CERN COURIER

CERN/PI 99.12.63

12

VOL. 3

pp. 151-162

December 1963

EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH

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 13 Member States, with contributions according to their national revenues : Austria (1.92 %), Belgium (3.78), Denmark (2.05), Federal Republic of Germany (22.47), France (18.34), Greece (0.60), Italy (10.65), Netherlands (3.87), Norway (1.46), Spain (3.36), Sweden (4.18), Switzerland (3.15), United Kingdom (24.17).
Contributions for 1963 total 92.5 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

During the first half of November the **proton synchrotron** was shut down for routine maintenance and modifications as well as changes to the external beams. One of the major jobs was the installation of new main cooling-water pipes between the cooling room and the South experimental hall, increasing the capacity available for the cooling of beam-transport magnets by about 20 per cent. In fact the limitation is now provided by the pumps rather than by the pipes and eventual replacement of these by more powerful ones will provide for an even greater flow.

Among the work carried out at the linac in this period were a rearrangement and realignment of all the apparatus concerned with transporting the proton beam from the end of the linac to the entry to the synchrotron, and a modification of one of the triplet magnetic lenses between the pre-injector and the linac. Further equipment for carrying out measurements on the beam was also put into place. One result of these efforts appears to have been a further increase in the current accelerated through the linac when operation was resumed.

In the ring, the radiofrequency accelerating unit in section no. 51 was removed, and the vacuum box for the 'rapid beam deflector' inserted in its place. At the same time the r.f. system was modified to allow for voltages of 3.05, 3.2 and 3.6 kV, instead of 2.85, 3.2 and 3.6 kV. The new lowest value corresponds to normal acceleration with the 15 accelerating cavities that remain. Among other work, the controls were finished and all the cabling installed for the rapid beam deflector, which will be used to provoke a relatively short burst of protons on an internal target.

The radiation produced around the accelerator during operation has caused the rubber tubing carrying the cooling water to and from the ring magnets to lose its elasticity and strength, and during this shut-down all the tubing was replaced, except on two magnets which were inaccessible because of part of the neutrino beam. The new tubing is expected to last about 4 years in most parts of the ring, but it may have to be renewed more often in the target areas, where the radiation intensity is much higher.

In the East experimental hall, a new beam, o_3, was constructed to serve the **École Polytechnique heavy-liquid bubble chamber,** now modified to contain a liquid-hydrogen target. By using a new type of jointed vacuum chamber between the poles of the bending magnets, it has been possible to make part of this beam common with the o_2 beam already in existence. Work was also begun on another beam, known as c_8, which is the latest in the family of 'c' beams to provide protons scattered out of the synchrotron at approximately full accelerated energy. In the South hall, more work on beam modifications prepared the long d_{15} beam for use in the calibration of spark chambers from the neutrino experiment, and changes for a similar purpose were made to the a_5 beam in the North hall.

The spark-chamber calibration runs were carried out when operation of the machine was started again on 21 November, and a number of counter and spark-chamber experiments were continued.

At the **synchro-cyclotron,** the main experiments, as for the past few months, were concerned with aspects of the 'polarization' of positrons (that is, the degree of alignment of the axis of spin with the direction of flight). Among results still being evaluated were those for the 'ABC experiment', the first part of which was carried out at the SC during September and October. The

The editor of CERN COURIER and the staff of the Public Information Office take this opportunity to send to all readers their best wishes for 1964.

Contents

The cover photograph shows that the main auditorium at CERN has more than one use, and that a young audience can be even more attentive than the physicists and engineers who more often occupy the seats. The occasion was the performance of a play called ' Capucines ', presented by the drama group of the international organizations, 'Harlequin and Co.', during the first of this year's two Christmas parties bringing together the children of CERN staff and some of those from neighbouring communities. Also on the programme were a film and a conjurer, as well as refreshments and the visit of Father Christmas.

CERN COURIER

is published monthly in English and in French. It is distributed free of charge to CERN employees, and others interested in the construction and use of particle accelerators or in the progress of nuclear physics in general.
The text of any article may be reprinted if credit is given to CERN COURIER. Copies of most illustrations are available to editors, without charge.
Advertisements are published on the sole responsibility of the advertisers.

Published by the
European Organization for Nuclear Research (CERN)

PUBLIC INFORMATION
Roger Anthoine

Editor :
Alec G. Hester

CERN, Geneva 23, Switzerland
Tel. 34 20 50

Printed in Switzerland

Lectures on bubble-chamber analysis programmes

To convert the measurements of the tracks on two stereoscopic photographs into a complete description of a particle interaction inside a bubble-chamber takes the IBM 7090 computer at CERN about 15 seconds. What is normally neglected in statements of this kind is the fact that to write the 'programme' for such a calculation has probably taken between 10 and 20 man years.

The computer does arithmetic ; the programme is a complete set of coded 'instructions' which causes the computer to perform a long series of mathematical operations on the data supplied to it by the input tapes, in order to solve a particular problem. The time taken to prepare the programme is well spent, of course when the same set of calculations has to be carried out on many thousands or hundreds of thousands of sets of data. What takes 15 seconds on an electronic computer might take several days with a hand calculator — and even that requires a programme of a kind.

Over the past few years the Data Handling (DD) Division at CERN has compiled a set of 'standard' programmes (referred to by cryptic names such as REAP, THRESH, and GRIND) for the solution of problems involving bubble-chamber interactions. Each experiment, however, requires specific modifications to the basic programme, which have to be worked out, incorporated and checked. This also takes time, and the experimental programme is now of such a size that the Division's programmes are being left with little opportunity for making fundamental improvements to the existing programmes and for working out new ones. When, earlier this year, the experimentation section of the Division was transferred to the Track Chambers Division, it was decided that the 'upkeep' of these existing programmes should also become the experimental physicists' responsibility after the end of 1963. In this way, the DD Division would be free to concentrate on new developments, such as more complicated programmes for the automatic analysis of bubble-chamber and spark-chamber photographs and the use of counters and spark chambers connected directly to the computer.

