

People and things

posed to solitons, are found as solutions of linear dispersionless wave equations and are pulse-like disturbances which travel along a particular direction without changing their shape. The introduction of nonlinear effects and dispersion immediately makes things more complicated.

In particular, nonlinear wave equations have no simple superposition principle, so that two different solutions of the equations cannot easily be added together to obtain another solution. In practice, this means that the solitary waves 'scatter' off each other without creating any new disturbance and continue on their way with their original shapes and velocities. These highly stable solitary waves are solitons.

Gravity waves in shallow water are a good example of such a system of nonlinear dispersive wave propagation and the solitary wave solutions of the relevant wave equations correspond to the phenomenon observed by Russell. Similar nonlinear dispersive systems are encountered in other branches of physics, including ionic collisions, acoustics, meteorology, plasma studies, lasers, magnetism and elementary particle theory. Soliton-like phenomena can appear in a wide variety of disguises.

One good classical example of wave behaviour in nonlinear systems is given by an array of vertically-suspended rigid pendulums moving with large oscillations. (In the usual school treatment of simple pendulum theory, the oscillations are considered to be small, so that the equations of motion are linear). If such an array of pendulums is inverted, it has a highly unstable equilibrium position and the slightest nudge to one pendulum makes it swing down and begin to oscillate about a downward vertical. This nudge is then transmitted along the line of pendulums, making each one in turn fall and begin to oscillate below its point of suspension.

This transmitted effect or 'kink' can also travel in either direction along the line of pendulums, giving 'antikinks' as well as kinks. A similar effect is found in ferromagnetism in the Bloch wall which separates domains of opposite magnetization. When one of the stable spin configurations is nudged, it flips over to lie in the opposite direction and this kink is transmitted through the ferromagnetic material. These kinks and antikinks travelling in opposite directions can produce soliton-like 'kink and antikink pairs' and effects due to such states have been observed in spectroscopy.

A different arrangement of coupled oscillators provides an example of a true soliton. Instead of vertically suspended rigid pendulums, imagine a line of rods joined by a horizontal torsion wire, each rod securely fixed at its middle to the wire. In equilibrium, these rods rest horizontally about the wire. If one of the rods is given a sharp nudge, this nudge is transmitted through the torsion wire to each rod in turn. The wavelike movement through the line of rods is a soliton.

One striking property of classical solitons is that, although they derive from a nonlinear field theory, they behave very much like particles — they are localized, they have a distinct energy and they are stable. This makes them interesting to particle theorists looking for new explanations of particle behaviour but the quantization of the necessary nonlinear field theories can be troublesome, so that the implications of quantum solitons are still to be explored fully.

In the meantime, solitons provide theorists with an additional method of assessing different quantum field theories and another framework for developing methods to overcome the limitations of field theory techniques.

Fermilab budget

We reported in the March issue the resignation of Professor R.R. Wilson as Director of the Fermi National Accelerator Laboratory in protest at the 'inadequate' funding of the Laboratory. Since then the Subcommittee of the USA House of Representatives has added substantial amounts to the budget submitted to Congress by President Carter. The changes are believed to include an increase from \$ 39 million to \$ 50 million for the Energy Doubler construction with \$ 20 million, rather than \$ 10 million, to be available in the 1979 Fiscal Year and \$ 30 million for 1980. A further \$ 24 million has been tabled for 1981 for completion of the Tevatron project.

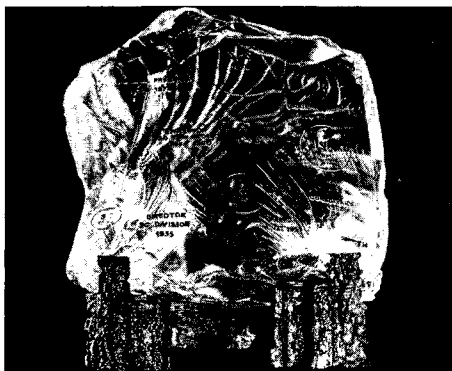
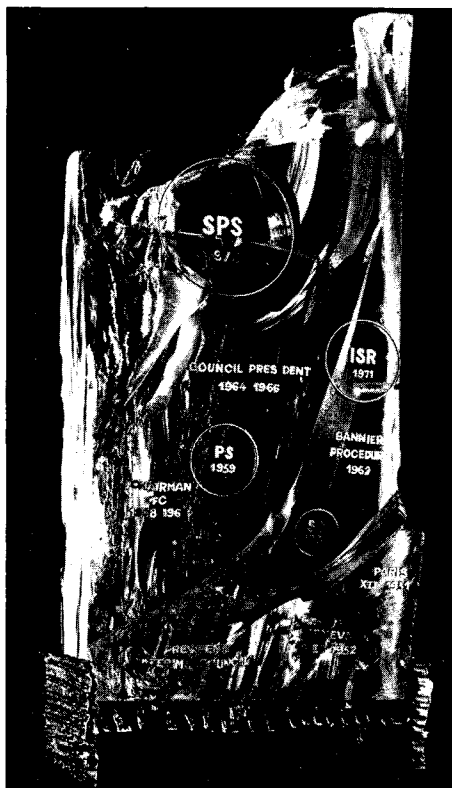
Overall there has been strong reaction to the President's budget proposal of \$ 295 million for the Department of Energy high energy physics programme (plus about \$ 25 million via the National Science Foundation) which is below the 'Low Budget Case' reviewed by the HEPAP Subpanel chaired by Jack Sandweiss in 1977. The Subpanel described this as follows:

'The consequences to the program would be a drastic reduction or termination of the lower energy fixed target and colliding beam programs, and a reduction in the level of support and number of university groups. In addition, levels of use of the new electron colliding beam facilities, of Fermilab, and of the proton colliding beam facility will only be at about 50 percent level. Further, the provision of equipment necessary to exploit these facilities will be substantially slowed. This funding level on a long term basis is close to that which would require a drastic revision in the long range program and probably is not adequate to keep the United States in a world competitive position in this field.'

In our February issue we carried a photograph of a block of leadglass which had come to grief in a very artistic way at Fermilab. CERN's contributions to modern art include a disintegrated bubble chamber window. Two pieces of this glass have been specially decorated by Mario Bellettieri, under the guidance of Eliane de Modzelewska, as mementos for retiring Council members J.H. Bannier and W. Gentner.

