19th Issue

# ORBIT

January 1964

The Journal of the Rutherford High Energy Laboratory

# The Nuclear and Radiochemistry Group

J G Cuninghame

Most of those working at the Rutherford Laboratory have seen the building with the decorative spiral staircase, whose double storey is tacked incongruously on to the single-storied sprawl of the P L A laboratories. Many probably know what sort of laboratories it houses, while a few courageous pioneers have even dared to set foot over the shoe-change barrier which separates the outside world from the imagined horrors which lurk inside it. The purpose of this article is to introduce the Nuclear and Radiochemistry Group and its Laboratory, Building R 34, to those in whom the word "chemistry" induces only incomprehension and ague.

The idea of extending the benefits which university physicists derive from the National Institute conception to chemists was sponsored by Dr G.H. Stafford. The Chemistry Division of A E R E. was asked at an early stage to advise on the design of the Laboratory and to agree to provide an experienced radiochemist who would carry on his own work in it once it was open, while still remaining on the Chemistry Division staff. He would act as the Laboratory Supervisor and would ensure the safe operation of a potentially dangerous building, while the Rutherford Laboratory provided the laboratory space and supplied all the equipment. The building was designed and built and, in December 1962, three nuclear chemists from A.E.R.E. moved in, closely followed by the first customer, who was a fixed term appointee from Oxford University.

At this point it is probably as well to define "nuclear chemistry" and "radiochemistry". There is disagreement among chemists as to what these names mean,some even holding that "nuclear chemist" is a contradiction in terms since chemistry ends, they assert, at the innermost electron shell. The majority however, would now accept the definition that a "nuclear chemist" is one who uses both chemical and physical techniques in research with radioactive materials, with the object of exploring the properties of the atomic nucleus. A definition of the term "radiochemist" is, however, less certain. To some it merely indicates a chemist who handles radioactive materials, while to others he is the counterpart of the nuclear chemist in that he employs similar techniques, but uses them to examine purely chemical problems.

What type of work is carried out in the new Laboratory ? In the first place it is important to realise that, unlike nuclear physicists, the chemists do not normally tie their research programme to a particular accelerator or reactor. A chemist will think of his problem, decide first what particles at what energies are needed and then make up his mind where to get them. He may need to use several different machines in one experimental series, but since in many cases he merely irradiates his target at the machine and then carries it back to his laboratory for processing and measurement, this is not an inconvenience. Chemists can, and frequently do, carry out "physical-type" experiments at the machine but this does not alter their essentially opportunist attitude. Nuclear chemists are concerned with the reactions and structure of nuclei and in the last few years there has been a distinct tendency for physicists to prefer to work with the lighter nuclei, leaving the field of the heavy ones more to chemists. Probably, this is because the greater complexity of the heavy element reactions often needs the additional resolution which can be obtained by the use of chemical separation methods. But also it is undoubtedly partly due to the special interest in the fission reaction shown by nuclear chemists ever since its discovery by two of them in 1939.

The A.E.R.E. team in the Laboratory, together with two distinguished American visitors from the University of Washington and from Los Alamos, are all working on aspects of the fission process; the team from the Geology Department of Oxford University is using radiochemical techniques to study the distribution of trace elements in rocks; the team from the Nuclear Physics Department of Oxford University is concerned with Hot Atom Chemistry (which deals with the breaking of chemical bonds by energy derived from nuclear reactions) as was the student from Cambridge University Chemistry Department. Other visitors have asked for space to work on spallation reactions, crystallography, and on medical problems using tracer techniques.

It is not easy to take a particular experiment for more detailed analysis without going into lengthy discussion about nuclear structures, energy levels, fission mechanisms etc... But perhaps one example, without amplifying our description too much, will serve to illustrate the type of work we do. This is an experiment by Professor Fairhall from the University of Washington. It involves exposing a bismuth target to the PLA 50MeV proton beam and examining the fragments which fly off when fission of the bismuth nucleus occurs. Information on the kinetic energies and excitation states of the fission fragments tells us a lot about the way fission develops in the nucleus. The energies with which the fragments fly off is dictated by the coulomb repulsion force between the fragments which each carry positive charge. This force overcomes the short-range force which normally holds the nucleus together. The energies will tell us something about how close together the fragments were just before they flew apart and therefore about the shape the nucleus took up just before fission occurred. Experiments of this type are helping us to understand the fission mechanism more thoroughly.

