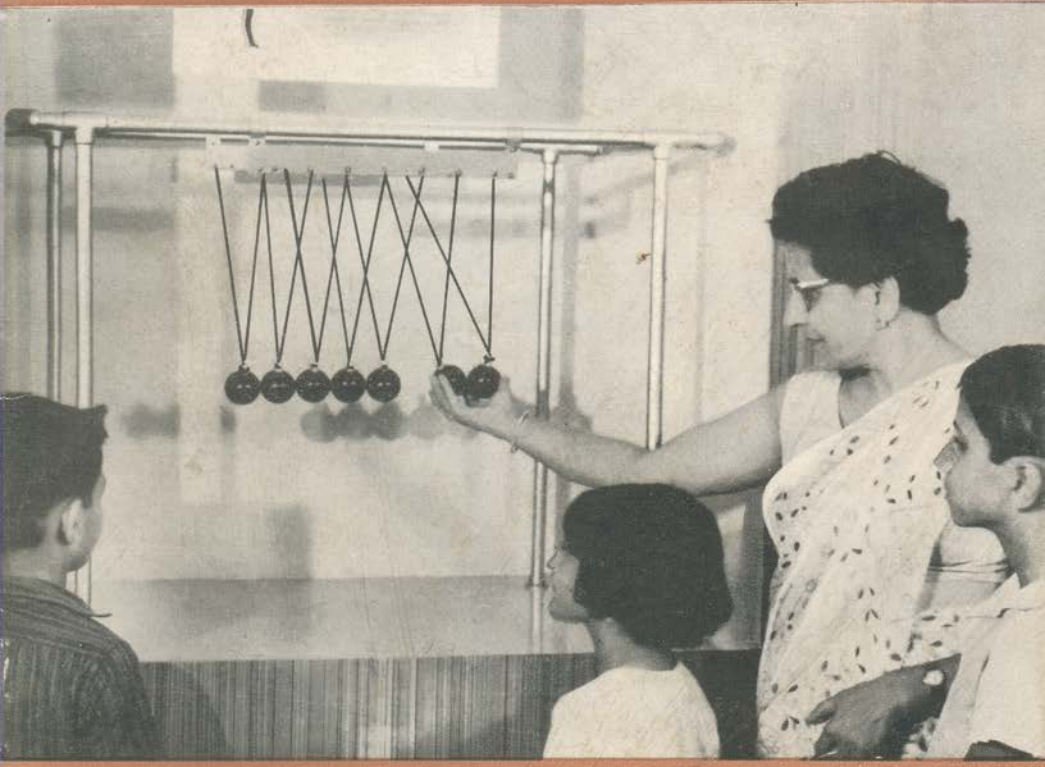
Popular science gallery



BIRLA INDUSTRIAL & TECHNOLOGICAL MUSEUM
19A, GURUSADAY ROAD, CALCUTTA-19
C. S. I. R. INDIA

GENERAL INFORMATION ON THE MUSEUM

Location	:	Crossing of Gurusaday Road and Syed Amir Ali Avenue, Calcutta-19. Bus routes : 10, 45, and 41 (via. Circus Avenue). Tram routes : 25, 26.
Admission	:	25 paise per head : Free for organized student groups.
Museum Hours	:	Open from 10 a.m. to 5 p.m.—Tuesdays to Sundays. Closed on Mondays, Doljatra and Kalipuja.
Museum Galleries	:	Nuclear Physics, Motive Power, Transport, Popular Science, Mining, Copper, Iron & Steel, Petroleum, Electricity, Electronics & Television and Communication.
Opportunities for everyone	:	● Galleries. ● Film shows. ● Popular lectures. ● Temporary exhibitions. ● Television shows. ● Sky observation programme. ● Reference library on scientific & technical subjects.
Opportunities for the students	:	Science demonstration lectures. Creative abilities centre. Science seminars. Science fairs. Conducted tours for organised groups.
Outdoor Activities	:	Three mobile science exhibition units. Three regional science museums. Science demonstration lectures in schools. Creative Abilities centres in schools. Teachers' Training programme.

A Section of the Popular Science Gallery

POPULAR SCIENCE GALLERY

In ancient times science was the exclusive possession of a minority, while for the vast majority it was a mysterious affair which hardly ever touched their daily life. In modern times the tremendous advance of science has led to a continuous stream of discoveries that have brought the fruits of science to the very door of common people. Science today enters into every aspect of their life. It is therefore necessary that they must acquire some understanding of its operations so that they cease to be a mystery and become part of their common intellectual heritage.

