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Edited by J.E. Rasmussen and Victoria S. Hewitson

26 August 1966

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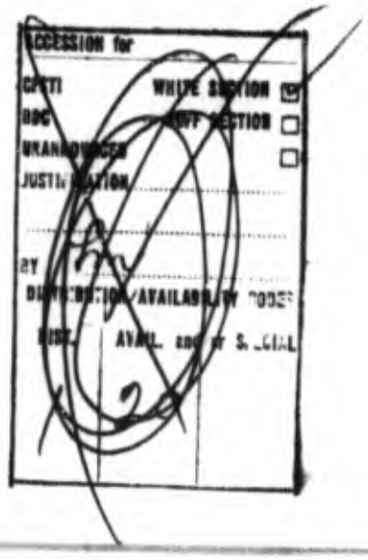
C.T. Froscher
Captain, U.S. Navy
Commanding Officer



ONR LONDON PERSONNEL CHANGES

Because of the nature of the personnel assignments in ONR London there always are a number of changes during the summer months. This summer is no exception although the changes are probably more extensive than usual. The last month has seen the arrival of both the new Commanding Officer and the new Chief Scientist, as well as many replacements on the scientific staff. This summary has been prepared to introduce the new Commanding Officer and Chief Scientist and to acquaint the readers of ESN with the present Naval Sciences Division staff, who will be responsible for much of the material which appears in this publication during the coming year.

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Captain Clarence T. Froscher USN relieved Captain William W. Schaefer USN as Commanding Officer of the London Branch Office of ONR and as the Assistant U.S. Naval Attache for Research on August 4, 1966.

Captain Clarence T. Froscher USN

Captain William W. Schaefer USN

Captain Froscher, a native of Dade County, Florida, graduated with distinction from the U.S. Naval Academy in June 1942. After serving two years in destroyers in the Pacific Theater, he was assigned to Flight Training and received his Wings on 30 July 1945. Following several tours of duty in Antisubmarine Warfare Patrol Squadrons, Captain Froscher earned a BS in Aeronautical Engineering at the US Naval Postgraduate School and MS in Fluid Mechanics at Stevens Institute of Technology. His subsequent duty assignments have been in the field of aviation research and development, aircraft logistics, and aircraft maintenance. He graduated from the Industrial War College in 1964, and served as Director of the Airframe Division in the Naval Air Systems Command prior to reporting in London.

Captain Schaefer, who served as Commanding Officer of ONRL since August 1964, has been assigned to the Naval Air Systems Command in Washington, D.C. as Executive Director for Field Support.

Mr. Aubrey W. Pryce replaced Dr. Peter King as Chief Scientist and Scientific Director on

Mr. Aubrey W. Pryce

Dr. Peter King

18 August. Mr. Pryce is a native of England and received his BSc from Imperial College of Science and Technology, University of London in 1939. During the war years he served as an Experimental Officer with the Engineering Laboratory of the British Admiralty. From 1947 to 1949 he was a Senior Scientific Officer in the Royal Naval Scientific Service. In 1949 he went to Washington, D.C. as a Navy staff member of what is now the British Defence Staff. In 1951 Mr. Pryce emigrated to the US and joined the staff of ONR Washington as a physicist in the Acoustics Branch. He has been head of that Branch since 1956 and is now on temporary leave of absence to serve in London.

Dr. Peter King, who served as Chief Scientist for the past two years, has assumed his new appointment as Deputy Chief of Naval Research and Chief Scientist of the Office of Naval Research. Washington, D.C.

The present staff of the Naval Sciences Division of ONR London, and their permanent affiliations, are as follows:

Dr. James A. Pierlein: Director, Chemistry Research Laboratory, Aerospace Research Laboratories, Wright-Patterson AFB, Ohio (Rocket research, propulsion).

Dr. Jerome B. Cohen: Professor of Materials Science, Northwestern University (Metallurgy: diffraction, electron microscopy, plastic deformation, thermodynamics).

Dr. John D. Costlow: Assoc. Professor, Duke University at the Duke Marine Laboratory, Beaufort, N.C. (Marine biology, biological oceanography, larval development and distribution, endocrinology of crustaceans).

Mr. Douglas C. Hornig: Chief, Chemical Engineering Division, Naval Ordnance Laboratory, White Oak, Md. has relieved Mr. Malcolm Coate as the NOL representative. (R and D on explosives, propellants and pyrotechnics).

Dr. Maurice W. Long: Chief, Electronics Division, Engineering Experiment Station, Georgia Institute of Technology, Atlanta, Ga. (Physicist (Electronics): Radar detection techniques; electromagnetic scattering from rough surfaces; millimeter and submillimeter waves).

Mr. Paul D. Maycock: Long Range Planning, Corporate Research and Engineering, Texas Instruments, Inc., Dallas, Texas (Solid state physics, advanced semiconductor devices, infrared systems, energy conversion, and thermal analysis).

Captain J.E. Rasmussen MSC USN: Formerly Director, Behavioral Sciences Department, Naval Medical Research Institute (Psychology, psychiatric assessment, human performance under stress).

Dr. Bernard O. Seraphin: Supervisory Research Physicist, NOTS, China Lake, Calif. (Solid state physics: semiconductor surface effects, band structure analysis, semiconductor optics).

Mr. Winfield G. Trott: Head, R and D Dept., U.S. Navy Underwater Sound Reference Laboratory, Orlando, Fla. (Physicist - acoustics (Underwater sound measurement, sonar test and evaluation)).

Dr. Harry E. Williams Assoc. Professor of Engineering, Harvey Mudd College, Claremont, Calif. Formerly with the Cal Tech Jet Propulsion Laboratory (Engineering mechanics - stress analysis, thin shell structures, hydrodynamics).

The following members of the scientific staff recently have departed from London:

Dr. Bodo Bartocha, who was Deputy Director for Naval Sciences, has returned to the Naval Propellant Plant, Indian Head, Md.

Dr. James G. Brennan has resumed his duties as Professor and Chairman, Department of Physics, The Catholic University of America, Washington, D.C.

Dr. Bernard Epstein has returned to the University of New Mexico as Professor of Mathematics.

Dr. John A. Nagay has resumed his duties as Assistant Head, Personnel and Training Branch, Psychological Sciences Division, ONR, Washington, D.C.

Dr. Clarence N. Peiss has returned to the University of Chicago as Professor of Physiology at the Medical School.

Mr. William S. Pellini has resumed his position at the Naval Research Laboratory, Washington, D.C. as Superintendent, Metallurgy Division.

Dr. S.Y. Tyree has joined the faculty of the College of William and Mary, Williamsburg, Va. as Professor of Chemistry.

Dr. Elliot Weinberg has resumed his duties as Chief Scientist at the ONR Branch Office, Pasadena (San Francisco Division).

BIOLOGICAL SCIENCES

Dental Training Conference, Garmisch

The Annual Dental Training Conference of the US Army, Europe, was held 26-28 May in Garmisch, Germany. Present were the Assistant Secretary of the Army for Research and Development, the Hon. Willis M. Hawkins, dental officers from the US Navy and Air Force, and senior dental officers from several foreign countries. Among them were: Lt. Col. Sven Walden (Netherlands), Lt. Col. Leon Richardson (Canada), Group Capt. W. Smith (UK), Lt. Col. Dr. Gerd Schwarz (Germany), Lt. Col. Halldor Trygge Gimmes (Norway), Col. Enver Plumer (Turkey), and the President of the German Dental Association, Dr. Walter Knott.

The meeting was well organized; a morning was given to formal presentations before the entire assembly, and the afternoons were divided into four specialty sessions: Oral Surgery, Periodontics, Prosthodontics, and Restorative Dentistry. At the time of registration, each attendee designated which of the sessions he wished to attend. It was explained that attendance at sessions other than the chosen one could not be encouraged because of space limitations. Since over 400 attended, the restriction was understandable.

Col. Robert Shira (Chief Dental Surgeon, USAREUR) is a distinguished oral surgeon, a fluent, entertaining speaker, and a charming man. No problem was too small -- ranging from accommodation to transportation -- for this busy man to solve.

Principal essayist was Prof. B. Cohen (Royal Coll. of Surgeons of England). His work has been reported by this writer, and much has appeared in the literature. However, since Cohen's work is of such importance, a brief summary of his paper follows: Cohen mentioned the changes taking place in modern research and the impact of technological developments on biological research. He felt that there was some risk of research workers becoming obsessed with the importance of apparatus and succumbing to the fascination of practicing techniques for their own sake.

One of the most important tools in biological research is the experimental animal. For dental investigations the small macaque monkey offers excellent possibilities. The dentition is similar to human, all parts of the mouth are accessible, they thrive and breed on diets identical with human diets, and they develop dental caries, as humans do, when maintained on a highly-refined carbohydrate diet.

The carious lesion in the monkey is similar to those of humans at the morphological, radiological, microscopic, and bacteriological levels. Cohen uses this animal in his research in periodontal dis-

ease. He outlined his published theories on the vulnerability of the interdental area in adolescence. Cohen feels that the initial lesion in periodontal disease often can be traced to events at the time of tooth eruption. He demonstrated a series of experiments on monkeys which were designed to test the hypothesis which arose from his earlier studies.