The building is designed for 12 to 16 chemists and is a medium-level Laboratory. The fume-hoods can handle activity levels similar to the hoods in the Chemistry Division of A.E.R.E. and suitable glove-box equipment can be installed to cope with a maximum of 50 grammes of plutonium at any one time. In addition to such facilities, the Laboratory has a cave equipped with manipulators, which is designed to handle up to 10MeV/curies of gamma activity with full alpha protection at the same time. Apart from these facilities and other chemical gear, the Laboratory is fitted out with electronic counting equipment which is as good as that to be found anywhere in the country, the automatic data handling system being a particular pride.

Apart from being an island of chemists in a sea of physicists, the Laboratory is different in that it is radioactive contamination, rather than radiation, which constitutes its main problem as far as the Radiation Protection Group is concerned. This difference seems to have given rise to a reluctance on the part of some to enter the building, probably because they do not know what precautions they should take. These precautions are really very simple :- Anyone wanting to visit one of the residents has only to put on a pair of canvas overshoes and a special laboratory coat at the shoe-change barrier and walk down the corridor to the office of the person he wants to see. He should not go through doors marked as "red" contamination or radiation areas, without first consulting a resident but then neither should he do this in any other unfamiliar building.

What of the future ? At present the Laboratory is not fully used and we can accept all comers. However, it seems likely that as new accelerators come into operation and as knowledge of the existence of the Laboratory and its first-class radiochemical facilities becomes disseminated, space will be at a premium. We trust that any tendency amongst the resident staff to acquire Rolls Royces at that time will not be misconstrued.

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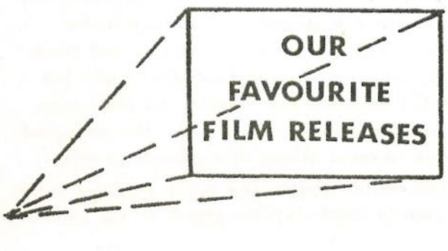


*DUTY OFFICERS : 'THE LONELINESS OF THE LONG CONTINUOUS RUNNER.'*

*INSTALLATION TEAMS : 'SATURDAY NIGHT AND SUNDAY MORNING.'*

*SECRETARIES : 'DR., NO.'*

*ANY MORE ? ED.*

# The First Experiments on Nimrod

Three experimental teams will open a new phase in the Laboratory's history in February when the first scheduled high energy physics run takes place on Nimrod. If everything goes to plan. the first run will take place between 1900 hours on 7 February and 0700 hours on 10 February.

The teams concerned represent a typical cross-section of the people we expect to work on Nimrod, involving people from three Universities, A.E.R.E. and the Rutherford Laboratory. They are known as P 2, N 1 and π 1, taking their name from the type of particle they are investigating and a serial number: thus the P 2 team investigates protons on the second of the proton beam lines the N 1 team are on the first of the neutron beam lines and the π 1 team are on the first of the pion beam lines.

A word about 'beam lines' : When the protons in the Nimrod ring have been accelerated to a desired energy, say 6 GeV, a 'target' (a block of tungsten for example) is put into its path. This produces many particles – neutrons, pions, kaons, scattered protons – as the accelerated protons crash into the atoms of the tungsten block. Sticking out of the Nimrod ring like fingers from the palm of a hand, are a number of 'beam lines'. These are channels along which some of the particles produced in the target can travel. Each beam line is 'tuned' to a particular type of particle which means that its direction with respect to the ring, its magnetic fields etc. are all arranged so that one type of particle can pass along the line while other types are bent off and lost into the walls of the channel. In this way we can separate out a particle for investigation and thus have a P line, a π line etc.....

The P 2 experiment : This is a collaboration experiment between Queen Mary College, London and A.E.R.E. A beam of scattered protons will travel along the P 2 beam line to a liquid hydrogen target. Here they will scatter off the protons in the hydrogen and, by means of scintillation counters and sonic spark chambers, the energies and the directions in which the protons are travelling before and after scattering will be precisely measured. The information will be recorded on a computer tape so that the details of the scatter can be computed later.

The N 1 experiment : This is a collaboration experiment between Bristol University, Birmingham University and another team from A.E.R.E. The neutrons will be directed at a liquid hydrogen target. There they will 'knock-on' protons which will pass through about 10 feet of high magnetic field and a system of counters and spark chambers. These will provide information on the energy and the angle with which each proton left the target. Again the data will be stored on computer tape.

