

Feature Science and Technology

Irresistible Magic of Technological Change

SOMETIMES a little thing can cause a major upset in technology. This is what happened to the computer world with the advent of the micro chips. And this is what happened to our publication world with the use of tracing paper in desk top publishing. Expensive RC or positive film roll of the photo-composition system was making it difficult for any expansion in the magazine as well as the best seller business (Sheba Prokashoni, for instance.)

At the time of the entry of the computer into the market in this area, alternatives to computer composing like the electronic golf-ball type-writers were still around, while the transition period saw the gradual death of the letter press or the hot metal process! Singapore Government Press had, once, been a laughing-stock for its outdated machines any system. But when the government asked it to make out on its own just like a private printing firm, it went on a buying spree with the latest computers, colour processing and offset printing machines coming in to the dismay of many a private printing firm which had bought first generation machines and were now stuck with them. So it seems that taking up technology later in the day after everyone else also has its plus points just as being the pioneer makes a vital difference in capturing a market.

One advantage the big firms

seized was printing for publishers abroad: Australia, UK and USA. Our work is of international standard. When it comes to proof reading, we can hold our own. In Singapore at a subsidiary of an international printing and publishing firm it happened that a large illustrated book on cricket (photos in both colour and black-and-white) showed Zaheer Abbas, the Pakistani star batsman, as being an Indian cricketer. Officials of the publishing firm noted the correction with interest but were not alarmed because the party

tion with a special pen containing special ink. The special nib makes the writing come out very thin and the special ink does not come off easily. The pen can also be used to put arrows, lines and, if one is an artist, sketches or designs as well. But this system was too expensive. Tracing sheets arrived to drive out the RC. Now a blade is still a required implement and so is a pen, some however, prefer to re-print a letter, words, paragraph and paste it on with scotch tape. The only problem here is that

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had done all the proof reading! When our work involved use of the RC for offset printing, we took the roll of thick film or plastic, where the matter was imprinted not on the reverse but plainly as in this article. Reversion would take place when the plate was made. Now the matter can be read only with a mirror. But when printing takes place, the letters will come out as they have. The benefit of RC with types not reversed is that correction can be carried out with a blade to scrape off the wrong letter/s and place the correc-

at times the scotch tape gets stuck on to some other paper or covering and come off. One will not be sure of this until printing is over and one has sat down to enjoy the reading matter now with the 's' missing in 'was' which had previously been computer printed as well! One does come across, all the some, the printing errors or that blight: the printer's devil.

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or graphics. Command problems sometimes cause curious but unpleasant difficulties. A page is all right in the final laser-print proof but in the tracing new and unwanted sentences crop up. For example in a Bangla article 'buffer stock' in parentheses of brackets becomes some mysterious phraseology in Bangla. The press people stare at the error and cannot figure out the reason.

Or a para comes out with perfect spacing in laser print but in tracing all the letters run together! Software engineers are 'needed', computer programmers say heavily. The press solves the problem by fixing the machine or by cutting up the words and pasting them separately if it is just a heading.

Desk top publishing has allowed many a magazine to come out to the competitive benefit of writers, editors, artists and others. Some worry about the in-fighting for readers and ads. However, it is realised that quality counts and the best will survive, others will have a marginal existence. Computer printing is now permitting dailies, weeklies and other periodicals along with books to be printed more attractively and with greater flexibility in terms of design both in the text and on the cover.

Technology is certainly to the consumers benefit — and the workers — if properly applied.

Images on a Purple Membrane

NORBERT Hampp from the Institute for Physical Chemistry at the University of Munich and Alfred Miller from the Wacker-Chemie company in Munich are successfully researching chemical image-processing with the Bacteriorhodopsin (BR) molecule, which is closely related to the rhodopsin in the retina of the human eye. It is integrated in the purple membrane of certain photosynthetically active bacteria which live in extremely saline seas.

Before it can be analysed in the laboratory, the purple membrane needs to be dissolved out of the bacteria and embedded in a plastic foil. The BR-molecule can then exist in two chemical forms, depending on the type of light it is exposed to: if the initial, violet form is irradiated with green light, it turns yellow. This process can be reversed with blue light.

