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Vijñan karmee

Vol. XIV

OCTOBER, 1962

No. 10



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Journal of the Association of Scientific Workers of India

(Founder-President : Shri Jawaharlal Nehru)

Vol. XIV

OCTOBER, 1962

No. 10

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The views expressed in the journal are not necessarily those of the Association of Scientific Workers of India.

Editorial

We, the Association of Scientific Workers of India, have been taking up the cause of scientific workers since its inception because we feel that future of India is dependent upon the industrial growth of our country and scientific worker is its core. We not only want that a scientific worker should get his due materially but we wish that conditions in India be so directed that the general atmosphere is conducive for the creation of scientific attitude towards life. Science may not only help scientific workers of future generations of India in earning their bread with honour and dignity but also it may pervade the whole being of the national character. He may get not only the money but also enjoyment and satisfaction through his scientific/technical profession. It is to this end that V. K. has been enduring throughout its existence. In last few months the Editorials have been demonstrating the constructive approach of the Association for building up a truly scientific/technical personnel. We have indicated in our previous issues the necessity of emphasis on certain definite and specific factors during education and training of an individual in India to enable him in his future life to take up the responsibilities cast on him by a developing industrialised society—even if he has to take up a field other than the strictly scientific one, be it that of an administrator or an economist. We would like to discuss in our forthcoming issues the necessary specific factors for a conducive atmosphere during his post-training period i.e. the professional

and even if he so desires he cannot give his best to his profession.

It will be a tragedy if the scientific/technical training obtained by an individual even under perfect conditions enumerated in some career. Let us be clear here that strictly speaking post-training period is not devoid of 'training' as far as scientific/technical profession is concerned. The whole of the career of such an individual is an academic one and if he has to be a true scientist he must always enhance his knowledge and capacity in his specialised field. Development of scientific talent has got no meaning if it does not foster the intrinsic growth of knowledge. As a famous Philosopher scientist put it, "Scientific knowledge grows like an organic tree, not as a compilation of collector's items. Facts, observations, discoveries, as items, are but the nutrients on which the tree of knowledge feeds, and not until they have been thoroughly absorbed and assimilated, have they truly enlarged the body of knowledge". Suffice it to say that this intake, digestion, assimilation, final utilisation and again intake etc. continues throughout the career of a scientific worker. Hence when we say the post-training period of a scientific worker, we mean that period of his life when the training is not the only responsibility of the individual. In other words it is the period when some further complex responsibilities of a family are cast on him and sometimes these duties become primary. If there is a conflict between the call of such responsibilities and that of scientific responsibility i.e. the latter hinder the fulfilment of his family responsibility it will be too much to expect him to ignore the former. Not only that, a disturbance in the fulfilment of his family obligations affect his concentration profoundly

and even if he so desires he cannot give his best to his profession.

It will be a tragedy if the scientific/technical training obtained by an individual even under perfect conditions enumerated in some of our previous issues though not practicable completely at present—is not conducive to his taking up a career in that field due to lack of factors necessary for the fulfilment of his duties towards his near and dear; and for that reason he has either to forego his scientific profession or he is disabled from giving his best. This will not only culminate in the withering away of the "Tree of knowledge" but also discourage others of treading the same path.

We do realize that there is a limitation to the reward, a scientist should expect in a developing economy—in the transitional period—from his profession. It is a well known fact that the material gains from such a profession will increase with amelioration of the financial status of the country which in itself is dependent on the efficiency of those engaged in the effort. We cannot while enumerating the various factors required for creating a proper atmosphere, ignore this 'vicious' or 'gracious' cycle. Keeping this point in view we will try to give a constructive approach to this problem and suggest the factors that will help preparing a proper atmosphere where a scientist can give best to the nation.

'AN APPEAL TO SCIENTIFIC & TECHNICAL PERSONNEL'

Since we earned our independence 15 years ago we have been striving to build our-selves into a prosperous and progressive nation. The very safety and integrity of our beloved motherland has now been threatened on its Northern borders. Although the clouds of vague danger were looming for quite sometime, the peace loving citizens of India realized the gravity of the situation when our dear Prime Minister conveyed to the Nation the account of ruthless and shocking violence with which our unscrupulous neighbour across the borders has chosen to outrage our integrity, honour and safety.

The call for National support and unity has no doubt affected everyone of our citizen—professionals, businessmen and the man in-the-street alike. To us, connected with scientific/technical professions and vocations, the moment of emergency is more than significant. Not only the development and prosperity alone of the country depends on our efforts but also by the very nature of our calling we must provide the necessary confidence in the citizen by our material efforts and strengthen the hands of our beloved Prime Minister by active and geared up cooperation.

The Association of Scientific Workers of India, therefore, appeals to all its members in various walks of life whether at the bench or high up in chanceries and policy rooms, as well as people in scientific and technical professions throughout India to respond to the call of the Prime Minister by girding up their loins and exert to the last bit of their talent and efforts in keeping the integrity and honour of our revered motherland intact at this hour of crisis. On us lies the larger share of responsibility, and let us demonstrate at this occasion that the prime value of Indian Science lies in its usefulness to the Nation, in the times of peace as well crisis.

The Association is fully confident that its members as well as other scientists/technologists of India will not linger behind at this hour of grave danger and give that additional confidence to the Nation which it has a right to call upon its citizens.

As a symbol of solemn pledge which we take at this occasion to stretch to all possible limits our capacity to do constructive work for the Nation we also request the members to donate their one day's earning to be utilized for the welfare and boosting up the morale of our Defence Forces—to indicate that along with the entire Nation, the scientists and technologists upon whose shoulders lies much greater responsibility, are also with them in fighting for the honour of the Nation.

An emergency fund for this purpose has been created by the ASWI and we request all the scientific/technical personnel to send their contributions to the Treasurer, ASWI, Sri J. S. Yadava, C/o Defence Research Laboratory (Stores), Napier Road, Kanpur.



Revolutionary techniques of construction

The demand for new buildings in the Federal Republic of Germany is greater than the supply of skilled labour, with the result that prices are rocketing while completion dates fall by the wayside. The use of modern industrial methods may meet the problem, and the Building Fair held recently at Essen, therefore, made prefabrication its topic of the day.

Nearly seven million homes have been built in Germany since the end of the war. About 600,000 new houses and apartments are still going up every year. This beehive activity, combined with industrial construction projects, is straining the construction industry to the bursting point.

To slow down a building boom which carried in it the seeds of inflation, the Bonn government placed a ban in spring on the construction of non-essential industrial and private homes of a value of more than \$ 20,000.

The clamour for houses in the lower and medium price ranges, however, continues. According to estimates of the building trade, the worst of the housing shortage in the large industrial centres like Hamburg, Dusseldorf and Essen will not be appreciably eased until 1965 or, more likely, 1967.

The great pace of progress in mass production and prefabrication of houses was demonstrated at the Deubau (short for "Deutsches Bauzentrum"—German Building Centre) building exhibition at Essen, the most important exhibition of its kind since the

international "Interbau" exhibition in Berlin five years ago.

A house in six hours

A prefabricated one-family house was put up at the exhibition in six hours. After four more days of work by plumbers, electricians and decorators, the house was ready for occupancy. Prefabrication was seen everywhere at the "Deubau": whole walls or wall sections, some with the plumbing and electric conduits already pressed into them; whole roofs, and floors ready to be laid almost like footmats, were shown.

The trend is rather toward houses with a "personal touch", though largely constructed from prefabricated parts. As shown at the "Deubau", about 70 to 80 per cent of the construction elements for a normal house can nowadays be prefabricated. The wide selection of prefabricated parts now available in Germany allows home-builders and architects to fashion houses to suit any, even the most extravagant, taste.

The advantages

The attraction of building houses with a large proportion of prefabricated parts is that fewer skilled building workers are needed, for many of the parts can be lifted in place by machines. A similar saving in skilled manpower, time and material is achieved in industrial construction by using new techniques. And thus the application of scientific techniques has been helping towards meeting an urgent social problem.

At the "Deubau", one construction firm demonstrated a wooden lattice-work frame that can be joined together flat on the ground, lifted at a single point at the centre by a crane to form an igloo-shaped cupola and then covered with a plastic material.

Another such example was a similarly-shaped semi-sphere of cellulose material inflated by a compressor. Once in place, it is covered on the inside with a two-inch-thick layer of polyester resin, to give it a surprising static strength. Either of these igloos can be built in a few hours and serve as a garage, exhibition hall, storage shed or the like.

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Revolutionary techniques for teaching the deaf

Details of revolutionary new British techniques for teaching deaf children to speak were given at the annual meeting of the British Association for the Advancement of Science now being held in Manchester. Besides those from Britain, scientists from several other countries are attending the meeting.

Sir Alexander and Lady Ewing, heads of Manchester University's department of audiology and education of the deaf, described the development of powerful high-fidelity amplifiers with microphones and headphones, and the results of British research on the speech and hearing mechanisms of the brain.

They told delegates that in an experiment with 72 children, ranging in age from under two to nearly four, very good results had been obtained. Three-year-olds who had been very deaf were now able to talk as ably as unhandicapped children.

The new equipment could be used in the home. To overcome psychological obstacles common in deaf babies, parents were taught

that everyday sounds must be associated with movement until the child was accustomed to hearing and would look for the source of sound.

High-power equipment

Sir Alexander Ewing said in an interview that deafness in children was common the world over. But children were seldom completely deaf and almost never dumb. He said dumbness was almost always due to the fact that the child had never heard the sounds it could make.

Describing the new high-power equipment developed in Britain, Sir Alexander said that noises as loud as that of a jet engine exhaust were needed. These had to be produced while reproducing sound faithfully.

Children taught to speak with hearing aids could, it was hoped, take their place in normal schools. But they were liable to suffer handicaps through poor acoustics and noise in classrooms, and the limitations of hearing aids.

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Colder winters forecast

But hotter summers, too!

Colder winters and hotter, fierier summers are forecast for the near future by Pulkovo astronomers studying the Sun.

It has been clear for sometime that the level of solar activity has a major effect on weather conditions.

In the northern hemisphere a pattern of wind circulation is established which brings drought and a fall in the level of the Caspian at the same time as the Arctic ice cover is thinned down. The opposite is also true.

Recent work has revealed that there is a cycle of about 100 year's duration in the

Sun's activity as well as the well-known 11-year cycle.

This longer variation consists of two periods of high and low activity—one lasting 33 years and the other 66 years.

The last period of low activity ended in 1932, since when the increased solar activity has led to a rise in temperature in the northern hemisphere. The level of the Caspian has fallen in this period.

This spell of high activity will come to an end in 1964-65 and then there will be more cold and snow in winter, while summers should be hotter and drier.

The level of the Caspian will cease to fall and the ice of the Arctic will become thicker.

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Soldering of aluminium on stainless steel
DSIR appl. Sci. & Tech. in Germany Ser. No. 7(1961), 14.

A new process has been developed which, it is claimed, overcomes the problems associated with the soldering of aluminium on stainless steel. Normally a fluxing agent, say zinc chloride ammonium chloride with hydrochloric acid or orthophosphorus acid has been used before the solder became active on the surface of the stainless steel. Part of the fluxing agent, however, is absorbed in the joints which are gradually destroyed in the presence of moisture due to electrolytic reactions. The new process does not use a fluxing agent and is stated to ensure extremely stable, corrosion-resistant and gas-tight joints. It also makes it unnecessary for the aluminium or the stainless steel to be galvanized.

When soldering by this method, the aluminium must first be roughened and then placed in a bath of trichloroethylene. A solder consisting of 1 per cent Pb, 1 per cent Ag,

1 per cent Fe, 0.1 per cent Si, 0.01 per cent Al, 0.01 per cent Cu, the rest being made up by Sn, has proved particularly suitable and while it is being applied the aluminium must be heated to about 350°C.

