NEWSLETTER

RETIRED CHARTERED ENGINEERS ASSOCIATION
WORTHING

Hon. Secretary: S. Oliver. Elphin, North Drive, Angmering, BN16 4JJ ☎ 01903 787116

FORTHCOMING EVENTS

3rd April	Wednesday	**Visit** to Flight Simulator, Gatwick see pages 10 & 11 for details and signing up
8th May	Wednesday	**Outing** to Body Shop, Littlehampton
19th to 23rd May		**Spring Break** to Norwich
20th June	Thursday	**Outing** to St Marys House, Bramber see pages 10 &11 for details and signing up
11th July	Thursday	**Outing** to Parham House, Pulborough see pages 10 &11 for details and signing up
15th August	Thursday	**Outing** to Wakehurst Place, Ardingly see pages 10 & 11 for details and signing up

Coffee Mornings

Laing's Arcade Cafe, Montague Street, Worthing.	Every Monday
Albion Inn, 110 Church Road, Hove.	First Wednesday of the month 3 Apr, 1 May, 5 Jun, 3 Jul, 7 Aug
Three Crowns, East Preston	Third Thursday of the month 18 Apr, 16 May, 20 Jun, 18 Jul, 15 Aug
Beach Hotel, Worthing (with Ladies)	Last Thursday of the month 28 Mar, 25 Apr, 30 May, 27 Jun, 25 Jul, 29 Aug

Coffee mornings commence at 10.30 a.m., except at The Beach, which is from 10.45 a.m.

Copy date for next Newsletter 12 Aug

Membership

We welcome the following new members:

1995 **TAYLOR, C.E.** F.I.Mech.E., F.I.E.E., F.I.Prod.E., F.I.P.E.NZ. *26, Hurst Avenue* *Worthing, BN11 5NZ* *(01903 249397)* Apprentice toolmaker (Hofman Eng.), Design Draughtsman (Decca), Industrial Eng.(Norris Ind.Consultants), Industrial Eng. Manager, 1963 Deputy Pricipal - Auckland Inst. of Technology responsible for regrouping & upgrading Technical education in Auckland area. 1975-85 Founder Principal/Director Carrington Univ. of Tech. in Auckland *Interests:* Literature, Music, Travel, DIY	1996 **NASH, L.J.** B.Sc.(Eng.), F.I.Mech.E., F.I.E.E., A.C.G.I. *83 Milton Mount Av, Pound Hill,* *Crawley, RH10 3DP* *(01293 882571)* 1948-51 British Elec. Auth., London Div, St Pauls grid control centre and system development. 1951-86 BEA, CEA, CEGB headquarters. Station planning manager, planning and siting of power stations. 1951-90 Consultant CEGB and Bitish Elec. Int. *Interests:* Croquet, Golf, Indoor Bowls, Probus, Music, Travel

RCEA on the Internet

The RCEA is mentioned under corresponding organisations in the Sussex Centre of the IEE. This can be found via the home page of the IEE at **http://www.iee.org.uk** or by going direct to the Sussex Centre home page at **http://www.eng.bton.ac.uk/iee/**

Nuclear safety, planning and development - Talk by L.J. Nash, guest, at the Durrington Community Centre, 10th January, 1996.

A summary for the interesting talk given by Len Nash graduate of Imperial College, London, and later working at the Electricity HQ, London, to the Engineers meeting at Durrington on January 10, 1996. The talk covered aspects of safety and planning for nuclear power stations, past, present and future, 36 members were presentand tha nks to the speaker was given by John Fowler.

Introduction

In the 1930's scientists realised that the atoms of very heavy elements, particularly uranium, were unstable and that under certain conditions could disintegrate to produce energy. It was found that uranium atoms all had 92 protons in their nucleibut not t he same number of neutrons. Some uranium atoms have 146 others only 143.The difference transpired to be crucial. Uranium with 146 neutrons is called uranium 238 (92 protons plus 146 neutronsequals 238, its atomic weight), this type of uraniu m is quite stable and common, but the other type form, uranium 235, has a veryspecial propert y; it breaks down when hit by another neutron in a way that supports a self sustaining reaction called 'Fission'. During fission a lot of atomic debris flies out. **Energy** is also produced and so are extra neutrons. These neutrons then hit other uranium atoms which in turn break down to produce more energy and more neutrons. These t hen hit further uranium atoms and so a chain reaction is set off. The chain reaction produces a great deal of energy, which was found can be controlled by placing the uranium inside other materials such as graphite which absorb some of the neutrons.Energy and heat are then released in a manageable way which is what happens in a nuclear reactor. U235 is the only isotope that supports a chain reaction. Uranium 238contain s less than 1% U235 and thus must be "enriched" to a level of 3 to 4% for common use in a reactor.