For this reason, the BR is suitable as a means of storing optical information, depending on the type of light-used. If this can be utilised successfully as a basis for technical applications, it will be possible to expand the memories of present-day computers by several orders of magnitude, as the individual molecules are much smaller than conventional 'bits' on magnetic tape. Moreover, whereas the memory units on magnetic tapes must be distributed strictly on one level, rhodopsin molecules can

be stacked in several layers so as to save space. Bacteriorhodopsin consists of two molecular components: light-sensitive retinal and a protein constituent. This protein is also responsible for the function of the molecule. Alterations in its chemical structure result in BR variations

and genetic techniques, various BR-types are obtained which, for example, react to the light of a wavelength longer than that which triggers the natural molecule's response. The first devices to use a BR-foil, e.g. an interferometry camera, are already being tested.

Using light to obtain and process information on the environment is a problem which has been solved by many organisms in the course of their phylogeny. The visual process in the human eye, for example, involves a chemical trick: rhodopsin molecules are "activated" by light; in other words, beams impinging upon them alter their structure, thus allowing them to store information for a brief period of time. This biochemical finding is now to be used for technical applications as well.

with new characteristics — a phenomenon which researchers have been focussing on particularly.

At the Max Planck Institute for Biochemistry in Martinsried, a team of scientist led by Professor Dieter Oesterhelt is dealing with structural changes in BR resulting from interventions in the genotype of the bacterium. As these interventions are not aimed at any specific result, the rhodopsin variations generated must be enriched an ascertained again with new physico-chemical methods.

By combining biochemical

Another interesting field involving the application of the bacteriorhodopsin is holography, which is the art of producing three-dimensional images of any object.

For this purpose, the object is illuminated with a laser beam, and the scattered rays are collected on light-sensitive material. The hologram thus obtained can be used to create a three-dimensional picture of the original. Using BR-foils, Hampp and Miller have successfully recorded holograms in real time, i.e. instantaneously and without requiring any time-consuming film de-

velopment. In contrast to conventional photosensitive material currently used in photography, such as silver halides, the BR-foil can always be reused after exposure. For this reason, it is theoretically possible to take up to 1000 shots per second at extremely high resolution.

Thus, changes in the location or perspective of an object recorded holographically can be registered immediately on BR-foils.

As all the data concerning the object is available instantaneously, holography is basically also suitable for the pattern recognition of complex shapes. However, this application is restricted by the fact that a laser must always be used as the light source.

Knowledge on the structure and operation of rhodopsin is continually being gained. As early as 1988, the German researchers Hartmut Michel, Johann Desenhofner and Robert Huber received the Nobel Prize for Chemistry, for their explanation of the structure of a rhodopsin complex from the purple bacterium. For the last several years, research groups have worked on further potential applications, including light-operated desalination plants and the generation of power from light using the principle of bacterial photosynthesis.

— German Research Service

Need for Protection against Radiation

THE number of major radiation sources used in research, medicine, agriculture and industry continues to grow and, while the overall safety record has been good, it is essential to ensure that users and regulatory authorities, particularly in developing countries, continue to be able to meet their responsibilities.

The emphasis of the Agency's radiation safety efforts are shifting towards encouraging the implementation of existing radiation protection guidance for normal circumstances and towards developing and applying radiation safety principles for probabilistic and de facto situations.

A recently completed revision by the International Commission on Radiological Protection (ICRP) of its basic recommendations on radiation protection has necessitated a revision of the IAEA basic safety standards for radiation protection. To facilitate the task, an interagency committee on radiation safety was formed in 1990.

An international symposium on radiation protection infrastructure examined radiation protection regulations, notification, registration, licensing, inspection and control programmes, national infrastructures and approaches which have proved to be effective; education and training; the role of professional associations; the contributions of radiation protection services such as personal dosimetry; and international activities.

The basic conclusion of the symposium was that many countries, particularly least developed ones, still lack the necessary infrastructure to implement a safety policy based on international recommendations.

The principles underlying the system of dose limitation can form the basis for planning intervention in the event of an accident.

Therefore, a revision of the safety series on the issue which establishes the principles for the protection of workers and the public in the

event of an accident, and guidance for their implementation was required and completed in 1990.

Regional co-operation on radiation safety continued in close collaboration with national technical co-operation projects in 1990 to strengthen radiation safety capabilities in developing Member States.