The stainless steel is also roughened and subsequently purified in trichloroethylene and 50 per cent hydrochloric acid. It is then heated to about 230°C., while a lead/tin solder consisting preferably of 50 per cent Pb and 50 per cent Sn is applied. After tinning, the surfaces of the aluminium and the stainless steel are joined and heated to about 260-320°C. with the aid of an acetylene-oxygen gas flame to enable them to fuse together.

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Non-shrinking and low expanding cement
Indian Patent Specification (Accepted) No. 70479, Council of Scientific & Industrial Research, New Delhi.

Shrinkage of concrete in buildings causes principally the formation of cracks which allow aggressive agents in the atmosphere or water to reach the interior of the concrete and reinforcing steel and develop internal stresses inside the concrete. As a result of research work carried out at the Central Building Research Institute, Roorkee, the specifications for the raw materials for non-shrinking and low expanding cement (LE cement) have been drawn up and the method of its preparation has been standardized. The cement consists essentially of ordinary Portland cement up to a maximum of 75 per cent (by wt) and an expanding component consisting of kaolin, lime and gypsum up to a maximum of 25 per cent. The new method offers the following advantages: (i) unlike in conventional methods, in the preparation of

'LE cement' all the raw materials are mixed as such, which eliminates labour and time required for preparing an 'expanding agent.' separately; (ii) there is no need for any manufacturing plant or big machinery to prepare 'LE cement'; (iii) the ultimate expansion of neat 'LE cement'; 'LE cement'—sand mortar, or 'LE cement'—concrete remains constant; 'LE cement' behaves just like Portland cement in wet condition after it has attained its ultimate expansion; and (iv) since the preparation of 'LE cement' does not require any pretreatment but a judicious mixing of the raw materials, it costs only 8 per cent more than ordinary Portland cement at the present market rates.

Raw materials—Table 1 gives the chemical composition of the raw materials required for the preparation of 'LE cement'.

Table 1—Specifications for raw materials

Constituents	Kaolin	Gyp-	Port-
	%	sur	land
		%	cement
			%
Free water ..	—	0.40	—
Combined water ..	—	19.60	—
Loss on ignition ..	14.82	—	1.70
Soluble silica (SiO ₂) ..	46.40	6.42	0.42
Iron oxide (Fe ₂ O ₃) ..	2.60	1.14	2.41
Aluminium oxide (Al ₂ O ₃) ..	36.20	nil	5.98
Calcium oxide (CaO) ..	—	30.02	63.24
Magnesium oxide (MgO) ..	—	nil	0.85
Sulphur trioxide (SO ₃) ..	—	42.20	2.35
Carbon dioxide (CO ₂) ..	—	0.20	—

Kaolin should be powdered to the required fineness and should be calcined at 800°C. for about 4-5 hr. The period of calcination for each sample of kaolin is determined experimentally so that no combined water is left

in the material. The calcined material should be stored in air-tight drums.

Hydrated lime required for the purpose is prepared as follows: high grade limestone (not less than 98 per cent pure) in 2 to 2½ in. pebble size is burnt at 900-950°C. for about 5-6 hr. in a muffle furnace or in any suitable shaft furnace. The resultant lime is spread on a platform in a heap of 6 in. thickness and water sprayed over it through a roso-can. As water is added, the lime should be well turned with a shovel. Care is taken that only minimum amount of water is added so that the whole mass gets hydrated, swells and becomes a fine powder. The hydrated mass is covered from all sides with waterproof sheet and allowed to stand for 16 hr. It is then dried at 100-105°C. in an oven till no free water is present. During the entire process, great care is taken to avoid carbonation of lime. The dry hydrated lime is stored in air-tight containers. The lime is tested for the loss of ignition before it is used for 'LE cement' and if the value exceeds 26 per cent, fresh hydrated lime should be prepared for the purpose.

Gypsum is air-dried and stored in dry condition. Fresh Portland cement is used in the process.

Process—Calcined kaolin (5.30 per cent), hydrated lime (7.20 per cent) and gypsum (2.50 per cent) are mixed together for 10 min. in a ball mill. Portland cement (75.00 per cent) is then added to the mill and the mixing is continued for another 5 min.

Properties of 'LE cement'—The per cent linear expansion under suitable conditions of testing for the neat 'LE cement', 1:1, 1:2 and 1:3 'LE cement'—sand mortars and 1-2:4, 'LE cement'—concrete after 28 days' water curing are 0.48, 0.43, 0.28, 0.24

and 0.10 per cent respectively. The compressive strengths of the above cements in the order of 28 days' water curing are 7140, 6050, 3990, 3070 and 3830 lb./sq. in. respectively. The expansion becomes constant at the maximum of 10 days' water curing. On further dry curing up to 90 days the expansion is reduced by 0.15 per cent for neat 'LE cement' 0.06 per cent for 1:3, 'LE cement'—sand mortar and 0.045 per cent for 1.2:4, 'LE cement'—concrete. Any accidental wetting of the cement after it is sufficiently old gives similar effect as with ordinary Portland cement. 'LE cement' satisfied the normal requirement of ordinary Portland cement in respect of other general properties and there is no abnormal fall in strength when compared to ordinary Portland cement. The total cost of production of 'LE cement' works out to Rs. 129.70 per ton.

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Solar Stations

In August 1961 the regular International Astronomical Congress attended by eminent scientists from all over the world was held in California, in the university city of Berkeley, not far from San Francisco.

Among the many problems that were discussed by the Congress was that of the solar corona studies. In summarizing the results of the discussions, the scientists again recognized that the most accurate investigations of the solar corona had been carried out by the staff of the Alpine Astronomical Station of the Pulkovo Observatory of the USSR Academy of Sciences, situated near the Greater Caucasus and headed by Candidate of Physical and Mathematical Sciences Mstislav Gnevyshev, one of the participants to the congress. Recognizing his personal record of service the Astronomical Congress

in August 1961 elected Mstislav Gnevyshev Vice-Chairman of the Solar Commission of the International Astronomical Union.

"To carry out our investigations", says Mstislav Gnevyshev, "we need clean, dust-free air. Just that kind of air is on the plateau where we have our premises."

M. Gnevyshev readily and in detail describes the instruments with which the station is equipped.

"If earlier the solar corona", he says "could be observed only during the total eclipse of the Sun, now we are in a position to make such observations whenever we need to. Incidentally it was at this place that scientists for the first time observed the solar corona not during the eclipse."

People who work here are fond of their profession. Raisa Gnevysheva, a devoted fellow worker and the wife of Mstislav Gnevyshev, has been conducting her research here since the station was opened. And her contribution to the work of the station is no small.

In one of the laboratories a young man, Valentin Makarov, a graduate of the Leningrad University and a research associate works here. He has recently made an important discovery that altered the previously held views on temperature and other properties of the sun-spots.

Every day this scientific townlet which is hemmed in by the mountains is filled with work. The observations of the Sun are organized on an around-the-clock basis. And it is small wonder that it was here that the glow of the sodium cloud emitted by the first Soviet space rocket was photographed on January 3, 1959. In honour of the launching by the USSR of the world's first artificial

satellite of the Earth the Presidium of the USSR Academy awarded the station with a special medal.

The Alpine astronomical station is the leading scientific centre among the similar scientific establishments of our country and the People's Democracies. Every day a great deal of information on the work done by them arrives here by wire to be carefully analyzed by the staff of the station. Students from higher educational establishments of Moscow, Leningrad, Lvov, Kiev, Sverdlovsk take here their practice. Scientists from Irkutsk, Pulkovo, Moscow, Baku and other cities and towns come to this station to enrich their knowledge on the subject. The workers of the station exchange scientific information with their opposite numbers in the USA, France, Switzerland, Japan, Australia.

The station is extending welcome to scientists from other countries too. It has become a good tradition here that any guest leaves a flag of the country he came from as a memento of his stay in the Caucasus. Such flags were left by astronomers from Hungary, Czechoslovakia, China, Rumania. The station was also visited by astronomers from the USA who expressed their admiration of the facilities and working conditions enjoyed by the Soviet scientists.

Man made fabrics

A simple process developed by the Linen Industry Research Association at Lambag, Belfast, has given the textile industry a completely new range of fabrics made from man-made fibres. By this process a wide variety of yarns given the name of A to Z yarns by the Research Association can be produced from any one type of man-made fibre and each

yarn is tailor-made to give a fabric with chosen characteristics.

A to Z yarns are particularly promising for machine and hand-knitted garments and sweaters have been made which are difficult to distinguish from those made of wools: they have remarkable clarity of stitch and wash without losing their shape. Woven fabrics made with these yarns are warm but light-weight have built-in crease resistance and drape well. In addition they have all the advantages of the synthetics in their drip-dry washability. Apart from their attractions for dresses and suits the wool-like resilience and bulk of A to Z yarns make them particularly suitable for carpets and their light-weight warmth and resistance to shrinkage meet the special requirements of blankets.

Because the process is simple the new yarns and fabrics can be made cheaply and quickly on existing machinery. A to Z yarns have already been spun at Lambeg from Acrilan, Courtelle, and other synthetics and application of the process to flax and viscose fibres is now being actively investigated.

Throughout the development work, L. I. R. A. has worked closely with those major producers of man-made fibres who are members of the Association and agreements to licence have been concluded with Chemstrand Limited and Courtaulds Limited.

A to Z yarns are the direct result of a fresh look at the fundamental problem of creasing started at Lambeg less than a year ago by a small team headed by the Director of the Research Association Mr. D. A. Derrett-Smith and the Deputy Director Mr. H. A. C. Todd. Existing methods of making crease-resisting fabrics relied on special methods of weaving and finishing. After studying the

mechanism of creasing the Research Association realised that to achieve effective and permanent crease resistance a change in the structure of the yarn itself was necessary. This has been achieved with the production of A to Z yarns; they have an open structure in which each individual fibre is free to move within the yarn. This gives both a resilient yarn and a crease resisting fabric. In addition the high proportion of entrained air in the yarn results in a fabric which is warm but light; in fact all the fabrics made so far have a very high warmth/weight ratio.

The process is still confidential and covered by patents so that the Linen Industry Research Association can now claim priority in all important textile markets. Commercial exploitation is being arranged by Shirley Development Limited and the financial terms of the agreement already negotiated indicate the importance of the process. Negotiations are also in progress at present to licence the process for making A to Z yarns in the USA.

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When deserts will bloom!

Deserts can be inexhaustible sources of development for all branches of national economy. They have vast expanses of fertile land, suitable for irrigation, enormous mineral reserves, in the first place of oil and gas, boundless grazing grounds, etc. Thanks to the extensive research, new resources have been discovered, industrial enterprises and inhabited points built in distant parts of desert, wells sunk with mechanical waterlifting devices for drawing underground water, irrigation and semi-irrigation agriculture moved far into it.

Experience has shown that highly effective methods of desert cultivation cannot easily be worked out by comparatively small

groups of scientific workers and small economic organisations. To avoid disconnected efforts and repetitions in the solution of all scientific problems of desert cultivation it was necessary to establish a special research institute, capable of comprehensively working out the problems that arise and of coordinating research and experimental work with kindred establishments.

A new desert institute

Such an institute, manned with specialists in various fields, has been opened by the Turkmen Academy of Sciences. It is the first of its kind in the USSR and the fourth in the world.

The major task of the Desert Institute is the scientific solution of a set of problems connected with the study and economic exploitation of desert territories.

At present the institute has seven laboratories, but plan to open several new ones in the nearest future.