The π 1 experiment : This experiment will be done by a high energy physics team from the Rutherford Laboratory. It is designed to provide information on a 'resonance' phenomenum which occurs when negative pions with a particular energy are scattered by protons. Along their beam line the pions will be subjected to a system of quadrupoles and bending magnets which will sort out the particles of the required energy. In the first part of the experiment the pions will hit a liquid hydrogen target surrounded by batteries of scintillation counters (60 in all). The counters will detect scattered particles over a wide range of scattering angles. The hydrogen target will then be replaced by a polarised proton target and the investigation repeated.

Before precise measurements can be made, the experimental teams have to be satisfied that every part of the experiment, from the targets to the complicated electronics collecting the data, is optimised and working reliably. And, of course, Nimrod has to be producing a good beam. This is called 'setting up' the experiments and can take anything up to 150 hours or more. The final data collection for these three experiments is therefore unlikely to start until sometime in March.

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## A PATTERN FOR AN EXPERIMENTAL AREA

Using size 12 needles cast on 83 (87, 91, 95, 99) sts.

1st row : K 2, Sl 1 purlwise, K 1, P 1, to end.

2nd row : Rib 3, K 1, P * Sl 1, K 1 p.s.s.o. ** (Rep. from * to ** twice).

3rd row : K 2, P 2 tog., from * to last 25.

4th row : K 1, P 1, π 1, π 2, N 1, ending with a wrong side row.

Cast off. Work other side in the same way.

# The Accelerator World

Dedication ceremonies were held in December at the recently completed accelerators in the U.S.A. – the 12.5 GeV Zero Gradient Synchrotron at the Argonne National Laboratory (first operated in September 1963) and the 3 GeV Princeton-Pennsylvania Accelerator (first operated in April 1963). Mr. Mullett, the Assistant Director, represented the Laboratory at both ceremonies.

The contract for a £300,000 electron linear accelerator has been placed with Vickers Armstrong Ltd. The accelerator is being built for Glasgow University at the National Engineering Laboratory, East Kilbride. It will be capable of accelerating both electrons and positrons and should be in operation in 1966.

A photograph was released in December by the Soviet News Agency 'Tass' showing the concrete tunnel, 1500 metres in circumference, of the 70 GeV proton synchrotron being built by the Institute of High Energy Physics at Serpukhov (near Moscow). The accelerator is essentially a conventional strong focusing machine with a 100 MeV linear injector. The linac is preceded by a 700 KeV preinjector which has a duoplasmatron ion source of improved design. This preinjector is built and is reported to give well defined proton beams of up to 400 mA. The accelerator is expected to be completed about the end of 1966.

## Meeting of the CERN Council

The 26th Session of the CERN Council was held on 17 December 1963. Representatives of the 13 member European countries and observers from other countries attended the meeting.

The approved budget for 1964 was 108 million Swiss francs (1 SF is equivalent to about 1s.8d.) which is an increase of 11% over the 1963 figure. Most of the member countries, including the U.K., also agreed to contribute an additional sum (950,000 SF for the U.K.) for design studies on future particle accelerators. Acceptance of this supplementary programme it was stressed does not commit contributing countries to any subsequent construction projects arising from the studies.

At a special meeting of the Council (the 25th Session) on 11 October 1963 a budget increase of 13% was called for in line with the 'Bannier Report'. It was urged that already it is very difficult to satisfy the demands of scientists from the member states to use the CERN facilities (70% of accelerator time at CERN goes to visiting teams) and that this difficulty is likely to get worse.

## HVEC Accelerator Conference

The 3rd International Accelerator Conference organised by the High Voltage Engineering Company was held in Boston, USA. on 11, 12 and 13 November 1963. Over 300 scientists attended the three day session including J.R. Bennett from the Cyclotron Group. Twenty-seven papers were delivered mainly concerned with HVEC products, electron linacs and tandem electrostatic generators, and with the research work underway using these types of machine.

At the time of the Conference the HVEC Emperor Tandem, the largest of its kind yet to be designed, had its column installed. Mechanically everything was behaving as expected and high voltage tests were about to begin.

