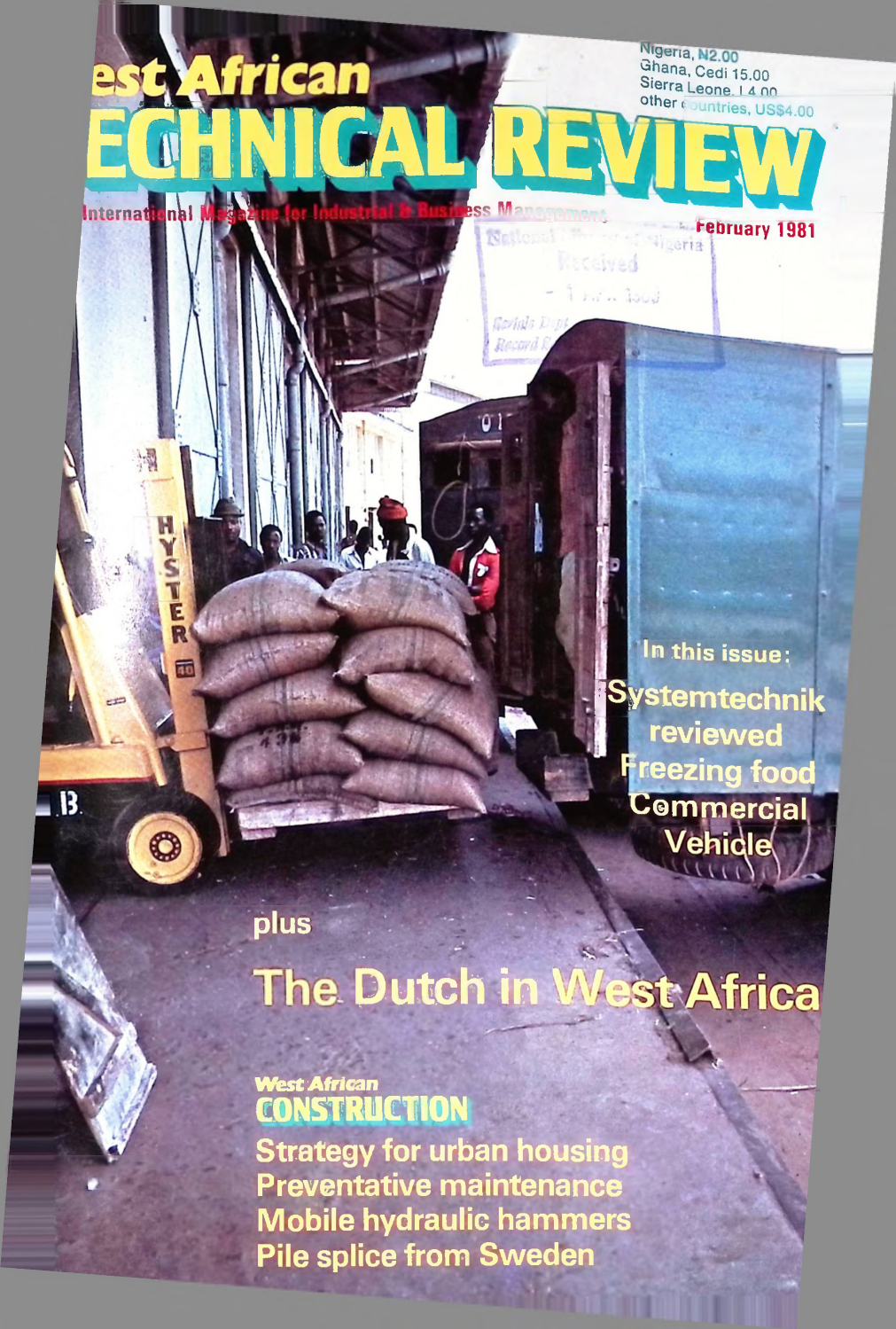
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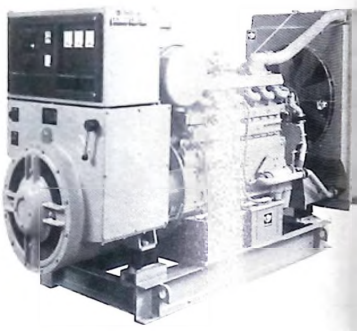

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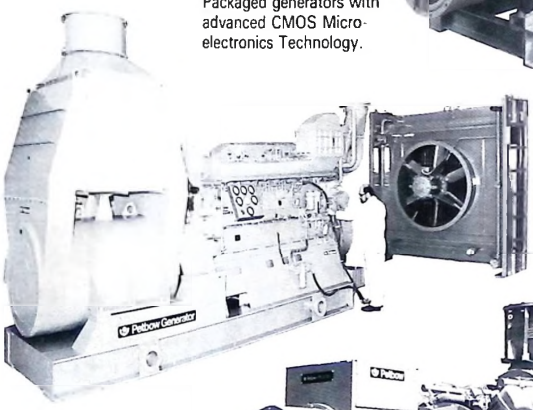

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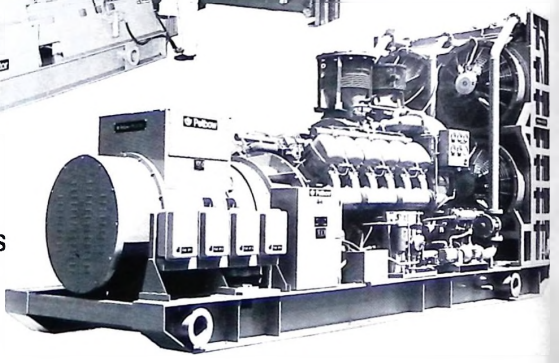

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This month's cover: A diesel engine powered Spacesaver 40 by Hyster, with 4,000lb (2 metric tonnes) capacity, at work in a Sierra Leone Product Marketing Board warehouse in Freetown. (Photo: Mike Manifold.) Turn to page 113 for hints about choosing the right kind of truck.

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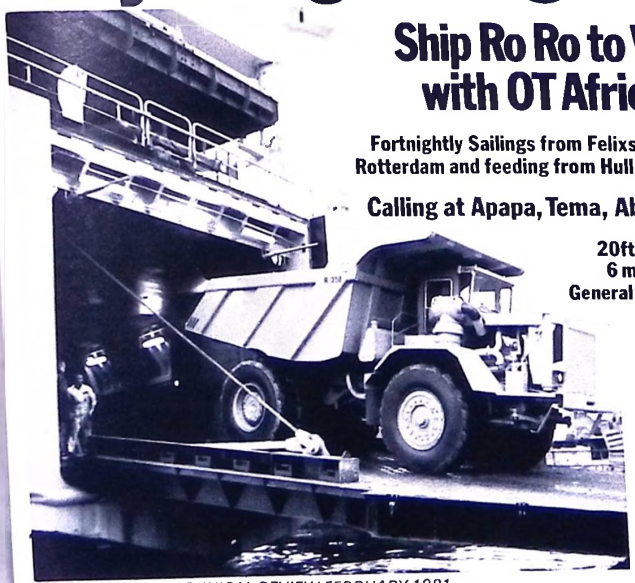

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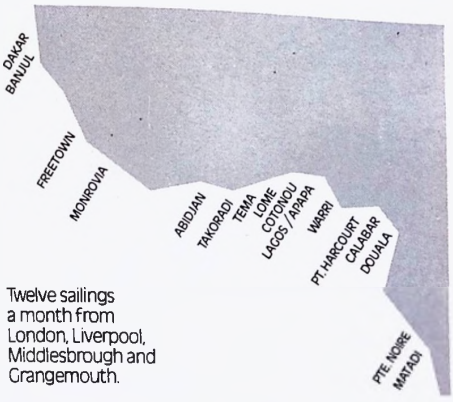

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Visits

Lord Carrington, British Foreign Secretary, will visit Nigeria on a mission beginning on February 18, accompanied by British bankers and businessmen. The emphasis of the visit will be on trade opportunities.

The British Foreign Office announced on February 3 that President Shehu Shagari will make a state visit to the UK from March 15 to March 20.

Marine insurance

The volume of marine business in the Nigerian insurance industry has grown fast in recent years and now accounts for up to 22.1 per cent of the total premium income of about N[illegible] million.

Marine insurance now comes next only to motor insurance – its growth has been attributed to the insurance decree of 1976, which required the insurance of all imports into the country by Nigeria registered insurers. Contrary to that obtained in the past when importers insured their goods with overseas insurance companies. The construction of new and modern ports in various parts of the country such as the Tin Can Island Port Complex, the new Warri Port, the new Calabar Port and several new Lighter Terminals has also helped a great deal to swell the volume of marine insurance business.

Coffee sorting machines (see below)

Hoechst UK

Estimated profits for Hoechst UK in 1980 amounted to £1.5 million. This represents a drop of £3 million on the 1979 figure; the impact of the recession had been greater than expected, said the company chairman, but results would have been far worse if early action had not been taken to axe about 200 jobs.

The 1980 figure is for Hoechst UK Trading only. The Hoechst UK group, the main British subsidiary of the German-based chemicals giant, includes subsidiaries and associates such as Optrex and Berger.

Electronic coffee-sorting

Sortex 1661 electronic machines for colour-sorting robusta coffee, installed in two banks of 25 at the Abidjan plant of Jean Abile-Gal SA, are among 100 such machines now in operation at three very large installations in the Ivory Coast. Developed and built at the Bow factory of **Gunson's Sortex Limited, UK.** Sortex machines provide accurate sorting where difference in surface colour or shade of a coffee bean indicated poor quality. Each bean is inspected at high speed during a free-fall path through an optical chamber where sensors detect sub-standard items and pass electronic signals to air ejectors which deflect the undesirable beans into a separate chute. Each Sortex 1661 machine, which has six sorting channels, can sort coffee beans at the rate of 120 kg/channel/hour. Sortex make machines for sorting virtually any free-flowing product, including frozen foods.

Massey Ferguson

The Canadian agricultural machinery firm of Massey Ferguson is to delay its annual meeting, which will now be held in April rather than March. The troubled firm wants to allow more time for clarification of some uncertainties about its $588 million refinancing plan.

Motorcyle production

A new joint venture company, Honda Manufacturing Nigeria, plans to begin motorcycle production in the spring. Four types of motorcycle will be assembled, ranging from 50 to 200cc; most of the larger parts will be imported from Japan. When completed, the new manufacturing facility will produce about 70,000 units annually during the first few years and eventually increase the volume to about 120,000 units.

Safari Bus

Renault Vehicles Industrielles is to create a new vehicle designed especially for Africa. The new "Safari Buss' will seat 12 passengers and be able to withstand tough road conditions and extreme temperatures. 30 buses have already been ordered by the Zambian Ministry of tourism.

Loan for rural electrification

The Export Credits Guarantee Department has guaranteed a £5.49 million loan which Lloyds Bank Limited has made available to the Oyo State Government of the Federal Republic of Nigeria.

The loan will help finance a contract awarded to Hawker Siddeley Power Engineering Limited by Oyo State Government for the support, erection and commissioning of electrical distribution and transmission networks. The contract awarded is in respect of Phase III of the scheme linking 53 rural townships.

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The equipment, called GTD 3 EAX, is installed in Caguas, Puerto Rico, for the Puerto Rico Cor cations Authority. A long-distance switching it can be expanded to handle up to 30,000 si neous conversations. It is the only one of its Latin America.

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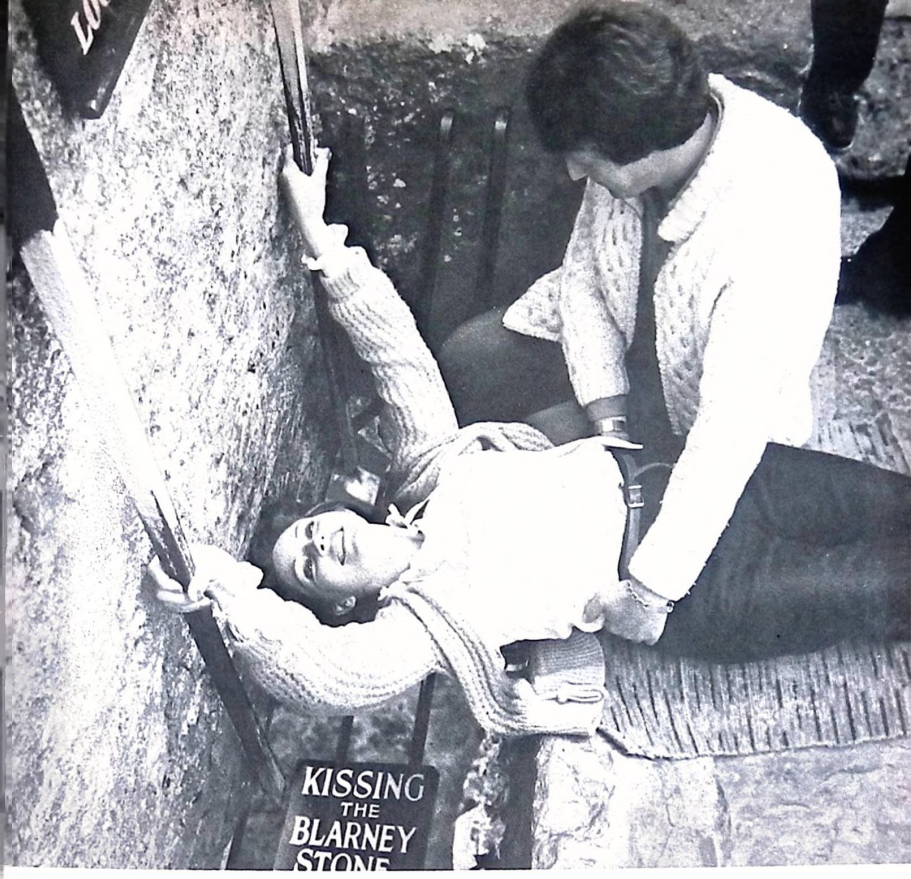

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1981 Nigerian budget proposals

According to a recent report drawn up by the Standard Chartered Bank Treasurer of the Nigerian-British Chamber of Commerce, President Shagari's 1981 Federal Budget proposals, incorporating a new formula for Revenue Allocation between the 19 states, will not be approved until mid-April.

The budget is the first full year budget of the civilian administration. It covers Federal spending for the first fiscal year of the Fourth Development Plan, 1981–5. Capital expenditure under the five-year plan will total ₦82b, of which ₦40b will be by the private sector.

The original proposals for revenue allocation were as follows: federally retained: ₦7.718b (53 per cent, compared with 76 per cent retained in 1980); statutory allocation to the States: ₦4.841b (34½ per cent) of the allocation ₦3,130,674. This includes the amount of ₦351 million for mineral producing states; allocations to local governments amount to ₦1.123b. The final 2½ per cent is to the new Federal Capital Territory, amounting to ₦350 million.

Federal Capital Expenditure is set at ₦8.982b, with recurrent expenditure at ₦3.297b. The proposed capital programme will be financed by a Budget surplus of ₦5.133b, internal loans of ₦1.100b, and external loans for specific projects amounting to ₦1.52b, leaving a deficit on the capital expenditure programme of ₦1.227b. However, this will almost certainly be avoided through increased oil revenues.

Nigeria intends to borrow ₦1.5b offshore to finance a total of 18 projects, headed by the Ajaokuta Steel Complex, which has been allocated ₦275 million, followed by the Delta Steel Complex which has been allocated ₦300 million.

In addition, ₦82,148,000 will be borrowed to finance 19 State rural development projects, including ₦8 million for the Sokoto State integrated agricultural projects, and ₦1,050,000 for the Kaduna State IRDP.

Agriculture

To offset the big agricultural imports of last year, the banks in Nigeria will have to deposit, on a non-interest bearing basis, with the Central Bank, their shortfalls in lending in the agriculture sector to be on-lent through the Federal Agriculture Bank. In addition, ₦40 million and ₦32 million are allocated to the Agricultural and Co-operative Bank, and the CBN Agriculture Credit Guarantee Scheme respectively (under which CBN guarantees loans made by the Commercial Banks to the Agriculture Sector). In addition, Government is to restructure the tariff of producer prices to ensure that they are attractive enough to persuade people to return to farming, and to make a decent living from it and that the prices are sufficiently competitive.

A system is being introduced to ensure that food shortages of imports under licences (e.g. rice) will be avoided. With immediate effect, no import licences for food items will be issued to individuals. There is a clear suggestion that in future they will only be issued to government agencies (e.g. NNSC).

Education

A total of ₦655 million has been set aside for Universities, of which ₦300 is for existing ones, and the balance for three new ones in Benue, Imo and Ondo States. The aim is to have one university, one polytechnic college, and one Advanced Teachers' Training College, in each state. In order to encourage further Nigerian investment in this section, government has also announced during the Fourth plan period the following targets should be reached.

Housing

In the housing sector, ₦50 million has been allocated to the Federal Mortgage Bank for provision of house loans. Shortfalls in Commercial Banks' lending to the private construction sector for the year 1980 will (like their agriculture lending shortfalls) have to be deposited with CBN for on-lending.

Fish conference

An international fish farming exhibition and conference is due to take place in Brighton, UK, from March 17–19, 1981. The exhibition will feature both equipment and end-product – farmed fish and shellfish. A wide range of plant, equipment, seafood products and services will be at the exhibition – from net cages, tanks and oyster brood to finance and consultancy.

Running concurrently with the exhibition will be a three-day conference comprising one morning and two afternoon sessions and having as its theme 'development-production-marketing'. Admission to the exhibition is complementary, but restricted to people engaged in fish farming or allied food industries such as processing and distribution. The exhibition will also be open to people who are considering investment or involvement in the industry.

For further information contact International Fish Farming Visitor Department or Conference Department, 11 Manchester Square, London W1M 5AB. Tel: 01-486 1951; Telex: 24591 MONTEX G.

EXECUTIVES' CALENDAR

A monthly service listing some of the major events in West Africa and around the world that could be of interest to our readers. Further information on these events can usually be obtained from the Embassy (commercial office) of the country concerned.

MARCH		
2-6	LABEX – International Laboratory Apparatus and Materials Exhibition	LONDON
8-15	SIMA – International Agricultural Machinery Exhibition	PARIS
9-12	Middle East Oil Show	BAHRAIN
10-13	POWTECH – International Powder Technology and Bulk Solids Exhibition	BIRMINGHAM
12-19	Fair of Libreville	GABON
11-13	IASI – International Automative Service Industrial Show	CHICAGO
13-18	INTERNORCA – International Trade Exhibition for Hotels, Catering, Bakeries & Confectioners	HAMBURG
16-21	V.K.L. – International Heating, Ventilation and Air Conditioning Exhibition	UTRECHT
17-21	ISH – International Sanitation, Heating, Air Conditioning Fair	FRANKFURT
19-27	FOUNDRY '81 – International Foundry Fair	BIRMINGHAM
23-27	MEDICA – International Hospital Equipment Exhibition	UTRECHT
30-5	WATER – Congress and Exhibition	BERLIN

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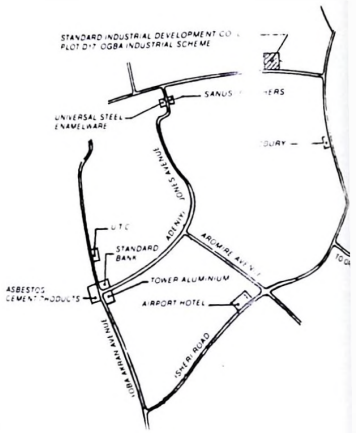

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OIL NEWS

NIGERIA'S OIL output in 1980 is likely to have totalled 747 million barrels, equivalent to a daily average rate of 2.04 million b/d. That is well below current production capacity of some 2.4 million b/d, and represent a decline of over 11 per cent from the previous year's record figure of 841 million barrles (or 2.30 million b/d). But prices rose sharply through the year, finishing at $40/barrel after OPEC's Bali meeting; in January 1980 they stood at only $30/barrel. As a result, oil revenues reached a record annual total of approximately $25,000 million. 1979's revenues, for comparison, are estimated at $15,000 million.

At its Bali meeting OPEC agreed on a three-tier package of prices, under which the top-quality African crudes could be sold at the basic $41/barrel. Libya and Algeria exceeded this figure, but Nigeria held back at $40/barrel while announcing that premiums would be charged additionally on term contracts, in line with market conditions. Below the African and similar crudes, Middle East oils are priced at around $36/barrel, while Saudi Light was fixed at $32/barrel–up by $2.0. Nigeria's rise to $40 is an increase of $3/barrel, or 8 per cent.

Lower output

Prospects for 1981 are for a slightly lower level of output for Nigeria, in view of the Bali price increase. Although the government announced that the present 2.15 million b/d "ceiling" level will continue to apply through the first half, it appears that output in the last quarter of 1980 was prorated by the government at the level of 2.0 million b/d, and this might continue to apply. Revenues, however, will rise to at least $30,000 million for the year.

Water-injection

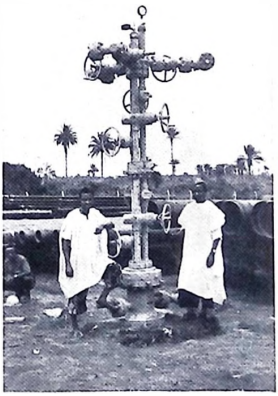
Gulf Oil expects to start-up in May this year a major water-injection facility – Nigeria's largest – at its Delta South field. By injecting up to 60,000 b/d of water into the producing structures, Gulf hopes to increase reservoir pressure and hence boost production by 21,000 b/d. Fresh water will be drawn from offshore aquifers, which will be drilled using Gulf's oil drilling facilities. Cost of the entire project is put at $7 million.

Gulf found that sea-water could not be used for injection due to its high solids content, resulting from nearness to the shoreline. The fresh aquifer water will be treated to control minerals, bacteria and precipates, and injected through four specially-drilled wells in the field. Production will rise from 38,000 b/d to 59,000 b/d within three years, and it is estimated that an additional 100 million barrels of oil will be recovered.

A much larger water injection project is planned by Gulf for its Meren field, which has only a very mild natural drive. If approved, the project will call for 200,000 b/d of sea-water to be pumped into Meren wells, boosting output from 80,000 b/d to 100,000 b/d within four years. An extra 120 million barrels could be available as a result of the project.

Tapa field soon on stream

The Tapa field, Nigeria's first major new field for five years, is expected to commence production in the near future. Tapa, lying in about 25ft of water off the mouth of the Benin River, is operated by the Gulf-NNPC venture. Production facilities are designed to handle 25,000 b/d of desalted and dewatered crude.



Elf to refine for NNPC

Elf, of France, has agreed to process Nigerian crude on behalf of the Nigerian National Petroleum Corporation and to return the gasoline streams to NNPC, under an accord announced in January.

Angola

Texaco is about to bring on stream the second of three small fields which will be flowing at a combined peak of 25,000 b/d by 1982. All are on block 2, where Texaco operates a production-sharing concession; shares are: Texaco 40 per cent, Sonangol (the state company) 25 per cent, and CFP and Petrobras with 17.5 per cent each. The first field, Cuntala, is already producing 1,800 b/d. The second, Essungo, is under development and will be fully in production through two platforms and nine wells by mid-year. The third, Etele, is scheduled for start-up at end-1981.

Cameroun

A gasfield has been discovered 2km offshore and 15km south of Douala, by a group headed by Gulf. According to the government, well tests were sufficiently encouraging for the field to be regarded as commercial. Shares are: Gulf 20 per cent, the state's Société Nationale d'Hydrocarbures du Cameroun 50 per cent, and Elf, Denison Mines, Total and Oceanic with 30 per cent jointly.

Congo

France's UIE Cherbourg yard will build, load out and install two 8-pile platforms for Elf Congo. One structure is for the Yanga field, the other for Sendji. The contracts include the assembly of the platform piles on site and also the risers. UIE's Marseilles yard recently was awarded a contract to fabricate and transport a production deck with module and boom for Elf Gabon's M'bya field.

Equatorial Guinea

Elf will explore offshore Fernando Poo, under an exploration agreement being negotiated. Acreage is still to be agreed. Other companies thought to be negotiating for drilling rights are Texaco and Mobil.

Spain's Hispanoil is expected to apply for permission to begin drilling work, after having completed and turned over to the government the results of a $3 million seismic survey.

Gabon

Aracca Petroleum has been granted a 350,000 acres offshore concession, Tassi Marin II. The company was also awarded two seismic options, which it will share with Oxoco and Sundance Oil.

Guinea

An International Development Association credit of SDR 22.1 million ($28.5 million) has been granted for the improvement and expansion of electricity distribution facilities in Conakry.

Ivory Coast

Phillips is drilling with the semi-submersible rig *Sedco J* into its Espair offshore prospect, which was rumoured last year to be a very substantial oilfield. It has also contracted the *Sedco 471* drillship, which is due on location in June when work finishes in Australia, and is negotiating for the *IRO Frigg* drillship and for the *Petrel* dynamically-positioned drillship, all for work offshore Ivory Coast.

Sierra Leone

Seismic work undertaken by Mobil has revealed various promising structures in the Turner's Peninsula area in the Bonthe district, off the southern part of the coast. Drilling is expected to commence in April.

Milk processing technology

A new processing and packaging method developed in Sweden will, if generally adopted, allow hundreds of millions of undernourished people in developing countries, who at present cannot drink milk, to do so freely without digestion problems.

ALTHOUGH MILK has been described as 'nature's most perfect food', providing a balanced mixture of protein, carbohydrate, fat, vitamins and minerals, many older children and adults cannot drink it because their bodies cannot digest one component – lactose (milk sugar). If they drink more than a small glassful of milk they usually suffer abdominal pains and diarrhoea.

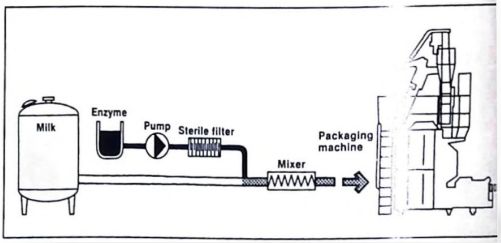
Infants and young children can, of course, drink milk without difficulty. They produce, in their small-intestines, an enzyme known as lact*ase* which breaks down the lact*ose* into simpler sugars that are readily digestible.

As a child grows, it produces less lactase. The decrease varies between different races and also depends on how much milk the individual continues to drink. The resulting 'lactose intolerance' is especially marked in population in Africa, South-East Asia, India, the Middle East and Latin America.

