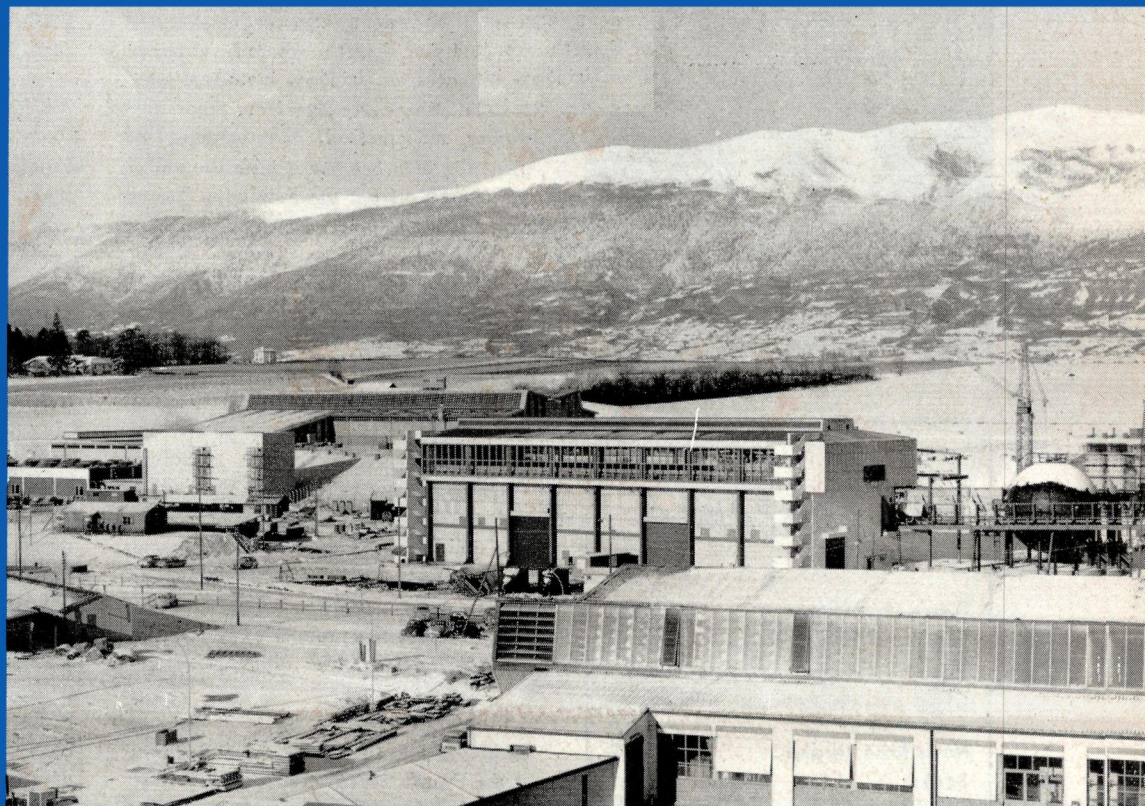


# COURIER

# ERN N



**3**

**VOL. 2**

**March 1962**

**EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH**

# Pierre GERMAIN

## Leader, Proton Synchrotron Machine Division



Pierre Germain was born in Brussels in 1922. His scientific career began at the University of Brussels, where he obtained his 'licence ès sciences mathématiques' in 1945. Proceeding then from theoretical studies to practical investigations, he spent the next two years, with the aid of a Fellowship from the Fondation Tassel, on the study of piezo-electric crystals.

Following this he became 'assistant' and then 'chef de travaux' to Prof. P. Kipfer, in the Institute of Applied Physics at the University. Here he was engaged on teaching duties and also the construction and testing of analogue computers, primarily for solving Laplace equations. These computers were of the electrolytic-tank or resistance-network types. During this time, in 1952, he became 'docteur ès sciences mathématiques', mainly for his design and construction of an analogue integrator for the product of two mathematical functions.

In August 1955 Dr. Germain came to CERN, to join the Radiofrequency Group of the Proton Synchrotron Division under Dr. Schmelzer. His main responsibility was the construction of the 'Hall computer' forming the first part of the frequency programme of the machine. The radiofrequency accelerating voltage has to be very accurately related to the strength of the magnetic field at each instant, and the Hall computer automatically calculates the required frequency from accurate measurements of the field. It is an analogue device with an accuracy about ten times higher than was usual at that time.

In 1958 Dr. Germain became deputy to Dr. Schmelzer. Later, with the reorganization of the Division following successful

completion of the machine, he joined the Machine Group, becoming its Leader in 1960.

With the further growth of CERN, Dr. Germain found himself as Leader of the Proton Synchrotron Machine Division in 1961.

This Division is responsible for the operation, maintenance, and improvement of the machine time, to provide for its exploitation as an instrument for nuclear-physics research. On the operations side, this involves (apart from actually running the machine) the weekly scheduling of the machine time, to provide for its most efficient use and sharing among the many experiments which demand different targets, secondary beams, and particle energies. It also includes various aspects of apparatus layout and safety and there is also much work of an unspectacular nature directed towards gradual improvement of the reliability, ease of operation, and flexibility of the machine. There is also a definite programme of development to improve performance and utilization: targets have had to be designed and new ones are still under development; the beam current, unexpectedly high to begin with and increased by a factor of 10 in the first year, is still not high enough, and various methods are being tried to improve it still further; a slow ejection system for the primary proton beam is being actively developed.

These, and other problems, form the everyday work of the MPS Division, playing its essential part in the gathering of much new nuclear-physics data and the occasional spectacular event such as the production of one of the first observed antixi particles •

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The cover photograph is a recent view of part of the CERN site, looking towards France and the Jura. In the centre can be seen the bubble-chamber building, recently completed at the end of the proton-synchrotron's East experimental area, with the hydrogen safety sphere (capped with snow) beside it and the experimental halls behind to the left. In the foreground is part of the main workshop.

Photo credits: All photos by CERN/PIO, except p. 5 - CERN/SIS.

## CERN COURIER

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The European Organization for Nuclear Research (CERN) came into being in 1954 as a co-operative enterprise among European governments in order to regain a first-rank position in nuclear science. At present it is supported by 14 Member States, with contributions according to their national revenues: Austria (1.87%), Belgium (4.02), Denmark (1.93), Federal Republic of Germany (18.92), France (20.57), Greece (1.12), Italy (9.78), Netherlands (3.73), Norway (1.56), Spain (4.16), Sweden (4.10), Switzerland (3.19), United Kingdom (24.40), Yugoslavia (0.65). The budget for 1962 is 78 million Swiss francs.

