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The main reason for going in the tank was to find out why Chain 2 had been behaving irregularly: charging current had been fluctuating, and disturbance was both heard on the audio (bang) amplifier and seen on the NMR. The effect did not always occur, but would start up eventually if Chain 2 was left running; in the end the chain was left off and the machine ran on Chains 1 and 3 very satisfactorily at a conditioned voltage of 13.6 MV.

Because demand on the 14UD was reduced by the AINSE conference it was decided to schedule a tank opening, attend to Chain 2, carry out a complete point change, do other work, and have work done in parallel in the source room on Level 5.

The first effort in the tank was to examine the entire charging system. Chains 1 and 3 had stretched by about the same amount as was found on the first opening after the new chains were fitted. Chain 2 had stretched some bit less because it had been off for most of the running time.

The pulleys of all chains were out of contact with the oiling pads when the motors were at rest and, clearly, no oiling had been taking place for some time; correspondingly it has to be remembered that the performance of chains 1 and 3 had been excellent.

We ran the motors and Nos. 1 and 3 "bottomed". There was no undue noise from any chain, nor did there appear to be unusually high wobble on either the ascending or descending half of any chain.

Before carrying out any work we did a charging test at 2; 4; 6 and 8 kV. There was no onset sparking until 6 kV, though in the case of Chain 1, there was a weak spark low on the negative inductor at a lower voltage. Within the usual limits all chains behaved the same.

The felt oiling pads were cut about by the new shimstock rims, even though the pads had been modified in such a way that we had believed they would not touch the rims, and would both survive and be effective. There was a general matted fuzz on all pads. The new chains appeared to be in good condition and had generally retained their original plated appearance, though pellets were pitted by spark damage at the rims. There was no evidence of hardening, cracking or other damage to the blue nylon pulley rims, either below or in the terminal. It was decided to remove, and leave out for this opening, all three oiler pads together with their supports, however, the three pulley rims were to be oiled in as close as possible to the usual way before final test and button-up.

The chains seemed to be somewhat twisted: i.e. the pellet rivets were not parallel to the plane of the rim of the pulley. It was believed that, when No. 1 terminal pulley, and No. 3 motor pulley were taken out early in December (to attend to the bearing wear which gave rise to finely divided steel powder) they were replaced out of correct alignment.

All 3 chains were removed; top and bottom pulleys were realigned with plumb bobs. Two pellets were taken out of chains 1 and 3; none were taken out of chain 2. During the procedure the mounting bolts for the bearing of the terminal pulley of chain 2 were found to be loose, and clearly had been loose since last adjustments.

An idler belonging to chain 3 in a casting about half way up the H.E. column had a large piece broken off it. This idler, and 2 others between the terminal and H.E. base were replaced. In the terminal all d.c. idlers (the terminal idlers with d.c. contact springs) were examined. Some of these idlers were touching the pellets obliquely and possibly there had been poor contact, if any at all. When adjusting the supports of these idlers in order to present their rims and contact springs in the correct aspect to the pellets it was found that the elongated bracket holes in the idler supports were marginally tight for all chains but just that much tighter for chain 2 and consequently the brackets for No.2 were removed and machined to allow adequate adjustment.

The down d.c. idler of chain 2 had only 1 contact spring and a new idler was fitted; the up idler of chain 1 was in poor condition and also was renewed.

When the new chains were in, and aligned, all casting idlers were examined again and adjusted where necessary. Because we felt that a good "basic start" had to be made, very careful attention was paid to all chains, idlers, inductors and chain tension.

The inductors were set with especial care; possibly the greatest attention yet was paid to symmetry of the chains in the inductors and the degree to which the straight part of the inductor was parallel to the chain, allowing the flare to take care of itself. This statement relates to both terminal and driving inductors.

The rims of the motor pulleys were touched with a Kimwipe wet with transformer oil while the pulleys were turned for one or two revolutions; then the pulleys were turned for at least one revolution of the chain (14 pulley turns) and the rims were arbitrarily "dried" until rims and chains seemed to have the correct oil film on them. No extra oil was put on to compensate for the removal of the oiler pads. The pre-button up charging tests seemed to go as usual for all 3 chains.

POINTS:

A complete set of points, column and tube, had arrived from NEC prior to the tank opening and we were confronted with the situation that tube points were needing to be changed at each opening while column points remained steadfastly in excellent condition, though slowly getting just that much duller with every interval. Tactics, rather than necessity, called for a change of all points, especially when one considers that most rings in each unit have to be removed to change all tube points, thereby presenting an ideal situation for changing column points as well. Because so many rings would be taken off in all units a thorough cleaning of the column would be facilitated.

Only 1 point in the machine needed to be replaced in terms of the usual criteria; this was a Type 3 point at 26/2/3 (Unit 26, Tube 2, Point 3 in the order seen by a particle travelling along the tube).

All points were removed and the ones newly received from NEC were put in. It was noted wryly that some of these new points had, instead of the conventional screws, the same star-headed versions which had evoked so much amusement before.