European Committee on SRF

The European Science Foundation has organized a look at the scene in Europe with regard to synchrotron radiation facilities. The synchrotron radiation user community has grown so dramatically in recent years (see also the report from the DESY Laboratory page 115) that a broad look at present and future needs seemed desirable. The ESF has issued a report 'Syn-



chrotron Radiation — a Perspective View for Europe' encouraging continued use of all existing facilities and urging that they be supplemented by facilities dedicated exclusively to this research. A particular recommendation was the building of an electron storage ring to provide beams of hard X-rays.

A Committee has been set up to consider the design of such a facility. Two sub-groups (on the machine, chaired by D.J. Thompson of Daresbury Laboratory, and on the instrumentation, chaired by D. Buras of Riso National Laboratory) met at the CNRS headquarters in Paris on 8 March. They are working towards producing a design proposal for an X-ray source by the end of 1979 so that the machine could be built as a joint European facility in the 1980s. The sub-groups will meet regularly at the various synchrotron radiation Laboratories in Europe.

Neutrons at Argonne

The USA President's budget for Fiscal Year 1979 included \$6.4 million construction money for the first phase of the intense pulsed neutron source (IPNS) planned at the Argonne National Laboratory. A year ago, the Laboratory received \$ 0.4 million to plan the facility. In a first phase, the 500 MeV proton synchrotron, Booster II, will be used providing 5×10^{12} protons per pulse at 30 Hz. Construction could begin in 1979, given Congressional approval, for completion in 1981. IPNS-II could follow using a 800 MeV High Intensity Synchrotron succeeding the ZGS which is scheduled to close down as from the end of Fiscal Year 1979. If construction begins in 1980 completion is expected in 1985. Another high intensity spallation neutron source, SNS, is to be built at the Rutherford Laboratory following the closedown of Nimrod in June of this year.

1. Antonino Zichichi, newly elected President of the European Physical Society.

2. Accelerator specialists from China (left to right: — Ho Lung, Han Tsien, Fang Shou-Hsien, Tsao Tsan) on an introductory tour of the CERN site with Eddie Powell of the Visits Service. They are at CERN for several months working on the design of their 30-50 GeV proton synchrotron.

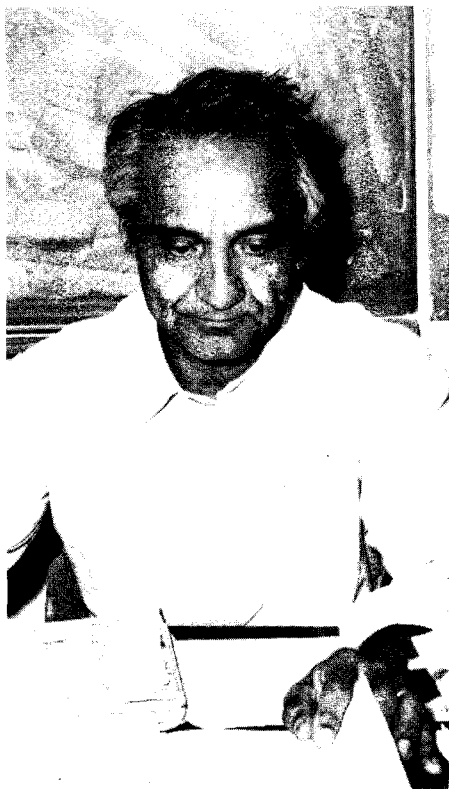
(Photo CERN 2.4.78)

Accelerator history project

A project to gather information and material on the history of accelerators is under way at Fermilab with the aim of assembling historical material on particle accelerators and on Fermilab in particular. Several other institutions have already done some work in this area, notably at the American Institute of Physics' History of Physics Center in New York and the Bancroft library project at U.C. Berkeley. Paul Forman's work on the history of accelerators exhibit at the Smithsonian Institute in Washington has also developed a great deal of interesting material. The Fermilab project hopes to draw upon the experience of these activities and complement their efforts.

Significant documents in the accelerator area including reports, photographs, drawings and pivotal log and data books are being collected. Equipment artefacts of reasonable, and even unreasonable, size are being gathered. At present there is a search for a Wimshurst machine, preferably one with a certain stylishness and an elegant contribution would be suitably acknowledged. Collections of personal notes and records of significant contributors to the field may also be incorporated. A room adjacent to the library has been set aside for a document centre. Artefacts will be displayed in the Central Laboratory Building and elsewhere around the site.

Another phase of the project is to collect the reminiscences of some of the individuals who have played an important role in the development of particle accelerators. In-depth oral histories have become a highly developed art in the last years but this type of interview requires a well prepared historian as interviewer. At Fermilab a complementary approach is being followed. Historical figures are invited to the Laboratory to lecture on the developments with which they were associated and also attend a luncheon



1.

with scientific colleagues. The luncheon conversations and the lectures are recorded on tape. William Brobeck, Herb Anderson and I.I. Rabi have recently been 'documented' in this way.

Lillian Hoddeson (a physicist, interested in the history of modern physics) has joined the project for a stint as Resident Archivist at Fermilab. She has recently reviewed the development of solid state physics at Bell Laboratories in Physics Today. She is working on a similar project at Los Alamos and coordinating all of these activities with the American Institute of Physics project.

Members of the guiding committee welcome advice on this project. The committee includes Bob Wilson, Dick Carrigan, Frank Cole, Ned Goldwasser, Drasko Jovanovic, Dick Lundy, Lee Teng and Roger Thompson.

On People

Professor Antonino Zichichi, INFN and CERN, became President of the European Physical Society on 1 April. The Vice-President is Professor Sergei Kapitza from the Moscow Institute for Physical Problems.

A misinterpretation of a communication led to the February issue carrying the information that Giorgio Bellettini has become Director of the National Laboratories of



2.

Frascati. Professor Bellettini has been Director of Frascati but that post is now held, since November 1977, by Professor Renato Scrimaglio. Our apologies for any embarrassment caused by this error.

Henry Bohm has been elected President of the Argonne Universities Association which operates Argonne National Laboratory. He is a solid state physicist of Austrian origin, now Professor of Physics at Wayne State University. He has worked in industry, at the Universities of Cornell, Purdue and Lancaster and with the Science Research Council in the UK.

The recipient of the 1978 Dannie Heineman Prize is Elliot Lieb of Princeton University who, together with Walter Thirring of Vienna University, in 1975 simplified the proof of the stability of matter in bulk, and had previously (in 1969 with Joel Lebowitz of Rutgers University) described how matter in bulk obeys the laws of thermodynamics.