Radiation protection advisory team (RAPAT) missions to review infrastructure needs and to define long-term strategies for technical assistance and co-operation were

conducted in Bolivia, the Libyan Arab Jamahiriya, Romania, Sri Lanka, and Uruguay. Radiation protection service activities increased in 1990 with personal monitoring services previously provided by WHO to some least developed countries being taken over by the Agency.

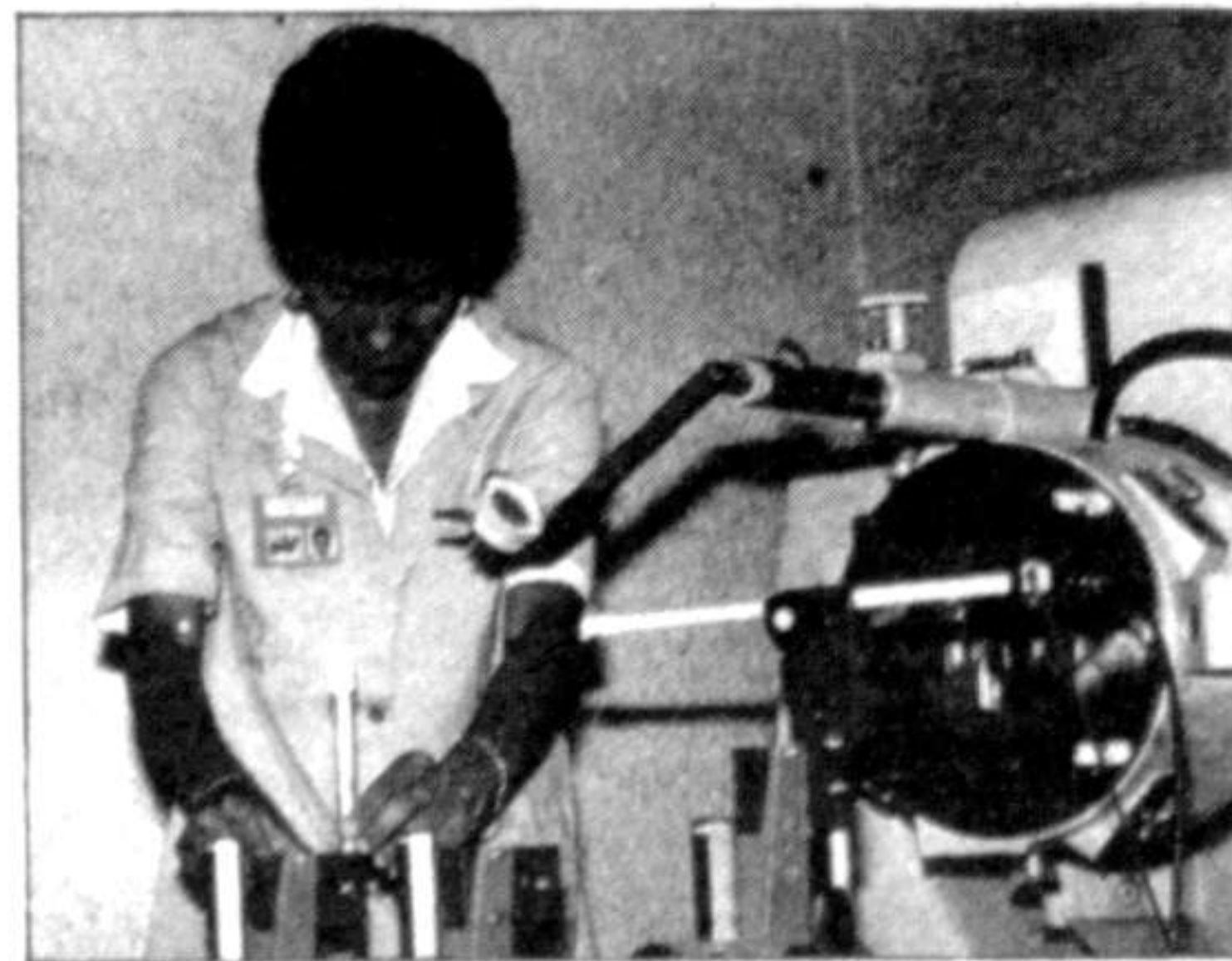
For monitoring or assessment purposes, as part of the project to assess the radiological consequences of Chernobyl, 8000 French film dosimeters were distributed and some 10,000 whole body counts were performed.

