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The Beehive Accelerator

F M Russell

Any study of particle accelerators shows that a remarkable, even startling, increase of the final energy to which particles can be accelerated has taken place during the short history of these machines. In evolving from the apparatus used by Sir John Cockroft in 1932 to the synchrotrons at CERN and Brookhaven, the energy has increased by 50,000 times. Highly energetic particles, however, are not in themselves unique, since Nature provides us with protons in the form of cosmic rays which are at least one hundred million times as energetic as those produced in our laboratories. The significance of these machines is that they produce large numbers of energetic particles at a time and place suitable for experiments to be performed.

Following the attainment of a given energy it has been customary and profitable in the past to search for ways to increase the number of particles accelerated. The need for increased yields of particles has, in fact, played a major part in determining the past course of the National Institute. The proton linear accelerator was selected since it would give an exciting 100 fold increase in intensity over the older synchrocyclotrons and NIMROD was designed from the start as a high intensity machine. In the same view, the variable energy cyclotron owes much of its potential usefulness to the high beam currents which are confidently anticipated.

A related subject of considerable importance to the experimental physicists using an accelerator is that of the 'duty-factor' of the beam issuing from the machine. In many experiments a machine with a 100% duty factor, that is, continuously on duty providing a beam, is required. This consideration influenced the choice of the V.E.C. and initiated the superconducting linac work sponsored by the Rutherford Laboratory.

It might be concluded from the preceding remarks that the policy of the Institute in the past has not been to gamble upon some spectacular success but rather to develop machines which are reliable and aim at achieving a copious supply of particles.

THE "BEEHIVE" ACCELERATOR – cont'd.

The factors which limit the intensity of the beams available from existing machines have been discussed in earlier editions of ORBIT. The chief limitation is the pulsed nature of operation. Although an unfortunate economic necessity in the case of the P.L.A., the pulsed nature is inherent in the principle of operation in such machines as NIMROD and the CERN proton synchrotron. Interest in machines of various types capable of supplying very high intensities has steadily grown over the last few years, principally with two applications in mind. They could be used as an injector for a very large, high energy machine such as is currently being studied independently in Europe, U.S.A. and Russia, or used directly for producing secondary particles, in particular the various mesons. One of these machines is known vulgarly as a "beehive".

The underlying idea of the beehive accelerator is the tailoring of a machine to the exact needs of the beam at all energies. This is achieved by separating the circular orbits in space so that the particles follow a path resembling a spiral helix. A good analogy is provided by imagining a beehive about which a coil of rope has been closely wrapped; the rope representing the evacuated pipe through which the particles are accelerated. Starting near the apex of the hive the particles are accelerated by repeatedly passing through electric fields produced inside cavities. These cavity resonators are spaced regularly around the hive – rather like one tier of a bunch of bananas hung over the beehive. (Certain slick city-dwellers have, in the past, had some difficulty with these analogies!) The increase in radius of successive orbits is a result of the steady increase in energy of the particles and the imposed condition of a constant period of rotation. A direct result of the fixed rotation period is that the frequency of the radio frequency is also fixed.

Since the particles pass any chosen point along the flight path only once during the entire process of acceleration, the magnetic field used to bend and guide the particles can be adjusted at each point to the desired strength and shape. This brings three important consequences. First, the magnetic field does not change with time; secondly, the principle of strong-focusing can be used to stabilise the particles in flight and confine them to the desired flight path; thirdly, the various resonances leading to instability of particle motion usually associated with machines using strong-focusing are eliminated.

The beehive accelerator has a fixed accelerating voltage frequency and fixed magnetic field and therefore it could be worked continuously. It can be shown also that the machine exhibits phase-stability of particle motion at all energies of the particles. Particles could be extracted from the machine at suitable points by the simple expedient of magnetically bending them out of the flight tube with an extraction efficiency of 100%.

The above description of the properties of a beehive accelerator could almost have been taken from an article describing a linear accelerator. Indeed, from the point of view of the beams obtainable from the two types of machine there is little or no difference. What, then, are the differences? Naturally, one very obvious difference is in the shape and size of the machine and its building; the beehive, being much more compact. The process of tank 'flattening' in linear machines is replaced by adjustment of the magnetic field in the beehive. The most significant difference, however, in in the amount of power used in feeding the cavity resonators, the beehive using less than one tenth of the power required by comparable linac. Secondary factors such as a smaller total volume under vacuum, the lower vacuum which could be tolerated and the reduced volume of machine to be enclosed by radiation shielding favour the beehive.

The close similarity to the linac is of use in estimating the maximum number of particles, upwards of 10^{17} protons per second, which could be contained and accelerated in this machine. In fact, it appears that the potential tools are now too good for the workmen! The question of whether such large numbers of particles are currently needed in research programmes must be, and is being, argued elsewhere. It is sufficient for the Institute to show that such a machine could be built now using only proven theories and techniques.