The institute has two research stations: the Repetek sandy desert station and the Nebit-Dag agricultural and forestry experimental station founded in 1912 and 1951, respectively. They offer excellent facilities for testing the results of laboratory work in the field and for making various experiments in desert cultivation. The institute has a staff of highly qualified specialists, among them two members of the Turkmen Academy of Sciences and eight Masters of Science.

Afforestation & greenery in desert

Besides the study of general problems, the Institute's work will be concentrated in the next few years in two districts showing good economic prospects. In the zone of the Kara-Kum canal the institute is already evolving measures for fixing sands and afforestation, for the protection of the great waterway

from sand drifts and wind erosion of the banks and the rational use of soil in the canal zone. In the south-west of Turkmenia, where ever new oil and gas deposits are mined, similar work for the protection of industrial enterprises and automobile roads from drifting sands is very necessary.

Another important problem is that of planting greenery in the branch channels, round deep water desert wells, etc. The stations of the institute have been set up to solve these and other immediate problems.

Desalinisation of water

In a distant experiment stations in the Zaungus district of Kara Kum the institute is conducting, in cooperation with the Geographic Institute of the USSR Academy of Sciences, research on the desalinisation of salinised underground waters by natural freezing.

The institute will be closely connected with the State committee of the Council of Ministers of the USSR for coordination of research work (dry zone section) and the desert commission of the presidium of the USSR Academy of Sciences.

Air breathing rocket engines

Satellites weighing 50 tons and a four-fold increase in present orbital payloads are possibilities if advanced forms of air-breathing engines are developed to take the place of giant rockets now used for satellite launchings, according to scientists at Bristol Siddeley Engines.

These scientists have specialised for some time on the development of air-breathing engines. They believe that the cost of these propulsion techniques is less than that for a large rocket vehicle.

They argue that the present payloads which can be put into orbit by current rocket-type launch vehicles represent only a small percentage of total launch weight—1.8 per cent. For the Atlas Agena B and between 2 and 3 per cent. for the Saturn.

The rocket engine differs from the air-breathing engine in carrying its own oxident as well as its fuel. The air-breathing engine carries fuel only and draws its oxygen from the air through which it passes.

Studies conducted by Bristol Siddeley have shown how large gains in payload can be obtained if the first stage of a satellite booster is accelerated by air-breathing engines.

Introducing colour into trees

A British firm of wood veneer producers have patented a process by which colours are introduced into living trees, blending naturally with the grain and figuring of the wood.

The process is secret. It is claimed that it takes only a few days for the colour to permeate the entire system of the tree. When the leaves turn colour the process is completed, the tree can be felled and the veneers obtained. The colours are fast to light.

Any colours can be introduced, singly or in variety, and the resulting veneers capture the contemporary mood for colour while retaining the traditional beauty and utility of wood.

The timber chosen for this new decorative development is beech. Already demand for many parts of the world is tremendous and before long the new veneers will be seen as surface decoration in ships and shops, exhibitions and theatres, in the boardroom,

the showroom—in fact, anywhere that wood is used as a decorative material.

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Miniature T.V. Set

One of the major new products at the National Radio Show held in London recently was a portable television set with an 8½" screen, weighing only 20 lb. It can be run off its own battery, a 12-volt car system or off the mains. It measures 13 in. long and 10½ ins. square.

Exhibitors also showed such devices as a TV baby alarm—an adaptor which gives parents a warning through the sound system of child's cries—super-fine tuning controls and TV screens that do not attract dust.

The British General Post Office had a stand on which 500 people at a time were taken on a movable circular table past scenes depicting 60 years of radio history. The climax of this show was a model of the Telstar tracking station in Southwest England.

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Plastic coated steel resist acid fumes

The high degree of corrosion-resistance in Stelvetite plastic-coated steel has been demonstrated under practical conditions at the plant of the British company which produces it.

In the pickle fan house, where Stelvetite sheeting forms part of the outlet fan ducting galvanised steel sheets used in the past have had to be replaced after five or six weeks because of the effect of the acid fumes. Sheets of the plastic-coated steel, however, which were in the same position for as long as 14 months, have recently been removed for inspection and found to be still capable of further prolonged use.

This part of the works, where the steel sheets go through a cleaning process, has a particularly severe corrosive atmosphere; chemical analysis at the Stelvetite ducting has shown a sulphuric acid content as high as 7,400 milligrams per 100 cubic metres, compared with an average of 13 milligrams in an area of open countryside some miles away from the steelworks.

The firm are using Stelvetite for wall sheeting in plant where conditions are generally wet and acidic, also as part of a shed wall by an ammonia storage tank and as roofing material in other sections of the steelworks. These sheets have already been in position for up to 18 months in these severe conditions without any cause for replacement.

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Weaving without shuttlecock

A method of weaving has been developed at the College of Science and Technology, Manchester, in which the yarn forming the cross thread, or weft, is thrown through the triangular opening made during the weaving process in the longways threads, or warp, of the cloth. An approach has thus been made to the weaver's ideal of not passing anything through the cloth other than the thread. The shuttle has been eliminated and no air or water jets are needed to carry the thread. Weaving speeds can be more than doubled and machine designs made simpler and cheaper.

The inventor is Prof. J.J. Vincent, head of the textile technology department of the College. The basic principle is to grip the thread between two rapidly revolving plastic rollers which throw it forward at speeds up to 400 ft (121.9 m.) a second and project it from distances over 6 ft. (1.82 m.) to keep

the thread straight, the roller speed is progressively reduced mechanically during projection, and to avoid waste the thread is retracted slightly before it is cut off. The loose ends are then tucked in mechanically to form a selvage before the next thread is thrown.

To further simplify the mechanism, Prof. Vincent is now experimenting with conical rollers driven at constant speed to project the thread. At the beginning of projection the thread is first gripped at the widest part of the rollers, which is moving at the highest linear speed. To produce the retardation for straightening, the thread is moved steadily towards the narrow part of the rollers where the linear speed is lower.

A prototype loom is now being made by an experimental organisation near Manchester and it is hoped to demonstrate it soon.

Space and time

Time standards between Britain and America have just been corrected to a high degree of accuracy in an experiment conducted jointly across the Atlantic via the space communications satellite Telstar.

The experiment was conducted by scientists at the British Post Office ground station at

Goonhilly Downs, in Cornwall, and the United States Naval Observatory.

Reference clocks in Britain and America have until now been synchronized by conventional methods to 1/1,000 sec. In this experiment the scientists transmitted precise time-signals over the Telstar circuit from quartz clocks and achieved measurements accurate to 1/100,000 sec.

Accurate co-ordination between Britain and the United States time services is internationally important because they form a primary link in the world system upon which radio navigation is based.

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Storm in the 'Cup'

Blasts of wind four times faster than the speed of sound can be created in the supersonic wind tunnels now being used for aerodynamic research at the Technion, Israel Institute of Technology in Haifa. Special high-speed cameras, set to take pictures in one-millionth of a second, photograph the flow of wind past models of wings or other bodies immersed in the man-made gales. This Aeronautical Engineering Department carries on research work for institutions both in Israel and abroad.

PRESS NEWS

COMMONWEALTH SCIENTISTS' CONFERENCE IN DELHI

Collaboration in tuberculosis research, the adequate supply of drinking water, and the organization of water resources for power and irrigation—all matters of vital concern to the emergent countries of the world—are among the subjects which will be discussed by leading Commonwealth scientists at a New Delhi conference this autumn.

The scientists, members of the British Commonwealth Scientific Committee, will also be discussing the organization of research in each of the member-countries, arrangements for distributing scientific information, and the provision of training schemes.

The meeting, to be held in November will have as its chairman Professor M. S. Thacker, Director-General of the Indian Council of Scientific & Industrial Research and Secretary to the Ministry of Scientific Research & Cultural Affairs.

The British delegation will be: Sir Harry Melville, Secretary to the Department of Scientific & Industrial Research; Sir Harold Himsworth, Secretary of the Medical Research Council; Sir William Slater, former Secretary of the Agricultural Research Council; Mr. Edward Nicholson, Director-General, Nature Conservancy; and Dr. W. Railston, Scientific Adviser, Department of Technical Co-operation. The British Commonwealth Scientific Committee (BCSC) stems from a recommendation made by the Royal Society in 1943 that the successful wartime collaboration of Commonwealth scientists should be continued when peace returned. A few years later a standing committee was set up to implement this and other recommendations concerning scientific liaison. At its meeting in 1958, held in Canada, the standing committee decided to reconstitute itself as BCSC.

Articles

SOME RECENT LESSONS OF SCIENTIFIC CO-OPERATION

BY PROFESSOR R. REVELLE, U. S. A.

International co-operation in science, like motherhood, has such obvious virtues that we tend to accept it uncritically in theory and discussion, though we may neglect it in practice and action. No one would deny that some mothers are better than others; similarly, international scientific co-operation can take various forms, some of them better than others. International co-operation in science has burgeoned mightily during the last fifteen years, and we have learned a good deal about its blessings and defects.

First, let us examine some reasons for co-operation. Major areas of scientific inquiry, such as oceanography, geophysics, meteorology, animal and human ecology, astrophysics, and public health take most meaningful form only on a broad regional, global, or universal framework. Hurricanes, droughts and pestilence know no national boundaries.

The world contains phenomena far beyond what is available within any single country.

Distant parts of the earth must be the stage for much scientific research. Thus a structure of international relationships is essential for progress in many kinds of science.

The applications of science to technology are exerting a revolutionary influence on men and nations. Scientific excellence is not the exclusive possession of any one nation or group of nations. The talents and capabilities of scientists in many lands constitute a

valuable resource for all nations and for all mankind.

But science has another and more subtle role. Its language, methods, and ethics are universal; its only limitations are those of the human mind. The objectivity, unity and independence of science transcend differences in political and social systems and make it truly supranational.

The supranational values of science at times appear to conflict with the foreign policies of nations; resolution of such seeming conflicts calls for statesmanship of a high order. Cooperation in science can be a powerful tool for building understanding among the peoples of the world only if its cohesive international force is aided rather than retarded by national attitudes, policies, and actions.

The varieties of co-operation

The most significant form of international scientific co-operation is simply to facilitate communication between scientists of different countries. Forms include organization and support of international scientific conferences, journals, abstracting and translation services; exchanges of persons, from graduate students to senior scientists; facilitation of such exchanges by compiling directories and publicizing opportunities as well as by financial support; exchanges of data which can be used to test hypotheses and theories; exchanges of instruments and techniques; development of the specialized languages of science by in-

ternational agreements on nomenclature and the definition of terms.

Since World War II, all these aids to communication have greatly increased. It is estimated that 15,000 to 20,000 United States scientists and engineers annually attend 2,000 international meetings where they have personal contact with some hundred thousand of their colleagues from many other countries. *Exchange* of scientists at its best implies the free movement of scientists across national boundaries for study, teaching, research, and the general exchange of knowledge, rather than the *quid pro quo* relationships characteristic of the U. S.-U. S. S. R. agreement.

A second form of co-operation comprises the relatively simultaneous measurement of phenomena that cut across national boundaries or are worldwide in nature. Careful planning, continuous communication, and free exchange of data are essential for success here. The International Geophysical Year, described in some detail below, was an example of this form of co-operation.

In all fields of science, it has long been recognized that standards of measurement and methods of observation must be intercalibrated on an international basis. The rise of many new sciences and technologies has multiplied the problem in recent years.

Some experimental instruments, such as the high-energy particle accelerator of modern physics, are not only fantastically expensive but extremely difficult to construct and operate. International co-operation in financing and utilizing accelerators has been quite successful at the European Centre for Nuclear Research (C.E.R.N.), and accelerators in the United States and the U.S.S.R. have also been made available to scientists of various nations.