# EDITORIAL

The annual report of the Advisory Council on Scientific Policy (ORBIT, November) was a set back for High Energy Physics in Europe. While accepting the validity of the scientific case for continuing to pursue High Energy Physics the Council came out strongly against increasing expenditure in this field until the needs of other areas of research are met. They not only baulked at the sums which would be needed for the next generation of accelerators (£120m for a 300 GeV synchrotron, £21m for storage rings at CERN – with the probability that national facilities, such as those provided by NIRNS, would be greatly increased in parallel) they said that even now nuclear physics 'accounts for a disproportionate amount of our total expenditure on scientific research'. In rather un official-report language they record 'an impression that nuclear physics is already getting a very large slice of a rather small cake'. (Judging by the Guardian article, 'Ha'p'oth of tar outlook threatens NIMROD's chances', there isn't much icing on the slice even if it is a big one.)

The problem of allocation is not a straightforward one. It is not just a question of compiling a list of the different areas of research – nuclear physics, cancer, space, biochemistry, psychiatry... – and sending each team away with an equal sum. Nuclear physics calls for very expensive equipment; the psychiatrists need far less to make an equivalent impression on their research.

In an ideal world the simple answer would be to increase the whole cake so that our slice could be increased in size while being the same or less in proportion. But a bigger cake would come from yet another apportionment – an increase in the national expenditure on fundamental research. Would this be justified when so many other demands are made on the national budget? If we could get at that £2,000m a year that goes on 'defence' there would be no problem, but that is a debate in itself.

Dr Bowden, Principal of the Manchester College of Science and Technology (who was awarded a life peerage in the New Year's Honours List) put the problem, and his personal response to it, very sharply in 'Science Review' on the BBC, 7 November when he said, 'I would prefer to put bathrooms and lavatories in Oldham rather than go into space.' How do we reconcile ourselves to spending millions of pounds on rockets or accelerators when vast numbers of people die of hunger, live in squalor, need medical attention ... and when, even in our own highly developed society, there are areas of great poverty? We have seen so much advertising recently from OXFAM and similar organisations that it has almost become a cliche to make a point with talk of starving children. But a point isn't any less meaningful for being brought up again and again. If it was our own children scratching around dustbins for food would we support increasing expenditure on fundamental research?

But, in the same way that we fight a fire not just be directly pouring water on it but by stopping it spreading, we fight the world's hunger not just by shipping out surplus wheat but by creating a whole environment where knowledge replaces ignorance and where resources are used to hold the situation in check for future generations. For an advanced country to press on with fundamental research is for it to press on acquiring knowledge. We don't know what, if any, benefit is going to come from a particular investigation but we do know that time and again fundamental research has brought knowledge which, in the hands of the engineers and technologists, has greatly enriched man's material well-being. It is particularly difficult to see where unravelling the mysteries of elementary particles can benefit our daily lives but it is not inconceivable that something evolving from our work will help underdeveloped countries much more than reallocating some accelerator expenditure direct to their food supplies.

This is, however, an unproven hypothesis. We should expect as much allowance as possible to be made for its fulfilment but cannot expect it to be indulged too much at the expense of immediate, clear cut needs.

Have we reached the point now where the sum being asked for the next phase of high energy physics work is just too high? Is it really necessary to have four accelerators of the size and cost now being discussed? The Russians have a 1000 GeV machine under detailed investigation; the Americans, if they implement the recommendations of the Ramsey Report, will have a 200 GeV machine at Berkeley and a 600–1000 GeV machine under study at Brookhaven; Europe is proposing a 300 GeV machine. When costs are well above £100m, 'four-off' seems extravagant even for the whole world. Have any attempts been made to discuss participation of all the interested parties in a smaller number of machines? We would like to hope that the Russians would join in but certainly America and Europe sharing one or two machines would be one way of easing the burden.

To return to the Advisory Council's report... '... 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.'

# Letters to the Editor

(Pseudonyms are accepted provided the authors name is known to the Editor).

EDITOR: B. Southworth,
National Institute for Research in Nuclear Science,
Room 2.2, Building R 1,
Rutherford High Energy Laboratory,
Chilton, Didcot, Berks.

Sir,

"Rhelian" is wrong in regarding the objects in our Royal Charter as instructions to the Institute as to what they must do; the objects are intentionally broadly worded and give the authority within which the Institute are free to form their policy. There is no doubt that the main reason for setting up the Institute was to provide facilities for university research, and that the Institute have taken this as the basis of their policy.

