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COMMISSION OF THE EUROPEAN COMMUNITIES

Multiannual Programme
of the Joint Research Centre
1980-1983

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Annual Status Report

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UTILIZATION OF RESEARCH RESULTS

1981

Research Staff (n°): 1 (*)
Budget: 453.000 ECU

Projects:

— Support to patent affairs
— Further development of inventions
— Support to licensees
— General information

(*) Covers coordination only.

Programme Manager: V. LUNGAGNANI
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1. INTRODUCTION

The word «utilization» is used in the title of this programme with limited meaning of «short-term exploitation» (by industries, commercial organisations, etc.) of the JRC research; the basic concept of this programme is to provide added value to research results as part of the innovation process.
While work is in progress towards the achievement of the JRC programme objectives, it may appear that some of the intermediate results are of direct use in a variety of immediate applications.

According to the Euratom Treaty, persons and organisations of Member States have the right to obtain non-exclusive licenses on patents and know-how owned by the Community, where they are able to make effective use of the inventions resulting from the execution of research programmes.

The operative machinery dealing with technical and legal aspects of its technology transfer process is under the responsibility of the Directorate General XIII - Direction A «New technologies».

Over the past years, several licence agreements have been signed covering a large spectrum of inventions: some 30 of such licence contracts are still on force.

At present about 50 inventions (patents or know-how) constitute the JRC potential portfolio in terms of technology transfer. This is the result of a process of selection made on the basis of specific technical and market criteria among several hundreds inventions JRC made since the origin.

It is important to consider that the opportunity for exploitation is in general becoming apparent when a relevant time (usual 3-5 years) is elapsed from the invention, and when the original project (in some cases the original programme) is terminated. This programme provides means for the exploitation of such inventions.

The hypothesis governing this programme is that an R & D environment (scientists and research managers) can more effectively direct efforts towards use in new and improved products (materials, processes, instruments, etc.) by means of a more attentive screening of current activities and by means of appropriate investments on innovative persons and laboratories.

2. RESULTS

Support to patent affairs

During the reporting period some twenty patents were applied, covering areas such as:

— welding methodologies
— machinery by electroerosion
— ultrasonic testing procedures
— solar collectors
— photovoltaic components
— high temperature oxygen sensors

Experimental and theoretical work was requested to several inventors in order to provide adequate exemplification of the various aspects of the patents proposals.

The following patents emanating from the JRC were filled by Euratom in 1981:

Patent Nr.	Date of issued	Title
83254	25.03.81	Appareil pour le prélèvement et l'analyse des plombifères atmosphériques
83264	27.03.81	Appareillage permettant la soudure de bouchons d'aiguille combustible nucléaire
83330	29.04.81	Transducteurs ultrasonores performants simplifiés
83329	29.04.81	Electrode expansible pour génération de cavité à l'intérieur d'une pièce massive
83333	04.05.81	Utilisation de textures de surface comme marque aléatoire d'identité unique
83337	05.05.81	Multimarkierungssiegel
83338	05.05.81	Appareil et méthode pour la lecture d'identité de sceaux
8124414	10.8.81	Solar energy collector with integrated heat storage and radiator
8124363	10.08.81	Device for passive heat transport
8126342	28.08.81	Photovoltaic schottky-barrier elements
8119120	02.10.81	Installation de pyrolyse, notamment pour des déchets végétaux tels que coques ou enveloppes de graines et procédé de fonctionnement
8123997	22.12.81	Système de surveillance d'une pluralité de conteneurs utilisant des sceaux ultrasonores
P3126576.6	06.07.81	Zylinderförmige Probenkapsel
83263	27.03.81	Spannungsarmer Kernbrennstoff auf Karbidbasis mit materialeigenem, metallischen Korngrenzfilm
8115483	20.05.81	Particle size distribution and particle mass concentration measurement apparatus and method for nuclear fuel aerosols
83452	24.06.81	Verfahren zur Wiederaufbereitung von bestrahlten Kernbrennstoffen
8124416	10.08.81	Solid state oxygen sensor

Further development of inventions and support to licensees

Effort devoted to the dissemination and exploitation of research results (development of prototypes, demonstration projects, feasibility contracts) concerned a variety of materials, processes, methods and instruments.

