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Editorial

In earlier issues of this journal, emphasis has been made through a series of articles on the need for cultivating an attitude of mild where a scientific career is taken up as a way of life rather than as a mere way of living. We propose to discus in the next few issues the factors that in our opinion are important and essential for fostering this attitude in the general public, particularly in the generations to come. At different stages of growth of the human being different means require to be adopted for this purpose in keeping with the maturity and mental make up of the individual. Man as we know is the sum total of the different forces affecting his physical and mental faculties at different stages of life. For a person to emerge as a true scientific worker in later life, it is necessary to create the right impression on the mind even from the pre-education all past of the individual's life.

Childhood as we all know is the most impressionable period of life. The impulse, mental and psychological, at this period are indelibly grafted in the young mind; they cling tighter and last much longer than the innumerable lessons in science, practical and theoretical imparted to him at later stages in life. Creation of irrational, unscientific and superstitious impluses at this juncture are bound to be harmful and will hinder the proper scientific attitude in later life. For example, a colourful and well depicted fairy tale creates a genuine curiosity in the boyish-mind, on the other hand stories of ghosts and horror comics may cause thrilling impulses leading to vague sense of fear or fill the young mind with ugly superstitions whose effects are life long whatever be the nature of training he receives later.

The child even at the tender age of one year has a personality and a psychology of his own. He finds happiness and recreation in boyish games devised by himself. He enjoys putting objects into containers such as a ball in a box though he may immediately undo what he has done. At the age of four to five years, be begins to grasp and learn things; objects of different shapes and colours attract him more than playmates of his own age. The psychologists grade him as toddler or an amateur explorer. He finds great diligent in unscrewing a toy and trying to assemble the pieces again. More often than not he gets himself lost in the latter process. If given chance he may find success in odd mechanical jobs such as screwing down an attachment or removing the wheels from a simple barrow. He gets his first lesson in the big universe round him and his progress is astoundingly rapid. This will be the real time for diverting his mental faculties towards the scientific outlook. It should be remembered that the process is facilitated by his outlook seldom comes bv itself. A golden opportunity will be lost if the proper outlook is not inculcated at this stage.

Setting up of Bal Bhawans with simple, attractive gadgets that can arouse the curiosity of the child, organising of children's exhibition and showing of educative films suitable for children at this stage are bound to awaken in the child of this age an yearning to understand nature in a rational and scientific way. His approach to later life will be moulded into a receptive way of thinking free from dogmas and prejudices created by age-old beliefs. He makes searching queries on any observation and tries to obtain answers in a healthy and progressive way. Even the interpretation of religion, morals and spirituality if carried out on a rational pattern will create a better impression than if the same is done on the basis of fanatic and conservative beliefs often lacking a realistic background. If the loop holes in the manner of child development are not made up at this stage it will be difficult to rectify at a later period. Scientific training imparted at later stages of life can result only in the mass production of mercenaries in the form of scientists where science is relegated to the status of merely a way of living. The importance of the scintific attitude in spheres of art and culture needs no emphasis. Lack of the scientific attitude in the child particularly in the fields of art, culture and law may, on his growing up pose a problem not only in his own instints and to the national benefits that can accrue from him but may even affect international issue involving cooperation, peace and progress.

It is with deep regret that the Association of Scientific Workers of India have to record the sad demise of Dr. Visvesvaraya on 14th April, 1962. Dr. Visvesvaraya the grand old Scientist of India was actively associated with Scientific and technical development of modern India. Even upto the last breath (101th year) he was active Scientist in the true meaning of the word. His contribution to Science, Scientific work and the Scientific Workers of this country will, however, remain as a permanent record of his dedication to the cause.

Editorial News

ECONOMICS OF TECHNICAL STUDENTSHIP

Science and Technology as we see it today is going to be a decisive factor for determining the rate of growth or development in any country. With every passing day scientists in a country are intensifying their struggle to uncover the perpetual causes of human misery—be it physical, psychological, meterial or even spiritual and find out remedies. The technologists is taking up the problem posed by scientists during his laboratory work and finding out means to put the latter's inventions and discoveries into practical shape so that the finding can be exploited best. Obviously the number of persons engaged in scientific and technological work in a developing country has to be ever increasing. For an under-developed country this rate of increase has to be tremendous if it is to catch up the nations ahead.

Economics of training schemes for this personnel is posing a big problem not only to underdeveloped countries but even to countries like U. S. A. Dr. Weinberg has worked out some impact of large scale science on the United States. (V. K. Jan.-Feb. 1962 p. 19-25 refers) The impact of economics, on India training schemes is worth studying. The salient features of such a study should be :—

(i) the cost of training in different branches of science and technology per student/trainee,

(ii) the cost of training as related to the extent of training,

(iii) methods that can be suggested to decrease the cost without affecting the efficiency and degree of training,

(iv) cost expected to be met by the student/trainee with respect to the total period of training,

(v) method to meet the cost of training by the student-scholarships, stipends, loans etc.

(vi) possibility of taking up some schemes for "earn while you learn" during the period of studentship and training keeping in veiw the connection of such schemes in general,

(vii) compatibility of technological training and part-time work (e. g. correspondence courses etc.),

(viii) economic aspects and necessity of extra-mural activities of trainees.

It is hoped that a proper study of such problems be made in India at an early date so as to give proper direction to Technical/Scientific training schemes.

Science News

HYDROGEN MAKES IRON

A famous metallurgist once said that "the blast furnace was a millstone hung upon modern metallurgy's neck as punishment for the sins in the field of research". The blast furnace has a history that dates back to several centuries. It has become the main plant for making pig iron, a plant that is reliable and rather efficient. Today, however, we are convinced that there are not very good prospects for it. Such an iron-making furnace is good only as long as there is coke and rich iron ore. But the stocks of coking coal are quite limited; the bulk of the ore mined is poor and dust ore. Such raw material cannot be charged directly into the blast furnace; it has to be crushed, dressed and baked into agglomerate. It is this complicated and expensive pre-treatment for making the charge that makes the scientists look for new methods of metal making without blast furnaces.

Among these methods there is the H-process, called so after the first letter of the Latin for hydrogen.

Of special interest and rather extensively conducted are the studies of a process which permits to produce iron in a boiling layer.

In a large pipe partitioned by diaphragms the iron ore, blasted with a hot stream of carbon monoxide, is reduced into iron. The diaphragms are perforated so as to have the gas pressure and the weight of the ore particles mutually balanced. Then the ore is "suspended" in the gas stream like a little ball upon a water fountain. The ore particles seem to be boiling; that is where the name "boiling layer" comes from. However, just crushed ore can't be used in the "boiling layer". The process involves quite high temperatures as high as 900°C. At such heat the ore particles will lose their natural hardness and start sticking together in large clods which are impermeable for gas. Special little balls—granules—are made of the ore; these granules prevent the ore from falling apart and stopping the process. Although the boiling layer present a doubtlessly prospective process for out-of-furnace, iron making, the problem of turning the ore into granules makes it quite complicated.

The H-process does not have these drawbacks.

The reduction of ore into iron by this method also takes place with the aid of the boiling layer, bur the carbon monoxide is substituted by hydrogen. And what's most important—the finely crushed enriched ore is fed directly into the plant. Naturally one might ask: why doesn't the ore stick into clods? The answer is the temperature of some 500°C at which the H-process goes on. With such "low" temperature (in terms of modern iron making) the ore particles don't lose their strength and, naturally, don't stick together. Meanwhile, the hydrogen pressure in the apparatus is extremely high for conventional metallurgical process, i e, several score of atmospheres. The hydrogen is pressed, as it were, inside the ore particles and joins with the oxygen of the oxide, forming ordinary water and pure iron. This iron is so pure and active that it is sufficient to put it in finely powdered form upon a piece of paper to have it quickly heat up and get ignited due to its energetically combining with air oxygen.

Such pure iron is used sometimes for powder metallurgy purposes even today. But the main significance of the H-process is in the iron-making of the future, since the cleanliness and simplicity of the H-process permit to do without a number of intricate metallurgical operations.

Of course, all this is still in the experimental stage today, but these experiments are turned towards the future and open up vast opportunities for producing metal by a simple and efficient out-of furnace method.

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Alumina Stronger Than Titanium

The staff members of a laboratory at the Mendeleyev Chemical Technology Institute in Moscow have developed the technology for the manufacture of alumina cutting tools. They are capable of standing metal machining temperatures as high as 1,200°C. Even hard tungsten alloys of titanium are inferior as to some properties to the new material.

Microlite—that's the name the scientists have given to the new material—consists of alumina and magnesium oxide. It will adequately substitute for hard alloys in the production of such parts as sandblast apparatus nozzles, dies for wire-drawing machines, etc.

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Glass as Tough as Steel

Drop a 5 lb. steel ball on a sheet of glass from a height of 6 ft. and see what happens-the ball bounces off without marking the glass, let alone breaking it! Such was the result of a test of a new chemically toughened glass developed by Vadim Ryabov at the Moscow Glass Research Institute.

Ryabov began his work on the new method after the late Academician Abram Joffe had discovered that the removal of a surface layer from glass and other materials led to a considerable increase in strength.

Under his supervision, a device called "The mist-maker" was built. In this an acid solution sprayed over a white hot strip of glass covers the surface with a haze, or "mist". As the glass cools, it becomes thugher and tougher underneath this layer until finally Ryabov could drop his heavy steel ball on it.

He also took the plate of glass and struck it against a corner of a steel table. Again, the glass remained undamaged. Not a single crack appeared in it.

"This glass is seven times tougher than the ordinary kind," Vadim Ryabov said, "and it is not affected by such blows."

Assembly of the first industrial installation for manufacturing toughened glass is now nearly completed at Gus-Khrustalny glass works of the USSR.

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Automatic Inspection

The shining surface of a steel bead has a microscopic speck, a result of corrosion, the disease of metal. If the quality inspector overlooks it, a ball-bearing will break down in a few months' time. The surface of the ball may have other defects-hollows, fissures, blisters, etc. How to detect them?

"The "photoelectric eye" is of help here. The Tractor and Farm Machinery Research Institute has produced an automatic photoelectric device which checks the quality of surface of ball-bearings 4 to 13 mm in diameter. If the ball has a flaw greater than 40 microns, the device will detect it.

The machine is fairly simple. A special mechanism rotates the ball, at which a light beam is directed. The beam is reflected from the polished surface to a light sensitive element. If the surface has a flaw, the beam "goes out" and triggers a sorting device which directs the ball to a special bunker.

The machine checks 4,700 balls in seven hours, and ten such machines can be operated by one person. The first six machines of this type are already operating at the First State Ball-Bearing Plant in Moscow.

This is only one of the vast number of modern automatic inspection machines employed in Soviet industry. At ball-bearing plants automatic inspection machines are being used to grade balls and rings and check the strength of the metal. Automatic machines check the quality of coatings and heat treatment, of radio and electronic circuits.

It would be hard to name a branch of industry where automatic inspectors are not used. Soviet scientists and engineers have produced dozens of automatic control devices and sensory transducers for them. A veritable miracle of technology is an electronic micrometer, with a tiny electronic tube as a sensor. The instrument checks tolerances of fractions of a micron.

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Rapid Advance

It should be noted that in the last few years the elaboration of automatic control devices is proceeding especially rapidly in the Soviet Union. The reason for this is that, during the last ten or fifteen years, Soviet engineering has progressed tremendously in the sphere of automation of so-called basic production processes, such as metal cutting and stamping.

But with regard to control operations the erroneous view prevailed that they were subsidiary operations and there was no need to hurry with their automation. A result of this conception is that pieces machined with the direct participation of automatic instruments then have to pass through the hands of a virtual army of quality inspectors. Naturally, such automation could not be regarded as complete or, as engineers call it, integrated. Today the designs of automatic transfer lines and shops are considered incomplete until they incorporate all the necessary automatic machines for quality inspection.

We have spoken here of automatic devices which replace man and make his work easier. But there are defects which man with his five senses is simply unable to detect. Even the sharpest eye cannot spot an air hole or treacherous hair-like fissures on the surface of metal parts. Some twenty years ago one could often see a trackwalker tapping rails to detect faults in them. But even the most trained ear cannot hope to detect every hidden faults, and this may lead to terrible consequences. Now reliable aids have come to the help of the railwaymen, metallurgists and builders.

First among such devices are X-rays and gamma rays. They penetrate through different substances in different ways. Thus, if there are cavities inside a metal object, they can be projected as spot on a special screen. An intricate in stallation called a be tatron is capable of investigating metal 20-30 cm. thick.

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Two killometre high tower city

Man will be able to observe the sun on the dullest of days by rising above the clouds not in a plane but in a lift.

The lift will whisk him two kilometres up to the top of a hexagonal tower with a base diameter of 140 metres. Running through the centre of the tower will be a transparent plastic cylinder 30 metres in diameter—the living nerve of the construction.

It will house numerous cinema and panoramic halls and restaurants. There will be view platforms and big open terraces for thousands of visitors. One hundred thousand people will be able to gather simultaneously in this great tower-city resembling a rocket standing on six fins, all poised for the launch.

The preliminary designs for the giant tower have been prepared at the laboratory of industrial technology of the Reinforced Concrete Research Inststute. This is the result of five years of experimenting by the staff of the laboratory under Viktor Mikhailov, member of the USSR Academy of Construction and Architecture.

The scientists believe that the tower could be built of factory-made components

Viktor Mikhailov is sure that the project is quite feasible.

Controlling Sex of Animal Progeny

Soviet scientists have achieved major successes in controlling the sex of the progeny of certain animal organisms, reported Boris Astaurov, Corresponding Member of the USSR Academy of Sciences.

Speaking at a meeting of the Committee for Inventions and Discoveries; Boris Astaurov described certain experiments with silk-worms, in which by controlling the temperature and other conditions it became possible to ensure the birth of female species only. A different temperature regime combined with ionising radiation in the male progeny only.

The discovery made by Astaurov is considered by Soviet scientists to be of immense significance to biology and genetics.

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Unique Microscope

A group of researchers of the USSR Academy of Sciences has produced Europe's first microscope for efficient observation of molten metal and other substances at a temperature of about 3,000°C. The high—temperature microscope is a large and intricate machine using latest achievements of optics and electronics.

Scientists now have at their disposal an instrument which will help to establish accurately the melting temperature of different alloys, to study the processes of crystallization, and to discover rare metals in molten silicate materials.

Articles

SOME SCIENTIFIC PROBLEMS OF SPACE CONQUEST

By Prof. D. Y. Martynov

Director of Schternberg Astronomical Institute, Moscow University

The space flights have enriched science with information of paramount importance. As a result of these launchings, scientists have obtained experimental data on the oblateness of the earth and the density of its atmosphere. Valuable information has been gathered about the composition, structure and density of the top layers of the atmosphere, about the border lines and composition of the earth's radiation belts and about the beams of charged particles emitted by the sun. The shortwave radiations of the sun and the composition of primary cosmic radiation has also been studied.

Likewise information has been obtained regarding the temperature inside and outside the satellite, the body temperatures, heartbeat and respiration rates of animal and human payloads. A considerable part of the hidden side of the moon has been photographed and it has been established that the moon has no magnetic field.

At present scientists and technicians have set themselves the task of launching manned flights to the moon. Many important scientific problems have to be solved, however, before the landing of a man on the moon or other planets becomes a reality.

One important hurdle to be crossed is the problem of the return of a space vehicle from a planet. With the present state of knowledge only in a trip to an area near the moon is it possible to launch the space vehicle so that it will return to the vicinity of the earth all by itself. In case a space vehicle is fired beyond the earth-moon system, this technique is entirely out of the question. Instead, the space vehicle will have to be guided from the ground or from within.

An Interesting Experiment

An important experiment to test the guidance and control system of a space vehicle over super-long distances was conducted last spring. The possibility was explored for sending a space vehicle towards another planet and for guiding it so that it would land on the desired planet or would be captured by it to become its artificial satellite.

The next stage now seems to be the return of automatic space vehicle from distant planets back to the earth by a command from the ground, for which purpose a space vehicle will have to carry an ample stock of fuel. Such a space vehicle will be heavy, but not so heavy as a manned vehicle.

One serious bottleneck in the precise calculations of space flight paths is the scale of the inter-planetary distances within the solar system. Now we know all these relative distances with a high degree of accuracy, but the measure of these distances has not yet been determined precisely enough. This measure is called the astronomical unit-the distance between the earth and the sun, equal to 149,500,000. km. This figure suffers from an uncertainty of more than 30,000 km.

On the other hand, radio observations of space vehicles moving through space give more accurate data. Therefore, by the time a space probe approaches, say Venus, we have already determined the distance it has covered with a high level of accuracy. From celestial mechanics, the same distance can be found on the basis of the astronomical unit.

A comparison of the two values of the same distance will give the accurate value of the astronomical unit expressed in kilometres. This will in turn improve the scale of the solar system, which is vital to any purposeful flight. For, if we know the astronomical unit with an uncertainty of over 30,000 km. a probe flying towards Venus some 270 million kilometres away from the earth may miss it by a wide margin of more than 50,000 km. because of our inaccurate knowledge of the astronomical unit alone.