J.A.V. WILLIS

Sir,

Contrary to public opinion, I am not the iconoclast signing himself "Rhelian", (in the last issue but one of "Orbit").

I am an entirely different iconoclast signing himself

N. MARSHALL KING

Sir,

The following quotation, reprinted in "Atom News" for December has caught my eye :

"... not all scientists are good; some are venal, some are stupid, some are plain dunderheads and rather more are pigheads. Some supervision, some system of checks and balances is required to see that they do not abuse the trusting, almost childish confidence with which the nation and all three political parties are investing in them".

The Economist on the Trend Report.

E G. HIGGINS

Sir,

Recent correspondence in 'The Guardian' considered that if an explosion went 'bang' an implosion should go 'gnab'. Could similar notation be used to remove 'anti' from the family of elementary particles ? I think the world of the notorp, nortcele, nortuen, um, ip, ix and amgis sounds intriguing.

ESAC-TUN

Sir,

May we use your columns to address 'The Theorists' :

Jealousy will get you nowhere.

P.L A ENGINEERS

Sir,

If readers of "Orbit" should have the misfortune to eat in the NIRNS restaurant at a table with one leg longer or shorter than the other three I can recommend coins of the realm as ideal shimming material. Half-crowns are good for coarse shimming down to the odd £1 note for final fitting.

Warning! Do not forget to remove the shims when leaving the table. Failure to do so will result in a notice ('... a sum of money was found ...') such as appeared on the back page of the November issue of "Orbit".

As for me, I am prepared to forfeit my twopence, as a penalty for negligence, in the same gracious manner that I have exercised on previous occasions in other restaurants. I lose more money that way...

SPOONFUL/2

Sir,

The staff of the Laboratory will know that it is our policy to draw attention to sits. vac. at other organisations, only in the case of CERN.

I am sure, however, that some of my personal friends would wish me to give a little publicity to this advertisement in The Times on 20th January.

*THE LARGEST CASINO IN GREAT BRITAIN WILL OPEN SHORTLY IN GLASGOW AND THE DIRECTORS INVITE APPLICATIONS FOR TWO KEY POSITIONS, NAMELY,*

**CASINO MANAGER**

**fully experienced, salary up to £9,000 per annum plus commission is offered.**

**HEAD CROUPIER**

**fully experienced, salary up to £7,000 per annum plus commission is offered.**

Applicants should reply giving full details of their personal background and business history. These applications will of course be treated in strict confidence.

R.M. JENKINS
Personnel.

**'New U K A E A research station**

A new laboratory to house a 4 KeV synchrotron for use as a research tool for university physicists is being built at Daresbury, Cheshire for the National Institute for Research in Nuclear Science.'

Electronics and Power. January 1964
The Journal of the Institute
of Electrical Engineers.

**'Mighty Atom Buys Four Computers**

Sir Roger Makins, speaking at the A.S.E.E. Exhibition Dinner at Grosvenor House, announced that the U K A E A has ordered two I C T Atlas and two English Electric-Leo K D F 9 computers.

One Atlas will be used on classified work at Aldermaston, the other at the Rutherford High Energy Laboratory of the National Institute for Research in Nuclear Science, Chilton, Harwell.'

Electronic Equipment News.
December 1963.

'Apart from the big machines, the accelerators, the radio telescopes, the gas-bubble chambers, there is the problem of the new institutions clustering round the facilities of a parent body, like N I R N S (the National Institute for Research in Nuclear Science) round Harwell, yet half resenting and half resented by the parent organisation which gave it birth.'

Minister for Science.
'Science and Politics'




## ACTION

A colour film of the Rutherford Laboratory is to be made in the next few months. The film will last about twenty minutes and will probably take the following pattern :

An introduction by a Laboratory scientist outlining the work of the Laboratory with reference to the two accelerators;

A look around the P L A and its experimental areas concentrating on a particular experiment in progress;

A tour of Nimrod – injector hall, magnet room, experimental areas, control room and power supply house;

On to bubble chambers, scanning rooms and the Orion computer (We are hoping to include some shots of the British National Hydrogen Bubble Chamber extracted from a film which D S I R are taking for their own purposes at C E R N, where the bubble chamber is temporarily stationed.

And finally back to the scientist for a brief summing up.

