rails down an incline then back up a slope to give added push to the missile's thrust. Patent 3,134,300.

An agricultural spray, consisting of hydrated lime, bentonite, kaolin and Celite, that reflects the direct rays of too strong a sun in summer and insulates the crops against killing frosts in winter. Patent 3,120,445.

A suspended dome that uses the principle of the catenary widely used for suspension bridges. Patent 3,139,957.

An inflated stomach balloon apparatus that uses the same heat exchange cycle as a conventional refrigerator to stop bleeding stomach ulcers. Patent 3,125,096.

Numbers following items are U.S. patent numbers. Printed copies of patents can be obtained from the U.S. Patent Office at 25¢ each. Order by number, do not send stamps, and address orders to the Commissioner of Patents, Washington, D. C. 20231.

SPACE

The U.S.S.R. launched a three-man spacecraft called "Sunrise," the only manned shot by any country during the year, with an astronaut, a doctor and a scientist who did not wear space-suits; the Sunrise used retrorockets as brakes to permit a soft landing.

Nimbus I, launched August 30, used an ingenious infrared TV camera to take unusually clear photographs of the earth's cloud cover, including the first night-time pictures ever made.

On September 17, it was announced that the United States has two already-working systems "with the ability to intercept and destroy armed satellites circling the earth in space."

A panel of the National Academy of Sciences recommended that the United States make Mars, not the moon, its main concern in space, with particular emphasis on the search for extraterrestrial life.

Mariner IV, following on the heels of its unsuccessful predecessor, made a good start late in November at being the first man-made object to take a close look at Mars, with arrival expected next July.

Two days later, the Russians announced the launching of their own Mars probe, Zond 2, although a troublesome power supply may have doomed the mission.

Early in the year the Soviet Union scored its first multiple satellite launching, with Elektrons 1 and 2 riding up on the same rocket to study the Van Allan radiation belts, followed in July by 3 and 4.

The 4,316 beautifully clear photographs of the moon taken by Ranger VII gave resolutions even higher than expected and were 1,000 times better than any previously possible.

SERT I flight from NASA's Wallops Island Station on a ballistic trajectory more than 2,000 miles over the Atlantic Ocean was the first successful test of an ion propulsion engine.

The largest man-made satellite in the sky, Echo 2, a mirror-finished balloon as big as a 13-story building, was launched January 25 and is being used for experiments by the United States, United Kingdom and the Soviet Union.

The first Orbiting Geophysical Observatory,

porcupinish OGO-1, carried 20 experiments of various kinds into orbit, of which 17 are sending back information.

NASA began the process of selecting scientists-astronauts who will begin training next year.

The Syncom 3 communications satellite transmitted live pictures of the Olympic Games in Tokyo from a position 22,300 miles above the intersection of the equator and the international date line.

The first live pictures between Japan and the United States were transmitted during January by Relay 2, which is equipped to handle TV, radio and two-way telephone conversations.

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The spider-like Lunar Landing Research Vehicle, or LLRV, designed to give astronauts practice in landing the Lunar Excursion Module on the moon, was completed and successfully tested.

The Air Force expanded several Top Secret series of "sky spy" satellites, including Samos, Midas and Vela Hotel, equipped for such tasks as observing enemy rocket trails, missile bases and nuclear tests.

The Soviet Union continued its Cosmos satellite program, launching numbers 25 through 50.

The heat of reentry into the atmosphere was measured by Project Fire, using a vehicle shaped like a Mercury capsule, launched from Cape Kennedy to a height of 520 miles, then "launched" back again from about 80 miles up to achieve a top speed of nearly 26,000 miles an hour, highest ever achieved in free flight by a man-made object.

Atlas-Centaur 3, prototype of the rocket that will "soft land" the un-manned Surveyor spacecraft on the moon, was finally launched.

American manned flight hopes, embodied in the two-man Gemini program, were delayed until 1965, although Saturn rockets, 5, 6 and 7 carried mockups of the Apollo lunar craft and developed an effective new guidance system.

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MEDICINE

Artificial Heart Outlook

➤ PARTIAL OR TOTAL heart substitutes are among the promising outlooks for the future, Dr. Bert K. Kusserow of the University of Vermont College of Medicine, Burlington, said at a meeting of the New York Academy of Sciences' division of instrumentation in New York.

In his own work, Dr. Kusserow has made drastic changes in the electrically driven pump he originally implanted in the abdomen of animals.

By placing his pump immediately outside the chest wall, Dr. Kusserow found that it worked just as well, was easier to replace and was less irritating to tissues.

The newer pump can carry approximately one-third of the heart load, supplying the left ventricle.

Although dogs formerly could be perfused by the pumping heart for only ten and a half hours, experimental animals can now be perfused more than two days, fully conscious and walking around.

There is less destruction of the blood elements with the newer, "gentler" instrument, and the pump is less likely to cause blood clotting.

Surveying the numerous investigations in artificial heart research, Dr. Kusserow told the meeting that one of two basic approaches

BIOTECHNOLOGY

Imitation Bone Made From Clay-like Material

➤ OUT OF A CLAY-LIKE material made from aluminum, science has artificially fashioned imitation human bone.

The new material promises to serve the living body almost better than the natural skeleton. It may also be used to replace eyeballs and develop non-sparking, non-reflective surgical tools.

This ceramic was produced by the cooperative research of a prominent orthopedic surgeon, the nation's largest pottery giftware manufacturer, and a major pharmaceutical firm.

Initial experiments on rabbit knee bone transplants at Baxter Laboratories, Inc., Morton Grove, Ill., showed that animal tissue will stick to the material as natural bone does.

However, three to four years of further evaluation is necessary before its safety for human use can be determined.

The material, known as Cerosium, is made from a porous ceramic composed mainly of an oxide of aluminum that is impregnated with epoxy resin, an inert plastic compound.

This combination provides a tough, non-reactive, flexible material, very similar to bone.

Haeger Potteries, Dundee, Ill., produced the ceramic material at the suggestion of Dr. Lyman Smith, Elgin, Ill. surgeon and assistant professor at Northwestern University.

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is being made. Some scientists propose total removal of the heart, followed by complete replacement with a blood pump. Others aim only at partial substitution and augmentation of existing heart function by a small pumping device coupled with the beating heart.

There has been considerable variation in pump design, including roller, ventricular, pendulum and sac types, Dr. Kusserow said. In general, such pumps have been driven by direct coupling with conventional power units such as small electric motors, cylindrical coils or wire, called solenoids, and compressed gases.

A few experiments are on record in which systems of rotating magnetic fields or inductive coupling with stationary coils have been used to transmit power across the intact body wall to an implanted pumping device or other receiving unit.

Attempts have also been made to power pumping systems biologically with skeletal muscle.

Although a number of difficulties remain, Dr. Kusserow said it appears from experiments with animals that pumping systems can be constructed safely enough for cautious use on selected humans.

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