This was the background to a series of lectures on bubble-chamber analysis programmes, organized by the Data Handling Division and held recently in the Council chamber at CERN, from 14 October to 7 November. The lecturers were the people who had developed the various programmes, the audience present and possible users of them. The aim of the lectures was to explain the mathematical methods involved in preparation and the detailed contents of each of the programmes. Although envisaged at an earlier stage as an informal discussion with the relatively few CERN physicists who would take over responsibility for the application of the general programmes to their own experiments, the actual course had about 110 participants, 50 from within CERN and 60 from outside. Most of the visitors were from universities and research institutes in the Member states who take bubble-chamber film from CERN for measuring and send the data back for analysis or else use a similar computer, but quite a number of them came from the U.S.A. This outside interest is not so remarkable, perhaps, when it is remembered that about two-thirds of all the bubble-chamber pictures obtained at CERN are used by other laboratories, often for experiments in which CERN does not otherwise collaborate.

After a general introduction and a talk on the programme REAP, by G. R. Macleod (DD Division), the first week of the course continued with sessions on THRESH, by W. G. Moorhead (DD) and Miss A. M. Cnops (DD), and ended with a discussion of tape-handling routines by R. Lorking (DD). REAP is the input programme which converts the information received on punched paper tape from the measuring projectors (IEPs) into a form suitable for the computer, checking it for consistency at the same time ; THRESH, the next stage in the series, is the geometrical reconstruction programme which controls the calculations necessary to convert the measurements made on each of the two stereoscopic photographs into space co-ordinates, the numbers representing the position of each track in three dimensions, inside the bubble-chamber.

The middle two weeks of the course were spent on GRIND, the lecturers being R. Böck (Track Chambers Division) and H. Schneider (also TC). GRIND tests certain kinematic hypotheses to find how closely each one fits the reconstructed event, thus, for example, enabling the physicist to determine the most probable explanation of the interaction. This programme produces a magnetic-tape 'library' for each experiment, containing all the calculated data for each of, perhaps, some 30 000 events.

In the last week the lectures concerned programmes more adapted to the analysis of specific experiments than to the general calculations performed by REAP, THRESH and GRIND. R. Böck, W. A. Cooper, G. Lynch, E. Malamud, (all TC) and F. Beck (DD) spoke on BAKE and SLICE, which both allow the GRIND output tapes to be scanned and additional calculations to be performed on them ; SUMX (adapted from a programme written at the Lawrence Radiation Laboratory in Berkeley, U.S.A.), which gives a graphical representation of the results in the form of histograms ; and MILLSTONE, a special version of GRIND for certain calculations ●

---

experiment has been designed to investigate an unexplained result, obtained earlier at Berkeley, that appeared to show a new resonant state of the two-pion system. This is the so-called 'ABC anomaly', named after its discoverers A. Abaskian, N. E. Booth and K. M. Crowe. The CERN experiment used a negative pion beam incident on a hydrogen target to produce a neutron and two pions, and the pion tracks were recorded by spark chambers. As well as scanning the pictures and measuring the tracks in the normal way, the group is trying out a simple automatic system in which the spot of light from the screen of a cathode - ray tube is made to scan automatically along the image of each gap of the spark chamber and to record the position of each spark. This data is fed into a computer to reconstruct the complete track. The method can only be used, however, with very 'clean' films containing few spurious sparks or other background.

Early in the month the 'temporary' extension to the neutron room, was dismantled and work then began on the permanent structure to replace it ●

Development of supplementary training

The success achieved last year by the newly organized technical-training programme showed that there was a strong demand for increased knowledge among the technicians as well as the scientific staff of CERN. A great many of them feel a need to extend their training, either by keeping up to date in their own field and increasing their understanding of it, or by acquiring a basic understanding of other techniques currently applied at CERN.

It is noteworthy that the four technical-training courses and the elementary mathematics course were followed regularly by about 300 students. A quarter of those in the technical courses sat for the examinations at the end of the year and ninety per cent. of them passed. At the same time, the formal organization of an academic training programme, consolidating the part CERN has always played in this field, met with the approval and interest of physicists and engineers, the younger ones in particular.

Following this encouraging lead, the Directorate last May created the **Training and Education Section,** whose functions are to organize, co-ordinate and develop both technical and academic training according to the needs of the Laboratory ; the section is helped in the establishment of its programmes by two advisory committees, already set up last year.

The activities organized by the section are of general interest ; they run in parallel with the courses and seminars of more specific interest arranged by some of the Divisions, but avoid interfering with them.

What follows is a brief outline of the 1963-64 programme :

1. ACADEMIC PROGRAMME

This year two series of lectures have been arranged, one theoretical and one experimental, both at post-graduate level. They deal mainly with the recent developments in elementary-particle physics, from the theoretical as well as the experimental and technological points of view, but are not intended to be only for specialists in each of these fields.

a) theoretical :

The theoretical series will consist of three courses, each lasting about three months, with one lecture per week. The first course, by J. Prentki on *Unitary symmetry,* began at the end of October. The second, on *High-energy collisions,* will be given by L. Van Hove.

b) experimental :

The experimental series will consist of a certain number of short courses on various subjects. The first was given by G. Puppi, on *Recent advances in elementary-particle physics — strong interactions.* Among other topics foreseen are: beam optics, bubble-chamber physics, superconductivity, neutrino physics, and computers in experimental physics.

It is worth mentioning that each of these courses attract 50 to 100 physicists and engineers, some of whom come from outside CERN.

2. TECHNICAL PROGRAMME

a) courses :

This year, the technical programme consists of 10 courses (at 'elementary' or 'specialized' level), each of 15 to 30 lessons given once or twice a week. Since nearly all the students prefer the courses to be in French, they are again being given in this language.

Level I ('elementary') :
Electrical engineering, by M. Schmidt and M. Morpurgo.
Electronics, by F. Ferger.
Vacuum technique, by H. Schultes.
Mathematics (2 levels), by F. Louis.

Level II ('specialized') :
Electrical engineering, by O. Bayard.
Electronics, by G. Amato.
Vacuum technique, by E. Fischer.
Mathematics, by F. Louis.
Strength of materials, by L. Solinas.

The courses of level I are of general educational value, intended for the non-specialist in the branch concerned. Those of level II are more for the specialists.

About 350 technicians and other staff have registered for this year's courses. Some of them take mathematics as well as their technical course, so that the total number of registrations is about 550.

In addition to the above programme, a course in basic physics is being prepared. This will use the principles of 'programmed instruction' and will follow the physics course devised in the United States, by the 'Physical Science Study Committee'. It will be used to try out the new methods of auto-instruction, which seem to offer great advantages in such a complex and 'busy' community as ours.

b) seminars :

The section is also organizing three series of technical seminars :
electronics,
mechanics (technology of materials and workshop processes),
accelerator technology.