If purified lactase is added to fresh milk some while before drinking, the enzyme converts lactose into digestible sugars outside the body. However, the technique requires expensive quantities of enzyme and the education of individual consumers, so it is not practical for the countries needing it most.

The solution now found was conceived by the Managing Director of the Swedish firm, Tetra Pale International AB, Hans Rausing. In the 'Tetra Lacta' process lactase is added to sterilised milk immediately before the milk is packed aseptically in long-life containers. Because of the long the milk, only minute amou enzyme (about ten parts per milli needed. Over seven or eight da enzyme pre-digests the lactose p making the milk fully digestibl norishing for lactose-intolerant sumers. Since the milk remains some without refrigeration for f six months, it can be transpor areas of malnutrition and stored cheaply. This method has been with excellent results by Tetra P school feeding projects in Malays Indonesia.

Circle No. 22 on enquiry



Tetra Brik Aseptic packages with ready-to-drink lactose free milk

Honey production course

An increased world demand for honey has meant steadily rising prices and a renewed interest from development planners in bee-farming. Awareness of the agricultural benefits of using bees to increase pollination in cross-pollinated fruit and seed crops is also spreading. Improved pollination leads to significant increases in crop yields.

It has been proved conclusively that the presence of the honey bee in fruit orchards and field crops can substantially increase yields of fruit and seed of cross-pollinated species; produce an extra "crop" in the form of honey and beeswax; and generate further beekeeping stock for expansion.

Minster Agriculture and Field honey farms of the UK have joined forces to pool their extensive experience in both crop production and bee farming to provide a full planning and implementation service which includes the provision of the necessary training. The service is unique in the field of agriculture and is of enormous potential benefit to countries of the developing world.

The services offered by the two companies are complementary to each other. Minster Agriculture is able to provide an extremely high level of expertise in fruit, vegetable and field production under both rain-fed and irrigated conditions. Field honey farms is able to provide a service which covers the whole spectrum of bee farming from the planning of projects through to training and implementation.

Over the past few years, the two companies have successfully run training courses in honey production and processing for candidates from several countries in Africa and the Far East. The number of places available on the 1981 course has been limited to ten. To be certain of securing a place, enquiries should therefore be directed immediately to: Alan Willens, Training Officer, Minster Agriculture Ltd, 13 Upper High Street, Thame, Oxon OX9 3HL, UK.

Paris-Dakar rally

The DAF/Mighty Mac Sportswear rally truck has finished. The 10,000km between Paris and Dakar in Senegal were completed in 20 days. The arduousness of the rally this year is borne out by the fact that of the more than 300 competitors who started in France, a mixture of motorcycles, cars and trucks, less than 30 per cent were still in the race by Dakar.

In the truck category, only eight of the sixteen starters arrived in Dakar, of which only three were still in the race. This means that half of the trucks had to give up on the murderous course through the Sahara, over rocks, through marshes and forests.

The DAF truck reached Dakar, but unfortunately out of the competition. The reason: Henk Thyssen, one of the three drivers, broke his arm and, on medical advice, had to be admitted to hospital as quickly as possible. The team lost so much time through this that they were eliminated from the race. In spite of this setback, the DAF rally team caught up with the rally caravan, and thus on 20 January were among the convoy of other rally participants who had also survived the gruelling conditions of the rally, and completed the last stage along the beach into Dakar. There they were welcomed by tens of thousands of Senegalese.

On 23 January the exhausted team arrived back in the Netherlands.

A Ford Transcontinental HA 5035, 6 x 4 articulated tractor unit was the first regular series-production truck to finish the rally.

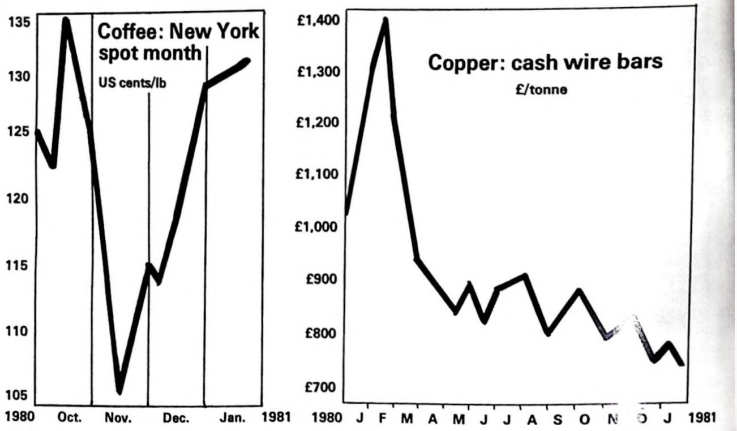
Overall winner of the truck class was a specialist Acmat 4 x 4 off-road vehicle prepared, entered and crewed by the French Army.

The second-placed Transcontinental crossed the finish line in Dakar 7 hours ahead of the only other finisher in the truck class – a Mercedes 1932.

West African TECHNICAL REVIEW

DAF truck in the rally: survived the course despite setbacks.

The Ford Transcontinental HA5035, first regular-series trucks to finish.



IT IS now obvious that the industrialised countries are not out of their economic troubles yet. In fact, as 1981 unfolds, many analysts are suggesting that industrial activity in the US and Europe is going to decline much further by the end of the year.

The implication for commodities used in all types of manufacturing processes is obvious: demand is unprecedentedly weak and prices for most materials have nowhere to go but down.

Just how bad the situation in the West gets will largely depend on the precise fiscal policies adopted by the new US president, Ronald Reagan. America remains the industrial powerhouse of the non-Communist world and developments there tend to spill over into other Western countries. At the moment, however, the US is in deep budgetary trouble and it seems unlikely Reagan will be able to wind down credit demand enough to bring interest rates down from the present cripplingly high level. High interest rates directly depress commodity prices by severely limiting manufacturers' ability to buy forward and build up stocks.

Metals

Perhaps the most obvious example of commodities reacting in this way to the recession in metals, and copper in particular. It looks more than likely that world copper production this year is going to exceed demand, perhaps by as much as 100,000 tonnes. This would be the largest surplus for six years.

The story is the same in tin. Production will be in surplus for the fifth year running, according to the latest forecasts, and the market could be further depressed by the possibility of increased sales from the US's strategic stockpile of the metal.

The case of rubber is more complex. Natural rubber makes up less than half of the total market in rubber types – the bulk of industry's usage being synthetics. There is thus a constant price war between synthetic and natural rubber. There is no doubt that natural rubber is now cheaper than the synthetic competition. Unfortunately the reason for this is high oil prices (hence higher feedstock costs for synthetics) and higher petrol costs are rapidly undermining natural rubber's potential strength. Rising oil costs slash demand for automobiles, and usage of rubber (both synthetic and natural) falls away dramatically.

At some stage, however, the recovery must come. The commodity markets traditionally stage sweeping boom and bust cycles and there is no reason to suppose that current developments are any different. The slump has gone further than in previous cycles but this could mean that the upward adjustment will be all the more extreme when it comes. A long period of recession leads to massive destocking by industry. When demand finally recovers manufacturers will therefore have a lot of buying to catch up on and prices, at least in the short-term, could rocket. In the interim, however, commodity producers seem to be stuck in the middle trying to make ends meet with falling export revenues.

Coffee agreement

One commodity whose fortunes have recovered somewhat amidst all the recessionary gloom is coffee. Although still way below its highs, coffee has stabilised in price in the last few months and traders are optimistic that it will consolidate these gains in the months ahead. Prices may not go any higher, but given the sharp fall-off in coffee values seen in 1980 it is quite something that the fall has been halted.

The reason for coffee's new-found health is the International Coffee Agreement signed by consumers and producers in London last October. Under the terms of the agreement all countries exports from members of the pract[illegible] carefully monitored and a strict ceiling is placed on the amount producers are allowed to export. When price of coffee falls these export quotas are tightened further and extra scarcity ports prices. The converse happens when prices rise too far.

Many observers were sceptical about the viability of the coffee agreement but the behaviour of the market since last October seems to suggest that the system is working. For the first time for a long time coffee roasters are actually finding that certain countries do not have any coffee for sale under the quota system and they are therefore being forced to pay more on the open market.

The International Coffee Agreement shows that co-operation between importer and exporter can work provided the situations taken by the co-ordinating body are rigid enough to really affect the global supply and demand picture.

Groundnut crop slump

Groundnut prices are soaring due to the failure of the US crop but Gambia is unlikely to reap much benefit from this strong market due to its own production problems, according to the latest field report from the US Agriculture Department.

The country's output of groundnuts in the 1980–81 season is likely to be only 50,000 to 55,000 tonnes. This is sharply down from the previous year's level of 79,100 tonnes. The main difficulty facing Gambian farmers this year has been prolonged drought, although this has been aggravated by late plantings and poor quality seeds.

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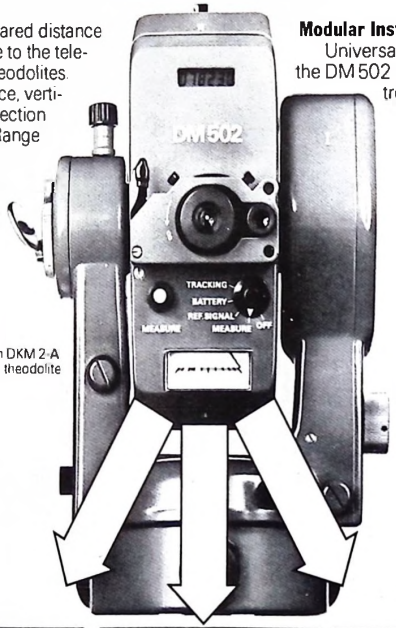
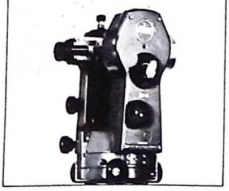


Kern DKM 2-A
One-second theodolite

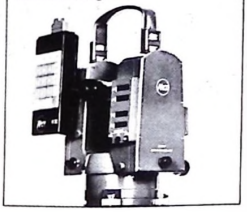
Modular Instrument System Kern

Kern K 1-S Engineer's theodolite with scale reading

Kern K 1-M Engineer's theodolite with micrometer reading



Kern E 1 Electronic theodolite with recording unit



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tellite station

he Federal Government of Nigeria has :ed a $20 million order with Harris Cor- ation of Melbourne, Florida for a large ellite communications earth station and exhibition centre near Kaduna. This is : latest stage in a federal project aimed at king the major population centres with a mestic satellite system. Nineteen earth ations – one per state – are currently at arious stages of completion. The stations ill relay television images and telephone alls through satellites posited over the Atlantic or Iandian oceans by Intelsat, the nternational 102-nation telecommuni- cations satellite organisation. The Nigerian system, named Domsat, will be managed by the Nigerian External Telecommuni- cations Agency.

UK Contracts

Mor Grenfell of the UK has opened an $8 million general line of credit to allow rian purchases of UK capital goods. ral Nigeria/UK contracts have been d recently: the biggest is that betwee awker Siddeley Power Engineer- ing an o State, concerning the connec- tion o ains electricity for 53 villages in the sta

Gui s Peat International of London has completed the financing and planning of a £3.2 million spark plugs factory in the Isolo area of Lagos. The project will be run by a new company, Autotech (Nigeria). Morgan Grenfell's credit line is being made to the Nigerian Bank of Commerce and Industry. Contracts financed by the loan must have a minimum value of $50,000 and be placed by January next year.

Ghana gold contract

James Scott (Electrical Transmission) Limited has been awarded contracts valued at approximately £1.5 million by The State Gold Mining Corporation in Ghana.

The contracts comprise the design, supply and erection of three overhead transmission lines for the Dunkwa Gold- fields and the design and supply of two transmission lines for the Prestea and Tarkwa Goldfields. The Dunkwa Gold- fields erection will be carried out using local labour. Work will being immediately and completion is scheduled for October, 1981.

Cameroun airport contract

Under a contract valued in excess of £12,000, a comprehensive time keeping system is to be supplied to Garoua Airport in Cameroun by Chloride Gent Ltd.

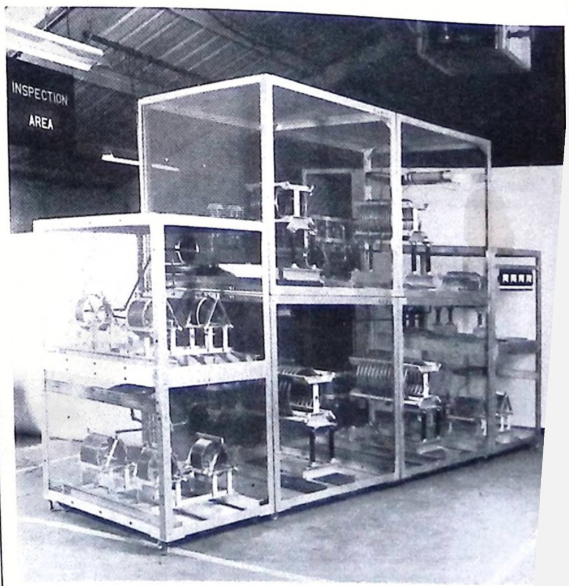
The order for the time keeping equipm- ent was obtained through Plessey Air- ports, Weybridge as part of the Garoua de- velopment project.

Mobile generators

Final adjustments to Wysepower mobile 25kVA generating sets which – ordered by the Dutch Civil Engineering Group Volker Stevin – will provide power on remote con- struction sites in Nigeria.

These six rugged units, housed in weatherproof enclosures will move around West and South Nigeria providing power on sites operated by the Nigerian Dredging and Marine Company Limited of Apapa.

After manufacturing to precise speci- fications Wysepower container packed these generators at their UK factory for direct shipment to Nigeria.



Part of the equipment supplied by CSA to the new Ethiopian Broadcasting Ser (see next page).

Shaking hands outside the Ethiopian Educational Mass Media headquarters in Addis Ababa, CSA (C&S Antennas Ltd) Technical Director, Brian Collins (at right of picture) is congratulated by Yihunbelay Mengistu, Head of the new country-wide broadcasting service, which goes on the air this month.

The new service, for which CSA supplied all antennas, ATUs, RF feeders and triplexers for the eleven stations involved, is designed to give practical advice to the population of Ethiopia (some 28,980,000 people) on such matters as how to improve crop growing, regulated diet and basic health care, as part of a national campaig the overall development of the coun

Under the new system, three b casting frequencies are provided a station to cater for the large numb different languages spoken thro Ethiopia (more than 70, with abou dialects).

This contract was won by CSA highly competitive international t tion particularly from Japan, Am and England.

The project was funded by the I national Develo ment Agency in junction with the World Bank.

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Ink-Jet Printing

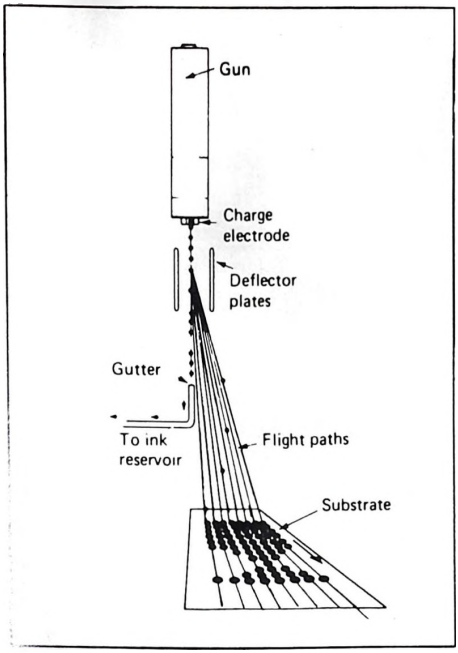


Diagram of continuous jet printing – in this set-up the droplets are deflected to print.

TRADITIONAL PRINTING processes work because of contact of an inked image against the stock. Ink-jet printing is a non-contact process that uses a stream of minute ink droplets projected from a very small nozzle. There are several ways in which the stream of droplets can be controlled to produce the image.

The most widely used system uses a continuous stream of droplets which are electrostatically charged as they leave a nozzle and are deflected in flight by the application of a high voltage to a set of deflector plates. The success of the process lies in the ability to charge each individual droplet to a pre-determined level. As the stream of charged droplets passes through the deflector plates, the trajectory of each drop (and hence its point of contact on the substrate) can be accurately controlled. The deflector plates are maintained at a constant electromagnetic potential and each drop is deflected by an amount proportional to its own charge.

Most drops will be unwanted and can be eliminated in a number of ways. Some can be left uncharged and collected by a gutter for recirculation whilst the charged drops pass on to the paper. This is the most popular method. The converse is also possible ie uncharged drops are those selected for printing, with all charged particles deflected to the gutter. This method is less popular as a large bank of nozzles is required for accurate resolution, but printing can be very fast.

Another technique is that known as 'drop on demand' or 'impulse' printing when individual drops are released from the nozzle only as required. The drops are not normally charged or deflected in their travel to the substrate. A matrix consisting of a bank of nozzles is required. This method is comparatively slow but is silent and cheap and has been adapted to produce larger drops for textile, carpet and poster printing.

Advantages

Because of the very high rate of drop production – 60-100,000 drops per second in a continuous jet printer – the charging or release of the individual droplets is controlled by electronic data stored on computer tape or disc. The obvious advantage of this is that the input can be continuously varied unlike conventional printing where the input (gravure cylinder, litho plate etc) is fixed. Thus ink-jet can be used to produce one copy or a few copies of many different documents. In addition, there is almost no limitations on the typeface that can be printed (even Chinese script is easily reproduced) – the computer input decides whether any given point on the matrix is printed or not.

As the process is non-contact, printing is possible on delicate, uneven or recessed surfaces and inks are available which give adhesion on non-absorbent surfaces such as metal, glass and plastic. Multicolour work is also possible due to recent developments in techniques and ink formulation. Very high speeds can be achieved, partly because the printers determined by the rate at which drops can be produced and charged. Some teleprinter-like machines are capable of 5,000 characters per second.

The extreme versatility, high speed at relatively low cost and non-contact property have established ink-jet in new printing applications and, increasingly, in fields where conventional printing has held its own.

Uses – now and in the future

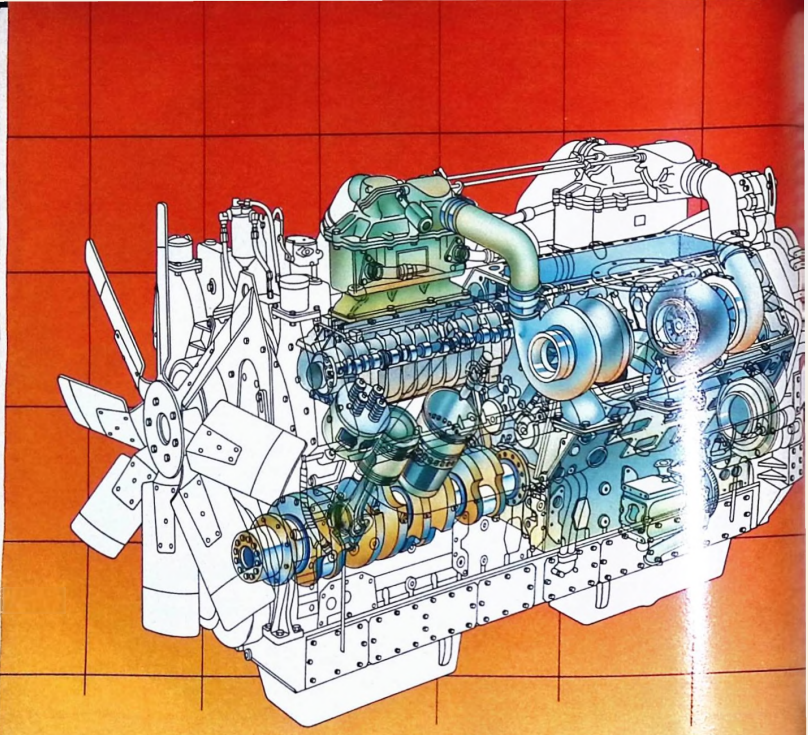
Can and package batch and date coding was one of the earliest applications of ink-jet. It is not the computer controllability that is important in these cases, but the ability to project drops of ink into recesses, the availability of inks which adhere to non-absorbent surfaces, plus the low cost and high speed compared to labelling. Beer and beverage cans, glass bottles and polythene containers can all be printed in this way. One application is the fitting of an ink-jet numbering unit at the delivery end of a litho press.

Coding of a different type can be used for document sorting, for which the versatility of ink-jet is ideally suited. In France, ink-jet is being used for coding of postal envelopes with fluorescent dots.

Communication through the printed word is the area where most development has taken place in recent years although ink-jet's high cost and lower quality are unlikely to have any significant short-term effect on conventional printing. Ink-jet only shows advantages when its variable data capability can be fully utilised and may prove a valuable addition to those printers producing bingo cards, lottery tickets etc.

Ink-jet is already established in the printing of business forms and personalised circular letters, as an addressing printer and may, in the future, be used as a means of inserting stop press into newspaper copy. As inflation continues, ink-jet may also be used for inserting up-to-date prices onto preprinted catalogues, thus eliminating the need for costly re-runs.

continued



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The Detroit Diesels

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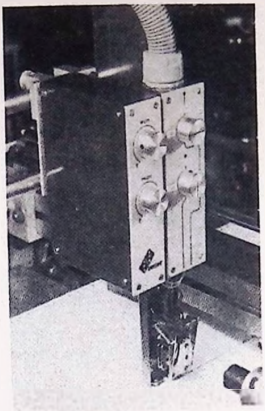
The short run capability is also being exploited for the printing of patterns on textiles and carpets and may be applicable for wallpaper printing in the future. Stocks of finished material can be kept to a minimum and 'one-off' patterns can be produced relatively cheaply. Avery recent application is in the production of large ($4m^2$) wall posters for decorating offices, reception areas and exhibition stands etc.

Many other uses have been found and others wait to be exploited as the technique develops. The inkmaker now has a much fuller understanding of the system and is able to formulate inks accordingly.

The Inks

The inkmaker faces a number of problems when formulating inks for ink-jet. The ink must have physical properties suitable for jet formation and charging whilst being capable of producing a sharp, dense and permanent image. One of the first problems is to produce an ink that will not clog the very fine nozzles used in most printers – in some cases as small as 35 micrometers.

Because of their large particle size, conventional pigmented systems are not normally suitable and most inks are based on soluble dyes. This is not the end of the problem as clogging can be caused by impurities in the seeding-out of, the dye, by excessive evaporation and drying of the ink in the nozzle, and even through the biological growth of fungus or bacteria in water based inks.



A Unijet jet printing head

Pigments are used in 'compound' jet systems, where a jet of clear ink is fired through a reservoir of pigment and picks up pigment particles as it travels. This is the system now used for textile and carpet printing and which may find use in short-run graphic reproduction where letterpress or lithography is un-economical. Fully pigmented inks can be used in some poster printing machines where much larger nozzles are used.

The ink must have the correct physical properties for accurate and consistent drop formation. High surface tension and low viscosity (1-4 centipoise) are important. The ink must be capable of accepting and holding an electrostatic charge and choice of solvent is therefore restricted to the most popular types. Water is the obvious choice but difficulty in obtaining fast drying and adequate adhesion on some non-absorbent stocks will be experienced. Methanol is the most widely used organic solvent, despite its toxicity, although it is now possible to produce inks with high conductivity using other solvents.

As with conventional inks, a binder is necessary to carry the colouring matter and bind it to the substrate. The binder must have extremely high solubility to give the low viscosities required and must not contain impurities. It must have fast solvent release, and give good adhesion and satisfy toxicity requirements where the need arises.

The versatility and short-run capabilities of ink-jet printing are the areas currently being exploited. Even with improvements in resolution, register and overall reproduction it is unlikely that ink-jet will make significant inroads into conventional print markets, except to satisfy very specific areas. ●

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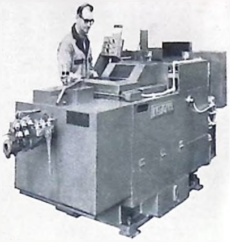

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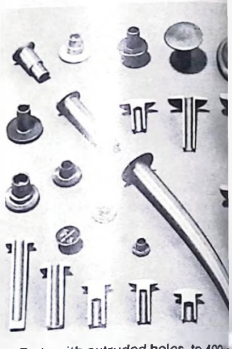

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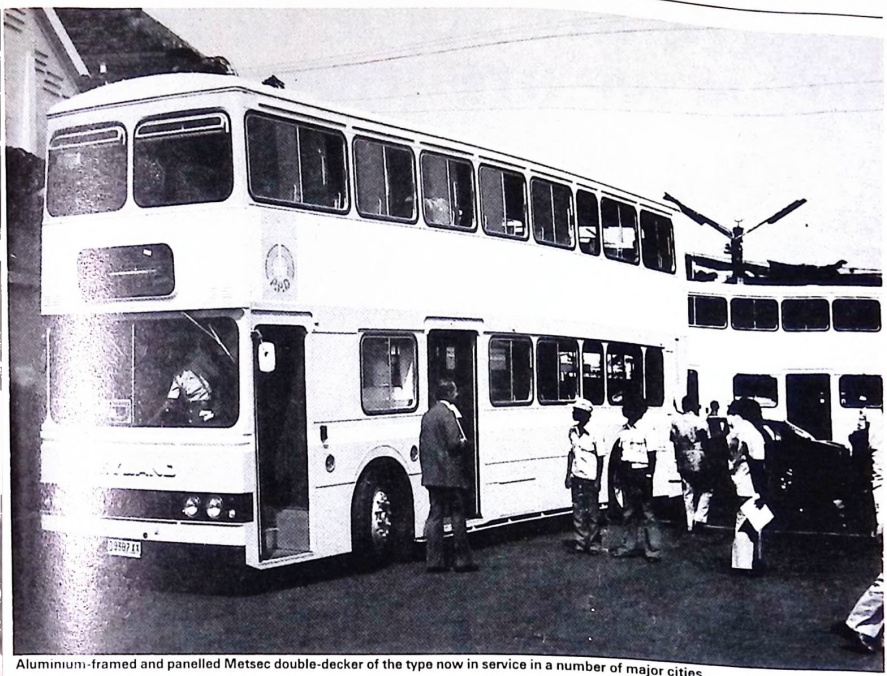
Commercial vehicle supplier – Duple Metsec



Aluminium-framed and panelled Metsec double-decker of the type now in service in a number of major cities.