Cohen described briefly the new dental research unit established at Down, Kent, by the Royal College of Surgeons. Facilities are available for 200-300 monkeys. The research program is planned to encompass caries and periodontal disease as well as other fields -- cleft palate, salivary functions, tumors of the joints, and the testing of filling materials and other therapeutic substances. (C.E. Meyers)

The 7th International Congress of Gerontology

The 7th International Congress of Gerontology was held 26 June - 2 July at the Hofbung-Kongresszentrum in Vienna, Austria. As did the other six Congresses, it applied a wide variety of viewpoints to the problems associated with physiological aging.

There were 101 sessions in all, covering the areas of Biology (including biochemistry and biophysics), Clinical Medicine, Economics, Education, Psychology, and Sociology. Clinical Medicine received the greatest emphasis with 51 sessions devoted to such topics as senile dementia, cardiovascular disease, surgery, and diseases of bones and joints. The general opinion among attendees was that noticeable advances had been made in almost every area since the last Congress (Copenhagen, Denmark; 1963).

The attendees numbered over 3,000 professional people representing forty-four countries. Such leading scientists as F. Verzar (Switzerland) and N.W. Shock (USA) were among those present. The country most heavily represented was the US, accounting for about 10% of the total participants. Germany, Austria, and Great Britain were also well represented. This was a large increase in attendance over that of the preceding Congress. The large increase is of some interest because it roughly indicates the growing world concern with gerontological problems. The Austrian Government is very much aware of the world's growing interest, and its representatives were quite emphatic (in opening session addresses to the entire Congress) in pointing out that Vienna is an excellent, "centrally-located" meeting place where "diverse cultures"might work in harmony. They also commented on the historical fame of the Vienna School of Medicine, and on the fact that the President of the International Gerontological Society is an Austrian, Prim. Doz. Dr. W. Doberauer. They invited permanent use of Vienna as a scientific headquarters and meeting place.

Scientifically, there is a growing interest in J. Bjorksten's theory that aging is basically due to the cross-linkage of protein molecules. In investigation along these lines, a large amount of research has gone into the biochemistry of aged tissue, with special emphasis on cross-linkage processes in collagen. The evidence accumulated so far suggests that J. Bjorksten could well be correct.

A disappointing feature of the Congress was that only three papers were presented on gerontological biophysics, and two of these were essentially strength of materials studies.

Overall, the major effort in gerontology is presently directed toward treatment of the symptoms of physiological aging, with a small but growing effort aimed at understanding the biochemistry of aging, and an almost nonexistent effort directed at the biophysics of aging. However, despite the small numerical size of the effort, the rate of progress of research into the basic cause (or causes) of aging indicates that a major increase in "useful" lifespan could well result within the next ten years. (D.G. Carpenter, Major, USAF, Physics Department, USAF Academy, Colorado 80840)

MATERIALS SCIENCES

Materials Science Club

About 200 scientists and engineers interested in all aspects of materials have formed a club in the UK. They meet about three times a year to present papers, and more important, for discussions. (This fall, for example, there will be a meeting on compatibility of composites involving metals, ceramics, plastics, cements, etc.) Some of the activities of the members will illustrate the scope of this informal group.

Prof. R.W. Cahn (Sussex Univ.), club chairman, has started an interesting new periodical, Journal of Materials Science. It brings together science and technology in a very well-done format. For example, papers on "The Measurement of Ionic Diffusion in LiF by NMR Techniques" and "A Review of the Use of Electron Beam Machines for Thermal Milling" appear in the first two issues.

Mr. L. Holiday (The Shell Chemical Co., Ltd., Manchester) edited the book, Composite Materials, recently published by Elsevier. Prof. W.A. Holmes-Walker, secretary, has initiated a program on materials at Brunel College, Acton, London.

While the plans for this College are not immediately connected to the activities of the club, an explanatory bit may not be out of order here. The College has received its charter as a University, and will move to its new campus in Uxbridge next year. A school of materials science is planned. After the first common year, students will be able to specialize in polymer science, metallurgy or ceramics. (Their entire program covers four years, involving periods in industry from April to October of each year.) (J.B. Cohen)

The Crystallographic Group at Battersea

The Crystallographic Group at Battersea College of Technology, a part of the Chemical Physics Department, is housed in the old St. John's School. This is one of many small, scattered buildings in Battersea serving as temporary sites for this College as it awaits its new campus in 1968, when it will become the new University of Surrey. A detailed report on the organization of science in the school and its educational program appeared in ONRL Tech. Report 21-66. Suffice it to say that this school has already embarked on a program which gives new students considerable exposure to all of the various fields of engineering and science and time to

"choose" among these at the beginning of their studies.

The Crystallographic Group is well equipped. There are about 14 units, including five diffractometers. About 50 undergraduate and 40 MSc students are trained annually in formal course work in this laboratory. (The MSc consists mainly of course work with a small project; in a break from tradition which seems to be a trend in the UK, the PhD candidates are urged to take course work for this degree.)

Dr. D. Lewis, a Reader in the Department, leads the group. Having been trained by Prof. Bernal, his research interests are far-ranging and interesting. The laboratory also serves informally as a service facility for other departments at the school, and I felt that I was back at my own lab when Dr. A. Crocker arrived with some of his students to discuss some unusual effects they had observed in Laue patterns from Mg.

Research is in three main areas:

(1) By use of Berg-Barrett photography, a study is being made of the primary and secondary deformation bands in single crystals of Al. Surprisingly, they form quite early in the deformation, in Stage I of the stress-strain curve. They start as short segments from the edge of the crystal and then spread across the width of the specimen. (This work is a continuation of Lewis' PhD research.)

(2) The habit of calcium carbonate scale is being examined. It has been found that this scale starts on the rough iron oxide inside a boiler or in water desalinization equipment, but does not grow epitaxially. Rather, it is mechanically occluded at ledges and holes. The group hopes to alter the subsequent build-up of the scale by altering the morphology in order to produce a fine powder that will flake and fall off. Attempts at causing these changes are being made with electrical fields.

(3) A very large effort is being put into the study of grinding halides, oxides and carbides (such as WC). Line broadening is the tool employed; in particular, integral line breadths of many peaks are examined to obtain particle size and microstrain. Measurements of the particle size in fine commercial powders with this method were found to be in excellent agreement with those obtained using electron microscopy and gas absorption. They discovered that with some of these powders, there was considerable broadening due to strain. On pulverizing bulk specimens of these materials, they found that for the first few minutes of grinding, the particle size was reduced to about 1000 Å. This was the true fragmentation size, as the same sizes were found on examining the powder in the electron microscope. Additional grinding caused no further reduction of the particle size, but quite surprisingly the mean micro-strain increased, reaching levels ten times those found in metals. These strains tend to vary as do the elastic constants, so that the materials appear to be under a residual stress independent of crystallographic direction. (This is similar to the micro-strain distribution in bcc metals, but in fcc metals, the microstrains do not vary as much with direction as do the elastic constants. Many of the oxides and halides examined by Lewis had fcc lattices.) As a result of this finding, the measurements can be used to obtain information on the ratios of elastic constants in different crystallographic directions. More important, the stored energy in these materials is quite large, well in excess of the surface energy associated with each particle. The sintering kinetics of milled substances should then be strongly affected by stress-induced diffusion; indeed, they find that sintering of Al_2O_3 will occur in a well-milled powder some 200° C lower than with the same powder in the annealed form.

With calcite, they hope to measure the energy of transformation to aragonite; the strain broadening of calcite levels-off with increasing grinding, and then aragonite lines appear in the pattern and grow in intensity, while those from the remaining calcite stay broad and decrease in intensity. Thus, the stored strain energy should be a measure of the transformation enthalpy.

This work clearly shows the ductility of many of the so-called brittle materials when the particle size is small. It is, in fact, well-known that many brittle compounds will deform considerably when their particle size is small and the particles are surrounded by a ductile matrix. Line broadening could prove to be a valuable method for studying the deformation of such materials.
(J.B. Cohen)

Chemical Education in Scotland

One is constantly exposed to the comment in the British Isles that Scottish universities are much more like American universities than are their English counterparts. In naive acceptance of this point of view, I had presumed that this meant that a student, during the course of his university education in Scotland, would indeed be exposed to a fair variety of disciplines. Such is not at all the case, and, should there be others who may be under the same illusion that I was, I would like to set the matter straight by giving a reasonable description of what education in chemistry is really like in Scottish universities.

The principal difference between the Scottish university educational system and the English is in the number of years each requires. To obtain an honors degree in chemistry at a Scottish university, the normal curriculum requires four years. Some very few students are admitted to "advanced standing," whereby they start in the second year and complete the honors degree in three years' time, exactly the equivalent of the English honors degree. The difference then is that students from the secondary school systems in Scotland come to university far less well-prepared in chemistry, mathematics and physics, than do their English counterparts. This is due to the fact that quite distinct sets of university-qualifying examinations are administered in the two geographical areas. The student in England, preparing for the university, is expected to specialize during his last two years, reading intensively in those subjects in which he expects to major at the college level. On the contrary, in Scotland the emphasis, in the secondary system, is on breadth of education. Thus, the first year a student matriculates in a Scottish university is devoted to what we would call general chemistry, general physics, and introductory mathematics. It is noteworthy to

stipulate that these are the only subjects studied by a chemistry major. The second through the fourth years of study in a Scottish university is very similar to the three years required for an honors degree in chemistry in an English university. Just for the record, let it be stated explicitly that a chemistry major will take no courses in English, history, art, political science, etc. He will study chemistry each of his four years with a bit of physics and math sprinkled in fairly liberally during the first year, in very small doses during the second and none at all in the last two.