Reactor Development

Three types of reactor design came to prominence.
The 'light' water cooled and moderated reactor (LWR) fuelled by enriched uranium. Two types: the boiling water reactor (BWR) in which steam to turn a turbine generator is produced directly in the reactor core, and the pressurised water reactor (PWR) in which steam is produced in an external or "secondary" system of piping connected to the reactor's primary system by means of heat exchangers and steam generators. The development of the LWR is rooted in nuclear research and development for U.S. submarines and aircraft carriers, by General Electric and Westinghouse.

The second reactor used in the civilian market was the gas cooled graphite moderated reactor (GCR) used by the UK in the 1950's fuelled by natural uranium andproduc ed high grade plutonium.

The third reactor concept to achieve commercial success was the heavy water cooled and moderated reactor (HWR) also fuelled with natural uranium. It was prime in Canada because of Canada's large resources of uranium.

The Advanced Gas Cooled Reactor (AGR) was built in the UK to replace Britain's first generation of Magnox nuclear plants, the reactors were designed in the 1960s to have improved energy production. Each was planned to provide 600 million watts o f electricity. The Government ordered five large twin reactor stations. Three different consortia of companies were set to build three different types of AGR. Industrial disputes and design changes during construction caused long delays and by the 1980's only two reactors at Hunterston and Hinkley Point had been built. Of the others on ly one of each planned pair of reactors had been built and these have had frequent operating problems. Prices also spiralled, one AGR at Dungeness was forecastto cos t more than 6 times its original estimate of £89 million.

Despite new technologies and nuclear power, near three quarters of UK's energyis sup plied by fossil fuels which has the debit of global warming from CO_2, acid rain from nitrous oxide and nitrogen dioxide and SO_2

Reactor operation

The Pressurised Water Reactor (PWR)

Inside the reactor, uranium is first placed inside long canisters. These rods are then sl
otted into a large lump of graphite, called the "core", along with an extra controlrod. This con
trol rod is usually made of a substance such as boron which absorbs
neutrons like a sponge. As the control rod is slowly removed from the core a nuclearchain rea
ction starts up and heat is produced. If too much heat is generated then the
control rod is simply returned, and more neutrons are absorbed and the reaction slows down.
To take away the heat a gas or liquid known as a coolant is pumped through the core. The co
olant gets heated to between 250 and 600^{O}C and is then used to turnwater into
steam. The steam drives a turbine which produces electricity. The nuclear
reactor is covered by a protective shield or dome made of concrete or heavy welded
steel.

The Fast Breeder Reactor

Designers have developed a reactor that produces more plutonium fuel than it burns,
and is named a Fast Breeder Reactor. They operate at high temperature 290^{O}C, and
produce excess quantities of plutonium. A blanket of Uranium 238 is wrapped round
the core and some of this is slowly transformed into plutonium as the reactor operates.This ty
pe of reactor uses sodium to remove the intense heat which the core produces.

The Future

The sun has provided the earth with life giving heat and light. The source of this power is nuclear fusion, where hydrogen atoms coalesce to form helium and in the process release vast amounts of energy. It is believed that if science can harness nuclear fusion with safety all energy problems would be solved, in the long term future. Designing fusion reactors is at the forefront of technology. The hydrogen atoms have to be heated to high temperatures, 100 million degrees C, before they will fuse into helium, the gases have to be contained in powerful magnetic fields that do not leak. The most advanced system is called a Tokamak, is Russian and holds the hydrogen isotope in a large doughnut
shaped magnetic container. A large Tokamak has been built by an EEC consortium at Culham, England and is used to learn how to generate power from nuclear fusion. A demonstration power plant may be ready by 2020 to 2030. It will also require supplies of lithium for its operation. The most rapid fusion reaction takes place in a 50–50 mixture of deuterium and tritium.

Tokamac Fusion Test Reactor

A machine that produces energy by using toroidal (doughnut shaped) magnetic

fields to confine a plasma of deuterium and tritium long enough to allow these elementsto fus
e.

Conclusion

Fossil fuels, oil and sea cavity natural gas may last another 100 years. Trappedmethan
e in hyrates under the oceans below 600 feet may last another 500 years subject to a means of extraction and recovery. The ultimate energy from fusion would seem likely to be decided on an analysis in engineering risk management, and damage limitation to mankind world wide.

Notes

Isotopes: Forms of an element that have different numbers of neutrons in their nucleii, but thesame numbers of protons.
Neutron:: An elementary particle found in an atom's nucleus and which brings about nuclear fission.
Graphite**:** Crystalline carbon which acts as a moderator to slow down neutrons inside a reactor making it easier for uranium to absorb them.
Magnox: The name given to the alloy which was used as fuel cladding in UK early reactors.