Bus manufacture offers more opportunities for local assembly, using indigenous labour, than production of trucks. The body structure of a bus, though comparatively unsophisticated in engineering terms, demands many manhours for assembly. The newly-formed Duple-Metsec company is geared to supplying bus body kits. Alan Bunting reports.

IT IS over 40 years since a British company called Metal Sections developed its "bus in a box" concept. The firm, familiarly known as Metsec, realised the export potential of steel-framed bus bodies which could be shipped overseas as compact, crated kits and subsequently assembled using local labour. Shipping costs were much reduced by the bodies being completely-knocked-down ("ckd"); a ready-assembled bus is wasteful of shipboard cargo space, representing largely a "box of air". At the same time, assembly in the customer's country provided work for the local labour force, and in due course this led to preferential rates of import duty for ckd equipment.

Since 1950 Metsec has supplied over 5,000 single-deck and 3,000 double-deck bus body kits to more than 40 countries. The Metsec division of the large Tube Investments conglomerate was sold last year to one of Britain's major bus and coach building concerns – the Duple Group.

Coherent marketing policy

Duple (Metsec) Ltd, though still operating from the same TI manufacturing plant, now has marketing links with one of Europe's main bus producers, with the result that Metsec kits are being marketed more single-mindedly, by a team which understands all aspects of the passenger vehicle business.

Traditionally Metsec bus bodies have been designed for the easiest possible assembly – sometimes out of doors or under the cover of rudimentary "buildings" made from the timber kit packing crates. But as passenger expectations have risen in terms of comfort and weather-protection – largely as the result of competition in the market place – so Metsec has responded with more advanced designs.

almost entirely built around single-deck buses. Such vehicles are often based on truck chassis already sold in that market, with hard springing and far-from-ideal front/rear weight distribution. In Nigeria both the Leyland and Bedford chassis importers have, over the years, offered complete single-deck buses, built up from Metsec body kits, the assembly work being carried out by the chassis importer.

Two years ago Metsec won a contract to supply 100 forty-seat bus kits to Ghana for mounting on Japanese Nissan chassis, while in Senegal Metsec buses have been built on Ford chassis.

Following the award of manufacturing licences by the Nigerian Government to the four major European commercial vehicle makers – Mercedes-Benz, Leyland, Iveco and Steyr – Duple (Metsec) began studying the possibility of bus kit supply to those four concerns, enabling them to include buses in their ranges, with the minimum of additional production facilities over and above those required for chassis manufacture.

An integral part of every Metsec contract is the supply of know-how and advice on setting up the assembly operation. In most cases this involves Metsec personnel

continued

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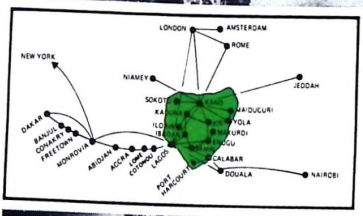

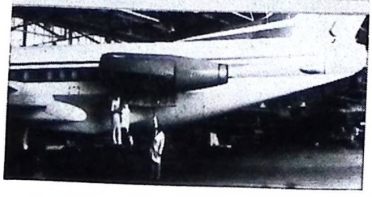

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on site. So far all Metsec single-deck bodies are of steel construction, which means low cost, easy repair (notably by welding) and fairly ready availability of replacement parts in the shape of steel pressings which as "one-offs" can be cut and folded using hand tools.

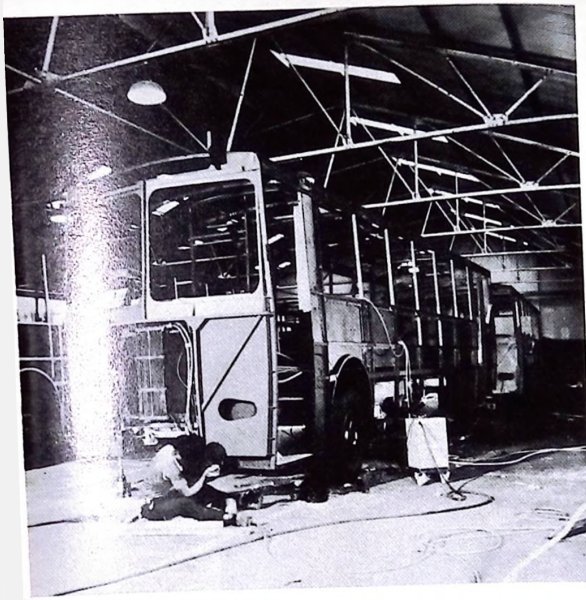
Aluminium

But there is now a trend in many markets to lighter-weight and more corrosion-resistant aluminium structures, using extruded sections which necessarily need to be supplied (in the event of damage replacement) by an aluminium stockist holding the right "suites" of extrusions.

Double deckers?

Aluminium has been adopted by Duple-Metsec primarily for double-deck buses. To date double-deckers have found little if any favour in West Africa. The mass-transit concept associated with double-deck – or even articulated – working is applicable primarily to the world's largest cities, where roadspace is at a premium and where the pay level of bus crews demands a close control of expenditure in relation to passenger capacity.

On a more practical "mechanical" note, double-deck buses are out of the question in many areas because of physical overhead obstructions, especially power and telephone lines. However it seems inevitable, in the Duple group's view, that the double-decker, at one time found only in London, is gradually growing in popularity and will be accepted in urban areas all over the world eventually.



Above, assembly of single-deck bodies in West Africa: where buses have been built in Nigeria, Ghana and Senegal. Below, typical Metsec single-decker in service based on a Leyland Victory 2 chassis.

Competition

Competition for Duple is much tougher in the double-deck field, coming from ready-assembled bodies produced, mostly in the UK, by companies like Metro-Cammell-Weymann and Walter Alexander on the same chassis. Rival vehicles also include so-called integral-construction double-deckers which have no separate chassis or, alternatively a vestigial semi-load-bearing underframe enabling the vehicle to be moved under its own power to the coachbuilders.

Obviously where a bus is put together locally, there is scope for cost reduction over and above the mere savings in shipping expense. Minor components can be sourced in the country of assembly, thereby providing further local work. Duple-Metsec says assembly of an average single-deck bus body requires around 1,000 man-hours of relatively unskilled labour, while a double-decker takes between 1,800 and 2,000 man-hours. The kits vary, however, in the extent to which they are knocked down. Some are part assembled by Metsec in the UK, being shipped out with complete side-panels intact for example.

Assembly is simplified through the use of easily-understood drawings and by keying every component with a clear prominent code number. Jibs employed in the manufacture of the sub-assemblies ensure that parts fit together immediately without further metal-working or large on-site jigging.

Bolting and rivetting

Construction is based, in all cases, on bolting (with lock-nuts) and riveting, rather than welding. In practice, relatively straightforward items like seats, floor coverings and trim are locally sourced, although longer production runs could justify local sourcing of items like glass and simple bracketry.

Because city bus operation is often government (or at least publicly) controlled, there is a tendency for Metsec assembly to be undertaken by government-sponsored factories, with buying of components arranged through public agencies.

Circle No. 19

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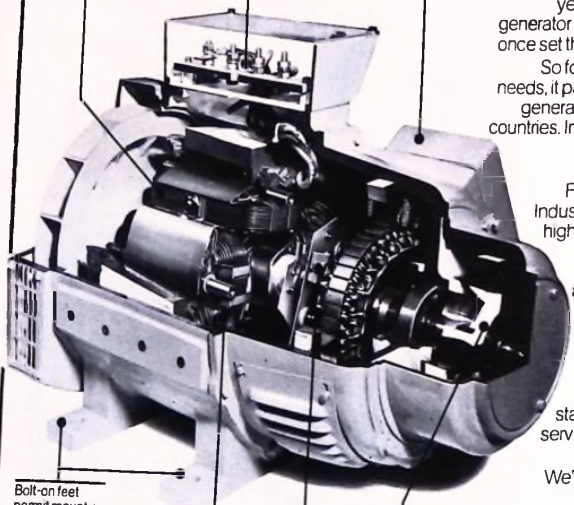

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Frozen food industry

Alan London continues his series about many different aspects of the frozen food industry.

IT MUST be emphasised that in the case of farm produce close co-operation between farmers and those who convert their produce into frozen food is necessary everywhere, whatever the type of produce. This is shown, for example, in a very impressive manner in the cultivation and harvesting of green peas in Britain. Green peas, it may be known, is a favourite vegetable to almost all sections of the population in that country: it is now, due to the frozen food industry, that can be enjoyed throughout the year in spite of the fact that the peas can only be harvested during the short time they are in peak of condition, which is during the seven-week period of July and August. During that time the whole crop produced by thousands of farmers has to be harvested and all subsequent processes completed such as the separation of pods from the vines, the removal of peas from the pods, the testing of samples for quality and tenderness and freezing them quickly – usually by subjecting them to a blast of intensely cold air, after which they are packaged and taken into store.

For weeks preceding the harvesting the fieldsmen representing the factory keep in very close touch with the farmers and in direct contact with the factory by portable shortwave radio to arrange for the arrival of the massive, self-propelled machines that perform the harvesting mechanically and for the trucks that carry the produce to the factory. The development of the cultivation by farmers of green peas has brought about a dramatic change in farming practice on many of Britain's farms, with benefit to all concerned.

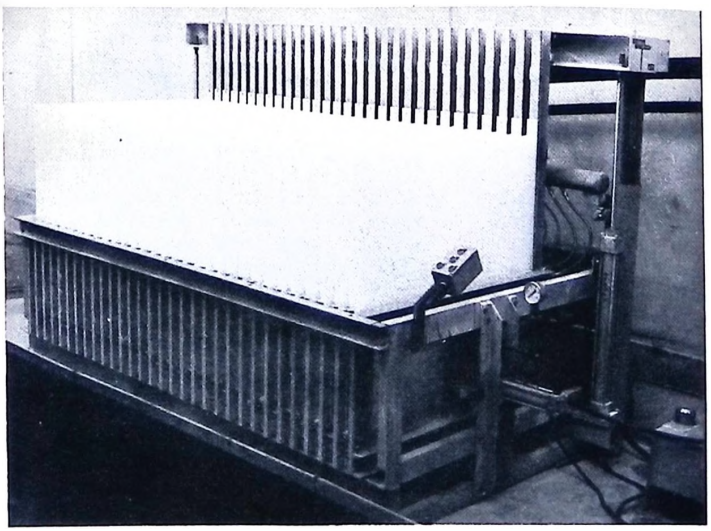
The fields of the farmer have, in fact, become the first stage in factory production. Although this system might appear to reduce the farmer's independence, it also brings him great advantages. By growing peas under contract, the farmer has the benefit of knowing well in advance that he will have no difficulties in finding a market for his produce and that he will receive prompt payment at the time of harvesting. Of course, the existence of a contract imposes considerable responsibilities on the farmer to carry out his obligations and always to strive to produce a crop of the highest possible quality, but the financial incentive encourages him to attain a high efficiency in his work.

Geographical influences

A comparison between the various features of countries in a temperate zone such as those in Northern Europe and a tropical zone as affecting the development of a quick-freezing food industry is interesting.

Many factors are in favour of temperate countries, in that they are in most cases relatively small and compact and the food-producing areas are not very far from the urban areas where most of the consumers live, so that difficulties in distribution due to long distances do not normally arise. Also most developed countries have a network of well-maintained roads with several carriageways that permit easy and speedy transport. However, in certain areas, developed and developing countries face the same problems.

In some large countries, both in temperate and tropical countries, where towns are a long distance apart, transportation of deep frozen foods may present problems. Obviously rapid transport is essential so it



A new vertical plate freezer from Italy, extremely compact and designed for rapid freezing of fluids or semi-fluids. The freezer works semi-automatically using forced circulation. Application of hot gas on the plates causes defrosting and release of the blocks of frozen matter.

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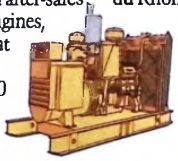

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continued from page 35

is highly desirable that the highways should be in good condition to prevent traffic delays. But the drivers of the vehicles should be skilled not only in driving but also in maintaining the cooling plant on the journey. They must ensure that if the cooling equipment has an electric generator driven by a petrol engine there are ample supplies of petrol on the vehicle. Also the vehicle should carry a range of spare parts, and the crew of the vehicle should be able to deal with at least minor breakdowns.

Exotic frozen foods

Apart from the demand for indigenous foods in deep frozen form, there is in European countries as in some fast developing countries like Niger a market for exotic produce. Many exotic fruits are imported preserved in syrup in cans, as well as other foods, but there nevertheless exists a wish for other foods that can only be imported successfully in many countries in the frozen form.

The importation – as does the exportation – of frozen foods necessitates comprehensive port facilities so that general and containerised cargo can be handled quickly and efficiently. To handle large refrigerated containers in some cases 40ft in length, suitable cranage must be available, and preferably load spreaders should be used for lifting such containers to avoid undue strains on the framework of the container itself.

Hold-over facilities should be available at the docks by which the cooling unit of a refrigerated container can be connected to the electricity supplies on the docks; otherwise an electricity supply from a stand-by generator must be available. In any case it is not advisable for a container containing frozen food to stand on the dockside in a hot sun for any longer than is absolutely necessary; consequently it is desirable for there to be special flat deck trucks standing by to carry the containers away.

Development tendencies

Over the years many factors have continued to popularise frozen foods. An especially interesting and almost dramatic development was the introduction of fish fingers. These enabled fish to be cooked by the housewife easily and quickly and served at the table in a new and appetising form. Previously in many cases she had had the task of buying the wet fish – which probably had been exposed to the air and flies – with bones, fins and skin which had to be removed, and cooking it; even when served it did not look particularly attractive.

Now she was able to buy just the edible parts of the fish in sealed packets, heat it for just a few minutes and serve it in dainty portions, possibly with golden breadcrumbs, all of which had an immediate appeal, especially to children. The success of the innovation was instant and the sales of fish fingers are now in the region of thousands of millions per year.

In due course followed a wide variety of other specially-prepared frozen products, including steaklets, beef burgers, cod-in-sauce, pizzas, ready meals, snacks like chicklets, cheeses and brunches and confectionery such as chocolate eclairs.

Of course, not all the products have an equally strong appeal in all countries, but some are extremely popular almost everywhere. As mentioned, there is a general tendency as standards of living rise for items that were initially considered luxuries to appear frequently on the table.

Feasibility

It may be feasible that in the same way that a frozen food industry has developed and attained large size in many countries, a similar industry can in time be built up in other countries that at present lack one, or have only a comparatively small one. In order to build such an industry a great deal of organisation may have to be carried out and facilities provided, not only in the form of plant, equipment and services but in the simplification of restrictions and other legal requirements.

The following articles in this series will deal with detailed considerations concerned with the types of plant and equipment needed at the various stages of the overall cold chain. ●

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Controlling river blindness

—reinvasion sets back WHO programme

The multi-million dollar programme to control river blindness in West Africa is in peril. The World Health Organisation seems powerless to stop the disease-carrying blackflies reinvading cleared areas – more ammunition for those who say that chemicals alone cannot defeat any insect. Robert Lamb reports.

RIVER BLINDNESS is caused by a worm which breeds in human beings. The worms travel through the bloodstream, and can penetrate the eye eventually causing blindness. The worm is carried from one human to another via the blood-sucking blackfly. The densest populations of infected blackflies are in the river valleys – the blackfly breeds in fast flowing rivers. And the near certainty of eventual river blindness has driven the villagers out of the valleys.

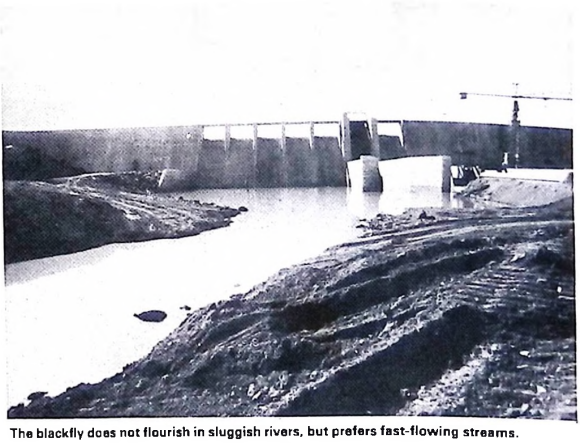
The disease – known medically as onchocerciasis – causes excruciating irritation when the worms gather under the skin in other parts of the body. Up to 40 million Africans suffer from this milder form of the disease and in the Sahel alone, 70,000 are blind. It also occurs in South America (where it may have been spread by the slave trade) and in North and South Yemen.

Chemical control

There are drugs which can cure onchocerciasis, but these are expensive and dangerous to administer without hospital supervision. At present the only practical way to control the fly is to kill the blackfly larvae in the rivers with chemicals.

In 1974 the World Health Organisation started a 20 year programme aimed at eliminating the blackfly from seven Sahelian countries. In marked contrast to the faltering malaria and sleeping sickness campaigns, WHO's onchocerciasis control programme has seemed an outstanding success. But now news is filtering out that this multi-million dollar campaign too is running into serious difficulties.

The problem is called reinvasion. Blackflies have begun to reoccupy areas where the local fly population had already been wiped out. Some of these invading flies may have flown vast distances – perhaps as much as 500km (310 miles). The trouble is that no-one knows for sure exactly where they are coming from. WHO knows that if it fails to control the blackfly, the most productive areas of this desperately poor region will stay unused.



The blackfly does not flourish in sluggish rivers, but prefers fast-flowing streams.

Medical experts think the disease may occur in cycles. When the risk of infection becomes too great, and too many peope go blind, the villagers gradually desert the settlement, the young people first. With no more infected humans left for the flies to bite, the disease cycle is temporarily broken. The area is free of the disease, and the cycle begins again when, one or two human generations later, the people move back to the village. Over the centuries, the cycle of desertion and recolonisation may have been repeated many times in the Sahel.

Breaking the cycle

The aim of the WHO campaign is to break this cycle of infection permanently. The idea is that eventually there will be no reservoir of infected humans left within the area covered by the programme to pass on the disease. The campaign was scheduled to last 20 years because the worm has a long life, 15 years or more, in the human host. But reinvasion has disrupted this convenient timetable and no one now knows how long the programme will have to continue.

The main culprit is a savanna species of the blackfly which the experts call Simulium Damnosum. WHO is attempting to control the fly over a vast slab of the Sahel stretching from the border of Guinea to Nigeria – 700,000 skm (273,000 sq miles) in all. For the past three years the perimeter of the control zone has been subject to reinvasion on three sides.

When the boundaries of the control zone were drawn up it was realised that reinvasion could pose a problem. But the WHO preliminary report spoke confidently of keeping it to "manageable proportions". There was evidence to show the blackfly could fly one hundred kilometres (62 miles). But is is now known that Simulium Damnosum can fly four or five times that distance.

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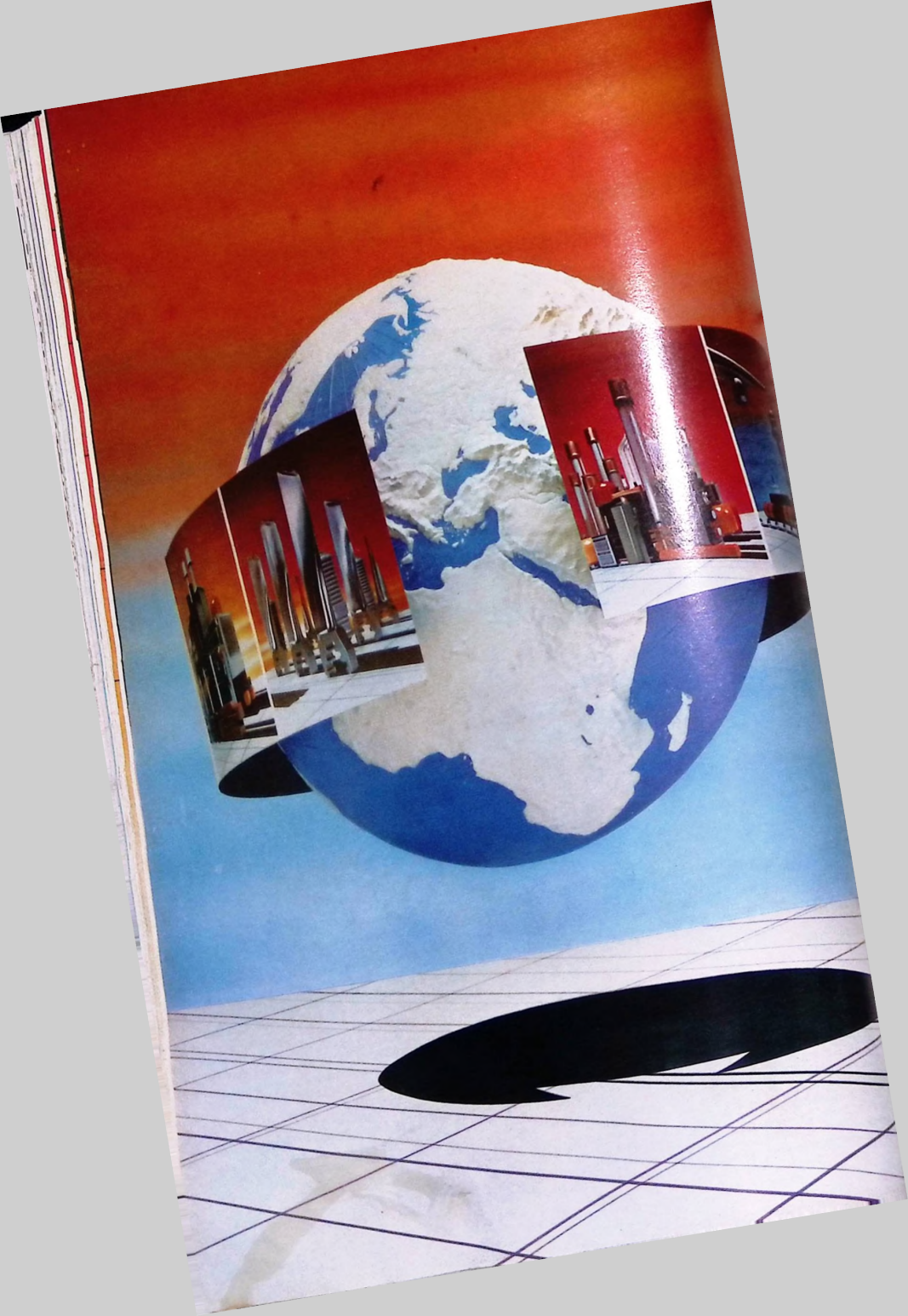

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Reinvasion is turning the programme into an expensive gamble – for which the USA, Canada and other European Community countries are paying, through a special fund set up by the World Bank. Figures just released show that the original price-tag – $120 million – will soon be passed.

One report published recently in the London Observer, says that wiping out the breeding sites of the invading flies could push up costs by a factor of ten. Dr John Davies, leader of the WHO Entomological Evaluation Unit, concedes that merely extending the control zone south into the Ivory Coast and Ghana will increase the cost by a half. "We have a programme that works", he says, "but it is essential that we find ways of economising."

Breeding habits

What made the programme seem practical in the first place is the fussy breeding habits of the blackfly: it will only lay its eggs in fast flowing rivers and streams. This makes it vulnerable to insecticide dumped just above the rapids. Even so, 14,000km (8,700 miles) of river have to be treated regularly and WHO has only eight helicopters and two aircraft to do the job.

The campaigns against the malaria mosquito and the tsetse fly which spreads sleeping sickness have involved using environmentally harmful chemicals, to which some mosquito species have developed a resistance. The blackfly has so far shown no sign of a resistance to Abate, the chemical chosen by WHO. Fish are not killed by Abate but it is known that the chemical can kill up to a third of the insects and other invertebrate life in the river.

WHO claims that spraying has interrupted the disease in all the areas not subject to reinvasion. A survey carried out this year in 25 villages in the centre of the control zone shows that children born after the start of the campaign have not been infected. And in some areas where the threat of infection has diminished, villagers have been moving back spontaneously. This is happening, for instance, in the White Volta Valley in northern Ghana.

But it is the programme's flanks, and not the centre, where the real problems arise. Reinvasion is happening in southern Mali and the Ivory Coast in the west, Ghana and isolated parts of Upper Volta in the centre, and in Togo and Benin in the east. WHO's latest evaluation report makes the gloomy prediction: "This phenomenon can be expected to occur each year". And the most disturbing aspect is that a very high proportion of the flies – up to 15 per cent – are already infected with river blindness before they enter the zone.

Where are these flies coming from? The fact that they arrive with the monsoon winds between May and August suggests that they come from a broad arc of savanna running through Senegal, Guinea, Liberia, Sierra Leone and the Ivory Coast. Controlling the fly over such a vast area would require a programme every bit as ambitious as the current one. A feasibility study is now underway.

Despite these setbacks, the W
gramme has strong claims to be
the UN's best organised project
element has been the almost
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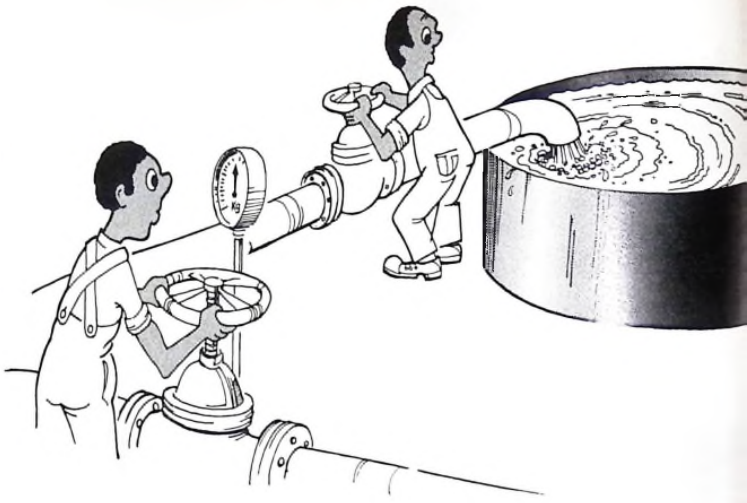

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Systemtechnik exhibitors previewed

As a major supplier of equipment to the Nigerian market, the British electro-technical industry is well represented at Nigeria's Systemtechnik exhibition in Lagos from March 23–28. Thirty companies will be featuring a wide range of products including power generation equipment, rotating electrical machines, motor control gear, switch-gear, installation equipment, conduit, fusegear, cables, mobile crane, lighting equipment, image intensifiers, television camera tubes, telecommunications equipment and cables, electronic equipment and engineering teaching and training equipment.