On a more tentative note, it is perhaps worth pointing out that the ideas motivating the superconducting linac project, principally the possibility of greatly reduced radio frequency power losses in the cavities, are equally applicable to a beehive type of machine. In particular, the more compact arrangement of the hive makes the problem of cooling the machine less formidable than in the corresponding linac case.

In conclusion it can be said that the ground work is now being laid for a new class of super high intensity accelerators of very high efficiency. As to when and where these ideas will crystallise into a real machine are not yet known but the efforts of various research groups, especially that at Oak Ridge, Tennessee, should cast some light onto this point.

An issue of a Japanese journal "Science Reports of the Society for the Research of Physics-Chemistry : Formerly 'Theoretical Chemistry' : Journal of Theoretical Science" has come to our attention. The chief editor is Mizuho Odagiri and the issue (Vol.VIII No.1) consisted of three articles by Mizuho Odagiri, Mizuho Odagiri and Hiroshi Ohno. Mizuho Odagiri's first article opens with the sentence "I have been framing a theoretical system named 'The Theory of Predialectic Superposition of Prestates' by me. Ref. 1 to 61." The list of 61 references were 61 papers by Mizuho Odagiri. Mizuho Odagiri's second article had 62 references .....

The European High Energy Physics Programme

The Annual Report of the Advisory Council on Scientific Policy, 1962–1963, was published on 31st October. Section II deals with 'The European High Energy Physics Programme' and has such important implications for the National Institute for Research in Nuclear Science that we are reproducing it in full.

Since it takes some 7 to 10 years to build a large accelerator, European physicists have for some time been considering what proposals they should put forward for the new machines to come into operation in the early seventies. A working party under Professor Amaldi has proposed a new proton synchrotron of up to 300 GeV, i.e. roughly ten times the energy of the present CERN machine, on the grounds that this is the order of increase necessary to enable the next significant step forward to be taken in exploring the laws of physics and the structure of matter at minute distances, i.e. below 10^{-14} cms. Preliminary studies of the design parameters and economics suggest that a machine of about this size would be the optimum and, as far as can be foreseen, could be built without running into any insuperable new engineering or physics problems.

It is also proposed that additional "storage rings" should be added to the existing CERN machine. This complementary project would provide a tool for the exploration of very high energies without duplicating the range of experimental possibilities for which the proposed proton synchrotron is required. The storage rings would provide a very useful window into a world of much higher energies than is yet accessible from any conventional accelerator.

The Cost of the European Proposals

The European working party proposed, as a first step, that design studies of the above two projects should be undertaken by CERN in 1964 at a cost of some £320,000. Meanwhile, the working party estimated the cost of the storage rings to be £21 million over the six years of the construction period, and the cost of the 300 GeV machine at about £120 million over an 8½ year construction period. The running costs are estimated at about £4 million in the first operating year for the storage rings, increasing thereafter by about 10 per cent per annum. The running costs for the 300 GeV machine are estimated at about £20 million in the first operating year, again increasing thereafter by about 10 per cent per annum. These estimates take account of experience in CERN and similar laboratories, but they may be subject to fairly considerable errors, particularly in respect of the 300 GeV machine, of which the cost estimates must be conjectural until the proposed design studies have been carried out.

The capital costs of the existing installation at CERN have amounted to over £20 million and the current annual running costs are about £8 million. The U K contribution has been just under 25 per cent. The proposals now put forward would represent a very substantial increase in the scale of international expenditure on research in this field. If the U.K. participated, our share of the cost would depend on which other countries also participated, but it would in any event result in a very substantial increase in the U.K. expenditure on high energy physics and this might be expected to require the allocation to that research of a higher proportion of the total funds available for scientific research.

It was against this background that we were invited, during the course of the year, to advise the Minister for Science on the attitude which the United Kingdom should take to these proposals. We had before us a report on the proposals from a representative body of nuclear physicists, under the chairmanship of Professor Flowers, set up by the Joint Consultative Panel for Nuclear Research of D.S.I.R. and NIRNS.

The DSIR/NIRNS Report

In their report, the DSIR/NIRNS working group based the case for supporting the new proposals on their belief, which we do not dispute, that physics is today on the threshold of far-reaching developments which will come to fruition with a new theory of the nature of matter and of its fundamental interactions, and that either at this stage or the one beyond, gravitation, the creation of matter, and the problems of cosmology are likely to be unified with high energy physics. As the working group say, at the present time we have, or shall shortly have, national facilities for high energy physics which are bettered only by those of the United States of America, while our share in CERN gives us opportunities which are second to none.