The character and aims of the Organization are defined in its Convention as follows: 'The Organization shall provide for collaboration among European States in nuclear research of a pure scientific and fundamental character, and in research essentially related thereto. The Organization shall have no concern with work for military requirements and the results of its experimental and theoretical work shall be published or otherwise made generally available.'

# Last month at CERN

The biggest news of the month was the discovery of the **antixi**, a positively charged antiparticle produced simultaneously with a negatively charged xi particle by the interaction of an antiproton with a proton. The discovery was made among photographs, taken with the 81-cm hydrogen bubble chamber in the separated antiproton beam of momentum 3 GeV/c just before Christmas, which are now being analysed at the École Polytechnique (Paris), CERN, and Imperial College (London). It was not the only one, however. While the interpretation of the event was in progress, news was received from Brookhaven that a surprisingly similar event was being analysed there.

Many people besides physicists are involved nowadays in such a discovery. In our case, the PS produced antiprotons by the impact of high-energy protons on a target; beam transport and the particle separator separated the antiprotons from other particles produced; the bubble chamber was operated to give tracks of the nuclear particles; the tens of thousands of photographs needed in order to 'capture' such a rare event then had to be processed, and investigated using special apparatus. Finally, calculations had to be carried out on the measurements, to prove unambiguously that the particle concerned was in fact the sought-for antixi. As a result, the physicists concerned took the unusual step of publishing the results not under their own names, which would have been a long list in any case, but under the names of the three organizations whose members principally took part in the discovery: CERN, École Polytechnique, Paris, and Département Saturne, Saclay (for details, see page 4).

According to the members of the **Proton Synchrotron Machine** Division, February was not particularly memorable. The accelerator ran steadily without any trouble, and some 370 hours were given to nuclear-physics experiments. Beam intensity was around  $2 \times 10^{11}$  protons per pulse. However, it seems that the first week was particularly successful. Running on an emergency schedule, arranged at the last minute because of the breakdown of the 32-cm hydrogen bubble chamber the week before, three separate experiments as well as a test run of the CERN propane chamber were carried out with unexpectedly great success.

The Cockcroft-Walton **pre-accelerator** has now been reinstalled, after its overhaul and repair by the manufacturers. Previous trouble was found to have been caused mainly by voltage breakdown along the column. New rectifiers have been fitted which are expected to have a greater life than the previous ones.

The CERN **electrostatic separator** installed in the South experimental hall has been operating with a potential of 730 kV across a gap of 14 cm. In test runs, the potential has been increased to 800 kV, across the same gap, with a sparking rate of about 1 every 5 minutes; this is tolerable for most nuclear-physics experiments, and special circuits protect the separator itself.

Among activities at the **synchro-cyclotron**, shielding

studies were carried out in collaboration with the Health Physics group at CERN and the Swiss Federal Institute of Technology (ETH) in Zurich. Measurements of neutron fluxes were made around the machine and in the shielding walls.

The **Accelerator Research** Division has begun to move into its new building, where all the work on storage rings will be concentrated. Initial work on the assembly of the 2-MeV electron storage-ring model has already been started.

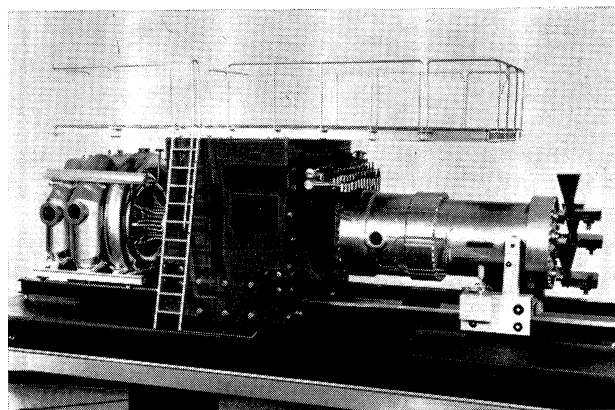
A study **group** is being formed by the Division to prepare design studies for possible future large-scale accelerator projects at CERN. This work will be done in collaboration with other Divisions and also with laboratories outside CERN.

The **Site and Buildings** Division has started work on a number of new projects, the biggest of which will be the roofing of the **East experimental area**. Concrete foundation work for the steel roof frames is progressing near the East junction.

At the other end of the area, the East bubble chamber building was finished in January, and preliminary work is now going ahead for the installation of the 2-m CERN hydrogen bubble chamber.

Prof. **L. Van Hove**, Leader of the Theory Division at CERN, is this year's recipient of the **Heinemann Prize** for Mathematical Physics, awarded by the American Institute of Physics and the American Physical Society. He expects to travel to Washington to receive the prize in April.

A meeting of the European participants in the **International Co-operative Emulsion Flights (ICEF)** programme took place at CERN on 19 February, to discuss the way in which the data so far accumulated should be made generally available ©



This 1/5-scale model of the CERN 1-m heavy-liquid bubble chamber has recently been put on show outside the Auditorium in the Administration Building. It was built originally in the Model Shop of the Site and Buildings Division's Main Workshop, to prove details of the design that could not be envisaged with certainty from drawings, such as the positioning of the system of tanks and gas lines. It also played an important part in showing that the body could be drawn out of the surrounding magnet (as shown) and lifted without breaking the end glass window, which itself weighs 1 ton. Now the model has been refurbished and painted for exhibition, as an example of the type of equipment that is designed and used at CERN for nuclear-physics experiments.

New fundamental particle discovered, the

# ANTI-XI-MINUS

The discovery of the **xi-minus antiparticle**, a positively charged xi and one of the few hitherto undiscovered 'strange particles', was reported simultaneously in the *Physical Review Letters* of 15 March, by physicists working at CERN and at Brookhaven National Laboratory, U.S.A.

Thus, one of the two remaining question marks on the list of the so-called 'elementary' particles can now be replaced by factual evidence. As Prof. Weisskopf has commented : 'This is an important discovery. In filling a gap in theoretical knowledge of fundamental physics, it allows physicists the world over to base more firmly their investigations on one of the great riddles of our time : what is matter made of and why is it so ?'

