euro spectra

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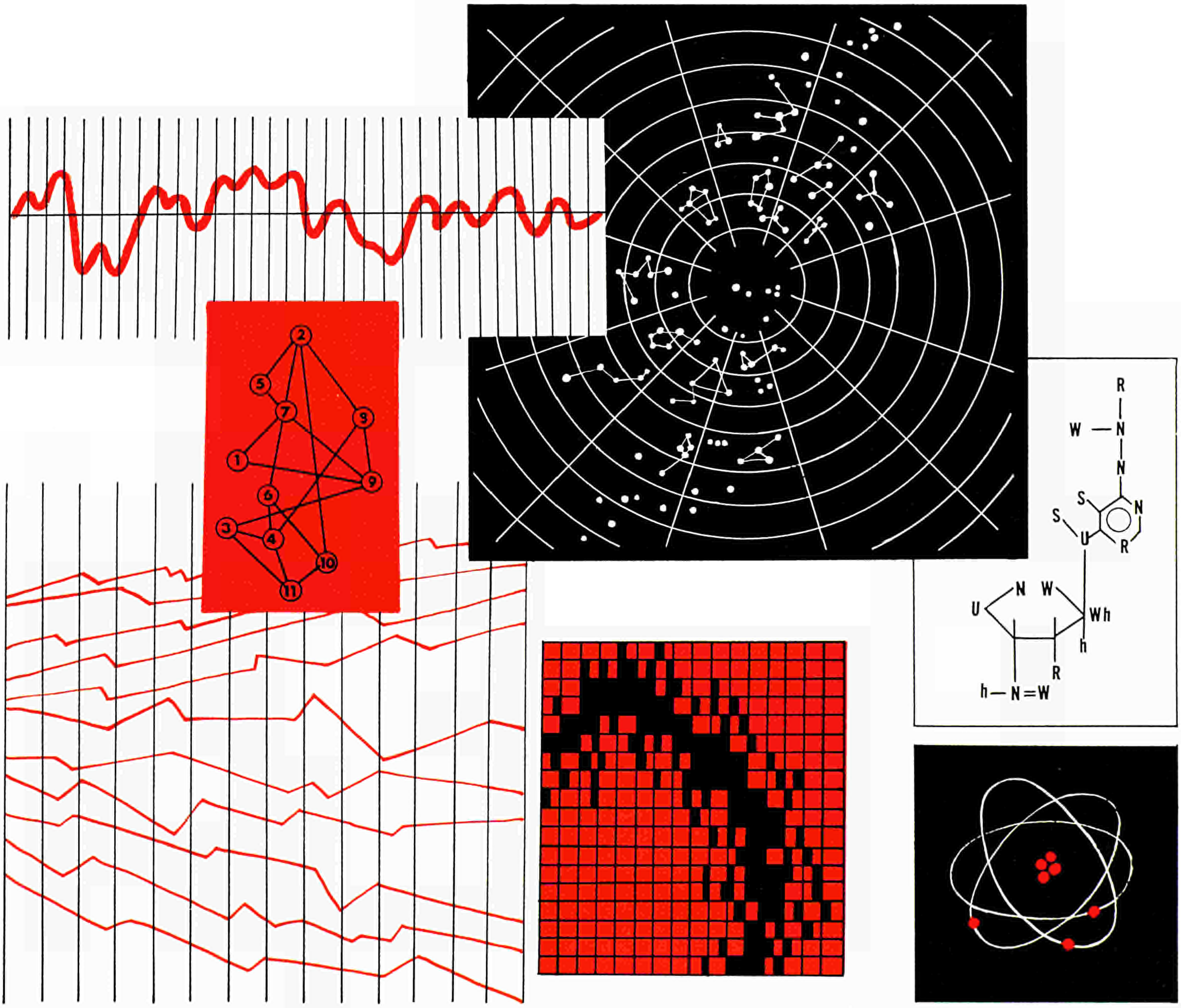

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Those among our readers who always skip the editorial will wonder why an Index 1962-1974 follows here the traditional yearly one. The reason is at the same time simple and logical: this is *euro-spectra*'s last number.

If the statement is blunt and abrupt, it does not, however, imply that the decision to suppress our review was made with a light heart; as it won't be difficult to guess, many important reasons concurred.

It is with much regret that we part from our readers, thus giving up a dialogue which developed in a friendly way — and five languages — for more than a dozen years. If our feeling is shared, we will be satisfied that our action and efforts have not been vain.

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Europe's Environment Programme: The Initial Phase

DIETRICH HAMMER

THE EUROPEAN COMMUNITIES' environment programme was formally approved by the Council of Ministers on 22 November 1973. Most of the activities proposed in it are due to be completed by 31 December 1975 at the latest. The time therefore seems ripe to pause and take stock. Looking back over the first year, we can see what has been achieved already; looking forward to 1975, we can weigh up what remains to be done.

On 7 November 1974, the Community Ministers of the Environment held their first Council meeting since the adoption of the programme in November 1973. From the point of view of the Community authorities, the meeting was a complete success. Not only did the Ministers expressly endorse the granting of top priority to the Environment Programme despite the energy crisis, they took a number of specific decisions relating to quality objectives for surface waters intended for drinking water production, to practical application of the "polluter pays" principle, to disposal of oil wastes and to future Community work on problems of energy and pollution of the environment. In addition, the Council decided that the Community as such should accede to two international agreements, namely the Convention of Paris on the prevention of marine pollution from land-based sources and the Strasbourg Convention on the protection of freshwater supplies. The Council of Ministers also held a discussion on the state of progress of the Environment Programme, in which a whole series of new actions to supplement the current programme were approved or suggested.

On 17 December, at a meeting of the Ministers for Social Affairs, a further decision was made which belongs to the environment in the broader sense: the Community decided to set up a *European Foundation for the improvement of living and working conditions.*

All of these Council of Ministers decisions, however, give only a partial picture of the work accomplished by the Commission during the first year of the Environment Programme. In the first place, they concern matters which were ripe for Council decisions anyway. They are not necessarily matters regarded by the Community as meriting absolute priority, although this is undeniably true of some of the decisions, for example, on ways of applying the "polluter pays" principle. Secondly, not all the Commission's work leads ultimately to Council decisions. The very important task of establishing the "Criteria" is based largely on the compiling and publishing of scientific reports in which the latest findings on the ecological and health-hazard effects of certain pollutants are assembled and analysed. Well over a dozen such reports have already appeared. Then again, in connection with the second phase of the Environment Programme, which is dedicated to improving the environment, numerous fundamental studies and investigations must first be carried out in order to define the aims and possibilities of Community action, since only general guidelines for the second phase were decided by the Council on 22 November 1973.

In particular cases, the Commission has already carried out important work.

Pollution control

Apart from the directive already adopted by the Council on quality objectives to be applied to surface water intended for drinking water production, the Commission has also prepared three further directives relating to the quality of water, i.e. to freshwater for bathing, sea-water for bathing and sea-water for shellfish breeding. It is worth mentioning in this connection that it is planned to set up a European network for surveillance and monitoring of water quality in larger rivers and watercourses and of certain air-borne pollutants liable to drift over great distances.

A major target of Community work is the field of industrial products, where the question of environment is linked with the free competition principle. If, for environmental reasons, different standards are laid down by the various

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countries for the same industrial products, the functioning of the Common Market, that is the free exchange of goods, may be affected. Product standards should therefore be made fundamentally uniform throughout the Community. The Commission has already put forward proposals in important individual cases, i.e. in connection with the composition of petrol and gas oil, which should lead to limitations being imposed on lead and sulphur contents and to restriction on discharging of these pollutants into the atmosphere. Further directives in preparation deal, for example, with the highest permissible content of lead in table-ware and of sulphur in heavy fuel oil, the composition of paints and varnishes, or the level of noise generated by building machinery and lawn-mowers. In addition, problems of approval for new synthetic materials and products prior to marketing are being investigated, likewise packaging, cleaning products and detergents.

Energy and the environment

The energy crisis highlighted the need for Europe not only to improve her fuel supply arrangements, but to provide herself with a system of electricity production that will make increasing use of certain energy sources, especially nuclear fuels. A number of serious problems must be faced here, firstly as regards the threat to the balance of aquatic life in rivers and lakes heated by cooling-water discharges, and secondly in connection with the storage and treatment of radioactive waste, for which no long-term solution is yet in sight.

On 23 April 1974, the Commission forwarded to the Council of Ministers a first summary report on the problems of pollution and nuisances connected with energy production. At its meeting on 7 November 1974, the Council adopted the conclusions of this report and requested the Commission to make every effort to advance all investigations in the controversial field of energy and the environment.

In pursuance of the programme, three branches in the industrial field were thoroughly examined in 1974 in collaboration with the national authorities and the relevant professional organizations. These were the paper and pulp industry, titanium oxide manufacture and the steel sector. In a report published at the end of October on the paper and pulp industry, where it is acknowledged that considerable problems of water pollution exist, there are concrete proposals for a prompt reduction of this pollution.

Problems of industrial waste have also received careful attention from Commission staff. As mentioned previously, the Council at its meeting on 7 November 1974 adopted a directive on disposal of waste oil as a result of which the Member States must take the necessary steps to collect and dispose of waste oils, and more especially to ensure that such oils are disposed of mainly by recycling rather than by mere destruction. In addition, the Commission has put forward a draft outline directive on waste disposal.

The sea - one of the most important factors in the world's overall ecological balance

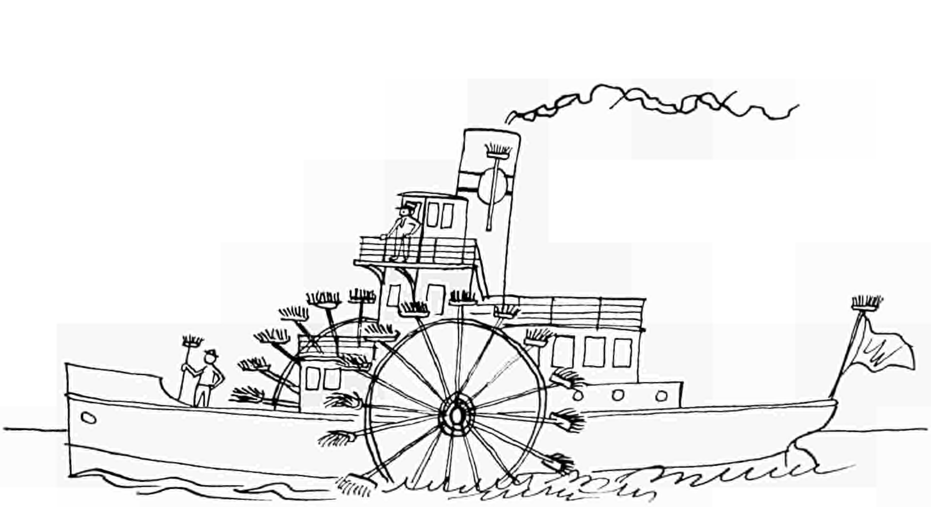
An international convention on the prevention of marine pollution from land-based sources was signed in February 1974 with the Commission as an active participant. Eight of the Member States of the Community have acceded to this Convention (the exception is Italy), which concerns the North Atlantic and the North Sea. Alongside the eight Member States, the Community as a separate body is to accede to this agreement, in accordance with the Council's decision taken on 7 November.

The Commission is also keeping its eye on all other international efforts aimed at reducing marine pollution. Even more emphasis must be placed in future upon surveillance and penal measures in this field, for pollution of the seas bodes consequences for the whole future of mankind which must not be underestimated.

The question of cleansing the Rhine is, of course, dealt with primarily by the Berne Convention on protection of the Rhine against pollution. The Commission is, however, a participant in the work of the international Rhine Commission and has reserved in the environment programme the right to make proposals to facilitate and expedite the necessary cleansing measures. The Community will participate in a Council of Europe project to protect international waterways.

Practical application of the "polluter pays" principle

Under the heading of economic matters arising out of environmental protection, the Council of Ministers had already made the "polluter pays" principle mandatory for the whole Community as regards allocation of the costs of anti-pollution measures, when it adopted the programme on 22 November 1973. Then, on 7 November 1974, the Council decided upon further definitions of, and procedures for applying, the "polluter pays" principle, and here a chapter on exceptions to immediate and complete application of this principle naturally played an important part. The Commission in fact believes, and justifiably so, that a rigid and over-systematic application of the "polluter pays" principle could at times hinder rather than help a rapid and lasting improvement in the environment. In such exceptional cases, carefully defined, the "polluter pays" principle



should, during a transition period, which must not, however, extend beyond 1980, give way to the "shared costs" principle under which certain forms of state aid are permissible.

For this purpose, the Commission had to alter its interpretation of Article 92 and subsequent articles of the *EEC* Treaty, under which aid granted by a Member State is only compatible with the common market under certain restricted conditions, and to designate certain environmental aid systems as conforming with the Treaty terms in so far as they fulfil certain requirements (time limit, maximum values, phased reduction). The Council has instructed the Commission to give special attention in further work to legal and economic matters concerning pollution which extends across national boundaries and to examine the possibilities for harmonization of national regulations in the field of liability law.

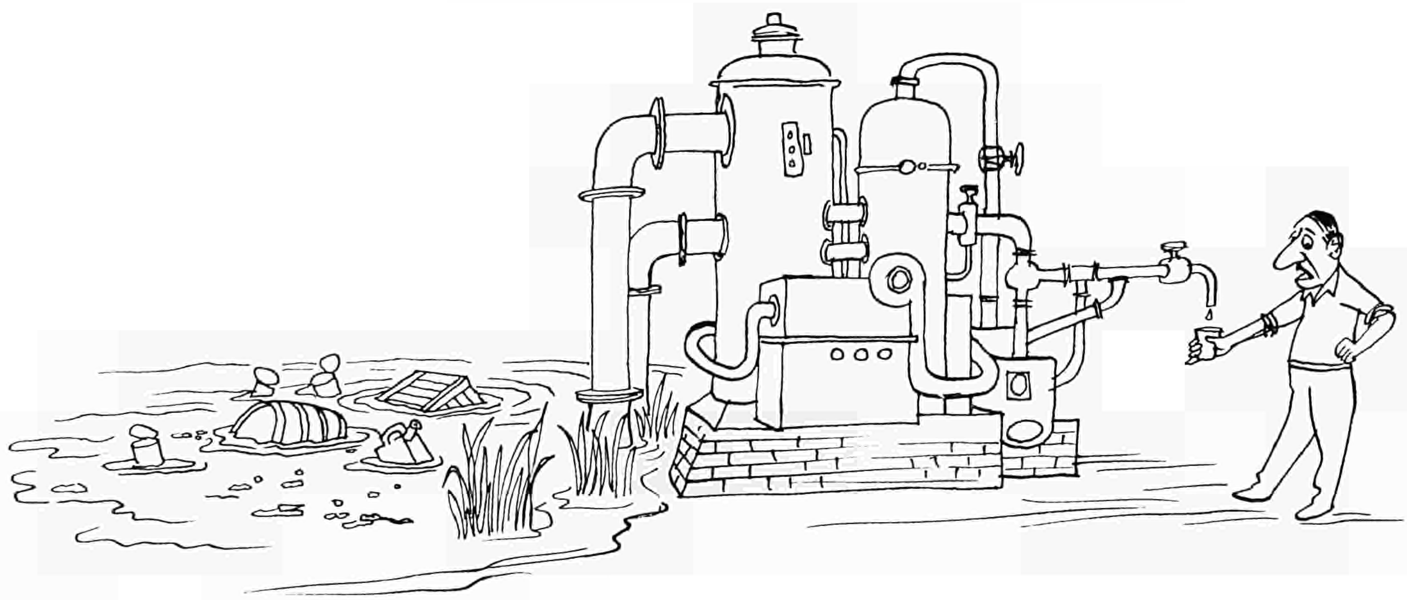
In addition, the Commission had a number of studies carried out which report on the effectiveness of economic instruments used to control environmental pollution; these studies should help to unravel the knotty problem of internalizing (or incorporating into the price-tag) the "social costs".