Technical assistance comprises those measures, short of the provision of significant capital, undertaken by a technically advanced country or intergovernmental organizations to develop the human and natural resources and technical capabilities of a less advanced country. The concept is only about fifteen years old, though it has some roots in colonial and missionary practices. Scientific research and the analytical methods of science have not been used to the maximum in any technical assistance programmes, most of which have been in the hands of educators, engineers and others concerned with short-term goals. Research is generally of limited usefulness in solving short-range problems, though modern methods of analysis of these problems could be better utilized than they have been.

Short-term problems often seem critically important, but the ultimate purpose of technical assistance must be the long-range one of assisting other nations or societies in their economic, political, and social development into free and viable communities in a modern world. For the long run, research can make significant contributions in many areas. Scientific investigation of major problems—both long-standing and emergent—which impede the social and economic growth of developing nations can lead to strengthening the basic resources of a country and its people.

Much modern technology must be simplified to be useful to developing countries. New technologies suited to available energy sources, environment, and economic and social patterns must often be developed.

Results could be better

While some technical assistance programmes have been notably successful, the results of many have been disappointing. Among

reasons for limited success has been lack of knowledge about factors such as the nature of change in societies, its dependence and effects upon individuals and upon the structure and mores of the society; effective communication of skills and ideas between different societies and cultures; and the usefulness of particular technologies in different cultures.

Improving the policies and practices of technical assistance, research and development can enlarge our body of knowledge and skill. The whole spectrum of the natural, social, and behavioural sciences should be utilized to understand the nature of transition in developing areas and to forecast the effectiveness of assistance proposals.

Advice from scientists experienced in planning and administration is greatly needed by many countries in helping to establish scientific research organizations and research priorities, and in producing scientists. The values and methods of science must be woven into the fabric of any society that is to be viable in the modern world. Many developing countries recognize this and have sought advice in establishing their own programmes of scientific research and development.

The developing countries need material assistance as well as advice to participate in modern science. Even in such a relatively advanced country as India, there is a tragic scarcity of scientific books and periodicals, scientific instruments, and biological reference collections. Instruments on hand are often out of service because spare parts are not available. Easily accessible funds for instrument repairs and replacement are of vital importance.

Equally serious in the poorer countries is the lack of jobs—and status—for young

scientists. Many of us have helped with the advanced education of young people from these countries who have later reported their lack of opportunity to use their specialized training back at home. Some of them have had to find work entirely outside science simply to keep their families alive.

Foundations or government agencies for the support of free research proposed by scientists themselves, analogous to the National Science Foundation in the United States, exist in few countries. Consequently scientists, in particular, struggle against great odds in following their own scientific imaginations and insights in most regions of the world.

All countries are experiencing a shortage both of creative scientists and of technicians to assist them. One answer is to increase the quantity and improve the quality of scientific education at all levels. Successful changes have been made in some countries, many of which could be adapted to conditions in other countries. Delay in utilizing such changes seems traceable in part to the conservatism of educators and the slow pace of governments, and in part to failures of communication between scientific educators. International co-operation in developing methods of scientific education is very much needed.

Breaking national barriers

Many kinds of national barriers interfere with the freedom and advance of science. They include economic restrictions on the passage of instruments across national boundaries; passport and visa restrictions which often involve conference-killing delays; and restrictions on the geographical areas of operation of research craft and scientific exploring parties.

Since all these barriers involve the policies of governments, the interactions between the scientific community in each country and its government, and between the international scientific community and the various intergovernmental organizations are needed to reduce or remove the obstacles. Two examples of relatively successful intergovernmental actions to facilitate scientific research are the recent treaty on Antarctica and the International Convention on the Scientific Exploration of the Continental Shelf.

An increasingly serious barrier to research in the fields of radio-astronomy, space science oceanography, and meteorology is the commercial pre-emption of radio frequencies for television and communications. Although no definite solutions are yet in sight, the International Council of Scientific Unions has taken vigorous steps to insure the allotment of critically important frequencies for radio-astronomy and to reduce interference on other frequency bands used for scientific purposes.

Mechanisms of co-operation

The most effective means of international scientific co-operation is as old as science. Quite simply, it involves two or three scientists from different countries working together in the same laboratory on a common problem. Often one is a teacher, the others his pupils. But in science all are equals; ideas and insights more often than not come from the pupils.

Many more formal means of scientific co-operation exist, varying widely in complexity and effectiveness—generally in inverse ratio.

Particularly in technical assistance programmes, sister relationships have been estab-

lished between corresponding departments in universities of different countries. A successful example is the relationship established between the University of California Medical School at San Francisco and the Medical School of the University of Jakarta in Indonesia. Similar sister relationships exist between governmental scientific agencies in different countries such as the one between the United States Geological Survey and the corresponding natural resources agencies in several South American countries.

For many years, private scientific and philanthropic foundations have played a major role in international scientific co-operation. During the last fifteen years their activities have been over-shadowed by the larger scale operations of governments, but the effectiveness of the foundations per unit of money or effort still ranks very high, because of their sophistication and experience.

The principal international organizations of scientists themselves are the 13 great international unions and their co-ordinating body, the International Council of Scientific Unions. The unions are very effective in fostering scientific communications through congresses and symposia, but they have proven singularly ineffective in co-operative research programmes. Consequently, the council has developed a new device: the special committee consisting of a small group of scientists drawn from the unions and operating through national committees in the co-operating countries. The International Geophysical Year was an outstanding example of a co-operative research programme carried through by a special committee.

The council is now in a critical stage, largely because of the increasing recognition by governments of the importance of science. In the future, I.C.S.U. may be largely controlled by the national unions.

A few regional organizations of scientists, such as the Pacific Science Association and the Pan Indian Ocean Association, have been effective in fostering international scientific communication, at least in certain fields. However, these organizations have been even less effective than the international unions in developing programmes of co-operative research.

Awkward but essential

A great many intergovernmental organizations have undertaken responsibilities for international scientific co-operation. Some, such as the World Meteorological Organization, and the new intergovernmental oceanographic Commission, are concerned exclusively with science and technology. Others, such as U. N. E. S. C. O. and the Food and Agriculture Organization, have broad missions which include scientific as well as other activities. All suffer from an inadequate budget, ponderous administrative machinery, and insufficient staff. Nevertheless, they thoroughly justify themselves as essential components of international scientific action. If they did not already exist it would be necessary to invent them.

Some regional intergovernmental organizations such as the International Council for the Exploration of the Sea, the European Centre for Nuclear Research, and the Inter-American Tuna Commission have very effectively advanced scientific research on an international scale. Others such as the Organization of American States have yet had little impact on science.

By far the largest, most complex and most expensive enterprise ever undertaken in international scientific co-operation was the International Geophysical Year. The I. G. Y. involved about 60,000 scientists and technicians from 66 nations working at thousands of stations literally from pole to pole. No one has dared estimate the total cost, but it was certainly in excess of a billion dollars. This vast and daring enterprise caught the imagination of the world and gave men everywhere a new conception of their planetary home. It helped to construct scientific bridges across political chasms, and greatly increased the role of science and of scientists in national policymaking and in diplomacy. Much solid scientific accomplishment came out of the I. G. Y.

The joint assault on Antarctica by some thirteen nations gave us a new level of knowledge about the shape and topography of that ice-buried continent. The co-ordinated studies of particles from the sun and their effects on the earth's upper atmosphere and surrounding plasma depended on the elaborate planning and communications systems developed during the I. G. Y. New impetus was given to seismology and the study of the earth's interior. In my own field of oceanography, much was learned about the ocean currents deep beneath the surface of the sea, and about the shape and structure of the deep sea floor. The great adventure of our time, man's exploration of outer space, began during the I. G. Y., and was undoubtedly accelerated by it.

But perhaps of equal importance for the future was the I. G. Y. discovery of a most effective means of international scientific co-operation. Nearly all the money spent during the I. G. Y. was spent by each nation separ-

ately in support of its own scientists who were taking part in the international programme. Only a few hundred thousand dollars were required for the apparatus of international co-ordination. Committees of scientists in each of the countries developed their own programmes, and these were presented to scientists of the other countries in a series of international meetings where programmes of the different countries were compared and plans for extensive modifications—usually expansions—were made. Scientists of each country would then return home and put pressure on their government to provide financial support for the national programme developed in the conference, basing their arguments largely on national prestige, on “keeping up with the Joneses.” Thus the great enterprise grew by a series of bootstrap-lifting stages.

Another long-range benefit of the I.G.Y. was its development of mechanisms for exchange of scientific data. World data centres were established in the United States, the U.S.S.R., and in Europe, and elaborate agreements were entered into by the scientists of the participating countries to provide each of these centres with all of the measurements made under the different scientific programmes. As far as is known, these agreements were fairly kept.

The peculiar virtues of the I. G. Y. centred on avoidance of a ponderous international bureaucracy; planning in each country by the scientists directly involved—an arrangement which led to a liberal interpretation of the objectives and scope of the scientific work eligible for support under the I.G.Y. umbrella; development of a means for large-scale support by individual governments; and development of mechanisms for

free exchange of a wide variety of scientific data.

But the I. G. Y. had defects as well as virtues: The emphasis was inevitably on systematic collection of relatively routine observations rather than on the individual theoretical and experimental work which constitutes the chief means of progress in scientific understanding. The whole enterprise was a high-pressure affair, and consequently its cost, in terms of human effort, as well as money, was perhaps excessive relative to the results obtained. Political considerations intruded themselves to the extent that the great land mass of mainland China was blanked out in the international programme of observations. At least in certain fields, the scientific representatives of some countries at the international planning conferences had no real authority to agree to any modifications of their national programmes. Hence, there was far less co-ordination of the actual scientific work than would have been desirable.

Facing the problems

—*Interference with theoretical and experimental research:* Far-reaching advances in science have usually come from individual scientists or groups of scientists doing what they are interested in at the moment, freely and excitedly following up new observations or insights in an essentially anarchic and unplanned fashion. The cumbersome apparatus of planning, logistics, agreement, and direction essential for co-operative international research is anathema to this kind of science.

—*Control by the wrong people:* In general the planning and direction of international scientific action is done either by bureaucrats or by so-called scientific statesmen, usually men who have long since ceased to do

significant scientific research. Science is a young man's game, and the young giants who are the real creators need to be brought in. But often they are too busy with their own research to be bothered with how other people should do theirs.

—*Interference by governments:* Science has become so expensive and so important that it can only be supported financially by governments, but there is still in all countries, even the most advanced ones, the profound lack of understanding of science by politicians, a situation often matched by the equally profound misunderstanding of politics by scientists. By its very nature science is more concerned with understanding than with action; politics can deal only with action and must attack today's problems regardless of the long future. Since governments tend to regard science as only one among many weapons or tools to be used in the accomplishment of social, economic, foreign policy, or military missions, they do not hesitate to restrict it or impede it to serve short-range goals. The concept of science for its own sake of gaining understanding—because un-

derstanding is a natural right of human beings—has never been more than partially accepted by politicians. Progress toward true international freemasonry of science must necessarily be slow.

Can scientific co-operation serve ends other than science itself? In the past international scientific co-operation has been most successful when it has dealt with the problems of communication between scientists, with the removal of the barriers to scientific research or with other matters regarding what might be called the internal business of science. But there are many problems of tragic intensity and world wide scope facing modern man—the wise use of the earth's resources, the rational control of the sizes of human populations, the great disparity in the levels of nutrition and the incidence of disease between peoples and the problem of arms control. It is by no means clear how scientific co-operation on a worldwide basis can best be used to attack these appalling questions of our time. But one may hope that the small step forward may be taken here at Stowe.