These are intended for the technical and scientific staff. Specialists from CERN or from outside will give either a single lecture or a short series of talks on particular subjects at an 'advanced' level.

The first sessions covered :

electronics : *Logic circuits and computers,* by W. Nijenhuis from the Philips Research Laboratories (Eindhoven),

mechanics : *Caoutchoucs naturels et synthétiques,* by H. R. Schwaller from the firm of Lonstroff, S.A. (Aarau).

3. GENERAL INFORMATION LECTURES ON PHYSICS AT CERN

General information lectures on important experiments or big technological projects at CERN are also organized by the training and education section. These lectures, given by some of those closely concerned with the projects, are aimed at a non-scientific audience and intended for the whole of the staff. They provide a good opportunity to the lecturers to repay the debt they owe to all those who have helped, in one way or another, by giving their audience an understanding of the general outlines and enabling them to appreciate the importance of the various experiments.

The first series describes the neutrino experiment, and consists of 4 lectures (the first of which has already been given), in French :

Neutrino physics, by G. von Dardel.
Neutrino interactions in the bubble chamber, by M. Paty.
Neutrino interactions in the spark chambers, by J. M. Gaillard.
The CERN neutrino beam, by G. Plass.

G. Vanderhaeghe

WHO'S WHO IN CERN

Guy VANDERHAEGHE

Head of Training and Education Section
Chairman of CERN Staff Association

CERN/PI 22.12.63

The evolution of CERN has brought about many changes, among which have been the adoption by the Organization of a degree of formal teaching responsibility and the rise of a fully representative staff association. Supervising both these aspects of present-day CERN life is Guy Vanderhaeghe.

Born in Belgium, near Brussels, in 1922, he entered the University of Brussels in 1939 to study physics. After his country was overrun during the war the University was eventually closed, and from then on studies were continued 'privately' by a few groups of students, with the secret help of professors and assistants.

Early in 1945 he passed his final examinations, in the reopened University, and was then appointed 'assistant' in the faculty of applied science. A year later he obtained a Fellowship from the 'Fonds National de la Recherche Scientifique', and in 1947 he transferred to the newly founded 'Centre de Physique Nucléaire' in the University.

There he worked under Prof. Max Cosyns and Prof. G. P. S. Occhialini on elementary-particle physics, using the newly developed emulsion technique. This involved him in many international collaborations with groups doing similar work, and gave him opportunities to travel widely in Europe. He obtained his Doctorate in 1952. Afterwards, he was appointed 'chercheur agréé' of the 'Institut Interuniversitaire des Sciences Nucléaires' of Belgium

Apart from research, he did some teaching, and was interested in more general educational problems outside the University. He also helped to found a Trade Union branch in the University.

In October 1958 he came to CERN as a research associate, for one year, and left emulsions to join a group carrying out one of the earliest precision experiments at the synchro-cyclotron using electronic-counter systems. When the proton synchrotron began operation just over a year later he was invited by the CERN emulsion group to stay on and take part in the first beam surveys and other experiments. In 1961 he was appointed a staff member. While still at Brussels he had devoted considerable attention to the problems involved in processing nuclear emulsions, and at CERN he took charge of all processing for both the CERN group and visiting teams. He also acted as 'linkman' on several experiments.

When, in the middle of 1962, moves were made to broaden the scope of the lectures and other instruction given to CERN staff, Guy Vanderhaeghe was asked if he would take responsibility for organizing the first technical training courses foreseen for October 1962. His appointment as head of the newly established Training and Education section followed in May 1963. His intention is to carry over the experimental approach to his new job, investigating new methods of teaching and other aids so as to be able to satisfy the rather special needs of the CERN 'students' in the best possible way.

Reviving his interest in 'trade union' matters, Guy Vanderhaeghe found himself on the committee of the CERN Staff Association in 1962, and early in June 1963 was elected this year's chairman.

The committee over which he presides consists of 24 other members, and a number of sub-committees look after the different areas of interest of the Association. Although of long standing, the Staff Association in the earlier days of CERN was more in the nature of a social club and it was mainly through the enthusiasm and drive of Mike Pentz, chairman from 1960-1962, that it developed also into a body fully capable of representing the staff on all matters affecting them. At the present time both aspects, 'trade union' and 'social', are widely represented in the Association's work. Its committee keeps under continuous study the questions of salaries and staff rules, working conditions, and welfare, and also looks after 'social and cultural activities'. Last winter a series of evening 'lectures on subjects of general interest' was launched, with great success, and arts and crafts exhibitions are organized from time to time. The Association's language courses (English, French, Russian, German, Italian and Spanish) are very popular, with a total attendence at the classes last year of about 600. Among the various sports and social clubs (which come under the auspices of the Association but are more or less autonomous), the car club has the largest membership, but it is probably the music club which is best known in Geneva, as a result of its highly appreciated chamber-music concerts in the auditorium, now in their fourth season. The photographic club is also well supported. English and French book clubs cater for more leisurely moments, while the ski, riding, football, table-tennis, basketball, and rifle clubs provide more active recreation for their many members.

It is perhaps characteristic of CERN that relations between the Staff Association and the Administration (in a general sense) are cordial and close, and the views of the Association are sought on all important matters concerning the staff.

The Association also acts in a less formal way. For example, after the earthquake at Skopje this year, it was largely instrumental in raising nearly 13 500 Swiss francs for the Red Cross relief fund, as well as arranging for a Red Cross team to collect blood from donors. More topically, the Christmas children's party, arranged annually in collaboration with the Administration, provides an afternoon's entertainment not only for the children of the CERN staff but also for a roughly equal number of local school-children. In fact this is not the only occasion for the Association to develop contacts with the local Swiss and French communities.