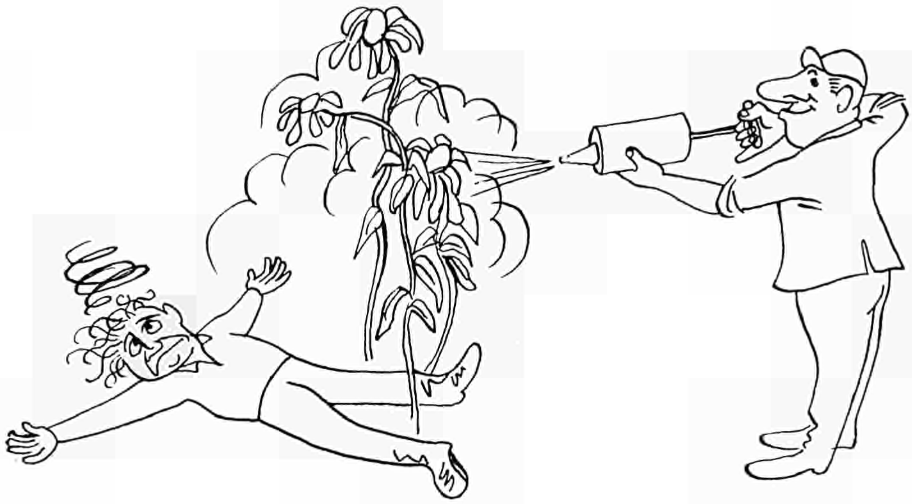
The means of guaranteeing better dissemination of knowledge on protection of the environment are being examined by two working parties, one representing the interests of the users of such knowledge, the other consisting of a group of specialists on information and data processing. The aim of their work is to construct a network for the exchange of information throughout the Community.

More than 22 million A.U.[1] have been made available to the research programme on the environment adopted by the Council. Of this sum, 16 million A.U. are allocated to research which will be carried out by the Community's own Joint Research Centre, and a further 6 million A.U. to contract research to be carried out under Commission contracts by research organizations in the various Member countries.

Another important part of the Commission's work consists in measures devoted to improvement of the environment, the aim being to give effect to the new "Environment" dimension in the context of the specific policies defined and pursued by the Community. The first result of this approach was the Directive adopted by the Council in January 1974 on mountain and hill farming and farming in certain less-favoured areas. Once the necessary implementing regulations have entered into force, it will be possible to support agricultural operations from the *EEC* Agricultural Fund if the farmers are prepared to remain in the relevant areas. A further Commission

[1] A.U. = Account Unit = F.B. 45.8564 (28 June 1974).





Directive to encourage reafforestation of uncultivated areas resulted from the same deliberations.

Agriculture also contributes to environmental pollution

The Commission has also examined the ecological consequences of modern agricultural production techniques, particularly the intensive use of certain fertilizers, the excessive application of pesticides, mechanization and monoculture problems. These investigations have revealed clearly the pollution due to intensive animal husbandry and to the excessive use of certain biocides. On the other hand, the effects of intensive application of artificial fertilizers on the quality of ground and surface waters has not yet received adequate study. Further studies still in progress relate purely to integrated or biological pest control and to quality requirements for agricultural products.

Of particular public interest is the Commission's work in the bird protection sector. It is an unhappy fact that every year, even in some Community countries, many millions of migrant birds are captured and used as food. Some species are threatened with extinction. A Community action must aim at protecting the nesting, breeding and refuge places and at restricting hunting at least to certain species. The Commission will be putting forward proposals during 1975, which will also cover certain animal species outside the bird world.

Environment problems connected with the depletion of certain natural resources were again brought conspicuously into the foreground by the energy crisis. Thorough examinations of future requirements of raw materials which cannot be recycled, of the potential medium- and long-term effects of depletion on the Community's environment and industrial policies, and of the possibilities for treatment and substitution, are being continuously carried out. Thirty different raw materials are being examined and first reports on the metals of the platinum group and on mercury have already appeared.

Measures to improve our natural and man-made environment

The Commission has also paid attention to town and country planning, but in this area the Community will only be able to devote itself to specific problems. Its activity is centred on the particular problems of sea-coasts and on general questions, arising today throughout the Community, on the reorganization and development of town centres. In 1975, preservation of the landscape and questions of maintaining or re-establishing the ecological balance throughout Europe will be the work themes receiving greatest emphasis.

The Commission's actions to improve the working environment cannot be listed here in detail, but it is worth mentioning that in November 1974, the Commission held a highly acclaimed colloquium on the improvement of working conditions in industry, which made important suggestions on future work.

Public work

Not every aspect of the environment can be regulated by laws and ordinances. The general public must be made aware of the problems, so that people will help to protect and improve our environment. At the Council meeting on 7 November, the Commission was requested to launch and co-ordinate a large-scale public campaign in the Community. This year will see the publication of a first report, intended for a wide general readership, on the state of the environment in the Community. In December 1974 the Commission, with the "Council of European Municipalities" and the "International Union of Local Authorities" *(IULA)*, arranged a symposium extending over several days in Rome, at which the Member States' locally and regionally elected representatives were acquainted with Community activities on the environment. Major Commission efforts are likewise to be expected this year in the area of secondary and higher education in "environment" subjects.

International co-operation

At the international level, the Community is collaborating in the environmental sector with various non-member states, both directly and under the auspices of international organizations. We have already referred to the Council

of Europe. The United Nations Environment Programme and the works of the *OECD*, the United Nations Regional Committee for Europe, where questions of coordination are continually cropping up for Community Member States, should also be mentioned. The function exercised by the Commission in this respect proved to be particularly effective during the work of the Environment Sub-Committee of the Conference on Security and Cooperation in Europe, which met for extended periods in Geneva in 1974.

A continuous collaboration with the United States was introduced by a formal exchange of letters signed in June 1974. Informal, and in some cases regular, contacts exist with a number of other countries.

Agreement on information

Under an agreement made between the Member States of the Community in 1973, it is mandatory for Member States to submit to the Commission all draft national laws relating to the environment in order that the latter may have the opportunity, where necessary, of taking steps to harmonize environmental protection measures within the Community. Up until the end of 1974, sixty-one draft laws, regulations or administrative provisions, and six international agreements in the environmental field, had been forwarded to the Commission. In regard to 16 of the 61 draft law submissions, the Commission requested the Member States concerned to desist from applying the proposed measures, in order to give it an opportunity to work out proposals for Community measures.

State of progress after the first year

The balance sheet which the Commission can produce for the first year of operation of the Community's environment programme will undoubtedly show a positive balance. In 1975 it will be a matter firstly of continuing work in progress on the basis of the first programme. A certain amount still remains to be accomplished here and it will not all be smooth going. At the same time, however, the Commission has to lay the foundations of Community work on the environment which will continue beyond 1975. In concrete terms, this means drawing up and implementing a supplementary programme that allows the measures already taken by the Community to be expanded and new priorities to be set up. Environment policy has become the Community's new "trademark". We must not disappoint those who, in this field as elsewhere, have every reason to expect positive results from the Community.

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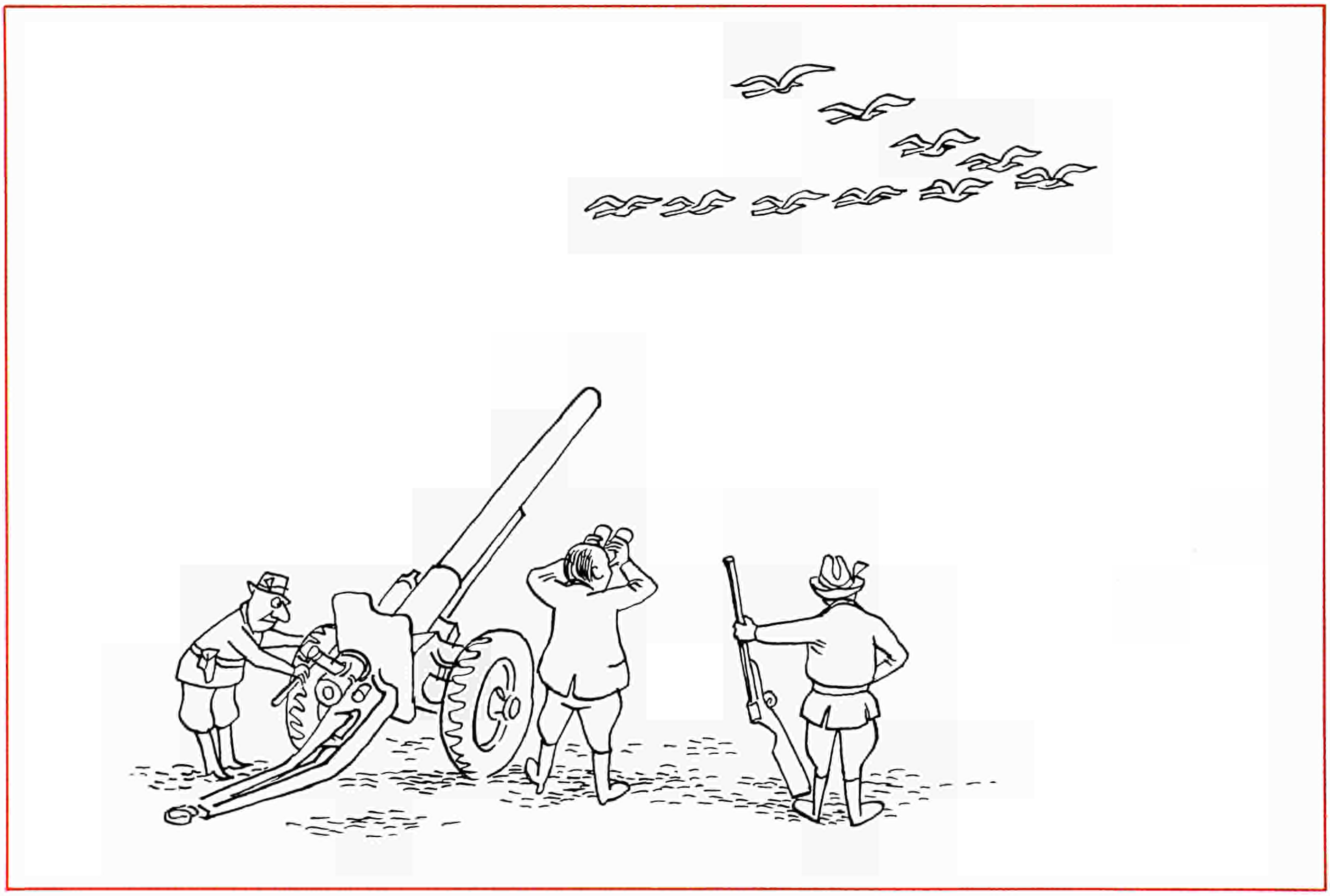

Physical rehabilitation

The place of movements required at work and the security factor in integrating the handicapped into society

ANDRÉ STORM

HELPING the handicapped to return to work in suitable jobs has always been regarded as the major aim of readaptation for the very simple reason that holding down a job is the surest sign of independence and is also a guaranteed means of making various acquisitions and of satisfying ordinary needs.

Society, for its part, reaps many benefits from the fact that handicapped people work. Having become useful members of society in their own right, they produce, consume and pay taxes like everyone else. The contribution they can make is most significant when a policy of full employment is pursued.

As early as 1940 the International Conference on Labour laid down how the handicapped were to be helped back into employment with due respect for the basic human right to work and it specified this in a number of recommendations to the various governments. Principles and rules for vocational guidance, professional training and employment services were thus drawn up. Furthermore, when the Council of Ministers met on 19 January 1973, the Council of Europe made recommendations to the various governments on the place to be occupied by physical rehabilitation and preliminary professional retraining in the readaptation process.

The Council of Europe recommended that this phase be integrated into the readaptation process. Finally, the *CEC* Directorate-General for Social Affairs had already carried out, eight years previously, a study of this phase, which is an essential step if the return to work is to be facilitated, to make the return to work easier. Thus, several surveys were financed and carried out within various Member States of the European Coal and Steel Community *(ECSC)*.

These decisions taken by various international, national and other public authorities, together with efforts made in various quarters to prepare the handicapped for the return to work, show that the readaptation process is an essential one today.

ANDRÉ STORM — Technical director of the Centre for functional retraining at the Clinique Reine Fabiola, Montignies-sur-Sambre, Belgium.

Readaptation and re-education

The sick and injured, in hospitals and then, if necessary, in specialized centres, go through a period of special care in the hands of doctors and their assistants (medical or functional readaptation). When this period is over, patients who have completely recovered or who are only slightly handicapped can go back to their old job. Otherwise, vocational guidance methods are used to evaluate the abilities they still possess: some go into firms where they perform jobs suited to their capabilities and others learn another trade, i.e., they undergo training for a different job before going back to work.

But as Professor Pierquin of Nancy(1) has said "... it is not so simple in practice. Some of the handicapped are unable to return to work immediately after their medical treatment or have not sufficient education or intellectual ability to warrant professional training. There are a considerable number of such people. It is possible to get them back to work by using certain methods which prolong the medical treatment and can be grouped under the heading "readaptation for work". Our opinion is that those methods can also be used in association with professional training in the purest sense of the term".

If readaptation is the process of helping the handicapped person to fit into his background, *re-education* is the use of a teaching programme in order to render this process more effective. Functional re-education is the correction of any motor, nervous, sensory or internal disorders resulting from pathological ailments. It is a continuous process involving physical exercises and work (occupational therapy) which are specially chosen to correct those disorders while *vocational readaptation* (or, better, vocational "training") is the process by which the handicapped person acquires the technical, theoretical and practical know-how to carry out a new trade. *Readaptation for work* could be described as accustoming the handicapped person to the particular conditions (both physical and mental) of whatever job he is going to be doing. Two means are necessarily involved in it—physical education and workshop activity, which are chosen and regulated to reflect the demands of the job. These activities take over where functional readaptation—to which they are very closely linked—leaves off and continue until the handicapped person returns to work. They can prepare the ground for vocational training or be carried out at the same time.