## NATURE'S BUILDING BLOCKS

The elementary particles now number 30. At the end of the list, the heaviest are the **xi particles** which are

also called **cascade particles**. They have either a negative or zero electric charge and a mass of about 2580 times that of the electron, one of the fundamental building blocks of Nature which is taken as the unit of particle mass. The xis are thus listed by physicists as heavy particles, or **baryons**, in one of the four classes of particles. They decay in  $10^{-10}$  second (one tenth of a thousandth of a millionth of a second), each into a lambda particle and a pion. It is the **antiparticle of the negative xi** (a positively charged xi) which has now been discovered.

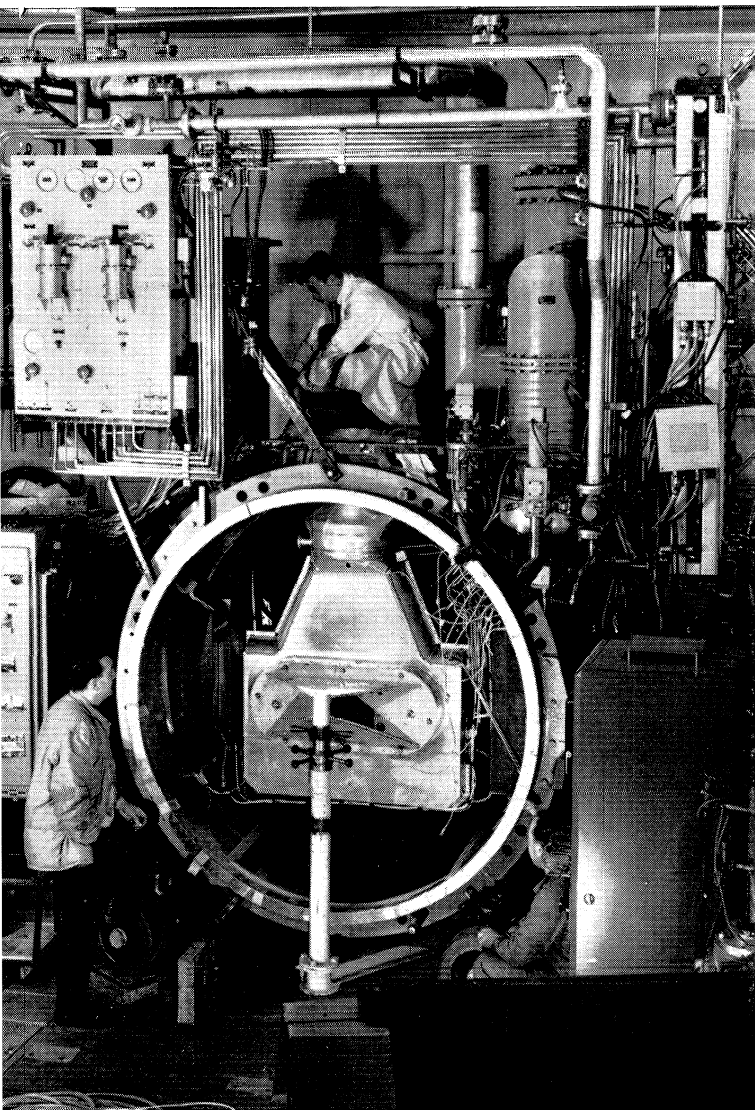
## ANTIPARTICLES AND THEIR CREATION

Many elementary particles have antiparticles, twins with opposite charges. Predicted theoretically by P.A.M. Dirac in 1928, the existence of antimatter was first proved in 1932 with the discovery of the positron (the anti-electron). Since then other antiparticles have been discovered, contributing to the total of 30 elementary particles and antiparticles of higher and higher mass.

Most of these particles and antiparticles are unstable : in very short times they decay into other particles or forms of energy. To observe them, physicists must perform true creation by driving them out of atomic nuclei bombarded by high-energy projectiles, e.g. protons accelerated by large accelerating machines. This is how large numbers of 'secondary' particles such as anti-protons are produced. In turn, the antiprotons 'annihilate' in bubble chambers, devices where the tracks they leave are photographed. In this way the mass of the antiproton is transformed into other forms of matter such as the xi-minus antiparticle, which physicists had been seeking for years.

## EUROPEAN SCIENTIFIC CO-OPERATION

In the CERN experiment which led to the discovery, 85 000 pictures were taken just before last Christmas in the 81-cm hydrogen bubble chamber. This apparatus was built by a group of engineers of the Department 'Saturne' of the Centre d'Études Nucléaires de Saclay