Bernard Knight

Visit to EUROTHERM CONTROLS Ltd, Faraday Close, Durrington on Wednesday 17th January, 1996 at 2.30 p.m.

This visit took place on the afternoon of the 17th January. Fifteen members attended and the factory visit was informative and interesting to those members present. We were met at reception by Ms Elizabeth Zuill, Departmental Manager, who conducted our party to the company conference room. After coffee Elizabeth Zuill introduced the company ongoing business plan with a Mission Statement from the Chairman which said: "Eurotherm's product development strategy is driven by an adopted plan for continuous improvement to ensure each generation of Eurotherm products give significant performance gains. With first-hand experience of the world's most advanced process technologies, design engineers create solutions which anticipate the evolving requirements of the market leaders in different industries, to achieve solutions that embody even higher levels of functionality, efficiency and ease of use. Eurotherm's developments combine three decades of process control experience with leading edge technology to produce products which meet the changing demands of the process industries. The ongoing commitment to research and development has resulted in the
launch of a number of challenging new products and product enhancements".

Management Information to Employees

- A clear statement to all staff of the product mission objective.
- Three year targets leading to product improvement are clearly set to all departments.
- Teams are made-up to measure objective performance against target plans.
- Individual requirements are set for operator achievements at factory floor level.
- Encouragement is given to the factory floor by visible displays on charts etc. of achievements and displayed for all to read.
- Illumination of a "fear" to employees in the display of "less than good news" relating to factory floor performance.
- Highlighting and summarising prime activities in support of targets.

In Support of Production Targets

- Flow of factory materials arriving at the production line locations on a "just in time" basis.
- Achieving – "on arrival at the factory" a minimum defect level from the sub supplier, from earlier "feed back" to the supplier on "found" arrival defects.
- Achieving high percentages of "In House" pass rates on finished assemblies "put together" by factory operatives.
- Improved product "lead times". Start of work to ready for despatch to customer.

Company Centres of Production

Eurotherm Controls Ltd – Durrington

Precision temperature controls including:Single function controllers, Control and multi–loop controllers, Power controllers

Eurotherm Chessel – France

Chart recording, monitoring data acquisition instruments and systems.

Eurotherm Drives Ltd – Littlehampton

AC/DC motor speed controllers and integrated speed systems.

Eurotherm Process Automation – Worthing

Integrated control and management systems from 'stand alone' controllers through to computer graphics

Eurotherm Gauging Systems – Newbury

Integrated measurement and control systems from basic profile monitoring to advanced plant wide automation.

Factory Floor Production

Our party was taken in two groups to tour the factory premises. Each with a Departmental Manager to explain the system and production methods.

General

Each particular metal box instrument assembly was placed on a production line consisting of 3 or 4 specialist machines. Each machine costing ~ £500k, some machines less in cost, others were higher.

The main component of each instrument pack was a printed circuit board sometimes with several silicone chips in the wired assembly.

The PCB circuits were designed by Eurotherm design offices, but the silicone chips were an outside purchase.

The PCB major component parts were pinned and soldered to the circuit boards as the board moves along the production line through selected machines.

At the testing station the operator sets the fully assembled instrument pack including PCB to the test panel for a circuit continuity test. The test panel display shows the word "pass" or "fail". By manipulating the test panel the defect can be located and generally repaired/made good by the operator to be retested and shown as "pass" ready for packing and despatch.

The factory was working a 24 hour 3 shift system with delivery to customers averaging ex–factory in seven days per item from receiving a purchase order. The short lead time achieved by the advanced manufacturing techniques designed by Eurotherm to give near total quality and adopting "Kaizan" (continuous improvement) from the Japanese way of working as company policy.

Study groups comprising operators from the factory floor and managers monitor all new productions for further cost saving techniques, leading to improved quality standards and best delivery on all new products to be manufactured.

Bernard Knight

Novel Engine Development - Talk by S.M. Butler, member at the Durrington Community Centre, 14th February, 1996.

The Free Piston Engine

The free piston engine is an internal combustion engine which either supplies gas (combustion products and excess air) to feed a turbine or compressed air for use with pneumatic tools.