Landing on the Moon

For a space flight to be of full value, it is important to solve the problem of landing on the moon or any other planet. It will not be so difficult to land on the moon which is devoid of any atmosphere or on Mars where the atmosphere is very thin. But it will be particulary difficult to land on Venus where the atmosphere is extremely dense.

Suppose we have overcome all the difficulties involved in space travel, and an astronaut lands on another planet; some time later he will have to set out for the return trip. To do so, he will have to go through the same stages but in a reverse seqence. He will have to take off from the planet for which he will have a hundred tons of fuel and he will have to brake his space ship during the re-entry.

Thus, manned space flight is an extremely involved technical problem. Until it is solved, engineers and scientists will concentrate on the perfection of scientific equipment for automatic satellites and space probes and communication equipments to ensure the transmission of as much information as possible.

One of the immediate objectives is to devise automatic cameras to take pictures of, say, Mars from close quarters, and the films would be recoverd in suitable containers by means of parachutes. Use will be made of increasingly more perfect TV equipment coupled to telescopes mounted on satellites and probes.

Other facilities to be still born out of the progress of science will also find many uses. In this way we shall be able to investigate the physical conditions on the moon and the planets much better than we can now, with earth-bound telescope.

As a matter of fact, already today we know quite enough about these celestial bodies for us to foresee what an astronaut will have to stand up to, when he steps on a planet.

Supply of Oxygen and Water

The overriding problems will be the adequate supply of oxygen for breathing and water for drinking. The point is that the Moon and Mercury are devoid of any atmosphere, while on Mars the content of oxygen and water vapours in the atmosphere is so negligible that doubts still exist as to whether there is oxygen there at all. As for Venus, the presence of water vapours has been proved, while information about oxygen is anything but certain. In any case, the astronaut will have to wear a pressurised suit.

Another problems is that of temperature. On the Moon, it fluctuates between -100°C and + 120°C during 29.5 days. Therefore the pressurised suit of an astronaut will have excellent thermal insulation. On Mars, the temperature varies from -60°C at night to +20°C, the highest temperature on the equator, in daytime. On Mercury, the temperature in daytime may be as high as + 400°C.

Venus seems to have a more moderate climate, but we cannot yet say for certain what is going on under its dense cloud cover. The radio observation carried out last year have shown that the temperature at the surface of Venus is about +300°C. We do not even know the length of a day on Venus which may be equal to several weeks or, perhaps, months by our standards.

The big planets—Jupiter, Saturn, etc.—cannot possibly be viewed as places suitable for a landing yet, for an astronaut would have to face eternal cold of —120°C. or even lower temperature, and an entirely different atmosphere consisting mainly of ammonia and methane.

Will the astronaut meet life anywhere? Possibly on Mars. But life on that planet may be unlike what we are accustomed to. That will be another world's life.

THE PROMOTION OF THE SCIENCES IN CANADA

In science, as in many other aspects of its national life, Canada is influenced on the one hand by the physical proximity of the United States and on the other by its strong personal and historical ties with the United Kingdom. The scientific connections between Canada and the rest of the Commonwealth, especially the United Kingdom, started through the migration of men of science to Canadian universities. An outstanding example was Lord Rutherford, who, coming to the United Kingdom from New Zealand, did much of his pioneer work on nuclear energy while on the staff of McGill University in Canada. This migratory tendency increased greatly during and after the second world war. A substantial number of Canadian students have been trained in the United Kingdom, assisted by various scholarships and schemes for the interchange of scientists, while research students from other Common wealth countries go to Canada under the Post-Doctorate Fellowship Scheme of the Canadian National Research Council.

While the National Research Council is now regarded as the central nationl research organisation, it is not by any means the only one. Research is carried on also by the federal deparments of agriculture, fisheries, mines and technical surveys, northern affairs and national health and welfare and other federal bodies such as Atomic Energy of Canada Ltd., the Defence Research Board and the Board of Grain Commissioners. Provincial governments also carry on research projects, largely on projects of local importance, and the universities conduct considerable fundamental research.

Agriculture

The first major research organisation in Canada was founded to investigate agricultural problems : in 1886, a system of experimental farms was established in the Canada Department of Agriculture. Most of the recearch is still conducted by the federal department, in co-operation with other agencies. Important research is also conducted by provincial departments of agriculture, provincal universities, and colleges of agriculture.

The Research Branch of the Canada Department of Agriculture was formed in 1959 by amalgamation of Experimental Farms Service and Science Service. The branch has 62 experimental farms and other research centres, from Newfoundland to the Yukon, including some where work is conducted on forest insects and tree diseases. Ten of the centres are research institutes, where studies are conducted on biological control of insects and weeds, dairy technology, farm animals, genetics and plant breedieg, insects, insect diseases, microbiology, pesticides, plants, and soils. Associated with the experimental farms are over 200 stations where experiments are conducted under conditions not found on the experimental farm sites. The headquarters of the branch is on the Central Experimental Farm, Ottawa.

The research branch serves a wide variety of agricultural and forest enterprises under diverse climatic and soil conditions. Specialists in various scientific disciplines (such as animal breeding, botany, chemistry, entomology, microbiology, plant breeding, plant pathology and soil science) co-operate in studying problems of national and regional concern. These include: developing better breeds of livestock, better varieties of field, orchard and garden plants and better farm machines; control of insects, mites and plant diseases; processing of fruits, vegetables, cereals, milk, wool and honey; classification of soils and study of soil needs in relation to fertilisers, crop rotations, drainage and irrigation; and improving ranges and pastures.

Mines and Geology

The federal Deparment of Mines and Technical Surveys came into being on 20th January, 1950, in the reorganisation of the former Department of Mines and Resources. The department has five branches—Surveys and Mapping Branch, Geological Survey of Canada, Mines Branch, Dominion Observatories, aud Geographical Branch. The department's functions also include the administration of the Emergency Gold Mining Assistance Act and of the Explosives Act.

The Surveys and Mapping Branch provides the base maps required for use in the development of Canada's natural resources, produces and distributes all Canadian aids to navigation, is responsible for legal surveys of federal lands and provides a national system of levelling and precision surveys for use as geodetic control by federal, provincial and private agencies.

The primary function of the Geological Survey of Canada is to obtain information on the geology of Canada that will be of assistance in the search for and development of mineral deposits. The results of its activities also provide a basis for the appraisal and conservation of Canada's mineral resources generally, including water supplies, for soil surveys, and for the solution of geological problems that frequently arise in construction projects.

Investigations undertaken in the laboratories of the Mines Branch cover a wide range of technical projects of importance to the advance of fundamental research; to the processing of ores, industrial minerals and fuels on a commercial scale; and to the theory and practice of physical metallurgy. The branch serves Canada's mineral industry through tests, investigations and research on all types of Canadian ores and minerals.

The Dominion Observatories, in addition to studies in positional astronomy and stellar physics, undertake research in seismology, terrestrial magnetism and gravity. The main units of the branch are at Ottawa, but the Dominion Astrophysical Observatory is located at Victoria, and a newly constructed radio telescope is at Penticton, British Columbia.

The function of the Geographical Branch is to organise and make available all the geographical data on Canada that might be of use in promoting the country's economic, commercial and social welfare. The work is of two kinds—the compilation of geographical material of national significance, and geographical surveys in the field. Land surface conditions, types of vegetation and the structure of towns and cities are typical subjects of investigation.

Forestry

Research in forestry and forest products is conducted by the Forestry Branch of the Department of Northern Affairs and National Resources, several provincial governments, the Pulp and Paper Research Institute of Canada, four universities with faculties in forestry, and a number of the larger industrial companies. In addition, the Forst Biology Division of the Research Branch, Department of Agriculture, conducts research in forest entomology and forest pathology.

The Forest Research Division of the fedral Forestry Branch conducts research related to silviculture, forest management, forest fire protection and forest inventory methods at six distinct offices and five forest experimental areas situated at strategic locations throughout Canada. Many studies are conducted on provincial Crown lands and private lands in co-operation with the provincial governments and the industry. Two forest products laboratories are maintained, one at Ottawa and the other at Vancouver, to conduct basic and applied research aimed at improvements in the use of wood and the reduction of waste. The Pulp and Paper Research Institute of Canada is responsible for research relating to paper pulps and paper, and a laboratory has been provided for its use by the Federal Government.

Fisheries

For fisheries research there is a Fisheries Research Board (set up in 1937 to succeed a Board, established in 1912, which succeeded a Board of Management dating back to 1898). The present board consists of a full-time paid chairman assisted by not more than eighteen other members, a majority of whom must be scientists. Members are appointed by the Minister of Fisheries and serve without remuneration but are paid expenses for attending meetings and doing other work for the board. The board is financed from Federal Government funds but, on occasion, carries out studies or experiments for other Federal Government agencies or international commissions from funds supplied by those agencies or commissions. Provincial governments, notably those of Quebec and Ontario, carry out some independent fisheries research but co-operate closely with the Fisheries Reserch Board.

The board operates seven main scientific stations, three units and two groups. Biological stations are situated at St. John's, Newfoundland; St. Andrews, New Brunswick; London, Ontario; Nanaimo, British Columbia; with an arctic unit in Montreal, Quebec. Technological stations are at Halifax, Nova Scotia; Grande Riviere, Quebec; Vancouver, British Columbia; with smaller units in St. John's Newfoundland, and London, Ontario. An oceanographic group operates from Halifax, Nova Scotia, and another from Nanaimo, British Columbia.

The chairman is assisted in his executive functions by an executive committee composed of members of the board. Advisory committees study the programmes of the various stations, units and groups, and report to the board at its annual meeting in January of each year in Ottawa

Under the Act setting it up the board 'has the conduct and control of investigations of practical and economic problems connected with marine and freshwater fisheries, flora and fauna, and such other work as may be assigned to it by the Minister'.

National Research Council

In 1917, the National Research Council of Canada was set up as an advisory body of eleven, subject to a cabinet committee known as the Privy Council Committee on Scientific and Industrial Research. The council's first project was to examine the state of Canada's scientific resources. The survey indicated that industrial research was virtually non-existent in Canada and that the supply of research workers was inadequate. The universities were absorbed in under-graduate work, the teaching staffs had little or no time for research, and graduate scholarships were lacking. Most Canadian students went abroad for postgraduate training and many did not return. The council accordingly made provision for the planning and integration of research work, the organisation of co-operative investigations, postgraduate training of scientists, and assistance to research by means of grants-in-aid to university professors. This outline formed the basis of the council's work until 1924. By this time about thirty associate committees, composed of experts in various fields, whose services were given free, were guiding a number of co-operative research projects on many of which graduate students were employed. The council had also decided that its obligations to industry could not be fulfilled until it had its own laboratory facilities. It accordingly started laboratory work on a small scale and planned for greater operations.

In 1932, the coucil opened its central laboratory in Ottawa, and large-scale research began. The new laboratory housed four divisions : Physics and Engineering, Biology and Agriculture, Chemistry, and Research Information There was little expansion during the thirties, but in 1936 it was possible to establish a Division of Mechanical Engineering, and in 1939 a new 130-acre site was acquired near Ottawa. This site has since been added to and now comprises 400 acres on which stands the greater part of the council's laboratory accommodation.

During the early years of the new laboratory a nucleus of highly trained specialists was engaged. When the second world war broke out this nucleus proved to be very valuable. The very large demands of wartime necessitated a tenfold expansion, which was achieved by building new staff around the original nucleus.

During the war twenty-one additional laboratories were established from Halifax to Vancouver. Temporary laboratories for cold weather were set up at suitable points. An Explosives Experimental Establishment, organised for wartime work at Valcartier in Quebec, is still in existence as part of a Service organisation. The council equipped large laboratories in Montreal for the Atomic Energy Project and then created the permanent establishment at Chalk River. The council also built radar laboratories near Ottawa, and cold weather stations at Winnipeg for testing jet engines, naval research stations on both coasts and, on the new site at Ottawa, a permanent group of nine buildings with the necessary wind tunnels and other equipment for aeronautical and engineering research. Shortly after the war, the council transferred responsibility for Service research to the new Defence Research Board which also took over Service laboratories at Valcartier. Halifax, Ottawa and other points. The Chalk River establishment, which had now acquired industrial importance, was set up in 1952 as a Crown company with the title Atomic Energy of Canada Ltd.

In 1946, a Division of Medical Research was established. This division has no laboratories and its function is the administration of the council's grants in aid of medical research. The division was a development from the Associate Committee on Medical Research which accomplished excellent work during the war.

In 1947, the council established a Division of Building Research to study broad problems of construction and to act as the research wing of the Government's Central Mortgage and Housing Corporation. In 1947, radio research, which had engaged only a handful of staff in 1939, was associated with the electrical engineering laboratories to form the Radio and Electrical Engineering Division.

In 1948, the Prairie Regional Laboratory, which was an outgrowth of the Division of Applied Biology, was set us on the campus of the University of Saskatchewan in Saskatoon. The council also set up the Atlantic Regional Laboratory on the campus of Dalhousie University in Halifax in 1952. In the same year the Division of Chemistry was divided into two divisions, Pure and Applied Chemistry. In 1955 the Division of Physics was similarly divided into Pure and Applied Physics.

The greater proportion of the work in the laboratories is of an applied nature, but in view of the importance of basic research, a considerable amount of this type of work is continually being done, particularly in physics, chemistry and biology. The programme of basic research assists in the development of a supply of top ranking scientists, many of whom move from the council's laboratories to universities and to industry.

As mentioned above, the council was concerned at the beginning with the stimulation of research and the need for scientists and engineers, and this is still one of the council's chief functions. One important method for increasing the supply of scientists has been the stimulation of research at the universities through grants in aid of research and scholarships. During the year 1958/59 the council spent \$C 5·5 million is these operations.

The council staff numbers 2,426 of whom 517 are scientists. In addition, 138 Post-Doctorate Fellows from a large number of countries make use of the laboratories.

(*To be concluded*)

SCIENTISTS URGE WIDER USE OF SEISMIC EXPLOSIONS TO EXPLORE NATURE OF THE EARTH'S CRUST

More systematic use of seismic explosions to obtain a truer picture of the profile of the earth's crust has been recommended by an international meeting of scientists at Unesco House in Paris.

The meeting was of a working group on investigations of the earth's crust convene l for the International Committee for Geophysics by Dr. Markus Bath of the Seismological Institu'e at Uppsala, Sweden. It was attended by twenty-six scientists from Cz choslovakia, the Federal Republic of Garmany, Ita'y, Japan, Sweden, the Union of South Africa, the United States and the U. S. S. R.

Shock waves produced either by earthquakes or explosions using charges of TNT travel at different speeds within the earth, depending upon the composition and the physical state of the material through which they pass and also upon the depth. Interpretation of seismometer recording of these waves can indicate the nature of this material.

But, it was brought out at the meeting, the picture obtained of the earth's crust through measurments of explosions is incomplete as present and probably inaccurate in datail. There has been a tendency to visualize it as being formed of regular, horizontal layers, but it now appears that the thickness and nature of these layers may vary very much from one region to another.

To answer this question, meeting recommended the international exchange of seismic explosion parties so that scientists may be able to extend their research across national boundaries, especially in region where discordant results have been obtained up to now.

Such free exchange already marked this meeting. It was brought out that method of investigating the earth's crust in the United States and the Soviet Union are basically similar since both countries have huge continental regions in which to work.

One of the purposes of the meeting was to ascertain apparent differences found in the s'ructure of the earth's crust in various parts of the world are due to basic differences in research methods. Following th working group's five-day session, the concensus was that this is not the case, and that these differences are real.

In another recommendation, the working group recognized that geophysical methods—such as seismic explosions or measurements of gravity and magnetism—cannot answer all questions concerning the earth's crust. It recommended the drilling of deep wells to explore the crustal layers down to the base of the crust, on a national or international basis.

The United States has already begun an experiment in drilling into the ocean floor off the coast of California in the Pacific. The oviet Union is planning to drill on land at several different places down to a depth of ten to fifteen kilometres. These drillings will be spread over a period of ten years.

The meeting also recommended drilling to measure the natural radioactivity of rocks below the earth's surface. Little is known about this radioactivity, but it is believed to explain the sharp rise in temperature (roughly 1 degree centigrade every 100 metres) encountered as one descends below the surface. The rise is too sharp to be explained on the basis of heat transmitted from the earth's core.

GIANT DAMS : KEYS TO FOOD AND POWER

Gaint dams and little dams mean irrigation and therefore food for the world. They mean generation, and therefore electric power for the machines of the world. They mean navigation, and therefore shipping for the wealth of the world.

They are built in tense international competition. But there is international co-operation too, and in this aspect they are a key to peace.

German International profiles the face of the dams, mammoth and modest, and tells how they unlock the gates to food and power.

"For every four persons on earth in 1950, there are today five!"