John Polkinghorne, Professor in the Department of Applied Mathematics and Theoretical Physics at the University of Cambridge, is giving up physics next year at the age of 48. He plans to spend some time at a theological college before entering the Church. He is the second distinguished Cambridge theoretician to give up

particle physics in recent years. His former colleague, Richard Eden, now concentrates on energy research.

A group of four accelerator specialists from the Institute of High Energy Physics at Peking arrived at CERN at the beginning of April to study accelerator construction problems during stays ranging from two to four months. The group is led by Ho Lung, Head of the Accelerator Division at the Institute, and includes Fang Shou-hsien (accelerator theorist), Tsao Tsan (looking after magnet design and measurement) and Han Tsien (looking after injection and ejection systems). China has recently announced its intention to build a 30 to 50 GeV proton synchrotron near Peking which could later be used as injector for a higher energy machine.

On the morning of 23 May, a ceremony in memory of Bernard Gregory will be held at the Ecole Polytechnique under the Presidency of L. Leprince-Ringuet. Speakers will be H. Curien, A. Astier, X. de Nazelle and I. Solomon.

A.N. Skrinsky has been appointed Director of the Institute of Nuclear Physics at Novosibirsk. Professor Skrinsky has been Acting Director since the death of G.I. Budker and has been a prominent scientist at the Institute for many years.