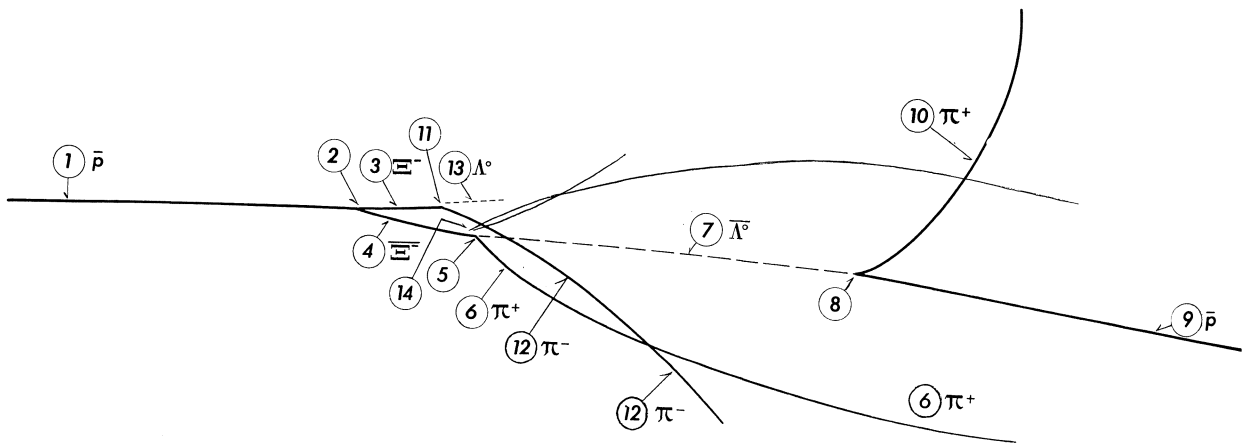
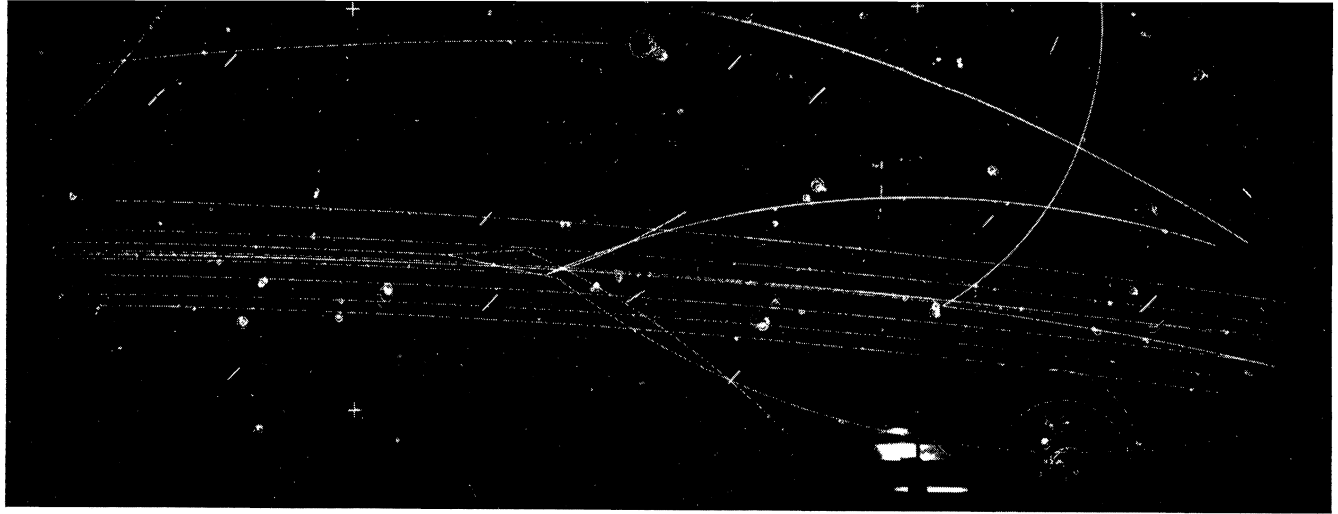
The 81-cm hydrogen bubble chamber partly dismantled. The chamber itself can be seen, surrounded by its liquid-hydrogen jacket, temporarily supported inside the outer cylindrical vacuum tank. To the left of the space above (normally occupied by the expansion system) is the reservoir assembly, with vacuum pumps to the right.

The CERN and Brookhaven bubble chamber photographs showing xi-minus antiparticles were found and measured independently within such a short time, early this year, that the two laboratories agreed on simultaneous publication the scientific announcements related to both experiments.

There are **four classes of particles** : photons, leptons, mesons, baryons. Xis can also be listed as **hyperons** which, together with **nucléons**, are sub-divisions of the baryon class.

**Bubble chambers** are nowadays huge devices (tens and sometimes hundreds of tons) recording photographically the tracks left by tiny particles in a proper material such as liquid hydrogen.

**GeV or BeV** are identical abbreviations for 1 000 000 000 electronvolts.



Antiprotons, produced by means of CERN's 28 GeV proton-synchrotron accelerator and associated apparatus, arrive with momenta of 3 GeV/c and pass at high speed through the liquid hydrogen of the 81-cm bubble chamber. One of these antiprotons (1) is seen to travel 20 cm in the chamber, and then collide at (2) with a hydrogen nucleus (a proton), resulting in mutual annihilation. The mass of the proton and the mass and kinetic energy of the antiproton give birth to two heavy particles, xi-hyperons: a negative xi (3) and its antiparticle (4), which is a positively charged antixi.

It is the latter particle which makes this photo so exceptional, because this is its first appearance, although it was predicted theoretically some years ago. Like all hyperons, the antixi quickly disintegrates: at (5), after about  $10^{-11}$  second (one ten-thousandth of a millionth of a second), it gives rise to a 'cascade' of other particles.

(France), and physicists from the Laboratoire de Physique, École Polytechnique, Paris. It was installed at CERN near the largest European accelerator, the 28 000-million-electronvolt proton synchrotron. The accelerated protons hitting a target produced secondary particles, from which antiprotons with an energy slightly above 3 GeV were selected and transported in a 100-metre-long channel to the bubble chamber by means of an electrostatic separator, magnetic lenses, and magnets.

One picture, illustrated here, showed an antiproton annihilating with a hydrogen nucleus in the bubble chamber and producing a xi and its antiparticle, the latter seen for the first time. Short-lived as they are, these disintegrated in turn into other components: lambdas and pions, as shown in the diagram.

Identification of the xi-minus antiparticle was possible through precise measurements and analysis of the appropriate bubble-chamber photograph by other physicists who, working back along the observed tracks, calculated the energies and masses of the different particles recorded on the film.

About 15 European physicists can be considered as

First it gives a positive pion (6) and an antilambda zero (7). This latter is a neutral particle which forms no track in the liquid hydrogen; it is thus shown by a dotted line on the diagram. It disintegrates in its turn, at (8), producing an antiproton (9) and another positive pion (10).

The other product of the initial collision at (2), the negative xi (3), itself disintegrates at (11) into a negative pion and a lambda zero, another neutral particle leaving no track [dotted line (13)]. The fate of this lambda zero is unknown. Possibly it escapes from the chamber and disintegrates outside. There is also the possibility that it disintegrates inside the chamber, but produces two neutral particles with no tracks: a neutron and a neutral pion.

The event indicated at (14) is due to the annihilation of another incident antiproton, and has nothing to do with the main reaction of interest.

responsible for the discovery made at CERN. They decided to credit not their own personal contribution but the co-operative effort of the CERN European enterprise, coupled with the work of the Paris École Polytechnique, and of the Department Saturne of Saclay.

#### A TECHNOLOGICAL SUCCESS

In the words of one of the physicists concerned, the discovery of the antiparticle of the xi-minus is also a success of modern technology.