The speaker was Eugene R. Black, President of the World Bank, addressing the Economic and Social Council of the United Nations in New York. Mr. Black continued:

"For every five today, in 40 years there will probably be ten. In the past half-minute alone, about 90 babies have been born into the world; only 60 persons have died, leaving a net increase of 30, or one every second.

"In 1961, the world's population will probably push beyond the three billion mark, and the figure will be doubled before the end of the century."

What is being done to feed these masses, to provide them with power, irrigation navigation?

At the present moment, teams of engineers are surveying the exact site of the Euphrates dam project in Syria. This will be the tenth major dam and power project in the 100 million dollar category to have been started outside the East Bloc since the mid 1950s.

In the same period, some 50 dams, weirs and related projects, involving expenditures of at least five million dollars each, have been begun either as separate units or as auxiliary projects, and more then 15 million dollars have been spent in all.

These pyramids of modern engineering and architecture have been erected under conditions of intense international competition among French, British, West German and American construction firms.

In collaboration with domestic enterprises millions of cubic meters of earth are being moved in the Sudan and in Pakistan, mile-long tunnels are being driven into the rocks at Assuan and into the Japanese and the European Alps. Such names as the Arimine Dam in Japan, the Cameron Highlands project in Malaya, the Grande Dixence in Switzerland, Baygorria dam in Uruguay, Gudu Barrage in Pakistan or the Tokke dam and power project in Norway illustrate the degree to which these undertakings have in recent years grown into important enterprises for the great international construction and electrical firms. Devolopments upon the sector are characterized by the following points :

in the developing conntries, the great power dam projects have grown to be objects of national prestige, with important political implications.

During the foreseeable future—for the next ten years at least—the lion's share of the rapidly increasing demand for electricity will be supplied by waterpower. Nuclear energy generation has not yet been developed to a point where it can compete with water.

The overall planning of the great power dam projects includes the necessary auxiliary undertakings from the generator plant over irrigation systems to the purchase of agricultural machinery and of animal breeding stock. A full planning program has become a prerequisite for the granting of a World Bank credit.

The financing of the projects is not uniform. There is a pronounced trend toward multilateral financing with the World Bank; however, bilateral financing has also been observed.

Typical examples of bilateral financing are the great dam projects in the Arab-speaking area, the Assuan and Euphrates dams.

Most of the great power dam and irrigation projects in the world are, financed on a multilateral basis by the World Bank. The areas of power dam construction, river regulation and electric energy production are growing into the major effort of the World Bank, as much as half a billion dollars being made available for such undertakings in the form of credits each year. These credits cause from two to three million kilowatts of new electric capacity to be brought into being every year.

The construction of a dam is often the first step of a developing country into the industrial age. A storage dam provides three of the basic necessities for economic development: energy for industry, irrigation for agriculture and communication through the creation of navigable rivers.

Insofar as it has not already been done, all of the large rivers in developing countries are now being examined for their feasibility for such key projects. The Nile in Egypt, the Euphrates in Syria, the Indus in India and Pakistan as well as the Charo Phya in Thailand are examples of this.

The latter project is typical. In its efforts to advance the living standard of its 22 million people, Thailand has undertaken its greatest enterprise ever, the Yanhee multi-purpose project, to create communication networks, electricity and sufficient irrigation for its farms. A credit from the World Bank amounting to 66 million dollars was used to build a dam 450 feet high on one of the tributaries of the Charo Phya. The capacity of the projected power plant will be one-half million kilowatt.

Another example, and one of the greatest works which the hand of man has ever created in Africa, is the Kariba dam across the Zambezi river, a few hundred Kilometers downstream from Victoria Falls. A dam 415 feet high serves to form the greatest artificial lake in the world; it was completed, in a remote backwoods and despite unparalleled flood conditions, in the short space of four years. This enterprise supplies the Federation of Rhodesia and Nyasaland with ample water for its agriculture; in addition, it has created a basis for industry. Already today, the modern industrial areas Salisbury and the copper belt are being provided with electricity from Kariba the power stations.

In india the Damodar valley corporation was begun near the end of the 1940s after the model of the American Tennessee Valley Authority. The final stages of this project were finished after ten years of effort near the end of the fifties. By storing the waters of the Damodar River, the Damodar Valley was made into the power source of one of the most important industrial centers in Asia. Today, this valley furnishes nearly all of the iron and copper of India as well as one-quarter of its coal, mica and chromite. In recent years a great steel industry, chemical and fertilizer plants, machine tool factories and other enterprises of heavy industry as well as a number of smaller industries have grown up in this valley.

Not only the developing countries but the industrial nations too are using the construction of major power dam projects to expand their industrial basis.

One of them is Japan.

Notwithstanding the fact that Japan's energy output has been considerably increased since 1945, it has not been easy for the Japanese to keep pace with the growing demand. Between 1952 and 1957, the consumption of electricity has been rising at the rate of eight to nine per cent a year. In an effort to help the power companies to master this problem of growing demand, Japan has since 1953 obtained World Bank credits in a total amount exceeding 150 million dollars, for the construction of water-power and heat-power generating stations.

Scarcity of Sites

The prize exhibit in this series of projects is the Arimine dam in the Japanese Alps, which comprises five power stations, one of which is already in operation. The project was ordered by the private firm Hokuriku Electric Power Company, which supplies the area of Toyama near the West Coast of Honshu with electricity. The Japanese alpine river Yoganyi is barred with a dam 445 feet high. Staggered downstream, five new power plants are being built to use the waters harnessed by this dam; an already existing generating plant is being enlarged. This will increase the capacity of the Hokuriku Electric Power Company by 261,000 kilowatts. Most of this project has been completed.

The mammoth Japanese dam demonstrates the difficulties which nature poses. A construction executive told *German International*: "In countries in which the production of electricity is well developed, it is difficult to find good building sites. Most of them have already been used for such projects." The rivers of Japan provide important opportunities for the development of electric power; however, all the more obvious locations for generating stations are already being exploited. Those that are left are located in high mountain gorges difficult of access, and the Arimine dam in the Japanese Alps is an example of this.

A dam project of special nature is the Cameron Highlands Hydro-Electric scheme in Malaya, at which West German firms have been engaged for several years. The Cameron project is the first construction stage of a program which is to exploit the Malayan water power potential deriving from the heavy rains in this mountainous area. The waters of four small rivers, the Telom, Kial, Habu and Bertam are being collected on the Cameron plateau, about 160 kilometers north of Kuala Lumpur, to drive the turbines of two generating stations.

The project, unusual since it involves the collection of the water of four small rivers instead of the regulation of one large one, involves the construction of two generating stations, the building of a 130 foot-high and 430 foot-wide dam at Ringlet Falls, and the driving of more than 12 miles of tunnel into solid rock. The wrok is to be finished by 1964.

Norse Project

One of the most important European power projects was virtually finished this year. This is the socalled Tokke Hydro-electric Development scheme in Norway, which will comprise three power plants with a combined capacity of 810,000 kilowatts. Transmission lines will also be built to connect networks serving southern and western Norway, and to export power to Sweden.

The Tokke scheme will regulate and utilize the waters of the Tokke and Vinje rivers in southern Norway. The two rivers rise in the Hardanger plateau, 3,000 feet above sea level, about 160 miles west of Oslo. Their headwaters consist of a complex of mountain lakes, several of which are being made into storage reservoirs by a series of lakes and tunnels. This will permit year-round regulating of the river flow to the three power plants of the Tokke scheme.

Total cost of the new power plants and lines will be some 58 million dollars; 25 million will be covered by a World Bank loan and the remainder will be met by the Norwegian government.

The high arch dams of the Flumendosa irrigation project in Sardinia (Italy) which serves to supply the Cagliari plain with water is, in addition to the great Rhone Valley dam project in France and various Austrian and Swiss projects, an example of major European enterprises.

Perhaps the most recent event in this international picture is the American agreement to advance 133 million dollars toward the construction of a dam on the Volta river in Ghana. The Ghana project is one of major size, not unlike the Assuan and Euphrates undertakings, and its completion should benefit Ghana materially.

The Boom Will Continue

Experts estimate that the boom will continue.

To know how urgent it is to bring energy to Turkey, for example, one need only consider that the annual per capita production of electricity in that country amounts to 30 kilowatt-hours. In the highly industrialized nations of this world, it comes to 2,000 to 5,000 kwh per capita a year.

In view of the increasing development of the European Energy Network, water power will maintain its significance as a permanent source of electricity. This is confirmed by the fact that those countries which are rich in energy bearing water, among them Austria, Switzerland, Scandinavia, Southern France and Italy, are developing their water power to a growing degree.

Food and power are to be assured the peoples of the world.

ASSOCIATION NEWS

Resolution Passed by Lucknow Branch of Association of Scientific Workers of India on 27th March, 1962

This meeting of the Lucknow Branch of the Association of Scientific Workers of India records its deep sense of sorrow at the sudden demise of Prof. Biresh Chandra Guha one of its founder members at the Central Drug Research Institute on the 20th March 1962. In Prof. Guha India has lost one of her most eminent scientists who by his vast scholarship and original contributions helped substantially in placing India on the world map of Biochemical Research. He represented this country in an effective manner in many International Scientific Conferences including the last International Congress of Biochemistry held in Moscow in 1961 where he was elected Chairman of the Section on Vitamins.

Prof. Guha had a distinguished career in the Calcutta Universty and chose research and teaching as his life-long profession. After post-graduate work and training under the guidance of Late Acharya P.C. Ray, the father of modern Chemistry in India, Dr. Guha went to England to work with Prof. Drummond. There his work on the metabolism of vitamin C brought him in close contact with Prof. Szent-Gyorgyi. On his return to India, he was appointed Ghosh Professor of Applied Chemistry in the University of Calcutta at the early age of thirty two, joining the galaxy of brilliant science teachers headed by the Acharya. His keen interest in different aspects of biochemieal research together with his organisational ability and inspiring leadership led to the development of an active school of biochemical research, one of the first in India. The contributions of his school in a wide variety of subjects such as nutrition, microbiological fermentation, vitamins and protein metabolism have been significant. As a research worker and teacher he possessed the outstanding and rather rare ability of establishing personal relations with his students and colleagues inspiring them to develop qualities of leadership and orginality of thought. But he was no mere academician. His talents were not confined to the narrow sphere of the University. His deep interest in development of science and technology in India was reflected in his active association with a number of research bodies, like the C.S.I.R. and I.C.M.R. in various capacities. He occupied responsible positions in the N.I.S., Indian Science Congress, Indian Chemical Society, Indian Science News Association, Bangiya Vigyan Parishad and others. His sudden death is all the more regrettable in that he has not been spared by Destiny to preside over the Indian Science Congress Association in 1963-64. Dissemination of scientific knowledge and popularization of Science were dear to his heart and both as a writer and speaker he had the unique capacity of making the most technical subject intelligible to the layman.

Though research and teaching was his mission in life he did not shirk any other form of service to the nation even if it involved his temporary absence from the academic field, when called upon to de so. He served the Government of India as C.T.A., Food Ministry, in the period of acute food shortage following war. Later he was appointed a member of the D.V.C., the first river valley project in modern India.

Though unassuming in nature, he possessed an innate strength of character that had been moulded by the influence of the builders of modern Bengal and in particular by philanthrophist-educationist the late Aswani Kumar Dutta of Barisal, his birth place. The political turmoil and revolutionary movement of Bengal influenced his thoughts from the early days and he developed a progressive social outlook which eventually matured to an ardent faith in Socialism. His nationalist leanings did not pass unobserved by the alien rulers. His radical and outspoken views often resulted in sharp differences of opinion particularly with authorities but his tact and understanding smoothed over any misunderstanding or rancour.

The versatility of character of Dr. Guha and spirit of service was exemplified during the Bengal Famine in 1943 when he almost converted his laboratory into a kitchen and fed many people every day. Scientist as he was, he thought of cheap sources of protein to maintain a desirable lavel of nutrition for the famine stricken people. He extracted vegetable protein from waste materials and distributed it in the form of agreeable eatables, at that time nicknamed "grass-chops."

His appreciation of the enormous potentiality of science and technology and their impact on society together with his keen awareness of his social responsibilities as a scientist brought him close to the rank and file of scientific workers in the country in the post-independence years. Together with late Prof. M. N. Saha he was one of the moving spirits and initiators of the A. S. W. I. in 1947, which he served in the capacity of first General Secretary and later as President and continued to be associated with it till his death. He was a staunch advocate of a strong association of scientific workers but free from political influences.

With these few words, we offer our humble homage not only to a great scientific worker and teacher but also to a good and noble man. In him, our Association has lost a leader, the community of the students of Science a very able and sympathetic teacher, guide and friend and our country an eminent scientist. May his soul rest in peace.

This meeting wishes to convey to Mrs. Guha its heart felt sympathy in her present bereavement.

REPORT OF THE SECRETARY
(Hyderabad Branch)

Annual report of the activities of the Branch for the Year 1961-62.

Paid Membership

The present strength of the membership is 100 compared to 120 in the last year. The fall in the membership is due to some of the members having left the laboratory. Subscription for the current year has still to be collected from 30 members. Attempts were made to start units at Nuitrition Research Laboratory, Engineering Research Laboratory and the Institute of Preventive Medicine, but they did not bear fruit.

BEC meeting

3 Ordinary BEC and one extraordinary BEC meetings were held during the period under review. A General Body Meeting was also held to discuss the change in the working hours of laboratory.

Science Lectures

The following lectures were arranged :

	Name of the speaker	Subject
1.	Prof. M. G. K. Menon	... Atomic Energy in India.
2.	Dr. (Mrs.) Jaya Nagaraja	... Neurosis today
3.	Dr. I. Bhushan Rao	... The Scientific investigation of crime
4.	Dr. I. Ramiah	... Recent developments in surgery
5.	Dr. Ramavataram	... The work of Noble Prize Winners for the year 1960.
6.	Prof. N. V. Subba Rao	
7.	Dr. Melvin Cohn	
8.	Dr. Williams	... The action of pencillin on Bacteria.
9.	Dr. Tuzo Wilson	... The world of International Geo-physical year
10.	Dr. Francios Gros	... How are proteins synthesised.

Some of the above lectures were arranged in collaboration with the Hyderabad Science Association and Regional Research Lab. Colloquium.

Specific problems taken up by the Branch

Amenities for the staff : A memorandum on the amenities to be provided to the staff in view of the change in the timings of the laboratory was submitted to the Director and most of the suggestions were approved. Some of the suggestions have already been implemented.

Staff benevolent fund : This, as the members may be aware, is under operation.

Laboratory hazards : A note on laboratory hazards and means to prevent them was submitted to the Director.

Medical Rules : A note prepared by the Sub-Committee specially formed for the purpose was distributed to the members of the staff for their use.

Publication of bulletins

3 issues of the bulletin were published during the year under review.

Film shows

17 films of scientific and general interest were shown during the period. This was done in collaboration with the RRL Club.

Social Get-together

A Social get-together was arranged in June 1961 and one of the highlights of the programme was a variety entertainment staged by the laboratory staff.

I must express my sincere thanks to the members of the Executive Committee who have always been helpful and co-operative. My thanks are also due to the President for his encouragement and guidance. Finally, I thank you all for having given me the honour of serving the Association as a Secretary.

H. Gopalakrishnan
Secretary.

W·F·S·W News

Special Committee of Government Experts Responsible for Drawing up a Draft Recommendation on Technical Education

WFSW has been invited to be represented by an Observer at the meeting of a Special Committee of Experts from both the technical and the legal fields appointed by Member States, on the subject. A tentative report is being drawn up which will contain the analysis of the replies which various Member States and certain international nongovernmental organisations have given to questions put to them in the preliminary report. This will also include preliminary draft of the Recommendation prepared by the Secretariat. At the first meeting of this Comittee to be held at UNESCO Headquarters in June-July 1962, the preliminary draft recommendations submitted by representative of Director General and Standing Orders for this committee will be considered in addition to the procedural matters.

The Sub-Committee will consists of Experts appointed by various members of States of UNESCO who will represent this case Representatives of United Nations Organisations, Specialised Agencies and the International Atomic Energy Agencies may also take part, in the work of the Committee. Other observers from international organisations will also be invited by the Director General for addressing the Committee. Any suggestion from the ASWI or the Indian Regional Center in regard to the work of the above Committee may please be sent to the Kanpur office.

SEVENTH GENERAL ASSEMBLY

Here is given at this stage certain information about the meetings in which the World Federation of Scientific Workers will be involved during the month of September 1962.

The symposium on "Higher Scientific and technological Education" will meet at the Lomonosov University of Moscow, from 9 to 13 September 1962. I would remind you that this Symposium is being convened and organised jointly by :

— The University of Moscow.

— The Bauman Technological Institute of Moscow.

— The Lenin Pedagogical Institute of Moscow.

— The World Federation of Scientific Workers.

Further information will be sent to you as soon as possible from the Organising Sub-Committee, after its meeting planned for 10 and 11 April, 1962 in Vienna (Austria).

The Seventh General Assembly of the Federation will also be held at the University of Moscow.

The first session will probably take place on the evening of 13 September 1962.