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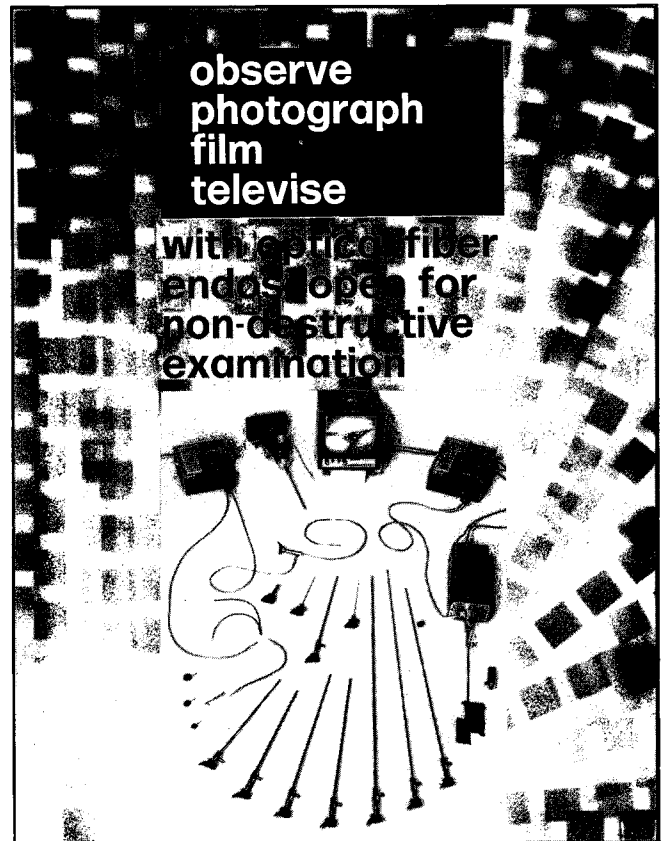
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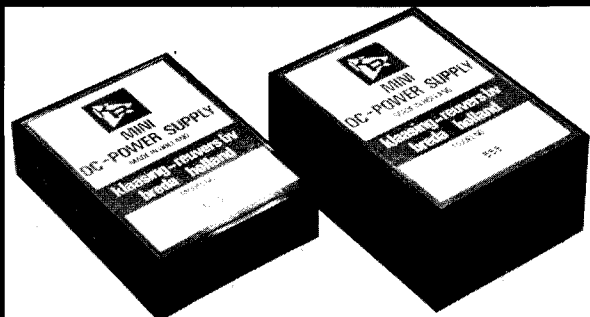
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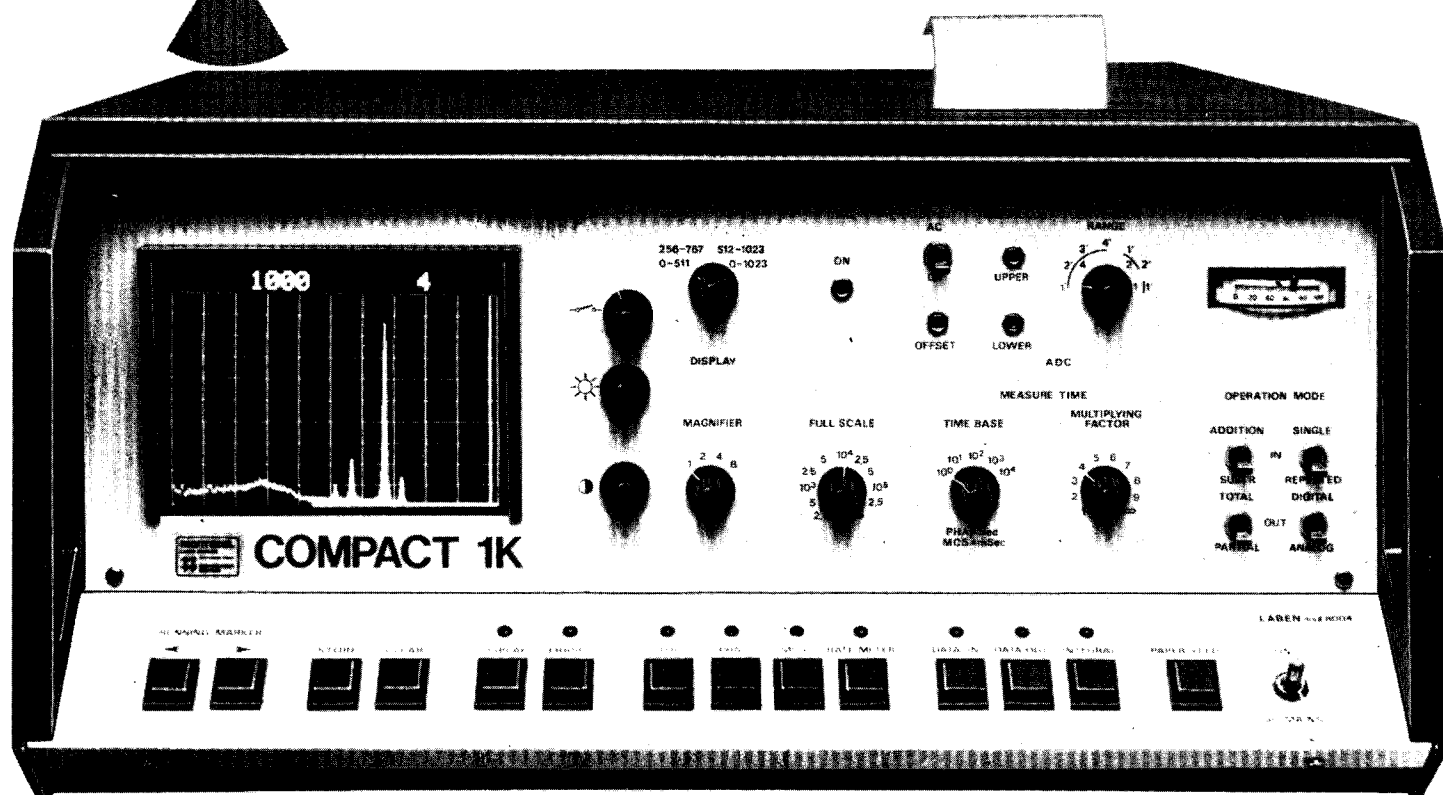