Already the effects of CERN and NIRNS are being felt, and physicists are beginning to return from the United States of America to make use of what has been provided at home, many of them of the highest ability. The working group draw attention to the risk that this process might be reversed, and a fresh wave of emigration created, if the United Kingdom were not to join in the proposed European developments. They conclude by recommending that the United Kingdom should continue to play a full part in European collaboration in high energy physics, and that it should be prepared to agree to a substantial enlargement of the existing programme in order to achieve significantly higher energies along the lines proposed. They make the further point that high energy physics

THE EUROPEAN HIGH ENERGY PHYSICS PROGRAMME – cont'd.

provides an excellent training ground in the most advanced techniques of vacuum engineering, high power electronics, and automatic data processing.

There is no reason to doubt the validity of the scientific case presented by the working group for this new step forward to higher energies in the field of nuclear physics, nor to question its interest and importance from the standpoint of pure science. In relation to our general level of expenditure on scientific research, however, its cost is very high and raises serious issues of priorities. The Council has, therefore, considered these proposals in relation to our general level of expenditure on scientific research.

A very large slice of a rather small cake

Nuclear physics is only a part of science, although it accounts for a disproportionate amount of our total expenditure on scientific research. It is much more expensive than most other types of scientific work, but, as the Council has repeatedly stressed, our expenditure on the rest of scientific research is too low. There is a widespread feeling of discontent among academic scientists at this state of affairs, and an impression that nuclear physics is already getting a very large slice of a rather small cake, despite the fact that the results to be obtained from it are likely to be of much less immediate practical importance than those from many other types of research.

The Advisory Council has seen forecast figures of expenditure for the Research Councils and the Atomic Energy Authority; for the Councils, these increase at an annual rate rather in excess of 10 per cent. There remains, independent of this, a serious deficiency in provision for universities and—unless something is done to meet the requirements of general scientific research in the universities by supplementing departmental research budgets, by increasing the supply of technical assistance of all grades and by creating more senior posts—an increase in expenditure on nuclear physics, on the scale which might well be involved in the proposals discussed above, would be unjustifiable and would also arouse considerable resentment among scientists at large. Hence, good as the research proposals in nuclear physics may be, the Council does not feel that the expenditure necessary for them would be justified unless Government is prepared to provide the relatively small sum needed to satisfy these legitimate needs of the rest of scientific research in universities. The satisfaction of these needs should have the highest priority.

Over and above the question of expenditure on nuclear physics in relation to that on pure science in general, there is also the very difficult question of its relation to expenditure on long-range technologically-oriented work with clearly defined economic objectives, e.g. in the power field. This question is, of course, much more economic and political than scientific, but the Council is seeking to make some appraisal of its scientific aspects.

Need for International Co-operation

It is understood that the United States is also planning for a 150–300 GeV machine and may also have a storage ring project, and similar schemes may well be mooted in Russia. This brings into sharp relief the urgent need for international co-operation on a world scale in areas of research such as nuclear physics and space, where extremely high and increasing expenditure is involved. It is obviously important that we should seek to extend the boundaries of human knowledge by working in such fields, but in a world where so much remains to be done in the application of science to human betterment, every effort must be made to see that such large sums are not expended on a purely national, or even on a continental, basis, especially where the primary motives are those of national prestige or aggrandisement.

To avoid duplication of effort and misuse of money and scientific manpower, every effort should be made by Governments first to co-ordinate efforts in nuclear physics and to seek full international co-operation now, before beginning the construction of a 300 GeV machine. The need to co-operate now is the more urgent since machines of even higher energy will assuredly be demanded in a few years' time.

The Accelerator World

The electron synchrotron under construction at Hamburg (the Deutsches Elektronen Synchrotron, DESY) will cost about 110 million German marks (one German mark is about 1s.9d.), which is 50 million more than the original estimate. The Hamburg Senate presented a report to the Hamburg State Council maintaining that developments in high energy physics have made many modifications and additions necessary. The output energy originally set at 6 GeV is now quoted at 7.5 GeV and the first beams are predicted for mid 1964.

The highest energy linear accelerator in the world is undergoing commissioning at Kharkov in Russia. The accelerator is a 2 GeV electron machine powered by 50 klystrons each delivering 20 Megawatts and is one of the projects at the Kharkov Physico-Technical Institute in the Ukraine. The Institute also has linear accelerators yielding 20 MeV protons, 3, 30 and 90 MeV electrons and heavy ions. It was here that Dr. Kurchatev began his research work which led to the Russian hydrogen bomb.

THE ACCELERATOR WORLD – cont'd

The Dutch firm, Philips, which has an annual budget of £36 million devoted to research, is making a commercial success of selling cyclotrons. Their cyclotron 'produces an intense, continuous beam of high energy particles and is relatively compact'. A number of their machines have been supplied to University Departments in Europe at a cost of about £500,000 and with a construction time of 18 months to two years. A section of the new research centre at Eindhoven already has enough orders for the cyclotrons to keep it busy for four years and they claim that the high development costs have already been recovered.