Many things can stand in the way of fostering a strong feeling of 'belonging' in the kind of large organization that CERN is now becoming, but an active Staff Association and the opportunity to gather informally for lectures and colloquia both help to keep the initial team spirit alive. It is well that someone who came to CERN 'because it was the best place to go to in Europe' should this year be responsible for both ●

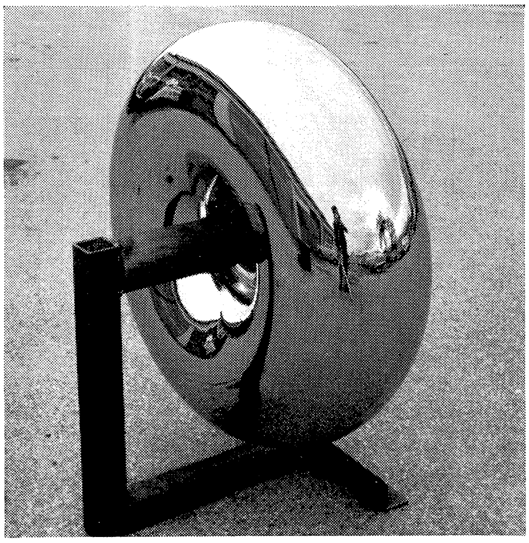
Puzzle photos

Many strange pieces of equipment are to be seen at CERN, especially in the experimental halls and workshops, and even to the expert eye it is often not at all obvious what any particular one is intended for.

Some of these items are shown in the photographs reproduced on these two pages. To give readers a chance to make their own guesses, the captions have been collected together overleaf.

Don't cheat !