In substance I would like to reiterate that the Scottish universities and American universities are alike in one, and only one, respect as I see it; to wit, the number of years required for the BS degree in chemistry, or whatever subject-matter discipline the student wishes to major in. In all other respects, it is my opinion that the Scottish universities are much more nearly akin to the English universities. (S.Y. Tyree)

Inorganic Chemistry at Aberdeen

H.F.W. Taylor was appointed Professor of Inorganic Chemistry at the University of Aberdeen one and a half years ago. His staff is composed of W. Moser, Reader; and the following inorganic lecturers: F.P. and L.S.D. Glasser (husband and wife), J.A. Gard, J.A. Duffy, G.P. McQuillan, J.H. Binks, and J.H. Holloway.

Taylor and the Glassers are crystallographers applying their methodology to the study of reactions among solid silicate phases. W. Moser is an expert in Sn(II) chemistry. Gard's specialty is electron microscopy. Binks is interested in theoretical inorganic chemistry. Holloway, a fluorine-chemist, is on leave at the Argonne National Laboratory for six months. McQuillan is a coordination compound chemist studying the new ligands $(C_6H_5)_3PS$, $(C_6H_5)_3PSe$, $(C_6H_5)_3AsS$, $(C_6H_5)_3SbS$, $(H_2N)_2CSe$ as donors toward $PdCl_2$, $HgCl_2$, $AuCl_3$, $TlCl$. Duffy does visible and infrared spectroscopy of transition metal solute species in aqueous media and in H_2SO_4.

Approximately 20 graduate students are working towards advanced degrees in inorganic chemistry. This represents about one-third of the total interest in chemistry at Aberdeen (the other two groups are physical and organic chemistry). An addition to the chemistry building, now under construction, will approximately double the present, modern facility. (S.Y. Tyree)

Inorganic Chemistry at Edinburgh

The comparison between inorganic chemistry at Edinburgh with that at Aberdeen is like unto the same comparison between Strathclyde and the University of Glasgow, both in Glasgow. In both Strathclyde and Aberdeen very strong, large groups, each headed by a Professor, maintain extensive research programs in inorganic chemistry. At the Universities of Glasgow and Edinburgh the situation is strikingly different, for in each of the schools of chemistry, the inorganic staff numbers three. In Glasgow the senior man, D.S. Payne, is a reader. In Edinburgh the senior man is only a lecturer. As might be expected, only a handful of graduate students major in inorganic chemistry.

The three senior staff in inorganic chemistry at the University of Edinburgh are: W.P. Doyle, R.O. Gould, and M.M. Harding (Mrs.). The latter is a crystallographer with interests in metal complexes. Gould is a young man who is a student of complex ion chemistry, but at the moment, learning x-ray crystallography by doing a structure. Doyle, the senior man, has developed an excellent technique for the measurement of diffuse reflectance spectra of inorganic materials. Some idea of his progress in this field can be obtained by reading one of his recent papers (J. Inorg. Nucl. Chem. 27, 1271-80 (1965)) in which Job's method of continuous variations has been applied to reactions between solids. The reflectance spectra obtained by Doyle and his students are better than any other reflectance spectra I have seen. (S.Y. Tyree)

Inorganic Chemistry in Vienna

There are two universities in Vienna, and thus two chemistry departments. At the University of Vienna, the chair in Inorganic Chemistry is to be filled shortly. Meanwhile, some inorganic chemistry is done in the Institute of Physical Chemistry under Prof. H. Nowotny. Nowotny's own interests are in the "refractory-hard"metal field; synthesis and characterization of metal carbides, nitrides, etc., i.e., highly refractory materials. However, one of his associates, N. Konopik, is interested in the hydrolytic behavior of germanic acid. In the pH range of 6→11 and from 10^{-3} M to 0.024 M total Ge, very careful pH titrations were performed. The species postulated in the solution are a function of the way she chooses to treat her data. Isopolyions are present, and her most recent preference is for an octamer. It is questionable whether or not the solutions represent the true equilibrium state.

At the Technical University of Vienna, Dr. V. Gutmann is the Professor of Inorganic Chemistry and Director of the Institute of Inorganic Chemistry. Gutmann has initiated a most ambitious and long-range program of non-aqueous chemistry. For a given solvent and a large number of metal ions, he is comparing the strength of a series of donor ligands by measuring formation constants. For the same metal ions the same series of donor ligands are to be compared in several non-aqueous solvents. This is to be a serious attempt to get at solvent effects; but it is apt to take a long time. Since all of the work is in non-aqueous solvents, it is most time-consuming since anhydrous conditions must be maintained.

The senior dozent under Gutmann is Dr. Meller, a jovial Viennese interested in B-N compounds. He has a small group of graduate students developing new methods of synthesis of B-N compounds and attempting the preparation of new compounds. Also he is completing a review paper on the subject.

The situation for young scientists in Austria is deplorable. The young PhD has three choices: (1) instructor in an Austrian Chemistry Department at ca. $125 a month. (2) industrial chemistry at ca. $250, or (3) emigrate. In questioning several young instructors in chemistry departments in Austria about the source of their automobile on the $125 a month salary,

two answers only were obtained. They either got the car while working as a post doctoral in the USA, or it was given to them by a relative .... Even in the matter of instrumentation it is apparent that Austrian chemists do not enjoy the affluence of the chemists in France, Germany, Italy, England and Scandinavia. Most certainly all of the laboratory buildings are pre-WW II, if not pre-WW I. It is a bit surprising to the writer that Austria is able to hold any of its really able scientists. (S.Y. Tyree)

Inorganic Chemistry at Innsbruck

E. Hayek is the Professor of Inorganic Chemistry and Director of the Institute of Inorganic and Analytical Chemistry at the University of Innsbruck. Chemistry is presently located in a very old building at Innsbruck, but it will soon be transferred to a building which was originally built for them at the University, but was converted for use as a press building during the 1964 winter Olympics. As yet, the equipping for use as a chemistry building seems to be a matter of less urgency than was its equipping for use by the press prior to the Olympics.

Hayek's interests have been for many years centered around basic salts, hydroxides, and their preparation from and relation to dissolved metal salts. His well-known older work on the solubilities of certain metal oxides and hydroxides in aqueous solutions of salts of the same metals anticipated the identification of many of the isopolycations "identified" recently by more modern techniques. His interests continue in the same area.

Dr. A. Engelbrecht has been made a professor in inorganic chemistry (without chair). He is a fluorine chemist, well known some 10 years ago for his preparation of perchloryl fluoride. Continuing his interests in fluorine chemistry, Engelbrecht and his students have most recently prepared a variety of derivatives of the -TeF_5 group. (S.Y. Tyree)

Inorganic Chemistry at the Technische Hochschule of Munich

There are three institutes of chemistry in the Technische Hochschule of Munich (THM), one for Physical Chemistry, another for Organic Chemistry, and the other for Inorganic Chemistry. The Professor of Inorganic Chemistry and Director of the Institute of Inorganic Chemistry is Dr. E.O. Fischer. This chair is the same one occupied for many years by Hieber. The latter is retired, but comes into the laboratory nearly every day. H. Lux and J. Jander are also professors without chair in the Institute, and there are three dozents.

At the moment Fischer's Institute is suffering from a problem which appears to be general over all of Germany. While the birthrate in the USA was climbing during the last years of and immediately after WW II, the birthrate in Germany declined sharply during the same period. Now, all students matriculating in chemistry at THM begin their studies in Fischer's institute. His teaching laboratories, designed for an entering class of 80, are now used for a class of 42 students, with some of those being recruited abroad. On the other hand, based on previous experience, Fischer anticipates that somewhat better than one-half of a class of first-year students will usually continue all the way through to the doctor's degree. Thus the drop-off has yet to be felt at the graduate level, but is about at the bottom of the curve for the first-year class.

Fischer himself continues to be what he describes as a "preparative" inorganic chemist. At the moment he is still very excited about "carbene compounds." One of his dozents, Dr. Fritz, is in charge of spectroscopy in the Institute. Fritz's equipment is extensive and excellent since Fischer is convinced of the efficacy of all kinds of spectroscopic tools as aids to chemical synthesis and characterization. Varian machines are used for nmr. German machines are used for esr and mass spectroscopy. A variety of infrared machines from several sources are available. (S.Y. Tyree)

MISCELLANEOUS

Navy European Patents Program

The Navy European Patents Program was established in the Spring of 1960. Prior to the establishment of the Program, certain international patent problems affecting the Navy were from time to time brought to the attention of the Navy Patent Counsel. In recognition that such foreign problems are not readily revealed or primarily solved without on-site Navy Patent representation, NEPP was set up in London. The primary mission of the Office of Patent Counsel, ONR London, is to support the Chief of Naval Research by providing services relating to patents, inventions, trademarks, copyrights, royalty payments, and matters connected therewith. A unique function of this office is to provide information regarding the patent policies of governments whose dealings with the US Government, within the framework of NATO and under certain bilateral agreements, generate international patent problems for the Navy. The Patent Counsel is responsible to the Commanding Officer of ONR London for the organization, the administration and the supervision of the Program and for providing services in accordance with the law and such other directives, orders or instructions as may be issued by proper authority. The Office is under the technical and management direction of the Assistant Chief of Naval Research for Patents.