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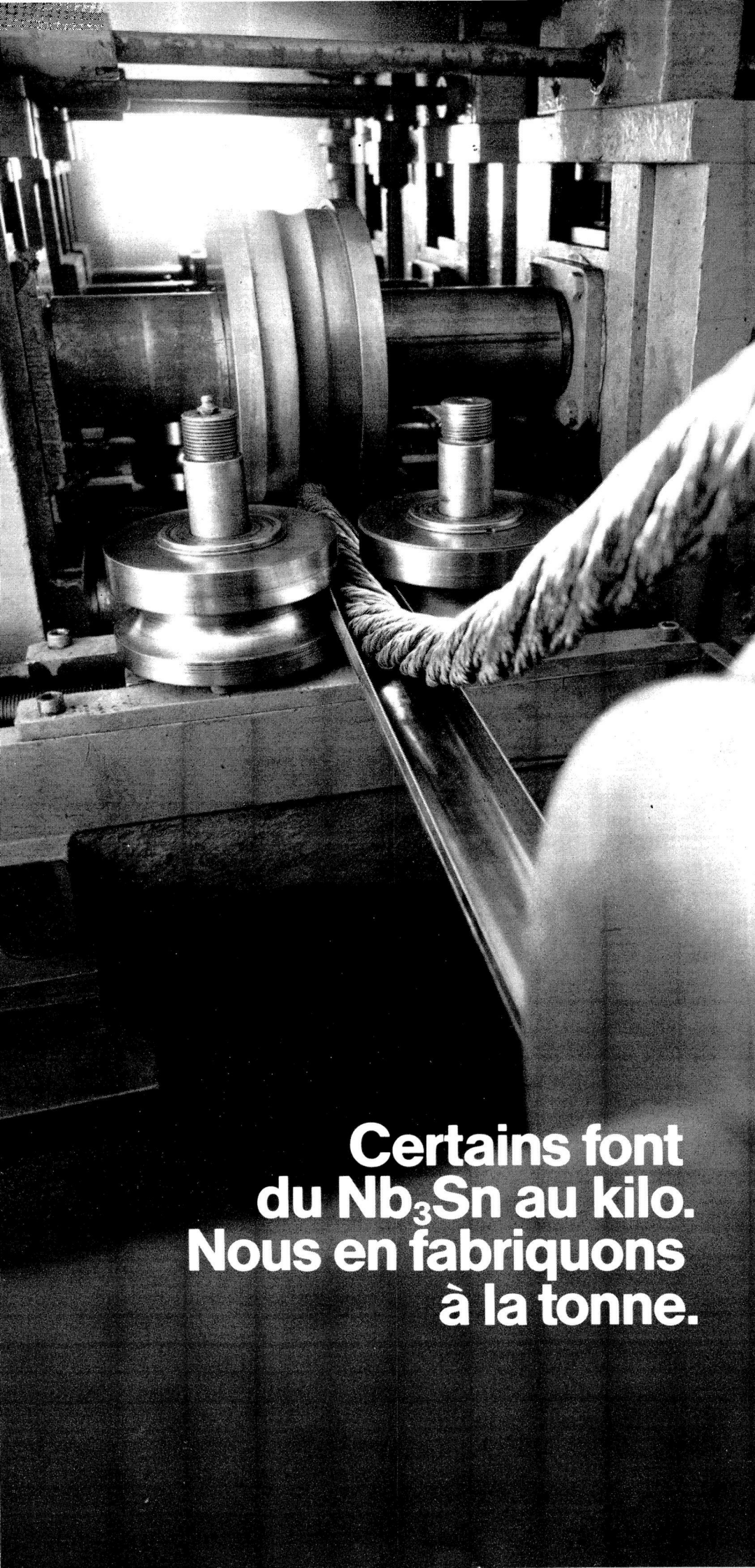
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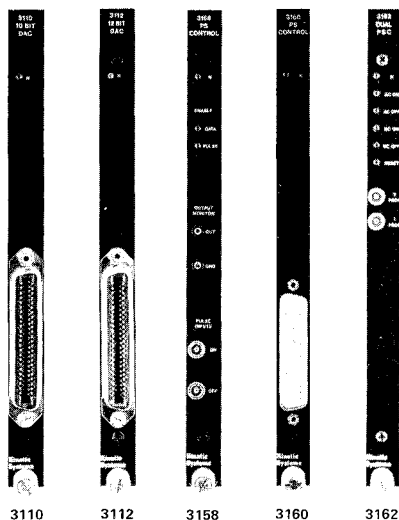
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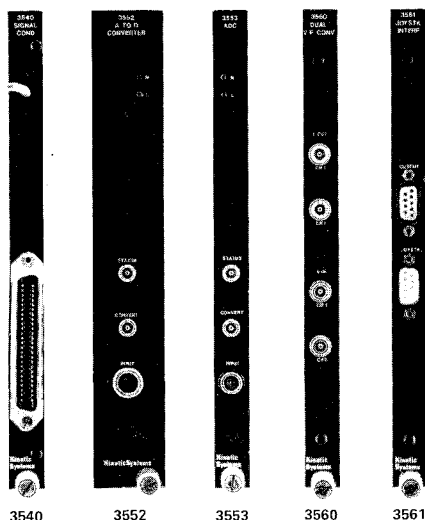
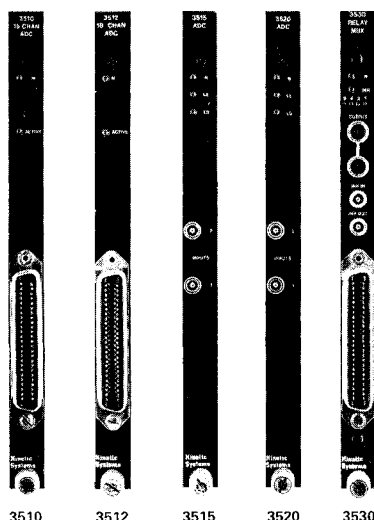