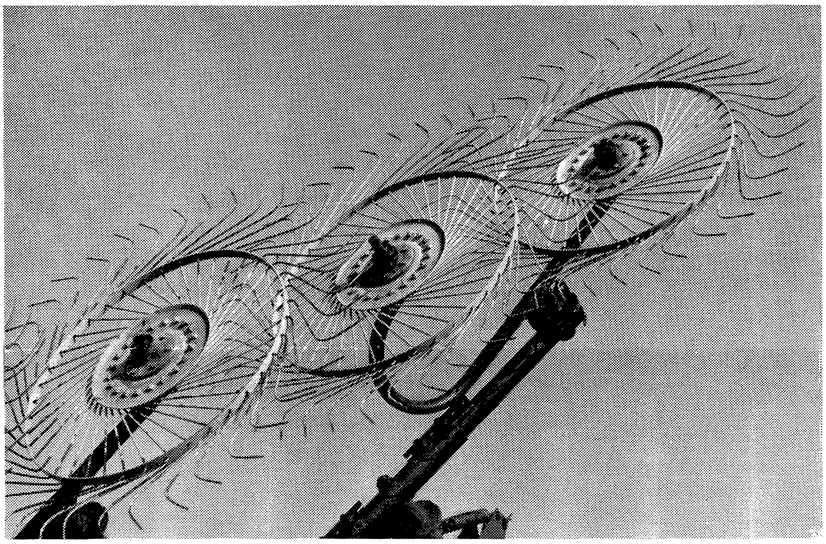
1



CERN/PI 145.4.63

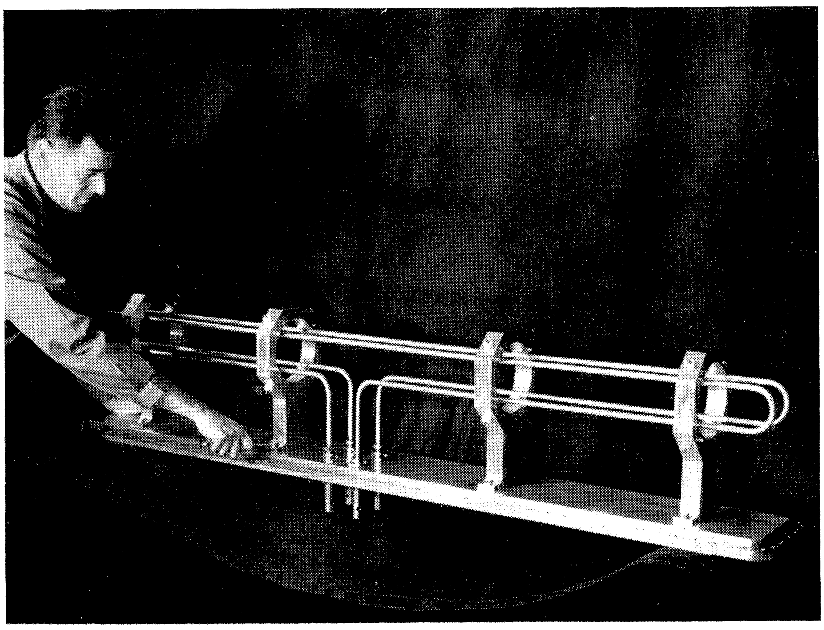
CERN/PI 6548

2



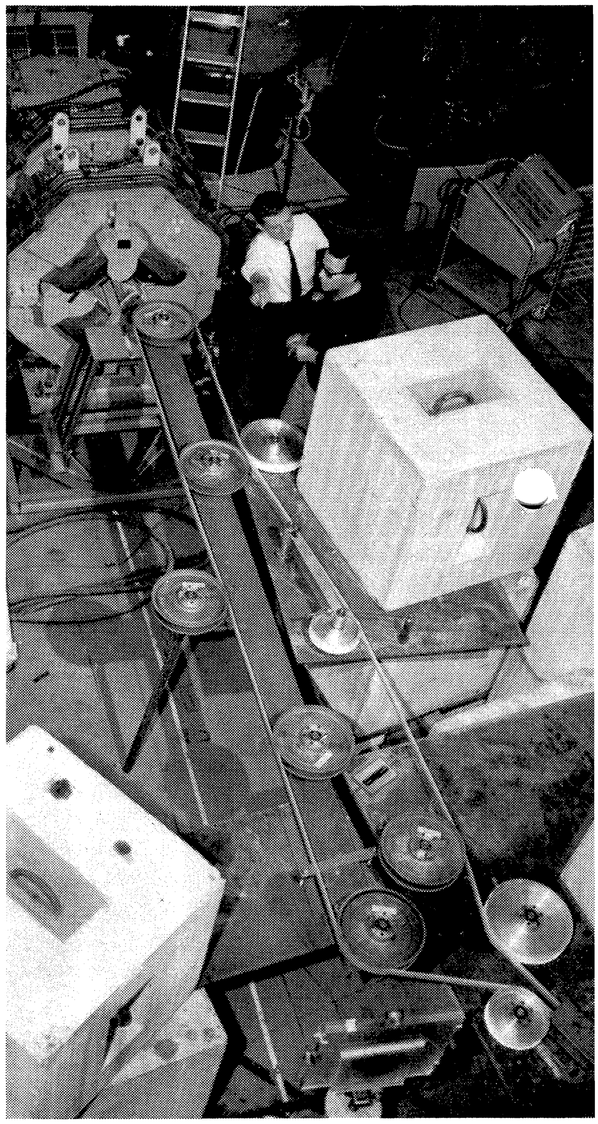
CERN/PI 82.11.63

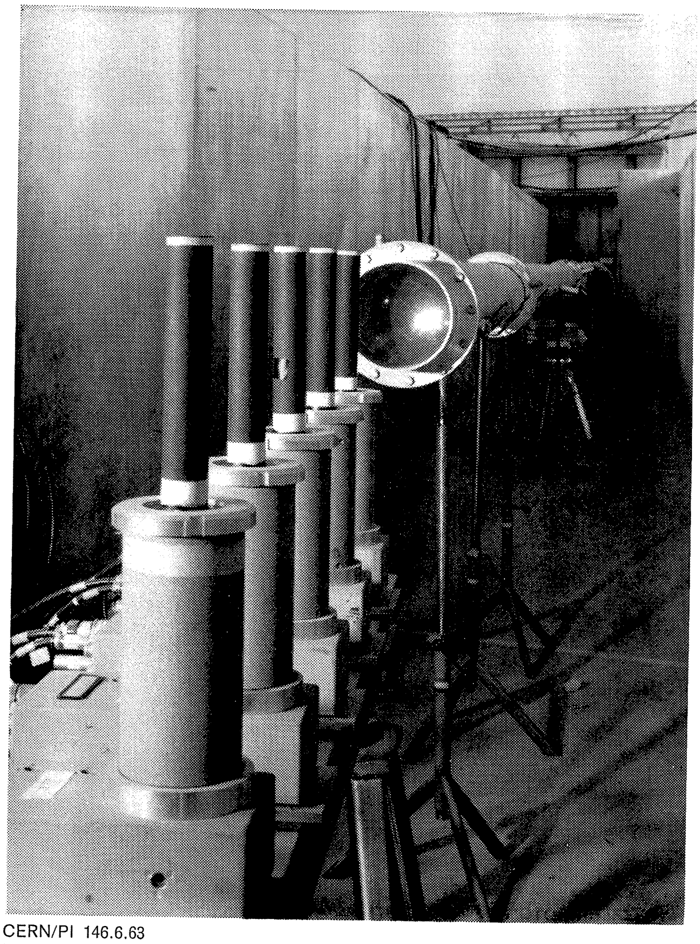
3



CERN/PI 91.7.63

4

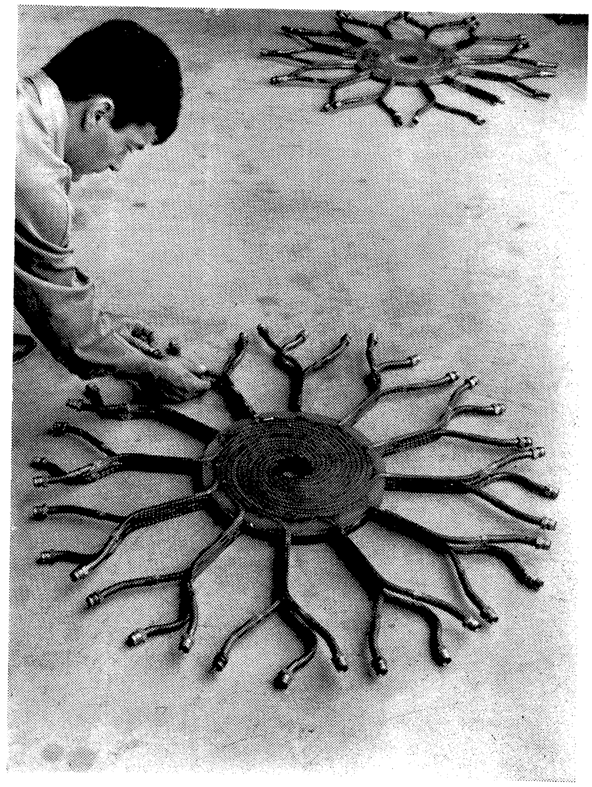




5

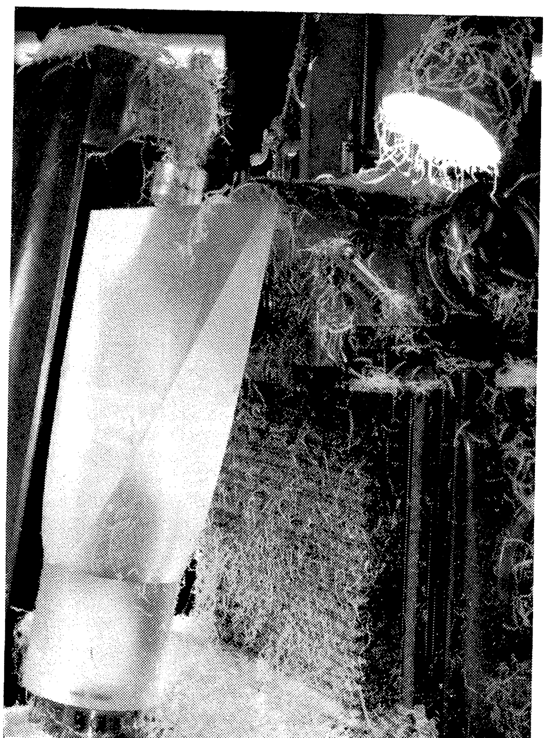
CERN/PI 146.6.63

6



CERN/PI 107.7.63

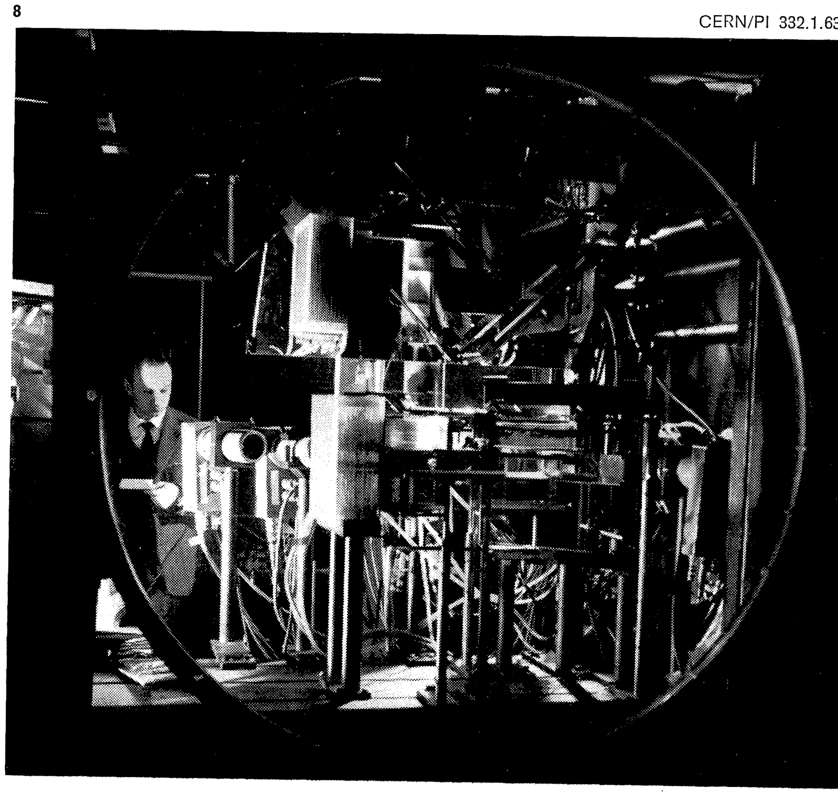
7



CERN/PI 1062

8

CERN/PI 332.1.63



BOOKS

An introduction to waves, rays and radiations in plasma media, by Julius J. Brandstatter (London, McGraw-Hill Publishing Co. Ltd., 1963 ; £5 16s. 6d.).

The publishers tell us that the author has worked as a mathematician and physicist in industry and has also been a lecturer. His varied experience probably explains why this basic handbook gives such a coherent account of the subject : waves, rays and radiation in plasma media. The approach is clearly mathematical, but the author has always kept in mind the physical aspects of the problems considered, and as a whole the book is extremely clear.

The titles of the chapters give an idea of the wide range of subjects treated :

— The homogeneous electron plasma in a uniform magnetic field.
— A résumé of the hydrodynamical equations and shock conditions for gases.
— The homogeneous ionic plasma in a magnetic field.
— Energy considerations and electrodynamics.
— The structure of waves in non-homogeneous media.
— Theory of propagation of waves in an inhomogeneous isotropic, dispersive and absorbing medium.
— Propagation phenomena based on the Boltzmann equation.
— Radiation in a plasma.

The book is rather unusual, because it deals completely with all aspects of the subject starting from the elementary mathematical and physical data, and particularly because it follows a single guide line throughout and never loses sight of the overall aspect of the phenomena studied, even though it gives comprehensive calculations. Accordingly, each chapter opens with an abstract. The author gathers together in his text ideas and techniques from many fields of mathematics and physics ; the mathematical forms used (vectors, matrixes, tensors) also make the description of the problems clear.

To sum up, this is a basic handbook for anyone working on ionized media. It forms a coherent whole, the quoting of references always being subordinated to the clarity of the text, and an ample bibliography is given at the end of each chapter.

This handsome 690-page book finishes with a set of problems on each subject.

M.P.

L'électronique dans les appareils de contrôle nucléaire (Electronics in nuclear control equipment), **Vol. 1,** by G. Nicolo (Paris, Éditions Eyrolles, 1963 ; 110 Fr.).

That first impressions do count is true even of a book, and in this case one's apprehension after the first glance is amply justified. The book is ostensibly destined to enlarge the gallery of practical handbooks on electronic equipment ;

SOLUTIONS TO ' PUZZLE PHOTOS

1. This is a highly polished metal torus intended to cap a condensor, charged to 300 000 volts, so as to reduce the discharge of electricity into the surrounding air. It was manufactured in the main workshop and is used by the linac group of the proton synchrotron.