For victims of industrial and road accidents, readaptation to the demands of the job and the movements involved must be organized systematically and should even be considered indispensable.

Integration into society

For many years the handicapped person was far too frequently expected to be integrated automatically into society by the mere fact of going back to work, whereas it is quite evident today that the handicapped person will only be successful in his return to work if this is linked to some suitable social action.

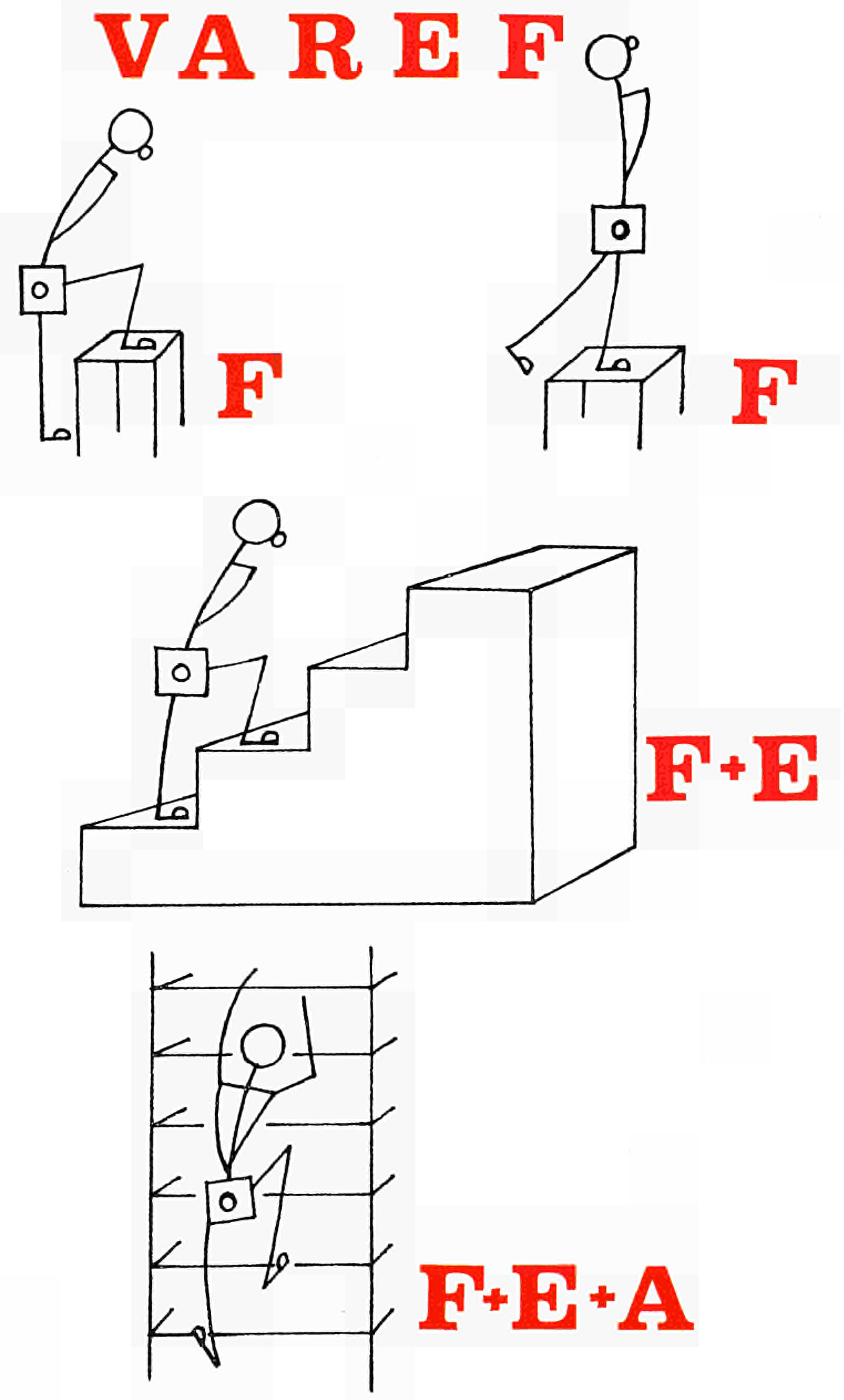

Fig. 1: VAREF *(speed, skill, stamina, staying-power, strength)—a formula describing the characteristics of physical exercise. If climbing onto a stepladder requires strength (F), then climbing a number of flights of a staircase requires endurance as well (F + E) and climbing up scaffolding and up several ladders requires strength, staying-power and skill (F + E + A).*

Vocation and social adaptation/re-adaptation are quite distinct. It is through their combined action that the handicapped person will rise through the various levels of integration and there must be a continuous interaction between them if successively higher levels are to be reached.

It is not without significance to note today just how much attention is being paid to questions of leisure, habitat, accessibility and sport for the handicapped suffering from physical, mental and sensory disorders.

It cannot be emphasized enough that holding down a job is only really possible if the individual is integrated into a stable and permanent position in society. Incomprehension on the part of the employer or the man in the street is not the only reason for the failure of the handicapped person to fit into a job; it can also be due to a disorganized infrastructure (an unsuitable place of work, poor access to buildings and public transport, and other harmful factors), difficulties arising from acceptance by his colleagues and those around him and, finally, to the handicapped person himself who must adapt, integrate, feel "at one with himself", in the same way as the others who are not handicapped. Rejection and failure are often the result of a kind of fear and mistrust based on a mutual lack of understanding.

We are increasingly coming round to the view that, in the functional and vocational readaptation of the handicapped person who is suffering from motor disorders and has not always been handicapped and also during the phase of observation, guidance and learning, in the course of special vocational training, the important thing is to be aware of the full potential of the handicapped person by thinking of him as a complete unit and not concentrating on his handicap. On this basis, the assessment will be accompanied by a search for abilities which can be properly exploited. Properly structured observation does not confine itself to the levels obtained from testing since, more than for any fit person, the handicapped person possesses a surprising ability to compensate.

Take your bearings before deciding which way to go—these are the guidelines, the route to be followed to help the not-so-fit to come out of their shell and flourish in our society.

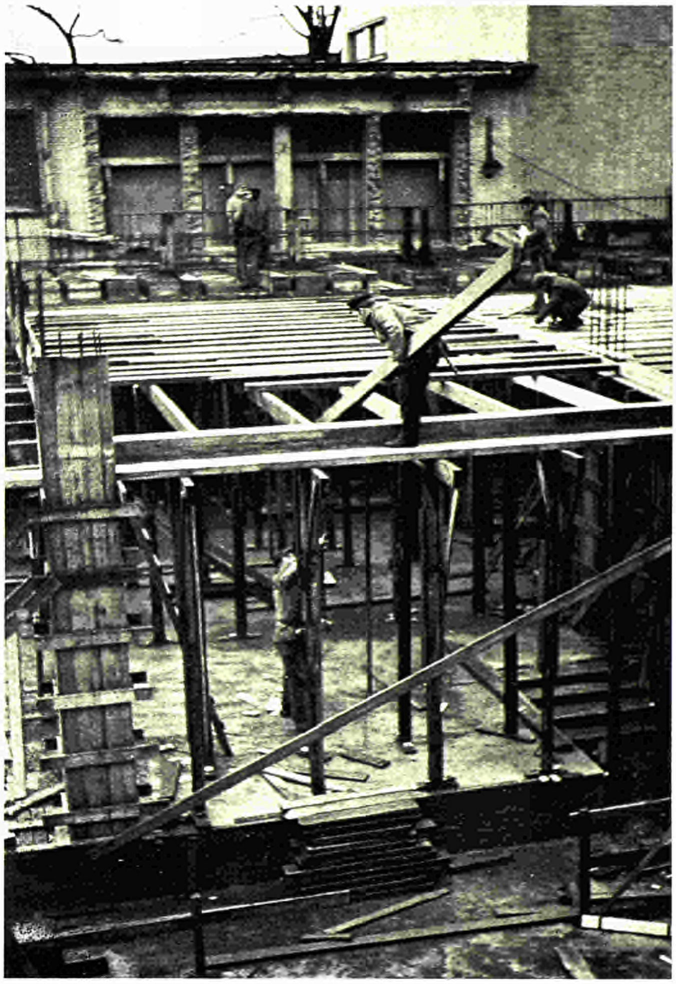

Fig. 2: *This is one of many common active movements connected with work: a construction worker loses his balance, so that physical training or retraining is necessary. Here he is relearning the feeling of being surrounded by space.*

Before studying the various components of vocational activity and stating the abilities which need to be developed in various teaching programmes, it should be noted that:

- vocational adaptation is a specific aim;
- social adaptation requires that the handicapped person be aware of his body; this is particularly important for the mentally handicapped. All therapists agree that some sort of regular keep-fit activity is essential.

Too often there occurs, when schooling is over, a "readjustment" stemming not from his job but from the situation of his body in space (spatial adjustment); the handicapped person becomes harassed by disturbances of the space around him.

With good guided training that instils automatic responses he acquires some regularity of rhythm and speed, but this will fade unless he is kept in practice.

Therefore an "active" break (a keep-fit form of physical education) during work in firms and in special workshops for the handicapped and access to leisure activities based on guided physical training are necessary. Getting the handicapped person to move about, even if it is only by letting himself go on a sportsfield, creates a space, a specific point of reference that will stop problems of a "psycho-affective" origin from again getting the upper hand. An inappropriate form of teaching will lead to unprecedented failure, for example, when the handicapped person is taking part in sporting or therapeutic leisure activities.

One should not seek to encourage the production of specific movements intended to re-educate one particular limb or set of muscles but rather to encourage adaptation to the surroundings so that the handicapped person is able to express himself; once he has adapted to his surroundings he can decide on the type of exercise he needs for his own re-education. An attempt should therefore be made to find his individual way of adapting.

Movement of the body, a functional means of expression, is a natural springboard to mastering all forms of intellectual, emotional and social activity.

The use of physical re-education for the mentally handicapped

The following questions can be answered in the affirmative in the case of the physically handicapped. Is the same true of the mentally handicapped?

Does physical activity lead to greater strength, flexibility, ease of adaptation and coordination and hence to more efficient and more fruitful performance?

Can selected activities help the handicapped to be better accepted by their colleagues over the years? Will they provide any useful help later on?

Do such activities bring about an improvement in certain social attitudes such as self-confidence, self-assurance, a sense of responsibility, initiative, team spirit and so on?

Physical education encourages the individual to experiment and to improvise movements, but the appropriate teaching is needed (e.g. jumping "like a kangaroo", miming some everyday activity etc.).

The handicapped person needs to observe before making his own experiment and he must be given help to identify its essential elements. Music and audiovisual techniques can heighten concepts and improve vocabulary, attitudes and the acquisition of various notions (e.g., a jack in the box, films showing various activities in slow motion; the use of scale models to help them use their hands to compensate for limited vocabulary and imagination). Abuse of these visual aids and over-long explanations should be avoided, since passive listening will interfere with the realization of the "models".

Since the movements need not be perfect and competition is not required, the exercise can be easy and simplified rules can be used.

Certain abilities can be acquired, not only by using the classic apparatus of the gymnasium, but by getting the handicapped person to invent or lay out his own improvised circuits, representing real situations, using beams, benches, panels, tyres, group transport, etc., in order to accustom them to everyday activities at the same time as developing the qualities needed to carry out a job.

"Safety first" obstacle courses, marks on the playground or the playing field, a long straight line divided into lengths equivalent to the width of a road to be crossed while the lights are green, teach the safety code in near-natural surroundings and prepare for "expeditions" to town.

If maximum benefit is to be obtained from a daily programme of this kind, the activities must meet some real need. They must be judiciously prepared and should aim, through this physical education, to simulate gestures made in the course of work or everyday activities.

This physical education should be presented to the handicapped and their families as part of a teaching programme and not as merely supplementary to the re-education of the individual. Success and improvement come more from functional adaptation than from any real effect on the handicap itself.

What is experienced in an exercise differs from one individual to another.

Some people might be tempted to think that physical education for the mentally deficient should be confined to medical gymnastics or physiotherapy when such features as apathy, lack of stamina, shuffling and a tendency to tiredness or poor carriage occur frequently. This is not so, however, since anyone who works with the mentally handicapped knows that these characteristics are not necessarily associated with mental backwardness. On the contrary, many of the defects seem to arise from an aimless existence or living conditions devoid of any possibility of participation, relaxation or relief.

Education and re-education

In the course of physical and professional activity, every opportunity should be seized to introduce notions of safety and first aid, the key points of which must be underlined. Safety is not a subject in isolation, a kind of professional moral code: it is at the very heart of things. Everyone must be aware of the need for safety and emphasis should thus be placed on reflexes, on good, healthy reactions, since the raw material of work well done is physical fitness; the essential elements of the exercise must therefore be mastered.

It is also necessary to fight against a fatalistic attitude, particularly towards occupational hazards (schools of vocational training or the institutes of technology normally lead the way in this respect and the centre for readaptation complements their work).

Homo faber lacking in education in the principles of safety is as much at a loss as *homo sapiens* with no notions of politeness.

Specialized physical education, coupled with the indispensable education of the muscles and associated with supervision of properly made physical effort, will facilitate gradual adaptation to the needs of the job or, for those who have not always been handicapped, a gradual return to working conditions.

The importance of this activity varies from one individual to the next and is closely linked to the difficulties inherent in the path to work and in work itself.

The movements most often needed at work should be replicated and made the subject of special gymnastic activity, taking into account the five following fundamentals: the physiological breakdown of the exercise, the movement needed for the job; the classification of the worker's movements, the basic factors of human work and job categories according to intensity of work.

Physiological breakdown of the exercise. Our ancestors have bequeathed us a natural biological set of equipment and we have various organs, systems and tissues. They enable us, on the one hand, to stand, walk, run and climb and, on the other hand, to perceive, digest, see and produce energy. In a word, we function.

We have three sets of qualities influencing the major functions:

a) the organic set: staying-power, stamina (heart and lungs);

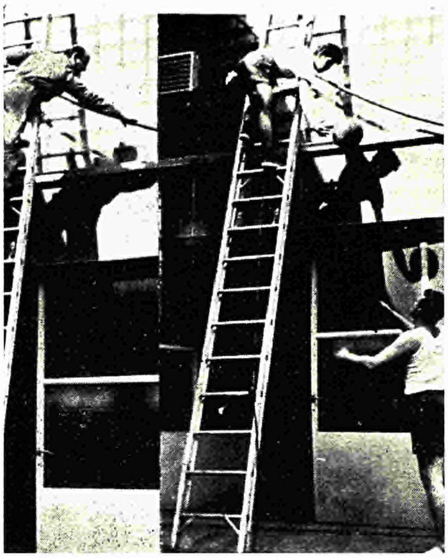

Fig. 3: *Climbing a ladder while pulling a cable is a movement which can be replicated in the gymnasium by throwing a medicine ball.*

b) the muscular set: strength, muscular stamina and staying-power (joints and muscles);

c) perceptual kinetic set: speed of movement (heart), skill, coordination, rapidity and precision (neuro-coordination).