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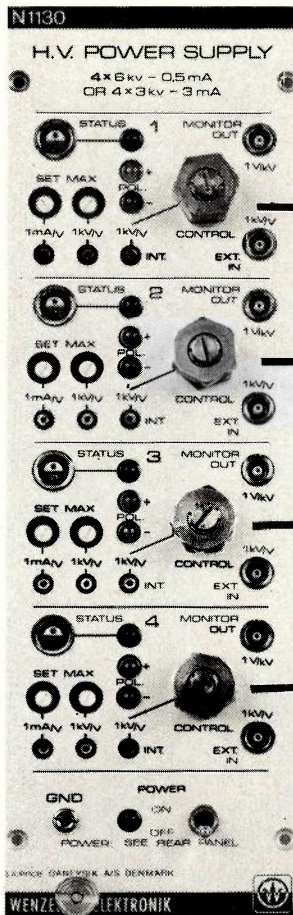
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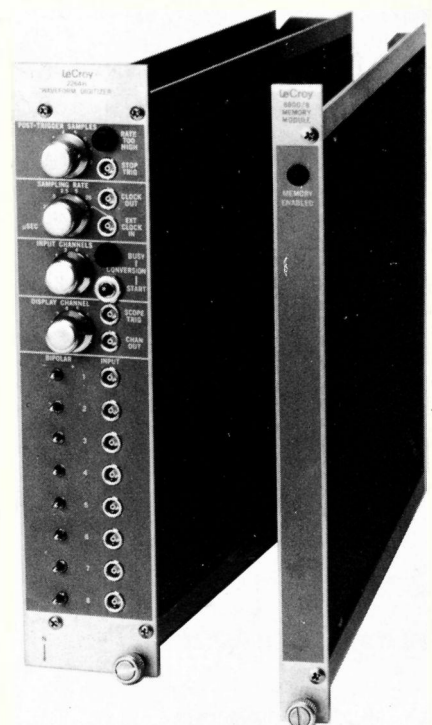
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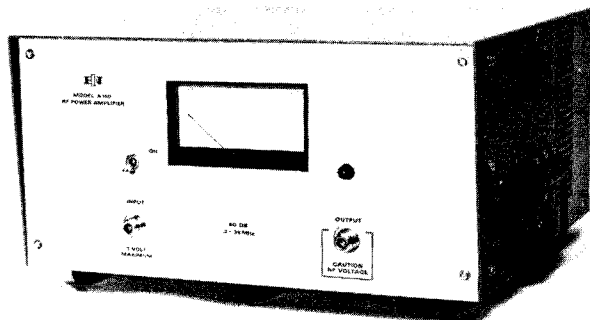
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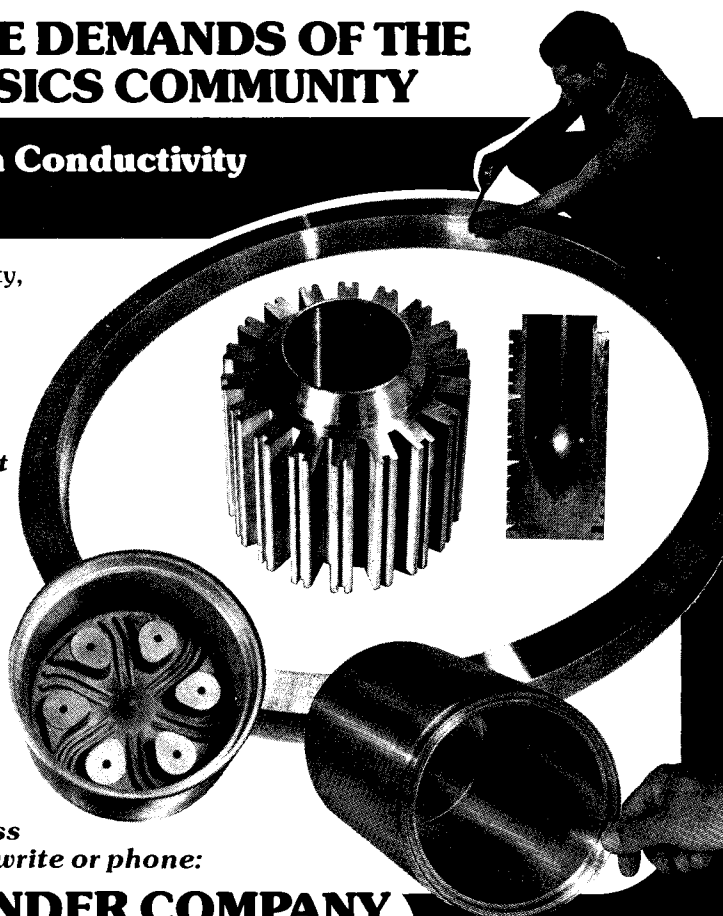
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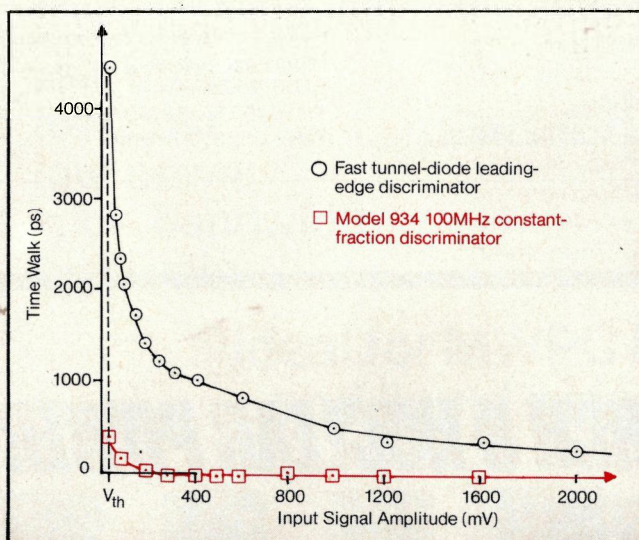
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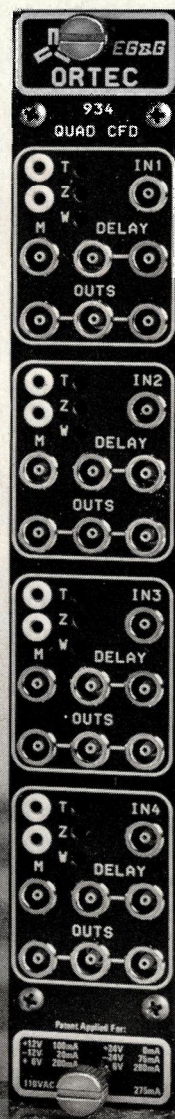