The purpose of this article is to give a clear understanding of the Navy's interests in inventive ideas, to outline some of the problems encountered in connection with patents, and to clarify the routines to be followed in submitting matters to the Navy Patent Organization's representative for patent matters. It is written not only to describe the functions of NEPP and the services which it performs, but also to draw attention to the responsibility of Government employees and Government contractors in connection with patent matters, and to provide information about the services, advice and assistance which the local Patent Counsel can render in his work.

The most reliable indication of the nature of the position as Director, US Navy European Patents Program, is the manner in which the time of the Director is occupied. Because the position is different from the usual Patent Counsel's billet, a large portion of his time is spent initially in

establishing and maintaining contacts with his European counterparts and acquiring at least the basic knowledge of patent laws of European countries. A substantial part of his time is devoted to merely keeping abreast of patent developments in Europe as well as reviewing the International Industrial Property Laws and Regulations of the European countries and International Agreements affecting the US Government's operations in Europe. In addition, the Director is expected by his foreign associates to be well informed on American patent law and practice and US Government patent policy. Accordingly, he relies on a steady communication from the Washington Office and reviews various patent publications.

In addition to the information-gathering function of this office, a program of patent contract follow-up has been instituted in conjunction with the contracts let by the Navy European Research Contracts Program. This involves eliciting patent disclosures from those contractors who have made inventions during the course of their contract work as required by the usual patent clauses of the contracts and liaison with the officials of the foreign government regarding the security classification of patent applications filed by contractors in the foreign countries. Results to date have proven that a vigorous program of patent follow-up has uncovered inventions which would otherwise remain unreported and unpatented. In many cases the inventor is a university professor who does not have the funds to file a patent application in the United States. In such cases this office may file a US patent application if the Navy has a sufficient interest to justify filing.

In addition to contract follow-up, some time is devoted to what may be called contract patent policy work. This involves drafting, in conjunction with European Counsel for the Army and Air Force, patent provisions for use in European research contracts, coordination with the European governmental organizations concerned with the patent provisions of research contracts in Europe, and the explanation of the clauses and the reason for their use in Europe through the ONR member of ASPR Patent Subcommittee.

The Director attends meetings of the NATO Working Group on Industrial Property at NATO Headquarters, where he assists the US Legal Advisor.

In addition, this office has the responsibility for the transmission of classified patent applications and correspondence relating thereto in those cases in which US private citizens file a patent application in Britain covering classified inventions. By centralizing this function in this office, it has been possible to expedite processing where necessary to preserve the foreign rights of these American applicants, and at the same time to provide assistance to any UK patent agent puzzled by the required methods of handling with regard to these classified applications.

The greatest proportion of the Director's time is spent on what might be called miscellaneous patent, trademark, and copyright matters. Such miscellany covers a broad spectrum, and a selection of representative examples are included to indicate the diversity of the subject matter which may be encountered. For example, he participates in negotiations of bilateral and multilateral agreements involving patent matters, provides on-the-spot assistance and guidance to patent personnel of foreign governments, explains, interprets and aids in carrying out arrangements concerning the international interchange of patent rights and technical information, et al.

Why Does the Government Need Patent Protection? - The Navy's extensive research and development program reaches into virtually every field of science and branch of engineering. Navy laboratories and private industrial plants performing research and development work under Navy contracts are constantly developing new and useful machines, compositions, processes, and items of manufacture. Since these inventions are property of an intangible nature, they must be protected by patents if the Government is to avoid payment of unnecessary royalties. One of the best means of protecting the Government against unnecessary liabilities and expense for patent infringement is a systematic program for the acquisition of patent rights. The Navy Patent Organization, established by ONR, provides the Navy with protection in these and other respects. Specifically, this Organization considers claims of patent infringement; files patent applications on inventions selected after Navy-wide evaluation; determines rights of the Government and the inventors, and secures licenses or assignments on appropriate inventions; and evaluates inventions and suggestions about them submitted by persons outside of the Navy to determine the extent of Navy interest. Each year the Patent Organization processes more than 2,000 invention disclosures, prepares an average of 700 patent applications, secures the grant of more than 600 patents, investigates approximately 35 patent infringement claims, and assists in defending the Government in about 40 suits in the Court of Claims.

There has been found to be considerable misapprehension as to the nature of a patent and the rights granted by the patent. Many people who are benefited most by the patent system are unaware of its real meaning and its immense value. It is therefore considered helpful at the outset to make clear what a patent is and to outline steps that must be taken to obtain a patent. By documenting his invention by means of a patent, an inventor may feel certain that his research efforts will not be lost, that other individuals or groups can profit from his experience, and that, perhaps most gratifying of all, his contribution may represent an advance in the defense pursuit of the United States and the free world. The issuance of a patent increases the stature of the inventor, both as an individual and as a Navy employee, because it gives tangible evidence of his professional ability. Moreover, patents are given wide publicity in patent journals and technical literature, and those concepts which are of particular public interest are often noted in trade journals and in the local national press. Other benefits also accrue to Navy inventors. When an invention disclosure has been authorized for preparation into a patent application, the Navy employee inventor is considered for a monetary award. Under the Navy incentive awards program, he is granted a minimum of $50 when his patent application is filed, and

he may be given additional monetary awards, depending on the merits of the invention and its use.

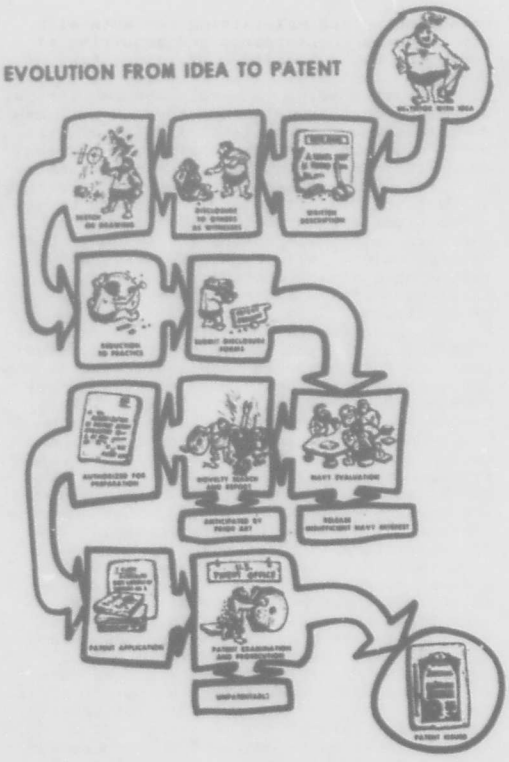
What can be patented? - Most patentable material falls into the following categories:

1. A process, art, or method of achieving a physical or chemical change in character or condition of an object or a material.
2. An apparatus or mechanical device, the interrelated parts of which function in conjunction with one another.
3. An article which is manufactured or made.
4. A composition of matter, such as a chemical compound or mixture of substances.

Recording the Concept - It is of utmost importance to an inventor to be able to provide the evidence needed to show the history of his invention. A chronological record of each step should be made in a bound notebook that is signed, dated, and witnessed. The inventor should then obtain a witness' dated signature and statement that the invention was disclosed to and understood by him. When possible, a drawing - signed, dated, and witnessed - should be made part of the record.

Step by Step to a Patent - When an invention is made, the Patent Counsel usually doesn't know about it until he is told. There are probably many ways that one can bring his invention to the attention of the Patent Counsel; and if one has any questions he should either call or drop into the Counsel's office for a discussion of the problem. Like most things, there is a preferred way to submit an invention. This is done by completing an original and two copies of Standard Form, NAVEXOS 2374, entitled "Record and Disclosure of Invention." This form has been designed to provide a convenient method for submitting the necessary information which will enable the Patent Counsel to begin to protect the idea. Copies of this form may be secured from a Navy supply office, or from the Patent Counsel's Office.

Evolution from Idea to Patent -



Conclusion - Summarizing, some of the most important thoughts mentioned previously will be repeated.

1. Keep a record of what you invent and have such records witnessed and understood by fellow employees capable of understanding the records.
2. Refer new developments to the Patent Counsel as soon as possible after the developments start.
3. Submit all apparently novel ideas and developments to the Patent Counsel regardless of whether or not it is thought they will be useful to the Navy.
4. Supply the Patent Counsel with as complete information as possible about each development submitted.
5. It should be made clear that the Patent Counsel is available to give service. You should feel free to discuss any patent questions with him, no matter how trivial they may seem.

Typical liaison services provided to date have included a survey of the patent practices of the British Government, and assisting NASA with their foreign patent matters. (F.A. Lukasik)

The Sport of Kings and Computers

The National Association of Bookmakers in England are planning to utilize a computer to calculate true place odds to be paid by bookmakers. These odds are now determined by the amount of money invested on horses to win, with the bookmaker generally paying one-

quarter the win odds for a horse backed to finish in the first three. The new odds will be computed to allow bookmakers a profit not exceeding 12½%.