Filming on the site will take place from 18 January to 5 February when both Nimrod and the P L A have shutdown periods. By early April the separate sequences will be assembled, edited and the final touches put to the film so that it will be ready for the week 20–25 April when the Nimrod Opening Ceremony will take place. There will also be a Press Day and a Laboratory Open Day in that week when the film will be shown.

A film has already been produced showing the story of the Nimrod vacuum vessels. Sequences were shot at various times during the past eighteen months and follow the vessels from the initial manufacture at Marston Excelsior Ltd. in Wolverhampton to their vacuum test at the Rutherford Laboratory and their installation in the magnet ring. Vessel repair techniques and installation of pole pieces are also shown. This film too should be available for screening on the Laboratory Open Days in April.

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*RUTHERFORD LABORATORY NOTICE NO. 128. THE STEERING COMMITTEE HAVE DECIDED TO CHANGE THEIR NAME TO 'SENIOR STAFF FORUM.'*

*COLLINS LITTLE GEM ENGLISH DICTIONARY :*
*FORUM – PUBLIC OR MARKET PLACE IN ROME WHERE CASES WERE TRIED AND ORATIONS DELIVERED.*

# Personnel News

## Congratulations to–

Janet Hoare (Nimrod Physics) on her engagement to David Trotman (AERE – R 12 Electronics).

John Mathews (HEP Elect.) and his wife Pat on the birth of a son, Ian, on 24 December.

Roy Griffiths (R 9 Mech.) and his wife Dorothy on the birth of a son, Paul, on 27 December.

John Pilcher (PLA Mech.) and his wife Wendy on the birth of a son, Shaun, on 2 January.

**and special congratulations to –**

Bert Rivers (General Worker, PLA) who was married on 21 December. Bert will be 71 next birthday and is our oldest employee.

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Mrs. Dorothy Jones, who retired on medical grounds a few months ago, has written to thank all her friends at the Laboratory who contributed to the present she received on her retirement.

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Dereck Gregson has been awarded the Royal Humane Society resuscitation certificate for his action last August which saved the life of one of his colleagues. The incident happened in the Magnet Room when his colleague was knocked unconscious by electric shock after coming into contact with mains terminals. His pulse and breathing had failed when Dereck reached him and revived him by mouth to mouth resuscitation.

## Comings and Goings

Dr A. Astbury joins High Energy Physics; R.T.F. Bird joins High Energy Physics Engineering.

Mrs. G. Collins joins Administration; M Stylianides joins Nimrod Beams.

W.J. Alder, W. Broadley and L.R.A. Brown join Central Engineering; J.P.W. Godfrey joins Electronics. The following people join Bubble Chamber (CERN) –

Dr. D. McMullen, R.W. Newport, Dr. D.B. Thomas, Dr. P.R. Williams, M.C. Morris, A.W. Eastwood, E.W. Fitzharris, J.F.Langdon, A.S. Marriot, K.F. Quinton, P.W. Burton, J.H. Craig, R.H. Downing and P. Shawcross.

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G.L. Cooper, Miss S. Bailey, Miss C.A.Harte, R. Burton and V.W.H.J. West have left us.

M.K. Craddock has completed his fixed term appointment.

H.C. Whitby has resumed permanent duties with AERE.

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A CHRISTIAN FELLOWSHIP GROUP

meets on the second and fourth Wednesday of each month at 1 p.m. in the PLA Conference Room, Building R 12. The meetings last about 20 minutes and all are welcome.

## CHILDRENS CHRISTMAS PARTY

Saturday 21 December was the date chosen by the Electrical and Mechanical Services Dance Committee for the Childrens Christmas Party financed by the proceeds of their dance. And they won't forget it in a hurry. It takes time for eardrums to recover from the sound of 324 feet stamped in unison on a hardwood floor, accompanied by a roar from 162 throats. Those same throats later passed 40 gallons of orange juice, 500 sandwiches, 350 cakes as well as biscuits, sweets and icecream.

No major incident marred the afternoon, though a fight over a discarded paper hat or balloon was not uncommon. Serious violence and widespread bloodshed were kept in check by an army of adult volunteers. Entertainment was provided by a group from the Toc H organisation and was enjoyed by adults and children alike.