The days of 14 and 15 September 1962 will be entirely devoted to the General Assembly.

Short meetings of the Bureau and the Executive Council are also planned. The time and place of these will be fixed later.

Affiliated Organisations and Members of the Executive Council are asked to send to the Secretary General, *by* 15 *June* 1962 *at the latest* :

(a) their proposals for amendments to the Constitution;

(b) their propasals for Resolution for the General Assembly;

(c) their nominations for members of the new Executive Council.

You will also find as annexes to this circular proposals submitted by the Association of Scientific Workers (U. K.) and by the Secretary General.

Representation at the General Assembly

In accordance with article 17 of the Constitution each Affiliated Organisation is entitled to the following representation:

1 delegate for a membership below or equal to 1000.

2 delegates for a membership between 1000 and 5000.

3 delegates for a membership between 5000 ane 15000.

4 delegates for a membership above 15000.

Voting rights are set out in article 18 of the constitution.

Each Affiliated Organisation also has the right to propose sending Observers. In order to make the necessary arrangment, I shall be grateful if you will be good enough to indicate to me *as soon as possible* your intentions in this matter.

Those taking part in the Symposium will be cordially invited to attend our General Assembly as Observers. The same is true for Corresponding Members.

Finally I would remind you that Affiliated Organisations in countries which have no representative on the Executive Council are entitled to appoint an Observer to attend the meeting of this Council. Similarly, Corresponding Members may be invited by the Secretary General to attend meeting of the Executive Council.

P. Biquard
General Secretary

Proposals for alterations to the Constitution from the Association of Scientific Warkers (U. K.)

Explanatory Note

The purpose of these proposals is to give the Executive Council somewhat more freedom in appointing editorial personnel and to put an end to the present situation where the choice of Central Editor is limited to the Honorary Secretaries.

Proposed Amendments to the Constitution

Article 28

To add "The Executive Council shall also appoint an Editorial Board and a Chairman of the Editorial Board who shall be a member of the Executive Council".

Article 31

To delete "the Central Editor" and substitute "the Chairman of the Editorial Board".

Article 32

To delete "(one of whom shall be the Central Editor)".

Resolution submitted by the Association of Scientific Workers (U. K.)

"That the General Assembly of the World Federation of Scientific Workers instructs the Executive Council to seek information from affiliated bodies as to the conditions under which scientists and technologists are seconded to work in other countries, particularly the underdeveloped countries. It instructs Executive Council to formulate a set of minimum recommendations on security and continuity of employment, the safeguarding of pension rights and other such questions which, if not dealt with satisfactorily, may prevent the secondment of the most suitable people."

Proposals for amendment to the Constitution presented by the Secretary General, on instructions of the Executive Council

Explanatory note

The importance of Corresponding Members and the increase in their number has made it necessary to clarify certain articles of the Constitution.

After consultation with Affiliated Organisations (circular W53/61 of 12 July 1961) and consideration by the Executive Council (22nd Meeting), the Secretary General proposes the following amendments:

Article 7 (new version)

The Executive Council shall have the power to nominate individual scientists as corresponding members. Such nomination may occur only after the Secretary General has investigated the qualifications and position of the scientist concerned and has made certain that the latter is well-informed on the activity and structure of the Federation.

Corresponding members may be nominated in only those countries where there is no affiliated organisation or where the proposed member is inelıgible for membership of the affiliated organisation.

This rule may be abrogated in certain exceptional cases, after consultation by the Secretary General with the affiliated organisation and with the express agreement of t e latter.

Corresponding members shall receive the publications of the Federation and certain circulars, as decided by the Secretary General.

Addition to Article 10

The annual subscriptions of corresponding members shall be fixed by the General Assembly.

Article 23 (new version)

Corresponding members of the Federation shall be eligible to attend the General Assembly and to speak, but they shall not be entitled to vote. They my be invited to attend meetings of the Executive Council as Observers or to take part in the work of Committees set up by the Federation.

Amendments to Article 26 of the Constitution

(Proposed by the Secretary General, in his personal capacity)

Explanatory Note

The application of article 26 has given rise to two types of problem:

(a) the 30 days grace can, in certain urgent cases, be too long;

(b) The application pure and simple of the rule of the majority may run the risk, in certain difficult cases of jeopardising the unity or even the existence of the Federation.

A certain flexibility should therefore be granted and it is to this end that the following proposal has been drafted

Proposed amendments

(a) replace the phrase in brackets in the second sentence by: (ensuring not less than thirty days grace after the receipt of the notice, except in urgent cases when the Secretary General shall effect the consultation by telegram giving a date which shall neverthless ensure not less then ten days grace).

(b) add the following paragraph at the end of the article: Should such a majority decision involve the risk of jeopardising the unity or the existence of the Federation, the Secretary General may, after consultation with the President and with the express agreement of the latter, deem unanimity essential. In such a case the Secretary General shall transmit an explanatory report to all affiliated organisations.

3 Lektion

Dear Friends,

Prem and Krishna were much interested to learn something about Germany's geography as well as details about towns and cities. Therefore, Mr. Walter Schmidt brought a map of Germany for to-day's lesson. Here is the conversation that followed :

Walter : Hier ist eine Karte; das ist eine Landkarte von Deutschland. Hier ist Hamburg, und dort ist München. Hamburg liegt in Norddeutschland, und München liegt in Süddeutschland.

Prem : Liegt Bremen in Norddeutschland ?

Walter : Ja, Bremen liegt in Norddeutschland.

Krishna : Liegt Bonn auch in Norddeutschland ?

Walter : Nein, Bonn liegt nicht in Norddeutschland, sondern in Westdeutschland. Düsseldorf und Köln liegen auch in Westdeutschland.

Prem : Wo liegt Breslau ?

Walter : Breslau liegt in Ostdeutschland.

Krishna : Ist Berlin auch eine Stadt ?

Walter : Ja, Berlin ist auch eine Stadt. Berlin liegt in Mitteldeutschland. Deutschland ist ein Land.

Prem : Ist Indien auch ein Land ?

Walter : Ja, Indien ist auch ein Land. Indien liegt in Asien. Asien ist ein Kontinent.

die Karte/n	the map/the card	die Landkarte/n	the map
von	of	Deutschland	Germany
dort	there	München	Munich
liegen	to lie/to be situated	liegt	lies/is situated
Norddeutschland	North-Germany	Süddeutschland	South-Germany
Bremen	Bremen	Bonn	Bonn

sondern	but/on the contrary	Westdeutschland	West-Germany
Düsseldorf	Duesseldorf	Köln	Cologne
Breslau	Breslau	Ostdeutschland	East-Germany
die Stadt/Städte	the town/the city	Mitteldeutschland	Central Germany
das Land/Länder	the country	Asien	Asia
der Kontinent/e	the continent		

Now we shall have a few minutes cf grammar. As you remember last time we had the article and have learned that there are three genders in the German Language. Besides the definite article, there is the indefinite. As you can see from the examples below, in German, as it is in English, there is no plural form of the indefinite article.

unbestimmt :	**Singular**	**Plural**
(indefinite)		
masculine	ein Schüler	Schüler
neuter	ein Heft	Hefte
feminine	eine Schule	Schulen
unbestimmt negativ :		
masculine	kein Schüler	keine Schüler
neuter	kein Heft	keine Hefte
feminine	keine Schule	keine Schulen

nicht ein (not one)=kein,
nicht eine (not one)=keine (feminine and plural)

4. Lektion

Dear friends !

For to day's lesson Prem, Krishna and Walter meet at Walter's residence. Read now what Walter tells his friends while showing them his room :

Walter : Hier ist ein Zimmer. Es ist mein Zimmer. Das Zimmer ist gross. Es hat einen Fussboden, eine Decke und vier Wände. Vorn sind die Fenster. Dort sind auch ein Tisch und Stühle. Hinten hängt ein Bild. Rechts ist die Tür und links hängt die Landkarte. Oben hängt die Lampe.

Let us begin our lesson now. Walter shows a pencil to Prem and asks Prem ;

Walter : Was habe ich hier, Prem ?

Prem : Sie haben einen Bleistift.

Walter : "Gut, Prem ! Und wie heisst der Plural ?"
Prem sagt einen Plural. Aber der Plural ist nicht richtig, er ist falsch. Walter wiederholt die Frage : "Wie heisst der Plural von "der Bleistift", Krishna ?

Krishna : "Die Bleistifte".

Walter : "Richtig ! Lernt immer den Artikel und den Plural ! Dann macht Ihr keine Fehler. Krishna, bilde jetzt einen Satz bitte !

Krishna : Der Bleistift ist lang.

Walter : Gut, und was ist das Gegenteil von lang ?

Krishna : Das Gegenteil von lang ist kurz.

Walter : Richtig, danke !

das Zimmer	the room	ein Zimmer	a room
gross	big/large	es	it
hat	has	der Furssboden	the floor
ein Fussboden	a floor	die Decke	the ceiling
eine Decke	a ceiling	vier	four
die Wand/Wände	the walls	vorn	in front/before
sind	are	das Fenster	the window
der Tisch/e	the table	der Stuhl/Stühle	the chair/s
hinten	behind/at the end	hängen/hängt	to hang/hangs or is hanging
das Bild/er	the picture/painting/photo	rechts	right hand side
die Tür/en	the door/doors	links	left hand side
oben	above/at the top	die Lampe/n	the lamp
beginnen	to start/to begin	mit	with
der Unterricht	the lesson	zeigen/zeigt	to show/shows
was	what	haben	to have
wie	how	wie heisst	what is the name of
sagen/sagt	to say/says	falsch	incorrect/wrong

wiederholen / wiederholt	to repeat/repets	die Frage/n	the question/questions
lernen	to learn	immer	always
dann	then	machen/macht	to make/makes
ihr	you	der Fehler	the mistake
bilden	to compose	der Satz/Sätze	to compose
bitte	please	lang	lang
das Gegenteil	contrary	kurz	short
Danke	thank you		

Translation of conversation (2nd lecture)

Good Day

Prem : May name is Prem Agarwal. I am Indian and learn German. I go to the school.

Walter : I am a German (national) and work in India. My name is Walter Schmidt. Prem is my friend.

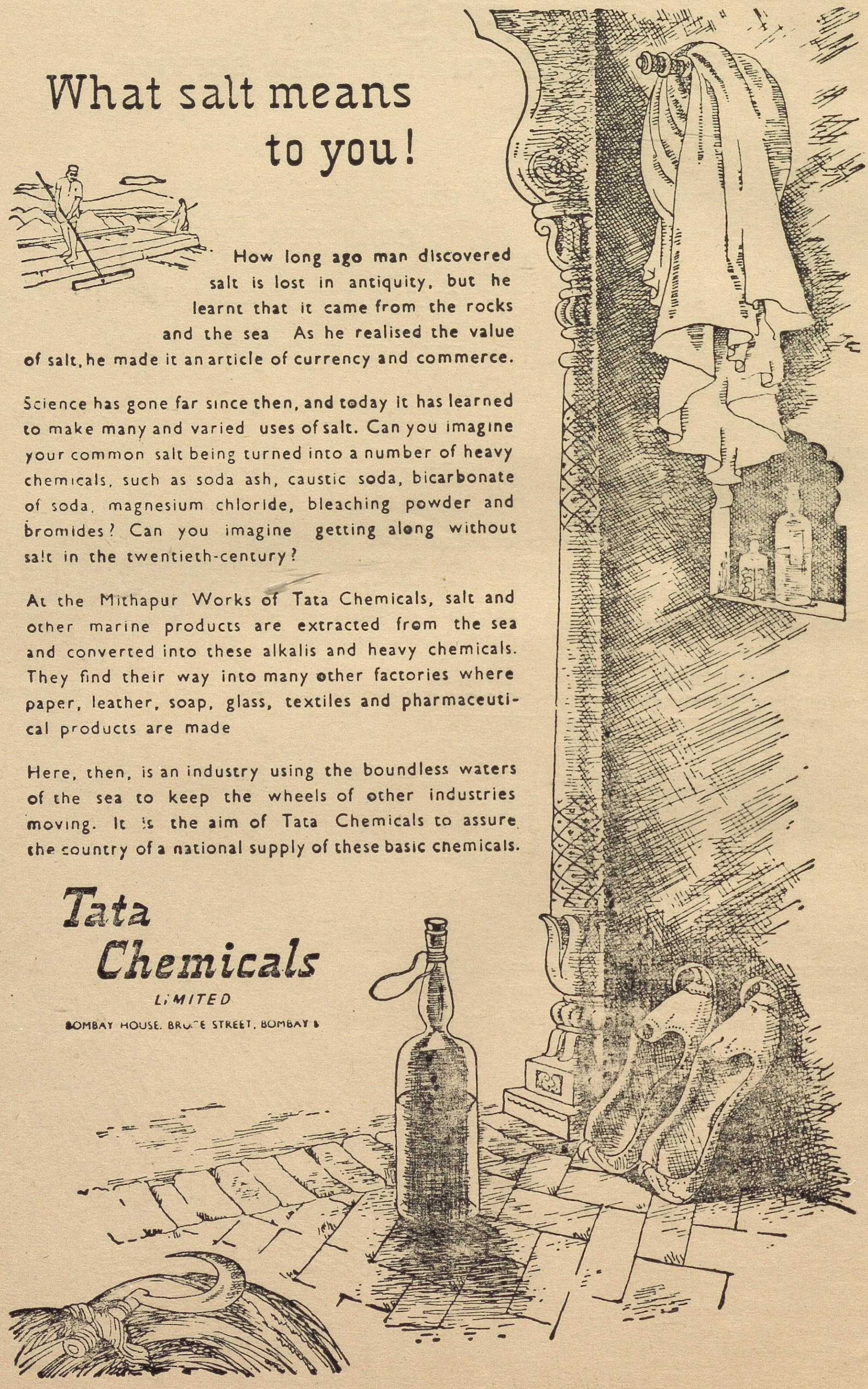
Prem : Walter is the teacher and I am the student. I work much and I am diligent.

Walter : Yes, it is right; Prem is not lazy, he is diligent.

Prem : Where is Krishna ? Does/has he not come ?

Walter : No, he does/has not come. He is on vacation but we now learn German (language), I ask and you answer. Here is the book. Here is also the copy book, the fountain pen and the pencil. We learn the rules and practice the grammar.

ALL NOUNS in German language start with a CAPITAL letter.


What salt means to you!
How long ago man discovered salt is lost in antiquity, but he learnt that it came from the rocks and the sea As he realised the value of salt, he made it an article of currency and commerce.
Science has gone far since then, and today it has learned to make many and varied uses of salt. Can you imagine your common salt being turned into a number of heavy chemicals, such as soda ash, caustic soda, bicarbonate of soda, magnesium chloride, bleaching powder and bromides? Can you imagine getting along without salt in the twentieth-century?
At the Mithapur Works of Tata Chemicals, salt and other marine products are extracted from the sea and converted into these alkalis and heavy chemicals. They find their way into many other factories where paper, leather, soap, glass, textiles and pharmaceutical products are made
Here, then, is an industry using the boundless waters of the sea to keep the wheels of other industries moving. It is the aim of Tata Chemicals to assure the country of a national supply of these basic chemicals.
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CONTENTS

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

Editorial

In continuation of editorial of the previous issue of this journal we would like to impress in this issue the importance of Systematic scientific education upto the secondary stage to begin with. The present day hotch potch system of teaching of science is not only nonconducive to development of scientific taste but is in a way opposing it. It is perhaps widely (mis) uuderstood that practical lessons in science should be undertaken only at the fag end of the secondary education period. It is not appreciated that the mind of the child in the earlier stages of secondary education must be trained to look to science as not only one of the many subjects to be mugged up for passing an examination but also to satisfy the inborn hunger and the thirst of the child for knowledge. This training can be best imparted more by practical lessons and less by theoretical groping in the dark. The practical demonstration by the teacher or through audio-visual gadgets will create a love for the subject and elementry harmless bench work by a junior student will be thrilling to his young mind.

During this period of life, the child is forced into tho role of an adult for one minute and that of a child in the next and if not guided properly he tends to be confused. Theorising much about science at such a vital stage will create a perpetual repellancy in the mind of the student and it may require a Herculian effort later on to change his wronge attitude thus developed.

In the light of the requirements of a democratic industrialised and complex society the educational needs of the individuals have to be broadened. Even an arts student who is going to take up commerce or history as his field of work must possess a working elementry technical knowledge not by studying science as one of the many subjects but as a working tool during his education period. Audio-visual materials like objects and models; diagrams, charts, graphs, cartoons and posters; maps and globes; flat pictures; filmstraps, recordings, transcription and tapes; motion pictures, radio and television will be of great help in inculcating the right type of attitude of mind for a pre-graduate student. If the investigational bend of mind is not deyeloped at this stage evolution of a true scientist, will be hampered beyond repair.