Work continued on preparation of three safety series publications on assessment of the occupational intake of ra-

dioactive materials; rapid monitoring of large groups of internally contaminated people; and direct methods for measuring radionuclides in man.

Environmental assessment and protection

In recognition of the global concern over the issue of radon, and in response to requests from 56 Member States, the Agency initiated, jointly with the Commission of the European Communities (CEC), a research programme on radon in the human envi-



An important component in radiation protection efforts is efficient calibration of dosimeters. (Photo: CNEB/Brazil)

ronment. The international programme will co-ordinate research efforts to quantify the impact of radon on man and will focus on international inter-calibration and intercomparison of radon measurement technology; standardization of large-scale radon survey techniques; institutionalized exchange of information on radon levels, dosimetric methods, and associated risk assessment, and radon mitigation techniques through research co-ordination meetings; and establishment of an international database on radon.

The IAEA transport regulations were amended in 1990 to include new, more stringent

provisions for the air transport of large quantities of radioactive materials. This was to provide the same level of protection for all modes of transport.

Data on the number of shipments, exposures due to transport activities, and accidents and mishaps were essential for assessing the effectiveness of transport regulations. Therefore, progress in this area continues in the compilation of a new directory of competent authority approval certificates, and data-base on accidents and incidents, and data collection on the number of shipments of radioactive materials.

In addition, the production of an international computer code for the assessment of the risks of transport operations under normal as well as nuclear accident conditions was pursued under a research programme aimed at the development of probabilistic safety assessment techniques.

Emergency planning and preparedness

A comprehensive exercise of the Agency's emergency response system (EIRS) was conducted in 1990 following extensive training of agency staff. The exercise resulted in modifications to procedures.

The Agency began development of specific guidance for Member States and international organizations for managing information and data exchanges during an accident or emergency to avoid confusion and promote the purposes of the conventions on early notification and assistance.

Interagency arrangements were concluded with the World Meteorological Organization (WMO) and the World Health Organization (WHO) for support in the event of a nuclear accident. WMO would provide predictions of the plume path and the expected magnitude of radioactive contamination in the early hours after an accidental release of radioactive materials, while WHO will provide emergency medical advice and assistance following radiological accidents.

Control of radiation sources

The Agency has strengthened its activities in the safe use, control, and manufacture of radiation sources, with special emphasis on training and development of practical guidance for competent authorities, users, and manufacturers.

Exposure assessment and handling

As a follow up to the implementation of the new ICRP recommendations to establish the annual limits on intake for the public, the Agency began preparation of a report on intake coefficients for radionuclides in food.

A new research programme was begun on the use of natural materials for dose assessments using solid state dosimetry techniques with natural and commonly available materials for accidental dosimetry.

— (IAEA)



Transportation of a spent fuel cask in the USA. (Photo: US Department of Energy)

Science Briefs

Diagnostic Kit from Molluscs

LUMINESCENT material found in the rare pholas dactylus mollusc is to be cloned and produced by bugs for use in new diagnostic kits that are expected to help victims of arthritis, asthma, kidney failure, diabetes, heart diseases, burns, trauma and accidents, reports London Press Service.

The kits are being developed by the Knight Scientific biotechnology company from

Plymouth in western England, where Jan and Robert Knight have been investigating the unique properties of the mollusc luminescent material for a number of years.

They are now working with Exeter University's biological sciences department to produce large amount of the material from microbes that have had certain genes of the hard shelled invertebrates inserted into them.

The diagnostic kits are aimed at diseases that involve large numbers of white blood

cells which sometimes become activated and produce chemicals that can damage healthy tissue. Sometimes these same cells, while still very active, lose their ability to destroy bacteria and people die from infection.

The new kits, which should be available within a year for research use, will use the luminescent material along with a novel device to separate the white to glow by substances produced by the activated white cell and the light produced can be easily measured.

This facility can be used to establish the effect of particular drugs on the output of the activated white cells. Pholasin can also be made to glow with certain enzymes and used as a probe to detect proteins and nucleic acids.