Construction of a 5 MeV electrostatic generator for use in low-energy physics experiments was recently completed at the Dubna Institute for Nuclear Research in Russia.

A cyclotron known as the 'neutron radiation facility' is under construction at the US Naval Radiological Defence Laboratory in California, USA. The machine which will be used mainly for neutron damage studies is expected to come into operation in 1963 and construction costs are estimated at $3 million.

Construction work began on the site of the Daresbury Nuclear Physics Laboratory in the second week of November.

Discovery of the Anti Xi Zero

A paper in the August 15th issue of Physical Review Letters announced the identification of an elementary particle, the anti xi zero, for the first time. This particle was predicted some years ago and the final identification, which took place at the Brookhaven National Laboratory in America, completes the list of elementary particles – all the particles in the groups now known have been identified by experiment.

A separated beam of antiprotons with an energy of 3.7 GeV was achieved from the Brookhaven 33 GeV AGS and a joint team from Brookhaven and Yale University obtained 300,000 photographs of the interactions of this beam with the protons in a 20 inch hydrogen bubble chamber. The anti xi zero, produced when an antiproton and a proton annihilate, leaves no track in a bubble chamber, nor do the anti lambda zero or the pi zero into which it decays. Three photographs however showed the positive pion and the antiproton from the decay of the anti lambda zero and measurements on their tracks established the chain of events involving the anti xi zero.

Nobel Prize

The Nobel Prize for Physics awards were announced on 4th November and included the first woman scientist to share a Nobel Prize since Madam Curie, the discoverer of radium, sixty years ago in 1903. She is Professor Maria Geoppert-Mayer of California University who shares half the prize (about £18,000) with Professor Hans Jensen of Heidelberg University for their work on nuclear shell structure. The other half of the prize goes to Professor Eugene Wigner of Princeton University for his contributions to the theory of the atomic nucleus and elementary particles.

CERN PS

The slow extraction system was successfully commissioned on the CERN proton synchrotron in August. Targets external to the machine can now be exposed to a proton beam for up to 20 milliseconds. (The fast extraction system which came into use several months ago bombards the target for 2 microseconds).

The synchrotron continues to operate very satisfactorily and new records for the beam intensity have been set up. Currents of over 60 milliamps have been injected into the ring from the linac and for one period of 100 pulses, the average accelerated beam intensity, with an energy of 24.8 GeV was 8.3×10^{11} protons per pulse. The highest single pulse was 9.06×10^{11}.

(CERN COURIER)

CERN Neutrino Results

The first detailed results of the neutrino experiments which began on the CERN proton synchrotron in July were announced at the International Conference on Elementary Particles held at Sienna, Italy in October.

The experiments were suggested by Pontecorvo in Russia and Schwartz in America and were first carried out at the Brookhaven National Laboratory in the USA. These first investigations, reported in July 1962 indicated that the neutrino which is produced when a pion decays into a muon (μ) is not the same as the neutrino produced in 'beta decay' when a neutron decays into a proton and an electron (e). The two types of neutrino are represented by the symbols ν_μ and ν_e.

Compared with the original Brookhaven work, CERN concentrated on improving the techniques used in the investigation. A 25 GeV beam was extracted from the synchrotron with high efficiency and, in collision with an external target, produced a beam of pions which was focused by a 'magnetic horn'. As the pions decayed a stream of neutrinos

THE ACCELERATOR WORLD – cont'd

were produced. Two methods of detection were used – a heavy liquid bubble chamber operating in a magnetic field of 27,000 gauss (which produced the first ever bubble chamber photographs of neutrino interactions) and a large spark chamber which weighed some 20 tons.

The results of the experiments confirmed the previous Brookhaven investigation, that there are in fact two types of neutrino, and were based on a much larger amount of data. The relation between the energy of the neutrino and the probability of it producing interactions proved to be in very good agreement with the theoretical predictions. The most interesting new information has not yet emerged from the analysis of the data, but before long some pronouncement should be possible on the existence of the 'intermediate boson' or 'W-particle' – an elementary particle long predicted by theory but so far undetected in experiment.

Et tu Brute

Since we are so ready to pick up errors in other journals and newspapers we must be all the more ready to eat humble pie when we make a mistake. In the October issue under 'The Accelerator World' we announced that the first cyclotron for a hospital is now being built in America and that the second cyclotron likely to come into use in a hospital is scheduled for the Hammersmith Hospital, London.