'In 1955', he said, 'European physicists could not hope to discover the antiproton. The apparatus was simply not in existence here. It had, however, been built in the U.S.A. and our American colleagues quickly made the proper use of it. But in the meantime, Western Europe had awakened to the need for nuclear research at high energies and was also building the large apparatus necessary to produce and detect materialization of the heavy particles the theoreticians had predicted. This new discovery is a proof that in our field Europe is now on a par with the United States and the U.S.S.R., thanks to the foresight of the CERN Member States in 1954.' •

# CERN and high-energy physiCS (part II)

by V. F. WEISSKOPF, Director-General

## THE ROLE OF CERN IN EUROPEAN HIGH-ENERGY PHYSICS

If CERN remains what it is now, it will be for several years the leading focus in Europe for elementary-particle physics. Other research centres with finished high-energy machines, such as Saclay, Frascati, Liverpool, and Birmingham, are doing important work, but the range of their accelerators is restricted and the size of these laboratories is small compared to that of CERN.

The central position of CERN in Europe is not based only upon its actual experimental work; there are other important factors. Because of the size of the Laboratory it can afford a large **Theory Division**, and has been able to attract extremely able theoreticians as staff members and as temporary visitors. CERN's Theory Division has become the European centre of advanced discussion and idea-making in this field. **Photographic emulsions** exposed to high-energy beams at CERN have been distributed all over Europe, and even further, for study and research. Over 100 physicists in European laboratories are now working continuously on emulsion material exposed at CERN. About 20 groups in different laboratories in Europe are carrying out research on **bubble-chamber pictures** taken here at CERN; these experiments were planned in common discussions and are executed by close collaboration between CERN and the groups outside. In fact, several bubble chambers made elsewhere have been brought to CERN for

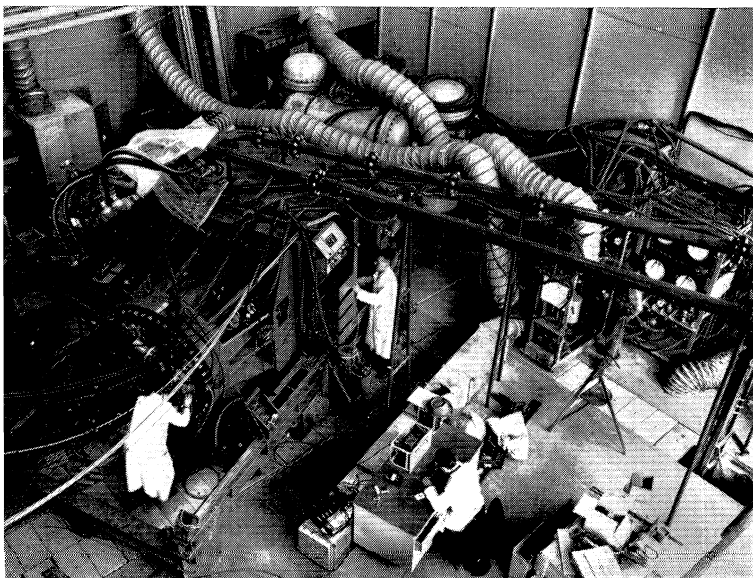
*The first part of this article, which dealt with the present state of high-energy physics and the part played in it by CERN, appeared in the February issue of CERN COURIER. The whole article is based on a paper prepared by the Director-General for the 20th Session of Council in December 1961.*

exploitation. About 200 European scientists come to CERN per annum as **visitors** for various periods to do actual scientific work, and this number is increasing.

There is no question that the existence of CERN has raised the quantity, originality, vigour, and significance of high-energy physics in Europe by a large and decisive amount. Not only the CERN Laboratory itself, but also the other high-energy centres in Europe are now recognized as being in the very forefront of basic science. So far, CERN has fulfilled the purpose for which it was founded. It no longer seems necessary to go to the U.S.A. in order to find opportunities for successful high-energy physics. How can this state of affairs be maintained?

High-energy physics, like any other active branch of science, is a rapidly evolving field. A laboratory is never finished; it must always adapt itself to new methods of research. But even apart from these new inventions and ideas of the future, CERN today is not yet equipped for the job it is supposed to do. The accelerators are working but can still be improved, and the equipment for exploitation is so far only partly finished. CERN's standing in the world and in Europe, as a centre for physics, is based not so much upon its past achievements (remarkable as they are) but upon an extrapolation to the future. It is based upon the assumption that along with the machines will come a supply of apparatus, space, and possibilities of adequate exploitation. If this assumption turns out to be wrong, the position of CERN, and consequently of Europe, will quickly deteriorate. Nothing is more discouraging, more deadly to scientific inspiration, than a laboratory with adequate machines but inadequate means to exploit them.

In the future, Europe will ask even more from CERN. The collaboration with European universities will increase in intensity, in amount, and in scope. In a few years the Nimrod machine in England and the DESY accelerator in Germany will be in use; other high-energy activities will be initiated elsewhere. The complexity of high-energy apparatus will grow. Europe



... bubble chambers made elsewhere have been brought to CERN for exploitation.' This photograph shows the 1-metre heavy-liquid bubble chamber belonging to the École Polytechnique, Paris, being set up for an experiment on high-energy particles from the proton synchrotron.



'A laboratory is never finished . . .'

A recent view of part of the new East experimental area, still under construction for the CERN proton synchrotron. The end of the building to house the 1.5-m British Hydrogen Bubble Chamber and the CERN 2-m hydrogen chamber can be seen on the right, with the hydrogen safety sphere between it and the compressor building. The safety sphere is designed to receive the hydrogen from either chamber in the event of an accident.

will be even more in need of a central laboratory which serves as a focal point for the interchange of ideas, and where people can acquire experience from the newest thoughts and methods. In this way the national enterprises will be able to avoid some of the initial teething troubles which we had at CERN.

Experience has shown many times, in the U.S.A. and in Europe, that a *young* scientific institution must have a growth rate well above 10% per annum in order to remain in a healthy state. It is a necessary condition, for the maintenance of CERN's status, for the fulfilment of the promise which CERN stands for, that the expenditure allowed for the next few years reflect this increase of at least 10% per annum. It is a 'sine qua non', an absolutely necessary condition. It is by no means a sufficient one. It will need a great amount of work, enthusiasm, and inventiveness on the part of European physicists in order to keep this promise. Judging from the spirit today we are confident that these additional conditions will be supplied, if the necessary opportunities are provided. If CERN activities were to be strangled by inadequate finance, the future of high-energy physics in Europe would be severely threatened. Not only would the investment in the CERN installations be wasted, but also the growth and development of the diverse new national endeavours would be impaired because of the fact that they depend strongly, in respect of man-power and ideas, upon a vigorous scientific life which has its centre in Europe.