CYBERNETICS IN OUR OUTER SPACE

By A. PROKHOROV AND I. ZAKHAROV

Members of Scientific Council for Cybernetics, USSR Academy of Sciences

For ages it has been man's dream to wrest himself away from the Earth, to soar into the mysterious depths of unfathomed space and solve the riddles of universe.

For man, there are no barriers! The Soviet-American cosmonauts—Gagarin, Titov, Nikolayev and Popovich, Glen Carpenter have overcome the Earth's attraction and flown into the unexplored realms of outer space. Man has forced his way into space and has planted himself there as master!

The successful launchings of spaceships are the logical result of the broad development of all fields of knowledge. Chemistry has contributed a new fuel that ensures the necessary thrust of the rocket motors. Metallurgy has developed super-strong materials capable of withstanding the enormous temperatures arising when the spaceship bursts through the denser layers of the atmosphere. Radio-electronics has equipped the spaceship with compact, quick-acting transistor instruments. Mathematics, aerodynamics, physics and a dozen other sciences have made invaluable contributions. Cybernetics holds a particular place among them it has become indispensable in literally all aspects of the problems of the conquest of space.

Cybernetics has revealed the remarkable possibilities of automatic universal computers. Any control process can be reduced to a chain of consecutive mathematical calculations. The computer performs these calculations at fantastic speed. Hundreds of the most experienced mathematicians are powerless to compete with it.

People have only to prepare the initial data for the calculations and feed it to the machine's "memory". The programme of operations to be performed is likewise fed to the machine. The computer operates without mistakes. There can only be a mistake if the person drawing up the programme himself makes a mistake. But this, too, can be avoided: engineers have worked out methods for automatically checking the machine's work.

A Revolution in Techniques

Cybernetics has brought about a revolution in techniques for designing technical systems. It has replaced the complicated analysis of drawings and the testing of experimental prototypes by the study of models, and these, too, can be made by means of computers.

By revealing the profound analogy between the work of the computer and the work of the control systems of the living organism, cybernetics has brought a new trend in investigations in biology and medicine.

This complicated, diversified range of problems, which can be solved by means of cybernetics has turned out to be, one might say, "made to order" for the conquest of space. Cybernetics has contributed inestimably to the solution of such problems as building spaceships, choosing the optimal design while taking into account an enormous number of factors, putting the ship into the desired orbit and checking the implementation of the entire flight programme.

Cybernetics has likewise been of great assistance in training cosmonauts in operation for their flight. Besides making it possible to design various automatic "trainers" special apparatus for testing and training space fliers—cybernetics has given experts in space medicine methods for the exact analysis of all the physiological processes taking place in the human body under diverse conditions. The results of this analysis have made it possible to draw up a list of requirements which must to be met by the spaceship, and has also made it possible to select the people best fitted for space-flight.

The speed with which science is developing is being constantly accelerated. The actual conquest of space has only just begun. As cosmonaut Titov has said: "It is now evident that people will appear more and more often in outer space, and will penetrate still further into its fathomless depths. The time is not far off when we shall have manned, long-lived artificial earth satellites. Then will come expeditions to the Moon and the organization there of permanent scientific stations. This experience will be used for the conquest of Venus, Mars and other planets. As yet these are only projects, but their implementation has now become nearer and more realistic. It may be that the time will come when space flights will be an everyday matter, and many people will even spend their holidays on such journeys, the way they now spend them hiking."

Tasks Confronting Cybernetics

What, concretely, are the tasks confronting cybernetics? We shall mention only a few of them. It is quite obvious that it will require a much higher degree of accuracy in controlling the rocket's course for a flight to other planets than that required for putting

an artificial earth satellite into orbit. There must be a reduction in the over-all dimensions of control-system elements because of the increased complexity of such systems, and their reliability must be sharply raised. What is most important, the very character of control of the spaceship during interplanetary flight must differ in principle from the techniques used for controlling orbital flights. The point is that the distances between the Earth and even the nearest planets are measured in millions of kilometres, not hundreds. Under these conditions the fact that signals from Earth to the interplanetary ships and back will arrive at their destination after considerable delay will be of decisive importance.

According to the laws of physics the speed with which such signal is disseminated cannot exceed the velocity of light, that is, three hundred thousand kilometers per second. Although that is a very high speed indeed, it is insufficient, under the conditions of interplanetary flight, to permit control of the spaceship from Earth.

How are we to find a solution to this extremely difficult problem? Cybernetics can once more be pressed into service. Machines are being designed which are capable of independently adapting themselves to quickly and unexpectedly changing situations—machines which can themselves analyse information received from effective pick-up apparatus so as to utilize it for carrying out effective control. These remarkable machines have many names: self-organizing, self-teaching, self-adjusting—but all these names have one syllable in common: "self". They can themselves carry out control.

It is on the basis of such autonomic control systems installed on the spaceship itself,

and operated by the space-fliers that operative control will be realized on the interplanetary expedition. Nevertheless, one must not assume that during such flights the astronauts will be cut off entirely from their planet. Communication with Earth will be maintained without fail. In this way the astronaut will receive general instructions elaborating the flight programme; he will feel that the Earth is following him in his work, that he is not alone. This will be absolutely indispensable for a lengthy stay in space.

The space-man must remain calm when he finds himself in fantastically unusual conditions for a protracted period; he must fully maintain all his physical and mental abilities. A reliable system of communication with Earth is an indispensable prerequisite for his successful work. But that is not all. Cybernetics, which looks on the human organism as a complicated self-controlled system, has provided techniques in space psychology for solving the difficult problem of ensuring the astronaut's normal psychic condition during lengthy flights. Experts have established the fact that contact with Earth is not enough. When sending expeditions to distant parts of the universe, a group of people must be sent together so that in the lifeless and silent depths of outer space where nothing is to be encountered but streams of cosmic rays and swarms of meteorites, a person will feel he has a friend beside him. This is all the more necessary for the fact that one person is simply unable to solve all the problems involved in the complicated programme of a space-flight. A certain amount of his time must be taken up with sleeping, eating and resting.

Constant and Powerful Ally

The cosmonaut's work is extremely difficult and exhausting. It requires not only great

knowledge and skill, but enormous self-control, courage and staunchness of spirit. It follows that in addition to the psychological qualities required of a person setting out on a long flight into outer space, his character must also meet certain requirements; for one thing he must be sociable—he must be able to live and work with the other members of the spaceship's crew. Drawing up these requirements and working out methods for selecting people on this basis is a very difficult matter and one of paramount importance. Cybernetics has made it possible to take the first steps in this direction. It should be noted that scientists have been fortunate in approaching this question.

Scientists must carry out a great number of calculations and experiments before the period of regular flights to other planets sets in. There have already laid a good foundation for the implementation of these titanic plans. Theoretical work on this problem is being carried out simultaneously with practical preparations for inter-planetary flight. Again cybernetics has come to the scientists assistance. The first to be sent out on interplanetary flights will be advanced self-controlled cybernetic machines. They will systematically transmit their observations to Earth by means of radio and television transmitters. They will independently control the spaceship's flight in all respects. By means of these machines experts will receive a mass of valuable scientific information about flight conditions and the possibility of human life on other planets.

The road to outer space is open. Scientists who have dedicated their lives to the conquest of unknown worlds are confidently advancing along this road. Their constant and powerful ally is cybernetics—the science of our space age.

DWARFISM IN HUMAN PATIENTS CURED BY HORMONES

By DELIA LANGE

The therapeutic endeavours to cure the abnormal dwarfism in human patients by the application of special hormones in the Federal Republic of Germany have made medical science win new success in the eternal struggle against disease and physical abnormality. For four decades now experiments have been going on with a view to help adults of both sexes, i.e. that are considered to be abnormally short, men below 59 inches and women shorter than 54 inches. In future genetically caused dwarfism will be cured, if in all other respects the body of the patient functions entirely normally, and is correctly proportioned, physically capable, and if the patient is of normal intelligence. This new method is one of the discoveries made by medical researchers at the Medical Clinic of Frankfurt University in the Federal Republic of Germany, that has caused keen interest in many places far beyond the borders of west German medical expert circles.

The Medical Science obtained knowledge in the twenties of this century that the anterior lobe of the pituitary gland (the hypophysis) produces a substance promoting growth; this recognition provided the basis for further research and has now produced good success. This growth hormone was first obtained from animals of the higher orders, and then injected into animals of lower orders; immediately good success of growth effects was found. Then the hormone of the hypophysis of cattle and pigs was injected into rats, which, in spite of the fact that the growth of their bone structure had been concluded, grew by an inch or so. Vice versa, when a dosis of hormones from the

hypophysis of lower animals was injected into animals of a higher development, no growth effects resulted. This knowledge was applied to human therapy. In order to be able to help human persons suffering from dwarfism, at first hormones were obtained from apes, who in biological and chemical respects, have a great similarity with man. These experiments, have not yielded any positive results in the past.

Independent from this work, similar experiments have been made with an extract obtained from the anterior lobe of the pituitary gland of man. This hormone can be isolated from the hypophysis of dead people, because the quantity of the hormones contained in the hypophysis is independent of age and sex. After preparatory doses, of minute quantities were introduced into the veins of two experimental persons, they received for forty or forty-five days respectively in to their muscles doses of five and 2.5 milligrams respectively of the obtained growth hormone. During this treatment the first patient grew by three quarters of an inch, and the other almost by one inch, in addition to both increasing in weight by no less than 11 pounds. Both patients reacted to the treatment, during which no other drugs were applied, by an increase in the contents of blood sugar.

The change in body length by only one inch may, perhaps, appear to be very small a success. However, this renewed growth can be clearly attributed to the hormone application, as in these two experimental persons their actual period of body growth had been

(Continued on page 34)

49 years ... not even a scratch

The rate of industrial accidents in India has increased from about 24 per thousand workers in 1938 to about 44 in 1959. Every year, over 93,000 workers are involved in accidents and 250 lives are lost. Also wasted annually are a million man-hours—enough to produce 170 broad gauge locomotives or 700 coaches for the Indian Railways.

Safety has always been Tata Steel's watchword as efficiency is hardly possible without it. 'No-accident month' as an annual feature, safety exhibitions, training in safety, safety awards, safer working conditions, a continuing campaign under the direction of joint councils to turn safety into a habit ... these are some of the means adopted in Jamshedpur to prevent accidents in the Plant.

Safety, however, depends largely on the worker himself because about 75 per cent of industrial accidents are found to be caused by human negligence. This is where men like Jamuna Dube, the oldest employee in Tata Steel, come in. He has worked for 49 years without ever sustaining an injury, not even a scratch.

The importance of safety was one of the first things that Jamshedpur taught Dube when he arrived in the Steel City half-a-century ago ... a city where industry is not merely a source of livelihood but a way of life.

JAMSHEDPUR THE STEEL CITY

The Tata Iron and Steel Company Limited.



TRANSPLANTATION OF BONE MARROW TO CURE LEUKEMIA.

BY MARLIS STAUDIGEL

For a long time medical science has been investigating numerous methods to obviate the dreaded and deadly cancer of the blood, i. e. leukemia, which is lethal in every case. Now it is hoped that even for the most dangerous forms of this disease a simple cure has been found, as Dr. F. Korinth of the University Clinic of the West German city of Mainz recently revealed to a number of medical colleagues on the occasion of a study conference. His demonstration showed the needle of the syringe penetrate deeply into the breast bone (sternum) of a healthy man, a donor, remove a certain dosis of bone marrow (osteomyelon) from it, and transplant it into the breast bone of a patient suffering from leukemia. This sterno-sternal marrow transplantation, as it has been called in the medical language, is a method developed and applied for the first time by Dr. F. Korinth at the University Clinic of Mainz. Already good success has been achieved, which aroused enthusiasm in the medical world.