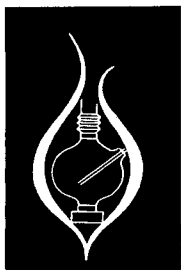
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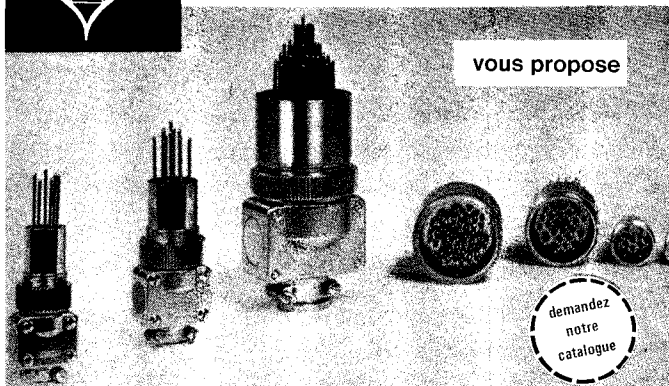
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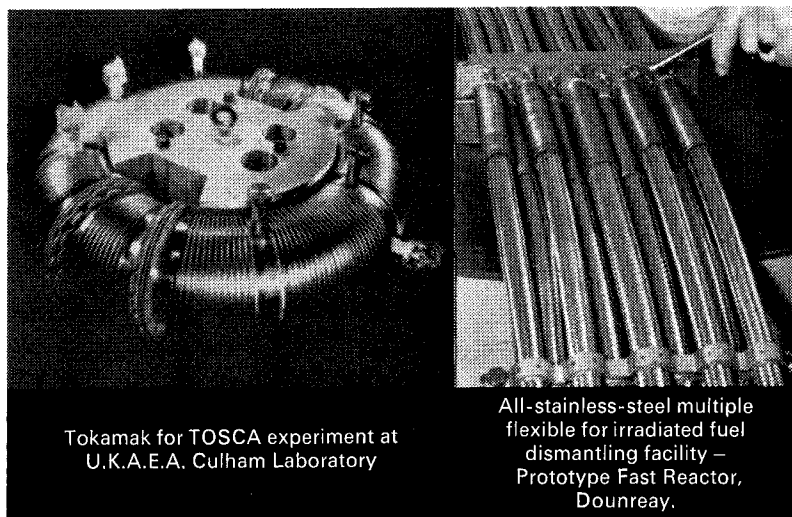
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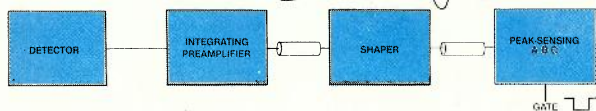
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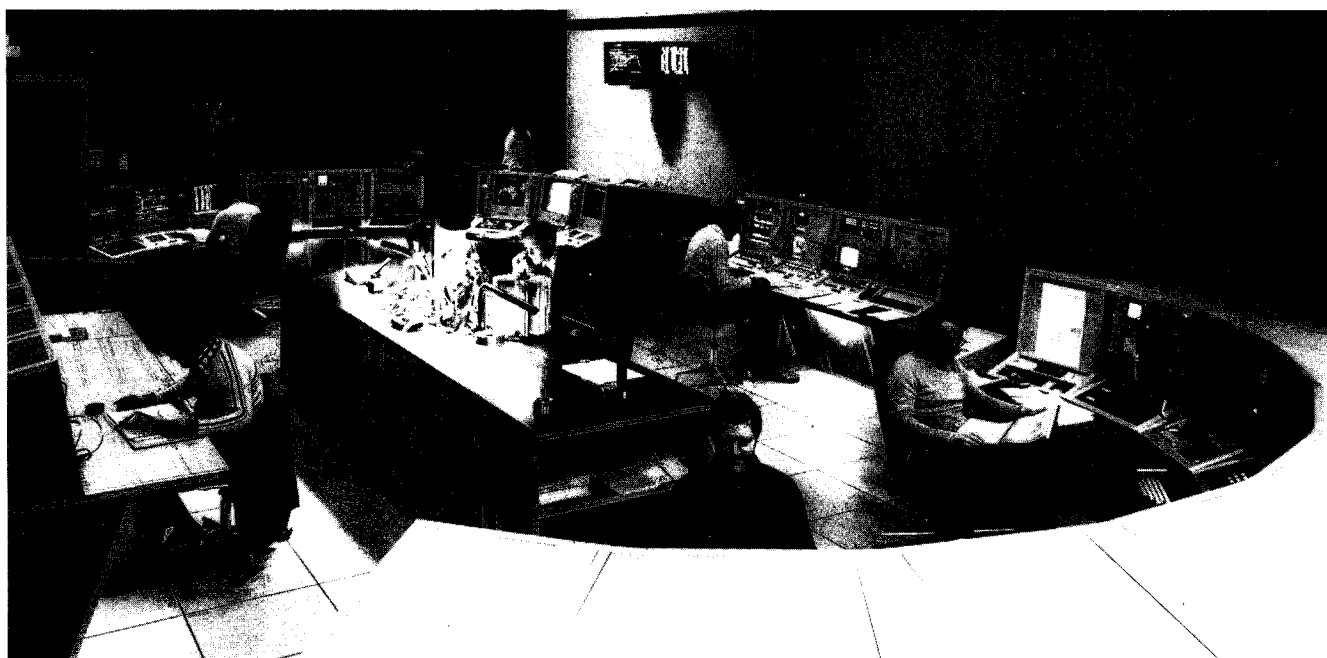
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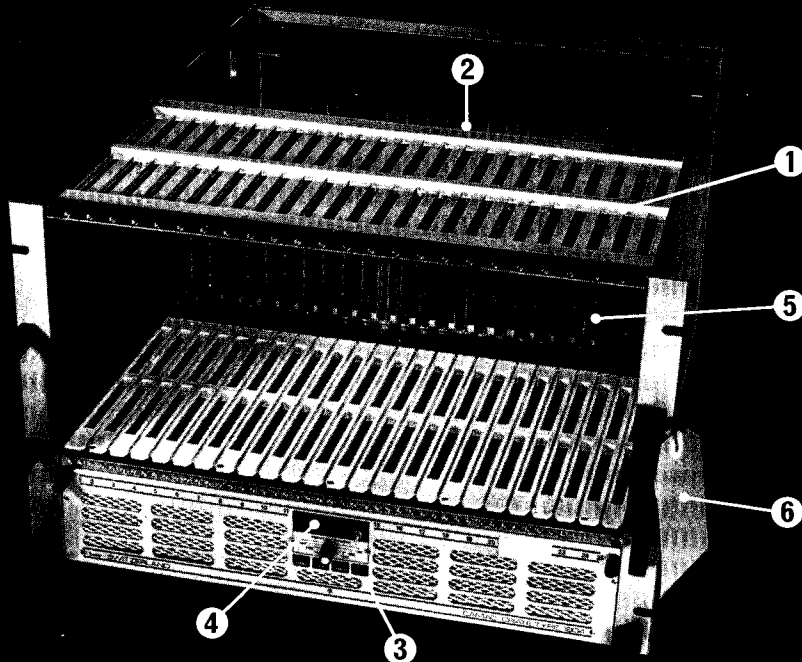
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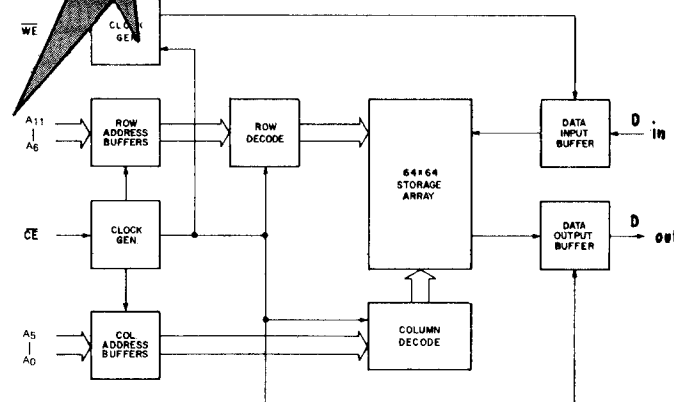
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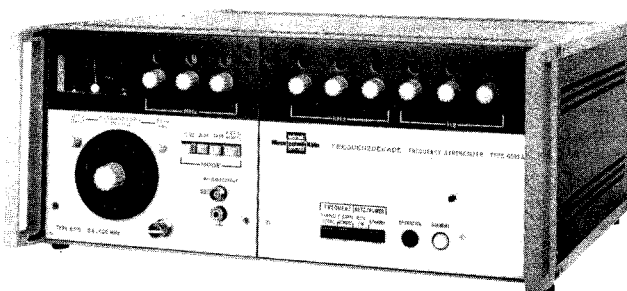