The highlight of the party was the arrival of Father Christmas (Alan Wells) – the shattering roar that greeted him must have shaken buildings in Swindon. There was an anxious moment when young Master Wells came face to face with Santa Claus. The riot that might have ensued if a voice had said, 'This isn't Father Christmas, it's my Dad', doesn't bear thinking about. But even Master Wells was deceived by layers of grease paint and yards of cotton wool.

Toward 6.00 p.m. the party drew to a close and the children were shepherded home. Behind them they left shattered nervous systems, a mountain of debris and the realisation that there were only 362 days to the next party.

To finish – a word of thanks from the Electrical and Mechanical Services Dance Committee to all those who helped in the organisation of the Dance and the Party.

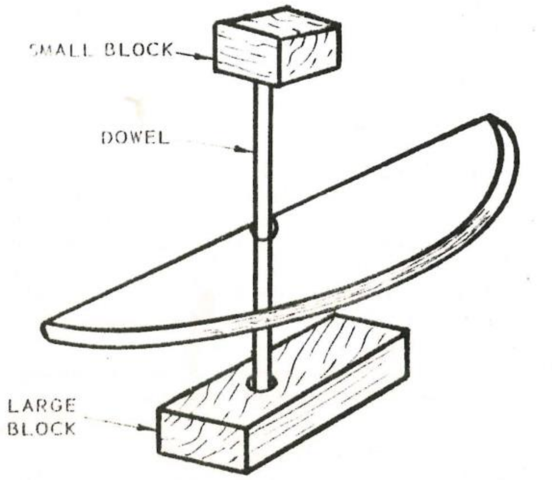
J.S.K.

# Playing with Fire

On television recently there was a science fiction serial in which some time travellers showed a prehistoric tribe how to make fire by rubbing sticks together. H's elder son wanted to know how it was done.

"We'll do it after tea," said H. (It seemed easy enough at that moment and at least he hadn't been asked to make the Time Machine itself).

After a few minutes activity in his shed, H came in with the No.1 apparatus, working on the well-known principle of the "fire drill." By working the bow backwards and forwards the dowel was rotated in a hole in the lower block, the smaller block being used as a steady. Brisk strokes with the bow produced




wisps of smoke from the tip of the dowel which soon poured out thick clouds filling the room with the acrid smell of smouldering wood. Then the dowel jammed in its hole and the bow string broke.

"Ah well," said H "the device lacks power. We just need a bigger bow and a stronger cord and a better bearing for the top end."

Actually it took several days to find a good bow string – nylon cord was the only thing man enough for the job. The other improvements weren't. All that happened was that clouds of smoke were produced and neat holes were drilled in the blocks. By this time H had been banished to the shed which was littered with blocks of wood with charred holes and worn down sticks. He tried various combinations of soft and hard woods, wood which had been preheated and wood which had been dried out by leaving it on top of the kitchen stove until Mrs. H could no longer stand the sight of it. Drilling holes was the only achievement. And without telling anybody, H had dipped the end of the stick in paraffin but all he got was vaporised paraffin.

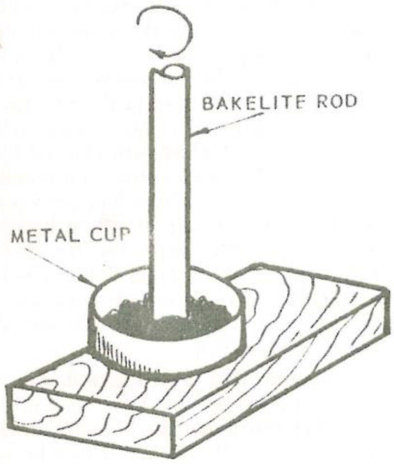
Three weeks passed and H still hadn't made fire. Fortunately in the TV serial, the Time Machine had moved on to another epoch and the boys had forgotten about the whole thing, so H didn't feel that he was under pressure. Secretly, he abandoned the bow and used an electric drill.

"You see there's an absolutely fundamental snag," said H at tea break next day, "the frictional heat is developed where the two surfaces are in contact and they must be under pressure, right? As soon as the wood gets hot enough to char, the mechanical pressure crumbles it to powder and a fresh layer is exposed. All the energy goes into wearing away the wood."