However, the novel method constitutes only the last, although most decisive step of a treatment, for which also previous stages of therapy are of the greatest importance. Leukemia is a disease of the bone marrow of many different varieties. As it is diseased tissue, it cannot receive any other tissue, without violent deadly reaction. First the diseased bone marrow must, therefore, be destroyed. For this purpose chemo-therapeutic means will be used. Only after this treatment has been completed can the method of bone marrow transplantation developed by Dr. Korinth be applied. Within a few days, in the several cases that have previously been tested, clearly a normal blood formation was found.

As compared to the previously used method of making the bone marrow transfusion into the arm veins, the new sterno-sternal bone marrow transplantation of Dr. Korinth's is less dangerous; apart from the fact that a much smaller quantity of healthy bone marrow is sufficient, there is no longer the danger of an emboly of the lungs, which had been dreaded so much in the past; such embolies had been caused by particles of the marrow.

Sensational reports of kidney transplantations made in America made this Mainz surgeon think to follow this in his own field. The decision to develop this method further was made when two years ago six Yugoslav scientists had received a deadly dosis of radio-active radiation in a reactor accident. In this case a French professor, Dr. Mathe, saved five of them by vein injections of bone marrow, after the bone marrow of the six researchers had already begun to disintegrate due to the radiation injury. With his new method Dr. Korinth cannot only cure patients suffering from leukemia, but also those suffering from radiation injuries, for whom there was no medical aid in the past. Hard radio-active radiation cannot be used for the destruction of bone marrow, because the by-effects cannot be controlled.

Medical experts in all the world have described this procedure developed by the German physician as revolutionary. It should be realized that it is only a question of time that the clinical tests of the chemo-therapeutical substances for the necessary pretreatment required for this method will be completed. This, however, would mean final victory of man over this terrible disease, leukemia against which there was no help in the past.

PROBING THE EARTH'S CRUST

BY PROFESSOR YURI KRAVTSOV

Soviet geologists plan to drill five holes six to nine miles deep in the earth's crust. The deepest ever drilled, they will help to reveal some of the most closely hidden secrets of our planet.

Since man became an intelligent being, he has puzzled over the nature of this cosmic home of his, the earth. Until recently he had only hypotheses based on scanty facts and speculation. The relatively limited character of research in the geological sciences and the modest scale of technical probings were until recently in no way commensurate with the importance of the problem of studying the depths of the earth.

Astronomers detect light and receive radio signals from stars half a billion light years away; but seismic soundings of the earth by means of explosions reach no deeper than tens or hundreds of miles. Some space laboratories have reached Venus and the moon; but the greatest depth reached by boreholes is five miles, and by mines something less than two miles.

Three Concentric Layers

According to present conceptions our planet is made up of three concentric layers—the crust, the mantle and the core. The crust under the oceans is usually no more than six miles thick; in mountain areas it may be as thick as 43 miles.

The crust is separated from the mantle by the so-called Mohorovicic layer where the velocity of seismic waves changes sharply, approximately from four to five miles per second. Since the velocity of sound depends on the density of the medium this means that

the density of the mantle is greater than that of the crust. Geologists believe, but this is by no means certain, that the composition of the mantle is similar to that of stone meteorites.

A number of scientists believe that the mantle exerts a decisive influence on the formation of the crust, the occurrence of ore deposits and the origin and existence of the atmosphere and oceans, thus indicating how important it is for us to penetrate the earth's crust.

Equally important are the potential energy sources generated by deep-seated processes. As we go down, the earth's temperature increases by one degree C. for each 15 to 100 feet of depth in volcanic regions and each 100 to 300 feet on continental platforms and shields. Add to this the fact that each year the earth dissipates into outer space a quantity of heat so great that to express it in terms of ergs requires a figure with 27 zeros. How is the enormous heat loss made up? Unless compensated for, the depths of the earth would long since have become ice-cold. The compensation is largely from gravitational compression of matter and radioactive processes. There also appears to be such other reasons for the presence of underground heat as nuclear energy and the energy of deformed atoms.

The depth of the earth represents a kind of "geocosmos." We know that at great altitudes in the cosmos, due to the effects of radiation, electrically neutral atoms are ionized, that is, they lose electrons and split into free charges. Deep in the earth, however, the tremendous pressure causes a deforma-

tion—"crumpling"—of the electron shells. At very great pressures the electron shells are destroyed altogether. Electrons lose their bonds with the atoms and form a kind of "electron gas."

The analogy with outer space is evident. In the depths of the earth, too, atomic structures are in an unstable, peculiarly plasma-like condition—a most interesting observation from the viewpoint of energetics. In fact the energy source hidden in the bowels of the earth can be compared only with the possibilities of thermo-nuclear energy. When we find ways to tap this energy—and this can be done only by penetrating the earth's depths—mankind will be assured of enough power for all time to carry through his most daring projects.

A view into the earth's depths will help us establish the mechanism by which volcanoes—magmatic foci—are formed, and to understand at long last the causes of earthquakes so that we can counteract them. It will also give us the answer to many other questions, for example: What induces the earth's magnetic field? Why do some parts of continents slowly subside while others rise? Do continents shift? Does the shape of the earth change?

Theoretically, there are three ways of penetrating to the abyssal zones of the earth—drilling deep holes, sinking mine shafts and traveling in special subsurface ships.

American scientists have taken the first steps. They propose to reach subcrustal matter through the thin basalt ocean floor where the basalt bed is only two to three miles thick. The first stage of drilling is now in progress. American geologists have presented the USSR Academy of Sciences with a

sample of under-ocean basalt that they brought to the surface.

Five Holes

The five holes for the wide scale research study will be drilled in various parts such as:

1. In the Caspian depression, the plan is to go down seven to eight miles in order to study the distribution and physical character of oil and gas, the changes in rock composition and structure, and to investigate the peculiarities of the crystalline bed of this deepest sedimentary basin of the world.

2. In the Urals, rocks contained in the copper-bearing band will be opened and studied. Here earth scientists are primarily interested in the distribution of ores and rock changes under the action of high temperatures and pressures. They will look into the conditions of the origin of magmatic chambers and the nature of the ancient bed of this geological structure.

3. In Transcaucasia, sedimentary and igneous rock strata are directly above the basalt layer at a depth of three to four miles. We are able, with a geological structure of this kind, to study the character and composition of the basalt layer under the Conrad surface (the surface of the basalt layer of the earth's crust). The Transcaucasian hole will permit us to study the influence of the basalt layer on the formation of metalliferous solutions and the distribution of matter in the lower levels of the earth's crust.

4. In the Karelian region, where the terrestrial rocks are 2.2 to 2.4 billion years old, the drilling will make it possible to study the basalt layer and the Conrad surface which lies above it, and to determine the origin of the earth's crust and the earth.

5. The southern part of the Kuril archipelago is thus far the only known land area in the Soviet Union where the bottom of the earth's crust comes as close to the surface as seven miles. A nine mile hole drilled at this point will pass through the whole mass of the earth's crust, which changes in character from continent to ocean. With this hole we will be able to open the upper part of the mantle and determine the composition and structure of the earth's interior.

Giant Step Forward

These deep holes represent a giant step forward in researching the earth's interior. But a thoroughgoing study of the great depths still requires the actual presence of men with research equipment. To solve this problem it has been suggested that a system of vertical and inclined mine shafts be sunk in a limited cross-sectional area in ladderlike, zigzag pattern. Theoretically, a mine of this type could be sunk to a depth of 19 miles.

The mine must be sunk by steps, from level to level. The depth of the separate levels is not to exceed the length of the functioning mine shafts, and each level will have independent installations for hoisting, water drainage, ventilation, etc.

It is possible to sink such a deep mine in the near future largely by using the shaft-sinking equipment we now have. The most serious problems at great depths would be

safety and climate. But similar problems have been successfully solved in space flight with specially designed air-conditioning equipment.

A deep mine can serve a variety of uses—as a field laboratory for a lengthy, comprehensive study of the depths; as a base at the lower levels of the earth's crust from which to study the mantle; as a pilot project for the utilization of the thermal energy of the earth's interior; and as an actual mine, should the borehole strike some rich mineral deposit.

“Underground Ships”

“Underground ships”—the idea is borrowed from our experience with outer space—are likely to become vastly important instruments for researching terrestrial depths. At first thought these self-contained geological probes may seem fantastic, but the design principle of similar machines is altogether realistic. The main function of the probes would be to pass up to the surface information on the character of matter at different depths and to send up samples.

We are beginning to dig into the bowels of our home planet-earth—with all the knowledge and tools we presently have available. The task will be a long and arduous one for scientists, engineers, and workers. This is a complex job, a greatly challenging one. But then, ours is a great age because it is an age of great ideas.

SCIENTIFIC RESEARCH BRINGS VISUAL TELEPHONE WITHIN PRACTICAL REACH

BY ERNEST CHISHOLM THOMSON

To verify a technical point, I went to the Science Museum, South Kensington, London, and found myself once again in one of the world's most amazing repositories of the fruits of brainpower. Much of the fruit, it is true, never ripened; there is sadness about certain incredible gadgets, such as those aimed at perpetual motion, which is only relieved by the thought of man's inextinguishable optimism.

But, taken all in all, a visit to the Science Museum is a mental tonic. The majority of exhibits, from ancient steam engines and early telegraphs and telephones, to primitive aircraft and the original Rover turbo-jet automobile, are pointers to unceasing progress.

On the very day of my visit, as it happened, a big forward step in communications was being reported on next door, in the Imperial College of Science and Technology, where the Science Museum has its reference library, my second port of call. It looks as if, in the relatively near future, we may have a visual telephone system.

"SQUEEZING" Pictures

To be seen as well as heard on the telephone will strike terror only in the hearts of people who have something to conceal. The evasive answer, so easy in sound only, will be exposed by the shamefaced glance and shifty eye, for it has been said, rightly, that television unmasks personalities and motives as does no other medium. Not that these considerations, I imagine, have ever crossed the minds of the brilliant team, under London University Telecommunications Professor Dr.

Colin Cherry, who have now brought the visual telephone within practical reach.

"It is not science fiction any more," said Professor Cherry, "to imagine the conference or board room meeting of the future using remote visual contact. Why waste time and money travelling to London? Why not have a room fitted out with television receivers and meet in voice and face, electronically?"

The trick is done by "information compression", that is, by squeezing pictures into a waveband much narrower than that used for normal television broadcasting, and so utilising the ordinary telephone line. The pictures demonstrated by the Imperial College show very little deterioration on those we enjoy daily in television entertainment. Britain's National Research Development Corporation, who have financed the enterprise, believe there will be a big demand for the "hear-and-see" phone.

Oddly enough, at a time when television is said to dominate our lives, Britain's Radio Equipment Manufacturers' Association is staggered by the enormous new demand for sound radio receivers. The swing of the pendulum is revealed in sales figures for the first quarter of 1962.

The 548,000 radios delivered to homes marked a 26 per cent. increase on the first quarter of 1961 and 45 per cent. on 1960. It may be that the younger generation find novelty in the radio set, this wonderful device you can enjoy without having to keep your eyes glued to it, as with a television set. Then, again, Britain's radio industry

has enterprisingly fostered the fashion of carrying around tiny transistor portable radios, which can fit into a handbag or rucksack.

Youth Hostel Boom

Incidentally, I came across a breed of young people this month who can get along without either radio or television. They are members of the Youth Hostels Association, who are now geared up to enjoy a holiday, cycling or roaming around on foot amid the beauties of Britain's countryside.

"Although we have nearly 300 camping hostels all over England and Wales," an official told me, "we don't equip them with radio or television, and probable never will. You see, hostellers provide their own entertainments."