2. This is not used for physics ; it is a ' Remy ' rake known as the ' sun '. Photographed here in its raised position, it is one of the more modest pieces of equipment at CERN, and although its aerial appearance reminds one of a group of spiders it is on the ground that it comes into its own. Attached to a tractor, its task is to rake up the cuttings from those areas of the site given over to grassland. Robust and easy to handle, it enables the work to be carried out in difficult, even-acrobatic positions (such as on ' Mount Citron ' and the mounds of the PS ring), and it holds a leading position among the garden staff's tools.

3. Although some people might think this is a scientific musical instrument, it is in fact the 'rapid beam deflector' destined for use in the synchrotron early in the new year. A pulse of electric current in these two coils will cause the accelerated proton beam to be deflected, in a horizontal plane, so as to impinge on a target further round the ring for a controlled period of time, normally 200 microseconds. At the end of this time the rest of the beam will resume its normal circulation and can be used for the bombardment of other targets. The deflector was made under the direction of the linac group in the workshop of the mechanical section of the MPS Division (formerly the workshop of the apparatus layout group). Tightening up the nuts in this photograph is André Gailloud.

4. This doesn't help to drive the synchro-cyclotron, but was used to transport radioactive atoms from the target position near the accelerator to the detecting position outside the shielding wall. The belt was made of polyethylene, a compound containing only hydrogen and carbon. Bombardment of this by the external proton beam of the synchro-cyclotron produced radioactive boron-8, which decays by emitting a positron, half of the atoms present at a given time disintegrating in 0.7 second. The boron atoms were carried by the belt at about 100 km/hour through the shielding wall into the proton room, where the positrons were guided magnetically into a 'polarimeter' which measured their state of polarization. Discussing the arrangement with a visitor (left) in this picture is L. Dick.

5. Earlier this year an experiment performed at the synchrotron gave new information on the unstable excited states of the proton. Polyethylene targets inside the accelerator were bombarded by the proton beam, and scattered protons and deuterons produced in the interactions were investigated with a high-resolution ' spectrometer '. The five objects to the left of this picture are scintillation counters forming part of this spectrometer. They detected particles coming from the target situated 80 metres away, at the other end of an evacuated pipe which can also be seen here. The apparatus was set up in the East hall, in a long ' corridor ' formed of concrete shielding blocks.

6. No connexion with photo no. 2, this many-legged octopus, tended by Mario Grossi, is actually a pile of three ' pancakes ' destined for a d.c. electromagnet under construction in NPA Division. Two more pancakes can be seen in the background. The magnet will produce a field of 100 000 gauss and will be used for testing the properties of superconducting samples. Each pancake is made of rectangular-section hollow conductor, 8.5 mm x 5.5 mm, spirally wound and cast in epoxy resin ; it is so arranged that there are 12 parallel water circuits for cooling, but one continuous electrical circuit as in a simple coil. The complete magnet contains eleven pancakes mounted in an iron yoke.