This analysis was generally accepted and it seemed to show that the simple two element system was fundamentally unsound – the way ahead was to go to a three element system. In other words, the stick and block merely generate heat which is conducted to a third material having a low flash point – some sort of 'tinder.' Nobody was quite sure what tinder was, but the dictionary described it as "rotting wood or charred linen." The Encyclopedia Brittanica suggested that the powdered wood produced by the two element system would itself form the tinder, but this is certainly not true of any wood likely to be found in the British Isles, though it may apply in the tropics. Using Mrs. H's electric cooker, it was demonstrated that charred cloth could be made to smoulder fairly easily. (She would never have found out but for the smell). Armed with this information, the No.2 apparatus was constructed. The heart of this is an aluminium cup about 1½" in diameter (the screw top of a distilled water bottle) which has a dimple in the bottom to fit the end of the ½" diameter bakelite rod. A generous supply of fragments of charred cloth was placed in the cup and the rod was rotated in an electric drill at about 2500 r.p.m. for

PLAYING WITH FIRE - (cont'd)

three or four minutes after which the cloth was found to be smouldering. A few expert puffs soon produced the long sought for flames and H shouted for his family to witness the result of two months sustained effort.




"The critical point," he explained, "is the blowing. You have to supply enough oxygen yet not blow the smouldering bits away and as soon as you get a flame you stop - or it'll blow out."

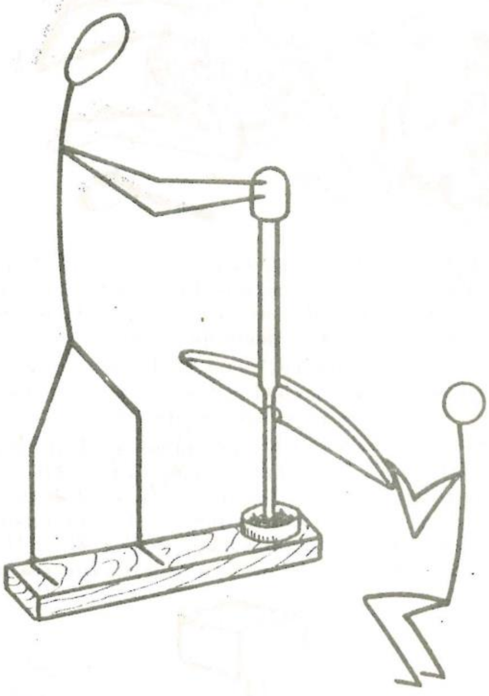
"I don't think it's a good idea to teach the boys to make fire anyway," said Mrs. H.

"Oh there's no danger," said H, knowing his sons, "they'll never make fire this way, it's too much like hard work. Anyhow in the event of a thermonuclear war, with our culture in ruins, the ability to make fire would be a matter of life and death - this knowledge might serve the boys in good stead."

As the investigation had proceeded, H had found his attitude to firemaking changing - for anyone to do it with primitive materials now seemed a tremendous achievement. It is probably quite wrong to suppose that any Ancient Briton could collect a few odd pieces of wood and make a fire. The firemaker must have been a highly skilled specialist with a stock of proper materials and, in view of the importance of fire to primitive people, he was probably a very powerful man, guarding the secrets of his trade closely - he may have been the actual leader of the tribe or at least some sort of witch doctor. There's certainly a touch of magic in the whole business and if the ordinary man in the cave tried to do it, with ordinary materials, he wouldn't succeed - even if he had grasped the principle of frictional heating. If this man moved caves, it would be much easier to take the fire with him than to make a fresh one.

"Isn't this why we want open fires in our homes?" said H. "Even in these days of central heating there is a deep seated desire to see actual flames. The Coal Board is on pretty safe ground really."

Of course, a satisfying solution requires a simple device to replace the electric drill and work is now in progress on the Model H Firemaster, as illustrated. This is a fire drill requiring two people - single handed firemaking needs a gymnast of at least Gold Medal standard. The metal cup is attached to a piece of wood . . . well you get the idea by now. Stroking the bow at two per second will produce the necessary r.p.m., which must be sustained for about four minutes.



Firemaking is accomplished in four stages. Stage one, the Drilling, an exhausting spasm of physical effort leading to stage two, the Smouldering. Then follows stage three, the Blowing, culminating in the sacred climax of the Flame, beautiful, delicate and short-lived. Stage four, the Kindling, in which a brand is lit and transferred to the firewood proper, must follow quickly.

This is the Firemaster - in the modern nuclear age no household should be without one.