It appears that they will benefit greater in races with a large number of runners. It is estimated that in the Grand National this year, the computed odds would have reduced slightly the place odds on the first three in the betting market, but would have extended them for practically every other runner, with increases of up to 60%. (R.L. McCracken)

PHYSICAL SCIENCES

British Defence Communications Satellite Work

An officer and twenty-two ratings from the Royal Navy are manning Britain's first military communications satellite ground terminal, located on grounds of the Signals Research and Development Establishment overlooking the glorious bathing beach near Christchurch (Hampshire). This is the first of three installations to be followed by similar military terminals, one in the Middle East to be manned by the RAF, and one in the Far East to be manned by the Army.

The Christchurch terminal has been operating daily in actual communications with a US Army terminal at Fort Dix, New Jersey, and in performing development tests via the IDCSP (Initial Defense Communications Satellite Project) satellites. The first set of seven of these satellites was launched on 16 June 1966 by the US Air Force, all in one launch, using the TITAN III-C launch vehicle.

The three terminals, which were developed and manufactured for the Ministry of Aviation by Marconi Ltd., of Chelmsford (Essex), employ 45-ft Cassegrain-feed parabolic dishes mounted inside 65-ft-high inflated radomes. The terminals are of a unique British design, but several of the critical components, including the Varian klystron and the AIL parametric amplifiers, were subcontracted to US firms.

SRDE employed a Philco satellite simulator (a sort of dummy satellite which performs electronically like a real one) prior to the launch, and mounted it on a high cliff on the Isle of Wight for crew practice and in order to align and test their equipment.

A two-year test period is planned for their terminals. If by the end of that time the results measure up to optimistic forecasts, a large number of military terminals will be fabricated to support the British defense installations on ship and shore throughout the world. The Royal Navy in particular is planning to employ small terminals using 6-8 ft dishes aboard all their combat ships, and the Army is very interested in developing terminals to mount on Land-Rovers.

The British are deadly serious about their communications satellite work, and accordingly, we note with unintended humor a remark in The Times (London) of 4 August 1966: "Indeed, with a central switchboard in Whitehall the first Sea Lord in his London office could speak to the flag officer, Far East, with no more difficulty than an S.T.D. caller has in making a call to any part of Britain." (Presuming of course that he can find a three-penny bit!) (B.I. Edelson)

Stimulated Emission and Molecular Processes

On 31 May, A. Kastler, President, convened the 16th Annual Meeting of the French Society of Chemical Physics. Having chosen the above topic for their four-day meeting, the organization Committee proceeded to invite a number of laser luminaries to report on recent research in this field. Lasers being "in" these days, some 250 individuals managed to get their names on the roster of registrants, and, depending on which paper was being given, some actually appeared at the UNESCO Palace from time to time. Considering the various competitive attractions offered by Paris in the spring, we are happy to note that almost never (while we were present at any rate) did the attendance drop below 30.

Having written in some detail about the UNESCO Palace in a recent issue of this Journal (ESN-20-5, pp. 73) we confine ourselves to a single addendum here. Namely, simultaneous translation facilities were not provided on this occasion; papers were given in either French or in English, with occasional anguished cries of "Slower, please" when individual neuron paths became overloaded.

Activities of the first two days centered around the increasingly popular CO_2 laser, with some attention also given to other molecular gas lasers and to more general research in molecular energy exchange involving CO, N_2O, N_2, O, H_2O, et al.

As an invited paper for the second day C. Patel offered a fine review of molecular lasers, which could produce, initially in 1964, only a few mW but now yield several hundred watts CW and efficiencies over 10% in present systems. Patel's well-attended paper reviewed electron impact excitation in pulsed CO, NH_3, CN, CH_3, H_2O and others; vibrational transfer in N_2-CO_2, N_2-CO, and N_2-N_2O systems; and chemical excitation in pulsed HCl and others.

Unlike previous papers which outlined rather minor but recent research results, Patel's was a carefully selected broad summary, eventually focusing down to a presentation of some details on his own recent research. Here the question of the mechanism by which foreign gases prove effective in laser systems was analyzed. One wants to know whether the process involves speeding up the upper-state excitation reaction or of increasing relaxation from the lower lasing state to the ground state. At Bell Laboratories, Patel's group has developed a nice experiment for adding foreign gas to CO_2-only, or to the CO_2-N_2 mixture at a later stage, thus, hopefully, enabling some sorting out of these two effects. Very recent results indicate that in adding H_2 the effective action is with CO_2, i.e., a lower-state depopulation, while for He the effect is largely on the N_2, which implies a contribution to the excitation of the upper state or a more general modification of the discharge. For O_2 very tentative results appear to show an effect similar to that of He.

On another topic, Patel pointed out that with relatively long lifetime ($t \approx 1$ msec) repetitive Q-switching can easily be accomplished, and at the moment 10 KW, 100 nanosec pulses are available, and some interesting applications other than burning up chunks of wood should be expected. The existence of an atmospheric "window" at the lasing frequency should provide some challenge, and the possibility of further investigation of non-linear effects should also be enhanced.

Summarizing, the speaker listed the following properties of molecular gas lasers as indigenous to the species:

a. Low gain (3 dB/m), high-power transitions

b. High efficiency (10-20%)

c. Power out on a number of closely spaced lines, with competition between various transitions

d. Ability to be Q-switched as noted above.

During some of the later papers, it was amusing to note a discussion on how to terminate such high-power, infrared laser systems. Evidently one cannot keep setting blocks of wood down at the end of the laser runway, with a continuous fire resulting -- nor can one simply dump the beam out the open window with consequent instant cooking of any wandering target. Some kind of absorbing black hole is needed, and one or two rather obvious designs were described.

Essentially, Patel set the tone of the second day's proceedings by posing the questions, and the various contributors provided some of the answers. W.J. Witteman (Eindhoven), for example, showed that the presence of impurities at pressures as low as 10^{-4} torr, appreciably affected his results. Specifically, even well-cooked and outgassed pyrex may provide such a degree of impurity, so that fused quartz is highly recommended. Employing this latter envelop, and hollow cylindrical electrodes which emit only from their inner surfaces, Witteman obtained 100 watts, CW, at 12.5% efficiency in a 2-m-long "atmosphere" laser, as these combinations of CO_2,N_2, H_2O are often called.

During the latter half of the second day and for the entire third day, chemical lasers, as variously interpreted, were given free rein. While little more could be said than was already described in the La Jolla Chemical Laser meeting about two years ago, it, nevertheless, could be said in greater detail -- and it was! Starting with a review of some of his father's work of 25 years ago, J.C. Polanyi of Toronto presented experimental results and a general survey of the entire field. Well-presented, lucid and incisive, this talk served to delineate the various types of reactions which may be expected to produce lasering. While, originally, the term chemical, as applied to lasers, was intended to mean that the original source for the energy in the beam should be found in the chemical reactants themselves, more recent relaxation of this requirement has allowed processes in which photo-dissociation, with resultant excited species and levels, to be counted. Polanyi described his own research in which HI is bombarded with H atoms from a discharge source and emission from atomic iodine is observed. Alternatively by employing 2537 A° light instead of a discharge source to obtain H atoms, he was able to observe similar results. The reaction is simply $H + HI \rightarrow H_2 + I^{(*)}$.

In general, it would appear that speculation on the future of chemical lasers, and their possible importance as compact, efficient sources, continues unabated. Problems are no nearer solution, and to this listener, at least, most of the papers sounded very much the same as they did two years ago.

A paper by G. Oster (Brooklyn Polytechnic) proved provocative in that Oster's data suggested to him that a very long-lived (over 40 msec) fluorescence in a compound of polymerized fluorescein in methyl methacrylate might be evidence of stimulated emission. A threshold was observed, but studies were not as complete as he would have liked -- partly due to the rapid carbonization of the central section after only four above-threshold pump flashes. As Oster noted, this sort of device could become an integral part of the American economy -- as the first of the "throw-away" lasers! In general, it was admitted that no line-narrowing had been observed, and no study had yet been made of the angular distribution of the radiation -- two bits of data which are surely essential before one can substantiate the presence of laser action. The very large gain reported may still prove to be caused by an as yet unidentified geometrical factor -- but the report was certainly an interesting one -- if not yet definitive.

By and large, the third day, in which the above paper was presented, was a day for chemists, with europium in chelates and various rare earths in dye solution serving as principal topics on the agenda, and with attendance relatively low. The final day of the meeting found nearly all attendees physically present, a circumstance, due at least in part, to the promised paper by B.P. Stoicheff of Toronto and to one by G. Mayer of CGTSF, Orsay. Naturally these authors developed their own work in Stimulated Raman Emission (SRE) and absorption -- Stoicheff making his offering in English; Mayer in French. As Stoicheff noted, the topic of SRE has provoked the interest of theorists from a time even before lasers had come into being. However, "Theorists have been interesting -- but not helpful to the experimentalists," Stoicheff reports. He also added that "... no matter what experiment is performed to clarify the situation, one simply gets deeper into the mud."