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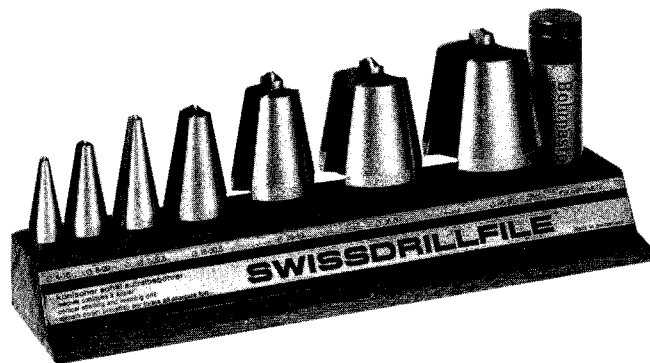
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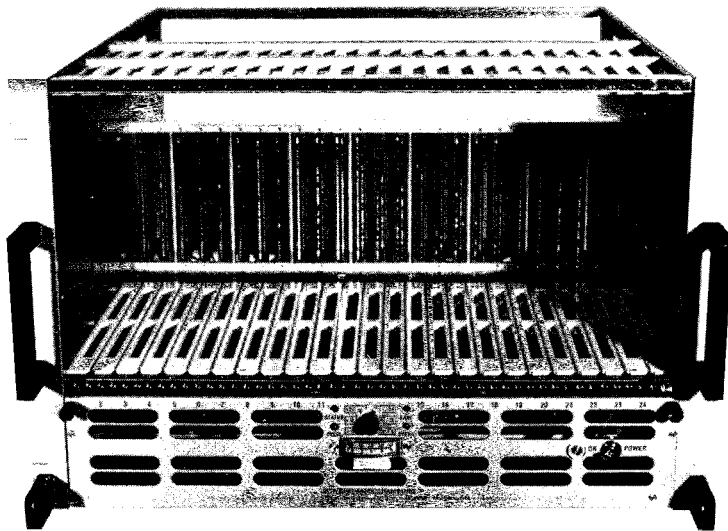
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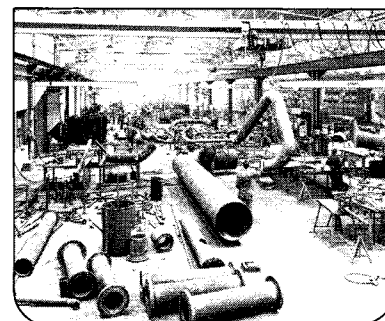
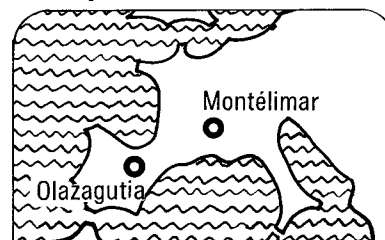
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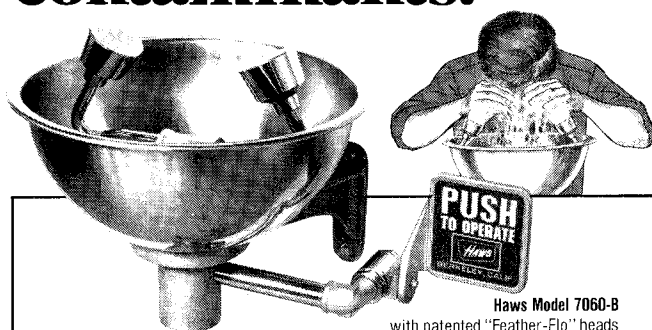
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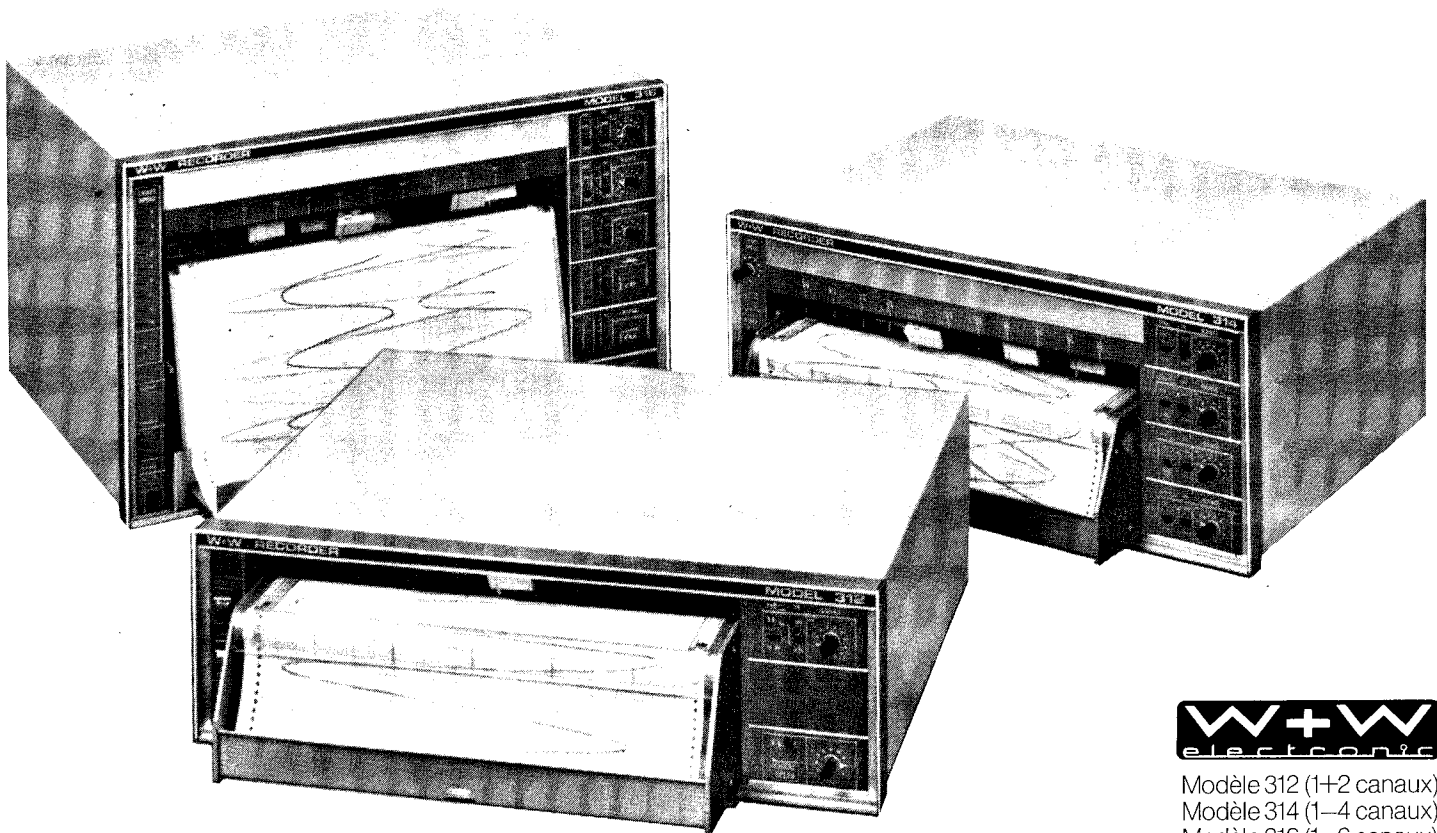
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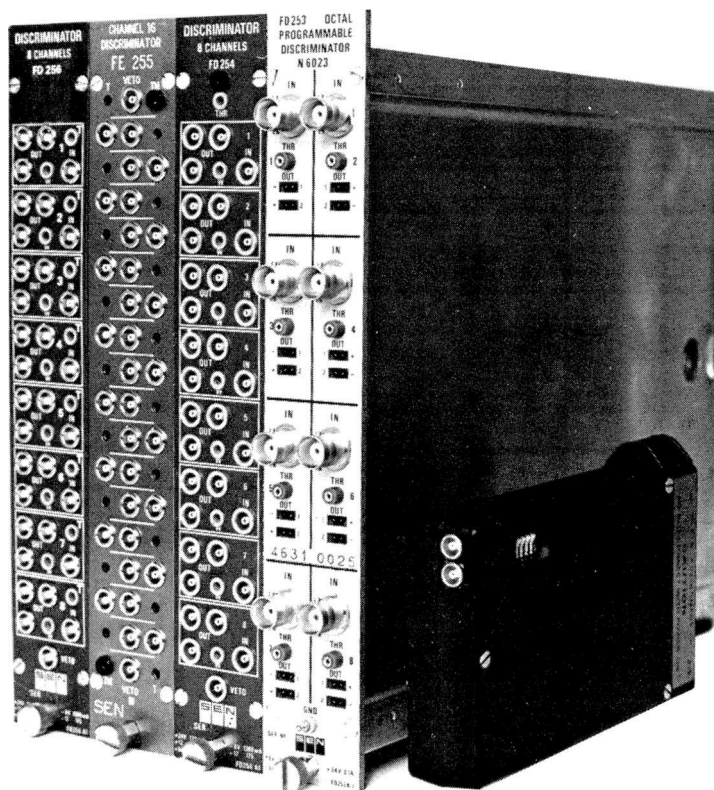
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