Clean Anode Paste Dosing from Norway

A CLEAN process for the production of anode paste for aluminium smelting is now available from Procon Engineering in Norway, reports the Journal Process Engineering.

Three innovations lie behind the claims for improved performance: closed and fully dust proof material vessels, precise forced feeding, and the loss-of-weight principle.

The closed vessels cut down on the need for air filtration, ventilation, cleaning and maintenance. Each vessel has a rotating feeder capable of handling any material, including filter dust and any fraction of petrol coke and anthracite. Liquid pitch is dosed by the same principle using a displacement pump.

The common problem of belt weighers, such as dust, are eliminated by the use of vessel load cells operating on the loss-of-weight principle. The journal said full documentation of dosing and composition can be provided at any time.

This feature is useful internally, but even more so for anode sales companies with customer demands for documented quality assurance. Procon Engineering developed the process in cooperation with Hydro Aluminium and has already supplied it to five Norwegian companies.

Women Scientists Rise to the Top

PROFESSOR Chen Zhe often feels lonely when attending conventions of the Institute of Electrical and Electronics Engineers (IEEE) in the United States.

Prof Chen, of the Beijing Institute of Aeronautics and Astronautics, says there are very few women among the 24,000 senior members of IEEE. Often the only other woman at IEEE conventions is her university colleague Mao Jianqin. Both are senior members of the IEEE.

Prof Chen feels proud though that most of IEEE's female senior members are from China. "We Chinese women have shown our power in the science world," she says.

A scholar in robotics, she is known for her achievements in the field of automatic control and guidance. The professor has published 30 books and 24 theses since 1986. Her paper on robot control presented at an international conference won a top prize from the International Federation of Automatic Control in 1987.

China has some 206,600 women in the natural sciences. They make up 38.4 per cent of the country's research force, according to the State Science and Technology Commission.

A number of them have accomplished what have either been recognised as breakthroughs or elevated China's status in particular fields.

Line Lanying, one of the first members of the Chinese Academy of Sciences (CAS) and vice-chairperson of the China Association for Science and Technology, succeeded in having a single crystal of gallium arsenide manufactured in one of China's space satellites in 1987, thus acquiring the world's first such material developed in space.

She has led China's research on semiconductors, enabling China — a late starter in the field — to keep abreast of research progress in developed countries.

Prof Zhang Yan of the Beijing Institute of Meteorology has studied disastrous weather, flood-causing torrential rain and meso-scale heavy rain for years, earning the name "conqueror of the meteorological cancer (torrential rain)." Her name appears in the International Who's Who of Intellectuals published in Britain.

From widespread illiteracy and bondage five or six decades ago, China's women are emerging as major achievers in the country's bid for technological advancement

Women scholars have also cut paths in high technology territories. More than 400 women researchers form the backbone of astronautic experiments at the Xichang Satellite Launching Centre in Southwest China's Sichuan province.

Sophisticated nuclear technology is employed by women scientists at the Chinese Atomic Energy Research Institute to do fuel analysis, analysis of nuclear missile loading and radiation chemistry.

Under China's feudal value system, a woman's virtue lay in her ignorance, so that very few girls went to school in the old days. Before the founding of the new China in 1949, 90 per cent of women were illiterate.

Statistics in 1931 compiled by the Civil Affairs Office in East China's Jiangsu province, a comparatively developed region, showed that women made up only 0.37 per cent of engineers, 5.1 per cent of

teachers and 3.16 per cent of medical doctors.

Since 1949 about 110 million illiterate women have learned to read and write. The number of female students has gone up 53 times in high school and 29 times in college.

China's literacy rate is 73.5 per cent, according to the UN Educational, Scientific and Cultural Organisation (UNESCO). It has a 24-1 pupil-teacher ratio. In 1987, 7.2 per cent of high school students were enrolled in technical and vocational courses. About 190 in every 100,000 Chinese en-