Pointing out that in such compounds as C_6H_6, and CS_2 extra components are observed, Stoicheff suggests that one is probably seeing cooperative effects between different molecules and that one important application of stimulated Raman emission might be to reveal the degree of molecular coupling in various solutions. In addition, a study of the spectra of short-lived species might also be "in the cards" if pulse times can be improved.

During the second half of his lecture, Stoicheff concentrated on the angular dependence of this stimulated radiation, once more remarking upon the difficulty of reconciling experiments with any reasonable theory. We join him in hoping that the advent of a new generation of very clean, single-mode, lasers will reduce the number of variables presently contributing to the general atmosphere of confusion. Developed with great care, patience and humor, Stoicheff's paper fully warranted the large attendance and warm applause it received.

While the schedule throughout the course of the meeting was the traditional one, allowing for the usual 2½ hour lunch break -- a minimum time, in our opinion, to enjoy a truly French lunch, we must record here, with some sadness, a new policy which may eventually be found in force for future meetings. For while our laser conference carried on, President de Gaulle and his Cabinet announced

a complete reform of the traditional civil service work pattern. Affecting the 60,000 or so civil servants who work in Paris, their new schedule calls for only a half hour lunch break. Henceforth they will have a five-day week, starting at 0845 and ending at 6 pm. Previously they had worked a five and a half-day week, and until 7 pm. To be successful, Prime Minister Pompidou called for a "certain discipline" in working habits. Specifically, he urged his ministerial colleagues not to start handing out new assignments to their employees near 6 pm. What effect these new rules will have on the gastronomic arts, as practiced in Paris, remains to be seen. (E. Weinberg)

Sea Echo Measurements at Shape Technical Centre

SHAPE Technical Centre (STC) is an organization composed of 350 civilian personnel drawn from the NATO nations and is located in The Hague, Netherlands. SHAPE Air Defence Technical Centre was established in 1955 to provide scientific and technical advice and assistance to SHAPE (Supreme Headquarters, Allied Powers, Europe) on air defense. The scope was expanded in 1963 to embrace technical advice and assistance on both air and ground defense and offence; its name was changed at that time.

The scientific program of the Centre originates in three ways: proposals for specific investigations are submitted by individual NATO nations, by SHAPE, or generated by personnel of the Centre itself. Assistance in establishing the annual STC program of work is provided to SACEUR (Supreme Commander Allied Powers Europe) by the Scientific Committee of National Representatives. The members of this Committee are scientists and engineers familiar with defense research and development in their respective countries. Each NATO nation has appointed a liaison officer, and the US position is presently held by Lt. Col. Allan F. Erwin, HQUSAF/AFRFD, Room 5D336, The Pentagon, Washington, D.C.

In 1968 STC is expected to move into its new building, but for the present the Centre is located in two separate places. One building houses management, the Operations Research Division, and the STC general purpose digital computer. The other building, located adjacent to RVO-TNO (a Netherlands government research laboratory), contains the Systems Research Division and the Communications Division, with their associated radar, data processing, and telecommunications laboratories.

According to Messrs J.P. Chaumont and A. Voss, measurements on average radar cross section per unit area, σ^o, of the sea have been under way at STC since the fall of 1965. At present only average values of echo are being measured, and the primary objective of the study is to obtain the percentages of time, on a long-term basis, that σ^o is expected to be between various levels. Effects of radar wavelength, polarization, and sea condition are being examined for angles near grazing incidence.

Six radars, on loan from the Netherlands Navy, are being used: two at L-band, three at S-band and one at X-band. The radars are all non-coherent pulsed types; some of the antennas are horizontally polarized and others are vertically polarized. The system parameters are as follows:

	L-Band	S-Band	X-Band
Azimuthal beamwidth	1.5°	3.3°	1.5°
Pulse length used	2 μs	0.5 μs	0.3 μs
Other pulse length available	5 μs	1.5 μs	0.1 μs

Calibration is obtained with "accurate" noise sources which are displayed on indicators with which return can be observed as a function of range. STC personnel estimate that σ^o obtained will be accurate to within 3 db.

The field-site geometry is such that the radars can look into the prevailing wave direction and perpendicular to that direction; because of various obstructions, the range of grazing angles available is limited to angles between 0.1° and 0.2°. Wave direction, wind speed and wind direction are being recorded. A wave height meter from which information is to be telemetered ashore is soon to be obtained.

Few, if any, absolute radar cross-section data are published on simultaneous measurements at L, S, and X bands and for 0.1° - 0.2° grazing angles. There are no reports available as yet on this program, but Chaumont estimates that data will be available by Fall of 1966. After this study is completed, STC personnel plan to make sea measurements with MTI radar. (M.W. Long)

Acoustical Yagi Antenna

Under the able direction of Prof. Irwin Meyer, the Third Physical Institute, University of Göttingen, Germany, has for 19 years been a leading center for experimental research in wave physics, with a strong emphasis on acoustics. Believing strongly in the unity of wave physics, Meyer has always encouraged research on electromagnetic waves, especially on phenomena that have their counterparts in acoustics.

Dr. R. Pottel heads the electromagnetic group which is currently studying absorbers (thin layers for broad-band performance) and transmission lines for electromagnetic waves and determining the electrical properties of electrolyte solutions and of solids. The electromagnetic group is well equipped for measurements from a few megacycles up to and including wave lengths as short as 4 mm. About 10 members of the Institute's professional staff of 40 are within the electromagnetic group; and the entire Institute staff numbers about 70. Each year four or five research students of the Institute receive the doctorate.

Dr. E.G. von Neumann has conducted extensive theoretical and experimental programs on the electromagnetic properties of dielectric-thread transmission lines, transmission lines of the Yagi type, and Yagi antennas. Based on analogies with the electromagnetic antenna, von Neumann has developed an acoustic Yagi antenna. Acoustic waves are propagated through a tube to air holes which are backed up by a reflector; metal discs serve as the Yagi elements. The arrangement effectively transforms sound waves into directional sound radiation and vice versa. Directional characteristics and gain have been determined (Acustica, 15, Issue 5, 1965) experimentally; the Yagi type acoustical transducer operates for frequencies between 8 and 12 kc, and over this band the

beamwidth is approximately 20°.

Von Neumann is currently writing a book on acoustics (to be published by Vieweg of Braunschweig, Germany) with Meyer, and paradoxically, except for the acoustical Yagi antenna, all his previous work has been with theoretical and experimental aspects of electromagnetic waves.

Von Neumann's papers on dielectric-thread and Yagi transmission lines have been published in Zeitschrift für angewandte Physik (Z. angew. Phys.). The dielectric-thread transmission line is a string of low-loss material, such as polystyrene, polyethylene, or quartz, with a free-space diameter of approximately a quarter wavelength. Such a transmission line is said to propagate the "dipole mode," because it is easy to launch such a surface wave with a dipole. The wave is loosely bound to the dielectric, and the field distribution is much like that for free space. Because most of the energy is transmitted outside of the string, the transmission loss is very low. Von Neumann has derived simple and tractable equations which describe the field in the vicinity of the thread, and has shown experimentally that his simplified equations are valid (Z. angew. Phys. 16, 452, 1964).

Transmission loss is so low that it must be measured with a cavity. A Fabry-Perot interferometer has been used for loss measurements at 5 mm, and the measured loss was only 0.1-dB per meter (Z. angew. Phys. 17, 304, 1964). The dipole mode is so lightly coupled to the string that severe loss exists at a bend, but a simple mirror can be used to create a low-loss bend. Tighter coupling to the thread can be accomplished by increasing thread diameter. In still another paper, von Neumann (Z. angew. Phys. 18, 71, 1964) discussed the practicality of gradually increasing the thread diameter in order to reduce loss around bends.

The external field distributions for a transmission line made of Yagi dipole elements, with spacing not exceeding a half wavelength, are the same as for the thread. Results of theory and experiment on the Yagi-type tranmission line have also been published (Z. angew. Phys. 19, 121, 1965). Propagation along a dielectric thread which passes through a hole in each of many metal plates has also been studied (Z. angew. Phys. 20, 57, 1965); because of the principle of Babinet, the mathematical problem is analogous to that for propagation along a dielectric thread on which are located equally-spaced metal discs. The Yagi-type transmission line has also been considered as a means of providing a transmission line suitable for making reflection coefficient measurements on absorbers. According to von Neumann, the method is not practical except for relatively large values of the reflection coefficient (Z. angew. Phys. 19, 297, 1965). Most of von Neumann's time is now being spent on preparing the acoustics book, but he is also completing a paper on the loss which exists between two closely-spaced and collinear dielectric threads (small gap).

There are two major facilities which help to illustrate the emphasis that Meyer places on pursuing the analogy between acoustic and electromagnetic waves. These large rooms, an anechoic room and a resonant chamber made for both acoustics and electromagnetic waves, were previously described by Ament (ONRL Report 40-60). For the resonant chamber, the Q at microwaves is approximately 2×10^6. While touring the building, it was learned that an analogy to a traveling-wave amplifier has been built with the wind tunnel -- turbulence for the slow-wave structure was made with slits. (M.W. Long)

Conference on Phonons

This Conference, sponsored by the Institute of Physics and The Physical Society, took place in Edinburgh, 6-7 April, about 2½ years after the International Conference on Lattice Dynamics in Copenhagen. To a certain extent it could be considered a smaller version of the Copenhagen conference. Of the 45 speakers listed in the program, 21 were associated with institutions in the UK, 9 from the US, and the rest from other countries. There were sessions devoted to lattice vibrations of imperfect crystals; lattice conductivity; phonon-photon interactions; lattice vibrations in covalent, metallic and disordered crystals; anharmonic effects; and spin waves.