The purpose of the Popular Science Gallery is exactly this. It seeks to answer in a popular way through models, exhibits and demonstrations such every day questions as:—how we hear ; how we see with our eyes ; how our brain works and the like.

With this aim in view the Popular Science Gallery puts on display exhibits on such fundamental disciplines of science as mechanics, electricity, electronics, optics and sound.

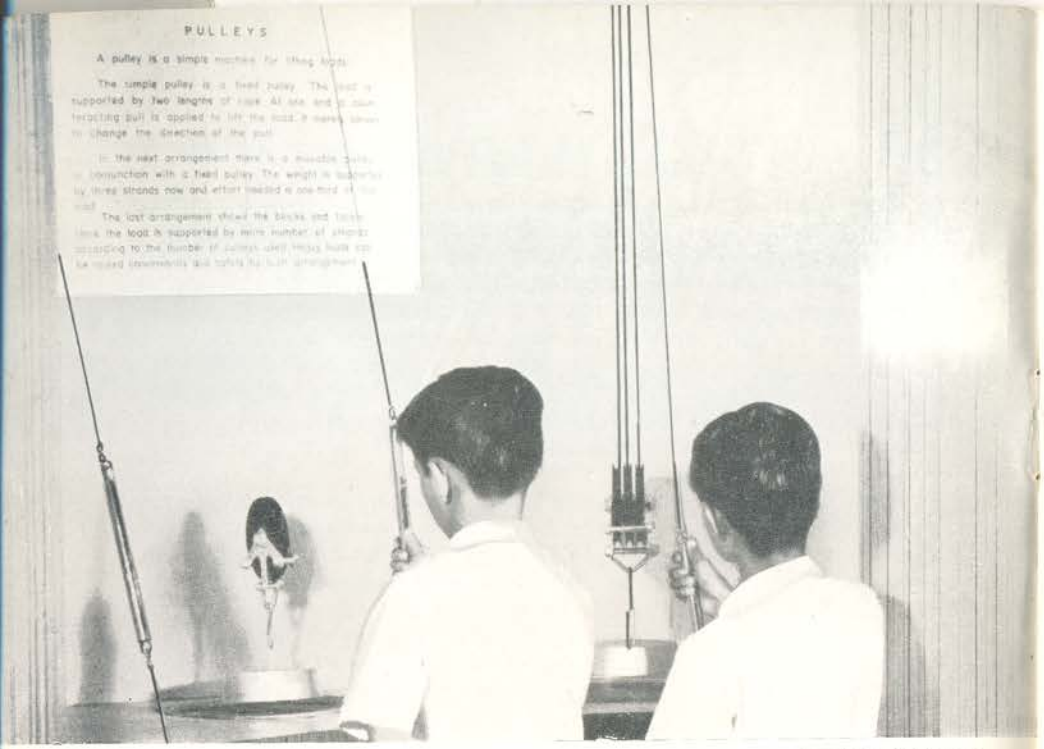
MECHANICS

Mechanics is the science which treats of the nature of forces and of their actions on bodies either directly or by the agency of machinery.

The first exhibit to catch the eye of the visitor is a model on "Transfer of Momentum". Momentum is the quantity of motion in a body measured by the product of the mass and velocity of the moving body. The model shows how the momentum of one body is transferred to another body.

The pulley is a simple mechanical device often used to lift large loads. Its components are a wheel, an axle and a frame. The mechanical advantage of a pulley system can be made large by combining into a single system several fixed and movable pulleys. They are known as a Pulley Block and Tackle. In the model of pulley system one can feel how it becomes easier to raise a load when the number of pulleys in the system is increased.

A working model demonstrates the principles of centrifugal and centripetal forces.



System of Pulleys

Exhibits on Wave Motion

In mechanical clocks time is regulated by a pendulum. It consists of a long arm with a weight fixed at the end and the whole pendulum is free to swing from side to side. The time taken for the swings depends upon the length of the arm. The greater the length the slower it swings and vice-versa. This is shown to the visitor by the model on "Oscillation of Pendulums".

A wooden conical roller which moves uphill is a very interesting exibit which explains the phenomenon of centre of gravity. Other interesting exhibits in this section are sympathetic pendulums and a cycloid.