In fact the Hammersmith cyclotron was commissioned as long ago as 1957 (see Proc. I.E.E., Sept. 1957, 'A Cyclotron for Medical Research'). This Medical Research Council fixed frequency cyclotron is used for research in radiotherapy, radiology and for the production of isotopes for diagnostic, therapeutic and medical research. It is designed to produce a 15 MeV, 200 μA external beam of deuterons.

The Scientific Salesmen

A Sunday newspaper recently carried an ad. for "an ambitious, dynamic young executive to train in the Scientific Sales Department of a large International Organisation".

Now just what is it that these people sell? Of course they could be just scientific instrument makers, but all this talk about "Dynamic Executives" and "International Organisations" . . . . . Could it be that the salesmen have challenged that hitherto impregnable bastion of propriety "The Reputable Scientific Journal" . . . . . Have they risen up against Nature itself . . . . . Worse still, could they be selling "Scientific Results?" . . . . . .

SCENE: The Boss's office in the Executive Suite of a large advertising agency. The Boss sits in a very large, expensively upholstered swivel chair behind a vast expanse of desk. He is a small, wiry man in his early forties. A young man enters and begins the long walk to the desk. He is tall, serious looking, with dark crew-cut hair and large spectacles. The Boss stares at him until he has reached the desk, motions him to a chair and then speaks, his voice sometimes rising abruptly to a shout - - - - - -

"Now see here Brubeck we need a little more zippy merchandising on this new account. This new business needs a fire ball and I'm putting you on it. I just fired Ernie Rutherford so *THIS IS YOUR BIG CHANCE.*"

"Yes Sir. thank you and I really appreciate your confidence in me."

"Good. (thinks: Where did we pick up this guy. he don't even speak English) Now I wanna give you a fast run down on this account. I just been round our client's research establishments and found some pretty screwball things. Took me a long time to find

out what the product was but I finally got the picture – their product is science. I don't mean missiles or satelites or radar, it's – er – well it's just plain *SCIENCE. BRUBECK SCIENCE – GET IT?* Kept saying they produced scientific results. But make no mistake about it, son, this is big business – their budgets run into millions and they got some pretty complicated hardware. Showed me a thing they called a bubble chamber – the names these guys choose! Absolutely no conception of the importance of names! Now what do the words "bubble chamber" mean to you, Brubeck, what images gell?"

"Bubble chamber – hmm – well Sir, I think I can get some nourishment from that – just thinking aloud as it were – yes, yes I see an airy sunlit room – wall to wall carpet – a few of those big soft cuddly toys in the background – sitting on the carpet is a beautiful golden-haired child – it's blowing bubbles from a clay pipe, great iridescent bubbles which float right up to the ceiling – yes this is terrific! – it's as if it can see its whole future in those bubbles – perhaps we could have the new convertible in one bubble and the new square-line fridge in another – just faintly you see – our new colour process would do that beautifully – – –"

"*OK, BRUBECK, OK CUT IT OUT.* Sure you were great on the Happy Sunshine Homes account, but you're off that now so forget it. This here bubble chamber is a scientific gadget and it photographs tracks of fundamental particles – or something. Say, some of those pictures are impressive – can't see why right now – if the colour were handled right we could do something with them. They told me their chamber was the best in the world. 'Who have you told about it?' I say, 'We're going to publish the results in the Proceedings of the Royal Society', they say, 'Never heard of it', I say, 'What's its circulation?' . . . . . What do you think they said, Brubeck, *WHAT DID THOSE GUYS SAY?*"

"They didn't know Sir."

"*WHY THEY SAID THEY DIDN'T KNO- – –* Say. that's right Brubeck that's very smart. (thinks : I'll have to watch this boy). They must be crazy, using a medium without even knowing the circulation! Who ever heard of this crummy magazine anyway? Another thing I found out is that this gadget has been working for over a year. A year and no publicity! If this business had been with us we should have had a campaign going a year *BEFORE* the thing was finished. Just think of it; it's like maybe General Motors spending ten million on a new model and then just asking a few people what they think about it! Why, those people might not like it – we can't run risks like that in big business! *IT'S OUR JOB TO TELL PEOPLE WHAT THEY LIKE, BRUBECK.* We have to re-orientate this entire thing publicitywise. How much do you think they spend on advertising out of six million a year. *HOW MUCH, BRUBECK?*"

"Nothing Sir."

"*WHY, THEY SPEND ABSOLUTELY NOTH- – – –* Right again Brubeck. (thinks : My ulcer is coming on again. If he takes my punch line just once more, he's back to the general office). Now, where they've specified items of hardware, I think we should go for the hard sell; for instance I got our research boys to give me a fast run through on bubble chambers and I figure we should have whole page ads. in all the big dailies to start with. Something on these lines – British Bubble Chambers (B.B.C. – reliability image, get it?) are

FOUR WAYS BETTER, BUY THE NEW B.B.C. WITH FOUR NEW WONDERFUL FEATURES:-

ONE – FORTY HUGE INCHES OF ACTIVE VOLUME.
TWO – SUPER COLD LIQUID HYDROGEN..
THREE – FASTER CYCLING.
FOUR – FABULOUS NEW RANGE OF ACCESSORIES.