Theoretical progress in the last few years on lattice vibrations in crystals with point imperfections was reviewed by Prof. C.W. McCombie (Univ. of Reading). It will be remembered that point imperfections introduce local changes in both the atomic mass and interatomic force constants and so modify the normal modes of the lattice. Straightforward procedures were outlined for obtaining information about the modifications to the modes produced by such local changes when the results of calculations of the normal modes of the perfect lattice are available. Such results are of interest in interpreting experimental results dealing with infrared absorption, vibronic transitions in electronic spectra, and thermal conductivity measured. Depending upon the particular situation, an experiment may reveal information about any or all of the following types of modes: (1) localized; (2) ordinary phonon or band and (3) non-localized or resonance. Localized modes are modes at new frequencies which appear on introduction of the imperfection in the perfect lattice. The quasi-localized or resonance modes appear in the frequency region of the ordinary phonon modes. As a result the data cannot always be analyzed in a straightforward manner.

Investigations of the vibrational structure of electronic transitions was discussed by several individuals. M.D. Sturge (Bell Telephone Labs.) showed whether the spectrum was characteristic of quasi-localized modes or ordinary phonon modes, depending on the coupling of the impurity atom to the lattice. A case where ordinary phonon modes were revealed quite nicely was shown by W.E. Bron (IBM Watson) on the case of Sm^{2+}:KBr. Theoretical treatments of the topic were presented by R.E. Hubner (Technische Hochschule, Stuttgart) and by J.V.D. Matthew and A. Hart-Davis (Univ. of York). The latter pointed out that quadratic effects in the electron-phonon interaction would lead to a broadening of the absorption associated with localized modes. Localized modes of Group III and Group V impurities in III-V compound semiconductors were reported by A.R. Goodwin, R.E.V. Chaddock, and S.D. Smith (Univ. of Reading). This choice of impurity and host lattice was advantageous in that free-carrier absorption was not as troublesome as in previous work by Smith's

group. Higher harmonics of the local mode frequency were observed, and this provides information about the anharmonic potential constants.

Infrared and Raman spectra associated with the lattice vibrations of perfect crystals were reviewed by F.A. Johnson (Royal Radar Establishment, Gt. Malvern, Worcs.). It was pointed out that in analyzing vibrational Raman spectra of multiphonon infrared spectra, it is often assumed as a first approximation that the coupling coefficient between the radiation and lattice vibrations is a slowly varying function of both the wave vector and phonon-band index in the absence of any known specific selection. While such a procedure is often useful in deducting the frequencies of various phonons, it cannot be employed as a useful measure of the intensity in any experimental situation. In particular, in recent months polarized laser Raman studies in GaP have provided extensive experimental data which can be compared with the infrared spectra. From this data it is inferred that the absorption intensity depends not only on the lattice vibration spectrum, but also on the band structure. Theoretical progress is being made on producing better quantitative estimates of the coupling coefficient and, thus, of the observed Raman or infrared spectrum. A number of other papers dealing with infrared and Raman spectra of pure crystals were presented.

The relation between the thermal conductivity and lattice vibrations was reviewed by R. Berman (Oxford). Unfortunately, several types of scattering processes may act simultaneously so that the frequency and temperature dependence of each are not generally known with certainty. Nevertheless, a number of important investigations on various materials have been carried out. In particular, this method has been useful in studying the isotope effect in LiF using ^{6}Li and ^{7}Li. It was noted that there have been some Russian investigations of the ^{3}He-^{4}He system. Various other papers on thermal conductivity in insulators and metals were presented. The zero-sound excitation in crystals of quartz and sapphire was the subject of a paper by J.N. Andrews, Jr., and M.W.P. Strandberg (MIT) describing an ingenious experiment. Such excitations are analogous to the zero-sound oscillation proposed by Landau for Fermi liquids.

Investigations of the lattice dynamics of solids as revealed by inelastic neutron scattering was discussed by A.D.B. Woods (Chalk River). Recent studies of the Kohn anomalies the dispersion curves of metals are of current interest. The lattice dynamics of niobium was given by R.I. Sharp (Cavendish Lab, Cambridge), and this agreed with the Chalk River investigations. In this case, the source of neutrons was a cold moderator providing a more intense beam of low-energy neutrons. This source was also used by G. Peckman (Univ. of Reading) along with a triple-axis spectrometer to study MgO. Dispersion curves for some metals were presented by W. Buhrer, T. Schneider, W. Glaser, and E. Stoll, in which the data were obtained by using a rotating crystal time-of-flight spectrometer at the Swiss Federal Institute for Reactor Research at Wuerenlingen.

In the realm of lattice dynamic calculations of perfect crystals, the latest calculations of J.R. Hardy (AERE, Harwell) and A.M. Karo (Livermore, Calif.) were given for polarizable ionic solids. Comparison with the infrared and Raman spectra were carried out where possible. The lattice dynamics of diatomic crystals with high dielectric constants (e.g., Tl halides, PbS, PbTe, SnTe) was discussed in a paper by E.R. Cowley, M.M. Elcombe and G.S. Pawley (Edinburgh). In addition to features which can be explained qualitatively in terms of conventional theories of ionic crystals, the dispersion curves of the three semiconductors show the effects of screening of the macroscopic electric field by conduction electrons.

Two experimental and two theoretical papers on spin waves were presented. The spin wave dispersion in $KMnF_3$ was determined at AERE, Harwell by S.J. Pickart (NOL, Silver Spring, Md.), M.F. Collins (AERE, Harwell) and C.G. Windsor (Harwell), and it was possible to deduce the nearest and next nearest neighbor exchange interactions and anisotropy field. Investigations of the spin-wave scattering of polarized neutrons from cobalt and nickel by A. Furrer, T. Schneider, and W. Halg (Wuerenlingen) provide information about the Fermi surface in these materials. However, there appears to be a discrepancy in the [111] direction between these measurements and those by optical, magnetoacoustic, and galvanomagnetic methods.

In this report only a few of many interesting papers have been mentioned. Although the subject of lattice vibrations can be considered a relatively old one in the field of solid state physics, there are still many interesting aspects of the subject on which active research is being pursued and for which there is evidence that this will continue in years to come. (M. Hass, NRL)

PSYCHOLOGICAL SCIENCES

Norwegian Institute for Applied Social Research

The Norwegian Government recently established an Institute for Applied Social Research (Institutt for Anvendt Sosialvitenskapelig Forskning) to fill a void in this applied field. While basic research in psychology and the social sciences certainly is as well established in Norway as in most European countries, there are a number of glaring deficiences in the applied field. For example, there are several institutes concerned with industrial psychology at the present time, but there is not a single group conducting large-scale studies either in the fields of school or clinical psychology. Moreover, while there is work on peace research and international conflict resolution, there is no research organization concerned with the domestic problems of the Norwegian population. The Institute for Applied Social Research has been established to fill this gap.

An advisory board has been appointed, and funds for the present calendar year have been appropriated even though no permanent director of the Institute has been appointed as yet. The advisory board or board of directors includes a number of eminent and professionally powerful individuals in Norwegian scientific, political, and university circles. In fact, if the stature of the board of directors is any indication of success, the Institute should make a major impact on the social and behavioral sciences within the foreseeable future. The composition

of the board is as follows:

E. Fjellbirkeland - Secretary of Norwegian Council on Scientific Policy (Chairman)
S. Lysgaard - Professor of Sociology, Oslo University
P.J. Bjerve - Director of Norwegian Central Statistical Register
R. Gerhardt - Director of Norwegian Military Psychology Institute (Representative of Norwegian Research Council on Science and Humanities)
Knut Mykland - Professor of History, University of Bergen
E. Rinde - Director of Institute for Social Research, Oslo
V. Aubert - Professor of Law and Sociology, University of Oslo

The above group has been quite active to date in formulating a basic structure for the Institute as well as guidelines for its operation. (Apparently none were given in the Government directive which established the organization.) No decision has been reached as to whether the activity of the organization will be fund-granting or contractual, as opposed to in-house in nature, or a combination of both. A critical aspect of this problem is the shortage of fully trained psychologists and sociologists in Norway.

Even though the basic structure of the Institute has not yet been decided, six projects have been accepted for grants in a broad category defined as "problems of the physically handicapped." These projects, all proposed by established Norwegian investigators, are concerned with the sociology, medical rehabilitation, and social psychology of the physically handicapped.

In the future it is hoped to expand the Institute program into the area of educational psychology. At the present time all innovations in Norwegian educational psychology reportedly must be adapted from programs of other countries, including the translation of psychological tests used in the school system. Although difficult to believe, it would appear that there is no capability at the present time in Norway to cross-validate tests on Norwegian populations. This is true, although it is clearly believed that there are cultural differences between Norway and the other Scandinavian countries for which the tests tend to be adapted.