Once a licence agreement is reached with an industrial partner, it becomes, in general apparent that various initiatives (advices, experiments, proof tests, etc.) should take place in order to bridge the gap between the research laboratory and the successful exploitation of the invention on the market.

Ultrasonic signature

Two industrial applications of JRC patents on seals with integrated transducers were found:

— ultrasonic integrated sensor system for uranium oxides, reference containers;

— special integrated sensor system for storage surveillance with continuous monitoring.

At the laboratory level, the application of the principle of the sensor integrated in the seal was investigated; in order to prepare the transfer of the «know-how» to industry, a preseries was manufactured (Fig. 1).

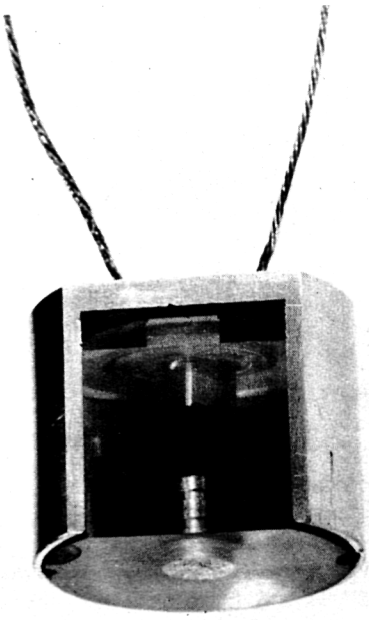

Fig. 1.

High precision furnace

The characterization at high temperatures of gas-controlled heat pipe furnaces has been completed.
Measurements were taken between 625 and 1070°C in a sodium-Inconel furnace. A very uniform temperature distribution was found along the chamber: for all the investigated temperatures the variations remained within 10 mk over a length of some 25 cm (ϕ 28 mm).
For a final, general characterization two sodium-Inconel furnaces were built and sent to the Australian National Measurement Laboratory and to the Physikalisch-Technische Bundesanstalt, Braunschweig.

Continuous support was given to a German firm, licensee of JRC patents in this field, for the development of commercial versions of gas-controlled heat pipe furnaces.

Gridded ionisation chamber

α-particle spectroscopy by grid-ionization chamber is performed to-day essentially for environmental control of α-emitting radio-isotopes. The grid-chamber has been substituted by the semiconductor detector for all cases in which the specific source activity is such as to allow a low source-detector geometry.
Theoretical studies on the statistical fluctuation of the total number of electrons produced in suitable gas mixtures by α-particles indicate an energy resolution which would be better than that presently obtained with semiconductor detectors.

The experimental apparatus is now ready for a systematic study of all the points of the program.
A new grid ionization chamber has been designed which will better match the following criteria:

— small internal chamber's volume;
— reduced outgassing from construction materials;
— more efficient vacuum tightness.

Removal of sulphur dioxide from waste gases

A laboratory prototype was constructed to test a process developed at JRC as fall-out of research activities related to Hydrogen Production Programme.

During the test period, the process was tried out with a mixture of air and SO_2 (2500 ppm). After the successful operation of this set-up; it was decided to operate the process with real flue gases. To this end, prototype was attached to a side stream of the flue gas from the power station of the JRC Ispra. This power station uses Bunker C grade oil as a fuel, with a sulphur content of about 2.5 wt%.

It must be noted that an evaluation and feasibility study of the process was started by a team of the T.U. Berlin upon initiative of D.G. XIII. Preliminary results of this study are very favourable and confirm the anticipated advantages of the process.