Conduit

Burn Tubes Limited will be exhibiting Burn Super Steel and pvc-covered conduit, together with a wide range of fittings and accessories.

Burn Super Steel conduit is available in light, medium, heavy and solid drawn ranges with a variety of finishes for an extensive range of applications. Standard Imperial sizes include ½, ¾, 1, 1¼, 1½, 2 inches while standard metric sizes are also available. For heavy protection Burn Super Steel is galvanised inside and out and offered with a black stove enamel finish.

Also on show will be Burn pvc-covered steel conduit. This has a protective coating of pvc in orange, the British Standard identification for electrical installation. It offers particular advantages in applications where hygiene is important such as schools, hospitals and canteens.

Burn Tubes Limited offers package deals of conduit, fittings and all necessary installation equipment for government schemes. Burn steel conduit is widely used throughout Nigeria.

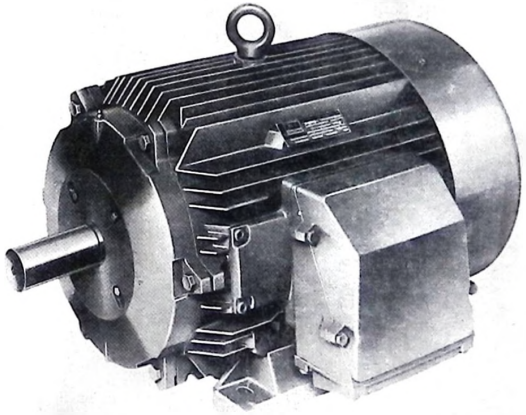
Wiring accessories

Crabtee Electrical Industries Limited, a member of the international Berec Group of Companies, are displaying ranges of electrical wiring accessories, circuit breakers and motor control gear.

The selection of wiring accessories being shown include the "Classic", "Corinthian" and "Rockergrid" ranges of lighting switches; socket-outlets, ceiling switches, a new dimmer switch, a shaver supply unit and a 45-amp cooker control unit.

Circuit breakers comprise the well-established C-50 miniature circuit breakers, consumer units and distribution boards and 100-amp single, double and triple-pole isolating switches. On show for the first time at this exhibition are Starbreaker miniature circuit breakers, consumer units and earth-leakage circuit breakers, together with FC range moulded case circuit breakers. Earth-leakage circuit breakers which include double and triple-pole current operated and voltage operated units are also being shown.

Motor control gear exhibits includes the



GEC Nigeria Electrical Plant Ltd will be exhibiting the 22kW (30hp) Alpak D180L frame motor.

successful "T" range of contactors and overload relays, for direct-on starting up to 10hp (7.5kW) and 15hp (11kW) for star-delta operation. The overload relays offer ambient temperature compensation, hand or automatic reset and remote trip indication and single phase protection.

Generators

On the stand of **Dale Electric** – recently described as "Britain's most successful generating set company" – are two important "firsts".

The company are showing a Conquest range generating set, powered by the new Rolls-Royce CV diesel engine. The Dale set saves on engineroom space and freight cost.

The Dale 8000 automatic control panel for the Dale generating sets is also on show. This advanced, yet simple to operate and maintain system, uses module cards that pull in and out for easy maintenance. And – an operator's dream – there are illuminated push buttons on the front of the panel, all carefully labelled, to make testing, fault-finding and start-up simple.

Also on the Dale stand is a Panda range set, powered by a Perkins diesel engine. Its economical power plus Dale technology in generating set design makes it a good buy for Nigeria.

For those who want their own small generating sets, Dale are showing the Conyers "Cadet" alternator – up to 9kVA. Conyers are a sister company of Dale. Throughout Nigeria Dale is supported by the after-sales service of Stokvis.

Fluorescent lighting

Fitzgerald Lighting Ltd is a private, limited liability family company whose directors have been involved in the fluorescent lighting industry for over 30 years.

The company's products are a standard range of fluorescent battens and accessories, circular fluorescent fittings, recessed and surface modular fittings, all of which are produced in a wide range of lamp sizes, voltages and frequencies. Other products available include emergency light fittings, display lighting and three-pin-plug tops. A selection of these products will be displaced on the company's stand.

The company's involvement in the export market has progressively increased.

continued

Small outlay Medium speed Large benefits

Invest in Blackstone 'Economy Range' packaged genera ing set

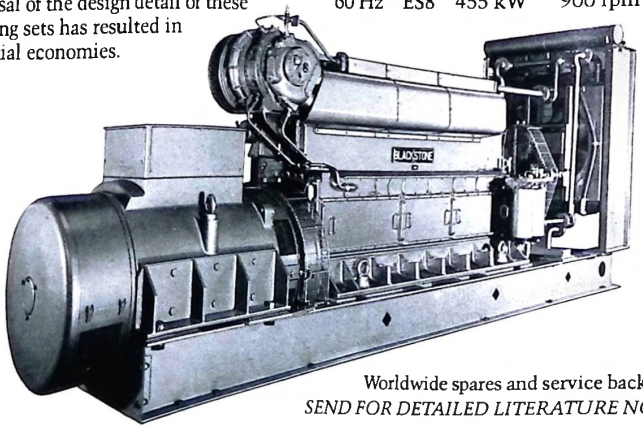
The Blackstone 'Economy Range' of standard packaged generating sets achieves the optimum in cost per kW by combining the reliability of medium speed running with carefully streamlined manufacturing and operating costs. In other words, long term dependability with maximum economy.

Quality and reliability have been maintained by utilising the features of the standard well-proven, medium speed Blackstone E Type engine but a complete reappraisal of the design detail of these generating sets has resulted in substantial economies.

'Economy Range ts are fully assembled and tested by r own skilled engineers to offer you wh we believe is most cost effective mean f diesel power generation available for b load, peak lopping or standby duties.

Manufactured in 6 and 8 cy inder units th following powers are avail ble at 415 volts

50 Hz	ES6	380 kW	1000 rpm
50 Hz	ES8	506 kW	1000 rpm
60 Hz	ES6	342 kW	900 rpm
60 Hz	ES8	455 kW	900 rpm



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Hawker Siddeley Group supplies electrical and mechanical equipment with world-wide sales and service.

Circle No. 247 on enquiry card

Latest figures published by the British Government Business Statistics Office indicate that the company now exports 28 per cent (in value) of all fluorescent fittings exported from Britain.

UK's biggest

GEC's SL-1 digital business communication system operating under stored-program (computer) control, a new portable thermal camera for fire detection, and the latest design of GEC SF6 circuit-breaker for 132kV service are among the diverse exhibits being shown by GEC companies at the "Systemtechnik" exhibition in Lagos. Also featured are: payphones, telephones, digital and [illegible] telecommunications equipment, telephone cables, spark gaps, camera tubes, image intensifiers, 11kV and 33kV oil circuit-breakers and a wide range of motors and rotating machines for general industrial applications.

GEC companies have supplied equipment to Nigeria for many years and have established manufacturing and sales support services in Lagos.

Cable

A cable manufacturing company of world standards, **Telephone Cables Limited** (TCL) offers to industry at large not only a wide range of quality telecommunications cable, but also the added strength of 50 years' experience.

TCL supplies all types of telephone cable – coaxial, polyethylene and paper insulated. Sizes vary from a single pair up to 4,800 pairs of conductors – both copper and aluminium conductors are available – and most of these cables can be produced to fulfil specific customer requirements and environmental conditions.

To meet a growing demand a number of optical fibre cables are also being produced for applications in telecommunications, industrial and military installations. Throughout all stages of TCL cable production a stringent programme of tests ensures high quality from the receipt of raw materials to the despatch of the finished product.

And, in addition to manufacturing know-how TCL also brings to every telecommunications project its widely accompanying skills, through cable design and network planning to complete cable installation. TCL is represented in Nigeria by Telephone Cables Nigeria Limited.

World force

The **Hawker Siddeley Group** is a world force in electrical and mechanical engineering, manufacturing in twenty countries. More than 56,000 people are employed within Hawker Siddeley – working for about 140 free-standing manufacturing and marketing companies.

Some Hawker Siddeley companies export as much as 90 per cent of their output, and many have consistently increased their exports in recent years.

The following subsidiary companies will be exhibiting at the Exhibition on the Hawker Siddeley stand: Brush Fusegear Ltd, Brush Power Equipment Ltd, Brush Switchgear Ltd, Hawker Siddeley Power Plant, and Mirrlees Blackstone.

Mobile crane

Jones Cranes Limited are exhibiting its Jones IF10 diesel hydraulic fast-travel mobile crane. Because of its compact size (4.40m long, 2.39m wide, 2.69m high) and rear wheel steer, it is very manoeuvrable and highly versatile in application, particularly in confined spaces. It is equipped with a 10.82m telescopic jib allowing a maximum outreach of 8.4m. A fly jib of 5m is available.

Fully blocked, the Jones IF10 will slew with 10 tonnes through 360° and has a free-on-wheels capacity of 8 tonnes over the front. The chassis incorporates a carry-deck for transporting loads up to 6 tonnes.

The cab is of steel fabrication and all controls have been ergonomically designed and positioned to reduce driver fatigue. The cab is fully detachable, and it takes only a few minutes to disconnect the electrics and release it from the chassis – making servicing easier and less costly.

Terminal blocks

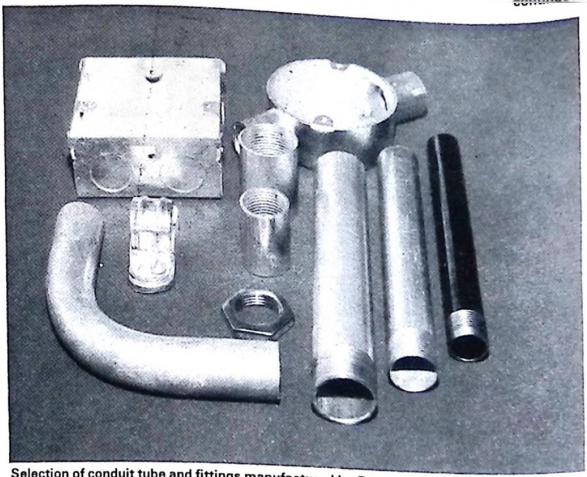
A range of rail-mounted terminal blocks to fit TS32, TS15 and TS35 rails for feed through, test/ disconnect, fuse, wire wrapping, stud, earth and neutral, compensating resistance, component holders (electronic), modular pneumatic tube connectors, termiswitch and alarm fuse terminals are being exhibited by **Klippon Electricals Ltd.**

A complete new range of steel enclosures is to be launched at the show which will feature solid-welded construction and improved longlife rubber gaskets for the lids to enhance resistance to moisture and dust. TB15 Series are available in five basic dimensions. The range is intended for indoor use only, and complements Klippon's already wide range of box-type enclosures.

Switchgear

Long and Crawford Limited established as Electrical Engineers over seventy years

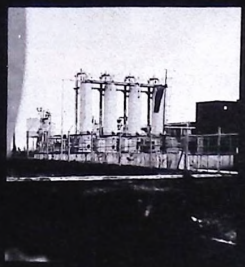
continued



Selection of conduit tube and fittings manufactured by Burn Tubes Ltd.

Adjusting low two panels of an audio channel on the Plesseyn PRD 1650 multiplex unit.

Power for commerce



Power for industry

Power for services

Power for the 1980's

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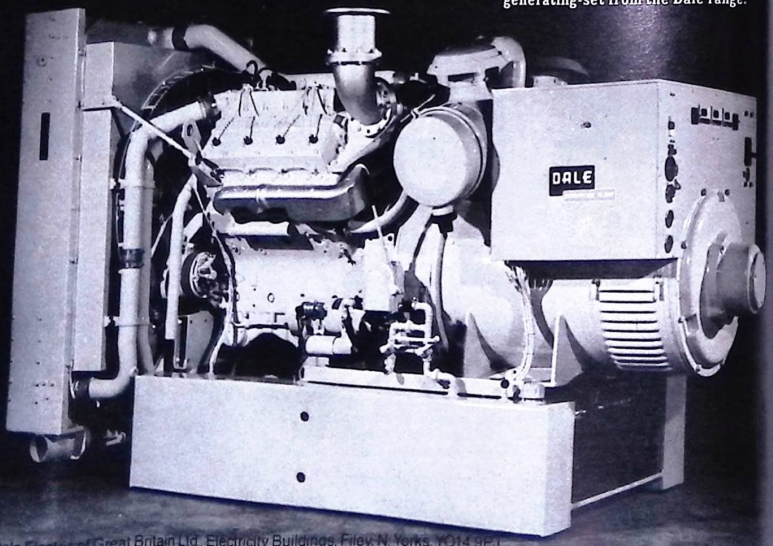
GENERATING SETS

Compact, low-weight, high-powered, generating-set from the Dale range.



Dale Electric of Great Britain Ltd. Electricity Buildings. Filey. N. Yorks. YO14 9PJ.
Telephone: Scarborough (0723) 514141 Telex: 52163
Offices in London, Midlands, Scotland, Holland, Scandinavia and the Gulf. Distributors throughout the world.

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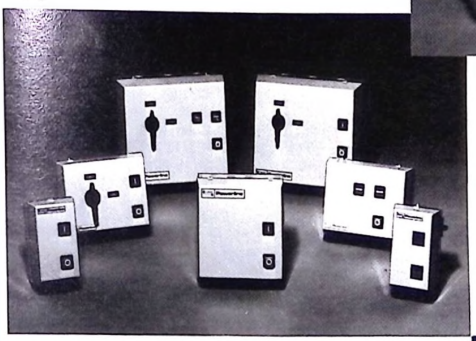
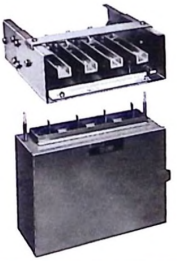
Simplex

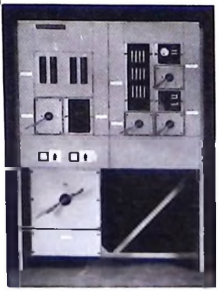
DISTRIBUTION

Simplex-GE — the power in Electrical Distribution products where quality and high technology provide total reliability for housing main and busbar systems, through distribution boards, fuse switches, switch fuses and circuit breakers to the control of power by motor starters and auxiliary equipment.

One name for all your electrical distribution and power control requirements for commercial and industrial application. Simplex-GE.







Simplex

SIMPLEX-GE LIMITED, HEAD OFFICE & EXPORT
P.O. Box 102, Ash Hall, STOKE ON TRENT ST2 9QD, England.
Tel: Ash Bank (078130) 3003
Telex: 36657 SGEL Cables: Tilectric, Stoke.

ago have now been manufacturing high voltage switchgear for over sixty years. The company specialises in a range of equipment for service from 3.3kV up to 24kV with normal current ratings up to 630 amps. The present range of indoor/outdoor Switchgear comprises oil switch and oil fuse switch equipment in both extensible and non-extensible forms together with HV metering facilities for both arrangements.

Long and Crawford Switchgear, apart from extensive usage in the UK is to be found in service with many of the world's supply authorities, including those of the Middle East, the Far East, Australasia, countries of South America, East Africa and West Africa, including Nigeria with whom the company has had a long-standing relationship.

The equipment to be shown at the exhibition will be extensible ring main Switchboard comprising R3 double oil switch/B3M busbar metering/GF3 oil fuse switch, together with a single oil switch unit type J3 fitted with motor drive for remote operation.

Power protection

Reyrolle Protection produces a wide range of power-system protection and associated equipment, using the expertise gained from over 50 years of experience in

Recently introduced Crabtree products which are on show for the first time at Systemtechnik.

the design and manufacture of these products.

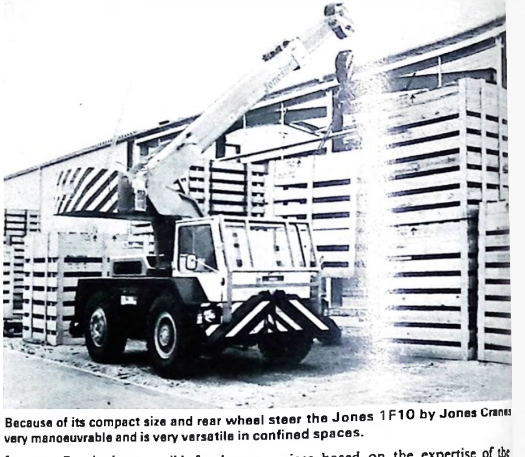
The Hebburn plant contains the company administration, research and development laboratories and the light engineering factory which are responsible for the development and manufacture of: auxiliary and tripping relays, electromechanical and static measuring relays, distance protection with intertripping, acceleration and blocking facilities, pilot-wire and transformer differential protection, phase comparison carrier current protection, voice frequency power line carrier, circuit-breaker fail and auto-reclose relays, check synchronising relays, alarm annunciators, earth monitoring/leakage units, miniature circuit-breakers and miniature control switches.

The Hetton factory is solely concerned with the production of the range of THR High-speed distance protection. The third factory at Peterlee is responsible for the research, development and production of the range of microprocessor based system control equipment.

Of the total output of these three manufacturing units, approximately 80 per cent is exported, either directly or indirectly, to over 45 countries worldwide.

Educational service

PCL International Services offe range of professional and educati



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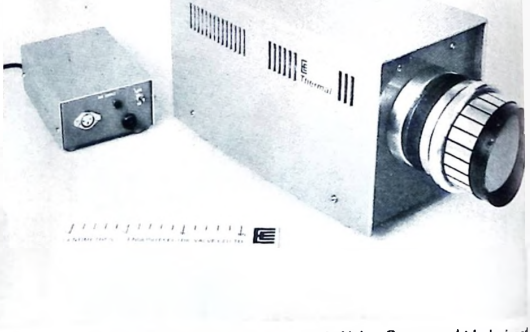

P4200 Pyroelectric Vidicon camera by English Electric Value Company Ltd, designed meet the operating requirements of the P8092 Pyrotechnic C Vidicon.

always been internationally orientated, the PCL has fostered many contractual links with institutions of higher education and related government departments in countries overseas.

The pattern of PCL involvement in support of higher and technical education in developing countries has so far included: analysis of education and training needs, either nationally or within specific industrial/commercial sectors and in relation to manpower demands.

For Systemtechnik 1981 PCL International Services will be displaying a laboratory test rig for two-phase heat transfer experiments which is being developed by the PCL so that the temperature and heat flux readings may be displayed graphically on VDU under the control of a dedicated microprocessor. This equipment will shortly be marketed for use in teaching laboratories used for the training of professional engineers. Also on the stand will be examples of PCL teacher supported learning packages and sample layouts of typical engineering laboratories.

Telecommunications

Plessey Telecommunications' wide range of equipment is reflected in the items being displayed; subscribers telephone apparatus, manual switchboards and digital electronic switching systems. These equipments have many applications offering advantages to organisations both large and small, and of course are supported by efficient local installation and maintenance services.

Plessey Radio Systems are displaying a working configuration of the highly reliable MK2 PRD1100 multi-channel Radio Relay equipment. The equipment is extremely versatile in its application providing a realistic alternative to telephone lines where their installation is uneconomical or impractical.

Plessey Avionics and Communications are exhibiting examples of equipment from its comprehensive range of multi-role combat radios. These include HF and VHF manpack/ vehicle radios, Groundsat the unique common-channel repeater station, and a highly successful digital message terminal.

Plessey Aerospace offer a range of Engine Driven Generator sets which provide reliable, high-quality electrical power at extremes of environment. Models are from 28V DC, 50Hz and 400Hz AC, 300W to 20kW, petrol- or diesel-engine driven.

Electrical cables

Sterling Cable Company (a part of the Raytheon Group) have for a great number of years manufactured electrical cables for use in installations of almost every size and type. These cables have been installed all over the world for a wide variety of applications which include oil and petrochemicals, public electrical utilities, mining, ships, defence, airports, construction.

A full range of cables are manufactured including many of a more specialist nature including fibre optics. One area in which Sterling Cable Company have been particularly successful is the oil and petrochemical industry where their cable has been extensively used on over 200 major contracts.

In addition, Sterling Cable Company are able to co-operate with other companies in their group where expertise in the electrical and electronics fields may be required.

Comprehensive

Simplex-GE are major manufacturers in the UK electrical industry providing a fully comprehensive range of electrical control, distribution and installation equipment, protection devices and lighting. All are manufactured to the highest standards at factories situated in various UK locations.

Each manufacturing unit specialises in a particular product area in the UK. At Brighton, for example, the well-established Allenwest and Simplex-GE motor control and distribution systems are manufactured, while in Wednesbury, Staffordshire, Simplex-GE has its main factory for the production of trunking and conduit products and busbar trunking systems.

Within the cycle of production manufacturing operations cover every aspect from foundry work and sheet metalwork with flowline production facilities for brazing and welding, spray painting booths, injection moulding sub-assemblies with vigorous checking for quality and final assembly of a multitude of individual components into the whole product range. Final quality control checking and testing is carried out before delivery through the Simplex-GE sales organisation based in the UK.

Sound expertise

With more than 20 years experience **TecQuipment** has established sound expertise in the development of training methods for engineering, science and technological disciplines.

Some 400 products make up the range, covering many levels of teaching from school to university and industrial and military training. The continued development of the product range enables it to be used in an integrated approach to engineering teaching. Individual products are backed with teaching software such as tapeslides, student work books, laboratory sheets and calculator programmes.

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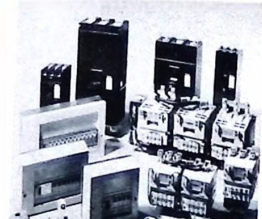

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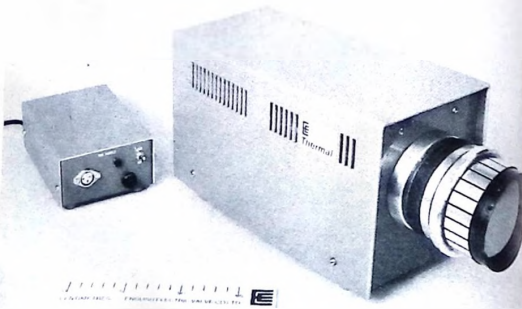

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Machinery installation and repositioning

Yard loading and u[illegible]oading

6 tonne nose hook [illegible]achment

Winching

Personnel carrier/maintenance

Materials handling

Focus on the Netherlands

Dutch developments

Planning ahead

A DUTCH company which specialises in business-organisation systems, **Efficienta B.V.** at Krimpen aan den IJssel (Holland), recently delivered a flight-chart to Nigeria Airways. The company claims that at present this system is the most progressive of airline-systems.

The system breaks down into four parts: on the first reference panel the details of each aircraft are monitored, such as the captain's name, and crew; the three following panels show the actual situation for that day, the next day and the day after the next day for each aircraft.

With this planning board – which has a dimension of $6\frac{1}{4} \times 2\frac{1}{4}$m – it is possible to follow closely each international, intercontinental and domestic flight. On each planning line per airplane the flight-number, the airports (departure, stops and final destination), the times of arrival and departure are detailed. Blue-coloured plannings symbols mean international outgoing flights, yellow means incoming flights and green indicates domestic flights. The colour red is used for alarm, eg delay, or worse. Since the workers of the co-ordination centre are informed about the flight-movements by this planning board, it is possible to react immediately and give instructions, like the switch to a replacement aircraft or the deviation of a flight insertion and flying over of a fresh c etc.

The use of such planning boards is totally new development in aviation. K (Royal Dutch Airlines) has been usi similar planning board for flight-m ment control at their headquarters Amstelveen for the past ten years. Philippine Airways and Kuwait Air are using Efficienta Flight Movement trol Boards. It should be noted that manual system works faster than tronic equipment, used by many airline companies.

Work being carried out on an irrigation project in Kano by the Dutch consulting engineers and architects, Haskonig. Haskonig was established in 1881 and has been working outside Europe since 1951. In West Africa, Haskonig has worked in river basin development, and flood control, erosion protection, planning and dam construction. For details of Haskonig's work in the River Niger Project turn to page 67.

History

Efficienta Business Organisat Systems BV has been active for over years in the field of developing and ma facturing magnetic planning syste which are especially used in compar where planning is a basis for an effic organisation, such as transport, facto office-organisations, computer-indus and service-rendering companies. At moment Efficienta products are distribu to 58 countries in the world.

Circle No. 00 on enquiry

Royal Boskalis Westminster forms new subsidiary

In order to adapt more effectively to developments in agriculture – particularly those in the third world – **Royal Boskalis Westminster nv** of Papendrecht, the Netherlands, has formed a specialist subsidiary.

Known as **Boskalis Westminster Agrio Contracting bv**, the new company will concentrate on especially large agricultural projects, primarily on a turnkey basis, which have a civil/ technical engineering bias.

With the world food shortage becoming an ever increasing problem, land cultivation, drainage and irrigation projects are given a high priority by development and financial institutions.

The formation of this new specialist subsidiary is a logical progression for Boskalis Westminster, an international contracting company already extensively engaged in large scale earth moving projects in connection with, for instance, the construction of irrigation canals and barrages.

Boskalis Westminster Agrio will be able to draw upon the expertise and services of its many sister companies, especially Hydronamic bv of Sliedrecht who specialise in harbour works and dredging as well as land development.

● Bos Kalis Westminster Ltd. had a successful year in 1980. Among Contracts awarded subsidiaries in the civil engineering division obtained orders in North Yemen, the UK, the Netherlands and in Mexico. The order in Mexico was for a large dry dock to be built in combination with a Mexican contractor. Work was started on laying a fuel pipeline in Algeria; in both the Netherlands and the UK smaller pipeline contracts are to be carried out.

Dutch developments

Drilling range from Conrad-Stork

Conrad-Stork has developed a new Conrad Pit-Digger. The Pit-Digger is a fully hydraulic rig and has been specially designed to excavate large diameter pits in alluvial mineral deposits (such as gold and diamond), and to carry out civil work, e.g. foundation testing and piling, sinking waterwells etc. (It shold be noted that the Pit-Digger does not penetrate hard rock).