7. Neither genuine frost nor the decoration of the tools by artificial snow for Christmas, but the machining in the main workshop of a plexiglas light guide for a scintillation counter. Such a light guide is used to connect a flat sheet of plastic scintillator to the circular face of a photomultiplier. Its special shape is carefully calculated and manufactured to ensure that a maximum amount of light is transferred from the rectangular top face to the circular bottom one, thus enabling the light produced in the scintillator by energetic particles to be detected and transformed into electrical signals by the photomultiplier.

8. This is not quite as mysterious as it looks ; simply G. Fidecaro with part of the equipment for an experiment on the polarization of the neutral sigma particle, viewed through the plexiglas lens 1.4 metres in diameter. Five spark chambers detected particles arising from the production of the sigma particles in a hydrogen target. Plane mirrors and the lens enabled a camera, placed 10-metres away at the focus of the lens, to ' look ' horizontally and vertically along every gap of each spark chamber, and photograph the sparks. A 1-ton cast-iron base, accurately flat to 0.05 mm, enabled the apparatus to be set up accurately, and a grid of fine lines (barely visible in this illustration) allowed the positions of the tracks to be measured accurately from the photographs. The grid was drawn on a sheet of glass, rather bigger than the lens, with the aid of a dentists' high-speed turbine drill. Both this and the lens are further examples of the precision work regularly done in CERN's main workshop.

however well-intentioned the author may have been, the present reviewer can only shake his head sadly and say jolly good show, better luck next time.

The first chapter is devoted to a brief résumé of the elements of nuclear physics. On the first page we are duly informed that helium consists of atoms weighing 6.65×10^{-27} kg and measuring some 1.86×10^{-10} m in diameter. Curious, but correct, we say; the author has evidently chosen this oblique way of indicating to the reader that he proposes to use the MKS system of units. On the next page, presumably to avoid monotony, pressures are given in millimetres and volumes are measured in litres ; our knowledge is considerably widened by being told that Planck's constant has the value 6.623×10^{-3} joule *per* second... Poor Plak or Plank takes more hammering later on.

Lest the reviewer be accused of meanness in picking on such trifling slips of the pen, let him assure the reader that the next 500-odd pages are a proof-reader's paradise. Systems of units are happily mixed with errors of fact. The spelling of proper names is left to the mercy of the author's whims ; formulae and sometimes equations, if not misprinted or inverted, may not bear much relation to the text, or vice versa. With the exception of a few instances distributed throughout the book at random, the lack of a legend to describe a diagram is a constant source of annoyance. The printer, too, seems to bear a grudge against the reader: at least he could not make up his mind in which type to set the book. The reviewer noticed that no less than six different fonts were used, excluding, of course, the (otherwise excellent) tables which themselves have undergone a species of offset process guaranteeing maximum illegibility.

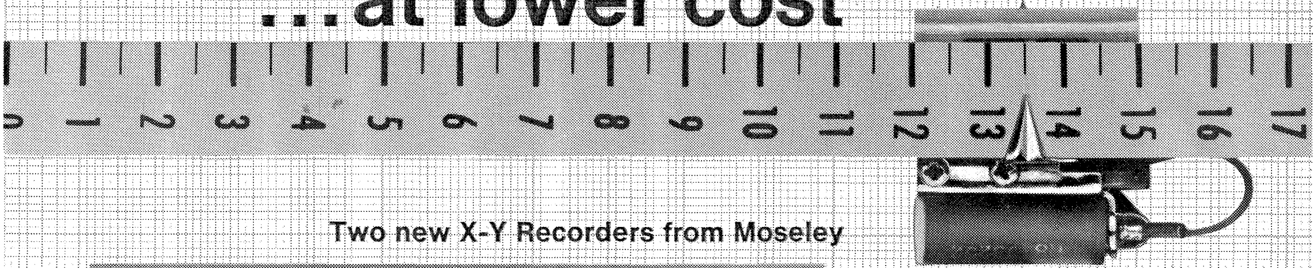
On the credit side, let it be said that the author has produced a mine of information of a rather ingenious kind for those who are patient enough to dig for it. The tables and diagrams, the curves and circuits, even if they suffer from the disadvantages mentioned above, are very good indeed. The author has spared himself no trouble to select unusual examples, drawn widely from nuclear engineering, to emphasize the points he wishes to make. The general arrangement of the book is sensible too : the introductory chapter, particle detectors, general circuits, stabilized sources of voltage and current for filaments and high tension, linear and logarithmic circuits, semiconductors (a chapter which errs on the side of brevity) and finally radiation effects. In view of its limited scope this last chapter could well have been omitted and the discussion on semiconductors enlarged.

For a book intended partially as a work of reference the index is painfully brief. Or is the reader of a book on electronics not supposed to look up entries in the index on the diode, triode, pentode, transistor or stability ? Surely a detailed index which includes an index of the useful tables and curves is not a luxury ? To give the author his due, his bibliography (after each chapter, unnumbered and not cross-referenced of course) is well chosen and representative of the subject.

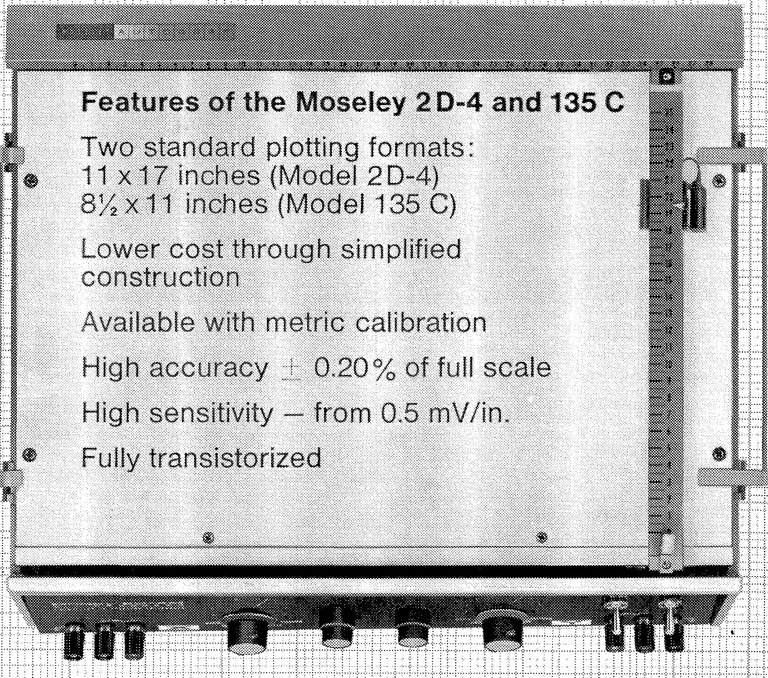
It behoves not this reviewer to condemn too widely, but in his opinion the author has not been served well by his publisher. To ask, for this untidy and careless collection of obviously badly edited lecture notes and facts, such a wickedly inflated price is an impertinence. Let us hope that the author and publisher will get together for an amended second edition sporting a more reasonable price tag — then, we would suggest, they will attract the buyers.