Aluminium-Calcium superplastic alloys

While research into new superplastic materials is continuing there is an immediate interest on exploiting the superplasticity of the Al-Ca alloys in metals forming processes. One of the most interesting developments is the application of the pressure forming or blowing technique used in the polymer and glass industry to the forming of superplastic eutectic Al-Ca in sheet form. In order to obtain appropriate indications, the deformation of a viscous Al-Ca membrane, clamped at its periphery and deformed by one-side pressure was considered: the operation consists of obtaining a low pressure forming cup through a rectangular die at the temperature 550°C and 600°C. This dies was designed so that on conclusion of the operation a piece would be obtained that with respect to original sheet would have a more than 50% the initial surface area. Results confirm the superplastic behaviour of the Al-Ca system at both temperatures 550 and 600°C.

Solar paints

Investigations were performed in order to characterize the helionero solar paint and improve resistance against water and salt corrosion, increase the adherence on different metals, reduce the sensitivity to the U.V. radiations and thermal aging. Thin films of various paints (primers) acting as interlayers between base materials and helionero paint, were tested. The effects on the mechanical and optical behaviour of helionero deposited on these bondcoats were studied using the several standard tests.

The primers improve the corrosion resistance of helionero paint deposited on mild steel, but increase also the I.R. emission. The primers have no effects on copper base materials and, if the surfaces were properly prepared, tha paint can stand severe corrosion and mechanical tests.

Solar wall panel

A new modular wall panel system has been developed, applicable to both existing buildings and new buildings - private, commercial and/or industrial - combining solar collector, thermal storage and radiator characteristics. The prerequisite for the system are complete autonomy of each unit, i.e. no auxiliary power supply or working media, hence, low installation and maintenance cost, no running expenditure; automatic and attendance free operation, using system driven controls; fixed shading to render the system inoperational during the season of low solar incidence, i.e. during the hot season; easy accessibility to replace heat storage material after its life span and using preferably a collector material with good thermal insulation characteristics.

The storage volume is filled with a granular encapsulated phase change material (PCM), offering a great energy density over a small temperature swing; the voids between granules serving as air ducts, thus forming a closed heat transfer loop with the solar collector.

The overall performance of the test assembly is encouraging, although the various geometries of individual sectors of the system may not be optimal. Field tests under almost daily varying conditions indicate a solar to thermal energy (storage) conversion of the order of 30 to 50%.

Passive downward heat transport

A semi - continuous device for passive downward heat transport has been designed, built and operated. Heat is transported as latent heat of evaporation, as in a heat pipe; the return of the liquid to the evaporator in the upper position is obtained through the action of an energy accumulator containing an inert gas and charged by the vapour itself during the phase of heat transport. The capability of winning the difference in level is exchanged with a difference of few degrees centigrades between heat source and heat store; this temperature difference is smaller when the working pressure is higher.
A first laboratory model, working at reduced pressure and with methanol as working fluid, was able to transport the heat against a height of 1,7 m with a temperature difference of about 15°C.

A device working under pressure was also built and operated. The maximum tested working pressure was of about 5 bar, with Freon - 11 as working fluid. Working at 5 bar it was possible to transfer the heat against a pressure corresponding to a height of about 10 m with a difference in temperature of about 20°C.

A drawing of the pressure device and some details are shown in Fig. 2 and Fig. 3.

A new system, working without pressurising gas, is now being tested. This system has a smaller temperature drop for a given difference in level and will better match the variable input power from a solar heat collector.