Physiological and pedagogical knowledge of movement means that the exercise can be adapted to the type of handicap in question. For example, the repetition of a gesture does not simply involve training the muscles, but also involves the heart and lungs.

The following is a simple formula, suggested by Bellin du Coteau, for illustrating the characteristics of the physical exercise and enabling these exercises to be categorized:

*V*itesse [speed] (heart);

*A*dresse [skill] (neuro-coordination);

*R*ésistance [stamina] (heart and lungs);

*E*ndurance [staying-power] (heart and lungs);

*F*orce [strength] (joints and muscles):

VAREF

Stamina and staying-power are closely related, although there is a slight difference between the two. Stamina is the quality which enables near-peak effort to be sustained over a period of time and staying-power is the ability to sustain a relatively small effort over a long period of time.

This analysis provides the way of selecting exercises so as to take into account the principle dominating action.

Speed is a question of contraction into a minimum time; skill depends on the difficulty of the movement and strength governs measured, slow and infrequent movements carried out to maximum capacity.

For example, climbing onto a stepladder requires strength (F); climbing a number of stairs requires both strength and staying-power (F + E); climbing up a scaffolding consisting of X stages and climbing several ladders requires strength, staying-power and skill (F + E + A) (Fig. 1).

The movement required at work — This implies physical effort or exertion. However, no attempt should be made to label jobs which are vague; it is far better to express them in terms of movements, as Delaet and Lobet do (2). They provide an exceptional amount of information in their book "Etude de la valeur

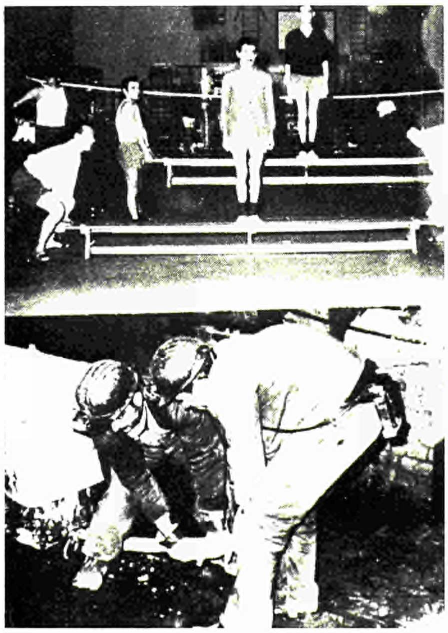

Fig. 4: *Putting a small derailed wagon back on the track involves the technique of lifting. In the gymnasium the key elements of proper handling will be emphasized.*

Fig. 5: *Certain movements used in the course of work can be replicated in exercises in the gym (gymno-professional activities): here the act of pushing a truck is replicated in a rugby scrum.*

économique des gestes professionnels" (A study of the economic value of movements required at work). The analysis of 1 300 jobs shows that they can all be done with 43 movements—24 of them movements of the hand—and their various combinations.

Classification of the movements used by the manual worker. There are three categories:

1. *Movements made in the job situation* (climbing a ladder, throwing bricks, etc.). In the course of his work the bricklayer or the construction worker has to do more than use his tools; he must also climb ladders, use hoists or move about on scaffolding, often at considerable height, while handling objects (Fig. 2). The crane driver has to fight against giddiness while operating the crane as well as judging distances and levels.
2. *Purely technical movements specific to a piece of machinery* (turning a handle, pushing a lever). These movements are lower down the hierarchy of difficulty but are extremely numerous in the jobs encountered in modern industry.
3. *Purely technical movements involving voluntary control* (filing, hammering, painting and welding). These are the movements of the specialized or skilled worker.

The fundamental factors of human work. Strength, speed and precision are at the basis of human work. Strength varies with the technique involved; it can be continuous, intermittent, quick or gradual. Here are some examples:

- the smith: quick bursts of strength with use of grip and fist completely closed;
- the cook: precision and strength vital for cutting meat, in addition to various types of gripping;
- the machine operator: speed and precision but also muscular endurance of the so-called press movement.

Mechanization considerably reduces the importance of the strength factor in favour of speed and precision. These two factors should not be neglected.

Job categories by intensity of work

Jobs can be divided into four categories:

1. *Heavy work:* requires strength, skill, precision, stamina and speed (the smith, the slaughterer). The construction worker is not simply manually skilled, his skill is also needed to help him keep his balance.
2. *Medium-heavy work:* all the main elements of the exercises are present but to a lesser degree (the fitter, the painter). An electricity lineman has one hand for work and the other ready for safety, in case he needs to hang on.
3. *Jobs involving alternate periods of work and rest:* the truck driver must also use the finger-palm gripping action vital to his job since he frequently needs to carry out manual actions.
4. *So-called sedentary jobs:* there are certain requisite qualities although the heart-lung functions are not absolutely necessary (the dress-maker, the clerk, the machine operator, the switchboard operator).

This variety of characteristics show that it is virtually impossible for an educator to be well-informed on every type of job. However, as a result of some sort of interpenetration, teachers of different subjects can draw up a syllabus.

Some jobs in the range will require strength, others skill, but an eye to security and safety will almost always be called for.

From the above five characteristics, it emerges that *multipurpose motor skills* can be developed by *exercises on the flat*, such as walking, running, crawling, falling (e.g., the fitter carrying a carboy), *exercises involving a change of level* such as moving about on some apparatus or construction with and without a load: in the former case in particular, going up, climbing, going down, jumping, gripping and hanging on and hanging down; overcoming obstacles [combating giddiness, for example, climbing a ladder while pulling a cable, an action which can be replicated in the gymnasium (Fig. 3)].

Handling:

- picking up, holding, carrying, throwing, putting down, pushing; for example, putting a small derailed wagon back on the track, which brings the technique of lifting into play. In the physical training room, attention will be drawn to the key elements for proper handling. The load is represent-

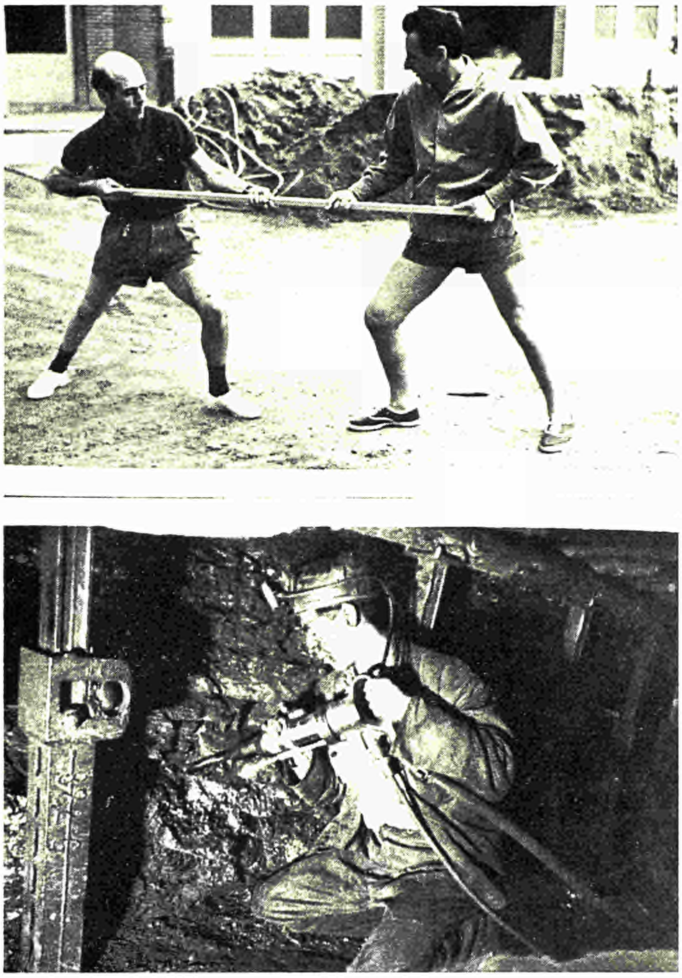

Fig. 6: *Another example of an exercise replicating a specific movement called for by the job.*

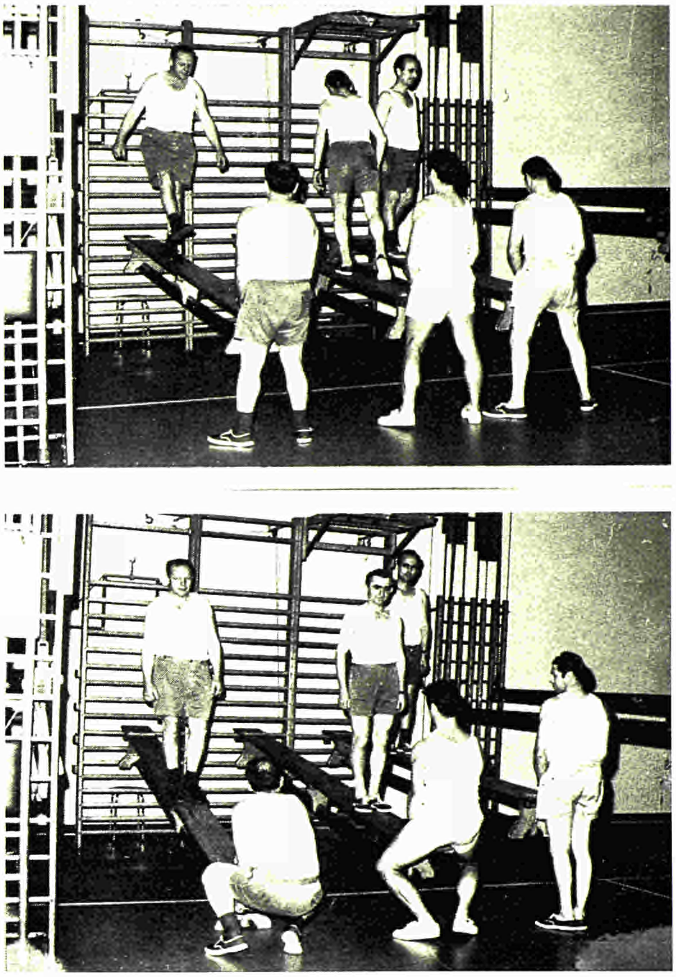

Fig. 7: *Learning proper handling techniques is associated with exercises involving changes of level and getting used to empty spaces.*

ed by a handicapped person who, of his own accord, carries out the retraining of his own sense of balance (Fig. 4);

- replicating the movements of the plasterer and the tiler by raising a trestle;
- replicating the movement of pushing a truck by forming a rugby scrum (Fig. 5).

Precision of movements (Fig. 6)

- handling and coordination (throwing tools or bricks). This range of possibilities should heighten the reactions of the team and the inclusion of this type of conditioning into the special vocational training syllabus would make integration easier for some people (Fig.s 7 and 8).

In the field with which we are now concerned, the aptitudes needed for human activity and those which provide a global answer to the need of all the functions are:

1. *Mental abilities*, i.e., an understanding of the operations involved in the job.
2. *Psycho-motor abilities* which depend on the proper working of the sensory system and the efficiency of the actions.
3. *The ability to perform movements* which are the practical value of the motor apparatus and are divided into access to the place of work, work position, form of the productive movement involved, practical efficiency and economy of movement. A movement is normal when it is properly controlled and when it is carried out with speed and efficiency; these are two qualities which have no precise limits and can always be perfected.
4. *Basic abilities*, i.e., resistance to fatigue and the capacity for potential powerful effort and for action.

Our whole system of education must be based on a preparation for an active life, in accordance with the principle of usefulness.

If adequate physical education can train muscular behaviour, then our teaching methods must be adapted to it. First of all the aims must be defined:

these are professional integration, human and social integration and integration into our civilization of leisure.

The ways and means of attaining them will now be examined. Various abilities must be acquired, in particular:

a) *adaptability* as regards movement and in the working environment;

b) *availability of muscular power;* (staying-power at work, the ability to sustain effort and perform a job properly);

c) *muscular efficiency* in physical handling (Fig. 6) and in the prevention of accidents and fatigue;

d) *precision of movement* (delicate gestures);

e) *attentiveness* (at the work station when adapting tools and machinery to the man);

f) *steady rhythm* (to cope with the work flow), work postures;

g) *basic organic stamina* (intensity and continuity in the rate at which the individual works, the speed of the machines, the overall rate of the team);

h) *safety*[1] at work, going to work, during leisure-time, at home;

i) *taste* (hobbies or leisure activities) to compensate fatigue;

j) *sociability* (relationships with the group, place in the group and a sense of responsibility).

Once the aims have been identified, various questions arise and they can all be summed up as follows:

- How ?
- By what means?
- Where?

A survey of the answers which can be given to these questions is given in Table I.

To sum up, adaptation comes either from availability of mental and psychomotor abilities, movement and basic aptitudes or from efficiency as regards safety, economy, precision and speed.

[1] It is known that the cause of 85-90% of accidents is a personal factor linked to physical condition *and* concentration when at work [Mihovilovic (3)].

Human activity demands coexistence, interpenetration of physical, psychological and intellectual qualities.

In any system of education, physical activities must be selected and organized to take account of the development of the requisite human faculties of the operation of "keeping one's hand in" (movements and elements of work), states of tension after work and the need for creative activity to stimulate vital functions.

Conclusions

In the same way as for functional training for the physically handicapped, in teaching itself and, more particularly in medico-educational institutes or at work, social solidarity is vital at all levels in a world where success can only be achieved collectively.

All the work carried out in the field must be based on the same conception and follow the same lines. Everyone, in whatever process, must work towards the same aim and any failure is due to an absence of interpenetration.

The individual, with his physical and psychological components, forms a complete unit and success depends on united efforts, i.e., medical and paramedical action, the contribution of all the teachers involved and cooperation on the part of the family and the collaboration of the handicapped person himself.

Many people must be called upon to contribute and their every activity must be prepared from the physical, psychological, administrative, professional and social points of view.

The advantage of a return to work properly prepared by effective liaison can thus readily be appreciated. The right "atmosphere" can only be created if all the people concerned are willing to help and believe in what they are doing. If we are all willing to work together, the goal will be reached and the benefit reaped by the boy or the man will be everybody's share.