Specific journals to meet the demands of budding scientist, depicting scientific fact in the language of children (in form of say fairy tales) and urging the student to perform some simple practical experiments even to demonstrate a'magic instinct' are the burning necessities for education at this age. It is an encouraging point that some of the periodicals and weeklies have taken up this type of impressive presentation but it is still much below the minimum requirem nts of the society. We have to enlarge and expand this type of general attitude towards scientific education at the secondary stage if we want future generations to have the required scientific/technical personnel on a massive scale-the paramount need of the hour.

Science News

IRON FROM THE SEA

Many people have been puzzled to find the yellow sands of the Black Sea Caucasian shores occasionally marked by spots of something greasy, heavy and dark.

Now and again, a wave coming on to the shore leaves a thin black edging on its retreat. And the further south you go, the more frequent are these curious spots.

In autumn and spring when high billows chase one another, the surf brings ashore a wide layer of black sand, more than foot thick.

A skin diver can find lots of this sand on the flat sea bed less than a half mile off shore.

There the water is shallow, not more than 12 to 16 feet deep and the bottom seems covered with a black shroud.

Iron 'Sand'

This black sand from the Black Sea was found in a laboratory of the Institute of Ore Geology. It was pure powdered iron.

Does this mean that, at the bottom of the Black Sea, there lies a big body of ore? It was quickly disabused! Nothing of the kind!

From where then, does the black sand come? "It has been washed down from the mountains," the scientists explained.

A river cooks up a "puff-pastry" in its estuary. Light particles of quartz, hornblende and felspar remain on shore, while the heavier magnetite—magnetic iron ore—shifts farther out into the sea, and settles there not far from the coast.

In stormy weather the waves drive it back on to the shore, to provide clues to iron deposits on land.

Confirmation

Boreholes have confirmed the forecasts. Explorations down to the easily accessible minimum depth of about 600 feet showed here that there were hundred of millions of tons of high-quality magnetite concentrate, with an iron content at least 70 per cent.

And samples taken at levels, even down to 1' 500 feet have shown an iron content almost identical with that of the coastal strip.

Is this ore profitable to mine? Its deposits are scattered over relatively large area, and some parts of it are below water or marsh.

A suction dredger will be used to 'mine' it on shore and afloat. The machine will suck in the sand—yellow and black or pulverised rock—from which the ore will be seperated out magnetically.

The suction dredger will indeed do two jobs, for by discharging the water into a drainage system it will reclaim the marshlands as well.

This coastal area, stretching for 60 miles, and the Kolkhida lowland with their resources of black sand will supply Transcancasian industry with plenty of ore for many years to come.

× × ×

The Underground Hydro-Electric Station

A surveying party came to the Sayany Mountains. They made their camp near the village of Maina on the bank of the Yenisei River, in the place where the mighty river breaks through the mountains. The geologists, surveyors, drillers, in fact every member of the expedition, press hard to complete by the spring-time the surveys so that the project report could be made and the hydro-electric station site be selected by the end of the year. It is going to be an unusual station. Its rock-filled dam in the canyon will be only 855 meters long which is nothing out of the ordinary as the modern hydro-electric giants go, but the designed 225 meters of the dam high are quite impressive. This height is nearly twice that of the Bratsk dam. The builders will cut two tremendous tunnels in left bank by which the Yenisei is to flow. This will have to be done so that the river should not hamper the operations to fill the dam.

As stone is placed into the dam a 200-meter tunnel will be driven in the rock of the right bank. Deep underground this tunnel will house the machine hall of the power station, with six units of upto 840,000 kw capacity each. One unit of the Sayany hydro-electric Station will have more capacity than that of the Dnieper Hydro-electric Station.

The original idea of the hydro-scheme layout was suggested by the terrain, while the fact that the power house will be constructed at the same time as the dam is to contribute greatly to time saving.

The Sayany Hydro-electric Station is going to be most economical power station in the Soviet Union. The cost of its energy will be 3 kopecks per 100 kwh. This is three to four times less than the cost of the power produced at the most efficient thermal stations of the country.

× × ×

New Uses of Solar Energy. Desert Irrigated With Aid of Sun

A bold scheme of conquering deserts has been advanced by some Soviet soler power experts. The same sun which dries up the land and burns all vegetation can help provide this land with water and cool the torrid atmosphere.

In recent times Soviet specialist have designed and partly built solar power installations needed to create an experimental "solar oasis" in the desert.

The main weapon of solar conquest of arid lands is the solar thermal power station (STPS) with which it will be possible to irrigate 5,000 hectares of land with water from artesian wells. The STPS is a 40-meters tower with a steam boiler attached to it. As many as 1,300 miror carriages circle the installation and automatically focus solar rays.

The STPS is adapted to distil drinking water and turn out ice for the food industry. Also effective are the solar Kitchen range, boiler, fruit and vegetable dryer and many other arrangements.

The scientific discussion brought out new fields of appliance of solar energy. The Turkmenian solarpower experts have been hailed by their colleagues elsewhere for havtng created a solar refrigerator. The Armenian seientists have experimented with the application of solar energy in testing elecric insulation materials which reduced this complicated process from five-six years to only one year. The Uzbek physicist have conceived the idea of using solar photocells to effect automatic remote-control of irrigation systems.

Plantations in Space

Plantations of the alga chlorella which will supply the crews of spaceships with regenerated oxygen, high-calorie food and vitamins have been designed by scientists in Leningrad.

The plantations are electronically cotrolled to maintain the conditions in which the chlorella will reproduce most effectively.

One type of installation consists of a series of troughs coated on the inside with polythene.

Nutritive salts circulate through the troughs in a solution into which is piped the carbon dioxide breathed out by the crew.

Small quantities of the alga seeded into the troughs quickly form a solid green mass which is extracted by means of a centrifuge and converted into food.

An alternative type of plantation uses a cascade of tanks instead of the trough system and has already shown very promising results in test which simulate closely the conditions which would be expected to obtain in a real flight.

Picture and Sound on Tape

An original video tape-recorder has been designed at the USSR Research Institute for Sound Recording. The instrument looks much like an odinary tape-recorder, but the tape is different. It can carry not only sound, but any picture that may be directly reproduced on a television screen without additional processing. Mass production of video tape-recorder is to be started and in a few years any consumer will be able to buy video tape-recordings of the finest theatrical productions films or variety concerts or of their favourite football team in an exciting game. It will be possible to reproduce picture and sound through the video and sound arrangement that will replace the conventional television set.

× × ×

Device to Tell Sex in Womb

Expectant mothers will soon be able to tell within 3 weeks of conception of the sex of the child they will bear. A new electronic device called the "argon chromatograph" costing about £ 700/- was displayed recently to scientists and doctors who attended opening of a new scientific instrument factory at Cambridge. The 'chromatograph' operates by analysing the steroids in the blood of pregnant women and could decide the sex of the foetus within 20 minutes.

Articles

CO-OPERATIVE EFFORT IN EXPLORATION OF SPACE

New European Organization Comes Into Being

By Keith Bean

Seven governments have singned the convention establishing the European Launcher Development Organization (ELDO)—Britain, Australia, Belgium, France, the Federal Republic of Germany, Italy, and the Netherlands. The organization will be setting up its headquarters in Paris within the next month or two. Already, scientists and engineers from the member countries have been working in co-ordination on the technical details.

The birth of ELDO is significant not only as creating a major third force in the exploration of space, but also because it demonstrates again the great potential which Western Europe can mobilize when it sets itself to co-ordinated co-operative effort.

Britain, particularly, has conducted a vigorous space research programme since 1955, and France has ambitious plans, but by combining together and joining their European neighbours and the Australians they make possible a comprehensive advance on a wide front.

Initial Programme

A questionnaire circulated last year revealed that some 55 research groups in a dozen European countries were interested in space research and had in mind some 150 experiments.

These countries—besides the European members of the ELDO group, they comprise Austria, Denmark, Norway, Spain, Sweden, and Switzerland—are expected to sign another convention about the middle of this year which will establish a European Space Research Organization (ESRO). The initial eight-year programme which the preliminary commission has worked out envisages the launching of some 440 sounding rockcts, 22 small earth satellites, eight deep space probes, four stabilized astronomical satellites, and two moon satellites. It is expected that ELDO launchers will be used to put up ESRO satellites.

Such a prospect would obviously put a big strain on the resources of even the richest West European nations, but when countries combine to mobilize their finance and their brain power it becomes plainly practical.

The first five years of ELDO's grogramme is expected to call for an expenditure of nearly £ [illegible]0, 000,000 (of which Britain will contributed £ 27,000,000), and the initial ESRO programme can be very roughly estimated at £ 100, 000,000, of which Britain will contribute a quarter.

Rocket Ranges

Australia's accession to ELDO makes it possible to use the Woomera rocket range for launching satellites. British scientists have already paid tribute to the valuable and extensive efforts of Australia scientists in the British space research programme. Fifty-one Skylark sounding rockets and some Black Knight rockets have been launched from Woomera, which, as the only permanent range in the Southern Hemisphere, provides data unique for those latitudes.

In addition, the ELDO and ESRO projects will doubtless have at their disposal ranges already set up by other member countries.

These new international groups will also be able to muster a formidable array of stations for tracking satellites and picking up the vast flow of data telemetered back to earth.

Britain, for instance, has the giant Jodrell Bank radio-telescope, which has received singnals from the American Pioneer V millions of miles away and also tracked the Soviet "Venus Probe" into deep space. Britain has, too, telemeter reception stations in England, the Falkland Islands down on the South Atlantic, and Singapore. All these and another station aboard a Naval ship near the island of Tristan da Cunha are in operation now that Britain's first satellite has been launched from America.

Visual Observation

Equally extended will be the new international organizations' means of visual observation of satellites—sometimes more accurate than radio-tracking. Britain has kine-theodolites in England, Scotland and Malta, and she also uses reports from a few amateur astronomers who have become very experienced in tracking the small, high and faint satellites with binoculars.

Australia proposes to establish a station to guide the ELDO rockets so that the satellites will "settle" into their correct orbits.

The first ELDO launchers, it is envisaged, will be three-stages vehicles—the first stage being Britain's Blue Streak, the second a French rocket, and the third a rocket developed under German leadership.

The Italians will take the lead in the development of the test satellites themselves, and the other countries will concentrate on tracking systems and other instrumentation.

One of the great advantages which can be foreseen from the establishment of ELDO is that, with a purposeful programme to go into space, its member countries will experience extensive side benefits which will spread widely throughout their industry. Space flights call for all sorts of new techniques and new materials, and American experience has already shown that the experimental and development work on rockets seeps through to improved industrial practices and consumer goods in thousands of ways.

All member countries of ELDO will freely exchange technical information gained in the organization's work. All will have the opportunity to join in the scientific, engineering and other activities. All will be able to enjoy the commercial benefits which will flow from them.

TECHNOLOGICAL EDUCATION IN BRITAIN

COURSES, QUALIFICATIONS AND SCHOLARSHIPS

The British system of technical education is probably more flexible than any other, and there are several routes by which any able student can achieve professional qualifications in technology.

Technological Courses

Apprentices entering industry on leaving secondary modern or secondary technical schools (or the equivalent schools in Scotland and Northern Ireland) train to become craftsmen at the age of 21. Their works training is supplemented by attendance at the local technical college for part-time day or evening classes preparing them for the certificates of the City and Guilds of London institute or equivalent qualification. There are opportunities for the best craft apprentices to transfer to courses leading to professional qualifications, but most future technologists will be educated up to the age of 17 or 18 at a secondary grammar school (senior secondary school in Scotland) or an independent school before proceeding to a university or major technical college to pursue a full-time degree course, or entering on a course of industrial training combined with attendance at a technical college. The latter courses are arranged in a variety of ways. It is becoming increasingly the practice of firms to allow release to technical institutions for one day a week, or for several months at a time (in the case of advanced students) for 'sandwich' courses. There is also a wide range of technological courses provided by correspondence colleges.

At universities in Britain a course of three or four years' full-time study leads to a first degree. In the technological faculties of most universities this is a Bachelor of Science (B. Sc.) degree, but at Oxford and Cambridge the first degree in every faculty is that of Bachelor of Arts (B A.) and in some universities the degree is named after the particular branch of study as in Bachelor of Engineering (B.Eng.) or Bachelor of Metallurgy (B. Met.). An advanced course at a technical college may lead to a university degree, to the Diploma in Technology, to the membership examinations of the appropriate professional institution, to the college's own qualification or to a Higher National Certificate or Diploma. Further research work will be needed to qualify for Membership of the College of Technology.

The National Certificate and Diploma schemes are operated by joint committees of the Ministry of Education for England and Wales, the Scottish Education Department or the Ministry of Education for Northern Ireland, the industries and the professional institutions concerned; the examinations in the final year are subject to assessment by assessors appointed by the institutions.

The National Certificate schemes were instituted shortly after the first world war. They are intended for part-time students employed in industry and are designed to set a minimum national standard representing continuous part-time study for five or six years from the age of 16 or 17. An Ordinary National Certificate is normally taken after three years' study, and a Higher National Certificate after a further two years. The Higher National Certificate is a qualification of approximately first degree standard in the subjects taken but being based on a part-time course it is necessarily narrower in scope.[1] Endorsements in respect of additional subjects may be awarded on the results of further study.

The diploma schemes, which at present attract fewer students, are designed to set a similar standard for full-time and (especially) 'sandwich' courses. An ordinary National Diploma is awarded on two years' full-time study, usually started at the age of 16. The Higher National Diploma requires three years' study and covers approximately the same ground as a university degree course. Students usually enter the course direct from school at the age of 17 or 18, or after a period of employment combined with part-time study.

The Diploma in Technology granted by the National Council for Technological Awards is denoted by Dip.Tech. (Eng.) for engineering and by Dip.Tech. for other technologies, and may be awarded in two honours classes and at a pass level. The minimum age of admission to recognised courses is normally 18 and the standard of admission that of the General Certificate of Education[2] with two appropriate subjects at advanced level and three subjects at ordinary level, or a comparable standard such as that of holders of good Ordinary National Certificates. Practical and academic training is integrated in the courses recognised for the award. These consist either of at least three years' full-time study at a major technical college together with suitable industrial training over an aggregate period of at least one year, to be completed by the end of the study course, or of a sandwich course covering at least four years' academic studies in a major technical college and including organised studies during the periods of practical training in industry. Courses recognised for the award include a thorough education in the fundamentals of science and technology and their application to development and design as well as liberal studies and some instruction in the principles of industrial organisation.

The diploma course is equivalent in standard to an honours degree course at British universities. A higher award, admission to membership of the College of Technologists, is planned as a mark of outstanding distinction for postgraduate level work carried out jointly in industry and a technical college over a period of three years.

Scholarships and Other Awards

Scholarships and other awards are now very widely available, for it is the national educational policy that no able boy or girl shall be prevented by lack of means from pursuing a university or other advanced course of study. The Ministry of Education offers over 2,000 State scholarships annually on open competition for students wishing to pursue full-time honours courses at universities and, in addition, supplements open scholarships and exhibitions at universities up to a number between 1,300 and 1,600 every

1. A team of specialists from Britain who visited the United States of America in 1951 estimated that holders of Higher National Certificates were, in their narrower technical field, advanced as far as, if not further than, the holder of a first degree from a university in the United States, whose standard was approximately that reached by the end of the second year of a degree course at a university in Britain. (See *Universities and Industry*, a report of the Anglo-American Council on Productivity, 1951.)

2. The General Certificate of Education examination is normally taken in England and Wales by grammar school pupils and an increasing number of secondary modern school pupils at about the age of 16 at ordinary level and at about 18 at advanced level.

year! Furthermore, the local education authorities (LEAs) are now making over 15,000 major awards each year to enable suitable quilified students to go to universities. These figures, for both ministry and local authority awards, cover courses in all faculties, but a substantial proportion of the awards are held in science and technology.

In addition to this general provision, there are certain special arrangements to enable students to follow technological courses. The number of Technical State Scholarships (for students not straight from school) awarded annually by the Ministry of Education was raised in 1957 from 150 to 225, and will be increased further as occasion demands, in particular, as courses are developed to lead to the Diploma in Technology. State scholarships were formerly tenable only for honours degree courses, in any subject, at universities and university colleges, but from 1956-57 they have been also tenable in technical colleges for approved courses leading to the Diploma in Technology. The local education authorities also make considerable numbers of grants at major award rates to students intending to pursue full-time courses at technical colleges and other institutions of further education, and the total number of State and LEA scholarships to students at technical colleges has risen from 2,330 in 1952 53 to 7,656 in 1958-59.

In Scotland, the award of bursaries is primarily the function of education authorities who are empowered to provide such assistance for students from their areas. The award of bursaries is not dependent upon examination results in the same way as in England and Wales, and applicants are generally regarded as eligible if they have the necessary entrance qualifications and can secure admission to the course they propose to follow. Awards are assessed to cover tuition fees, books, travelling expenses and an adequate maintenance grant. There are also some scholarship available from various endowments, from the universities and from the Carnegie Trust for the universities of Scotland.