Encapsulation of gases in zeolites

A new procedure to immobilise and to store safely gases in zeolites had previously been developed at Antwerpen University in cooperation with CRNM-Geel in order to encapsulate

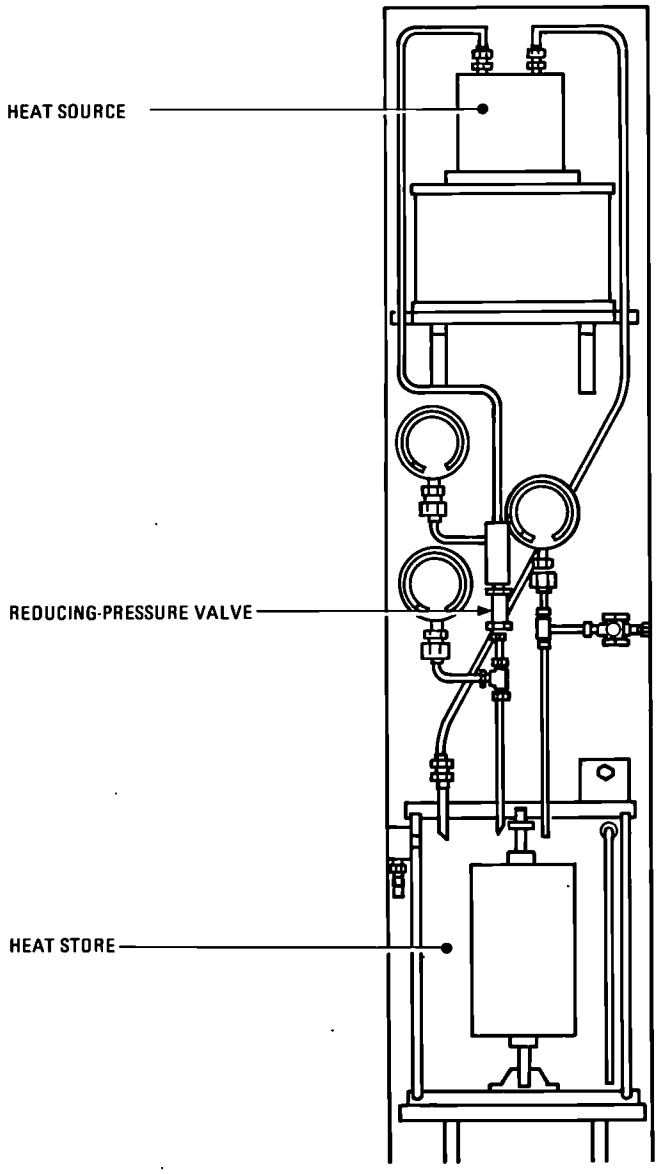

Fig. 2.

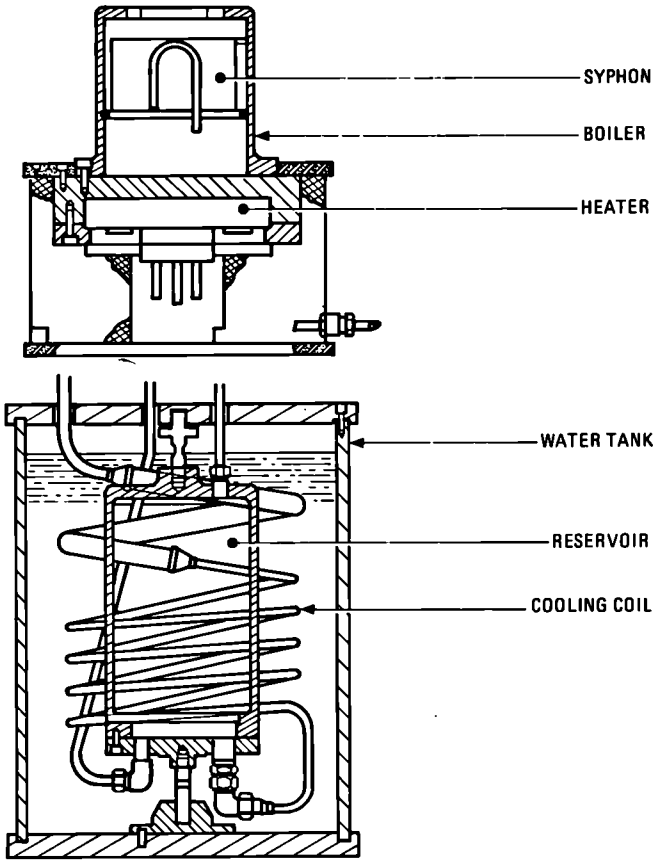

Fig. 3.