Just a suggestion of course. Now we got to sell the science as well and this looks like a tough one. I play these things by the seat of my pants and I figure that the big idea here is power. *YES SIR, POWER IS THE BIG IDEA!* In the modern world, science means power – influence, prestige, status, glamour – *THE REALLY IMPORTANT THINGS BRUBECK, GET IT?* Look at de Gaulle, he's got the message! *SCIENCE IS POWER!* I think the psychology boys will go along with that line Brubeck."

"Yes indeed Sir, very Adlerian, if I may say so."

"Adlerian? – er, oh yeah, – – *OF COURSE IT'S ADLERIAN BRUBECK, WHAT HAVE I JUST BEEN SAYING?*"

"I wonder Sir – I agree with you absolutely of course and this is just a tentative suggestion I'm throwing in – I wonder if we should go just a teeny weeny bit Freudian on this one?"

"Maybe. (thinks : Freudian? Freudian? Now who the hell was he?)"

"It seems to me Sir, that there's more than a hint of sex in all this science – this idea of conquest of nature for instance, and the desire for dominance and control. Then again, many scientists have described the actual experience of making an important discovery in explicitly sexual terms – 'like being in love' they say."

"*RUBBISH!* That's power you just been talking about, *POWER!* What do you want to do, show pictures of a bubble chamber with some cheesecake?"

"Well Sir that would be a little crude, I feel – – –"

"*IT WOULD BE BAD ADVERTISING!* You can sell a lot of things with a nice dame. but not this. (thinks : This boy's a nut case – what are we teaching them these days?) *WHAT ARE WE TEACHING THEM?*"

"I beg your pardon Sir?"

"Just thinking aloud Brubeck (thinks : My God I better take a pill – where are they, where are my pills?)"

"They're on the side of your desk Sir."

"What are?"

"Your pills "

"(thinks : Did I say that out loud again? I been overworking, that's it! Need a rest. This science thing is going to take it out of me, I just know it!)"

"Sir?"

"(thinks : Am I right about the power angle? I was so sure a few minutes ago. There could be a goldmine here but if I'm wrong we'll take a hell of a beating!)"

"er – Sir – ahem!"

"(thinks : Must get a grip on myself – can't loose my nerve at this stage. But the risks, the risks – it's frightening!)"

"Will that be all Sir?"

"*WHY, ARE YOU STILL HERE, BRUBECK? THIS SCIENCE ACCOUNT NEEDS A GO GETTER, A MAN WITH CONFIDENCE, A MAN WITH FAITH IN WHAT HE'S DOING! NOW GET OUT THERE AND SELL!*"

Letters to the Editor

Letters may be addressed to 'The Editor, ORBIT, Building R 1'. Pseudonyms are accepted provided the authors name is known to the Editor.

Sir,

One often hears the Charter cited as evidence for the belief that NIRNS exists to provide a service for the Universities. I have just been reading the Charter and I can find no justification for this extremely narrow concept of the functions of NIRNS.

The reasons why the Institute was set up are embodied in the Royal Charter in paragraph 4. Only the first four objects need concern us here :-

(a) To carry out research of any nature in connection with nuclear science or any matter related thereto.

(b) To provide, equip and operate facilities of any description which may, in the opinion of the Institute, be required for the purposes of any such research as aforesaid.

(c) Without prejudice to the generality of the foregoing, to provide, equip and operate, for common use by Universities and by other institutions and persons engaged in research in nuclear and related matters, facilities which by reason of their size or cost or otherwise howsoever are beyond the scope of individual Universities, institutions or persons as aforesaid.

(d) To permit and encourage scientists of Universities, Colleges and the United Kingdom Atomic Energy Authority and other institutions, as well as scientists of industrial laboratories, to make such use of facilities provided as aforesaid as the Institute may determine to be appropriate.

To me this says clearly that the Institute must do nuclear research, but also provided it does not interfere with this objective, allow Universities and other competent people to use its facilities. No distinction in order of importance is made between Universities, Colleges, the UKAEA, industrial laboratories and other institutions. In order to make the Charter mean that we exist to serve the Universities one must severely downgrade (a), ignore the first eight words of (c) and then insert some additional words which make it clear that (c) and (d) are the prime objects of the Institute and that the Universities have priority over other users.