SOUND

Throughout life we are surrounded by sounds—sounds of human voices, sounds of the city, sounds of the countryside. But what are sounds ? They are series of compressions and rarefactions in an elastic medium such as air, water, wood or steel, produced by a vibrating body. Hearing begins when sound vibrations reach our ears. In a fraction of a second the mechanism of ear carries the vibrations along nerves to the brain and so we "hear".

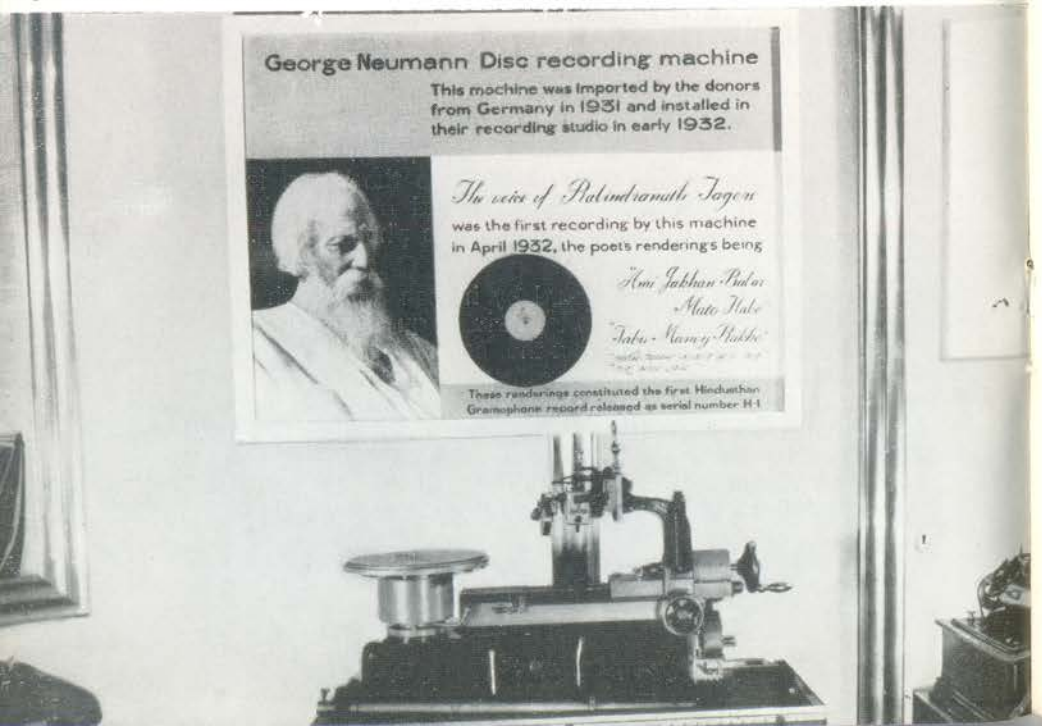
The wonderful mechanism, our ear, that enables us to sort out all the different kinds of sound is the first exhibit in this section in an animated model.

All sounds are results of vibrations and are always transmitted through some medium. Therefore sound cannot travel through a vacuum. Astronauts on landing on the moon found it to be a silent, soundless world. This is because the moon is almost a perfect vacuum. Hence no sound could be transmitted except through wireless. A model explains this phenomenon.

Not all sounds can be heard by human ear. If the vibrations that strike our eardrum are of low frequency—20 vibrations a second—our ear cannot detect the sound. On the other hand if those vibrations are of high frequency—20,000 vibrations a second—our ear again cannot detect it. So sound which is to be heard by a human ear must have frequencies ranging between 20 and 20,000 cycles per second. A visitor, if he so desires, can test his ear by an 'Audiometer' exhibited in the gallery. He can also "see" the modulations of his voice on an "Oscilloscope".