The "sing-song" in the common room at nights is as much a part of the fun as cooking meals and even washing-up. In 12 months the membership has grown from 181,000 to nearly 187,000.

Three shillings and threepence a night (a shilling less for those under 16) is the cost

of a bed and cooking facilities. The men's and women's dormitories have double-decker bunks. The hostels are of all kinds and sizes. The smallest has 12 beds and the largest 194. A few were specially built, but the majority have been adapted, from historic mansions, inns, water-mills and even a "haunted" rectory. They include a shepherd's hut and a 12th-century castle.

In the easy, relaxed atmosphere of the youth hostels, lasting friendships are formed. The international element is strong. At almost any hostel you will find young people from the Commonwealth as well as the Continent of Europe. Britain's Y.H.A. is affiliated to the International Youth Hostel Federation, sharing the simple basic principle—no barriers of race, creed or political belief.

I discovered, too, there are scarcely any age barriers. A sprinkling of active old-age pensioners are on the membership roll. The lower age limit is normally five years, but even babies can absorb the lust for travel in two family hostels in England's Lake District and the Isle of Man.

(Continued from page 27)

concluded for a long time before the treatment. A series of new experiments will begin in the near future, to supply the answer to the question as to whether and to what degree an even stronger promotion of growth can be achieved in patients without endan-

gering their lives. Medicine appears to have opened up another secret way in which to correct some of the shortcomings in nature and man, and to help handicapped human beings to enjoy normal life.

A UNIQUE SHIP TO BE PUT TOGETHER BY THE CAPTAIN

CONTROL OF NATURAL PROCESSES

BY ACADEMICIAN E. FEODOROV

Can the course of the natural processes be switched over so that they would be of more use to us? We are doing it on a comparatively small scale. Having built a storage reservoir we take care, for instance, to see that such biochemical conditions should be set in there as would prevent its silting or overgrowth with useless weeds, and would help to breed fish.

However, the thoughts of the scientists go farther to seek the possibilities of, and ways to the transformation of the unfavourable features of our planet, for example, for change of certain climatic phenomena.

Many people believe it a remote and possibly, an unfeasible task, because the climate-forming processes are connected with movements of huge masses of air and water, with changes of forms of tremendous amounts of energy. Yet one must keep in mind that the natural processes can be controlled.

It has already been proved that certain features of the weather are controllable. To disperse an overcooled cloud does not require heating and evaporation of the water it contains, for it would have taken several millions of kwh of energy per cubic kilometre of the cloud. It will be sufficient to scatter a small quantity of solid carbon dioxide for the cloud to turn crystal and disperse due to the processes utilizing the energy already contained in the cloud.

Though still very modest, the first successes present a standpoint for seeking the possibilities to control the large climateforming processes. Along with the scientists this problem attracts the attention of many enthusiasts. For example, can arctic be warmed

up? True, the proposal to dam the Bering Strait for this purpose, suggested by engineer Shumilin about ten years ago, and in a somewhat modified variant by engineer Borisov, do not have an adequate scientific foundation.

Irrespective of the engineering side of these proposals, science as yet does not possess the data to estimate the climatic effect of such steps even if they were carried out.

Still the calculations of many scientists make ground for the hypothesis that the ice cap of the Arctic ocean is an unstable phenomenon, and once destroyed would not reappear. The laws of the climate-forming processes are very complex but understandable. Solution of such problems needs both the theoretical calculations and large-scale experiments in specially selected areas which would serve as a kind of testing ground.

The researchers in the field of the science of the Earth have done much to study the natural processes, and are paying a great deal of attention to developing the methods to forecast their unhampered progress. The time has come now for a conscientious approach to the use of the natural resources to raise their effect and to transform them for the benefit of mankind. Scientific and technical progress enables man to employ the riches and forces of nature most effectively in the interests of the people, to discover new types of energy and to create materials, to develop means of weather control, and to master outer space."

The problem of transformation of the natural conditions in all its scope is one of the most interesting tasks now facing the science.

A UNIQUE SHIP TO BE PUT TOGETHER BY THE CAPTAIN

BY PETER ELLER

Light-metal shipping is still in its early stages, for in the whole world there are only four ships made of this material. All of them ply the seas under the flag of Hamburg shipping companies. On the River Rhine and the River Elbe they can be observed: silvery vessels busily criss-crossing the waters.

According to statements recently made by the owners, the aluminium ships in the course of eighteen months of active employment have proved their great advantages very well: first the elimination of all paint and conservation work, no contamination of the cargo, less damage in the case of collision due to the higher flexibility of the material, no formation of sparks and thereby elimination of explosion danger, higher speed by lower friction resistance of the ship's hull and last but not least there is the corrosion resistance of the light metal. The ships, moreover, are lighter and softer, can easily be cleaned, have a lower weight, and, therefore, greater capacity and a longer lifetime at lower up-keep costs.

"Marleen-I" is the bunkering launch employed on the River Elbe between the port of Hamburg and the North Sea; like its sister ship stationed on the River Rhine she is 35 feet long, has a beam of 20 feet, and her draught is 9 feet, and her capacity is 200 tons. This type of vessel is highly manoeuvrable and has the relatively high speed of 16 knots which makes it possible to supply bunker oil to other ships at full speed, and yet even to turn round and catch up with other ships going into the opposite direction. Passing over of bunker stores to other vessels is more rapidly than in the past, for the discharge devices have been arranged differently from the conventional methods in such a manner that all dials and gauges can be read abaft.

At present one ship yard on the River Weser in the north of the Federal Republic of Germany is building another interesting type of vessel: an aluminium tanker for inland waterways, the "ATR I", a ship that can be put together from several independent ship units, with replaceable ship ends and couplings. The stern unit houses the propulsion plant, comfortable accommodation rooms, and can be coupled to one or two other units, but it can be also work alone as a push boat tug. In less than five minutes the individual units can be taken apart amidst the river. Couplings are fully automatic. articulated tanker can be better adapted to local conditions than a rigid hull, and can therefore ply in very narrow rivers and narrow bends. Moreover, the draught of ATR I with just under six feet is below that of conventional inland waterway tankers of the same carrying capacity. The bridge can be lowered when the vessel passes underneath bridges, and the upper part can be removed hydraulically in a few seconds. There is also a novel rudder construction enabling the ship to be manoeuvred in very narrow port basins. This tanker is particularly suitable for river navigation. The ATR I is an ideal multi-purpose vessel which can be used as a tanker or freighter, or as a combined unit. Thus, for example, cargoes can be loaded and carried at the same time of coal and chemicals, and also of oil, depending on the desires of the shippers. The individual units can be discharged and loaded at different places. A prototype of the new articulated ship, a combined aluminium and steel design, has been in operation for six months with very good success.



18. Lektion

Dear friends !

Ein Telefongespräch

Herr Narain will Dr. Breuer anrufen, aber er hat zu Haus kein Telefon. Er muss zur Post gehen und von dort telefonieren. Er geht in die Post. Dort sind drei Fernsprechkabellen. Eine Kabelle ist noch frei. Er geht in die Kabelle, nimmt das Telefonbuch. (Fernsprechkabellenbuch) und sucht die Telefonnummer. Er liest :

Breu, Fritz, in Firma Breu & Co.

Mchn-Pasing, Bahnhofstr. 18

47 62 41

Breucher Anita, Modesalon, M. 23,

Rheinstr. 7

73 76 02

Breuer Robert, Dr. med. dent.

Zahnarzt, M. 22, Maximilianstr. 18

29 71 62

Jetzt wirft er zwei Zehnpfennigstücke ein, nimmt den Hörer ab und wählt die Nummer. Er dreht die Wahlscheibe sechsmal :

2, 9, 7, 1, 6, 2. Er hört ein Stimme.

—Hier Frau Breuer.

—Hier Narain. Guten Tag Frau Breuer, kann ich mit Ihrem Mann sprechen ?

—Mein Mann ist leider nicht zu Haus. Er kommt aber um 8 Uhr nach Haus. Wollen Sie bitte nach 8 Uhr noch einmal anrufen ?

—Das ist nicht nötig. Grüßen Sie ihn bitte von mir Ich danke Ihnen und Ihrem Mann für die Einladung. Ich komme morgen abend.

—Schön, Herr Narain. Wir erwarten Sie morgen um halb acht zum Abendessen. Auf Wiedersehen !

—Auf Wiedersehen, Frau Breuer !

Herr Narain hängt den Hörer wieder ein und verlässt die Telefonzelle

Das Telefon — der Fernsprecher

das Telefonbuch — das Fernsprechkabellenbuch

telefonieren mit — anrufen (Akk.)

Herr Narain telefonierte mit Dr. Breuer— Er ruft Dr. Breuer an.

Dear friends, you will realise that you have made good progress so far; you can even venture to make a telephone-call. Please try now the following exercises and see whether you can do them without any mistake.

Exercise—Bilden Sie den Akkusativ

Der Lehrer zeigt ein—Bleistift. Die Kinder fragen d—Frau.

Was zeigt der Lehrer? Der Lehrer zeigt d—Tisch (Zimmer, Tafel Bleistift, Fenster, Kreide, Fehler).

Bilden Sie die Verbform und den Akkusativ.

Der Lehrer frag-ein-Schüler. Der Schüler antwort—und schreib—ein—Satz ae die Tafel.

haben—kein, keine :

Was Sie hier? Ich ein—Bleistift—..... Sie auch ein-Füller?
Nein, ich Mein Freund ein—Buch.. du auch ein—Buch?

Lesen Sie :

6, 10, 8, 5, 3, 9, 7, 4, 2, 1, 11, 18, 13, 15, 19, 12, 14, 17, 16, 15, 64,
74, 29, 92, 68, 96, 66, 35, 78, 55, 27, 46, 21, 77, 91, 82, 139, 416, 926, 555,
915, 1294, 7512, 5432, 6666, 4711.

abnehmen	to take off	das Telefon	telephone
anrufen	to ring up, to phone	das Telefonge- spräch/e	telephone-call
der Arzt	doctor	telefonieren	to call
drehen	to turn, to dial	die Telefon- nummer/n	telephone- number
einhängen	to put on	wählen	to dial
einwerfen	to put in	die Wahlscheibe/n	selector dial
Der Fernsprecher	telephone	der Zahnarzt/ ärzte	dentist
die Fernsprech- zelle/n	telephone- booth	die Zelle/n	box/booth
hören	to hear	Dr. med. dent.	Dental Surgeon
der Hörer	receiver		
— mal	— times		
der Modosalon/a	fashion house		
nötig	necessary		
sprechen	to speak		
die Stimme/n	voice		

(The German degree mentioned above is an abbreviation of the Latin words "Doctor medicinae dentarium" written German as "Doktor der Zahnheilkunde").

19. Lektion

Dear friends !

To-day Walter tells his friends. Prem and Krishna, about the house where he lives in Germany.

Mein Haus ist in der Gartenstrasse. Wollen Sie es sehen ? Ich zeige es Ihnen. Es hat zwei Stockwerke. Unten im Erdgeschoss wohne ich mit meiner Frau und meinen Kindern. Ueber uns wohnt Familie Müller. Das ist die Haustür. Ueber der Haustür ist die Hausnummer.

Wir treten jetzt durch die Haustür in das Haus ein und kommen in den Hausflur. Hier im Hausflur ist die Treppe. Aber wir bleiben hier unten und gehen in unsere Wohnung. Hinter dieser Tür ist die Kellertreppe. Wir wollen jetzt nicht in den Keller gehen. Im Keller liegen nur die Kohlen für den Winter. Ich nehme den Schlüssel aus der Tasche und stecke ihn ins Schloss, schliesse die Tür auf, und wir können in unsere Wohnung eintreten.