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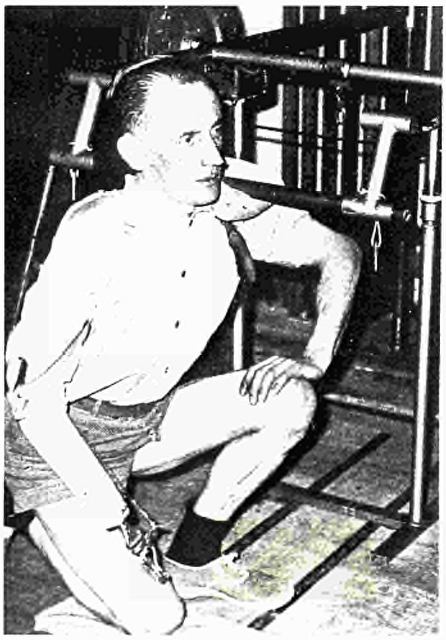

Fig. 8: *Restoring coordination to a welder who has lost an arm.*

This muscular training, or putting into good physical condition, is an activity which can be superimposed on the capacity for work of the handicapped person, for whom strength, staying power and skill are indispensable, with or without any technical konwledge.

Table I: *If satisfactory results are to be obtained from training the handicapped for work, a thorough analysis of the means to be used is required.*

How?	*By what means?*	*Where?*
Through the development of: – motor and psychomotor abilities; – "safety" reflexes; – motor skill (to be created); – economy of effort through automation and the consequent improvement of precision and skill; – balance and getting used to the void, combating giddiness; – muscular efficiency of the major factors of the exercise and the various forms of gripping;	Physical education and physiotherapy in interpenetration with teachers of vocational training;	In the primary secondary and above all technical special special vocational schools, in functional training and vocational retraining;
– the study of the job in the light of current possibilities (the crane driver and tranquillizers!); – the fight against hazards; – awareness of danger, hence activities to ensure safety; – the organization of leisure through a choice of sport, culture, handicrafts; – the tendency to eliminate frustration and complexes.	– occupational medicine; – work counsellor; – ergonomist; – physical training instructor: combating deformities, gymnastics for relaxation; – furthering of the process by the social services; – socio-cultural organizer.	– factory; – retraining workshop; – special workshop for the handicapped; – propaganda from various work promotion committees; – national association for prevention of industrial accidents; – committees on safety and hygiene; – by careful retraining; – easily accessible sports grounds (remove architectural barriers).

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Calcium : a possible substitute for geochemically scarce metals

GIOVANNI PELLEGRINI, GIOVANNI PIATTI

MATERIALS are considered to be one of the legs of the tripod (materials, energy, information) on which our technological society rests.

The events of recent years leave no doubt that social and political stability and international cooperation are better assured if our materials situation is sound and the supply smooth and continuous.

It has been predicted that in a not-too-distant future we shall run out of some critical materials or not have enough energy available to provide them. On the other hand, some people think that shortage problems will not necessarily persist too far into the future, because the whole technological basis of society changes in the long run and consequently the key-resources base changes. In other terms, it has been argued that the interest of future generations will better be served if we leave them technology and productive equipment rather than materials in the ground.

It is self-evident, however, that the exponential increase in demand for some non-renewable resources cannot be satisfied indefinitely and that wiser choice and use of these resources are advisable in the immediate future. One can easily imagine that future generations will blame us for having burnt oil, which is the best raw material for the organic chemical industry, thus dispersing carbon into the atmosphere. Or we can roughly estimate how small would be the reserves and how high the cost of copper at the present time, had this metal not been replaced by aluminium as an electrical conductor.

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It is clear at this moment that one should keep options open for the future in order to avoid shortages of materials in the years ahead : we would best serve the coming generations, if we could leave them *both* technological equipment *and* mineral reserves in the ground. This obviously implies an effort by governments and research organizations to establish adequate policies for the conservation of scarce resources and for better utilization of more abundant ones.

A careful analysis of these problems and of the possible measures to avoid those connected with future scarcity has been recently presented (1).

Non-renewable resources and their availability

The term "non-renewable resources" is applied to ores (such as those of iron, aluminium, copper, lead, titanium, zinc, magnesium, fluorine) and fossil fuels which formed over a very long geological period of time, so that they must be regarded as non-renewable.

Their natural source is the continental earth crust, which is essentially a mixture of Na, Ca, K, Al, Fe, Mg, Ti, quartz and lesser amounts of other oxides, phosphates, fluorides, sulphides, chlorides, sulphates and carbonates.

Table I shows the technologically most important ferrous and non-ferrous elements listed according to their geochemical abundance in the earth crust, and indicates the ease or difficulty of converting such minerals into the elemental form.

It is worth noting that only the upper 3.5 km (1/9) of the continental crust are accessible for exploitation at present. Therefore a distinction should be made between actual *reserves* (identified minerals accessible for exploitation) and *resources*, which are considered as the sum-total of reserves to be discovered and exploited in the future.

The non-renewable character of the ore resources would have little effect on the availability of some key metals, were we not faced with a rapid exponential rise of population and, consequently, with a rapid exponential increase of the world demand.

Most of the non-ferrous metals upon wich our technological society is based are concentrated in deposits irregularly distributed throughout the earth's continental crust. Therefore, future scarcities may depend for a great part on political events, geographical obstacles, and the cost of the energy needed to extract the metals. Table II gives a quantitative estimate of the future availability of some key materials, and from columns 3, 5 and 6 one may deduce that in a not-too-distant future the situation may become critical, especially as regards the availability of lead and copper and, to a lesser extent, of nickel and zinc, since the identified reserves in the outer continental crust are relatively small and the chances of locating new reserves in the near future are slighter for these than for other more abundant metals. These aspects can be seen more clearly from Mc Kelvey's diagram, in which the estimate reserves in 1970 of a selected number of key metals are plotted versus their abundance in the earth's crust (3). A version of this diagram is shown in Fig. 1.

Prof. F. Roberts (4) drew a possible scenario for the life-cycle of copper by estimating at each point of time the cumulative extraction Q_e of this metal, the identified reserves Q_r, and the cumulative discoveries Q_d (with $Q_d = Q_e + Q_r$). The scenario is illustrated in Fig. 2. Assuming 1 800 million tonnes as the upper limit of the total resources (Q_{ult}), it emerges that the amount of copper reserves falls rapidly at the end of this century and will be wholly exhausted around 2050. The author also notes that the general pattern does not change significantly, if the upper limit of the ultimate global resources is changed; e.g., doubling the ultimate resources to 3 600 million tonnes, the life-cycle would be extended only by less than 10 years.

These estimates suggest that economy policies should be urgently promoted as regards the use and choice of non-renew-

Table I: *Average amount of some important ferrous and non-ferrous elements in the earth's crust.*

Elements	Crustal abundance Grams/tonne	Conversion to elemental form	
Abundant:			
Silicon	277 200	Difficult	
Aluminium	81 300	Difficult	
Iron	50 000		Easy
Calcium	36 300	Difficult	
Sodium	28 300	Difficult	
Potassium	25 900	Difficult	
Magnesium	20 900	Difficult	
Titanium	4 400	Difficult	
Manganese	1 000	Difficult	
Scarce:			
Chromium	200	Difficult	
Vanadium	150	Difficult	
Zinc	132		Easy
Nickel	80		Easy
Copper	70		Easy
Tungsten	69	Difficult	
Tin	40		Easy
Cobalt	23		Easy
Lead	16		Easy
Molybdenum	15	Difficult	
Beryllium	6	Difficult	
Uranium	4	Difficult	
Mercury	0.5		Easy
Silver	0.1		Easy

Table II: *Resources of the outer crust and demand in 1970 (Ref. 1, p. 5).*

Element	% in average rock	Tonnes in outer 3.5 km of continental crust	% in solid deposit of minimum workable grade	Identified resources (tonnes)	1970 demand (tonnes)
Fe	4.65	7×10^{16}	25	3.5×10^{11}	4×10^{8}
Al	8.05	12×10^{16}	23	3×10^{9}	1.2×10^{7}
Ti	0.45	6.7×10^{15}	10	1.2×10^{9}	1.4×10^{6}
Ni	0.0058	8.7×10^{13}	1.5	8.4×10^{7}	6×10^{5}
Cu	0.0047	7×10^{13}	0.4	3.1×10^{8}	6×10^{6}
Zn	0.0083	1.3×10^{14}	4.0	1.5×10^{9}	5×10^{6}
Pb	0.0016	2.4×10^{13}	4.0	1.3×10^{8}	3.3×10^{6}
F	0.066	1×10^{15}	20	4.2×10^{7}	1.9×10^{6}
C	0.122	1.8×10^{15}	35	3×10^{12}	4×10^{9}

able resources that are scarce and/or unevenly distributed in the earth crust.

It is obviously superfluous to say that the most appropriate ways to forestall problems of material scarcities are: a) by augmenting the resources, or b) by restricting the growth of world demand. Any broadening of our base of resources is limited, however, by their finite nature and by political boundaries, so the efforts of scientists and engineers should be devoted particularly to the conservation of scarce materials by applying such measures as may render an economising policy as painless as possible. Possible conservation measures were recently discussed and recommended by the Conference on the Conservation of Materials (1) namely:

- More recycling of scrap materials;
- More economical use of materials in the design of articles;
- Increasing the life of articles by improved design;
- Replacing present materials with different materials based on more abundant resources.

Up to now, research organizations and institutes have made very little effort towards more efficient recycling of scrap or to develop new technologies that will provide manufacturers with useful substitutes for those materials whose long-term availability is considered to be most critical.

These two possible measures for the maintenance of material supplies in the future are emphasized by M. Brooks (5). It is clear that scarcity problems cannot be solved on a permanent basis by switching to substitutes whose crustal abundance is less than 0.02 wt percent, as appears from Table I. Moreover, from the same Table it appears that most of the geochemically abundant elements (except iron) are difficult to convert into elemental form, so that production entails rather high energy costs. Fig. 3 gives the prices of some metals versus the concentration in their ore deposits, as well as an indication of price evolution over the period 1962-1970 (6). It emerges clearly that, while the prices are widely scattered, Fe, Pb, Zn, Cu, and Co are markedly cheaper than the others. The first four can be recognized as metals which have been produced on a large scale for a long time, so that they are probably being produced as efficiently

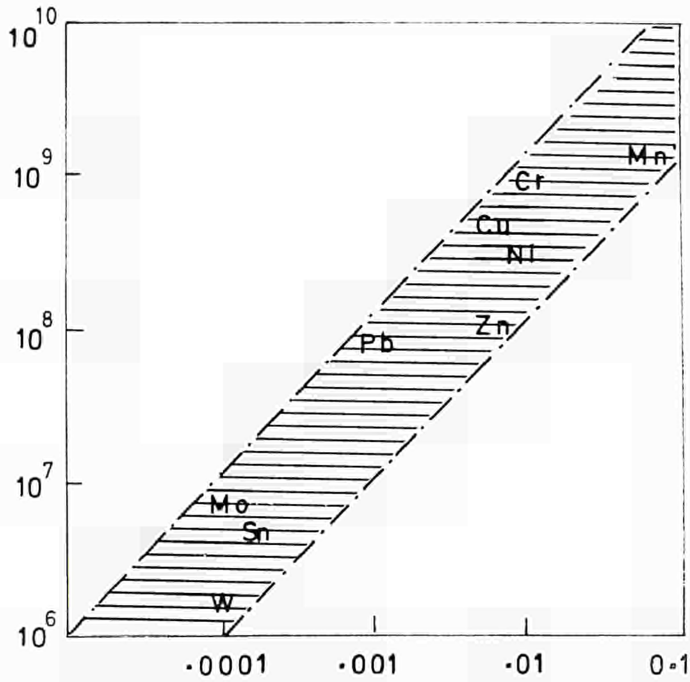


Fig. 1: *Mc Kelvey's diagram showing the world reserves of some key metals (in tonnes) plotted versus their abundance in the earth's crust (% by wt.) (ref. 1, p. 52). The dotted lines enclose the 1970 reserves (approx.).*

as possible. Moreover, one notes the outstanding position of calcium as regards the high element/impurity ratio in the ore deposits and the tendency to become cheaper as the scale and efficiency of production increase. The following are guide values of the energy required for production of the metals defined as "difficult to convert" and "easily converted":

Difficult to convert	*kWh/tonne*
aluminium (from 50% bauxite)	90 000
calcium (electrolytic)	52 000
magnesium (electrolytic)	30 000
Easily converted	
copper (from 1% ore)	20 000
zinc	14 700
lead	19 900

These figures show that calcium is competitive with other materials as far as price and energy consumption are concerned, especially if one takes into account that price and energy costs can be further lowered by expanded use and exploitation on a larger scale. Moreover, from recent events we have learnt that the price of a mineral source depends more upon political boundaries and distribution difficulties than on the actual costs of extraction.

Fig. 4 gives an interesting picture of how the prices of a number of non-ferrous metals have moved relatively to those of steel over the past 70 years (7). One notes the gradual cheapening of aluminium and the rapid increase in price of the other metals at the begining of World War II. The cheapening of Al can be attributed to the gradual improvement of production techniques, which in turn were stimulated by a widening use of Al as a structural and packaging material and as a substitute for lead in cable sheathing and for copper as an electrical conductor. All these utilizations were favoured by one particular property —lightness.

The rapid rise in price of other metals around 1940 is clearly due to the political implications of World War II, which had an enormous impact both on distribution and on demand inflated by the war industry.

Obviously any attempt at developing new materials based on more abundant and equally distributed resources should be accompanied by a detailed examination of the materials' properties, the application requirements and the technical suitability. Unfortunately, this is not possible in the case of such completely new alloys, whose mechanical and physical properties are generally very different from those of the separate alloy components, and the choice can be based only on the analysis of the properties of the individual components.

The most interesting aspects of calcium and its uses in modern technologies are illustrated below.

Calcium

Calcium occupies the fifth place in order of abundance in the earth's crust (about 3.5 wt%). From a rough extrapolation of Mc Kelvey's diagram (Fig. 1) the minable reserves amount to about 10^{11} tonnes, while those of aluminium are of the order of 10^9 tonnes. In nature it is present in highly concentrated form as carbonate in marble, limestone, calcite and chalk, as phosphate in phosphorite, as sulphate in gypsum, anhydride and alabaster, as fluoride in fluorspar and as pure silicate in wollstonite. Calcium is likewise a basic component of many rocks (e.g., dolomite) and organisms such as coral, bones of animals, egg-shells and shellfish. The most important characteristics of calcium are its high concentration in various minerals and rocks (up to 45%), and its abundance spread uniformly over the whole earth crust.

At present, on the industrial scale, Ca is prepared by electrolysis of fused calcium chloride as the primary source. Normal commercial calcium is not very pure (94-97%), the major impurities being calcium oxide (2-5%), sodium (0.5-0.8%), magnesium (0.25-1%), chlorine (0.5%) and iron (0.5%).

Highly pure forms (up to 99.9%) are produced by distillation and redistillation at temperatures between 800° and 850 °C and pressures of 20-30 mm Hg. Purification on the small scale is achieved by the zone refining method, which consists merely in moving a molten zone slowly along an ingot so that most of the impurities, being more soluble than the principal element, are "swept" along to the end of the ingot.