Some Exhibits on Sound

Original Disc Recording Machine



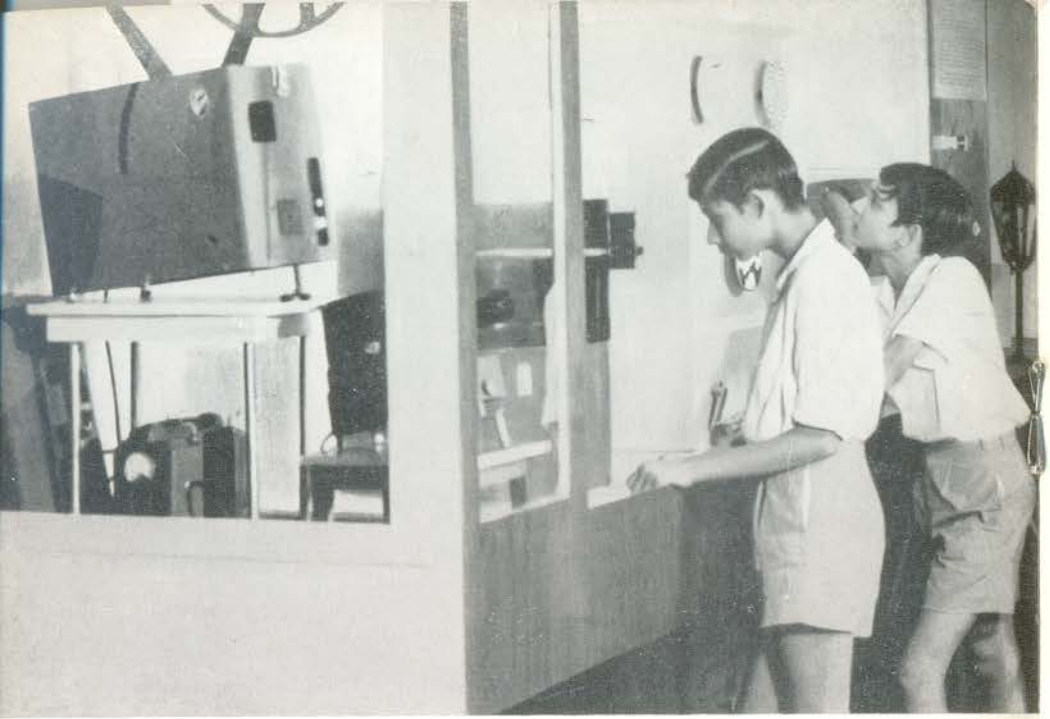
How does music differ from noise ? In music man designs and controls the sounds that reach our brains. In noise—such as a thunder clap—no one is attempting to design or control the sound. In musical sounds vibrations are regular and periodic, also frequency and pitch are controlled, while the noise is a jumbled mixture of waves of varying frequencies of no fixed order. This difference is demonstrated by the model—"Musical Disc."

The pitch of a note made by a string depends upon its length, upon how tightly it is stretched and upon the mass of the wire. This is demonstrated by another exhibit.

A panel puts on display different kinds of musical instruments broadly divided into :—bowed-string (Violin, Sarengi etc.) ; plucked-string (Sitar, Guitar, Sarode etc.) ; percussion (Tabla, Mridanga etc.) and instruments based on vibration of air columns. Tape recordings explain the scientific principles involved in these instruments. There are arrangements for demonstration of stereo-records and for recording of visitors' voice in a Tape-recorder. A visitor can play an 'Electronic Organ'. An Edisonian Gramophone and an antique recording machine in which the voice of Tagore was recorded are also on display.