Taking the first example, the gasifyer was developed to be a prime mover for use in power stations, ships, trains etc. It consists basically of two opposed piston assemblies each consisting of a diesel piston rigidly connected to a compressor piston [1]. The compressor piston has a dual function, on the outward stroke it compresses the air in the cylinder [3] which acts as a cushion or spring to produce the energy to return the pistons on the inward stroke. Also on the outward stroke the other side of the compressor piston draws air into the cylinder [4] through the suction valves [5]. When the diesel piston uncovers the exhaust ports the gases

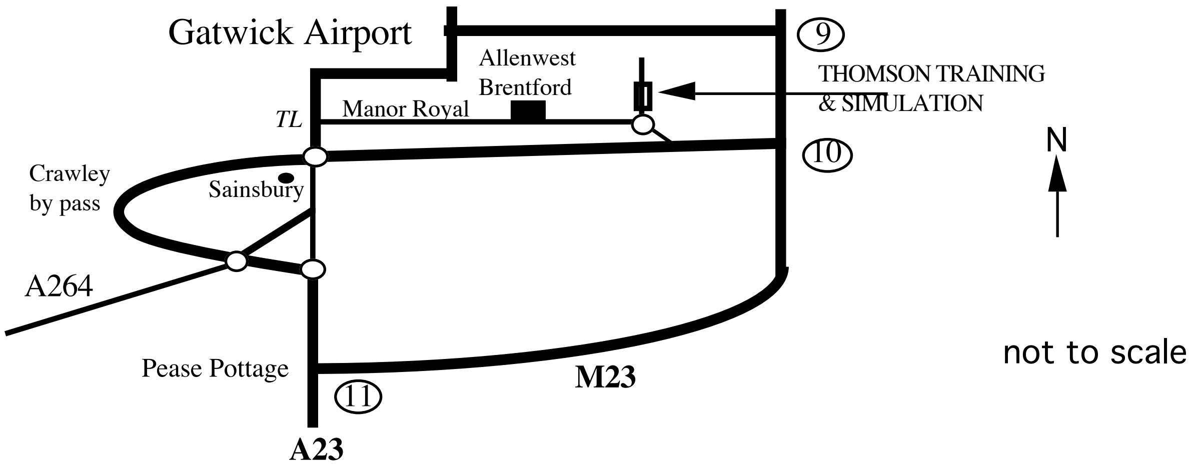
are ejected to the turbine together with the excess scavenge air which passes through the cylinder.

On the inward stroke the air in the compressor cylinder [4] is delivered through the non return valves [6] into the volume around the diesel cylinder to provide the scavenge air for the next stroke. When the diesel pistons have reached their inner dead point, fuel is injected through the fuel injector [7] and the cycle repeats.

As there is no restraint on the piston assembly by the linkage, the length of the stroke can be varied to suit the load requirement. At the normal full load the gas is delivered to the turbine at 50 psi (3,5 kg/cm^2) and 400°C.

Stan Butler

Visit to Thomson Training & Simulation, Crawley on Wednesday 3rd April 1996 at 2.30 p.m.



Outing with Ladies to St Mary's House & Gardens, Bramber, West Sussex on Thursday, 20th June 1996 at 2.30 p.m.

Car parking area near house and opposite side of road, also close to St Mary's House (free)

Outing with Ladies to Parham House & Gardens, Pulborough, West Sussex on Thursday, 11th July 1996 at 2.30 p.m.

Entrance on A283 Storrington to Pulborough road. Car park at site.

Outing with Ladies to Wakehurst Place & Gardens, West Sussex on Thursday, 15th August 1996 at 2.30 p.m.

Entrance on Ardingly road B2028. Parking atn site (free)

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To: E.B. Trotter, 34 The Marlinspike, Shoreham by Sea, BN43 5RD Tel: 01273 453088
I wish to participate in the visit to **Thomson Training & Simulation** on Wednesday, 3rd April 1996 at 2.30 p.m.

Full Name ....(Block capitals)

Address ....

....

Phone No............................ **Applications by 20th March, 1996**

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To: E.B. Trotter, 34 The Marlinspike, Shoreham by Sea, BN43 5RD Tel: 01273 453088
I wish to participate in the outing to **St Mary's House & Gardens** on Thursday, 20th June 1996 at 2.30 p.m.

Full Name ....(Block capitals)

Address ....

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Phone No............................ **Applications by 5th June, 1996**

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To: E.B. Trotter, 34 The Marlinspike, Shoreham by Sea, BN43 5RD Tel: 01273 453088
I wish to participate in the outing to **Parham House & Gardens** on Thursday, 11th July 1996 at 2.30 p.m.

Full Name ....(Block capitals)

Address ....

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Phone No............................ **Applications by 27th June, 1996**

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To: E.B. Trotter, 34 The Marlinspike, Shoreham by Sea, BN43 5RD Tel: 01273 453088
I wish to participate in the outing to **Wakehurst Place Gardens** on Thursday, 15th August 1996 at 2.30 p.m.

Full Name ....(Block capitals)

Address ....

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Phone No.............................   **Applications by 1st August, 1996**

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