Northern Ireland university and further education scholarships are awarded by the various local edncation authorities to assist students to follow full-time courses at universities and institutions of further education. The number of such awards has risen from 898 in 1952-53 to 2,469 in 1958-59. State exhibitions are awarded by the Ministry of Education and are tenable for a maximum of four years. The holder of a State exhibition is required to pursue a full-time honours course at a university and the awards are supplemented by university scholarships granted by the local education authorities. A substantial number of these scholarships are held in science and technology.

The Ministry of Education for Northern Ireland also awards postgraduate studentships for training in methods of research and for advanced courses in science and technology at universties and colleges. In 1958-59, 42 such awards were held.

The Department of Scientific and Industrial Research (DSIR) offers nearly 1,900 postgraduate studentships and fellowships in science and technology and the number is expected to rise to about 3,800 by 1963-64 at a cost of over £1½ million. In addition, the amount of money available under the DSIR

For fuller information on awards tenable at universities see COI reference paper R. 4124, *Universities in Britain*.

scheme of grants for special research—to assist investigations into projects in science and technology at universities and colleges—is expected to increase to about £1¾ million for 1963-64. The DSIR also makes awards for study and research abroad.

The Ministry of Aviation (formerly the Ministry of Supply) awards up to ten scholarships a year for civilians to attend the Royal Military College of Science for a three-year course leading to degrees in chemistry, physics mathematics or engineering.

Boys whose academic qualifications admit them to the honours degree course of the engineering faculty of a British university may apply for Birfield university scholarships. Up to three a year are awarded by the Birfield Group (of 23 industrial companies): they cover tuition fees plus £325-£350 a year during university training and two years engineering apprenticeship follow with a starting salary of £550-£700 a year: a staff appointment satisfying the requirements for membership of a professional engineering institution will be made at the end of the apprenticeship.

Imperial Chemical Industries (ICI) which already contributed financial aid valued at about £250,000 to the universities each year in the form of grants, scholarships and fellowships, in 1956 instituted a scheme of about 50 scholarships a year at five universities to facilitate the transfer to science courses of suitable students who have qualified for admission to an arts course. The value of the scholarships is based on State scholarship rates and provides for the first year at the university during which the students take a specil preliminary science course. The students then become eligible for the ordinary State or local authority awards, but ICI continues to make small awards of 30 to 50 a year to those who pass on to an honours science course. The universities taking part in the first instance were Oxford, Cambridge, London (Imperial College), Durham (King's College, Newcastle) and Liverpool, and in 1957 Birmingham, Bristol and Sheffield came into the scheme, which now offers 65 scholarships a year.

Up to 20 scholarships in civil engineering (£300-£400 a year) are awarded to young men obtaining places at universities by the Association of Consulting Engineers and the Federation of Civil Engineering Contractors. The English Electric group of companies also offer 30 scholarships (£450 a year) to students reading for an honours degree in engineering, applied science, mathematics or any technological subject related to the engineering industry.

The National Coal Board offers up to 100 university scholarships a year, covering free tuition and a maintenance allowance. The board has awarded 813 scholarships for university courses in mining and other branches of engineering since 1948, including 430 to employees and 383 to external applicants. The board also awards non-technical scholarships to employees for university degree courses in sciences and subjects other than engineering. (All the industry's future managers will not come from the universities; however, part-time study by men working in the industry will still provide a large proportion and this method of working for promotion, traditional in coal-mining, is encouraged by the offer of paid release for study during working hours.)

There are also open scholarships awarded by individual universities and colleges. For instance, as a memorial to Mr. Maurice Lubbock, founder of a firm of engineering consultants and chairman of a number of engineering companies, an open scholarship in engineering at his old college (Balliol, Oxford) has been endowed by the companies. There are scholarships available at Manchester College of Science and Technology for chemistry, engineering and other subjects allied to textile technology. Similar scholarships, exhibitions or bursaries are available at nearly all universities: some date from the nineteenth century, while others have been created as recently as the present decade.

(*Courtesy British Informations Services*)

RESEARCH ORGANISATIONS IN CANADA—II

Defence Research Board

Four basic responsibilities set the pattern for the operations carried out by the scientific staff of the Defence Research Board, an integral part of Canada's Department of National Defence and established in 1947.

These obligations comprise : the provision of sound scientific advice to the Minister of National Defence, the Chiefs of Staff and to the Armed Forces; meeting the research needs of the Armed Forces; contributing to the collective security of Canada and the western world through fundamental and applied research programmes; and encouraging research of defence interest within the universities and through other agencies.

Policy and operational direction emanate from the Defence Research Board, which comprises a chairman, vice-chairman, five *ex officio* members and a number of appointed members, usually numbering seven.

The chairman, who sits on the Chiefs of Staff Committee with the same status as a Chief of Staff, and the vice-chairman, are full-time salaried members. The *ex officio* members comprise the Chiefs of Staff for the Navy, the Army and the Air Force, the Deputy Minister of National Defence and the President of the National Research Council. The appointed members include a representative of the Department of Defence Production, outstanding university scientists and leading Canadian industrialists. All serve normally for three-year terms. The chairman possesses many of the financial and other powers of a Deputy Minister and reports directly to the Minister of National Defence.

Executive responsibility for carrying out the programme rests with the chairman who is assisted by several senior scientific officers and a senior administrative officer through a management committee.

Eight headquarters directorates represent the numerous active scientific fields of Canadian defence research and an additional two concern personnel and general servics. The Board's eight research laboratories, located across the country, are headed by chief superintendents or superintendents, depending on their size. The smallest, which also provides research facilities for visiting scientists, is the responsibility of an officer-in-charge.

Two senior scientific staff members are associated with the Canadian Joint Staffs in London and Washington and are known as Defence Research Members. Supported by their staffs, they facilitate the passage of scientific information between the board and appropriate research and development agencies in the two countries concerned.

Each of the three Chiefs of Staff is also provided with a scientific adviser who 'lives' with the Service concerned, working directly with that Service and the board. The incumbents are senior scientists who have risen to their posts through the various echelons within the defence research organisation.

Since 1947, the board has invested about \$C 90 million in physical assets, comprising well-equipped, permanent scientific laboratories. Of its total staff of 2,800,600 are professional scientists or engineers and 800 provide technical support.

The Defence Research Board activities have contributed usefully not only to Canada's defence programme, but also to defence science in general within the NATO alliance and particularly in conjunction with the programmes of the United Kingdom and the United States.

Nuclear Energy

At first, research and devlopment work in nuclear energy was undertaken jointly by Canada and the United Kingdom at Chalk River, Ontario. But, in 1946, this war-time partnership ceased with the setting up in Britain of the Atomic Energy Research Establishment at Harwell, and, in 1947, the Canadian National Research Council (NRC) assumed sole responsibility for the Chalk River project. In 1952, control passed from the NRC to a new Crown company—Atomic Energy of Canada Ltd. Under an Act passed by the Canadian Parliament in June 1954 to amend the Atomic Energy Control Act, 1952, the organisation was again changed. The name of the Crown company controlling the Chalk River project was changed to Nuclear Research Ltd., and a holding company, called Atomic Energy of Canada Ltd., was formed to hold the stock both of Nuclear Research Ltd., and of Eldorado Mining and Refining Ltd., the Crown company which, among other things, buys uranium ores and concentrates produced by private companies in Canada.

Canada's atomic energy establishment, located in Ontario on the Ottawa River five miles from the village of Chalk River, about 130 miles from Ottawa, is engaged in four main aetivities :

(1) development of economic atomic power;

(2) fundamental research;

(3) operation of nuclear reactors and separation of nuclear fuels (plutonium and uranium 233);

(4) production of radio-active isotopes and associated equipment such as therapy units for cancer treatment.

In 1946, an Atomic Energy Control Act was passed in Canada 'to make provision for the control and supervision of the development, application and use of atomic energy'. Under this Act the Atomic Energy Control Board was erected, with two main powers : (1) to regulate the production and application of materials relating to atomic energy, particularly fissionable materials; and (2) to make and administer security regulations required by the Canadian atomic energy programme.

Provincial Research Foundations and Councils

A number of Canadian provinces have research organisations, supported largely by the provincial government and conducting research on provincial problems. Each maintains an information service for the benefit of industry within the province and these services work in close co-operation with the Technical Information Service of the National Research Council and with scientific branches of federal Government departments.

The Research Council of Alberta, Edmonton, has been in existence since 1921. Its investigations cover a wide field including biological cycles, soil conditions, uses for coal, problems connected with the oil and natural gas resources, utilisation of tar sands, and studies of the development of hailstorms. The Research Council has its own building on the university campus.

The British Columbia Research Council, Vancouver, was established in 1954 to coordinate provincial research, initiate industrial research, and assist in developing research by means of scholarships and grants-in-aid. It does research work in co-operation with an industry, or for specific firms, on a payment basis, or on the council's own initiative. It has many interesting projects, particularly in fisheries, agriculture and mining and the secondary industries. It has had very rapid growth and is now established in its own laboratories at the University of British Columbia.

The Nova Scotia Research Foundation, Halifax, was established in 1946. It has no laboratories and its task is the stimulation of research in facilities already established in the province. It also arranges for research to be done elsewhere if necessary. It has arranged and financed surveys on minerals and other raw materials for industry and collected primary data on mining, soils, lumber, seaweed utilisation and land use in Nova Scotia. Its library and information service are at the disposal of industry anywhere in the province.

The Ontario Research Foundation, Toronto was established in 1928 for the improvement of manufacturing and other industry and the development of the natural resources of Ontario. This is a non-profit scientific organisation which udertakes research on a fee basis with the object of assisting public and industry in technological matters. Since it is established in a heavily industrialised province, its facilities are kept busy. It provides a number of scholarships and grants-in-aid of research at universities in Ontario.

The Saskatchewan Research Council, Saskatoon, was set up in 1947 to foster a programme of scientific and industrial research. Among its problems are the geology of Saskatchewan, beneficiation of uranium and other ores, antibiotics in milk supplies, building foundations suitable for Saskatchewan soils. Saskatchewan is primarily an agricultural province but industry is developing and the council will be able to make good use of its laboratories, opened at the University Saskatchewan in 1958.

(*Courtesy "The Promotion of The Sciences in The Commonwealth" London.*)

THE SUN WILL WORK FOR US

BN N. ZHFLEZNOV

"The last ton of coal on our planet was mined!" This sad news, economists assert, may resound throughout the world already in 2061. And as far as petroleum and gas are concerned, the reserves of these fuels will probably be exhausted even earlier, say at the end of the 20th century.

Such an unhappy picture is depicted by heliotechnicians as soon as the talk touches on the prospects of utilizing new forms of power, and specifically the energy of solar radiation.

The future generations, and perhaps the generation of the present-day schoolchildren, will wonder how our priceless wealth—the energy of the sun—was uneconomically used. For the sun brings our planet such an amount of heat which would suffice to evaporate the Azov Sea within several minutes. The earth receives in one year considerably more power than is contained in all the world reserves of power resources, excluding of course, the possible resources of thermonuclear energy.

From Solar Kitchen to Solar Electric Station

The first units compelling soler energy to do useful work (solar ktichens, bathhouse and driers) were made back in the thirties, but at that time work in this direction was considered more like an absorbing experiment: the efficiency of the initial solar transformers working on metal thermo-elements was too low. Thanks to the work of the pupils of the late Academician A. Ioffe in connection with the successes scored by the physics of solids, semiconductor materials have been obtained at the present time—thermoocuples which can provide an efficiency coefficiant of up to 13 per cent. This means that the utilisation of solar rays can hold a worthy place in the country's power balance already in the near future.

The staff of the heliotechnical laboratory is excited now bv the problem of creating within the next two or three years thermo-electric generators which would become the prototype of the power plant of the future. The process of the transformation of energy there will proceed as "cleanly, noiselessly and without any human beings' help" as when solar light turns into energy-rich organic matter in plants.

The second important direction in which a group of enthusiasts of the laboratory is now working is the elaboration of photoelements transforming radiant energy directly into electricity. Crystals with given properties obtained by physicists enabled heliotechnicians to create transformers with an efficiency of as much as 10-11 per cent.

In recent times photoelements too began to be used successfully for the transformation of solar energy directly into electricity. Scientists proposed that spherical mirors focusing the rays be used for increasing the "harvest" of energy obtained per unit of the photoelements' area The photoelements are cooled by water to prevent in such cases the inevitable overheating.

The concentration of solar rays as much as 160-fold led to a 70-fold increase in the output of electricity. Thus another path to the conquest of radiant energy has been discovered.

Solar Houses

The laboratory is flooded with sunlight. The sweltering July noon made the huge window facing Lenin prospect very hot.

"Come back in about two years," the staff members of the laboratory joked, "then we heliotechnical specialists won't have to feel embarrassed for receiving you in such a hot room. Special surfacing material with the properties of a semi-conductor put on the window panes will transform the warm sun-rays into coolness and bring fans and air moisteners into action.

The hosts of the solar laboratory drew for us a picture of the morrow of solar energy. Numerous solar combines will gather the "harvest" of radiant energy throughout the country, and especially in the countryside of the southern republics. In the next several years they will be able to release 50-60 per cent of the fuel in small-scale power consumption in our southern areas, where 50 million people live. These accumulators of solar energy will help set up and expand bases in deserts, improve the conditions for the growth of farm crops (heating the ground at times of frosts, watering the fields with warm water, creating the beat conditions for raising crops like *chlorella*).

The heliotechnicians enthusiastically talk about the "solar house" project, the prototype of the future residence. The roof of such a house will have additional functions to its main job now: it will serve as a sort of reception device of an electric station, which will provide an abundance of energy even for a multistorey house.

Scientific Activities In The World

PLANS FOR INTERNATIONAL OCEANOGRAPHIC EXPEDITIONS ARE ANNOUNCED BY U. S., U. S. S. R. IN PARIS

Plans for two large-scale oceanographic expeditions with international fleets of research vessels operating in the Atlantic and Pacific under the auspices of the Intergovernmental Oceanographic Commission have been announced by the United States and the U.S.S.R. at Unesco House in Paris.

The proposals were made at a three-day meeting of the bureau and the consultative committee (together composed of representatives of Australia, Argentina Brazil, Canada, France,/Federal Republic of Germany, Japan, Poland, the United Kingdom, the United States and the U.S.S.R.) of the Intergovernmental Oceanographic Commission.

The United States proposal calls for an international synoptic study of the tropical Atlantic with vessels operating simultaneously for a 30-day winter survey early in 19 3 and then a 30-day summer survey. Rear Admiral H. Arnold Karo, director of the U.S. Coast and Geodetic Survey, announced the proposal and added that a working group of the Commission's member states will meet to discuss the research project on May 28 and 29 in Washington.

Dr. Harris B. Stewart, chief oceanographer of the Coast and Geodetic Survey, explained that this intensive international study of the tropical Atlantic has been planned with both scientific and economic purposes in mind.

From the viewpoint of oceanographer research, the belt of the Atlantic spreading over five degrees of latitude on each side of the Equator is of unusual interest. Here, current systems of the North and South Atlantic meet and an underwater Equatorial current running exactly along the Equator from west to east (that is, in the opposite direction of surface currents) has been recently discovered.

Economically speaking, oceanographers are interested in exploring possibilities for the development of fisheries at the eastern end of the tropical Atlantic in the Gulf of Guinea. Such a development could open new sources of food for developing countries in Africa.

The proposal of the U.S.S.R. aims at large-scale joint international surveys of the northern Atlantic and Pacific at a later date, covering the period from 1964 to 1966 Presented by the Soviet National Oceanographic Committee, the proposal calls for four cruises and the simultaneous use of 2 research vessels in the Atlantic and 20 ships in the Pacific.

The purposes of this vast programme include the study of ocean currents; the ocean's influence upon the weather; physical, chemical and biological processes; gravitational, magnetic and electrical fields in the ocean; and the geological structure of the ocean floor.

The U.S.S.R. noted that such a study would be of great value in finding the answers to a host of problems, inculding weather forecasting, the use of the ocean's energy resources, the creation of rational fishing methods, and the development of a system for the prospecting and utilization of the ocean's mineral resources.

The bureau of the Intergovernmental Oceanographic Commission, at its Paris meeting, commended the Soviet proposal and asked that its scientific aspects be evaluated by the Scientific Committee on Oceanic Research (an offshoot of the International Council of Scientific Unions) so that it could be considered at the Commission's next plenary session to be held at Unesco House this September.

At this meeting, the bureau named Dr. William M. Cameron of Canada to serve as chairman of the Commission, replacing the late Dr. Anton Bruun of Denmark. Vice-Admiral V.A. Tchekourov of the U.S.S.R. is vice-chairman of the Commission.

SCIENTISTS ADOPT STANDARD LEGEND FOR WORLD MAPS OF WATER RESOURCES

A standard international system of signs, symbols and colours to be used on maps of the earth's water resources has just been adopted by scientists from eight countries at meeting in Unesco House in Paris.

The meeting brought together experts from the Federal Republic of Germany, France, Hungary, the Netherlands, Morocco, Tunisia, the United Kingdom and the United States who represented two scientific groups—the International Association of Hydrogeologists and the International Association of Scientific Hydrogeology—working on the problem. Observers from Unesco and the UN Food and Agriculture Organisation also participated.