The Charter doesn't say this and the reason cannot be that it is loosely worded. The very skilful lawyers who draft Acts of Parliament must always remember that when the Courts interpret an Act they will be concerned solely with the precise meaning of the words and not at all with the intentions of Parliament when the Act was passed. 'It is accordingly the duty of the draughtsmen of these authoratitive texts to try to imagine every possible combination of circumstances to which his words might apply and every conceivable misinterpretation that might be put on them and take precautions accordingly.' (Sir Ernest Gowers - 'The Complete Plain Words'). Clearly then, if serving the Universities was intended to be the main purpose of the Institute the Charter would have been written to make this indisputably clear.

Does it matter? Leaving aside discussion of the principle that it is the duty of public servants to carry out the wishes of Parliament, it matters because the Rutherford Laboratory would be transformed by a more precise interpretation of the Charter.

With the present policy, virtually the whole Laboratory will become the scientific equivalent of a service station with staff cast in the role of superior motor mechanics. But unless a sizeable section of the Laboratory is doing creative scientific work, the Laboratory will become a dull place staffed by dull people. On the other hand, if an attempt is made to build up a strong high energy physics group of international repute using permanent staff, we will attract and hold some of the best young physicists from the Universities. A fully integrated group such as this would not only have an electrifying effect on the intellectual atmosphere of the Laboratory but would surely use the accelerators in a much more efficient and sophisticated way than groups of transient visitors.

Perhaps this is too black and white. Nevertheless it is a fact that if a brilliant young nuclear physicist wants to work at the Rutherford Laboratory he can be offered a permanent post in supporting work such as data reduction or beam handling but he can only be offered a temporary post to do nuclear physics. That seems to me a quite extraordinary situation in an Institute for Research in Nuclear Science.

RHELIAN.

Sir,

In the Editorial Column of October's ORBIT you suggest that the Minister for Science should be a man with scientific training and then go on to deplore that the number of scientists willing to become involved in political life is very small.

It has been shown that the present trend (potent word, that) is to select a man and then if he doesn't happen to be an M.P. proceed to make him one. May I also suggest that the man required for this post, whilst from time to time he may be required to have his head in the clouds, must at all times have his feet planted firmly on the ground. An engineer in fact!

An engineer would be an excellent interpreter of what the scientist "is on about" to the matter of fact people who control the national purse. He has had something like a scientific training, indeed he is often more scientific in his approach to a problem than the scientist, who, let's face it, does from time to time jump to the wrong conclusion. Furthermore the engineer is concerned with doing things, not just talking or theorising about them.

Having attempted to broaden and improve your list of candidates for this key post, may I now criticise your publication. October's copy, the 16th issue is still woefully short of pictures and a decent layout. The brew is good but you are still offering it in a cup, slightly better than the original cracked

LETTERS TO THE EDITOR - cont'd

vessel, but a long way from a decent glass. or better still a pewter tankard.

What has happened to your Correspondence Column, it has shrunk to dismal proportions. Can it be that your readers are so settled and complacent in their gilded labs., workshops and offices that they prefer the easy and convenient to the difficult and challenging, but very much more stimulating, parry and thrust of a public forum - shades of Parkinson (!) and apologies to P. F. Smith.

E. G. HIGGINS.

The Rutherford Laboratory Dance

The Restaurant has been used for so many functions by now that it might be called a universal joint. On Friday 1st November it was the turn of the Rutherford Laboratory Dance and 400 people enjoyed an excellent evenings entertainment. For one person in particular the Dance was a real knock-out. The modest cost meant that probably for the first time at a Laboratory Dance a true cross-section of the Laboratory was present and the high proportion of young people made sure that the Dance was twice as lively for it. 'Dress Informal' also helped to set the scene; it certainly sounds more decent than 'Dress Optional' – the organisers obviously didn't want an out and out Bacchanalia.

A gentleman in a yellow bowler hat, initially mistaken for Acker Bilk, proved to be Win Spinks who acted as M.C. and a young lady on a swinging electronic organ, which nearly cost the Laboratory a fortune in windows, was the highlight of the Roger Alan band who provided the music. And the music. Really with it. No stately Gavottes from the dying days of the Hapsburg Empire but the Twist and occasionally something that might well have been a Mashed Potato.

As the band warmed up and the drink went down, the coloured lights circling the rotunda seemed to take on fresh sparkle. Conversation, that lost art of the T.V. age, flourished and the most dignified figures were seen to execute rhythmic contortions on the dance floor. Proof once again of the adage 'Alcohol in moderation is the lubricant of civilisation' (Pears Medical Journal 1954). One small way-out group were doing the Cavern Stomp to everything from the 'Gay Gordons' to 'She Loves You. Ye Ye Ye'. The Cavern Stomp evolved from an unfortunate incident in the Liverpool cellar club 'The Cavern' which was one of the first homes of the Mersey Beat movement. It is quite a small room and is usually thronged with Beatle worshippers. (Did you hear the radio interviewer ask a young girl queuing for Beatle tickets what the Beatles did to her? She said 'Oooh, I don't like to say on the radio'). One night, The Cavern was packed solid and a young girl really went Bingo on Ringo and threw a fit. Unable to move in the crowd she was held in the vertical position while the shakes played themselves out. Overcome with admiration for this new outlet for self-expression the whole audience took it up. A new dance form was born.