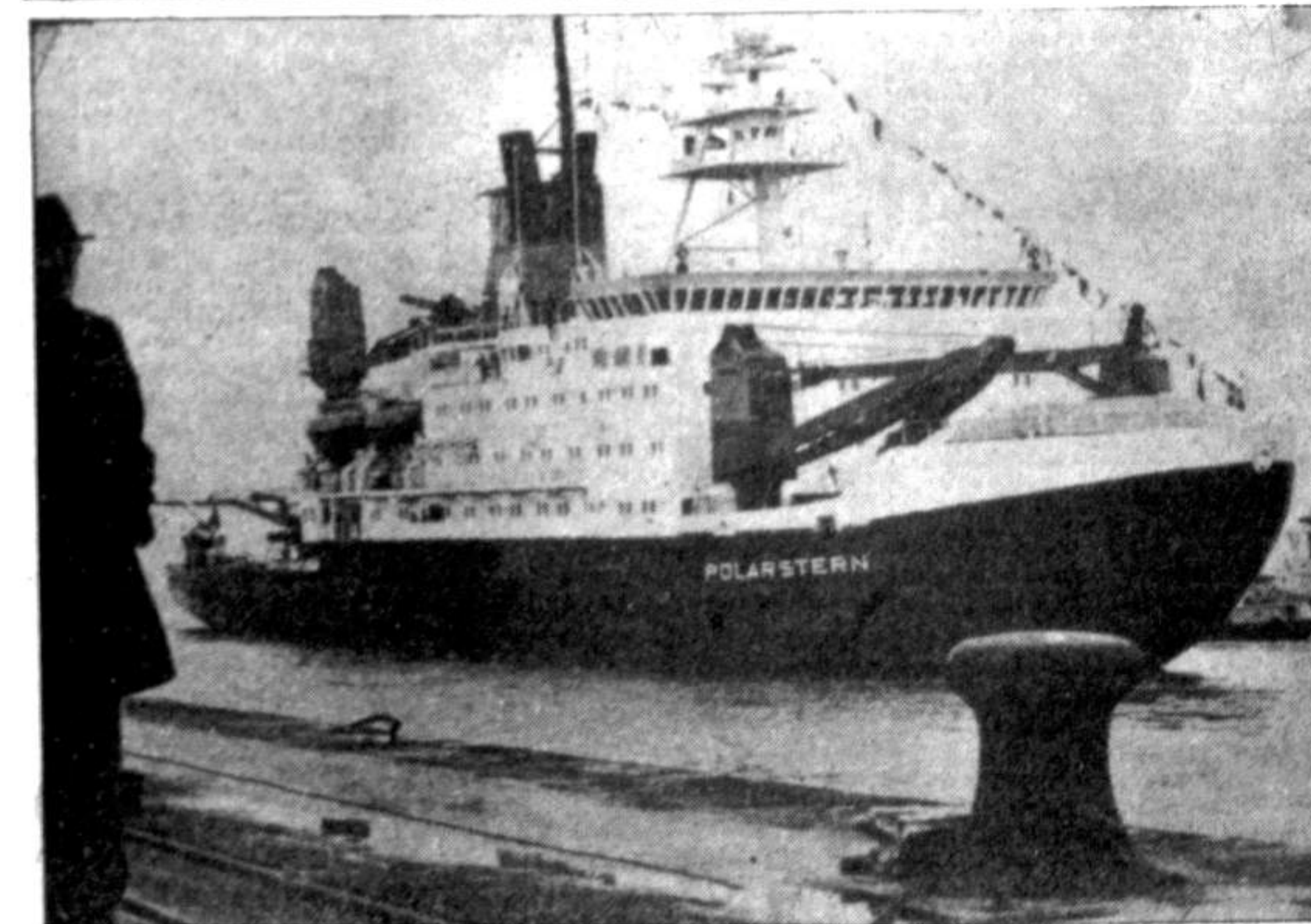
joyed a harmonious family life, says Mao. "We would not get anywhere in our career if family life is marred."

What is upsetting, she says, is invisible sex discrimination in the workplace.

She points to the pyramid shape of the numbers of female scientists at different levels — the higher the level, the fewer women scholars one will find. Although women makeup about one-third of CAS research personnel, they hold hardly 10 per cent of senior titles.

But while opposing gender bias, women scientists should be more aggressive and enterprising, says Zhu Lilan. "We should first do our job well, rather than wait for someone else to liberate us."

— Depthnews Asia



With the research and supply vessel FS "Polarstern" (photo), The Federal Republic of Germany has an ultra-modern, floating research laboratory at its disposal. The ship has completed numerous expeditions in Arctic and Antarctic water since it was first commissioned in 1982.

— Photo INP