(very) expensive enriched noble gas isotopes ($ 2000-100 000 per liter STP) for use as spikes in Isotope Dilution Mass Spectrometry and possibly for the development of gas spike Reference Materials.

The procedure is based on a combination of an adsorption and a structural modification process, resulting in a closing of the zeolite pores. Load capacities of 40 ml Xe per g Zeolite had been attained.

So far the encapsulation procedure was carried out and optimized in laboratory glass equipment. Under the terms of a new contract a metal pre-pilot installation will be built to examine the capabilities of the method for industrial applications. The new equipment will also allow to study and improve the Zeolite load capacity since encapsulation will be possible at pressures above 1 atm. (0-7 atm). Increases of load capacity of at least a factor two are expected.

Synthetic language

SLANG (= synthetic language) is a soft- and hardware package for recording, storing, synthesis and reproduction of digitized human speech signals. Software and Hardware for the SLANG-system has been improved and completed during 1981.

With SLANG a library of speech elements can be generated via microphone, amplifier, filter and AD-converter and stored on magnetic disk unit.

This library can be easily modified and adapted to various vocabularies. With SPRESA and automatic Interpreter has been developed, which is capable to translate tables of texts into spoken words. The words are converted into acoustic signals through a DA converter with filter and audio amplifier.

Licence agreements have been concluded with industrial companies.

High resolution colour display

The activity in 1981 has been mainly concentrated on the hardware and software development of a microprocessor controlled high resolution colour display. The hardware system has a modular structure which permits a great flexibility to configure the system to various applications (selectable hardware features: image resolution, number of colours, joystick, data acquisition modules and computer-computer link).

The software activities concerned the development of:

— a graphic library which includes standard graphic functions (vectors, circles, etc.) and symbols for experiment automation (valves, pumps, tanks, etc.);

— application programs: graphic editor, acquisition and visualization of temperature distribution, display of ultrasonic data.

A supplementary electronic unit has been added to the system which converts the video signal to a PAC signal for recording on standard video cassettes. These cassettes represent a standard and cheap interchange medium of graphical data.

The realized system is not only a graphical terminal (commercially available) but a stand-alone computer system which performs data acquisition in real-time, elaboration, display on TV-monitor and recording on video cassettes.

GENERAL INFORMATION

In 1981 the JRC participated, in close collaboration with D.G. XIII, to several fairs and exhibitions:

— HANNOVER MESSE	- Hannover in April (Fig. 4)
— INOVA	- Paris in April
— EXHIBITION AT HEAT PIPE CONF.	- London in September
— SYSTEMS	- München in October
— SITEF	- Toulouse in October

Fig. 4.

JRC activities in the following areas were presented:

— solar paints
— passive downward heat transport
— synthetic language
— high resolution colour display
— AC motor speed control
— tribology
— visualization of ultrasonic beams
— carving massive metal pieces by electroerosion

3. CONCLUSIONS

Prospects of development for this JRC programme look good. Of course, patents and licences were part of normal JRC activity since its origin: the new feature of this programme is that through an increased JRC activity in this field as well as a structured support to D.G. XIII, the process of utilization can be started at an earlier stage, with the deliberate purpose of achieving practical results as early as possible, through an adequate R & D effort.

Key element of this process is the systematic identification, within JRC programme, of those research areas, concepts ideas, that might present interest for industry and for the public sector. In this respect, D.G. XIII by its market survey and contacts with industry is providing JRC with essential information to carry out this programme.

For further information concerning the JRC programmes, please contact the Directorate General of JRC, rue de la Loi, 200, B - 1049 BRUSSELS (Belgium)

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