#### FUTURE DEVELOPMENTS

It is difficult to predict the future developments in high-energy physics for the next 10 years. A definite

trend, however, is plainly visible. The region of several thousand MeV is going to produce more and more interesting results. The new world of phenomena we have mentioned before will be thoroughly studied. It is just this region which, at present, can best be investigated with the CERN PS machine. As a general rule, say 25 GeV, is most useful as a quantitative tool not for the study of phenomena occurring at the maximum energy but rather at a lower energy, say in the region between 3 and 10 GeV. The maximum energy is used mostly for exploratory research.

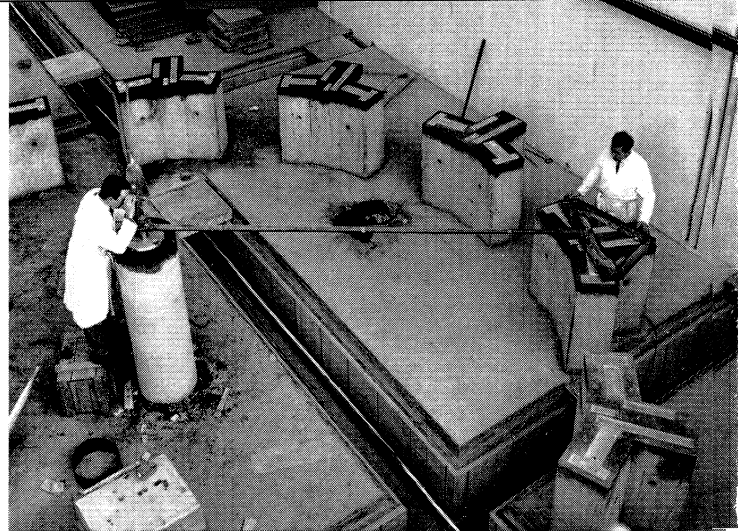
As research in the region of several GeV goes on, the necessity for beams of higher intensity than those available at the CERN PS will become apparent. At the same time, the growing European community of high-energy physicists is, in all probability, going to construct **national accelerators**, perhaps not quite as large as the CERN PS but with more advanced systems. They will be capable of producing, if not higher energies, at least considerably higher intensities than the CERN PS. In about 10 years, therefore, we expect that CERN with its present machines only will no longer be the unique European centre which it is now.

Outside Europe, in particular in the U.S.A., we expect to see the construction of machines not only of higher intensity than at CERN, but also of considerably higher energy. There are no technical reasons preventing the construction of machines with 10 to 50 times the energy of the CERN PS and up to 100 times its intensity. These machines *will* be constructed sooner or later. Scientifically speaking, they would serve two purposes. One is the production of very intense beams, at 'lower

energy' (that is, the present PS energy), of antiparticles and all kinds of mesons. In this respect, such machines would be many hundred times more efficient than PS-type accelerators, just as the CERN PS is many hundred times more efficient than the Cosmotron or even the Bevatron, for example in the production of antiprotons. The other purpose is the exploration of completely new phenomena which might happen at the high energies attainable with these new machines. When such machines are realized — it may take less than a decade — Europe will again be left behind in this field of physics if no plans for comparable facilities here have been prepared.

It has been seriously questioned whether Europe should keep up its own high-energy research on this new level in the future. The cost of the large machines would lie in a range five to ten times the cost of the PS. It should, however, be remembered that the total scientific effort in Europe will certainly increase tremendously during the next decade. High-energy physics even on this scale would still be appreciably less expensive than some other branches of scientific and technical research, such as space exploration for example. One must keep in mind, however, that high-energy physics aims at the most fundamental questions of science : the basic structure of matter and energy. It is a field of research in which Europe always had a commanding position which must be maintained also in the future.

Even so, the high cost makes it more important to study very thoroughly all possible alternatives and possibilities, so as to find perhaps a way of keeping



'One of these possibilities . . . is the construction of so-called "storage rings" . . .'

J. Brüderlein (left), from PS Survey Group, and W. Sax, Engineering Drawing Office, are here engaged on levelling the foundation supports for a storage-ring model being built by the Accelerator Research Division.

Europe's high-energy physics in the forefront without having to spend such enormous sums. This is why we have planned at CERN to have an active group studying future possibilities. One of these possibilities already considered is the construction of so-called '**storage rings**', which would make it possible to use the present PS itself in order to attain what is equivalent, for certain special purposes only, to an energy of more than 1000 GeV. It would not give us any beams of high intensity, however. The cost of this project would be about equal to that of the present CERN PS and its associated equipment.

The problem of future larger machines in Europe must be strictly separated from that of the development of the CERN Laboratory with its present accelerators. The latter problem was discussed above, where the attempt was made to show that a gradual increase of expenses and activities over the next few years is an absolute necessity for the attainment of the aims of CERN as conceived when the institution was founded eight years ago. Our present subject, however, is the future of CERN *after* it has fulfilled this first and immediate task.

The discussion of this long-range future cannot be carried out without considering the possibility of an **intercontinental project** of a very large accelerator. In view of the relatively large costs involved and the possibility of sharing the risks, it seems very rational that the first venture should be carried out on a world scale. The most rational solution, however, is not necessarily the one that can be adopted under the present world conditions. Nevertheless, it is necessary for Europe, and in particular for this CERN Study Group, to follow closely the possibility of such an intercontinental enterprise, especially because, if it were ever realized, the most logical place for it would be somewhere in Europe. There is no question that such a turn of events would be of great benefit to European physics •

**CERN PS** is the proton synchrotron accelerator at CERN which gives protons (the nuclei of hydrogen atoms) an energy of up to 28 GeV. It began operating in November 1959.

The **Bevatron** is a proton synchrotron, at the Lawrence Radiation Laboratory, University of California, U.S.A., giving a maximum energy of 6 GeV. It operated first in 1954.

The **Cosmotron** is a slightly smaller machine, a proton synchrotron at Brookhaven National Laboratory, New York, U.S.A. It accelerates protons to 3 GeV and has been in operation since 1952.