The research sponsored by the new organization will be multidisciplinary in nature and will range from medicine to sociology. In fact, it would appear that the emphasis would be rather heavy in the area of medicine and social psychology, even though there is no physician and only one psychologist on the board of directors. (J.E. Rasmussen)

NEWS AND NOTES

Capshell, Royal Dutch Shell's experimental submersible pressure vessel has recently completed shallow water trials in the Mediterranean, 100 miles north of Rome. The next stage of this vessel's trials will be in deeper water, up to 600 ft, in the same area off the Monte Argentario. No official statements have yet been made on the results of the trials, but the London Financial Times reports that they are understood to have been successful. The Capshell operation simulates normal conditions for the upkeep of an offshore well-head on a Continental Shelf oil field, and the present trials have been to ascertain the behavior of the vessel on the sea bed and the reactions of the dozen divers who have been taking part. Physiological data obtained is being studied by Prof. A.A. Buhlmann of Zurich Univ., who is in charge of this aspect of the operation. Different types of breathing gases have been tested, together with different types of tools to ascertain those most suitable for work on the sea bed.

Denmark's Institute of Technology has recently opened a new acoustic laboratory valued at 8 million kroner ($1 = 6.9 Dkr). The Head of the establishment is Dr. Fritz Ingerslev. Within the laboratory, noise research is being carried out in two diametrically opposed areas. One of these areas consists of a room with very considerable resonance and the other comprises two rooms of "dead silence." The resonant room will be used to study and examine the quality of noise absorbing materials. Walls and ceilings are fabricated of reinforced concrete and equipped with remarkable convex "bubbles" which cause the noise to be thrown bac' in all directions. The acoustic quality is similar to that found in large churches. The "dead" rooms are so arranged that all possible noise is absorbed by the walls. One of these two rooms, probably the "best" in Europe, is covered with 10,000 pieces of 1.5-m-long strips of mineral wool, which effectively absorb 99.75% of the generated noise. (Extract from Berlingske Tidende, June 7, 1966, Denmark, quoted in American Embassy, Stockholm, Science News - Scandinavia, No. 4, 1966.)

The Chemical Society and the University of Nottingham have established a Chemical Society Research Unit in Information Dissemination and Retrieval at Nottingham. This Unit has been created to undertake research in areas complementary to those of the research program of the American Chemical Society's Chemical Abstracts Service.

A Grant of £35,000 from the Wellcome Trust to University College Hospital Medical School, London, to establish a Chair of Experimental Pathology, will lead to the return from the US of Dr. J.D. Judah, who formerly worked at the School. He has been Director and Prof. of Metabolic Research at Chicago Medical School since 1963. He will work here on the action of drugs in the body and the mechanism of cell injury in liver damage.

As a result of the death of Prof. H.G. Radden, Prof. Ernest Matthews has agreed to become temporary Dean of the Turner Dental School in the University of Manchester. Matthews is Prof. of Prosthetic Dentistry and Director of the Prosthetics Dept. in the School.

Prof. J. Brown, Professor of Electrical Engineering at University College, London, has been appointed to the Chair of Light Electrical Engineerin at the Imperial College of Science and Technology, London, as from 1 Oct 1967.

L. Castilleje, Lecturer in Theoretical Physics and Fellow of Wadham College, has been appointed to the second Chair of Physics at University College, London.

Dr. R. Nicholson will leave Cambridge Univ. in September for a Chair in Metallurgy at Manchester Univ.

Dr. P.B. Hirsch and Dr. M. Whelan leave the Cavendish Laboratory, Cambridge Univ., in September to become Professor and Reader, respectively, in the Department of Metallurgy at Oxford Univ.

Mr. N.L. Parr, recently Director, Metallurgy Division of the Admiralty Research Laboratory, Holton Heath (near Poole), Dorset, has been selected to be the new Director, Materials Research Dept (Naval), succeeding Mr. E.J. Vaughan, who has recently retired.

H. Charnock, Principal Scientific Officer in the National Institute of Oceanography, has been appointed to the Chair of Physical Oceanography in the Univ. of Southampton.

Prof. R.S. Silver, Professor of Mechanical Engineering in the Heriot-Watt Univ., Glasgow, has been appointed to the James Watt Chair of Mechanical Engineering, at that University.

Dr. T.D.V. Lawrie, an authority on heart diseases, who is a consultant physician and consultant cardiologist at the Royal Infirmary, Glasgow, has been appointed to the new Walton Chair of Medical Cardiology at the Univ. of Glasgow.

Dr. P.R. Bryant, presently principal scientific officer in the Telecommunications Research Laboratories of the General Electric Company, has been appointed to the Chair of Electronic Engineering in the School of Engineering Science, University College of North Wales, Bangor.

Dr. A.B. Foster, Reader at the Univ. of Birmingham, has been appointed to the Chair of Chemistry at the Institute of Cancer Research, from 1 Oct 66.

Prof. R.W. Tiffen, Prof. of Applied Mathematics at Birbeck College, has been appointed to the Chair of Mathematics at Birkbeck College from 1 Oct 66.

Dr. Brian Harris has returned after three-and-a-half years in the US with Pratt and Whitney, and will join the staff at the Univ. of Sussex this fall.

Dr. P. Beardmore, Lecturer in Metallurgy at Liverpool Univ., has taken a position on the scientific staff of Ford Scientific Laboratory, Detroit, Michigan.

Dr. W.J. McG. Tegart, Reader in Metallurgy at Sheffield Univ., has taken the Chair in Metallurgy at the Royal College of Aeronautics, Cranfield, which was vacated recently by Prof. A.J. Kennedy, who now heads the British Non-Ferrous Metals Research Association.

Dr. J.K. Lubbeck, a Lecturer in Engineering in Cambridge Univ., who is spending a year as Prof. of Advanced Engineering at Chulalongkorn Univ., Thailand, has been appointed to the recently founded additional Chair of Electrical Engineering at Cambridge Univ.

Dr. J.B. Adams, Director of the Culham Laboratory, Oxford has been appointed a full-time member of the UK Atomic Energy Authority for a period of five years from 1 Oct this year. He also becomes a member of the Advisory Council on Technology in the Ministry of Technology.

The title of Professor has been conferred on the following: Dr. F.F. Heymann, Reader in Physics at University College, London; Dr. Satya Prakash Datta, Professor of Medical Biochemistry at University College, London; Dr. R.M.H. McMinn, Professor of Anatomy at King's College, London; Dr. J.F.J. Dippy, Professor of Chemistry at the Chelsea College of Science and Technology, London; Dr. L.S. Bosanquet, Professor of Mathematics at University College, London; Dr. R.A. Kekwick, FRS, Professor of Biophysics, Lister Institute of Preventive Medicine, Univ. of London; Dr. S.J. Pirt, Professor of Microbiology, Queen Elizabeth College, London; and Dr. J.C. Sloper, Professor of Experimental Pathology, Charing Cross Hospital Medical School, London.

The death occurred in June of Prof. S.B. Watkins, who had been Professor of Chemical Engineering at King's College, London, since 1963.

Prof. F.A. Vening Meinesz, the distinguished Dutch geophysicist, died on 11 Aug.

Dr. Alan P. Goffe, the virologist, was lost at sea in a sailing accident earlier this month. He was Head of the Dept. of Experimental Cytology at the Wellcome Research Laboratories, Beckenham, only completed eight months ago for the research program which he had planned.

Technical Reports of ONRL

The following reports have recently been issued by ONRL. Copies may be obtained gratis by Defense Dept. and other US Government personnel, ONR contractors, and other American scientists who have a legitimate interest. However, because of the frequent content of proprietary and prepublication information, the reports cannot be sent to libraries or to citizens of foreign countries. Requests for ONRL reports should be addressed to: Commanding Officer, Office of Naval Research Branch Office, Box 39, Fleet Post Office, New York, New York 09510.

ONRL-32-66	Applications of Fracture-Safe Design Concepts in the Development of Weldable Structural Steels in Europe by W.S. Pellini
ONRL-33-66	Experimental Physics in Israel. Part II. The Weizmann Institute of Science by Dr. I. Estermann
ONRL-34-66	Mathematical Activities in Israel by B. Epstein
ONRL-35-66	Notes on Psychological Training and Research in Yugoslavia by J.E. Rasmussen

ONRL-36-66 Some Nuclear Centers in France, Germany, Switzerland and Italy by J.G. Brennan

ONRL-37-66 Solid State physics in Scandinavia by B.O. Seraphin

ONRL-38-66 Inorganic Chemistry in Italy by S.Y. Tyree

The following conference reports are releasable to European scientists:

ONRL-C-13-66 Fifth International Symposium on Rarefied Gas Dynamics by I. Estermann

ONRL-C-14-66 International Union of Pure and Applied Chemistry (IUPAC) International Symposium on Macromolecular Chemistry, Prague by A.L. Powell

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13. ABSTRACT

This is a monthly publication presenting brief articles concerning recent developments in European scientific research. It is hoped that these articles (which do not constitute part of the scientific literature) may prove of value to both American and European scientists by disclosing interesting information well in advance of the usual scientific publications.

The articles are written by members of the scientific staff of ONRL, with an occasional article contributed by a visiting stateside scientist.

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