Tube/column stringers were fitted to the 5 units still remaining without them; hence the entire column now has stringers.

Black dust in the vicinity of the coupling between the lower shaft and its main alternator led to the discovery that the rubber coupling was almost completely sheared. Having no replacement a different type was fitted and an adaptor made to accommodate it.

The alternator bearing in the 5 MeV casting was very noisy, and was replaced.

Three more r.f. straps were fitted from the top of the column to the roof of the tank; there are now 8 of these around the top of the column. They are copper strip, 3 inches wide and about 16 gauge.

Quite a few of the ANU Type 1 shorting rod rollers had seized up, though because of their shape, the rods contact them and pass easily. The Type 2 devices being tested are in perfect condition.

The 3 nylon tubes which had been fitted "in parallel" with each other from the terminal to the 17 MeV casting, for the purpose of observing their behaviour under SF₆ and high voltage, appeared to be in perfect condition. They were taken out, pressurized to 80 psi, and immersed in water for more sensitive detection of leaks; no leaks were observed at all.

It is likely that the "on-off" type control rods (i.e. the ones which do not perform continuously variable functions, such as lens control, or sublimator variac control), will be replaced by pneumatic devices of the type which has operated the ANU design foil changer perfectly for a number of years in the EN.

The midsection pump was opened. One sublimator was wrecked and the other unused; the wrecked one was replaced. The NEC ionizer was taken out of the pump permanently as it has not been used since the 10 l/s pump was fitted in the midsection. Series resistors were fitted to limit current drawn by the pump. The metering fault was found to be due to a short imposed by a shielding box too closely fitted. The box was omitted for the time being.

Sublimators in both terminal pumps were changed manually.

Pyrotenax, which was installed some months ago, was meggered and found to be 15-20 megohms; it read about megohms at last opening but was not meggered in its "unused" state at installation.

The rear of the foil changer was opened and the foils checked. About 80% of the sample examined were broken; also the beam spot was slightly higher, and to the left, (for a vertical foil) than appeared before. The spacer fitted earlier to correct for the error in length of the then new NEC foil holders was taken out and a tapered spacer fitted to correct additionally for the offset beam pattern on the foils.

Three groups of foils were loaded: one group was 5 micrograms and another 2-3 micrograms. Two batches of collodion were tried.

Top and bottom of every casting was cleaned with a vacuum cleaner. Every unit of shaft was wiped vigorously with a dry Kimwipe and this removed the dusty discolouration which had been accumulating steadily. Tests on a short section of shaft, using oral fluid, established that the film on the perspex responded readily to this solvent. The section was dried by particularly vigorous rubbing and no more of the shaft was treated, partly because the basic constituent of the solvent is undesirable in the machine and partly because of low availability of the solvent in quantity.

Each ring was checked carefully for looseness on the posts and several adjustments were made to screws. We continue to feel that real damage can occur easily to post fittings on which the rings clip and full examination, however tedious, is mandatory in regard to safe ring connections.

The entire upper surface of the platform was lifted and the cavity below was vacuum cleaned. Not much dust, or other material, was found, and that which did appear was under the small plates. There is good reason to believe that, when 4 quadrants of carpet are laid on the platform for all tank openings, and removed at the end, there will rarely be any profit in lifting the checker plates.

Paint on the under surface of the platform is flaking slightly directly below the cables; these areas were brushed with a wire brush into a vacuum cleaner.

We believe that the steadily improving performance of the 14UD in terms of volts attainable is due, in part, to hygiene in the tank.

THE ION SOURCE.

During the tank opening major activity took place on Level 5. The source was stripped, the beam line opened up and a separate team of workers set up a level and a theodolite to observe the behaviour and reproducibility of the inflection magnet when rotated. It was soon clear that the existing arrangement was intolerable. Adjusting devices were made and fitted below the magnet plinth. Stops with precision locators were fitted to the magnet itself and the top of the plinth.

The weight of the magnet was taken by the gantry and the entire magnet assembly was moved and adjusted in accordance with the new devices. Finally, two positions were determined: one for the existing source and one for the Sputtercone source which is to be installed shortly. The magnet was rotated a number of times and reproducibility was very good.

Full alignment of the present source was carried out.

Before the source beam line was closed up a crosspiece was fitted to the rear of the inflection magnet: the straight through end will eventually carry a viewing port and the other two ends the 2 l/s pump and a valve with fitting for leak chasing head.

After gassing up all voltage and tube and column metering appeared normal and there was little trouble in reaching 11 MV.

However, not long after the experimenters began to use the machine it became clear that the Chain 2 trouble had not been cured. Breakdown noise could be heard on the audio (bang) amplifier and seen at the same time on the NMR; likewise the same metering effects were there.

For a time we believed the fault might occur when Chain 2 and at least one of the other motors were run together because the way the motors drop at startup might be bringing a high voltage lead near ground somewhere. We later ran Chain 2 on its own and it worked well with 23 kV inductor volts for about 20 minutes, then the effect began again. This disposed of the two-motor idea and we assume that chain stretch is a likely cause.

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