The **DESY** accelerator (Deutsches Elektronen-Synchrotron) is an electron synchrotron, which will give electrons (the particles that make up electric currents) an energy of 6 GeV. It is being built now at Hamburg, Federal Republic of Germany.

**Nimrod** is a proton synchrotron being built at the Rutherford High Energy Laboratory, near Harwell, in the U.K. It will produce a maximum energy of 7 GeV.

The **energies** of nuclear particles are measured in multiples of a unit called the electronvolt. This is invariably written **eV**, and the multiples as

**MeV**, which is 1 000 000 eV, or

**GeV**, which is 1 000 MeV

(in the U.S.A., BeV is used instead of GeV).

Particle accelerators are very often designated by the maximum energy they can give to a particle ; thus the 28-GeV PS at CERN produces protons having nearly five times the energy of those from the 6-GeV Bevatron.



# News from Abroad

## STANFORD

For the record, we would like to report that 'Project M' (for Monster!) has received U.S. Government approval, and the first moves are being made in the construction of what will be the largest and most expensive research instrument of its kind in the world.

This is the 20-GeV electron linear accelerator, to be built at Stanford University, California, U.S.A., financed by the U.S. Atomic Energy Commission. It will accelerate electrons inside a straight vacuum tube 2-miles long (3 km), in a concrete tunnel buried under 11 metres of earth. Every 12 metres, radio waves will be fed to the tube from a total of 240 large klystron oscillators, to provide the energy to speed up the electrons to 99.999999% of the speed of light. Proposed experiments include studies of the processes induced by high-energy electrons, studies of nuclear-particle structure, experiments with secondary-particle beams produced by the high-intensity electron beam, tests of the basic theory of electromagnetism, maybe even the study of new particles and other phenomena as yet unknown. It is planned eventually to raise the maximum energy to 40-45 GeV, by feeding power from one klystron every 3 metres.

The construction of the machine and associated laboratories is estimated to cost 114 million dollars, 4 times the cost of the CERN proton synchrotron, with a running cost of 15 to 20 million dollars

per year. When completed in about 1967, some 700 people will be employed.

The Director of the project is Prof. **Wolfgang K. H. Panofsky**, who has been at Stanford since 1951 and until recently was in charge of the University's present largest linear accelerator, the 1-GeV Mark III.

Another member of Stanford, Prof. **Robert Hofstadter**, was awarded a Nobel Prize for Physics last year, for his work on nuclear structure carried out with the Mark III machine.

## BROOKHAVEN

Also for the record, the 33-GeV **Alternating Gradient Synchrotron (AGS)** at Brookhaven National Laboratory, U.S.A., was dedicated on 13 September 1961, immediately following the 1961 **Brookhaven International Conference on High Energy Accelerators**.

The Conference itself was a disappointment to many, since at the last minute the expected delegation from the Soviet Union was unable to come. The hoped-for exchange of ideas on future larger accelerators and on the possibility of building a new 'world' machine had to be postponed until some future date.

## BERKELEY

The U.S. National Science Foundation, through the American Institute of Physics,

is financing a historical study on the **origins and development of quantum physics**. Under the chairmanship of Prof. J.A. Wheeler, of Princeton University, the sponsoring committee is aiming 'to record interviews with men central in the 1913-1938 quantum revolution and to retrieve documentary material on quantum theory and related scientific developments, 1898-1938.'

In a recent letter to the English publication *The New Scientist*, Dr. Thomas S. Kuhn, Professor of the History of Science, University of California, and Director of the project, has appealed for information about :

- '(1) letters bearing on the history of quantum physics ;
- (2) manuscript materials ;
- (3) records of meetings ;
- (4) photographs and films ;
- (5) recollections of seminars where critical steps were discussed; of moments at which an important concept emerged ; and of occasions when the outlook of one investigator was dramatically changed by another.'

Until September the project's address is 224 Stephens Memorial Hall, University of California, Berkeley 4, California, U.S.A. After that it will move to Universitets Institut for Teoretisk Fysik, Blegdamsvej 17, Copenhagen, Denmark, to facilitate work with European scientists ©

## BOOKS

One of the difficulties confronting scientists who try to explain their work to non-scientists, and those who try to understand the latest advances in science, is that so often scientist and non-scientist speak nearly different languages. To describe his work adequately, the scientist very often uses words and ideas which to him are as familiar as everyday speech, but which to his audience are vague or completely foreign. To get a full understanding of the latest ideas in high-energy physics, for example, it is almost essential to acquire some knowledge of this basic language.

**L'atome, source d'énergie**, (Librairie Payot, Lausanne, 5.— fr. s.), by Jacqueline Juillard, should be a useful little book for anyone wishing to acquire this basic understanding. No 37 in the series of 'Petits Atlas Payot Lausanne', it is a convenient-sized pocket book that describes in a concise logical way the development of our ideas about atoms and nuclei, from those of the atom and chemical elements to the practical uses of fission and the experiments on the fusion of nuclei. One chapter is devoted to the subject of particle accelerators.

The book is clearly written, well laid-out, and well illustrated. A few faults can be found, the worst being an unfortunate confusion between strange particles and anti-

*For the first time, we include in this issue some brief reviews of books which we believe may be of interest to our readers. We hope to make this a regular feature of CERN COURIER, in which we shall comment mainly, but probably not exclusively, on books having some connexion with high-energy physics research.*

matter, but there is little in the simplification that a physicist can take real exception to. For those who would like an explanation of 'energy', 'electronvolt', and why a nucleus is so difficult to hit, this book provides a very good introduction to the marvels of nuclear and particle physics.

A.G.H.

The **dictionnaire agenda annuaire atomique**, published by the monthly journal *Industries Atomiques* (Editions de la Grange-Batelière, Paris, 18.— N.F. ; Agence d'Editions Charles Durr, Brussels, 175.— fr. b. ; Editions René Kister, Geneva, 16.— fr. s.), combines the functions of a reference book for nuclear industry and desk diary for 1962.

In the former section there is a chapter giving the addresses of national official nuclear-energy organizations throughout the world, and one dealing with the structure and activities of the different international organizations. However, the largest part of the book (120 pages) is devoted to the 'Nuclear Dictionary' compiled by Dr. J. Combe and Dr. Marie-José Weill and previously published in sections in *Industries Atomiques*. (Dr. Combe is joint leader of the Nuclear

(continued on p. 10)

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## BOOKS (cont.)