St. L.

accurate X-Y plotting...
...at lower cost



Two new X-Y Recorders from Moseley



Features of the Moseley 2D-4 and 135 C

Two standard plotting formats:
11 x 17 inches (Model 2D-4)
8½ x 11 inches (Model 135 C)

Lower cost through simplified construction

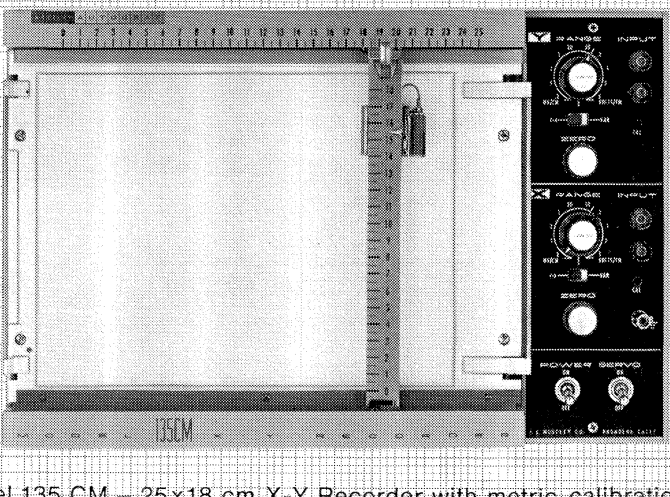
Available with metric calibration

High accuracy ± 0.20% of full scale

High sensitivity – from 0.5 mV/in.

Fully transistorized

Model 2D-4M – 38x25 cm X-Y Recorder with metric calibration



Model 135 CM – 25x18 cm X-Y Recorder with metric calibration

Brief specifications:

(Same for 2D-4 and 135 C except when noted)
Writing area:
Model 2D-4 11x17 inches
Model 135C 8½ x 11 inches
Input ranges (X and Y): ten ranges, 0.5 mV/in. – 50 V/in. with vernier.
Accuracy: ± 0,1% of full scale on 0.5 mV/in. range.
Input resistance: 200 k Ohms per volt full scale.
Common mode rejection: 120 db at DC
Writing speed: 15 in./sec maximum, each axis.
Prices:
2D-4: Fr. 6900.- 135C: Fr. 5505.-
(no additional cost for metric calibration)

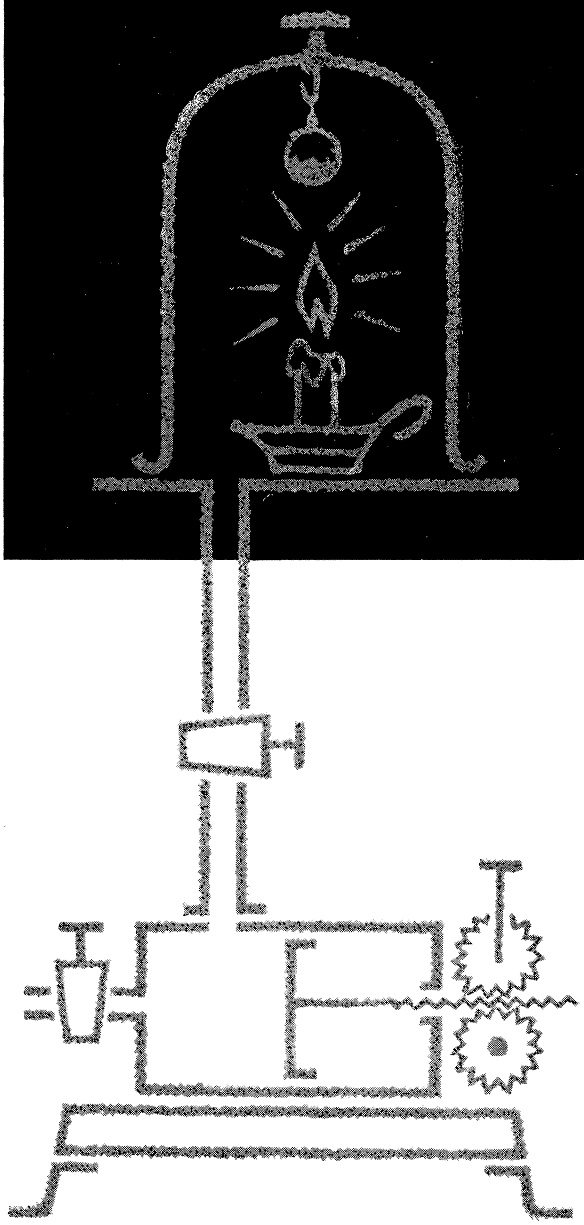
Other Moseley Recorders (most available with metric calibration at no extra cost):
A complete series of X-Y and strip chart recorders is available from Moseley. Additional features in other Moseley recorders are built-in time base, higher accuracy and faster recording speeds. Useful recording accessories from Moseley include: wave form translators for oscilloscopes, character printers, AC-DC converters and roll chart devices.

HEWLETT-PACKARD

For information, contact your hp distributor

INGENIEURBÜRO M.P. FREY

WANKDORFFELDSTRASSE 66, BERNE
TELEPHONE (031) 42 00 78



Modern High Vacuum Coating Units

Invisible in every BALZERS Coating Unit are years of experience of engineers and physicists, obtained in research and production of thin films. It is because of these hidden assets that BALZERS Coating Units are as good as they are. Your investment in a BALZERS Coating Unit is money well spent, especially if linked with the advantageous periodical service scheme which BALZERS operate.

BALZERS

BALZERS AKTIENGESELLSCHAFT FÜR HOCHVAKUUMTECHNIK UND DÜNNE SCHICHTEN

BALZERS, PRINCIPALITY OF LIECHTENSTEIN