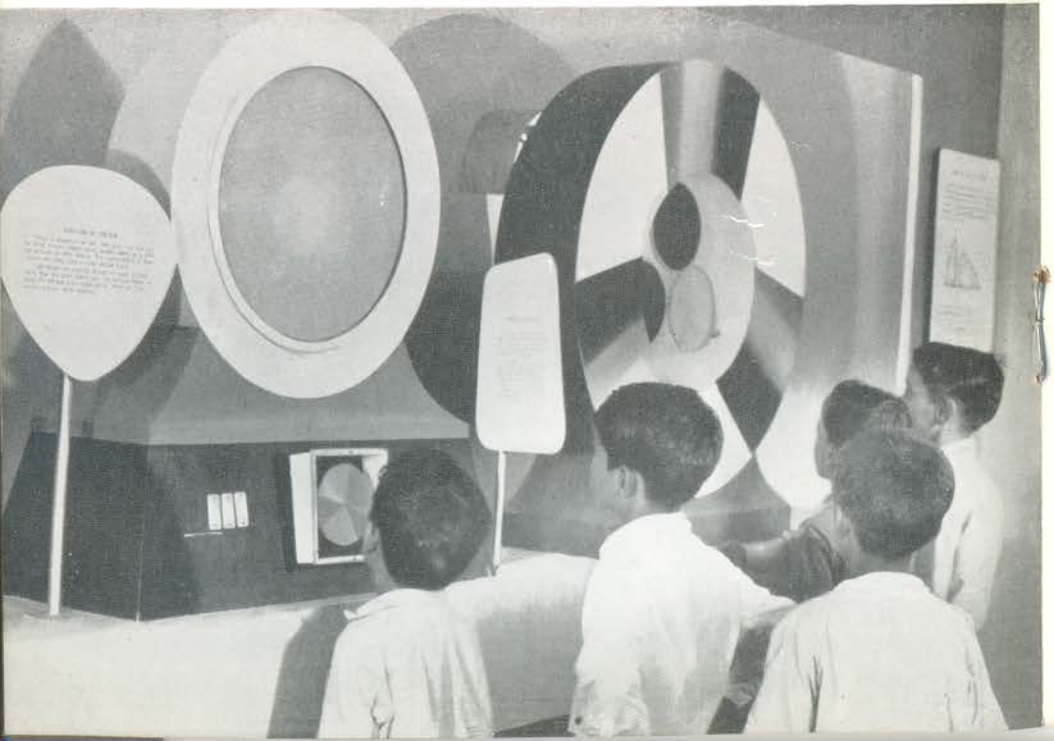
OPTICS

The section opens with the model of an eye which explains its functions. Another exhibit shows its similarity with a camera. We can see because every object reflects light to our eyes, and the brain interprets the sensations carried to it from the eyes. The eyes are image forming devices which are similar in principle to the ordinary camera. Each has a lens to focus and a surface which reacts to light—film in the case of camera and retina in the case of eye. The light rays reflected from the object pass through the cornea at the front of the eyeball, then through the eye lens to the retina which is in the back of the eye. The lens forms an inverted real image of the object on the sensitive film of the retina, which is then carried to the brain by the optic nerve. In the brain the image is turned right side up again. The eye has an iris which opens and closes like the diaphragm of the camera and controls the amount of light entering inside the eye. The real difference between the camera and the eye lies in the adjustment of the lenses. In the camera, the lens is moved forward or backward manually to focus for different object distances while the eye lens makes this adjustment automatically with the help of different control muscles by becoming thinner or thicker.



Students Observing Exhibits on Motion Pictures

Exhibits on Colour



A human being can see an object in three dimensions because of his having two eyes. A model demonstrates this phenomenon.

Motion pictures depend on a particular property of the eye. Light from an object falls on the retina at the back of the eye. As soon as the light is withdrawn, the retina stops registering it. But for a fraction of a second the brain keeps on seeing the object after the light has gone. There is a difference of about one sixteenth of a second between the disappearance of the light and the fading of the image from the brain. If the eye sees a series of pictures of a moving object, and if each picture is taken less than one sixteenth of a second after the one before, so that the object has not moved very much in the meantime, then the eye sees a continuous motion. This is the secret of motion pictures. The brain, because of what is called "persistence of vision", thinks it sees movement, but in reality it sees separate images which follow one another quickly enough to give this sense of movement.

This phenomenon is utilized in making a very interesting model of a 'Ghost Image". Two crossed sticks rotate at a speed of more than 20 revolutions per second. The ghost is visible when its image is thrown from a slide projector on these moving sticks in a dark room. But as soon as the sticks stop the image disappears.

The cinema and slide projectors are on view for the visitors.

The most common defects of vision are short-sightedness and far-sightedness. In the condition called short-sightedness or myopia the retina is further away from the lens than in the normal eye. To correct this defect a concave lens is placed in front of the eye. In long-sightedness or hypermetropia the retina is closer to the eye lens than in a normal eye. A convex lens is used to remedy this defect. An exhibit explains these defects and shows how they can be rectified by means of spectacles.

The discovery of electromagnetic waves is one of the most exciting stories in the history of science. The Scottish physicist, Clerk Maxwell suggested that light is a form of electromagnetic wave.

Like other forms of energy, light energy is also invisible. The light we seem to see when the car headlight is put on or when the rays of sunlight enter through the window is, in fact, illuminated

Experiments on Defects of Vision

Automatic Electronic Room

particles of dust and smoke in the air. The model "Light is invisible" explains this phenomenon.