Excavation is performed by means of a grab inside casing, which is lowered by slow and intermittent rotation. The casing is forced down by its own weight and the additional weight of the rotating device clamped to it. The lower end of the casing is protected by a special casing shoe with welded-on cutting edges; if required, it is provided with saw-teeth.

The rig itself consists of three main parts: a diesel hydraulic power set of 42 horse power mounted on a skid together with a 2 ton free-fall winch and control panel; a tubular steel tripot mast with top sheave arrangement; a rotary-table suitable for intermittant rotation.

The rig is so constructed that it can be unassembled in various smaller parts enabling the user to transport the rig in areas where access to the drilling site is a big problem (eg jungle conditions).

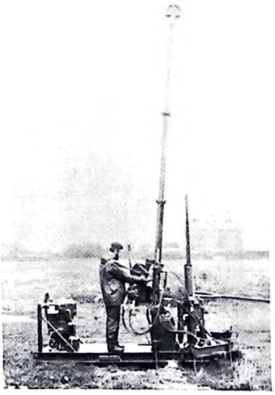
Soil investigation

The Conrad Stork Drilling Department has always been heavily involved in placer exploration in alluvial (unconsolidated) soils. The "Banka"-handdrill is known practically all over the world; the Power Pioneer (PP-150), a tripod semi-mechanised percussions rig, has been, and is still used by many contrctors for soil investigation and placer exploration, but has also been copied by various firms, especially in the UK.

Skid mounted

A new development in the range of percussion equipment in the Power Pioneer range is the PP-350. This is basically a skid mounted rig powered by a 26hp diesel engine and fully hydraulically driven. The mast is of a simple telescopic construction (three sections) with a height from the centre of the crown sheave to the ground level of 6m. Its maximum hoisting capacity is 1,5 ton.

As a result of the large pull-down force, it is necessary to anchor the rig to the ground with the help of ground anchors (consisting of one-blade augers) which are screwed into the soils by a hydraulic "anchor spanner" which, obtaining its hydraulic power from the rig, can be operated by two men, thus making it a minor operation. As an optional, auger



drilling or rotary drilling (flushing) can be performed. The total weight of the machine is not more than 2,000 kilos and so it can be shipped as a compact package of 3,5 x 1,35 x 1,4 = 6,6cu.m by trailer, truck ship or even by air.

In case of the unconsolidated soil condition maximum drilling depths of approximately 80m with a 6" casing can be achieved.

The automatic percussion winch (oscillator-winch combination) is built against the mast at chest level for convenient drilling; all control levers are at the same height. The casing is pressed into the ground with the help of a special "diabolo" spider and slips construction and two hydraulic cylinders. The largest casing diameter is 9" (225mm); the pull-down force on the casing is 15,000kg, the pull-up force (to withdraw the casing) 25,000kg.

KLM Dutch airlines

With the construction of an International Airport in Kano in the early 30s, the horizon for air travel to and from Nigeria first really opened; but it was not until March 1947 that KLM Royal Dutch Airlines commenced scheduled flights.

In January 1961, KLM extended her area of operations to the new International Airport at Lagos. KLM began with the famous Douglas DC-4 aircraft, having a capacity of only 44 passengers.

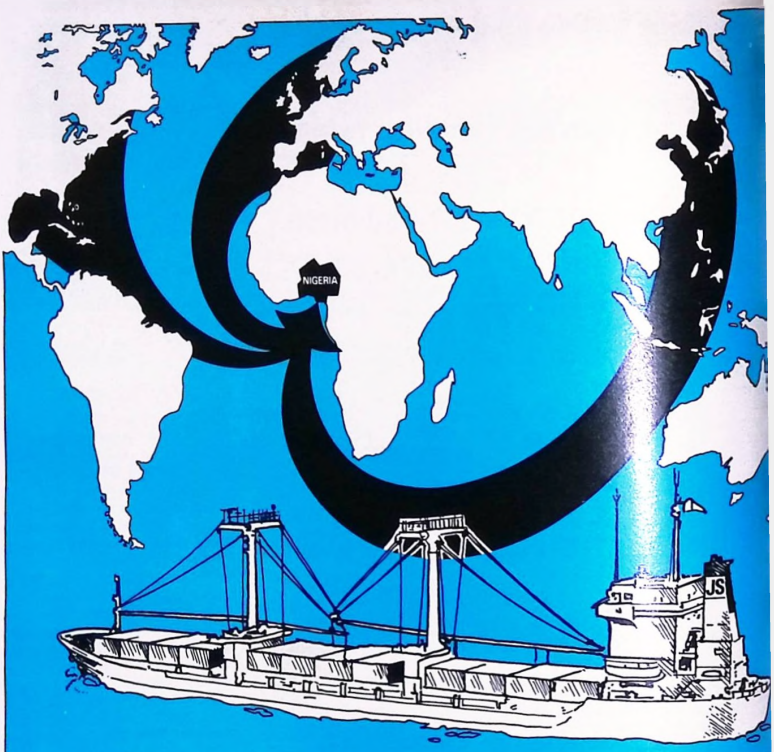
The demand and supply of highly skilled manpower and industrial investments from abroad following the Nigerian oil boom resulted in an immense boost to the total airline market. KLM soon responded by providing more modern aircraft, culminating today in the DC-10 with a load capacity of 263 passengers, and three flights weekly to Lagos and two to Kano.

The close relationship between KLM and Nigeria Airways is now strengthened by KLM's contract to work with the national carrier on an expansion and development, managerial and training contract.

Livestock projects

The company **Firma Schaap** offers a step by step approach with education, training and transfer of know how in livestock projects, sometimes with the possibility of (co)-financing.

In the last decades the idea of setting up pilot-cattle-stations with technical assistance has become popular in various countries. The stations built by Schaap serve as model farms and professional education-centres on all levels. Cross-



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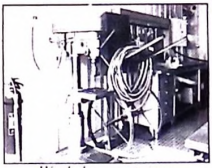
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Dutch trade partner

Products and expertise for West Africa

DUTCH companies have had an important role to play in West African countries for at least the past thirty years. Their strength lies as much in exporting products as in providing services, especially in the civil engineering sector, and more specifically in the field of dredging.

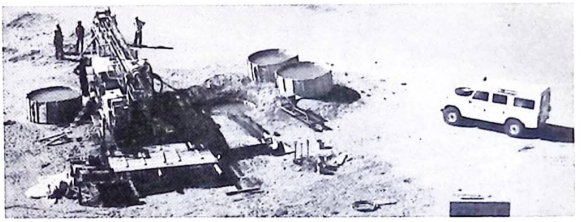
Like the Swiss, the Dutch have no colonial experience to draw on when working in West Africa and like the Swiss, the Dutch have developed expertise in certain areas of technology at home which has found markets and overseas. Thus the Dutch have had to develop techniques for tackling the geographical and topographical problems associated with flat countries, techniques ranging from dredging to land reclamation and flood prevention – all problems which have emerged in urban developments along the West African coastline (and even in rural areas). Dutch companies such as Royal Boskalis Westminster provide an obvious example of this expertise having been extensively involved in reclaiming land around Lagos as well as in dredging land as a preliminary to port construction. On the manufacturing side the Dutch are important in Nigeria for light goods and raw materials – electronic equipment, lime and pipes are all important exports. While on the agricultural side agricultural expertise at home is reflected in exports to Nigeria.

Nigeria is the Netherlands' biggest trading partner in West Africa, followed by Senegal where extensive work is being carried out for the improvement of the water supply and sanitation. In 1979 Cameroun overtook the Ivory Coast as the Netherlands third biggest trading partner in West Africa, a situation which has not changed during the January to May 1980 period.

Oil

Predictably enough, Netherlands trade with Nigeria revolves substantially round oil. The Netherlands has for at least the last three years run a trade deficit with Nigeria because of this; in 1979 the deficit stood at 2,672,911,000 guilders. In 1978 the Netherlands imported 9,804,817,000kg of crude oil, a figure which rose to 12,906,291,000kg in 1979. Figures available for 1980 (January to May) stand at 4,810,753,000kg in oil.

In the past the deficit was softened to some extent by the existence of Dutch refining facilities. While Nigeria's biggest export to the Netherlands is crude oil, the Netherlands' main export to Nigeria is refined oil (1,821,356,000kg in 1979). This oil is being refined at the Rotterdam refineries (the biggest refining centre in Europe). With the construction and commissioning of the Kaduna refinery last year, the Nigerians could be needing the refining services of the Dutch much less. The trade deficit could subsequently increase, unless the Dutch find new export markets and civil engineering projects to work on. The major opportunity here, albeit on a short term basis, is the construction of the Federal Capital Abuja, which is scheduled for completion in 1983.



Water-well drilling in Mali, undertaken by the Dutch group IWACO (International Water Supply Consultants). See page 69 for further details.

Agricultural produce

The second biggest Dutch export to Nigeria last year (during the first six months) was milk and cream. A major supplier of this in powdered form is CCF (Cooperatieve Condensfabriek "Friesland") in Reeuwarden. In 1979 Nigeria imported 69,445kg of milk and cream, only exceeded in that year by fish imports. Next to foodstuffs, Nigeria imports a good deal of fertiliser – a total of 18,759,000kg, and judging by the figures for the first six months of last year, when 11,506,000kg of fertiliser was imported, the import of fertiliser for the whole of last year will be greater than in 1979.

Reflecting the development of a domestic steel industry and the continuing growth in construction, limestone and other raw materials for construction comprise a major Dutch export to Nigeria. In 1979

continued

Exports to West Africa

Units – volume in 1,000kg, value in 1,000 guilders *N1=6.85 guilders*

Country	1978		1979		1980 (Jan-May)	
	Volume	Value	Volume	Value	Volume	Value
Mali	1,163	3,319	2,980	7,039	512	2,094
Senegal	236,249	119,828	186,815	115,939	87,718	58,707
Gambia	3,169	4,660	18,563	11,252	5,385	5,726
Sierra Leone	16,623	19,506	15,750	22,555	5,633	14,453
Liberia	56,690	200,160	27,207	52,244	8,743	20,962
Ivory Coast	81,744	199,340	79,998	199,930	48,126	93,531
Ghana	23,210	92,432	14,907	40,629	15,941	20,191
Togo	31,299	45,916	66,608	67,072	31,249	43,390
Benin	11,195	39,600	31,042	56,302	3,916	23,083
Nigeria	1,053,391	952,292	2,234,663	1,450,135	1,035,634	898,492
Cameroun	62,771	49,330	175,756	106,371	70,805	52,247
Gabon	8,873	23,310	8,760	21,188	4,955	16,464

Source: Maandstatstaatistiek van de Buitenlandse Handel-per Land

imen Pushy Cats 1300 and 1500

Stan Fisher

an Tug IV

Poly Cat 990

tan Tug 3800

Stan Tender 1400

an Tanker

Multi Cat

61,516,000kg of these items were imported. Figures for 1980 (first six months) indicate there could be an increase on this for the whole of the year. Other exports of importance include, electronic equipment, pipes, paper and organic and inorganic products.

The future

The next five years will be interesting and testing for Nigeria's Dutch trade partner, and their relationship could see some changes. In the first place there will be strong emphasis placed by the Nigerian Government on agricultural self sufficiency. This could hit milk and fish exports, but it could lead to an increasing demand in turnkey and consultancy services. Fertiliser exports will probably increase in response to the drive to ensure higher agricultural yields, but could subsequently fall as Nigeria's fertiliser production programme gets off the ground.

Perhaps the most important change between the two trading partners will be in the oil sector. There can be no doubt that the Netherlands will continue to import substantial amounts of crude oil from Nigeria as long as the Middle East crisis continues, but imports of Dutch refined oil should fall off once the Kaduna refinery starts handling the 4.5m tonnes a year which was predicted in 1979.

To redress a growing imbalance of trade in the fifties the Dutch will have to step up their presence in major construction projects, offering those services which established the reputation of this country in the early fifties. ●

Imports from West Africa

Units – volume in 1,000kg, value in 1,000 guilders *N1=6.85 guilders*

Country	1978		1979		1980 (Jan-May)	
	Volume	Value	Volume	Value	Volume	Value
Mali	3,888	13,876	2,748	9,183	2,515	9,337
Senegal	10,695	29,940	6,619	8,313	1,229	2,262
Gambia	724	2,833	279	538	445	366
Sierra Leone	6,502	94,881	7,191	21,820	4,905	24,928
Liberia	893,567	114,083	937,676	70,651	198,705	55,840
Ivory Coast	133,514	523,405	119,563	449,031	61,638	141,831
Ghana	52,891	266,481	61,735	182,041	9,223	43,147
Togo	639,290	120,890	738,176	129,391	243,185	64,718
Benin	3,404	10,774	3,064	7,423	5,446	15,863
Nigeria	9,967,010	2,493,131	13,062,501	4,123,046	4,864,752	2,459,460
Cameroun	154,301	440,195	155,682	467,986	77,568	247,779
Gabon	243,919	72,505	216,377	79,633	58,365	30,214

Source: Maandstatistiek van de Buitenlandse Handel per Land

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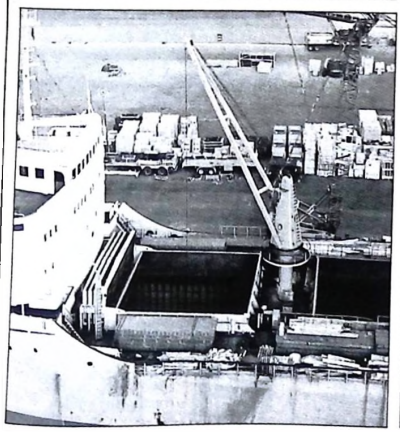

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Nedeco: putting their heads together

Training on the job – a joint NEDECO – Inland Waterways survey.

IN THE early 1950's a group of Dutch consulting engineers considered ways and means of making available to overseas clients the collected Netherlands expertise in the fields of civil and hydraulic engineering, agriculture and industrial development. With Government encouragement, but not participation, the idea was formed of an umbrella organisation under which independent consultants who wished to work abroad could operate and co-operate; the organisation was called NEDECO, Netherlands Engineering Consultants.

In order to provide a wider range of services to prospective Clients the NEDECO organisation included not only independent consultants, but also specialised private and public institutions; to complete the organisation the Government afforded NEDECO the opportunity to hire expert Government specialists when such expertise was not available elsewhere.

The original conception of spreading traditionally Dutch skills and knowledge around the world has been extended to include practically all fields of engineering, agriculture, economics, industrial process plants, organisation, operation and project management; in recent years the training of overseas staff to operate and manage development projects has also assumed greater importance.

Due to its organisational set-up, NEDECO is able to combine and co-ordinate a wide range of Dutch engineering skill and experience. By making the fullest use of consultants and departments specialised in particular disciplines and by incorporating specialists from laboratories, research and economic institutes, NEDECO can readily build up a project team adapted to the specific requirements of any given problem or study, irrespective of its nature or scope. This system of co-operation does not imply divided liability because as the co-ordinating organisation NEDECO always remains responsible to the Client, both financially and professionally.

The NEDECO foundation is not subsidised by Government and is completely independent of contracting and manufacturing interests.

Recent activities of NEDECO in Nigeria include agricultural feasibility studies in the Cross and Imo River Basins; engineering consulstancy work at the new University of Ilorin; detailed investigation of irrigation possibilities in the Hadejia-Jama'ara River Basin; masterplanning and design of the new naval base at Port Harcourt; consultancy to the Niger Delta Basin Development Authority; and extensive work on development of the River Niger. ●

Jeco Shipping

JECO SHIPPING was founded in 1974 and started its services to Nigeria in 1975 from the continent to Port Harcourt, during the time of congestion in Nigeria. The sailings were mainly based on project cargo which was shipped by smaller shallow draft vessels, with special berthing arrangements in Port Harcourt.

Jeco Shipping's vessels had a quick turn-round. An important part of the success in the beginning was the personal service of staff based in Nigeria, whenever a vessel arrived, to assist receivers with their documentation and problems. Other services, like assisting shippers to get their documents to Nigeria before vessels arrive also helped to establish good contact with regular clients during the years.

Jeco Shipping has built up a fortnightly service from the Continent/U.K. and Scandinavia to Nigeria, with a fleet of modern vessels, carrying containers as well as general cargo and project cargo. Since January 1980 two new ships are on long-term time-charter within the fleet: m/v "Nigerian Brewer" and m/v "Togo Brewer", designed as multi-purpose, semi container vessels, equipped with own derricks for handling containers. Cargo up to 24 tonnes can be loaded into any hatch; anything of 48 tonnes, or more, can be handled by twinning derricks.

The size of Jeco Shipping enables the management to take a detailed and day-to-day interest in it's operations. Not only does the company offer advantages in rates of freight, equipment, techniques and systems, but it also offers extra protection against damage and pilferage. Jeco's agents will be pleased to tell prospective clients anything they might wish to know about the company's services.

Because of Jeco Shipping's many new developments, and due to the increase in volume of cargo and sailings, the company found it necessary to establish an organisation in Nigeria, with a highly qualified and experienced staff, to handle vessels and to look after the line's interests. This organisation in Nigeria also guarantees the shippers and receivers a high standard of service, cargo-handling, documentation, re cargo claims, transportation etc. Th JS organisation started operations 1980 under the name of Co Maritime Agencies C.M.A. (Nigeria The head office is in Lagos; a branch of C.M.A. will be established in Harcourt.

In Nigeria Jeco Shipping is represented by **Umarco (Nigeria) Ltd., 11 Industry Road, P.O. Box 253, Port Harcourt, Telex: 61172,** *(Port Agents)*

Coastal Services (Nig.) Ltd., 42/ 22 Warehouse Road, P.O. Box 97, Lagos/Apapa, Telex: 21226, Cable: Cosenil *(Port Agents)*

Combined Maritime Agencies (Nig.) Ltd., Lagos, *(Line Representative)*

In Senegal: **S.O.A.E.M., 53, Bild Pinet Laprade, Box 835, Dakar, Tel: 26894, Telex: 508 Cable: Questafrimar (Port Agents)**

"Nigerian Brewer", a vessel of the Jeuro Container Lines UK/West African service

In November 1979 Jeco Shipping lished a ne nd independent servic the Far Ea osts to Nigeria. First to sail wa e m/v "Ippolitos". DWAT, an 2 meters LOA.

This vess as soon followed up second vess m/v "Golden Lilac" these two sa ssful sailings Jeco Sh decided to a 20 days regular programme his JS Far East ser carrying co iners as well as cargo.

Basic port of call for this servi Yokohama, obe, Keelung, Hong Bangkok and Singapore.

To guarantee shippers in the Far E good and reliable service Jeco Shi established its own office in Hong where their own representatives to with a network of well trained and fessional agents throughout the Far are giving reliable service and inform to shippers.

In 17th March 1980 Jeco Shi became an official member of "American West African Freight Co ence", and has started a new service the Gulf ports to Nigeria; the inaugu sailing was held on the 1st May, 1980

Basic ports of call are Houston, Orleans and Mobile. It is the intent have a 20 day's regular service modern equipped vessels which can containers as well as break bulk cargo

During the year of 1980 Jeco Shi extended this America/West Africa s to the East coast of the U.S.A. Canada.

Jeco Shipping has also establish own office in New York/N.Y., to str line its activities and has its own r sentatives on the spot to guarantee a service for the American shippers.

Jeco Shipping's latest fleet additi MV Doris. This multi-purpose vessel, under a german flag was built early in and made her maiden trip in Octob that year. The vessel is equipped w closed and open shelter decker and container capacity of 193 TEUs. The two cranes on board with han capacities of five tonnes and two c which can handle 40 tonnes. The vess travel at 16 knots.

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Dredging up transport

Focus on Haskoning

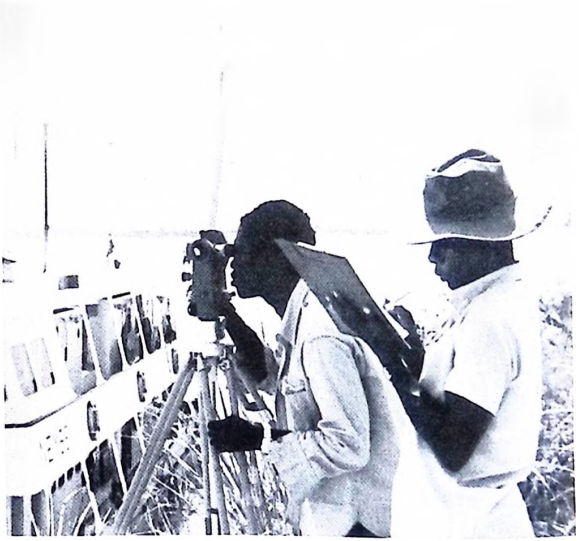
HASKONING, Consulting Engineers and Architects, is one of the major Dutch consultancy firms, and has been working in Nigeria since 1951. Numerous projects and studies have since been carried out by Haskoning through NEDECO, the umbrella organisation of co-operating Dutch consultancy firms for working abroad, and later on, since 1977, also via the branch office Haskoning Nigeria Ltd. in Lagos.

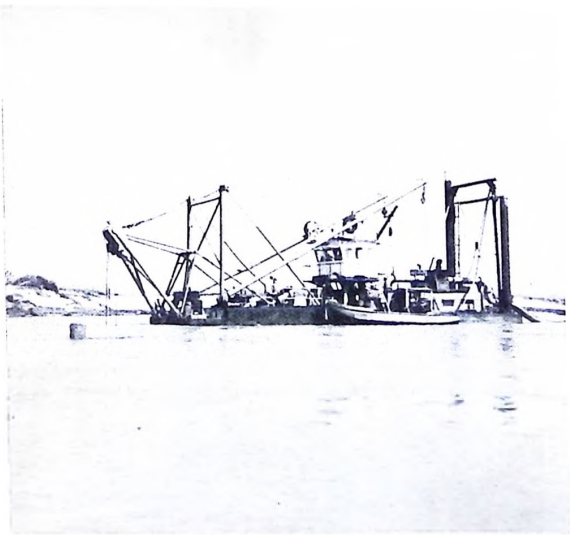
At present a number of projects are under execution in Nigeria in the field of river basin development and flood control, erosion protection, planning and dam construction.

For one of these, the River Niger Project, Haskoning Nigeria Ltd worked in close co-operation with the ENPLAN Group, a leading Nigerian Consultants firm as well as NEDECO and Koninklijke Bos Kalis Westminster.

Industrial needs

The River Niger Project reflects Nigeria's growing industrial needs; in the first place the project is linked to the Ajaokuta steel plant and associated industries. Located 20km downstream from Lokoja at the confluence of the Niger and Benue rivers, the Ajaokuta development has already given rise to brisk traffic in transporting materials for construction; in the future, cargo and freight will consist of raw materials for processing and manufacturing. Planners of that other major Nigerian project, the establishment of the new Federal capital, Abuja, also have a vested interest in the River Niger project as a means of opening up new transport routes from the sea to the heart of the country.





Triangular survey reference points at shallow river section to be surveyed (above). Cutter suction dredger at work near Lokoja (below).

Looking back on the two and a half years of working on the River Niger it can be concluded that the experimental dredging contract, which the project basically was, has been completed successfully. The major goal, improving the navigability by means of dredging, has been realised.

During the two low water periods, four cutter dredgers were working to improve the depth at some 35 shallow crossing and shoals to a least available depth, LAD, of 1.5m (guaranteed for ten months of the year). Hydrographic surveys were performed covering a total length of 90km of river; these were, on average, 2km wide. The surveys were repeated regularly to monitor morphological changes. The navigation channel resulting from the dredging operations was buoyed with over 600 buoys.

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Circle No. 255 on enquiry card

Facilities

However, at present the developments of river transport is hampered by the lack of river ports, vessels and barges. Existing port facilities are inadequate and obsolete, and the transport companies who are operating the vessels seem to have lost interest in river transportation.

This does, to some extent, undermine one of the basic aims of the project, namely to provide navigable channels specifically for barges 60m long and 9.5m wide between Warri and Lokoja; this scope was broadened at a later stage to include barges with a length of 150m and 20m wide. On the branch of river running from Port Harcourt to the Niger-Forcados fork, a navigable channel was dredged for single barge operation with barges of 40m long and 9.5m wide.

Because of the lack of operational vessels to take opportunity of the improvements described above, and because of the delayed developments of the Ajaokuta steel plant, the impact of the project on its environment is not yet been fully realised, and it would therefore, be premature to judge it until the level of activity on the river has reverted to what it was when NEDECO first identified the parameters and goals of the project.

It is clear that the River Niger has great navigation potential. Even without improvement the river forms an excellent transportation route for six months of the year. With the aid of recurrent dredging and permanent river improvement works where appropriate, the navigability can be extended to the full year, depending on the dredging capacity that is employed. The plans to construct more dams for hydro-power generation are of great significance, since future dams will improve and regulate the flow conditions considerably.

The Government of Nigeria for its part is stimulating the development of the Inland Waterways Transportation facilities, and contracts are being awarded for inland port development and construction. Barges have been ordered, and are scheduled to be delivered early on this year. It is hoped that private enterprise will respond to these activiies, and that the result will be a revival of the river transport along the entire length of the River Niger, restoring the river to its historical role as a majestic waterway into the heart of Nigeria. ●

Marketing of Repetex step and repeat machines

Hitherto, sles and service of the Repetex step and repeat machines was in the hands of **Tetterode Nederland BV,** whilst development and manufacturing was the responsibility of **Moes Machines BV,** Oldenzaal, Netherlands.

In a recent meeting between the two companies, it was decided that hence-forth development, production, saes and service will be concentrated in Moes Machines to increase efficiency and enable closer contacts between engineering and endusers.

At present the Repetex machine is available in a semi-automatic and a fully automatic version. A newly developed Computer Numerical Controlled step and repeat machine is undergoing a severe test-run program and is expected to be released for sale mid-October.

IWACO activities

INTERNATIONAL WATER SUPPLY CONSULTANTS IWACO BV is an independent firm, specifically qualified in water supply, waste water treatment, groundwater investigations, geo-hydrology, agro-hydrology, geophysics and environmental issues in urban and rural areas as well as for domestic, industrial and agricultural purposes. In these fields IWACO is an independent adviser on technical, financial, social, training, management and organisational purposes. IWACO has its own chemical and hydro-geological laboratory, field equipment and computer facilities and has access, through its terminals, to the larger computer centres in the Netherlands and abroad.