An alternative and relatively cheap primary source for the production of metallic calcium is lime. Pidgeon and Mc Carty (8) patented a method consisting in the thermal reduction of CaO by powdered aluminium: finely ground lime, containing less than 3% impurities and

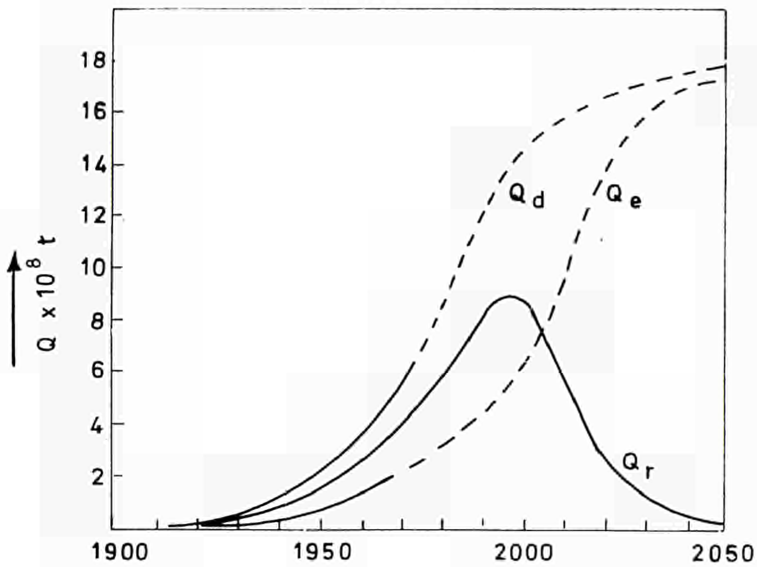
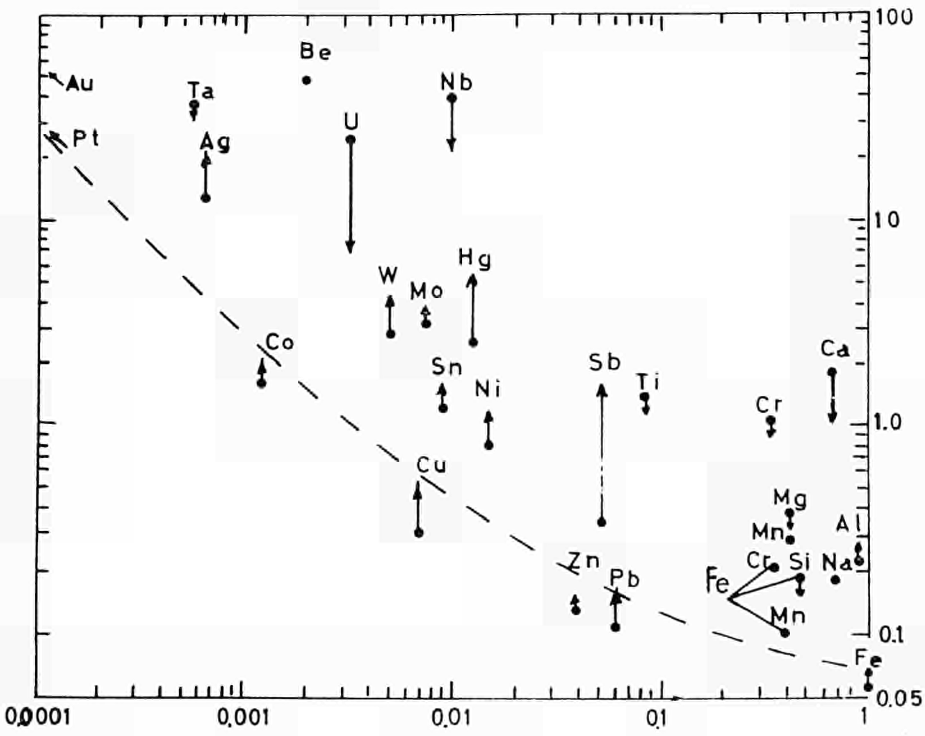


Fig. 2: *Possible exploitation cycle for copper (ref. 1, p. 73). A Q_{ult} = 1 800 million tonnes is assumed.*

Fig. 3: *Price (dollars per pound) of some metals in March 1962 (dot) and March 1970 (arrow, if different from 1962 price) located at positions on the abscissa corresponding to the element/impurity ratio of their ore deposits (ref. 6, p. 22).*



not more than 1% magnesium oxide, is briquetted with a 5-20% excess of powdered Al as a reducing agent. The briquettes are heated in vacuum (10 to 20 μ Hg) at 1 170 °C. A retort is used, designed in such a way that the calcium vapour is condensed in a zone maintained at about 740 °C while magnesium vapours condense in a zone maintained in the range of 275-350 °C.

At present the thermal reduction process is still not competitive against the electrolytic process, in spite of the high quality of the product obtained. It is not clear why this is the case, as it would be expected that large scale production could be more cheaply achieved by the thermal reduction technique.

The high chemical reactivity of calcium, and the precautions which have to be taken when handling it, are probably the main causes of its limited industrial exploitation as a structural material. One may note, however, that calcium—although the cheapest of the earth alkali metals—is still considerably more expensive than sodium. On the other hand, it is considerably less reactive. The production of sodium is more than 100 times that of calcium. Whilst in organic synthesis Na is competitive against Ca, in metallurgical work Ca presents the advantages of having a higher melting point and a lower vapour pressure. Moreover, Ca can be conveniently stored and manipulated at room temperature because a thin oxide layer forms on its surface, protecting it against further attack by air.

Calcium metal may be handled like aluminium and magnesium. It may be touched and may come in contact with the skin without danger. It can be machined in a lathe, shaped, drilled, threaded, sawn, extruded, drawn into wire, pressed and hammered into plates.

As regards the crystal line structure, it is worth noting that Melsert et al. (9) found the existence of three allotropic modifications of calcium:

α-Ca: face centred, cubic;

β-Ca: hexagonal, close packed;

γ-Ca: body centred, cubic

with transition points lying at about 250 °C and 450 °C. Tables and books currently list two allotropic forms, the α-face-centred cubic form up to 464 °C and a β-hexagonal close-packed structure

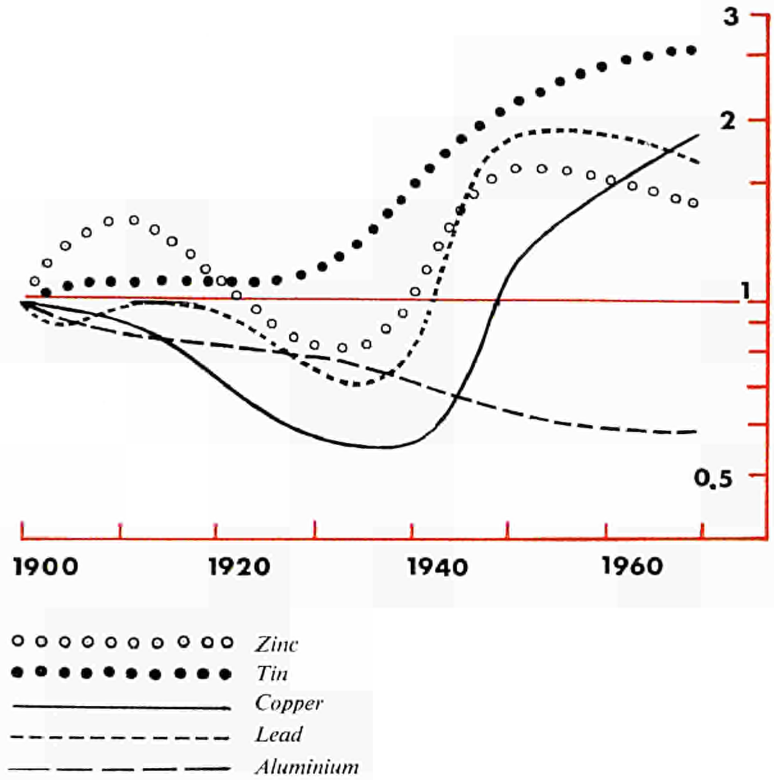
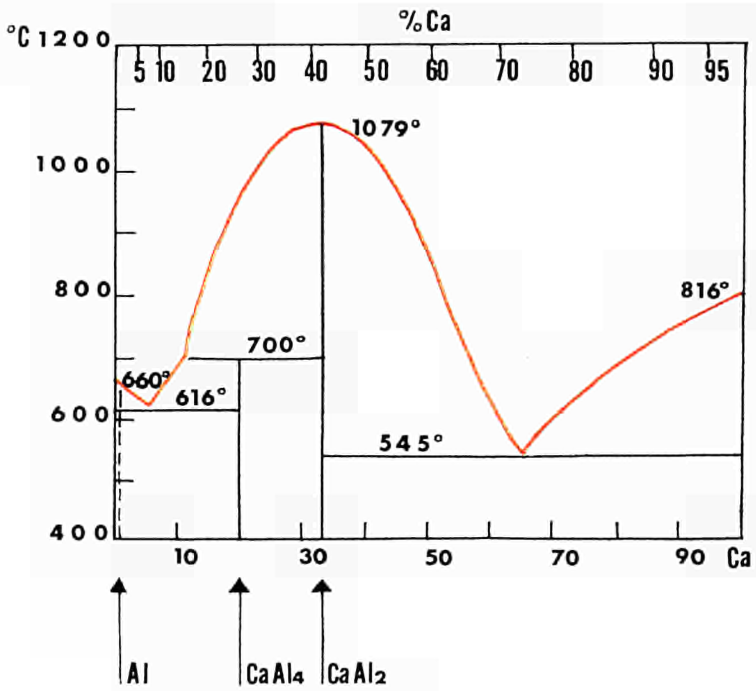


Fig. 4: *Price change, relative to steel, of a number of non-ferrous metals over the past 70 years (1).*

Fig. 5: *Constitutional diagram of the binary system aluminium-calcium (ref. 12, p. 76).*



up to the melting point. It is not known if, when and how the presence of impurities might affect the structure or determine the formation of intermediate allotropic forms. It is well known, however, that the tensile properties are greatly affected by the presence of impurities as well as by the fabrication methods. Calcium metal hardens upon mechanical working as is shown by the values of yield point, ultimate strength, elongation and reduction in area.

Mechanical properties: Calcium is harder than sodium, and softer than aluminium and magnesium. It has a Brinell hardness of 17 compared with 20 of pure Al and 30 of Mg. An outstanding feature is elongation, which in extruded wires reaches values of 60%. This property, however, has been found to be highly sensitive to impurities: e.g., 94 to 96% calcium shows no elongation.

No creep is observed on loading calcium with less than 570 psi (pounds per square inch) at room temperature. Crushing tests show complete recrystallization of calcium around 300 °C and above this temperature during deformation. The pressure required for deformation decreases with temperature and shows a sharp break at 440 °C which is close to the transformation temperature (464 °C). Above 460 °C calcium deforms plastically under very small loadings.

Applications: On a larger scale they are based mainly on its high affinity for oxygen, carbon, sulphur, nitrogen etc... In recent years calcium has found more and more applications as a "metal vitamin" (i.e., alloying element) because of its beneficial influence on certain properties of the alloys. The most common applications are summarized as follows:

- as reducer for the industrial preparation of Be, Cr, Zr, Th, U and rare earth metals;
- as deoxidizer for copper, nickel and iron;
- as desulphurizer for oil;
- as desulphurizer and deoxidizer for numerous alloys such as Cr–Ni, Fe–Ni, Ni–Co, Ni–Cr–Fe, nickel bronzes, steel and tin bronzes;
- as debismuthizer for Pb;
- as an agent for refining the graphitic carbon in cast iron;
- as alloying agent for Al and for bearing metals of the Pb–Ca or Pb–Ba–Ca type;
- as alloying agent for the production of the age-hardening lead alloys for cable sheaths and battery plates;
- as modifying agent for Mg and Al;
- as fixing agent for nitrogen in the purification of inert gases;
- as getter in vacuum technology.

A typical application as modifying agent is the addition of 0.25% Ca to Mg-alloys to refine the grain structure, reduce inflammability and modify the

Table III: *Some specific properties of Ca compared with those of copper, iron, aluminium and sodium.*

	Density g/cm³	Relative density	Resistivity (micro-ohms/cm)	Relative resistivity	Thermal conductivity (cal/cm/cm²/sec/°C)	Relative thermal conductivity
Cu standard	8.94	1.00	1.69 (20 °C)	1.00	0.93 (20 °C)	1.00
Fe	7.87	0.88	10.7	6.33	0.17	0.19
Al	2.70	0.30	2.66	1.57	0.50	0.54
Ca	1.55	0.17	4.6	2.72	0.3	0.32
Na	0.97	0.11	4.3 (0 °C)	2.54	0.32	0.34

	E-modulus psi × 10⁶	Relative E-modulus	Thermal neutron absorption cross section barns/atom	Relative absorption cross section
Cu standard	17	1.00	3.77	1.00
Fe	30	1.76	2.53	0.67
Al	10	0.61	0.23	0.06
Ca	3-4	0.17-0.23	0.44	0.12
Na	—	—	2.07	0.55

strengthening heat treatments. A further example is the precipitation-hardening of Pb–Ca alloys based on the very slight solid solubility of Ca in Pb at ordinary temperatures (about 0.01%).

Calcium alloys: From the literature it is deduced that the phase diagrams of Ca with Al, Cu, H_2, Au, Pb, Mg, Ni, Si, Ag, Sn and Zn are quite well known, whilst the constitution diagrams of Ca with Sb, Be, Bi, B, Cd, Li, Hg, N, Pt, Na and Tl are incomplete or not yet studied.

A Ca-base alloy of commercial importance is the Ca–Si alloy obtained from lime, silica and a carbonaceous reducing agent by treatment in an electric furnace. This alloy is used mainly as a deoxidizer and degasifier in the production of steel and of high-tensile-strength grey irons. Ca–Si alloy also improves the fluidity of steel. A frequently-used substitute for the Ca–Si alloy in steel production is the ternary Ca–Mn–Si alloy which provides three elements to produce low melting point reaction products which coalesce and are easily separated from the melt. It has the beneficial effect of freeing steel of oxides, gases and other non-metallic impurities, as well as of facilitating castings by increasing fluidity.

Pb–Ca alloys are employed particularly as antifrictional products, the intermetallic compound Pb_3Ca assuring the required hardness and wear resistance.

A point worth noting is that investigations of the electrical-contact properties of alloys of Ag, Cu, Cd, Sn and Zn containing 1 to 7% Ca show that addition of Ca increases the contact properties of Ag (10).

From this it emerges that the exploitation of Ca as an alloying element is rather limited at present and further research work in this field is desirable.

Useful indications for the preparation of new Ca-alloys and for an exploration of possible fields of application may be gained from the comparison of some interesting properties of Ca with those of other metals. Calcium density, electrical resistivity, thermal conductivity, E-modulus, thermal neutron absorption cross-section and relative values are shown compared with those of copper, iron, aluminium and sodium in Table III; the data presented show that calcium makes alloys much lighter, is a better thermal insulator than aluminium, and has about the same transparency as the latter for thermal neutrons.