Visible light takes up only a tiny section of the electro-magnetic spectrum. Ordinary white light is a mixture of light belonging to the whole range of visible spectrum. This was first properly established by Sir Isaac Newton. He discovered that white light could be broken into several spectral colours which could be recombined to form white light again. Newton's classic experiment through the prism splits up the ray of white light into seven main colours—Red, Orange, Yellow, Green, Blue, Indigo and Violet.

The colour of objects around us depends on two things : the kind of light and the surface on which it falls. A set of exhibits explains the science of colour. Electromagnetic waves having frequencies above violet range are called ultraviolet rays which are not visible to the eye. But when these rays fall on fluorescent paints, visible radiations are given out. A model explains this phenomenon.

When light is passed through certain crystals like tourmaline it can be transmitted or stopped by another such crystal if the latter be placed in a particular position relative to the former. Such a light is called a polarised light. When polarised light is passed through a birefringent material like cellotape different colours are produced at different angles of the polaroid sheet. A model shows how this property can be put to use for drawing beautiful paintings with remarkable colour compositions.

A series of exhibits demonstrates the properties of lenses, mirrors and prisms. The principles of reflection, refraction, convergence, divergence and dispersion of light are also explained. Two exhibits are devoted to the principle of interference and double refraction.

A model shows how with the help of a periscope one can see over or around opaque solid objects which otherwise prevent direct viewing.

The 'Vanishing Flower" is another very interesting exhibit in this section. The visitor will see the virtual image of an object in a convex mirror which will elude him as he tries to catch it.

Light moves in a straight line. But it can bend or take a turn due to the phenomenon of "total internal reflection". This is displayed by means of two exhibits.

Anti-aircraft Radar

Radar Controlled Anti-aircraft Gun

Lenses are used in making telescopes, microscopes, binoculars and many other optical instruments. Cut sections of binoculars and microscopes are on view. Various simple and compound microscopes, and also a terrestrial telescope are on display which the visitors are allowed to handle.

ELECTRONICS AND POPULAR EXHIBITS

The science of electronics deals with the utilization of controlled flow of electrons through high vacuum, gas or semi-conducting media. The science and technology of electronics have achieved wonders in recent times, specially in the field of space research.

The most wonderful exhibit in the Popular Science Gallery is the "Electronic Room". Here everything works automatically. The door of the room is opened and closed by a signal from a human voice. When a person enters the room he intercepts the light beam falling on a photo-electric cell and the change in current is utilized to put on the lights and fan inside the room. When the visitor settles down on the seat the capacitance of his body stops the oscillation of an oscillator which in turn operates a relay that puts off the ceiling light and puts on the table light while the fan is still revolving.

Another model using photo-electric cell is a water tap operated automatically by an approaching tumbler. The game with electronics is an attractive exhibit. Here a computer plays crosses and noughts with a visitor.

The utilization of the device of capacity effect is shown by a safe which when approached operates a Burglar Alarm. Two other highly interesting exhibits of this section are the "Automatic Anti-aircraft Gun" and the "Transmission of sound through light". The first model demonstrates the principle of operation of modern radar controlled anti-aircarft guns. Whenever an enemy aircraft is tracked by a radar the anti-aircraft gun is locked with the radar by a selsyn motor. And the gun automatically fires when the enemy aircraft has been pin pointed by the radar.

In the second exhibit a light is placed on the focus of a big concave mirror. This light is modulated by a recorded music through a pre-amplifier. The modulated light beam travels parallel and falls on a second concave mirror placed at a distance. The light beam gets concentrated on the focus where a photo-electric

Illusive Doll

Automatic Water Jug

cell is placed. The current variations from the photo-electric cell are fed into an audio amplifier which reproduces the original music. When the light beam is intercepted by a visitor the music fades away or even comes to a stop.

Sometimes rotating objects like table fans appear stationary or seems to rotate in opposite direction at night under fluorescent light. This happens due to stroboscopic effect. The model on "Magic Light" explains this. When a flickering light is thrown on a moving object it appears stationary or to move in opposite direction depending on the rate of flickering. This type of flickering light is called stroboscopic light. In the above model as this magic ligth falls on pouring tea it appears to move upwards from the cup to the teapot.

The Gallery on popular science ends with the model on "Space Travel". When a visitor presses the control switch a rocket shoots up and disappears. After a short while a satellite appears in the sky, approaches the moon and circles round it with a bleep-bleep signal.

The Museum Building

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