IWACO was established in 1969 and mid-1980 had about 60 permanent staff. IWACO has offices in Rotterdam (HQ) and Boxtel in the Netherlands; in Jakarta, Balikpapan, Bandung and Palembang in Indonesia; and in Ouagadougou in Upper Volta. About 75 per cent of IWACO's activities are based overseas.

In the early days of its existence IWACO concentrated on water supply, but gradually started to branch out – always keeping water supply as its pivotal strength – into adjacent sectors. For instance, some two years ago IWACO decided to develop a new field of activities as part of its package, rural development. Like in urban areas, the importance of water and sanitation as economic goods as well as social necessities in rural communities is increasingly recognised; and they are now seen as essential elements of basic human needs and crucial for development. To provide adequate water and sanitation for everyone substantial funds are needed. Reaching as many people as quickly as possible requires innovative designs and approach. This is true not only for water and sanitation but for directly productive and social sectors as well; adding up to an integrated rural development approach. IWACO is heavily involved in meeting the challenge and is seriously trying to focus in its con-

continued on page 78

Below: Waterwell inspection, Upper Volta.

Company viewpoint

Water – a number one priority

THE world's total water supply (including salt and frozen water) is estimated at some 1.5 billion cubic kilometres. Taken together, the iceans, seas, ice caps and glaciers comprice 99.35 per cent of this huge water mass which is inaccessible or unfit – and consequently lost – for human consumption. Salt water can be desalinated and made potable technologically, but costs are prohibitive. The remaining 0.65 per cent include the water of all great rivers and lakes, the inland seas, streams, brooks, pools, swamps and lagoons, together with all vapour, rain and snow in the atmosphere and – last but not least – the ground water. Only that very last bit of 0.6 per cent is available to support all life on earth. And exactly that very tast "tiny" portion of less than one per cent is being increasingly contaminated by human being

Miraculous liquid

On second consideration, the most ordinary liquid on our globe is very extraordinary. Water is the only common substance that exists naturally in all three fundamental states of matter: liquid (water), solid (ice) and gas (vapour). This wonderful life-sustaining liquor conceals many miracles which make our world habitable.

Another miracle is that water belongs to the very few substances that are heavier as liquids than as solids. Solid ice floats on liquid water forming an insulating skin which protects the water beneath from further freezing. If ice were heavier than water, it would sink to the bottom and gradually build up from there. Soon there would be no more life on earth, for all water would be locked up in ice. Enormous climate changes would follow and make our planet uninhabitable.

A third unique property of water is that the world supply is fixed and finite, although its worldwide distribution is very uneven. Consequently, the larger the world population, the less water will remain available for everyone. It is assessed that by the year 2,000 the world population will have almost doubled.

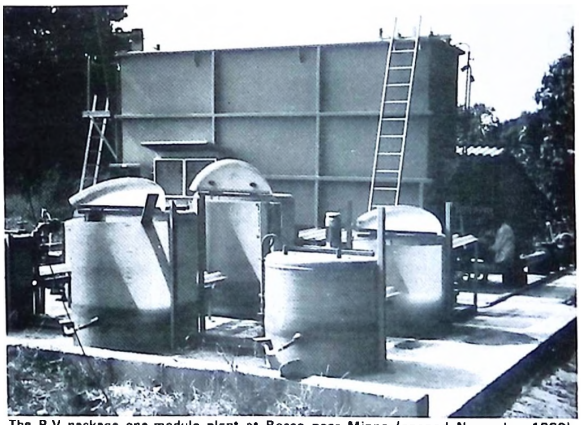
A still more interesting phenomenon is the so-called hydrologic cycle which has been endlessly recycling the earth's water ovr and over again from the very beginning. The cycle starts with rain precipitating from clouds and then sinking into the soil, partly running into lakes, channels and other water courses, and partly seeping eventually into the ocean. Simultaneously, evaporation starts on the reverse stage of the cycle. Most water rises from wet grounds, lakes, rivers, the leaves of plants and above all from the ocean. All the evaporated water collects in clouds. As these cool, precipitation takes place – and the cycle repeats itself. Consequently, it is a process by which water constantly circulates from the sea to the atmosphere to the earth and back to the sea again.

Present situation

We find ourselves in a difficult situation in this century; locally or regionally the water quality is steadily deteriorating and while the world population grows, the total water supply available remains finite. The demand for domestic, agricultural and industrial water supply is increasing daily because of population growth, industrialisation, urbanisation and widespread dissipation and high quality water has become an expensive commodity. It is reported that at least 30,000 people die daily because they have inadequate water and sanitation facilities. Unlike victims of earthquakes, floods and other natural catastrophes, they do not reach the front pages of the world press. This "permanent disaster" is the most compelling justification for the establishment of a United Nations Water and Sanitation Decade, on 10 November, 1980 in New York, in order to provide two billion more people with fresh water supply and sanitation facilities.

The World Health Organisation (WHO), the World Bank and the UK Development Programme have been active for some years doing the foundation work. In over 100 countries analyses have been carried out and in some 400 countries plans are now being elaborated in detail. Cost effective technologies are being studied to find the most appropriate and cheapest equipment for every country.

Manufacturers in the water treatment branch have been designing and developing new plant and equipment, ranging from single hand pumps and rapid gravity filters up to the most modern mobile water well drilling rigs and sophisticated water treatment facilities.



The P-V package one-module plant at Bosso near Minna (opened November 1980), capacity 50m³.

Dutch answer

Experience has shown that, in general, it is not advisable to build complex, large-size and therefore vulnerable water treatment facilities with sophisticated processes and equipment requiring a highly skilled workforce for operation and maintenance. Apart from the high capital costs involved, such ultramodern plant can easily break down for many reasons, such as negligence, unskilled attendance, lack of spare parts and poor maintenance. Simple prefabricated construction and ease of operation are therefore prerequisites.

One of the leading manufacturers and pioneers in the field of water treatment who succeeded in bringing safe drinking water

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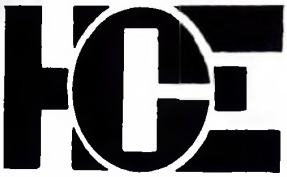

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Circle No. 284 on enquiry card

nearer to remote villagers, is the firm of Pielkenrood-Vinitex BV of Assendelft, Holland. In the early 1970s an experienced team of qualified Pielkenrood engineers set to work to design, develop and test appropriate package units that could do the job properly and could even operate in the remotest village.

1. The basic concept is modular, that is to say each plant consists of one or more standard modules in different designs, sizes, capacities and weights. Each module is a prefabricated steel construction ensuring short delivery times, also of spare parts.
2. Modular construction ensures flexibility on two counts: capacity and investment. As far as capacity is concerned, only current requirements need be met, avoiding costly overdimensioning of basins, etc. with a view to future needs. By comparison this makes conventional concrete drinking water facilities cumbersome and expensive. The "and-so" principle of the modular concept allows extension – basically limitless – of existing plant later on to keep pace with a growing population. As regards capital costs, this concept is also attractive: no long-term credits nor initial capital waste, since the client pays only for the capacity invested at the moment of start-up. Gradual phased extension economises on capital cost and allows the total investment to be spread over a range of years.
3. Working conditions may alter: variations in the composition of the raw water or in the temperature of water and atmosphere may occur, rainfall may be light or heavy or none. The P-V modules can surmount all these difficulties.
4. Ease of transportation makes the skid-mounted units suitable for installation even in the remotest places.
5. Erection costs on site are low and take only a minimum of time, due to the components being standardised, prefabricated, shop-assembled and completely controlled before shipment.
6. Simple construction makes operation and maintenance easy; local operators receive thorough training from Pielkenrood-Vinitex and after start-up they receive complete verbal and written instructions for operation and maintenance.

Rural and urban supply

The skid-mounted modules for rural water supply are available in capacities ranging from 10 to 100m³/h (0.05 to 0.5 million imperial gallons per day). For urban use the plants are built with capacities of 100m³/h and up. This type of plant can provide employment for local labour, as the installation work – with local materials, if possible – is usually carried out by local manpower under P-V's final supervision and responsibility. P-V principally undertake the designing, engineering, drawing, prefabricating and allied work.

It is also worth noting that these complete installations can service as complementary plant to relieve overloaded existing municipal drinking water supply works or to provide additional potable water capacity for rapidly expanding communities.

On 24 March 1980 the Governor of the federal state of Niger officially opened the first P-V facility (capacity 50m³/h) in Katcha which supplies drinking water to the villagers at 20 public tap points. The purified water of the Kaduna river is pumped to a covered storage reservoir on a hill through a 2km long pipeline and intermittently distributed from there to the 20 hydrants over a total length of 10km.

This packaged plant was the first of a range of eight similar facilities which are now either ready for use or nearing completing in Kuta (50m³/h), Bosso near Minna (50m³/h), Zungeru (100m³/h), Kontagora (100m³/h), Agaie (200m³/h), Lapai (200m³/h) and Kagara (200m³/h). In November 1979 the Niger State Water Board of Minna awarded a multimillion worth contract for the supply, erection and start-up of this type of plant. If the daily ration of water in rural areas is calculated at 100 l/day/inhabitant (which is 10 times the bare minimum of 10 1), a plant of 50m³/h capacity operating 12 hours a day will provide potable water for about 6.000 villagers.

Physico-chemical treatment

In these compact plants water from the river undrgoes the following treatment:

(a) Coagulation, mostly with alum sulphate as a coagulant (takes a few seconds);
(b) Flocculation in a 3-stage CPF (Corrugated Plate Flocculator);
(c) Clarification in a CFI (Cross Flow Interceptor);
(d) Filtration in a high rate filter;
(e) Disinfection;
(f) Stabilisation by pH adjustment.

Already it seems that the Water Decade is making a substantial contribution to improving the health and welfare of a great part of the world's population. Numerous countries have already promised massively increased budgets for improving the lot of their rural populations. Therefore, implemementation of water projects should be given high priority. ●

Circle No. 1 on Enquiry Card.

Water supply reassessed

Founded in 1917, DHV Consulting Engineers is a private company with an impressive track record of civil engineering projects world-wide, ranging from hydraulic port and road engineering, public health and environmental engineering, transports and traffic engineering, urban and regional development, architecture, structural and geotechnical engineering. In West Africa DHV has worked in both francophone and anglophone countries, often operating under the name of NEDECO (Netherlands Engineering Consultants) alongside with other Dutch consultants.

In Senegal DHV has worked substantially in the water supply and sanitation sectors, drawing up the master plan for water supply, sewerage and sewage treatment in Dakar and a sanitation project for Soumbedioune Bay. An interesting example of a small-scale project undertaken by DHV is the work done on Ile a Morphil in the same country to improve access to the island by constructing roads and improving the ferry service and thereby stimulating the regional economy. In Nigeria DHV is working on the Lagos water supply programme along with Scanwater and Degremont. The company is particularly anxious to introduce the principle of shallow wells, which it has put into practice in Tanzania, to Nigeria and other West African countries. The following article summarises the principle behind construction and operation of shallow wells.*

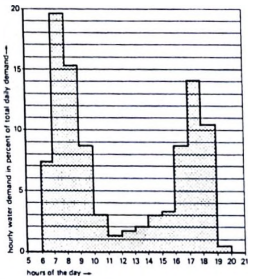
INCREASED ATTENTION is being paid to the water supply in rural areas where – especially in developing countries – the vast majority of the entire population live. Here the prevailing conditions often dictate other solutions for the water supply problem than in urban areas, but rural conditions impose limitations on the scope of the water supply planner: in the first place financial resources are very restricted; secondly the remoteness of rural communities lead to problems in co-ordinating water supply to a scattered population, finding skilled personnel prepared to live on the job and ensuring a steady flow of spare parts for pumps, engines and other machinery.

In general terms, there are a number of basic alternative ways of supplying water to any community; water can come from rivers and lakes (surface water) or from the ground; it can be piped or supplied individually; supplies can be pumped or moved by gravity.

Surface water

With only a few exceptions surface water (in rivers, lakes, pools) is bacteriologically unsafe, contains high sediment loads, and as a matter of standard practice will require more or less complicated treatment. The ensuing investment costs, energy costs, chemical costs, and the need for trained, skilled operators result in a general preference for groundwater over surface water.

Groundwater may be obtained from springs, wells or boreholes. Springs can offer excellent water supply opportunities, but are generally found in hilly or mountainous areas only, and may require long pipelines in order to bring the water to the people. For larger and concentrated settlements this may be a feasible solution, but for a more dispersed population the investment costs, may still be prohibitive, the more so when pumping to transport the water. For less concentrated settlements other means of abstracting groundwater will thus have to be found, eg boreholes and wells.



Fluctuation of water demand over the day (rural communities, East Africa).

Deep groundwater often has an excellent quality but may still pose problems: for the construction of boreholes special equipment is necessary, with skilled operators, especially for deeper boreholes; only aquifers with a high transmissivity are suitable; the groundwater table may be so low that using hand pumps is virtually impossible and engine-driven pumps have to be chosen. Not only are the running costs vastly increased in that case, but the provision of spare parts may now become a critical factor as these are – as a rule – not manufactured locally.

Most of these difficulties are overcome when shallow to medium-depth wells are used: simple tools and unskilled labour are sufficient; even aquifers with lower transmissivity can be used, since dug wells possess a certain storage capacity; the use of hand pumps is now possible in any case, so running costs are vastly reduced. Furthermore investment costs are lowest for shallow wells as compared to other possibilities.

In view of the above it will not be surprising that more and more shallow wells are being chosen as one of the best ways of tackling ther enormous task of supplying the world's rural population with water. On the other hand shallow wells should not be considered an all-round panacea. In certain cases shallow wells will simply not be possible, for reasons of soil conditions, and danger of pollution, whereas for larger concentrated settlements piped water supply systems may be required, for which other possibilities may be more feasible.

Locating shallow wells

The decision to locate a shallow well at a certain site will generally be based on two kinds of consideration. The first, which may be called "technical" is rather obvious: the site should be suitable for making a shallow well, ie it should be accessible, the soil type should permit the construction of a well and, most important of all, there should be good-quality water in sufficient quantity.

The second kind of considerations is less clearly defined. Socio-economics and politics may play an important role here. Much depends on the authority or person who provides the funds for construction. When the (local) government is in charge of well construction, priority lists of villages where wells are to be located may be available. The following aspects should be included in such a list: existing ("natural") water supply sources; quality of this water; absolute or relative lack of water; development potential of the village; earning capacity and per capita income of the

continued

**This article has been summarised from the opening chapter of the book Shallow Wells, second edition, 1979. Copyright © 1978, 1979 by Development Co-operation Information Department. The Shallow Wells Programme was financed by the Netherlands Government, Development Co-operation Department and the Tanzanian Government, and executed by DHV.*

villagers; size of the village/settlement and industrial or trade activities.

Political considerations, such as stemming the flood of rural population to the larger cities, or concentrated development of certain rural areas, may also be important in deciding where shallow wells should be located.

How many wells

The number of shallow wells which are needed for a certain village depend on the following factors:

(a) The number of villagers, at present, and in the future.

(b) The distance between the houses and the well. In Shinyanga in Tanzania the aim at present is to restrict the maximum distance to 1·2kms.

(c) The maximum number of people that can be supplied through one well.

Experience in many parts of the world shows that when water is supplied through hand pumps – whether on shallow wells, boreholes or small reservoirs – through public taps or in other ways where the water has to be carried home, the consumption per head will not exceed approximately 25l/d. During the execution of the Shinyanga Shallow Wells project the capacity of shallow wells has regularly been investigated. The results show with piston diameters of 7.5– 5.10cm (3·4in) capacities of 1,200 to 2,000l/h were found, based on one full stroke per second and an effective pumping time of 75 per cent.

If it is assumed that the pump is used continuously over ten hours per day, the total volume of water pumped would be 12 to 20cm, which is equivalent to the daily water demand of some 500 to 800 people. In practice, however, the collection of water is more or less concentrated in ten peak demand periods: in in the early morning and one in the afternoon (fig 1), which reduces the effective well capacity, limiting the number of consumers to approximately 250 per well according to experience.

The number of wells required is found by dividing the (actual or future) number of villagers by 250. Then, after the hydrogeological survey has been carried out and well sites have been selected the distances between the houses an the wells are checked. In dispersed settlements the criterion of one well per 250 inhabitants may lead to maximum walking distances in excess of one to two kms. In such cases additional wells may have to be constructed, just to reduce the maximum walking distance. As a consequence the number of people per well is reduced, but investment costs per capita are increased.

In Shinyanga Region in a numb cases so-called "rainy-season wells" constructed. For some villages it app to be impossible to find shallow wells w perennial supply of water within adopted maximum walking distance o to two kms. In such cases well were c tructed as close to the village as poss and additional wells (the rainy-se wells) were built at strategic points w the one to two km radius. These wells h good-quality water during the larger pa the year, but run dry in the second ha the dry season.

In this way an attempt was mad accustoming the population to using g quality water only in the wet season pe would object to the obligatory walk to perennial wells and would resort to more readily available, but polluted, wa from pools and the like. In the dry sea the latter do not exist any more, and t perennial wells then constitute the o source of water available.

IWACO continued from page 69

sultancy on people.

IWACO is often working in rural areas where development depends to a large extent on whether or not sufficient quantities of exploitable groundwater resources can be located. Because the supply of energy in such areas is often equally difficult, IWACO decided recently to start experimenting with small scale alternative sources of energy (solar, wind) and, in general, to investigate the energy balance of villages.

Such "extensions" of water supply are fully covered by the expertise of its staff, which by now is truly multi-disciplinary.

The staff of IWACO are specialists in a variety of disciplines: civil engineering, sanitary engineering, hydrology including geohydrology and agro-hydrology, soil-mechanics; geology, geophysics, chemistry, structural engineering, land and water use, economics, management and quantity surveying.

Projects which IWACO is able to operate are not limited by in-house know-how; it co-operates regularly with other specialised consultancy firms at home and abroad, as well as with universities and other specialised agencies.

A considerable number of projects abroad, particularly in developing countries, have been commissioned to IWACO by various governmental institutions, international financing agencies and by the Netherlands government.

IWACO is able to prepare a project from the identification and preliminary phase – long-term planning and feasibility studies – through the design phase, which includes preliminary design, technical specifications and tender documents, up to the final phase, which includes tendering, supervision during the implementation of the works and training.

IWACO in Upper-Volta

In 1979 IWACO decided to establish a branch office at Ouagadougou. The first year only projects within Upper Volta were executed, but it is intended to cover more West African countries, and in particular the Sahel region, (from this office). The main aims for setting up a regional office are tht the IWACO package of services and attitude of its personnel cover and link up excellently with the Sahel problems; and solving the Sahel problems requires time. The so called "hit and run missions" are disastrous for such an area. Therefore, a consultant has to be willing to stay for a longer period, and a permanent establishment makes it possible to engage and to train local personnel. At the end of the first year IWACO-Ouagadougou counted some 15 local employees.

Groundwater supply

Due to the success of the programm sponsored by multi- and bilateral agen to eradicate riverblindness. The prepa tions of resettlement in the riverbasins the Red and White Volta rivers has start The Development Authority of the Val of the White and Red Volta riv requested IWACO to carry out geo-hyd logical and geo-physical investigations determine locations for drilling for groun water supply to provide water for hum consumption and livestock.

To prepare water-well drilling activities number of basic studies have been carri out (hydrogeological reconnaissan studies and geophysical investigations) close co-operation with the State Uni sity of Utrecht a new geophysical inves gation method has been tested. Th method seems to be successful and will b used in future geophysical investigations a standard approach.

Other activities

Other projects in which IWACO is or has been involved in the West Africa region are: water supply in Bendel State, Nigeria dixcove water supply extension project Ghana; urban water supply in Brazzaville Congo; urban water supply in Dakar Senegal; water supply for the city of Pointe Noire, Congo.

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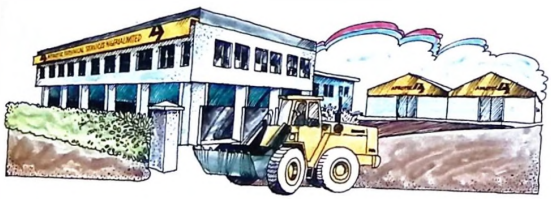

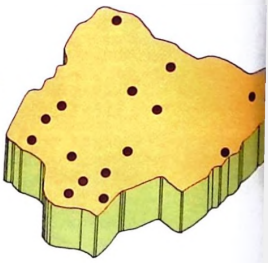

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Circle No. 216 on enquiry card

West African
CONSTRUCTION

Trophy goes to Hiab-Foco

The International Trophy of Industry, awarded by the International Institute for Promotion and Prestige, Geneva, has been won by **Hiab-Foco AB** of Sweden, for their "superb international reputation gained in less than two decades in the field of hydraulic technology and the manufacture and marketing of vehicle-borne hydraulic loaders".

With a total of 16,000 truck-mounted cranes sold in 80 (roughly 40 per cent of the total world market) the Hiab-Foco Group's turnover for 1980/81 amounted to approximately SEK 1,000 million, of which 85 per cent was exports.

The Group's success was ascribed to close collaboration with users at the design stage, to mechanical accuracy (down to 1 micron in hydraulic cylinders) and to meticulous testing – in some cases up to 25 per cent above required levels – as well as great care over operator training and after-sales maintenance.

Czechoslovak machine tool plant

Czechoslovakia will build an engineering-metallurgical plant for the production of machine tools in the Nigerian state of Anambra, by the end of 1986, under a 2,000 million crowns contract signed recently by the Czechoslovak "Skoda-export" foreign trade enterprise and the Ministry of Industry and Technology of Anambra.

The plant will have an annual capacity of 5,200 machines with a total weight of 500 tons. It will supply the Nigerian national economy with the basic machine tools, a foundry will be part of the plant, with an annual capacity of 7,000 tons of castings.

The contract provides for Czechoslovak technical aid at the plant's construction and training of 30 Nigerians in Czechoslovak engineering plants.

Second Feeder Roads project in Benin

The International Development Association (IDA) has announced the approval of a credit of SDR5.5 million ($7 million) to the Government of the People's Republic of Benin for a second feeder roads project.

The $8.7 million project provides for the improvement and subsequent maintenance of the country's feeder road network. It will also include technical assistance aimed at strengthening the Feeder Roads Division within the Ministry of Public Works. The project will finance the construction of some 700km and the maintenance of about 1,200km of feeder roads.

Highway maintenance equipment and spare parts, materials, and supplies will be provided, and a highway maintenance brigade and special feeder road maintenance brigades will be established.

The technical assistance provided under the First Feeder Roads Project will continue through the first year of the project. This assistance is then expected to be phased out and to be replaced by Beninoise counterpart staff who have been on the job since early 1980.

The principal beneficiaries of the project will be farmers who will have year-round access to markets for their surplus production. Other users, who will realise important savings from reduced vehicle operating costs, will also benefit. The Government of Benin will contribute $1.7 million towards the cost of the project.

The IDA credit is for 50 years, including ten years of grace. It carries no interest but will bear a service charge of ¾ of 1 per cent to cover the Association's administrative expenses.

Dumptruck orders

Two major orders worth US$5.2 million have been won by DJB Engineering Limited of the UK for the recently announced "B" Series version of its D330 articulated truck – the D330B.

The first order, for 18 of these 33 tons (30 tonnes) payload trucks has been placed by the major Italian contractor SATO for use on the Dadin Kowa dam project in Nigeria, where over 1.5 million m^3 of material has to be moved in very difficult conditions.

The second order for 9 D330B's is destined for the United States for use by Browning Ferris Industries (BFI) in their landfill operations.

Roads for the future

The Nigerian Federal Ministry of Works is at present processing tenders for contracts for road construction in the country. Total cost of these contracts is estimated at ₦596 million.

One of the most important roads due to be constructed is the Maidaguri–Biu road, which will bring into completion the major north–south route of the Calabar–Maidaguri road. Altogether about 2,110km of road are involved in the forthcoming contracts.

Focus on architecture – PRC

Living in Nigeria

Our Architectural Correspondent, Noel Moffet, analyses a national urban housing strategy conceived by an American firm, Planning Research Company for the Nigerian Government.

Left and below: the layouts of the new towns and villages echo those of the old ones.

THE NIGERIAN Government has been aware of housing problems in the cities ever since independence in 1960. Housing and the quality of the urban environment have been an important part of a succession of 5-year National Plans. But progress has been very slow. The Federal Military Government expressed its dissatisfaction with the way things were going many times. Speaking in 1976 the Federal Commissioner for Housing, Urban Development and Environment had this to say:

"One of the many weaknesses of Nigeria's planning effort hitherto has been its heavy emphasis on sectoral and financial planning almost to total neglect of physical planning. The effect of this is now becoming increasingly reflected in the form of disorderly spatial and environmental development, despite the rapidly increasing level of economic activity and rising incomes which the country has achieved in recent years. It is therefore the main objective of policy during this Plan period to reverse this trend by paying greater attention to regional development, including physical and environmental planning, in order to enhance the quality of life for all citizens as development progresses."

This was the unsatisfactory, unhappy situation when, early last year, the Federal Government asked PRC (Nigeria) Ltd. – A planning research company with offices in Lagos and Virginia USA – to examine the situation and suggest "a strategy to meet housing needs in Nigeria's urban areas." The company was one of the three authors of the master plan for Abuja and had already proposed interesting housing options in connection with the development of the new federal capital city. Their National Housing Strategy report was therefore awaited with great interest. It has now been presented and is being carefully studied by the Federal Government.

The report on the whole is thorough, clear and well presented. It is primarily concerned with economics and finance and is divided into five sections: Policy/Sponsorship, Land provision, Finance, Infrastructure and Construction. It examines what it somewhat prosaically calls Nigeria's "Housing delivery system" in considerable detail, under each of these headings; it then recommends a national housing strategy – to be applied over a period of ten to 15 years; and suggests eight first steps towards its implementation.

Policy sponsorship

"A clear housing policy and programme must be developed by the National Assembly and the Ministry of Housing and Environment ... principal executive responsibility should be placed at state levels, with provision for 'ultimate' (my italics) transfer to local control for land assembly, project sponsorship and programme monitoring."

Remembering the past, sad history of Federal/ State co-operation in getting homes built, many Nigerians will read this with a degree of scepticism and will press for an early, rather than a late, transfer to local control.

"A mix of public and private initiative should be maintained in housing supply to provide affordable standards in response to effective market demands. Target national annual production of urban housing will be 440,000 dwelling units, of which 115,000 annually should be low-to medium-priced units (₦4000 to ₦7000 per dwelling). Home ownership should be promoted and strongly supported."