Jetzt sind wir im Korridor. Hier ist die Garderobe. Bitte hängen Sie Ihren Mantel an den Haken und legen Sie Ihren Hut auf die Hutablage !

Hier links ist das Wohnzimmer, neben dem Wohnzimmer sind mein Arbeitszimmer und das Kinderzimmer. Dort hinten ist das Schlafzimmer, und hier rechts ist die Küche. Zwischen der Küche und dem Schlafzimmer ist das Bad mit der Toilette.

Wir gehen jetzt durch diese Tür ins Wohnzimmer. Sehen Sie, diese Möbel sind ganz neu : die Couch steht dort an der Wand ; vor der Couch stehen der Tisch und die Stühle ; auf dem Boden liegt ein Teppich. Dort in die Ecke wollen wir auch noch einen Sessel stellen. An diese Wand hier hänge ich noch ein Bild.

Im Wohnzimmer ist noch eine Tür. Sie geht auf die Terasse. Hinter dem Haus ist unser Garten. Links neben dem Haus steht die Garage für meinen Wagen.

Jetzt gehen wir um das Haus wieder nach vorn auf die Strasse. Dort oben bei Müllers sehen Sie einen Balkon. Er ist über der Haustür. Oben auf dem Dach sind noch zwei Kamine.

Ist dieses Haus nicht sehr schön ? Es ist mein Haus, und ich liebe es sehr.

das Arbeitszimmer	study	das Bad	} bathroom
aufschliessen	to unlock	das Badezimmer	
der Balkon	balcöny	die Hutablage	hat rack
das Bild/er	picture	der Kamin	chimney
die Couch/es	couch	der Keller	cellar
das Dach/	roof	das Kinderzimmer	nursery
eintreten	to enter	die Kohle	coal

das Erdgeschoss	ground-floor	der Korridor	passage
die Garage	garage	legen	to put
die Garderobe/n	hall-stand	der Mantel	coat
der Garten	garden	die Möbel	furniture
gehen aus	to lead to	neu	new
der Haken	peg	das Schlafazimmer	bedroom
der Hausflur	hall	schliessen	to shut/to close
die Hausnummer/n	(street)number	das Schloss	lock
die Haustür/en	street door	der Schlüssel	key
		schön	fine
der Hut	hat	sehen	to see
der Sessel	armchair	setzen	to put/to set
secken	to put	stellen	to put
das Stockwerk	storey	die Tasche	pocket
der Teppich	carpet	die Terasse	terrace
die Toilette	WC	die Treppe	stairs
der Wagen	car	das Wohnzimmer	sitting-room

	Singular			Plural
	MASC.	NEUT.	FEM.	masc. neut. fem.
Nom.	der dieser	das dieses	die diese	die diese
Akk.	den diesen	das dieses	die diese	die diese
Dat.	dem diesem	dem diesem	der dieser	den diesen

Die Endungen beim Demonstrativpronomen sind wie die Endungen beim Artikel.

20. Lektion

Dear friends !

To-day we shall discuss a very interesting chapter of German grammar. Though many students believe that this chapter is a difficult one, I should say they will not find it so bad as that if they give it their full attention. And now we shall begin with.

woher — wo — wohin
wherefrom — where — whereto

Woher kommt er? Er kommt von) aus) Deutschland von) aus) Calcutta	Wo ist er Er ist in Deutschland in Bombay	wohin fährt er? Er fährt nach Deutschland nach Delhi
--	--	---

Prepositions governing the accusative or the dative

Such prepositions require the accusative when the verb expresses a progressive movement. They are followed by the dative when the verb does not express a change of position, or when the subject of the sentence does not change its position in relation to the noun or personal pronoun governed by a preposition: e.g. er geht immer hinter ihm.

The main difference between "an" and "neben" is that "an" denotes contact, whereas "neben" suggests a somewhat less close proximity to the side of something.

Praepositionen mit dem Akkusativ oder dem Dative.

Wohin gehe ich? — Ich gehe an den Tisch, auf die Treppe, hinter die Tür, neben die Tafel, in das Zimmer, unter die Lampe, vor das Haus, zwischen das Auto und das Haus.

Wohin hänge ich die Lampe? — Ich hänge die Lampe über den Tisch.

Wo stehe ich? — Ich stehe am (an dem) Tisch, auf der Treppe, hinter der Tür, neben der Tafel, im (in dem) Zimmer, unter der Lampe, vor dem Haus, zwischen dem Auto und dem Haus.

Wo hängt die Lampe? — Die Lampe hängt über dem Tisch.

An, auf, hinter, neben, in, ueber, unter, vor und zwischen

MIT AKKUSATIV (wohin?) ODER DATIV (wo?)

am — an dem im — in dem

ans — an das ins — in das

Wohin....? Wo.....?

Ich lege das Buch *auf den* Tisch. Das Buch *liegt auf dem* Tisch.

Die Verben legen, stellen, setzen haben ein Akkusativobject und die Präposition mit den Akkusativ.

Die Verben liegen, stehen, sitzen haben kein Object und die Präposition mit dem Dative.

Die Verben hängen und stecken haben ein Akkusativobject und die Präposition mit dem Akkusativ odet kein Object und die Präposition mit dem Dativ.

Exercises :

Aendern Sie die Sätze (change the sentences)

For instance: Der Lehrer kommt jetzt in die Schule.

Jetzt kommt der Lehrer in die Schule.

In die Schule kommt der Lehrer jetzt.

1.) Herr Müller zählt zuerst die Geldstücke.

2.) Die Regel ist immer richtig.

3.) Herr Müller diktiert den Satz schnell. (diktiert — to dictate,
to give a dictation.)

Antworten Sie : (give the answer)

1). Wo wohnt Herr Breuer ? (Köln)

2). Wohin fährt er heute ? (Frankfurt)

3). Wann fährt Herr Breuer ab ? (heute)

Ergänzen Sie die Sätze : (Fill up the blanks)

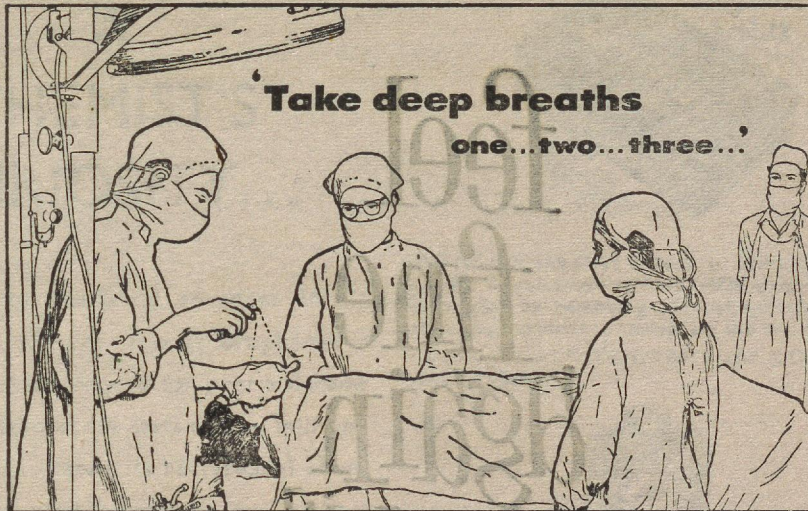
1. Ich gehe in Zimmer.

2. Wir fahren zu Post.

3. Er leg—sein—Hut auf .. Tisch und häng— sein—
Mantel an .. Wand.

4. Wo—kommt das Geld ?

5. Sie ging durch .. Gartentür, rechts die
Hauptstrasse entlang bis zu—Hauptbahnhof.



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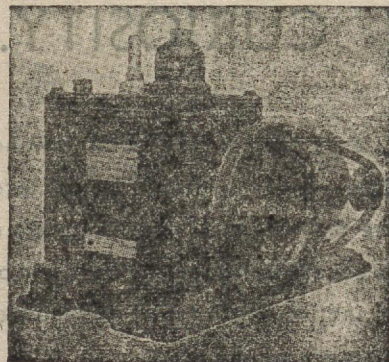
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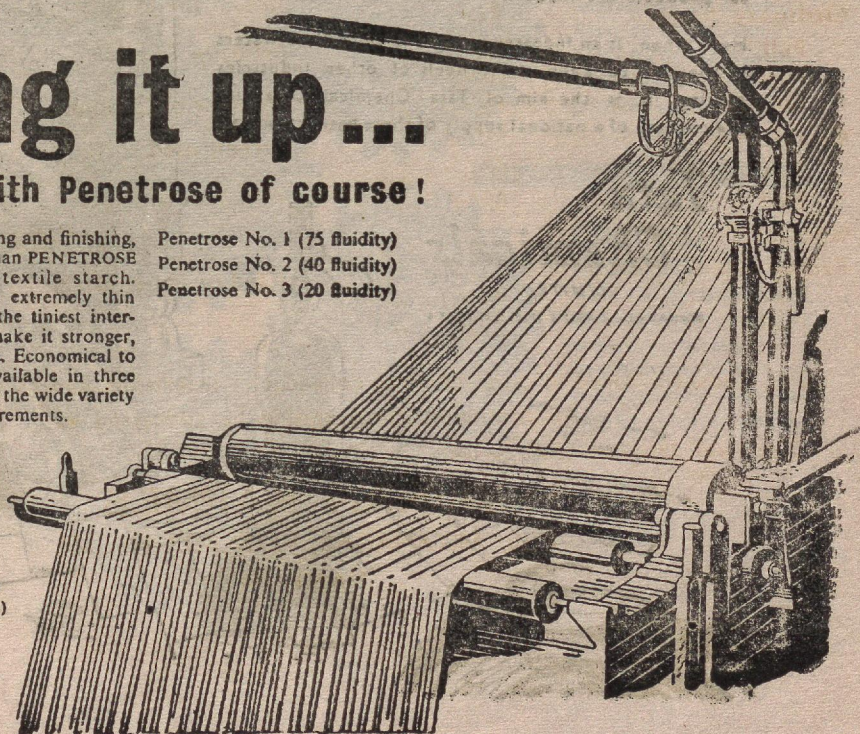
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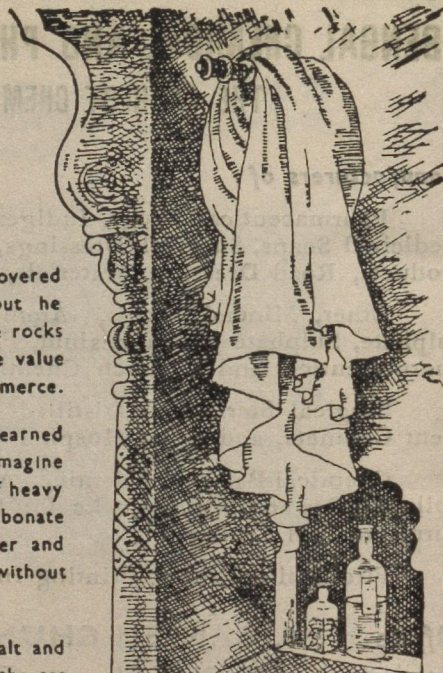
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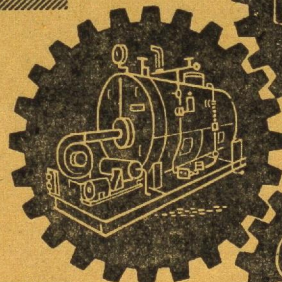
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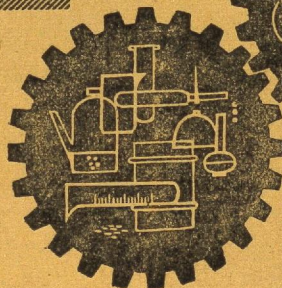
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