A new Al–Ca alloy prepared by unidirectional solidification

The use of Ca as a possible alloying element for structural and non-structural applications is being studied at Ispra under the Composite Materials programme, using the rather recent technique of unidirectional solidification which is one of the simplest and perhaps most promising for the production of fibre-reinforced materials, provided that a suitable eutectic consisting of a relatively

Table IV: *Mechanical properties at room temperature of the Al–Al_4Ca unidirectionally solidified eutectic alloy compared with pure aluminium (99.5%) and with a dispersion strengthened Al–Al_2O_3 alloy (S.A.P. 10%).*

	Al–Al_4Ca lamellar composite rolled	Aluminium 99.5% rolled and annealed	S.A.P. 10% Al_2O_3 extruded bar
Yield strength (kg/mm²)	25	4.5	22
Tensile strength (kg/mm²)	29	8	30
Elongation at rupture (%)	5	40	15
Brinell hardness (kg/mm²)	50	20	85

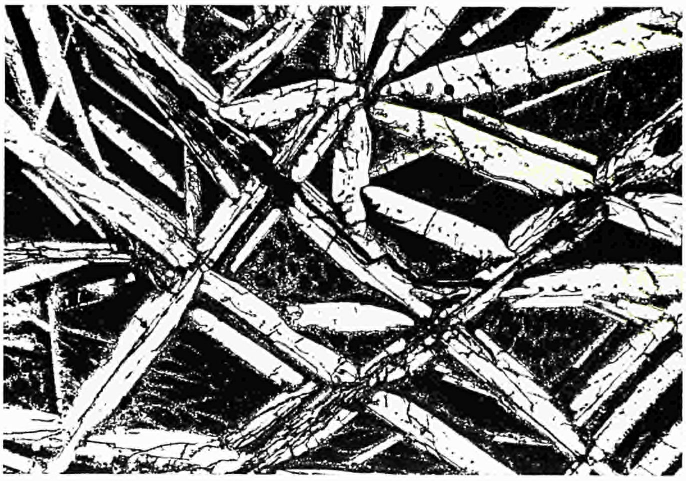


Fig. 6: *Microstructure of an Al–Al_4Ca eutectic alloy (7.6 wt% Ca) as obtained by fusion in a normal crucible.*

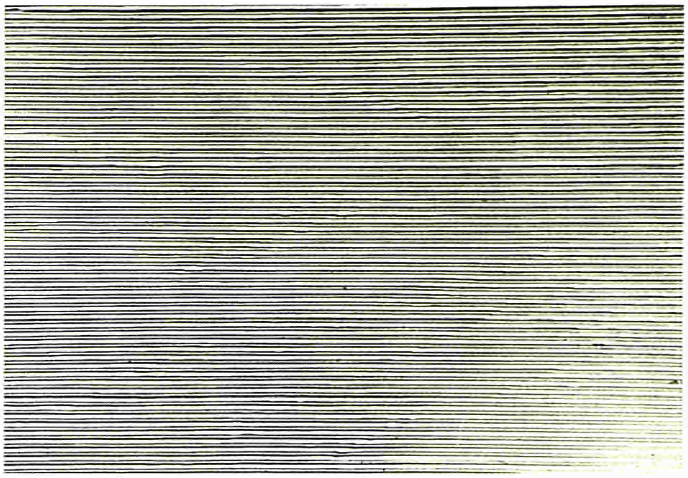
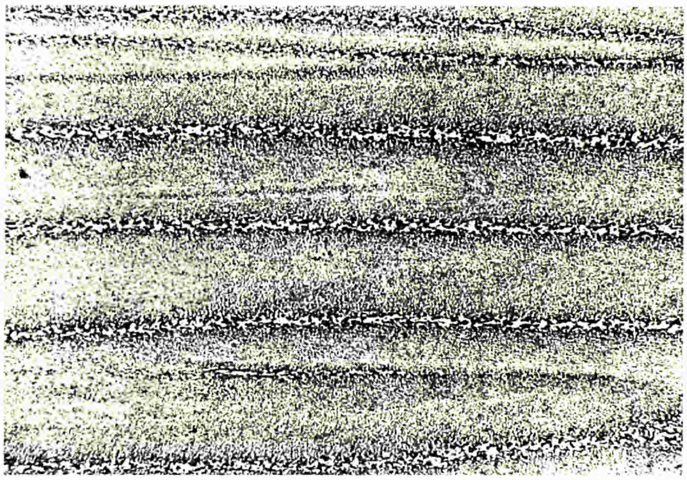


Fig. 7: *Regular composite structure of an Al–Al_4Ca eutectic alloy (7.6 wt% Ca) as obtained by unidirectional solidification (R = 5.5 cm/h).*



a) *section parallel to the rolling plane (× 200);*

b) *section perpendicular to the rolling plane (× 200).*

Fig. 8: *Microstructure of an Al–Al_4Ca unidirectionally solidified eutectic (7.6 wt% Ca, R = 4.9 cm/h) after rolling in a direction parallel to the lamellae.*

Fig. 9: *Metallographic section of an Al–Al_4Ca unidirectionally solidified eutectic (rolled) after an exposure of 480 hr to sea-water at room temperature (× 1 000)*

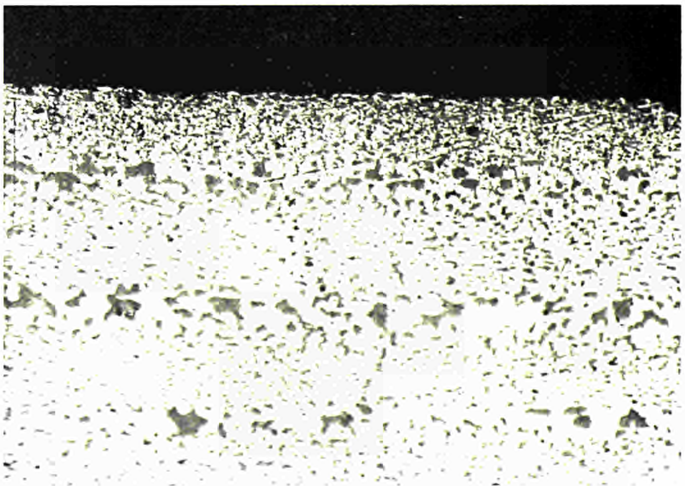


Fig. 10: *Metallographic section of a pure aluminium plate (99.9) after an exposure of 480 hours to sea-water at room temperature (× 1 000).*

hard intermetallic compound phase and a ductile matrix is found (11).

Pilot experiments on Al-Ca (7.6%) binary eutectic has already been carried out at Ispra in the past (12) using Al 99.98% and Ca of commercial purity (99.8). It was observed that the microstructure is rather sensitive to the purity of the component elements and that the lamellar or rod-like structure is inhibited by the presence of impurities. At present Al–Ca eutectics are being prepared from Ca 99.95% and the investigations are extending towards the Ca hyper-eutectic region up to 20% calcium. The phase diagram of Al–Ca as reported in the literature is shown in Fig. 5 (13).

Fig.s 6 and 7 show the microstructure of the eutectic alloy (7.6 wt% Ca) as obtained respectively by normal fusion in a crucible and after unidirectional solidification. The reinforcing phase in the unidirectionally solidified specimens is the body-centred tetragonal intermetallic compound Al_4Ca (white lamellae) which occupies a volume fraction of about 30%. Isolated crystals of the Al_4Ca phase immersed for several weeks in water at room temperature conserved the original bright metallic surface, indicating that the corrosion resistance to water is good at normal temperatures. Master alloys containing up to 12-14% wt Ca can be easily extruded at temperatures around 440 °C. Extruded ingots as well as unidirectionally solidified bars are well rollable at temperatures between 400 and 450 °C.

Fig. 8 shows the microstructure of the unidirectionally solidified eutectic alloy after rolling, viewed on a section (a) parallel and, (b) perpendicular to the rolling plane (the lamellae are aligned parallel to the direction of lamination).

The mechanical behaviour of the Al–Ca lamellar eutectic is typical of many fibre-reinforced composite materials with a high yield strength very close to their ultimate strength and with a relatively low elongation at rupture. In Table IV some characteristic properties (at room temperature) of the Al–Ca lamellar eutectic are compared with those of Al (99.5%) and of a dispersion-strengthened Al–Al_2O_3 alloy (S.A.P. 10% Al_2O_3) (14).

Preliminary corrosion investigations in various environments such as atmosphere, ground, sea-water, prove that the corrosion resistance at room temperature is competitive with that of aluminium.

Fig.s 9 and 10 compare a metallographic section of an Al–Al_4Ca plate and of pure Al after a 480 hr exposure to sea-water. Like Al, the Al–Al_4Ca composite can be easily anodized, so that resistance against corrosive agents can be further ameliorated. However, the most outstanding properties of the Al–Al_4Ca eutectic alloy resulting from the experimental work carried out so far are its remarkable lightness (density = 2.5 g/cm^3) and its superplastic behaviour at temperatures around 450 °C (patent pending).

Conclusions

The consumption of certain key metals at rates like those of recent years is expected to cause serious shortage problems in a not-too-distant future. We therefore need to start establishing and practising a wiser choice and use of geochemically scarce engineering materials.

It is suggested that research should be directed towards substituting more readily available substances for those dwindling materials and towards the development and exploitation of new technologies that will make it easier to introduce useful substitutes.

Calcium is recognized as a potential substitute material because of its crustal abundance, its high concentration grade in ores and rocks and its uniform geological distribution. Both the price and the energy required for the extraction of calcium are competitive with those of other metals, especially if one takes into account that exploitation on a larger scale may further improve the efficiency of production and consequently reduce the energy costs.

The properties of Al–Ca eutectic alloys (7.6 wt% Ca) prepared by unidirectional solidification are attractive and further research work on Ca as an alloying element for structural applications should be rewarding.

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On the humanization of biomedical techniques

WINFRIED BECKER

The aims and choice of tasks in the field of biomedical techniques (BMT) *should take very special account of human needs. Accordingly the* BMT *engineer must distinguish himself by a commitment extending far beyond his specialization and by a high degree of readiness to accept responsibility.*

What is meant by "humanization"?

Humanization is, in this case, to mean above all the adjustment of the research and development plans, of the employment of appliances, and of the expected concomitant stresses to the feelings of others. In this case "others" means not only the patient but also the person who takes care of him.

The choice of projects too, based on their feasibility in the light of funds allotted, can truly be an aspect of humanization. To an increasing degree, the question of cost determines the bounds of possibility. It is therefore necessary to concentrate efforts on employing limited means in order to endow aids with the greatest possible efficacy. Realization of this often requires the *BMT* engineer to set aside his own favourite concepts and provide a more effective service to Man instead. These efforts towards concentration should receive full national and supranational coordination aids in an appropriate manner.

Finally, guidelines for future needs may also be included in these considerations; what we have in mind is planning and procedure which promise to guarantee that human beings continue to live in the greatest possible happiness.

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Engineering thinking related to patients

It is not always a matter of course for the biomedical engineer to relate his planning and action to the patient. This is due above all to his inclination towards the technical perfectionist thinking inherent in his profession and to his consequent prejudice when it should be a question of deciding *against* a technically supreme solution and for a solution which is most useful to the patient in his particular situation. Also, the fact that quick success is hardly ever possible in *BMT* work easily produces, above all in younger engineers, an aversion against the continual adaptation of his plans and their continuous testing in the patient. A way of thinking in terms of the overall optimization of the interaction between Man and machine is still a necessary guiding force for the *BMT* engineer. This way of thinking must take several aspects into consideration and not only those relating to efficiency. For symbiosis between patient and equipment in the case of dependence on the appliance, aspects of the quality of life attained by the patient and experienced by him can also be of decisive importance.

For the medical engineer working in very close association with the patient there arise, however, two main threats to the successful carrying out of research work:

He should not (save in exceptional or emergency cases) become a repair technician owing to the hospital's inadequate infrastructure and he must at all costs try to avoid isolation from colleagues of his own profession since he could otherwise become intellectually unproductive after a certain time.

Two examples from the field of prostheses of the extremities which are relevant to the "engineer's solution" may help to explain this:

1st Problem:

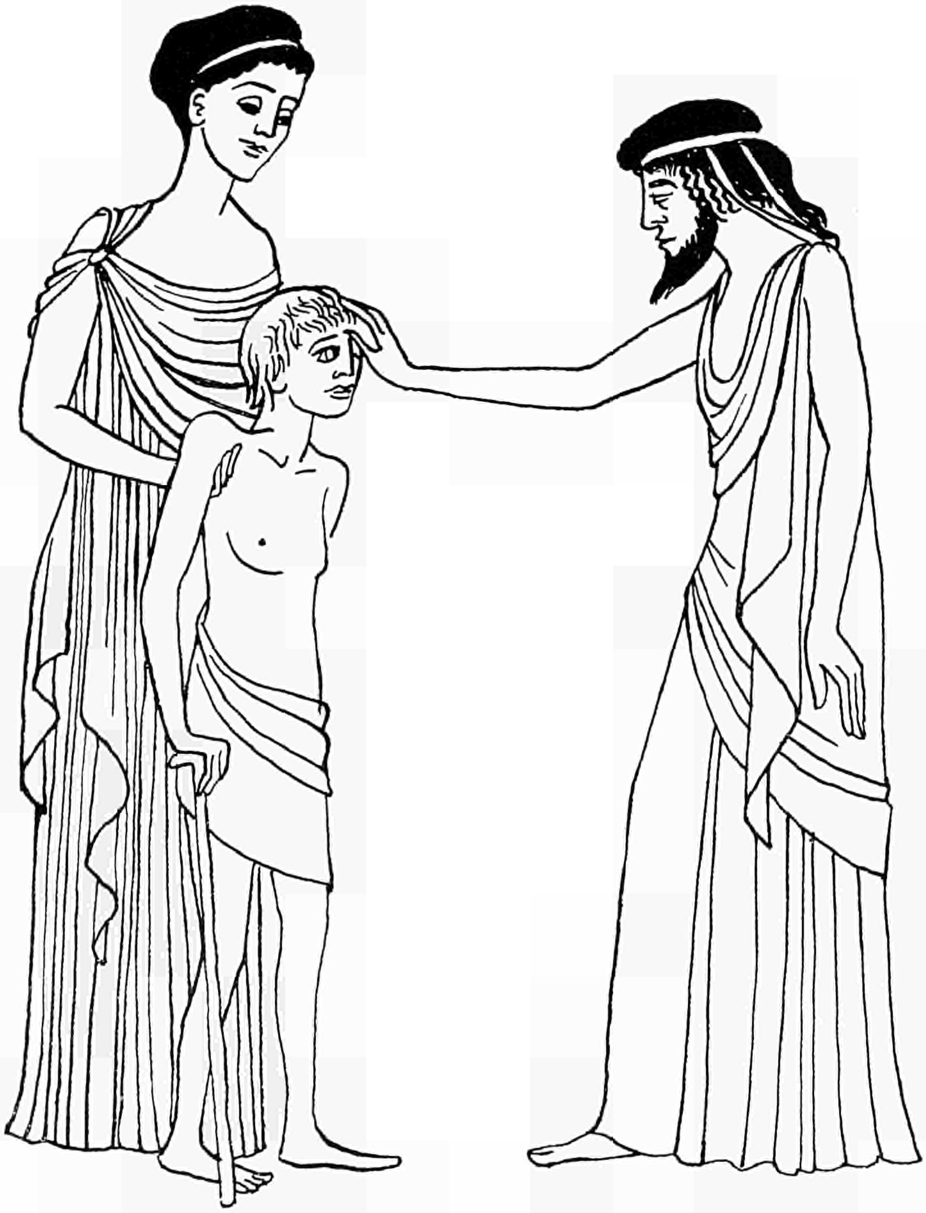
For the myo-electrical control of a hand a large number of signal sources (residual muscles and "secondary" muscles) are required.