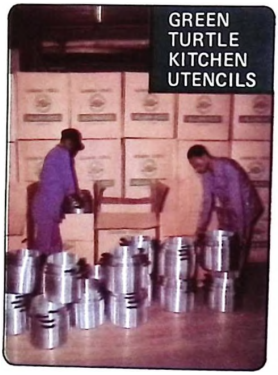
This target of 440,000 urban dwellings per year gets much closer to the United Nations' estimated 700,000 (for all Nigeria, urban and rural) than the Federal Housing Authority's modest 1974 figure of 54,000. It will seem odd though to many people that there should be more than twice as many intermediate-cost dwellings as low-cost.

"Programmes should be initiated to encourage formation and to provide for legitimisation of co-operative housing

continued on page 83

ALUMACO

- pioneers in aluminium manufacturing in industrially developing Nigeria



Alumaco pioneered aluminium manufacturing in Nigeria in 1960 with the manufacture of Green Turtle Kitchen utensils.

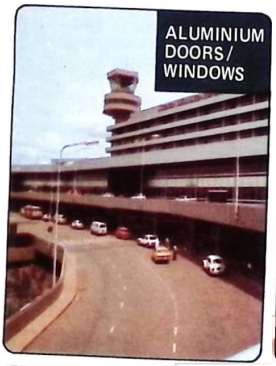
Realizing the needs of Nigerians for quality aluminium products we diversified to the manufacture of aluminium doors, windows and roofing sheets for building industry; prefabricated cold rooms for storage and aluminium refrigerated trailers and pick-ups for delivery.

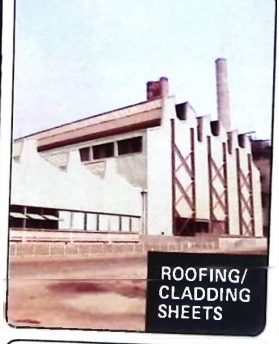
Our close association with Alusuisse the giant Swiss world renowned aluminium producers established in 1959 has ensured the continuance in new technology and training programmes with the Company.

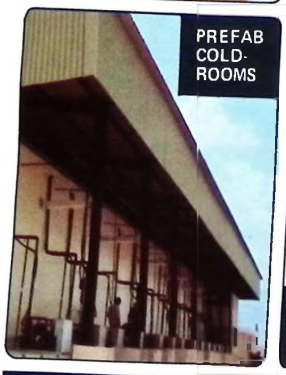
With two manufacturing plants at Ikeja and Oshodi and our present Kaduna Enugu (and future Kano) sales offices as well as our numerous accredited dealers we have been able to ensure stable supply of our products to our various consumers all over the country.

Not only has our existence created employment for more than 1,300 Nigerians; we have also gone public thereby enabling many Nigerians to participate in our continued growth.

We believe that in the years ahead our pioneering influence will lead us on to providing much better products and services to the people of industrially developing Nigeria.







Aluminium Manufacturing Company of Nigeria Limited
32 Creek Road, P.O. Box 60, Apapa.

Circle No. 299 on enquiry card

societies. These societies, building on Nigerian social traditions, would have the ability to act as developer and long-term property and loan manager, bridging the gap between individual dwelling occupant and formal financing agencies."

This may well prove to be the wisest statement of the report and could become the brightest star in the Nigerian firmament. Governments in other rapidly-developing countries have squandered millions of pounds, dollars and yen, with the best of intentions, on building houses which people disliked intensely, couldn't relate to and often refused to live in. John Turner discovered that, while government housing remainded empty, unlet and unloved, almost half the population of Lusaka were living, often illegally, in squatter compounds. The figures for other capital cities are equally alarming: one-third of Manila's (Philippines) population squat, one-third of Caracas's (Venezuela) and one-half of Ankara's (Turkey).

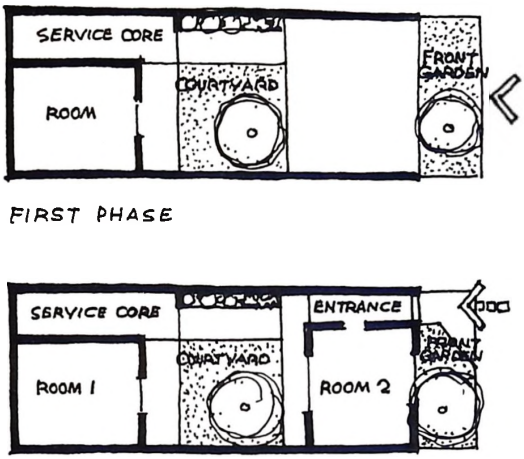
But the "legitimization of housing co-operative societies" must be done unobtrusively, the initiative coming from below, not from above, with government providing finance and skilled advice when needed. A "them-and-us" situation should be avoided at all costs. People should feel that they are doing – in a modern, urban context – what their fathers and grandfathers have always done – building their own homes in their own way.

Land Provision

"Existing legal powers of government should be used to provide maximum assistance to both public and private provision of housing through assembly and release of land for development. Local area surveys and plans should be prepared to assure that new housing is optimally located ... land should be released to developers in substantial "packages" suitable for development of large housing projects."

Yes and no. Many a good housing project has never got off the ground because of difficulties in acquiring the land. So everything that can be done should be done to make sure that land for housing is there when it is needed.

It is true that most builders are only interested in developing land for housing if the project is sufficiently large to bring him a very good return for his money. On the other hand experience around the world has shown that people relate best to small developments. In the housing world small is undoubtedly beautiful. Somehow an acceptable balance must be struck between the size of the project and the amount of the profit expected by the developer. Most co-ops would prefer small sites where development would have an identifiable "human" scale. It is also a fact that, inside Nigeria's cities, small sites can be obtained more easily and quicker than large ones – and Nigeria needs new housing quickly.



Groundplan of a modest core house

Finance

"Adequate capital must be provided for growth in housing production. The credit system must then be expanded to permit acess of the full range of urban households to long-tern housing finance.

A nationwide system is required to provide credit at local levels, supported by refinancing through secondary markets. These local credit outlets must offer appropriate lending instruments to match the relatively low and often irregular incomes of the majority of the urban population."

It is good to see that the authors of this report realise that many Nigerians earn their living in a comparatively irregular, haphazard way and that housing loans and their repayment must be geared to this situation. Failure to understand this has been one of the main reasons for the lack of success of previous housing programmes.

The report suggests "actions to be taken" to ensure the success of these financial proposals. Among them are four which seem to me especially relevant:

1 **"Support the establishment of linkages between informal savings co-operatives and formal sector savings and mortgage lending institutions through federation and technical assistance."**
2 **"Develop framework and incentives to mobilise private capital and savings into the housing sector, including expanded FMB operations and support for private and co-operative savings institutions."**
3 **"Establish lending instruments for formal or legitimised informal lending institutions with flexible terms and collateral requirements appropriate to low-income households, especially on a group or project basis."**
4 **"Establish a programme of financial assistance to aid small-scale building contractors."**

One innocent reader of this report can't help wondering if the "legitimised informal lending institution" is in fact a euphemism for the ubiquitous, time-honoured, sometimes indispensible character whom many of us know so well and often fear – the money-lender.

These financial recommendations are in fact saying to the Federal Government that it is more likely to succeed in its housing objectives if it helps people to help themselves than if it tries to play a "we-know-what's-best-for-you" role.

Construction

"Growth in housing construction should be encouraged through improvements in productive capacity of the building industry. At the same time, use of indigenous construction practices and materials should be encouraged, to reduce import requirements and to foster housing design most responsive to local needs and traditions.

Modest core houses with basic services on small sites can be afforded by most households. Such units can then be expanded by the household's own self-help efforts or when household resources later permit. Building research and information dissemination, linked with labour training, are practical elements of the strategy to increase indigenous building industry capacity."

What good sense this is! One is reminded of Kainji, which surely showed the way. When 42,000 people lost their

continued from previous page

Response to Noel Moffett review

by A. C. Lemer, Ph.D, Project Director.

Professor Moffett has presented well some of the highlights of the background against which housing strategy in Nigeria must be reviewed. We estimated that annual housing production in Nigeria's urban areas is less than one-fifth of the effective demand, and in the absence of major policy initiative is likely to continue to fall far below needs. We decided that if we wanted to strengthen the housing construction industry, we should concentrate where the need is great and where the system could in principle be self-supporting. Thus, we focused on housing for the middle income ranges. We feel that the first order of business should be to establish an improved and self-sustaining production system.

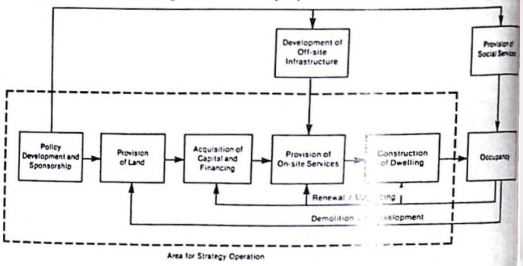
One of the major impediments to immediate success is the lack of a trained and experienced cadre of mid-level managers and administrators, in industry as well as in government. We thus deferred placing responsibility for housing at local levels, where it ultimately belongs. Similarly, we concluded that increased housing production would have to be concentrated initially in the hands of large-scale developers. In both cases, we recommend that training be provided to create as quickly as possible a broader distribution of the skills needed for meeting Nigeria's needs.

Throughout our policy, we have tried to be sensitive to Nigeria's unique and rather diverse cultural character. For example, while the money-lender is indeed an ubiquitous institution, the co-operative savings and self-help organisation, known by a number of terms such as "esusu", is also a widespread Nigerian financial force. It is the latter type of institution which we would prefer to see legitimatised.

Nigeria's diversity also lends us to question whether the architectural design of housing is an appropriate topic to be addressed at a national level. Certainly it was beyond the scope of our concern for national strategy. However, even with adequate time and resources, we would hesitate to try to find singular architectural solutions to the housing problem, which would be uniformly appropriate to the varied regions of Nigeria. I personally would leave the sociological and architectural aspects of housing strategy to the market economics and socio-political forces of the villages and towns. What we would hope for in a strategy is creation of a favourable climate for development of local initiative.

Finally, we would hope that action would be forthcoming – action to build housing. The idea of nationwide popular "debates" on housing strategy suggest that the people have the leisure and inclination to discuss issues. We would argue that the problems of Nigeria's urban housing are sufficiently clear and acute that such debate is a luxury which is too costly if it delays action. Certainly we must continue to explore the problem and possible solutions, but we should now be learning by experience.

Strategy operates through the delivery system.



homes following the construction of the giant hydro-electric dam and lake on the river Niger, new ones had to be built quickly, with a minimum amount of disruption to the lives of the local people and in a manner acceptable to them.

The Lagos architects Fry Drew Atkinson designed the layouts of the new towns and villages to echo those of the old ones but mud walls and thatched roofs gave way to walls of large laterite blocks and precast conical roofs of asbestos cement erected by the people themselves. Other architects have recently demonstrated that the Nigerian tradition of grouping rooms in a linear fashion lends itself admirably to modern urban living.

Fist steps

If the recommended housing strategy is to succeed the report suggests, eight first steps should be taken:

(i) Ministry and National Assembly joint development and adoption of a national policy.

(ii) Centralise federal level planning management and executive functions for housing.

(iii) Develop planning, design and institutional guidelines.

(iv) Implement state and local development planning processes.

(v) Identify pilot projects and commerce project development under state and FHA sponsorship.

(vi) Provide seed capital for pilot projects with cost recovery through an expanded low-income mortgage programme.

(vii) Hold national housing conference for federal, state and local participants.

(viii) Institute national training programme for development and monitoring agency personnel.

These are interesting first steps; and some of them are urgent. But, surprisingly, the most important and most urgent one is not among them: "Consult the people who are going to live in these urban dewellings". In order to find out what kind of houses people in all sections of Nigerian society really want, there should be a full-blooded, continuing, nation-wide series of debates sponsored by the Government, organised perhaps by a few of the older universities and reported at length in the press.

A "national housing conference for federal, state and local participants" is not enough. There should be many conferences, large and small, formal and informal, regional and local, at which people should be encouraged freely to express their views and state their opinions. And these views and opinions should guide and direct the Government, as its housing strategy develops.

Assessment

This is a fine report. It outlines an admirable strategy for urban housing. The Government should accept it in principle, straightway and take the first steps towards implementing its main recommendations. Perhaps some of these steps have already been taken? Perhaps the great housing debate has already begun?

Good advice has been given on the necessary economic and financial foundations of a sound, pragmatic, urban housing strategy. Further advice is now needed on the more difficult – and in the long run more important – sociological and architectural aspects of that strategy.

Preventative Maintenance
Part two

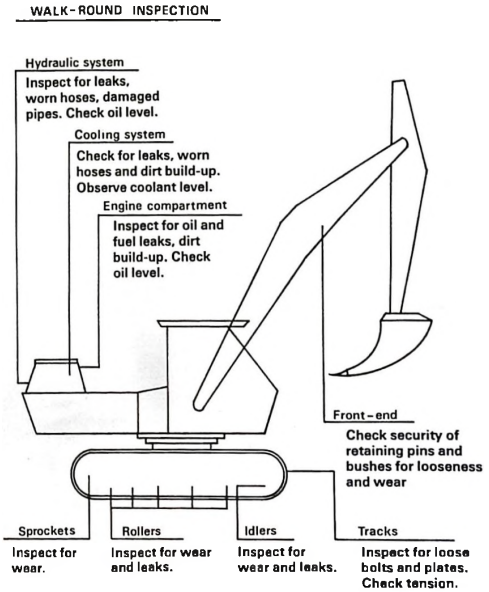
THE MECHANICS of operating a preventative maintenance scheme depend, as was detailed in part one of this series in November *West African Technical Review*, on the provision of carefully detailed, scheduled log books for each machine in the plant fleet. At predetermined times, usually based on the number of working hours and coinciding with normal servicing periods, components and sub-assemblies known to have wearing properties, are inspected and reported on with regard to their condition and fitness for service bearing in mind life expectancy between the inspection periods.

In this way potential component failure can often be anticipated and a sudden breakdown averted by appropriate replacement or remedial measures. Slack, or non-operational periods can be used for this work, both inspection and remedial procedures, so that normal working continues with the minimum amount of interruption.

In addition to preventative maintenance schemes set up as part of standard service procedures, much can be done to anticipate trouble by the machine operator. Daily servicing routines such as re-fuelling, greasing, minor adjustments and cleaning, provides an opportunity for at least a visual inspection of surrounding areas and quite often developing trouble can be spotted before it reaches expensive proportions. To quote an example, recently, the driver of a large loading shovel noticed, when topping up the batteries, that the braided earth lead was badly corroded where electrolyte had been spilled on it. By immediately reporting it, a new lead was able to be fitted before the damaged one failed completely.

Expense

If this had not been done the result of a complete failure would have been very expensive indeed. The alternator would have certainly burnt out, the battery would have been insufficiently charged to start the engine and the cost of components and lost time would have reached a considerable sum. Another example, which could have had very serious consequences, was the case of a dumper driver who noticed oil on the back plate of a brake when he was washing the machine. Calling a mechanic, it was found that a hydraulic brake pipe had been demanaged allowing a small amount of oil to escape every time the brake was applied. The eventual complete failure of this pipe would have rendered both the back brakes, inoperative or, if the fluid reservoir had become completely



empty, all the brakes could have failed – a horrifying thought on the steep slope leading to the quarry bottom where the machine was working!

In both of these cases, although a breakdown was averted by early detection of developing trouble, the important lesson is that early detection means that remedial measures can be taken at a time that is convenient and less disruptive to operational schedules. Certainly a simple operator training session in "trouble spotting" is a very useful and worthwhile exercise which can profitably be built into a staff development programme. The value of equipment places in drivers hands makes it only sensible to take every precaution to ensure that he is trained to fully understand his responsibilities abut keeping that machine working.

Operator training can be classed as a very important part of preventative maintenance; after all, he is the most likely person to spot developing trouble.

Too many operators are taught which levers to pull and which pedals to press without any knowledge of the function of the machine being imparted to them. Admittedly, there is little point in training an operator to the standards of a mechanic but a sound working kowledge of his machine will help to get the best out of it and to be able to anticipate trouble by accurately describing the symptoms of abnormal functioning.

It is difficult to generalise on the routine of preventative maintenance because no two types of machine are exactly alike. It will be better therefore to take a specific type of machine and study the extensions of normal servicing routines which will provide a record of functioning to allow early diagnosis of impending failure. The modern hydraulic excavator is a good machine to study because it is sufficiently complex to provide examples of almost everything likely to be subject to premature failure.

All makers will supply, as part of the operating instructions, recommendations for routine servicing based on a specific number of working hours. These instructions must be broken down into work with-

continued

in the capabilities of the operator, and work needing the attention of a trained mechanic. For example:

Every 10 service hours or daily

Radiator:
Check coolant level.
Air inlet:
Check for obstruction – clean.
Engine crankcase:
Check oil level – top up.

This is the driver's work but if instructions are issued for a simultaneous inspection of all areas immediately surrounding those being worked on – hose connections for leaks – radiator matrix for obstructions – radiator pressurising cap spring tension – oil leaks – access panel fastenings and hinges checked for security etc., this visual inspection will quickly determine if all if well before developing trouble reaches serious proportions.

Every [illegible] hours or weekly.
Slew bearing:
Lubricate
Slew gear box: Check oil level.
Hydraulic system:
Check oil level
Batteries:
Check electrolyte level.
Front end equipment:
Lubricate nipples.

Further instructions could well read as follows: *Examine slew bearing bolts for tightness. Check hydraulic system for leaks. Check tank venting or pressurising valves. Clean breathers. Examine all front end bushes for excessive wear and slack pin retainers. None of these small points would stop the machine working but could lead to further trouble if left unattended.*

Every 250 hours or monthly.
Engine crankcase:
Change oil and oil filters.
Fan and alternator:
Check belts for wear and adjust tension.

Additional checks could include the following: *check old oil for traces of "foreign" matter. Examine old filters for excessive build up of dirt. Much can be diagnosed from the contents of old oil filters and sump oil about the state of wear and performance of an engine, even with only a visual inspection. Full analysis in a laboratory is even more definitive. Check alternator greasers when these are fitted. Check holding down bolts for tightness. Check pulleys for alignment, especially if the drive belts are worn.*

Every 500 hours or 3 months.
Hydraulic system:
Change filter elements and wash filter screen.

Additional checks should including the following: *examine deposits on filters for traces of metal particles, gum or varnish which will indicate respectively, pump or motor wear, high operating temperatures.*

Every 1,000 hours or six months.
Engine valves:
Check and adjust clearances.

An examination of the deposits on the inside of the cylinder head cover will give a good indication of the operating temperature and the efficiency of the re-breather piping.

Every 2,000 hours or one year.
Slew gearbox:
Change oil.
Pump drive:
Change oil.
Hydraulic system:
Change oil and wash filler and filler strainer.

This also provides an opportunity to examine the contents of the oils in terms of metal deposits indicating wear. If possible a full laboratory analysis should be undertaken.
Cooling system:
Drain, flush out and re-fill with correct solution.
Coolant hoses:
Change hoses.

Other adjustments and checks may be listed under an "as necessary" heading and it is difficult to accurately allocate time scales to this work because much of it is variable due to operating conditions. However, many machines today are fitted with indicators for such things as filters and air cleaners which remove the guesswork from

continued

Fig.2

Example of log book for a hydraulic excavator

Machine Number 1234 Total hours worked: 2500		
500-hour Preventative Maintenance Inspection.		
Relief valve settings	Main 1	138 BAR
	Main 2	135 5 BAR
	Main 3	110 4BAR *
	SLRV 1	137 BAR
	SLRV 2	136 7 BAR
	SLRV 3	136 5 BAR
Pump flow rate	No. 1	135 l/M
	No. 2	132 l/M
	No. 3	60 l/M
Hyd. oil temperature	From pump	71°C
	Into tank	70°C
	Into cooler	80°C
	Out of cooler	70°C
Pump running	Backlash and noise	O K.
Hydraulic tank pressure	Venting valve	2 5BAR *
Battery	S.G. Cell 1	1·22
	Cell 2	1·25
	Cell 3	1 15
	Cell 4	1·23
	etc	
Engine	Idle speed	750 R/M
	Max. speed (no load)	2250 R/M
	Max. speed (full load)	2150 R/M
	Oil pressure	9·8 KG/CM²
	Thermostat opens at	65°C
	Mounting bolt torque	9·5 KGF/M
Controls	Boom hoist	SLACK *
	Dipper arm	O K.
	Bucket	O·K.
	RH Travel	STIFF
	LH Travel	O·K.
	Slew	O·K.
Hyd. control valves	Spools VB 1	O·K.
	Spools VB 2	O·K.
	Spools VB 3	2ND TIGHT – O·K.*
Signed P. Ilwazie	Date 1 – 2 – 81	Action? YES. *

these important service requirements. For example:

When required.

Air intake:
Clean when indicator shows red with engine running at high idle.

Fuel system:
Change filters when fuel gauge registeres "out" with engine running.

These service jobs also provide the opportunity to check the build up of dust and dirt around all internal parts of the engine compartment. Dirt will cover leaky joints, loose bolts, worn wiring and a host of other potential danger spots. Cleaning is part of routine servicing and is the opportunity for close inspection of many otherwise forgotten areas. The cooling system should be drained and cleaned if the engine overheats.

This work will only be undertaken after checking that waterpump drive belts are intact and the thermostat is working correctly, but again, a number of associated components will be available for inspection at the same time. Such as the fuel tank where moisture and sediment should be drained if the engine misfires or frequent filter changes are necessary. Check for corrosion and leaks at the same time, also check that mounting bolts are secure.

With such simple additions to routine servicing, mainy impending troubles will be spotted long before they develop to a catastrophic level, but programmed inspected and testing by trained mechanics is the ultimate aim of preventative maintenance. Still thinking in terms of a hydraulic excavator, such a schedule, which will be part of the machines log book, may well read as shown on previous page.

The above only indicates, of course, the type of work which should be listed in the machine log book. It would be outside the scope of this article to prepare a complete list which, for a modern excavator, is very comprehensive. The important thing to remember is that all inspections and checks *must* be logged as only then will a picture of performance and developing trouble be sufficiently clear to anticipate where attention must be paid to avoid the possibility of a breakdown.

Planning is the key to successful machine operation, planning which keeps a critical eye on problem areas and lists the action taken to maintain optimum performance. The log book is the "bible" and an example of how this may be laid out is shown in figure 2.

Danger areas

This illustration shows a machine about one and a half years old and the logged report of the 500 hour inspection has brought to light six possible danger areas which might cause serious trouble. First, the pressure on the No. 3 main relief valve is obviously down. It may be that only adjustment is necessary to bring it back to standard, but it would be prudent to keep an eye on this valve as a weak or possibly broken spring may be causing the trouble and failure would lead to the circuit involved becoming completely inoperative.

In the second instance, the pressure in the hydraulic tank is too high. One bar is, at the most, all that is required to ensure the exclusion of dirt and avoid cavitation at the pump inlet. The chances are that the venting valve is faulty and will have to be replaced.

Thirdly, the number three cell of the battery has a low specific gravity which indicates that it is not holding its charge. Sediment in the bottom of the cell may be the reason or possibly a losse internal connection.

Fourthly, the boom hoist control is reported to be slack. Again adjustment may be all that is necessary but a check should be made for loose adjusters, broken connecting pins or worn bushes in the lever linkage.

Fifthly, the right hand travel control is reported to be tight. Lack of lubrication, broken components or even a sticking spool may be the reason. Further investigation is necessary before either something breaks or there is an accident because the operator looses control.

Lastly, the second spool in the number three hydraulic control valve is reported to be tight. This may be a simple case of dirt or a much more serious problem of a build up of gums and lacquer on the spool due to overheating.

Every 500 hours or three months

Hydraulic system Examine all external connections for leaks. Test pressure of relief valve operation, adjust if necessary. Measure oil temperature. Test pump(s) output flow rate and compare with previous test reading. (Rapid fall-off denotes deteriorating pump components.) Listen to pumps on and off load; noise denotes wear, check pump coupling and mountings. Measure hydraulic tank pressure.

Battery Test electrolyte with hydrometer for even charging of each cell.

Alternator Test output with ampmeter and voltmeter via regulator. Blow out alternator if working in dusty conditions. Check sliprings and brushes for wear.

Engine Check idle speed with tachometer. Check maximum governed speed both on and off load. Check oil pressure with external gauge. Check working temperature of thermostat opening. Torque down mounting bolts.

Controls Check all controls for backlash, adjust or replace. Check directional hydraulic control valves for correct spool travel, centring and hold.

Every 1,000 hours or six months.

In addition to the work detailed in the 500 hour schedule:

Hydraulic system Test and log all relief valve pressures, reset if necessary. Test backpressure in return lines. Examine all flexible hoses for signs of strain or wear at the connections. Replace if necessary, otherwise check for tightness. Take and examine sample of oil from hydraulic tank.

Note: After a period of time, the logged variations in the relief valve settings will provide a picture of circuit efficiency. A rise in back pressure will indicate that all is not well with either the filter system or that an accumulation of debris is reducing efficiency. Kinked or damaged hoses will also contribute to the problem.

Engine Check fuel pump timing and injectors for carbon building. Examine exhaust system for signs of corrosion.

Cab and canopies Inspect for loose panels, broken hinges and stays, loose sound insulation and general signs of deterioration.

Front and equipment Inspect for cracks in welding, worn or broken retaining pins, bucket teeth wear and general condition.

Tracks and running gear Inspect for loose or missing bolts, cracked or missing track pads. Examine gearboxes for oil leaks and signs of excessive back-lash in the sprocket drive. Check final drive chains and sprockets (when fitted) for wear and backlast. Inspect brakes for satisfactory operation.

Spare parts

By carefully analysing the maintenance reports, another benefit may be had from the information collected. Much of the forward ordering of spare parts is a matter of guesswork or reliance on the machine makers recommendations. With comprehensive records over the machines life many problems may be identified before they reach the point of requiring component replacement, but a warning of impending trouble means that the necessary parts may be forward ordered and be ready and waiting when they are eventually needed. This saves time and sometimes money too as many makers charge a premium for parts ordered on an emergency breakdown basis and if they have to be airfreighted to a remote part of the world, the cost is even higher.