The purpose of the meeting was to devise a standard legend instantly legible both to scientists and laymen—particularly economic planners and farmers—who are confronted by the earth's growing shortage of water in both its dry and wet zones. At present, five systems and symbols are in use in the Federal Republic of Germany, France, Morocco, the United States and the U. S. S. R. The Moroccan system was taken as the basis for the new standard international legend, because for scientific and technical reasons, all countries could adopt it easily.

The hydrogeological map itself is not much more than a dacade old. On a scale ranging from 1:5,000,000 down to 1:20,000, it groups data on climate, surface water, the permeability of rock formations, and the underground water table. Accurately drawn, it enables the engineer to pinpoint the exact depth where water can be found at a given point and the flow which a well can be expected to yield.

Such maps are of extreme importance to hydrogeologists, Unesco officials explained, because economic factors require them to be far more accurate than oil prospectors. The problems of finding water and oil are the same—but the geologist need only be right 15% of the time when he is looking for oil. When prospecting for water, he has to succeed in 85% of his drilling operations to keep his balance sheet in the black.

ARTHUR C. CLARKE, BRITISH SCIENCE WRITER, IS SELECTED AS WINNER OF KALINGA PRIZE

Mr. Arthur C. Clarke, British science and science-fiction writer, has been selected as the tenth winner of the international Kalinga Prize of 1,000 pounds sterling for the popularization of science, it was announced at Unesco House in Paris.

The Kalinga Prize, awarded by an international jury appointed by Unesco, is a personal donation by Mr. Bijoyanand Patnaik, an Indian industrialist, who is Chief Minister of the State of Orissa and a director of the Kalinga Foundation, named after the empire ruled by the peace-loving Asoka in India twenty-two centuries ago.

Mr. Clarke, whose home is in Ceylon, was nominated by the Ceylon Association for the Advancement of Science. The jury which awarded the Kalinga Prize this year was composed of Profeesor I.I. Artobolevski of the Academy of Science of the U.S.S.R., Professor Giuseppe Montalenti of the Institute of Genetics of Rome University, and Dr. M. S. Randhawa, adviser on natural resources and scientific research to the Planning Commission of India.

Previous winners of the prize, founded in 1951, have been Louis de Broglie (France), Julian Huxley (United Kingdom), Weldemar Kaempffert United States), Augusto Pi Suner (Venezuela), George Gamow (United States), Bertrand Russell (United Kigdom), Karl von Frisch (Germany and Austria), Jean Rostand (France) and Ritchie Calder (United Kingdom).

Mr. Clarke might be called the first Kalinga Prize winner to be chosen from the space age. He is a former chairman of the British Interplanetary Society and he is now president of the Ceylon Astronomical Association. Interplanetary flights, spaceships and expeditions into the cosmos are among the subjects of his twenty-eight books, both fiction and non-fiction, which have sold two million copies in fifteen languages. He has also written extensively for magazines.

The ocean depths, that other great unknown, have also challenged Mr. Clarke. Since 1954, he has been actively engaged in underwater exploration and photography along the Great Barrier Reef of Australia and the coast of Ceylon.

Among the books he has published are *Interplanetary flight*, *The Exploraiion of Space*, *Voice Across the Sea*, *The Ch llenge of the Spaceship*, *The First Five Fathoms*, *The Challenge of the Sea*, *The Other Side of the Sky* and *A Fall of Moondust*.

Mr. Clarke, who is forty-four years old, has made numerous radio and television appearances in the United Kingdom and the United States.

VEGETATIVELY PROPAGATED PLANTS

The first meeting of the Vegetatively Propagated Plants Subcommittee was held in Manak Bhavan, New Delhi on Monday, 16 April 1962 under the Chairmanship of Dr. Pushkarnath, Director, Central Potato Research Institute, Simla and was attended by the Officers of the Government of India as well as by a representative of the Bharat Krishak Samaj.

In his address, Dr. Pushkarnath stated that there was a great scope for extension in the field of agricultural commodities and in that context standardization was much more necessary in the vegetatively propagated plants than in the grain crops.

The Subcommittee decided to take up the subjects of seed potatoes and sugar cane setts for preparation of Indian Standards. In order to fix a priority for other materials, it was agreed to collect information regarding the trade—both export as well as internal—in nursery stocks of different categories.

INSTITUTION OF CHEMISTS (INDIA)

ASSOCIATESHIP EXAMINATION, 1963

The Thirteenth Associateship Examination of the Institution of Chemists (India) will be held in November. 1963. The last date for Registration is 30th November, 1962. The Examination in Group A (Analytical Chemistry) is divided into the following eleven sections and each candidate will be examined in two of them according to his choice as approved by the Council, in addition to the General Chemistry including Organic, Inorganic, Physical and Applied Analytical Chemistry: (1) Analysis of Minerals, Silicates, Ores and Alloys: (2) Analysis of Drugs & Pharmaceutcals, (3) Analysis of Foods, (4) Analysis of Water and Sewage, (5) Biochemical Analysis (6) Analysis of Oils, Fats and Soaps, (7) Fuel and Gas Analysis, (8) Analysis of Soils and Fertilisers, (9) Analysis connected with Forensic Chemistry, (10) Analysis connected with Leather Chemistry, and (11) Analysis connected with Textile Chemistry. The Examination is recognised by the Government of India as equivalent to M. Sc. in Chemistry for purposes of recruitment of Chemists.

Further enquiries may be made to the Honorary Secretaries, Institution of Chemists (India), Chemical Department, Medical College, Calcutta 12.

ASSOCIATION NEWS

HYDERABAD BR NCH

The General Body Meeting of the Hyderabad of ASWI was held on 30-3-62 in the Committee Room, RRL, Hyderabad. The Secretary's report and the Treasurer's report were a opted. The following office-bearers have been elected to the Branch Committee :—

Dr. B. S. R. Sastry	... President
Dr. M. R. Subharam	... Vice-President
Sri G. Thyagarajan	... Secretary
Sri K. M. Ghouse & Sri Khurshid Hussain	... Jt. Secretaries
Dr. B. Rama Rao	... Treasurer
Sri H. Gopalkrishnan	... Member
,, Baldev Singh	... ,,
,, Gopinath	... ,,
,, G. Gopalkrishna Murthy	... ,,
Dr. Y. Venkatesham	... ,,
Dr. R. Vaidyeswaran	... ,,
Sri Vijayasarathv	... ,,
,, S. V. S. Kashmiri	... ,,
,, Seshacharyalu	... ,,
,, Gopi Reddy	... ,,
,, Shenoliker	... ,,
,, P. Sundershan	... ,,

5 Lektion

Dear Friends,

We shall have the grammar first to-day.

The Verb

In the case of verbs with stem ending in —t or —d add an "e" between the stem and the flexional ending in the 2nd and 3rd persons singular and the 2nd person plural: du antwortest, er antwortet, ihr antwortet. German has no progressive form as English has. Try to avoid translating literally. I am coming, I am going : In German these are : ich komme, ich gehe.

The interrogative is formed by simple inversion: antwortest du ? The imperative is also formed in the same way. It differs from the question by the tone of voice, and, when written, is followed by an exclamation mark : kommen Sie ! The negative is formed by adding nicht : er fragt nicht.

Ich gehe in die Schule. Walter und ich arbeiten; wir arbeiten zusammen. Prem fragt : "Lernst Du auch Deutsch ?" Prem und Krishna lernen Deutsch. Ich frage : "Arbeitet ihr viel ?" Der Lehrer sagt :

"Sie lernen Schnell."

New words : zusammen together
schnell fast/quick

INFINITIV

sagen		antworten	
	Präsens		
ich sage	—e	ich antworte	—e
du sagst	—st	du antwortest	—est
er, es, sie sagt	—t	er, es, sie antworten	—et
wir sagen	—en	wir antworten	—en

ihr sagt	—t	ihr antwortet	—et
sie, Sie sagen	—en	sie, Sie antworten	—en

negativ :

ich sage nicht	ich antworte nicht
Frage : sage ich ?	antworte ich ?
sage ich nicht ?	antworte ich nicht ?

Walter diktiert jetzt den Satz :

Asien ist gross, aber Europa ist klein. Prem und Krishna schreiben den Satz. Prem versteht ein Wort nicht. Er fragt Walter.

Prem : Was heisst klein, bitte ? Ich verstehe das Wort nicht. Walter erklärt das Wort. Er schreibt das Wort und ein Beispiel an die Tafel. "Das Kind ist klein."

Prem und Krishna lernen viele Wörter und bilden Sätze. Aber sie machen noch viele Fehler. Walter verbessert die Fehler. Der Unterricht ist aus. Auf Wiedersehen !"

diktieren	to dictate
klein	small/short
schreiben/schreibt	to write/writes
verstehen/versteht	to understand/understands
das Wort/Wörter	the word/words
erklären	to explain/to make clear
das Beispiel/e	the example
die Tafel/n	the blackboard/blackboards/slates
das Kind/er	the child
sie	they
noch	yet/as yet
viele	many
verbessern	to correct
dauern/dauert	to last/lasts
die Stunde/n	the hour
aus	out of/over
Auf Wiedersehen	Good bye/see you again
schliessen	to close/to shut
das Haus/Häuser	the house/houses
nach Haus gehen	to go home

Infinitiv : sein das Verb *sein* ist unregelmässig

ich bin	wir sind
du bist	ihr seid
er, es, sie ist	sie, Sie sind

sein=to be
unregelmässig=irregular

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6. Lektion

Dear friends !

As you know, when one visits a foreign country the first few questions one raises while going about are : "How much does this cost ?" How much money do you have ?" etc. Questions of that kind will have to be replied to in figures. The main difference between English and German here is that the Englishman will say "Twenty-one" while a German will say "one and twenty." Listen now to what our three friends say :

Walter : Wir haben viele Finger.
Krishna : Wir zählen die Finger.
Walter : Eins, zwei, drei, vier, fünf, sechs, sieben, acht, neun, zehn.
Prem : Wir haben zehn Finger.——

Krishna hat viel Geld. Er zählt das Geld. Er hat Geldstücke und Geldscheine. Er zählt zuerst die Geldstücke. Elf, zwölf, dreizehn, vierzehn, fünfzehn, sechzehn, siebzehn, achtzehn, neunzehn, zwanzig.——

Prem : Wieviel Geld haben Sie jetzt ?
Krishna : Ich habe jetzt zwanzig Rupien.
Walter : Jetzt zählen Sie die Scheine.
Krishna : dreissig, vierzig, fünfzig, sechzig, siebzig, achtzig, neunzig, hundert, einhundertzehn, einhundertzwanzig.
Prem : Sie haben einhundertzwanzig Rupien. Krishna hat auch noch Kleingeld, aber das sind nur naye paise, die naye paise zählt er nicht.
Prem : Wieviel Mark sind eine Rupie.
Walter : Eine Mark ist eine Rupie und zwölf naye paise.
Jetzt rechnen wir. Prem kauft einen Füller, ein Buch, zwei Hefte, zwei Bleistifte und Briefpapier. Der Füller ist teuer. Er

kostet DM 13,50. Die Hefte sind billig. Ein Heft kostet nur DM—,25.

Das Buch kostet Dm 7,20. Ein Bleistift kortet DM—,33.

Das Briefpapier kostet DM 1,80. Wievicl zahlt Prem ?

Krishna : Prem zahlt DM 23,66

The German style of representing 0.25 is—0,25 and 1,000,000 is 1 00 0000

der Finger	the finger
zählen /zählt	to count/counts
das Geld	the money
das Geldstück	the coin
der Geldschein	the bank note
zuerst	at first/to begin with
das Kleingeld	small change
nur	only
die Mark	DM/unit of German currency
die Rupie	Rs/Indian currency
rechnen	to count/to do arithmetic
kaufen	to buy
das Briefpapier	stationery paper
teuer	costly/expensive
kosten	to cost
billig	cheap/not costly
der Pfennig	one hundredth of one DM
zahlen	to pay

0—null	11—elf	22—zweiundzwanzig
1—eins	12—zwölf	23—dreiundzwanzig
2—zwei	13—dreizehn	24—vierundzwanzig
3—drei	14—vierzehn	25—fünfundzwanzig
4—vier	15—fünfzehn	26—sechsundzwanzig
5—fünf	16—sechzehn	27—siebenundzwanxig
6—sechs	17—siebzehn	28—achtundzwanzig
7—sieben	18—achtzehn	29—neunundzwanzig
8—acht	19—neunzehn	30—dreissig
9—neun	20—zwannig	40—vierzig
10—zehn	21—einundzwanzig	50—fünfzig

60—sechzig	90—neunzig	110—hundertzehn
70—siebzig	100—hundert	200—zweihundert
80—achtzig	101—hunderteins	300—dreihunder

7. Lektion

Dear friends !

To-day I should like to tell you something about the noun. As you remember, it was in the first lesson that you learnt about the three articles in German. In this connection I should like to remind you that you should *always* learn the *noun and* the *article* together.

Nominative and Accusative

The subject of a sentence is always in the nominative case. It denotes the person or thing about whom or which something is said. It may be a noun or a personal pronoun. The verb in the sentence agrees in person and number with the subject. Many verbs require not only a subject, but also an object, which is in the accusative case. The accusative object is the person or thing affected by the action of the subject. It may be either a noun or a personal pronoun.

Sentence :	*Nominative* :	*Accusative*:
The teacher asks the boy	The teacher asks	the boy
The student writes a letter	The student writes	a letter

In German the nominative and accusative forms of the articles are the same, with the exception of the masculine singular : den, einen.

The noun being a very important part of speech, there must be a way to ask for it and, already, there comes the interrogative pronoun. The interrogative pronouns wer ? (nom.) and wen ? (acc.) ask about persons, and was ? (nom. or acc.) asks about things.

By the way, we need the figures not only to count our money but for calculating the time too. Do listen to what Walter tells his friends, Prem and Krishna.

Walter ; Der Tag hat vierundzwanzig (24) Stunden,
eine Stunde hat sechzig (60) Minuten
und eine Minute hat sechzig (60) Sekunden.
Ich habe eine Uhr. Prem, hast Du auch eine Uhr ?

Prem : Ja, ich habe eine Uhr.
Jetzt ist es acht (8) Uhr.
Herr Müller kommt um neun (9) Uhr

Walter : Wir haben noch eine Stunde Zeit.
Die Arbeit beginnt um neun Uhr.

Krishna : Ich habe heute Unterricht. Er dauert drei (3) Stunden; von neun bis zwölf (12) Uhr.
Von zwei bis drei Uhr mache ich Aufgaben.

die Minute/n	the minute
die Sekunde/n	the second
die Uhr/en	the watch/the clock
kommt	comes
um 9 Uhr	*at* 9 o'clock
die Zeit/en	the time
heute	to-day
von..—bis..	from.. to ..
Aufgaben machen	to do home-work
die Aufgabe/n	the task

Personal Pronoun

While talking to you, the address is always "you", because in Euglish there is no other form at all. In German, where we have different forms to address persons, I would have to use "Sie" and here we come to the Personal pronoun.

The familiar form of address is *du* in the singular and *ihr* in the plural. This form of address is used in the family and among close friends; God is addressed as du, and animals are also spoken to in this manner. It is used, in addition, by adults when speaking to children, and by small children when addressing adults. It is also the usual form of address among work-mates of equal status, especially male manual workers. In all cases, apart from those mentioned, *Sie* is the form of address, both in the singular and the plural. *Sie* is then capitalized, and the verb takes the form of the 3rd person plural : Sie gehen.

Translation of Lecture No. 3

Walter : Here is a mapcard; that is a map of Germany. Here is Hamburg and there is Munich. Hamburg lies in North Germany and Munich lies in South Germany.

Prem : Does Bremen lie in North Germany ?

Walter : Yes, Bremen lies in North Germany.

Krishna : Does Bonn also lie in North Germany ?

Walter : No, Bonn does not lie in North Germany but in West Germany. Duesseldorf and Cologne also lie in West Germany.

Prem : Where does Breslau lie ?

Walter : Breslau lies in East Germany.

Krishna : Is Berlin also a city ?

Walter : Yes, Berlin is also a city. Berlin lies in Central Germany. Germany is a country.

Prem : Is India also a country.

Walter : Yes, India is also a country. India lies in Asia. Asia is a continent.

Lecture No. 4

Note :

Den and **einen** are used instead of **der** and **ein** (masculin) if the noun with which they are used is object or accusative thus :

Have you the map ?	Haben Sie **den** Laddkarte.
He has a hat.	Er hat **einen** Hut.

(To find the object pose the question 'whom' or 'what'—

Example : Have you the key ? Have you 'whom' or what ? "The key")

Walter : Here is a room. It is my room. The room is big. It has a floor[1], a ceiling[2] and four walls. The windows are in front. There is also a table and chairs. At the end is hanging a picture[3]. On right hand side is the door and left hand side hangs a map. At the top hangs the lamp.

Walter : What have I here, Prem ?