A technically brilliant solution (control of each finger individually) is useless for the patient at the present state of the biomedical art because, (a) not enough sources can be found and (b) the patient does not learn to coordinate them. In addition, however, there are differences depending on the patient's intelligence.

A further solution that might be possible would be the electronic processing of the composite signals from just a few sources to give several instructions (by mini-computer, as it is attached to the patient). However, this solution does not hold out hopes of great success as it involves overtaxing the patient with coding demands.

Yet another possibility would be a learning matrix (Steinbuch type) built into the prosthesis and programmed by the patient himself, or by others, so that, by means of the electromyographic (*EMG*) source, complex movement sequences, that have to be performed frequently by the patient (e.g., spiral movements), could then be controlled simply by instructions such as "on, off, quick, slow". (Training phase: setting-up of configurations according to the frequency of situations; use phase: autonomous execution of programme in the "on" position.)

Otherwise a solution adapted to the patient could consist in a multifunctional hand in which, by means of only two double sources, firstly the four differentially inter-coupled fingers and secondly the thumb position would be controlled, such a hand hence being automatically adapted to the gripping position as far as the four fingers are concerned.



2nd Problem:

Control of an arm prosthesis in a patient amputated at the shoulder requires the provision of suitable *EMG* sources, the combination of which the patient would have to learn in order to control arm movement, which is extremely difficult. An idea applying to Man (Temple University Team, Phila.) is the use of *EMG* sources in the trapezius muscle region. The signals are picked up by approximately 10 electrodes and are then processed via an evaluating matrix. Since, when the arms are moved, these muscles are always activated with them, it is possible, with a correct evaluation system, to control the arm movements after an extremely short training period (e.g., one hour) because a natural pattern is involved (trials with war-wounded or accident victims shortly after amputation).

As an additional example, this time relating to cases of paralysis, mention should be made of the problem of enabling a person, who is severely paralysed by a transverse lesion of the spinal cord and has lost control of his arms and legs, to operate his motor-driven invalid chair. Switches in the vicinity of the face etc., not only impair his few remaining voluntary motor functions but also wound his aesthetic feelings and human dignity. Inconspicuous control by means of invisible signal converters, as, for example, control by means of wire loops located behind the teeth of the upper and lower jaws, is a solution [1] adapted to the needs of the patient.

The signals are transmitted passively (without any incorporated battery), according to the position of the wire loops in relation to each other, to a coiled wire aerial fixed to the collar. In this way the handicapped person can produce various signals to control his wheel-chair by shifting his lower jaw in relation to his upper jaw.

Safety costs money

The safety of the patient poses a special problem, particularly where there is interaction between several electrotechnical appliances attached to the same patient. The engineer's responsibility in this case even extends to their practical operating conditions. Where many electromedical instruments are employed simultaneously in the operating theatre, e.g. in open-heart operations, the complexity of apparatus which does not satisfy extremely strict safety regulations can have a fatal effect, since only a few microampères of stray current, the prevention of which is still very difficult to guarantee, can have a lethal result.

International bodies such as the International Electrotechnical Commission have been endeavouring for years to produce satisfactory safety specifications. In difficult cases, as the one just described, it is, however, not often possible to obtain the consent of all the national representations since the expenditure, arising out of the necessarily strict measures, for hospital administrations for example, is considered impossible to meet. Therefore, it is preferred to chance the increased risk for certain groups of patients in order not to be obliged to make budgetary cuts in the fields of diagnosis, treatment or nursing. This depressing consideration leads us on to a general problem.

Improved technology in hospitals seldom helps to reduce costs

The problems which hospital establishments have in meeting all their costs are becoming more and more prominent: What can still be done? In a few cases retrenchment of costs through more sophisticated *BMT* is mainly feasible by adjusting organizational measures to the technical situation. It is usually clear, however, that improved technology increases the total cost of treating patients. If technical improvement applies to only one group of patients the other groups will possibly have to be deprived to some extent or, for example, nursing will have to be simplified in favour of generally improved technical appliances, etc. Merely on account of their further development, biomedical techniques therefore indirectly make the patients' situation considerably worse and the *BMT* engineer should also at least be aware of the pitfalls involved so that he tries to take account of the cost factor for production and utilization in his development work. This is an indirect relationship between patients and his work.

Are mass examinations for early diagnosis necessary in any case ?

No doubt it is a great advantage if biomedical techniques make available the means to offer to many people, by means of mass examinations, a chance of receiving far more effective treatment for an affliction which is only in its incipient stage. This field of early diagnosis is a favourite stamping ground for *BMT* engineers and is regarded very favourably by the health authorities. However, in this case too, an unconvential approach is called for: What is the use of expensive technical developments employed for the early detection of non-infectious diseases if there is practically no chance of such diseases responding to treatment? These techniques only make the patient realize his hopeless position a little sooner. At this juncture it is not a question of discriminating against early diagnosis techniques but of showing that, time after time, overall considerations, which go beyond the scope of technical research laboratory thinking, are required of the *BMT* engineer.

There is a care gap

In contrast to the attractive *BMT* subjects, the so extraordinarily important field, for example to people handicapped by disease or age, of small and medium-sized technical aids for the accomplishment of everyday activities as independently as possible is still but little favoured by engineers (perhaps owing to its lack of academic prestige). At the same time many people could thus be enabled to lead a happier life, many nurses could be spared or could have their workload lightened and beds in homes or hospitals could be freed.

The transfer of nursing for the sick and disabled from hospitals and homes into the private sphere is at present a widely discussed aspect of medical planning (even in the case of patients

[1] J.A. MAASS and V.S. MAASS: *Biotelemetry II*, 2nd International Symposium, Davos, 1974.

dependent upon appliances: man-machine "symbiosis").

Furthermore, an important aspect is that of providing nursing staff with relief from tasks which they scarcely could be expected to carry out. Owing to the necessity of such activities it is very difficult to find nursing staff. In addition, the nurses have too little strength left over for performing more human tasks for the patient.

It is therefore a matter of making nurses free, with the help of technical aids, for the more human care of the patient (for instance, sometimes writing a letter for him). In this way, not only would the patient be helped but the nursing profession would be made more attractive or would be held in higher general esteem and hence it would be easier to find nursing staff.

As already said, none of these things are aspects of *BMT* research and development that promise prestige but they are generally considered urgent by certain discerning experts. To increase his personal incentives the engineer would have to detach himself from the necessarily outmoded idea of the prestige of research in itself and, on the other hand, attach more importance to the ethics of service to others.

Drawn-out death, a lonely road ?

Through the resources of medicine and biomedical techniques, especially in modern intensive care units, the dying process of many people has been considerably and terrifyingly retarded. The newspapers are full of discussions concerning help to the dying and prolongation of life. In these cases decisions can certainly not be taken on a global basis. If therefore, owing to the availability of resources the dying of many patients is protracted in almost unbearable proportions and if it is not wished and if it is not possible to expect the doctor to take the decision concerning the end of a life, why has scarcely anyone had the idea that new responsibilities have arisen from this new situation we have created? Yet it would be obvious that we would not leave a person slowly approaching death alone with the tubes, wires and catheters. To the same extent, as we compel him to make the pilgrimage along this road which has now become longer and stonier, often in great distress and fear of no longer being able to complete or pass on much, we should, however, as well as we can across the limits which separate our two lives from each other, accompany him on his road, by having plenty of time for him, even if it is without words, simply by communicating through our nearness to him. Is that a luxury? Is it "feasible" in our world which is run to a timetable? If we cannot do that we also have no right to enter into discussions concerning the help to the dying or to support the humanly one-sided progress of corresponding biomedical techniques.

What is urgent ?

Besides the well-known existing urgency criteria for the promotion of *BMT* research and development, for example:

(a) incidence of similar cases,

(b) degree of acute mortality risk,

(c) therapeutic prospects,

(d) recuperation of outlay through (partial) rehabilitation,

yet another humanly orientated point of view should take its place: urgency should also be determined by the severity of the affliction experienced by the patient.

Expressed in a somewhat simplified form, that would mean approximately, when singling out the first of the criteria listed above (simply as an illustration, realizing the impossibility of pinpointing these things with rigid formulae), that:

urgency = severity of the patient's affliction x incidence of the cases.

Side effects

The introduction into medicine of highly developed technology just as any treatment of patients with highly active medicinal preparations too, almost always produces an often vast number of mostly negative side effects (as calculated from the overall picture). Owing to concentration on the goal directly pursued, these side effects are often given too little attention or remain completely undetected.

Fundamentally, a basic concept of what is generally to be attained is always necessary.

Let us first of all take an example from medicine itself.

At present, medicine takes too little account of the improper use of the word "cure". Thus, for example, by the administration of medicaments, it displaces the clearly diagnosable symptoms —the disease—to a diffuse background of effects where these symptoms are levelled out into side effects, so that they no longer strike one as prominent but often, not until years later, they can produce a plexus of unexpected fresh symptoms. As a result many "cured" patients become extremely dependent on medicines or ill from side effects [2].

Example for data processing systems in medicine

There has been, and still is no doubt as to the necessity and desirability of introducing modern data processing into medicine and it is, moreover, relatively simple. However, it will be extraordinarily difficult at the same time to remain within limits, i.e., exclude certain fields which must be reserved for communication between human beings.

The relationship between human beings must not be characterized by program inflexibility. Thus, there is an essential and fundamentally necessary factor in relations between human beings — the existence of trust. Without trust, the structures of communication between human beings would be stifled by an unmanageable number of control procedures and would destroy themselves. The number of the necessary safety checks rises sharply according as the users are directly concerned, according to the number of the relevant degrees of freedom of their thought and to the intrinsic complexity of the system, as occurs and is unalterable where there is communication between human beings (especially in the case of questions which concern them very directly, such as those of their health).

[2] The considerations underlying this example are taken from *"Die präparierte Zeit"* by A.M.K. Müller, Radius-Verlag.

As a result of the ever-increasing extension, without reflection, of the practice of compelling human beings to communicate with computers there arises the danger, immensely fraught with grave consequences, that our thinking may slowly change its development towards the direction of stereotyped decisions: If "Yes", then this or if "Do not know", then that, etc.

This way of thinking suppresses shades of meaning, the uncertainties of that which cannot be clearly expressed but which is nevertheless felt and allows creativeness derived from the free imagination to perish.

Similarly, there are also many problems relating to the side effects of other technical devices in medicine, such as the danger of the degeneration of the endogenous faculties or functions still possessed by a handicapped person owing to the constant use of technical aids and the consequent growing dependency on them. Precisely here the problem of the view of the human being as a whole is raised once again.

Aspects of the promotion of little researched BMT fields

Understandably, *BMT* research and development in industry are determined by short-term criteria of utility and, above all, marketability. Accordingly, the situation often arises in which numbers of problems, which are important but whose successful solution is uncertain, are not tackled by industrial research. In such cases the coordination and financing of certain schemes should be promoted with the funds of a State or of a group of States. Briefly, this then applies, *inter alia,* in the following cases where:

(*a*) no immediate results can be expected and consequently industrial research is not committed;

(*b*) considerable interdisciplinary work is requisite and the studies cannot therefore be carried out by individual research establishments;

(*c*) there is concealment of the state of research (as is sometimes practised in industrial research or in research establishments financed by industry) the effect of which must be considered to be contrary to the interests of humanity.

On the other hand, in order to promote industrial research into *BMT* it would be important to guarantee production on a larger scale, but, apart from a few exceptions, this is, in fact, usually not the case in *BMT*. A solution could be found by:

— the creation of major marketing areas by means of coordination (possibly by including the developing countries);

— the development of modular systems in which only the direct patient appliance-interface (linking section) would have to be produced individually or in quite small batches (possibly by smallish subcontract suppliers).

Coordination efforts

In various European countries studies have been and are being carried out to deal with the parameters for the purposeful planning of *BMT* research.

Since 1973 attempts have been made to take stock of, coordinate and promote *BMT* projects at a European Communities level. Thus, for example, within the framework of the Committee for Medical Research and Public Health of the Commission of the European Communities, a Working Party on Biomedical Techniques has been set up with representatives from the Community countries who are to make coordination and consultation proposals and designate research projects worth promoting at European level. Furthermore, an endeavour is being made effectively to disseminate knowledge among European scientists and establishments. In addition, this Working Party, in cooperation with the Directorate-General for Scientific and Technical Information and Information Management, concerns itself with the problem of stimulating closer cooperation between research establishments and clinical users on the one hand and health authorities and health statisticians on the other, within the framework of the European Community. These efforts are based on the requirement, which is rapidly becoming more evident, to include, to a more considerable extent than hitherto, macroeconomic views in the planning and promotion of *BMT* research and development.

The humanity of Man

All the considerations and aspirations set out here coincide with the very topical recognition of the need to tackle the future oneself in such a way that survival of human beings, of a kind which is felt to be purposeful, is made possible. The good sense required for this is ultimately based on the human quality of Man and it is therefore this quality above all which is worth saving and strengthening.

The teams working on biomedical techniques are necessarily structured on an interdisciplinary basis. Therefore mutual esteem (in many places this is unfortunately still, or once again, clearly absent) and intensive endeavour to bridge the gaps between the different schools of thought in the disciplines constitute an inevitable and, in this case, a really vitally important requirement.

We should always remain conscious of the fact that hitherto, from the technical point of view, we have unfortunately been able to help only very imperfectly, that, in all modesty, it is therefore a question of increasing happiness (which is to be understood as being quite individual and therefore generally undefinable) among human beings, of also furthering the joy of living for those who are captives of disease or handicap and thereby of helping to give life a meaning both for those who receive and those who give — which is fundamentally one and the same thing.

EUSPA 13-14

With this issue of "Euro-Spectra" we take leave of our readers. After tossing for many years in the swell of European activities, our little barque has reached port.

Before going ashore we would like to acknowledge our debt to the members of the Commission's Translation Divisions for their valuable and continued assistance in steering a true course. They never (or hardly ever!) complained, but with genuine enthusiasm provided accurate and elegant translation of very difficult texts. We salute them all and convey to them our most cordial thanks with which our readers who have followed us throughout our voyage will undoubtedly wish to associate themselves.

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