Emulsion Group at CERN, and Dr. Weill was until recently, in the Nuclear Chemistry Group.) The dictionary lists some 600 words, those 'which are the most useful for the understanding of current works on nuclear-physics subjects', each with a description of its meaning. Some of these descriptions are quite long, the idea being not just to define terms, as in so many glossaries of this type, but to make the whole serve as a basic introduction to the subjects of nuclear physics and nuclear chemistry. It is not a layman's introduction, since no attempt is made to avoid symbols, Greek letters, and mathematical formulae, but the specialized concepts of the subject matter are clearly explained in simple scientific terms. Each entry includes also the equivalent words in English, German and Russian. Added interest is given by the inclusion of biographical details of Nobel Prizewinners in physics, and a number of references to important papers of historical interest.

Other sections of the book give a list of the world's experimental power reactors and nuclear power stations (unfortunately not fully up to date in all details), some rather obscure details on radioactive contamination levels, and a useful set of conversion factors for the most common units of measurement.

Apart from many advertisements throughout the book, there is a separate "Buyer's Guide", with entries classified under various sub-headings. The companies listed are mostly French, Belgian or Swiss, although there is apparently no reason why more should not be included from other countries.

The diary section is laid out in vertical columns, one for each day, with a week on each double page. Each day is subdivided into hours for noting appointments, etc.

A.G.H. •

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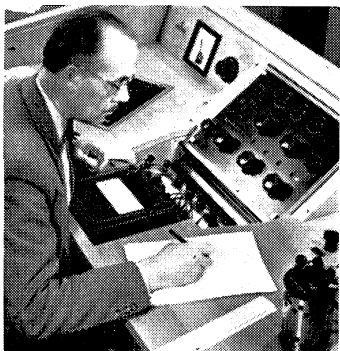
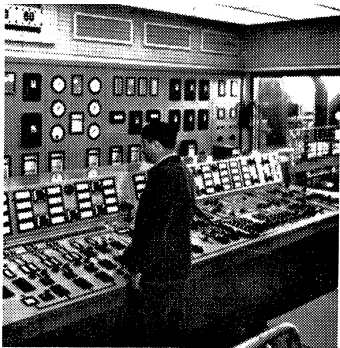
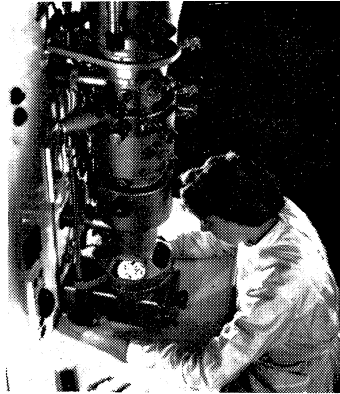
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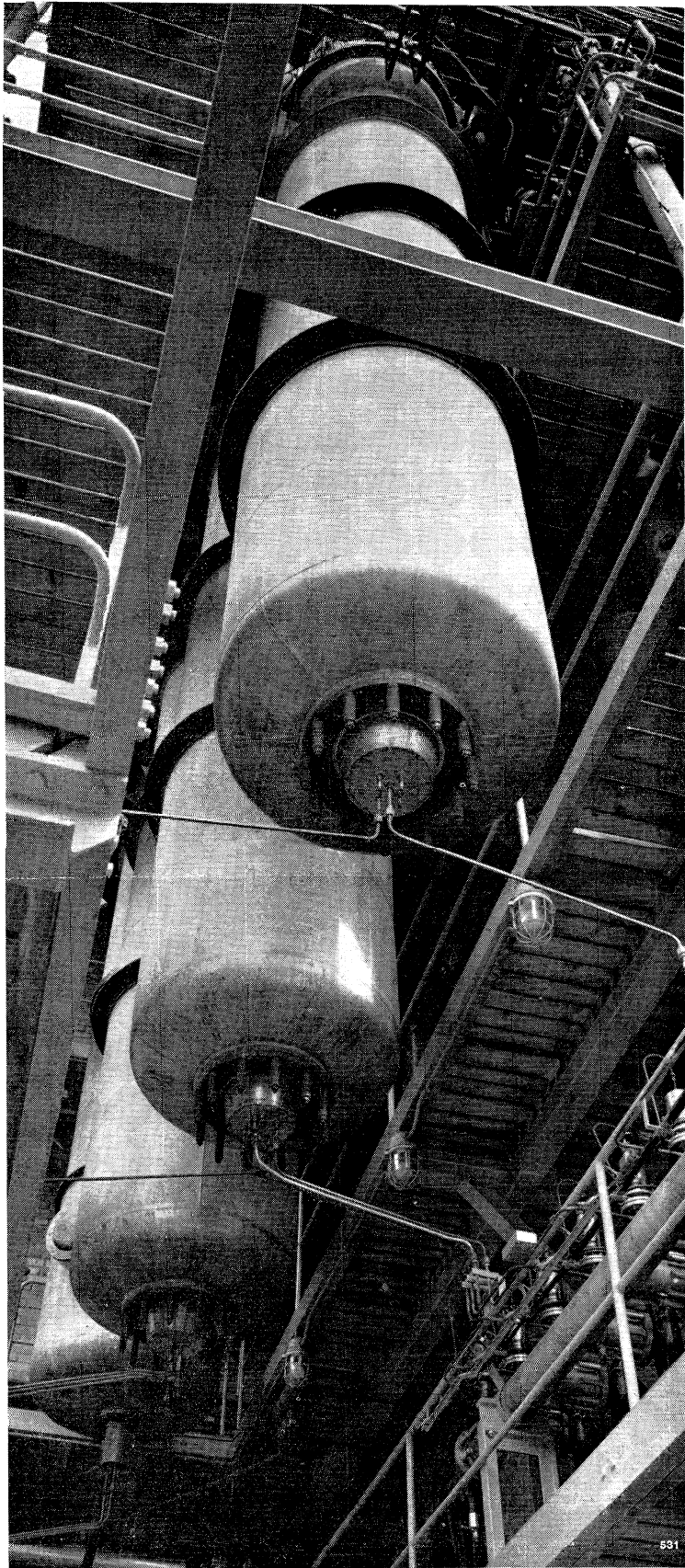
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