The traditional Restaurant queue formed when the Buffet, supplied by Staff Caterers Ltd. - the usual Restaurant catering firm, was announced and 500 sandwiches and 800 cakes went to join the drink. Some socially irresponsible person from among the other 399 people present had four cakes because I didn't see any.

Then the party hats came round. Type Coco the Clown went very well with a red nose and type Sheik of Arabi went very well on those who were fishing in the typing pool. A Twist contest was organised and was won by person or persons unknown who Twisted so much they drilled and tapped the dance floor and had to be removed by a screwdriver.

Finally let us record our thanks to the organisers - Normal Pickles, Bill Young, Frank Telling, Gordon Acaster, Harold Wright, Marion Roberts and Win Spinks; to Win Spinks again for his services as M.C.; to the doormen Jack Townsend and Les Skidmore; to Dorothy Belton who looked after the cloakroom and all others who helped to provide a most enjoyable evening for us all.

'DID YOU GET HIS NUMBER?'

Personnel News

Congratulations to—

Mike O'Connell, Beam Handling Group and his wife Joy on the birth of a son, David Michael, on 19th October.

Bill Langley, Beam Handling Group, on his marriage to Miss Barbara Town on 26th October.

Mike Audus, Bubble Chamber Group, has won the 1962 Television Prize awarded by the British Institution of Radio Engineers to the most outstanding candidate in the specialist subject of television in their Graduate Examination. The prize was awarded at the Annual General Meeting of the Institution on 27th November.

Comings and Goings

R. L. Conrod and Mrs. J. C. Conrod join the Atlas Laboratory.

W. J. Bridle, G. A. Collins and F. Knott join Central Engineering.

H. A. Davis joins Administration; R. Mavin joins Nimrod Engineering.

E. G. Auld and Dr. N. H. Lipmann join High Energy Physics; R. G. Cooper joins PLA Accelerator Physics.

P. J. Daly has completed his fixed term appointment.

Mrs. D. E. Jones has retired on medical grounds.

Mrs. E. M. Cowan, P. D. Morgan and E. J. Sewell have left us.

John Wilkins Prize

Dr. Pickavance, Director of the Rutherford Laboratory, presented the John Wilkins Prizes for 1963 at the Staff Meeting on 31st October.

The prize for the best craft apprentice went to Terence Christopher Adams, aged 17, who selected as his prize 'Machinery's Handbook.' His citation reads 'Adams is a first year apprentice and has proved to be most willing and conscientious during his training at Winfrith. He has a good practical record and in addition he was successful in his examinations in the first year of the Mechanical Engineering Technicians Course. These achievements are all the more creditable as he lost ten weeks at a critical period of the year as a result of a motor accident.'

The prize for the best scientific assistant was awarded to Geoffrey Alan Tomlin, aged 21, who chose 'Electronics' by Parker as his prize. His citation reads 'Tomlin joined Accelerator Division AERE in February 1959. He was transferred to NIRNS (Rutherford Laboratory, Magnet Group) in January 1961. He has H.N.C. A1 and is now on a Dip. Tech. (Electrical Engineering) Sandwich Course. His result at the end of the first year was described by the Head of the Department of Electrical Engineering and Physics at the Borough Polytechnic as 'excellent'. He was top of his class.'

Ted Higgins, Central Engineering, succeeds Frank Telling, Assistant to Chief Engineer, on the ORBIT Editorial Board.

During the first week of November a sum of money was found in the Laboratory Restaurant. Will the owner please contact Mr. Jenkins, R 20.

'GRAND XMAS DANCE'

Electrical and Mechanical Services have organised a Christmas Dance to take place on Friday 13th December, from 8.30 to 1.00 a.m., in the Restaurant. Music supplied by 'The Viscounts' : Buffet Supper ; Bar.

Tickets 8s.0d., including buffet, available from G. Acaster R 1, J. Lawler R 9, C. Daniel R 9, K. Freeston PLA, G. Hackett R 2.

WHY ARE WE ALRIGHT, JACK?

THE CURRENT ISSUE OF 'ENGINEERING' NOVEMBER 8TH, 1963 HAS AN ARTICLE (P.579) ENTITLED 'WHY ARE SALARIES HIGHER FOR ENGINEERS?'