Prem : You have a pencil[4].

Walter : Good, Prem ! and what is the name of the plural ?

Prem : Tells a plural. But the plural is not right, it is wrong. Walter repeats the question, "What is the name of the plural of 'the pencil', Krishna ?"

Krishna : The pencils

Walter : Right[1], One learns always the article[5] and the plural[6], then he does not make any mistake. Krishna, now compose a sentence[6] please

Krishna : The pencil is long.

Walter : Good, and what is the opposite of 'long'.

Krishna : The opposite of 'long' is 'short'.

Walter : Right, thanks !

1, 2, 3, 4, 5 & 6 all are nouns used as objects or in accusative sence but 1, 4, 5 and 6 are masculine nouns whereas 2 & 3 are feminine and neuter nouns respectively. Thus einen and den are ueed in former and ein/eine used in latter cases.

A HIGHER EDUCATION APPROPRIATE TO THE DEVELOPMENT SCIENCE AND TECHNOLOGY

By Dr. F. Netter, France

The problem of higher scientific and technological education is under consideration in the most diverse countries. The sciences and their applications in the most varied fields of human activity are developing at an ever-increasing speed and on an ever-widening scale. This is a matter of great concern to all those in responsible positions in their country, be they statesman, leaders of industry, trade unionists, teachers or merely citizens who take the trouble to think. They are considering ways and means of training and adapting a huge peaceful army of scientists and technicians for the manifold tasks that the future has in store. The swift advance of modern society makes this imperative.

Scientists are amongst the first to worry about this problem. Particularly qualified to contribute to its solution, they have to explain their point of view and cannot evade their responsibility.

The W. F. S. W. and the Moscow Symposium

The World Fedration of scientific Workers has already raised these question on many occassions. It is particularly well placed to bring a valuable contribution to this subject by the promotion of an *exchange of experiences on a world scale.* In fact, for over fifteen years the W. F. S. W. has consistently acted as a bridge between scientists beloging to the most different political, economic and social systems. Thanks to it, there has always been a meeting-place between British, Chinese, American, Soviet, French, German, Indian scientists and many more. The W. F. S. W., however, does not wish to offer opportunities only for the exchange of views, however valuable these may be in avoiding a lack of understanding whose consequences can be grave. By the very nature of their work, scientists are able easily to find a common language, that of objectivity, of honesty, of rigour and of good sense. The Fedration wishes to do some-thing constructlve. Hence the idea of arranging discussions on subjects of prime interest to all scientists in an attempt to make progress in these matters.

The W. F. S. W., on considering a new subject for discussion, was therefore particularly glad when its affiliated organization in the Soviet Union made it possile to hold a symposium on *Higher Scientific and technological Education* in common with important specialized institutions of the U. S. S. R. For it is well known througout the widest circles that the Soviet Union has particularly profitable experiences in the sphere of education.

This is how the Symposium came to be organized which will be held *in Moscow from* 9 *to* 13 *September* 1962 under the joint sponsorship of the *World Federation of Scientific Workers*, and of three Moscow institutions: the *Lomonosov State University, the Bauman*

Technological Institute and the *Lenin Pedagogical Institute*. The presence of this last Institution amongst the organizers of the Symposium is indicative of the importance which the members of the Organizing Committee have attached to pedagogical problems as their work had developed.

The opining of the Symposium, originally fixed for 7 September, has been postponed to 9 September to make it possible for some participants to attend a meeting arranged by the "Pugwash Committee."

Many leading figures have been invited to take part in the proceedings. The total number of participants from outside the Soviet Union has been limited to 200. This number ensures both a wide representation of outlooks and and background of the different parts of the world, and also small enough number of people so that the discussion can proceed with maximum efficiency. The technical arrangements made by the Soviet hosts will be the best guarantee of this efficiency, thanks largely to a simultaneous translation system and to the distribution of the texts of reports received sufficiently in advance.

A contribution of the W. F. S. W. to the Symposium lies in its affiliated organizations. These, which are for the most part trade union bodies, will speak with an authority, not only that of the leading individuals or of ordinary members, but with the authority of what they represent. The British and French affiliated organizations, for example, like those of the socialist countries, are the most representative association of scientific workers in their country. Their opinions therefore carry great weight. The contribution of the W. F. S. W. in this field is irreplaceable, all the more so since it covers a field where it does not attempt to compete with the international unions or trade union fedrations. On the contrary, it links together associations belonging to international unions which differ and, it is well to remark, which are strongly opposed on certain points.

Lively discussions

During the Symposium, members of the W. F. S. W. will, be particularly concerned to see that questions are not posed solely in academic terms. It is not only a matter of stating "what is to be done," but of trying to arrive at the conditions for good results according to the possibilities and circumstances of each individual country.

Thus it is not desirable to restrict oneself to defining the elements of the training of teachers. Concrete question must be posed: who should be trained? to what end?—and they must be answered on *a world scale*. The question of education cannot be tackled in a vacuum, ignoring the fact that 50 per cent of the world's children do not attend school and that another 25 per cent do not receive the education which they would be able to claim. There will be no real solution to the problem of higher education so long as primary education is not really extended to all peoples.

Without attempting to cover everything at the Moscow Symposium, it will be valuable for different aspects of the subjects under discussion to be raised. The W. F. S. W. will contribute to this by stressing one of the basic themes of its activity, that of international co-operation. The Symposium must, moreover, help to establish relations between scientists of various countries and to widen such relation when they already exist.

In their concern to give the widest possible scope to the discussion, the members of the Organizing Sub-Committee, who met early in January 1962, outlined a provisional plan for the proceedings. In commenting upon this pro ramme, we shall deal briefly with few of the principal points taken into account at that meeting.

Contributions of a general character will open this Symposium. They will stress the importance of the discussion by defining the position of *Scince and Technology in the world of the future* and will present a compsoite picture of *the aims and tasks of higher education.* Two points will receive particular attention: the case of *poorly-equipped countries whose dev lopment has only recently be n undertaken* and *the role of international relations in the optimum extension of higher educat on.* On this point there will be a special contribution from UNESCO.

These general surveys will be supplemented by the work of three parallel sections which will consider:

— higher scientific and technological education, under the chairmanship of professor L. Lazarev of the Bauman Technological Institute (Moscow);

— higher education in the social and historical sciences, under the chairmanship of Professor L. Rosenfeld (The Netherlands);

— the training of teachers for what it has been agreed to call secondary education, under the chairmanship of Professor P. C. Mahalanobis (India).

It will no longer be a matter of general statements covering wide fields, but of detailed contributions specific to certain points of the discussions. Moreover, it is to be hoped that these contributions will not quote successes alone. It would certainly be well to study successes. But an account of the misca'culations and the half-successes is often quite as instructive. Critical accounts, not hesitating to pose new problems, sincere comparisons must be the basis of a lively discussion; but one weighted in a constructive direction, stressing the improvements to be made and the forms of organization appropriate to the various countries. The representatives of the newly-developing countries will without any doubt regard this discussion as high priority, since they have particularly urgent and vast problems to solve.

Co-operation in the development of science and technology

The mark of a genuine higher education must be that it never loses sight of the role and mission of science and technology in the march of progress. This is the basis for the work of the first section of the Symposium. It is certainly necessary to train specialists, but this is not enough. What is sought is the all-round development of man as an individual and as a citizen. Therefore, one of the points provided for in the programme is *the role of the humanities and the social sciences*, including the study of languages, in the education of science and technology students.

The relations between theory and prac ice will be central to the discussion. But it would be well to be flexible in reaching conclusions so as to take local conditions into account. Readers of the last number of *Scientific World* have already had a glimps, for example, of the problems of technical education in Italy. It certainly appears that a considerable part of technical education in that country can be provided by the specific arrangements made by different industries. But this type of solution would tend to be restricted to already prosperous, highly industrialized areas of the country. Now modern society demands solutions for the whole of Italy on a different scale.

It is obvious that an analysis valid in this case is not applicable to a very different one, that of the People's Republic of Korea, such as appeared in a recent article in the magazine *Korea Today*. There, in contrast, the key solution is sought in the education of people while employed in production and the association of educational establishments with the factories. Some 60 per cent of the employees of big factories are following courses at various levels The aim in view is really gigantic: to have trained, by the end of 1967, 176 000 engineers and specialists, thereby multiplying their number tenfold in seven years.

The exchange of experiences between higher educational establishments will have more direct repercussions in countries with analogous levels of development. Thus the problem of *the degree of specialization* and of the stage at which specialization should be introduced is of great concern to the highly industrialized contries. The tendency is too often to produce narrow specialists. On the contrary, it seems advantageous to introduce specialization as late as possible.

Thus, a colloquium held in France by the National Union of Higher Education, one of the associations belonging to the Union of Scientific Workers, examined the reform to be recommended in the first stage of university education, following secondary education. The need to satisfy the requirements of industry and of national education led to the idea of providing two cycles of higher education. One of them, the shorter, would train in two year plus one year of practical work intermediate technical personnel and some teachers. The other, leading to a degree in four years, would constitute higher education proper, leading to all teaching and research careers and preparing high level cadres for industry. The difficult problem, however, is to ensure that the short cycle is not simply an out let for those unsuited to long-term education; that it does correspond to a choice of specialization and not to a sorting out of mediocre elements. Then again, such recommendations are unworkable unless they are accompanied by an assessment of the necessary *means*, whether these be administrative personnel, buildings, or technicians, who are indispensable to the working of the new type of education as planned. Hence these data are also to be found in the papers presented at this colloquium.

The same realistic concern is shown by the Union of Scientific Workers (the French association affiliated to the W.F.S,W.) in its preparation for the holding this spring of a day's study on "resources for research." Its conclusions will also be a contribution to the Moscow Symposium, where it is intended, still in the first section, to examine *the role of Scientific research in the educational system*. One can certainly easily agree that it is of prime importance in the training of scientists, but there again it all depends on the resources available.

Others themes will be raised. One of them, and we have already indicated its importance for under-equipped countries, *methods of education without interrupting work*, will be dealt with in several contributions.

Another typical question is that of *the further improvement of the qualification of scientists*, *technologists and teachers*. Interesting examples will certainly be given, including that of M.I.T. in the United States. In France, for example, there are courses arranged for engineers who are former pupils of the Ecole Polytechnique so as to acquaint them with concepts which have developed considerably since they were students: nuclear physics, the chemical bond, and more recently modern algebra have been amongst the subjects.

The Training of teachers

An exchange of experience on the training of secondary school teachers is all the more important as it is one of the most natural tasks of higher education; but it has, moreover, to put an end to a particular evil.

To appreciate the difficulty of this problem, it is necesary to know that in a number of countries this responsibility is not given to specialized institutions. Teachers are sometimes trained at the same time as engineers intended for industry.

The situation in *countries which have recently embarked on development* is especially worthy of attention. It is in this, however, that countries with a rich experience and high level of development can advise and also directly help the others. The experience of the Soviet Union in this respect will certainly provide an important contribution to the discussion. Methods of *training teachers without interrupting work*, by correspondence, for example, will also be considered for these countries.

In this section we shall find once more the concern, already expressed, regarding the *further training of teachers* during the course of their careers. It is not possible to live on the fund of knowledge learnt at the training college when science and technology are advancing at the speed with which we are today familiar. Must each individual teacher then provide a solution by making a lone effort to keep up to date? Is this not, on the contrary, a problem for the state as a whole? These questions must be answered.

The same is true of the thorny problem of pedagogical research. There is often a negative attitude with regard to this, just as if a specialist's knowledge were all that was required to teach: a good mathematics teacher ought to be a good mathematician; for the rest, the qualities he lacked would eventually be achieved bit by bit during the practice of teaching. Such a view is unjustified and dangerous. Hence *contemporary problems of pedagogical science* will be examined in the third section of the Symposium.

The training of man

The humanist character of the Symposium is especially marked by the importance attached to the social and historial sciences, to which the whole of the second section is devoted, with the same headings as the first (on theory and practice—specialization—research, etc.).

The social sciences have a big part to play in modern life. *They must help in the training of man*. Their aim is to make possible a common way of life. In many countries the social sciences are scarcely appreciated and they are said to be on the decline. In fact, their level and their role are more likely to be enhanced.

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It is in seeking a balance between the sciences and the humanities, between the training of man and the progress of technology, that the Symposium will conclude. This is not to claim that all will be settled. But the aim of the Symposium is to make some advance in the mutual understanding between scientists for the realization of a common aim: to place higher education in a position to respond to the needs of the modern world.

Invitations have already gone out to institutions and individuals in more than 60 countries. Replies received so far are a guarantee of very high-level participation, including representation of certain of the most famous universities and institutions of higher education. National Committees and study groups have been set up in many countries to prepare reports. This shows the wide interest roused by this Symposium and augurs well for its success.

Like all international gatherings, this one will certainly have positive effect on the international climate. Such meeting always help to improve the situation, for they show very different people can act together for the benefit of their fellows.

The Symposium will finally achieve its aim if the participants leave with the feeling that their own personal experience has been enriched; because then, in fact, it will be the experience of all that has been enriched, and there is no question that these gains will be able to be put into effect in the cause of progress.

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2	2	22	24	42	45	62	66	82	88
3	3	23	25	43	46	63	68	83	89
4	4	24	26	44	47	64	69	84	90
5	5	25	27	45	48	65	70	85	91
6	6	26	28	46	49	66	71	86	92
7	8	27	29	47	50	67	72	87	93
8	9	28	30	48	51	68	73	88	94
9	10	29	31	49	53	69	74	89	95
10	11	30	32	50	54	70	75	90	96
11	12	31	33	51	55	71	76	91	98
12	13	32	34	52	56	72	77	92	99
13	14	33	35	53	57	73	78	93	100
14	15	34	36	54	58	74	79	94	101
15	16	35	38	55	59	75	80	95	102
16	17	36	39	56	60	76	81	96	103
17	18	37	40	57	61	77	83	97	104
18	19	38	41	58	62	78	84	98	105
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3	3·22	13	13·93	23	24·65	33	35·37	43	46·08
4	4·29	14	15·00	24	25·72	34	36·44	44	47·15
5	5·36	15	16·08	25	26·79	35	37·51	45	48·23
6	6·43	16	17·15	26	27·86	36	38·58	46	49·30
7	7·50	17	18·22	27	28·94	37	39·65	47	50·37
8	8·57	18	19·29	28	30·01	38	40·72	48	51·44
9	9·65	19	20·36	29	31·08	39	41·80	49	52·51
10	10·72	20	21·43	30	32·15	40	42·87	50	53·58

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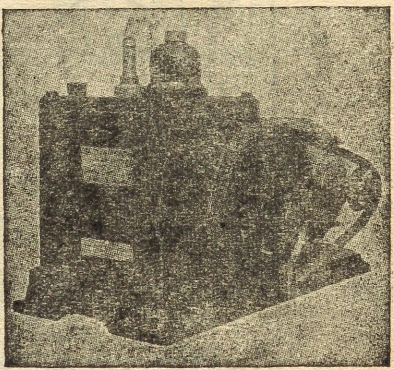

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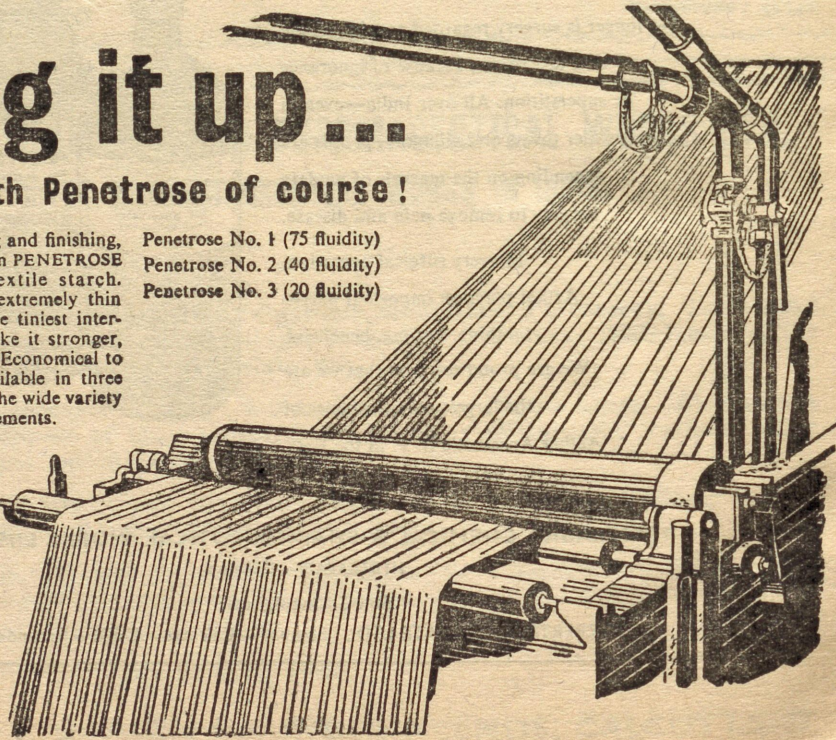

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