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Circle No. 236 on enquiry card

New Mechanical pile splice

Delays on site while concrete piles are spliced are less and less acceptable, so high is the capital investment tied up in modern construction projects.
A new mechanical splice invented in Sweden allows precast piles to be spliced on site by unskilled labour in just two minutes. The simple, inexpensive design also lends itself to economical mass-production of precast pile sections in the factory. The excellent mechanical performance of the DYN-A-SPLICE has confirmed by independent tests in the USA and Sweden.

IN CONTEMPLATING the design of a new splice that would allow precast pile-sections to be joined together in the field, the Swedish designers of the DYN-A-SPLICE went back to first principles. What are the ideal properties of such a splice?

In the first place it should be at least as strong as the pile itself to withstand stress of every type. The spliced pile should reproduce as closely as possible the mechnical behaviour of a single, unspliced pile of the same total length; secondly, the joint should be quick and simple to complete in the field. It should require no special tools and, in particular, no skilled labour such as welders who would have to be brought in specially; thirdly, the splice components should be inexpensive in terms of materials content and manufacturing costs, and easy to handle, store and transport. If special preparation of the pile-sections is necessary, series production (preferably automatic) should be feasible at low cost. Tolerances required should be no stricter than those needed anyway in the manufacture of pile-sections; finally, the splice should be suitable for both prestressed and reinforced piles, and should be adaptable to all pile cross-sections commonly used.

Lighter sections

As buildings become generally larger, demanding more from their foundations, and as less-stable ground is used, the call for an effective and economical pile-splicing system meeting these requirements becomes more urgent. Long, unspliced piles have many disadvantages. The greatest is the difficulty of handling and transporting them. Special long vehicles are required. Heavy site cranes are needed to unload the vehicles. Heavy, expensive driving-rigs are needed. Often, stresses likely during handling are greater than driving and working stresses, and piles must be designed stronger than otherwise necessary. Even so, there is always a significant fraction of expensive breakages.

With an 'ideal' pile-splicing system available, piles could be made up on site to any required length. Pile dimensions and strengths would be related entirely to driving and working duties. Pile lengths could be selected and adjusted at short notice to suit the different soil conditions encountered during field operations, making accurate prediction of lengths unnecessary. Pile-sections of relatively few standard sizes could be manufactured and stocked to cover all site needs, so minimising cash 'lock-up'. The sections could be transported on conventional vehicles and all but the largest diameters loaded and unloaded by a crane mounted on the vehicle itself.

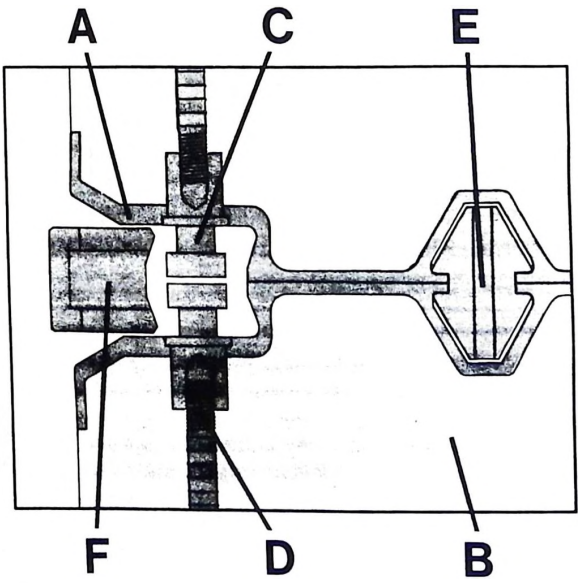

Fig. 3

Many different and ingenious splices have been designed, and most of these have been used safely and successfully to support buildings or structures. Nevertheless, most of these designs are compromises. Those giving good mechanical performance have generally been expensive and complicated, requiring time-consuming preparatory and/or on-site completion work. Those simple to prepare and complete usually have deficiences in mechanical performance which limit their applications.

A few years ago, a survey of twenty splice designs showed on-site completion times ranging from 20 minutes minimum to 120 minutes maximum.

Two identical castings

Though still naturally something of a compromise, the new DYN-A-SPLICE is believed to have no obvious weaknesses when set against the "ideal" criteria. In tension, compression, bending moment, shear and torsion it has proved to be at least as strong as the two concrete elements being joined. Full scale trials have confirmed the results of laboratory investigations, and the splice has successfully passed two of the most rigorous sets of tests in the world – the standards laid down by CalTrans, the California Department of Transportation, in the USA, and those of the Swedish Building Code 1975. Test results are discussed in more detail below.

The design is suitable for reinforced or prestressed piles, solid or hollow, with

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square, round, hexagonal or octagonal cross-sections. The two halves of the joint are identical lightweight castings, which simplifies storage and stock-control in the factory. These castings are easily fitted on a semi-automatic, mass-production basis to the maching moulded ends of the precast concrete pile-sections.

However, perhaps the most dramatic advantage of the DYN-A-SPLICE is that spliced pile thus behaves like an unspliced reinforced pile cast in one piece.

The splice-plates (Fig. 3,A) are ductile-iron castings which fit accurately over the moulded ends (B) of the previously cast pile-sections. They are then secured by steel bolts (C) which screw onto the threaded ends of the cast-in reinforcement-bars (D). Because the plates are not welded to the reinforcement-bars before casting (as required by many splice designs), the problem of storing awkward cage-like structures does not arise.

On site, the bottom pile-section is driven normally, the only protection needed for the splice-plate being a piece of wood. A central zinc-alloy pin (E) is then inserted, to aid alignment of the top and bottom sections. When the top section is in place, the joint is completed by hammering ductile-

The upper element is positioned above it.

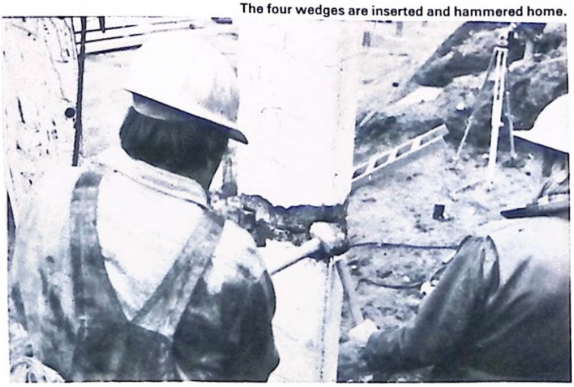
The lower element is driven.

iron wedges (F) into cavities in the splice. This pulls the bolts in the two sections together, completing the straight-line tensile connection. The two plates are *not* spliced, but act simply as fixtures for the bolts and to distribute compressive forces over the whole cross-section.

The central zinc pin provides electrolytic protection against corrosion, but in particularly corrosive soils the whole splice

continued

The four wedges are inserted and hammered home.

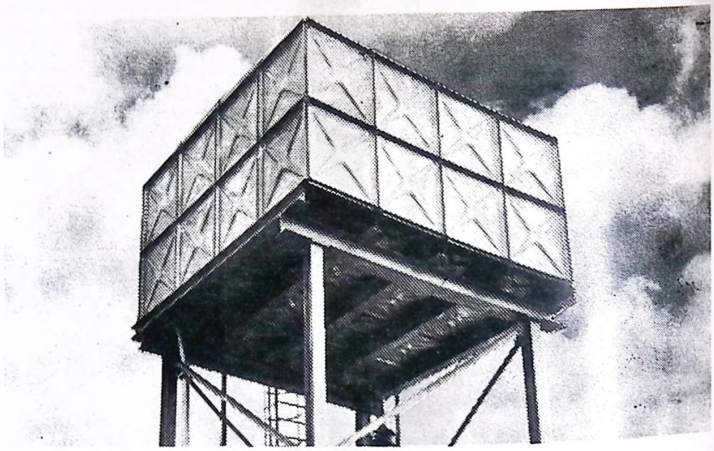


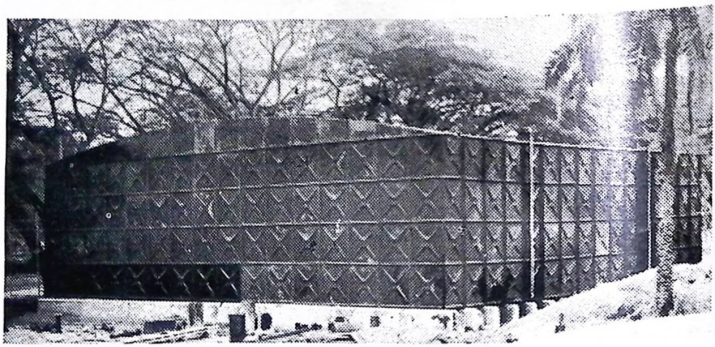
completion of the joint on site takes literally a couple of minutes and requires no skill beyond that of wielding a heavy hammer. The investment involved in modern building projects is such that even twenty minutes idle time by the piledriving rig represents unacceptable loss of production.

Straight-line transmission

Technically, the distinctive feature of the new design is the separation of compressive and tensile forces. Compressive forces are distributed over the whole cross-sectional area of the concrete, but tensile forces are transmitted directly from the reinforcement bars of one concrete element to the reinforcement bars of the other. The

The author, Dan Göransson, is a member of the A. Joint Corporation.





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can be given a protective coating.

The DYN-A-SPLICE design has been patented in 45 countries, and the product will be marketed worldwide, preferably through local licensing agreements. Where necessary, the manufacturers will also separately license a complete system for manufacturing precast concrete pile-sections, either in a permanent factory or in a mobile plant suitable for remote construction sites. The sections normally range up to 13m long which allows them to be transported economically on a conventional 12m flat-bed vehicle.

Independent tests

Piles joined with the DYN-A-SPLICE were tested against Swedish Building Code standards in September 1979. The Swedish National Institute for Materials Testings, *Statens Provningsanstalt*, conducted the tests at Chalmers University of Technology, Gothenburg.

solid rock, then extracted for bending tests. These were performed on 3.6m-long sections sawn symmetrically about the splice. These sections were supported on two points 3.0m apart (Fig. 4); weights were loaded on at points 1.0m apart; and the deflection of the splice relative to two points 1.4m apart (this deflection known as d1.4) was measured at the specified bending moment of 40kNm. Tensile tests were conducted separately. Results were as follows:

	ultimate tension kN	*ultimate bending moment kNm*	*stiffness (d1.4 at 40kNm bending moment)*
Swedish Building Code requirement	450 (minimum)	51 (minimum)	3,38 (maximum)
DYN-A-SPLICE	512	83	2,10

Two upper and two lower pile-sections were cast. These were 4m long, 300mm square in section, reinforced by four 20mm-diameter rods. The two splices piles were driven by 3,000 blows each towards

Visual checking after driving showed no cracking of the concrete nor damage to the splices, and there was no measurable change in the 180° angle between the pile halves.

In December 1979, piles jointed with the DYN-A-SPLICE were tested against CalTrans requirements at San Jose State University, California. (Fig. 5 shows a bending test in progress.) The 300mm-square prestressed piles were reinforced with four 25mm-diameter rods. In these tests, no prior driving was specified. The strengths achieved were as follows:

	tension kN	*bending kNm*	*shear kN*
Caltrans requires	512	102	311
DYN-A-SPLICE	788	129	489+[3]
Unitary unspliced pile	800[1]	115[2]	—

(1) theoretical limit, not tested
(2) tested limit
(3) tests stopped before failure for safety reasons

Compression tests produced failure of the concrete at loads between 3,800 and 4,000kN, but no splice failures. Corrosion tests on loaded piles showed negligible splice corrosion (under 0,025 mm/year) under 'worst-case' conditions. The conclusion was that the DYN-A-SPLICE can develop the full structural capacity of a 300mm prestressed pile having a 28-day compressive strength of 41MN/m².

Subsequently, thirty spliced 300mm prestressed piles made by Santa Fe-Pomeroy, Inc., who cast the test specimens, were used to support the new Liberty House department store in Sacramento, California. ●

Extr
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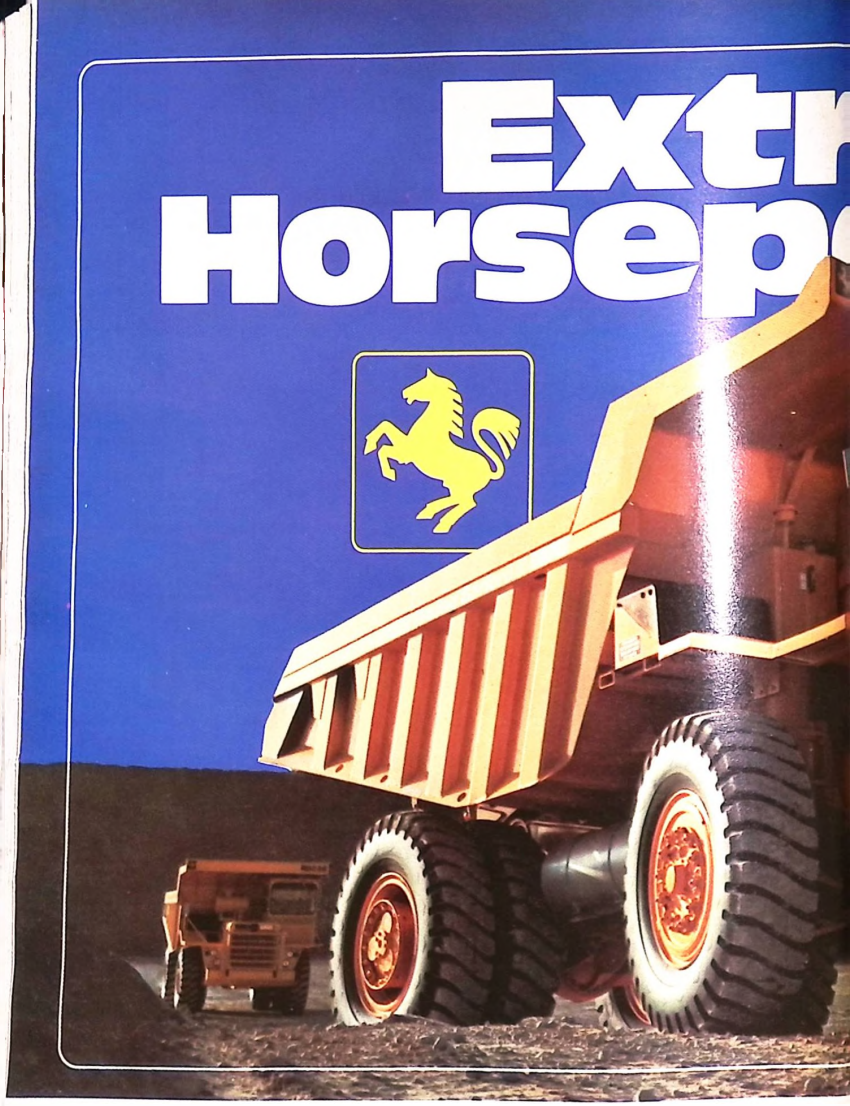

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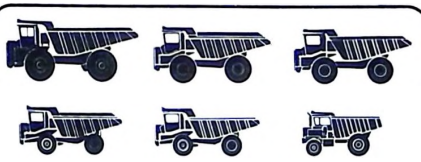

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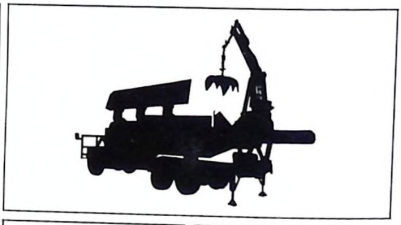

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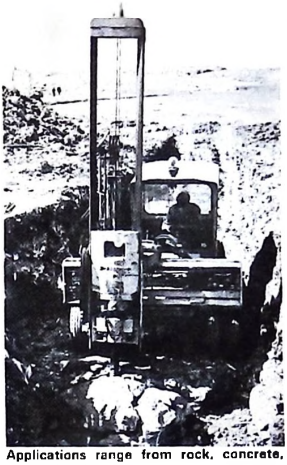
Circle No. 251 on enquiry card

Hydraulic mobile hammers

Large-scale breaking of concrete, asphalt and rock is the kind of work usually associated with mobile hydraulic hammers. In fact, their operating speed means they can also cut trenches, compact fill, drive posts, punch holes and do numerous other large and small jobs much more efficiently than conventional tools and techniques. In this article, the author examines some methods of using these all-round workhorses and details case histories which indicate possible time-savings, of 90 per cent.*



Applications range from rock, concrete, and asphalt breaking.

SEVERAL YEARS ago, in Blackpool, UK, a mobile hydraulic hammer was being used for road breaking for an open-cut trunk sewer. At the same time, the main contractor was punching well points through 75mm of tarmac and 250mm of reinforced concrete so that the underlying waterlogged soil could be pumped dry. A pneumatic jack hammer was being used and was taking between 30 and 45 minutes per well point. Then the road-breaking contractor suggested that the mobile hammer, fitted with a post-hole tool, could do the job more quickly. In the event, it reduced the time taken to punch each well point to between three and four minutes – a time saving of some 90 per cent. Moreover, the neat perforations obtained simplified the de-watering process and allowed the sewer to be laid more quickly.

This example is a routine illustration of the way in which the mobile hydraulic hammer has proved to be an effective all-round workhorse for the construction engineer. Its applications range from rock, concrete and asphalt breaking to cutting trenches, driving posts, compacting fill punching holes and even cutting recesses in asphalt roads for reflector-studs or cats' eyes. This breadth of use is expecially important for the owner operator who needs to obtain maximum use from his investment.

Using the hammer, the overall time taken to complete contracts is often greatly reduced. Work can be finished in two days which would otherwise take between three weeks and three months. This brings other savings, too: ancillary plant and equipment can be hired for shorter periods; there are fewer traffic hold-ups and less inconvenience: and of course there are important cash-flow benefits.

The mobile hydraulic hammer was developed by Arrow Construction Equipment. Their D500 is built on a four-wheeled chassis, with the hammer assembly at the front and the engine at the rear. The hammer assembly comprises a 612-kg dropping weight in a frame guide which traverses a cross slide on the front of the machine and can be titled 9° from the vertical position; it can also be laid back in a horizontal position for travelling. The hammmer operates at a rate of between 26 and 120 strokes per minute, and the stroke is adjustable between 76mm and 3,05 metres. Maximum energy per blow is 1866kgm.

High-energy blow

The hammer weight can be fitted with more than 20 different tools, which can be changed in minutes. The blunt scoring tool for breaking concrete shows the fundamental difference in operation compared with a jack hammer. It breaks the concrete in one high-energy blow instead of punching or chipping away laboriously at the surface. Concrete can be broken into large or small pieces in this way, and steel reinforcement can be broken at the same time. The tool can be set to control the extent of the break as well as the size of the broken material. An additional advantage is the long tool-life. Table I shows the speeds attainable.

To the operator, a major benefit is that there is no risk of contracting White Fingers, the vibration-induced disease associated with jack hammers. There is growing medical concern about this serious disabling condition, which may cause permanent damage to the nerves, bones and muslces of the upper limbs, and can lead, it is believed, to blood clotting and thrombosis.

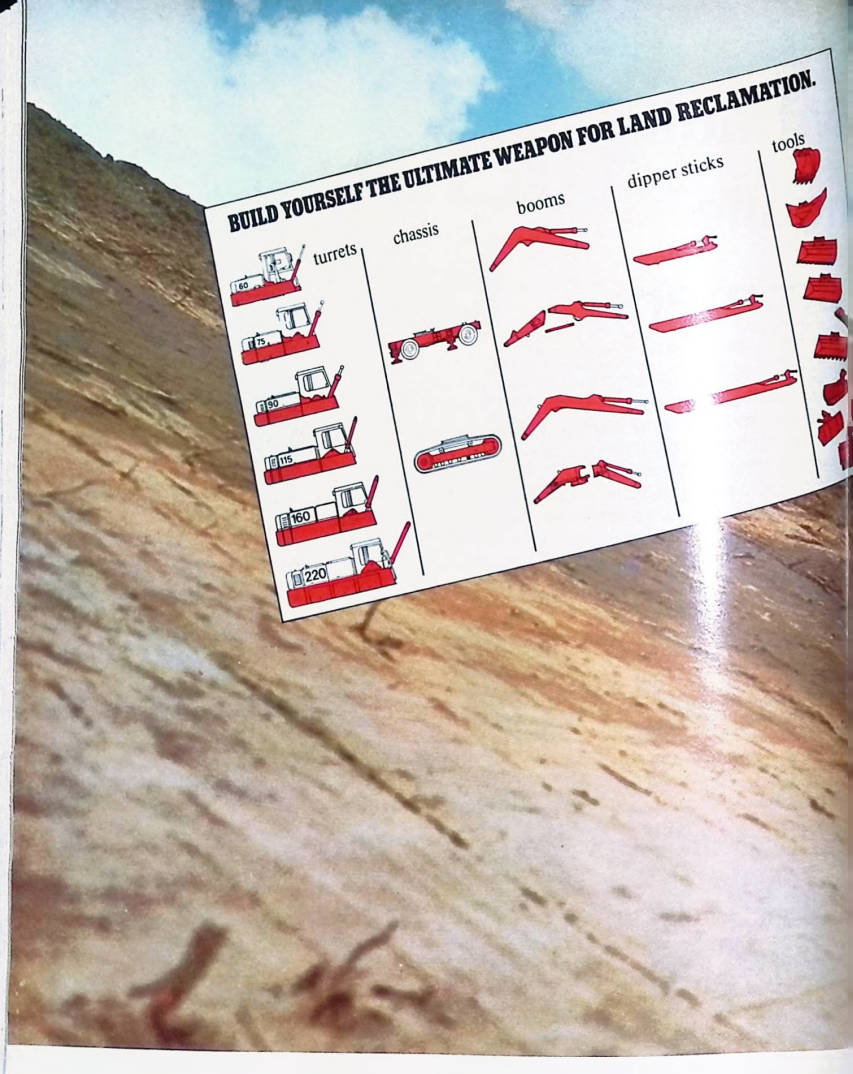
At the University Hills shopping centre in Colorado, USA, 168m² of 300-mm- to 600-mm-thick concrete kerb, gutter and pavement was broken into rubble using the mobile hammer in 34 minutes. The contractor involved had previouslt estimated 18 hours for the job, using two jack hammers. Nearby shop-owners appreci-

continued

Table 1 *Breaking concrete slabs with the Arrow D500 hammer*

Thickness		Output	
in	*mm*	*sq.yd/h*	*m²/h*
4	100	1,500	1,250
6	150	900	750
8	205	550	450
10	255	300	250
12	305	180	150
14	355	100	85

**T. Nancarrow is Managing Director of Arrow Construction Equipment Ltd., UK, who have recently appointed Morpol Industries Corporation Ltd., Lagos, as their agents.*



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ated the low noise – no more than from a diesel engine – with which the job was done.

In the Netherlands, at the Valkenburg military airfield, more than 10,000m² of 150-mm-thick hard concrete had to be broken out into 200-mm pieces without damaging the underlying 300-mm-thick layer of rough concrete to which it was attached. Using one mobile hammer, the work was done in 50 hours over four days – compared with the 1,200 hours over six weeks it would have taken five pneumatic breakers. Soft concrete can also be done quickly and efficiently, typically at a rate of 25m² per hour.

Table 2 *Compaction in narrow places with the Arrow D500 hammer* (Road Research Laboratory report LR 229)

Backfill	Output	
	cu.yd/h	*m³/h*
cohesive soils	46	35
well-graded granular soils	22	17
uniformly graded backfill	17	13

The mobile hydraulic hammer can be used for cutting trenches, driving posts, compacting fill, punching holes and even cutting recesses in asphalt roads for reflector-studs or cats' eyes.

Avoids traffic disruption

In crowded city streets, the machine's speed and the way in which it breaks the surface material are advantages in reducing obstruction or traffic hazard. The surface of a car-park centre square in the Dutch city of The Hague was broken up after the morning rush hour. During lunch-time and afternoon, traffic was able to drive safely over the broken surface, which was still flat and in place, until the concrete could be removed later in the evening by front-end loaders.

Where there are pipes and other services beneath the road surface, the mobile hammer avoids damaging them by vibration. The shock waves from the impact of the hammer do not travel far into the ground, but are dissipated across the surface.

Concrete or asphalt is readily broken up using the machine, which is especially useful when cutting it out prior to excavation of tenches. With the hammer tool set in line with the required trench, a central cut is made, followed by a further cut at each side. This causes the concrete or asphalt to break to the centre, avoiding back-facturing and giving very clean edges to the trench. This work can be carried out routinely at a rate of 1–2 minutes per linear metre of trench.

During subsequent excavation of the trench, any rock encountered can speedily be dealt with using the special rock-breaking head and tool. The maximum energy of more than 1850kgm per blow smashes rock much more quickly than the repeated low-energy blows of conventional hydraulic breakers.

When the trench has been made and the services installed, the machine is ready for use in yet another role. It permits single fills up to 1,8 metres thick to be compacted in three passes, giving a better result more quickly and at reduced cost. AASHO-180 Test Procedure test figures show compaction of 95 to 100 per cent. The plastic flow of back-fill around the service pipe gives radial support to it within the trench. The hammer of the tamper can be operated at an angle to key the back-fill into the sides of the trench, eliminating the possibility of slippage or subsidence, and helping to avoid subsequent damage resulting from frost or water erosion.

The machine is much more effective than most other compaction equipment in areas around structure footings and alongside retaining walls. In a report by Britain's Road Research Laboratory, it was found to be capable of compacting cohesive soils to a state suitable for earthwork construction at a rate of about 35m³ per hour.

Quicker post installation

Among the many types of posts installed using the mobile hammer are those for highway safety-barriers and fences. Wood, steel and concrete posts up to 300-mm square can be driven directly into the ground using a post-holder accessory. This method ensures that the post is driven cleanly and accurately into the ground, which then supports it like a driven pile. It also minimises subsidence and eliminates moisture pockets which might lead to rotting or corrosion. Compared with the traditional method of excavating a hole and setting the post in concrete, the process is considerably quicker and cheaper. To install posts for parking metres, road signs and the like, a punch is used to make a hole in the ground of the exact shape and size required.

The British Road Research Laboratory found the total cost of installing a double-sided safety barrier using the D500 hammer in this way to be considerably less than using the traditional method. Furthermore, the driven posts were more reliable under load than the concrete-mounted ones, with extremely important implications for crash safety. A tool is available for extracting damaged posts.

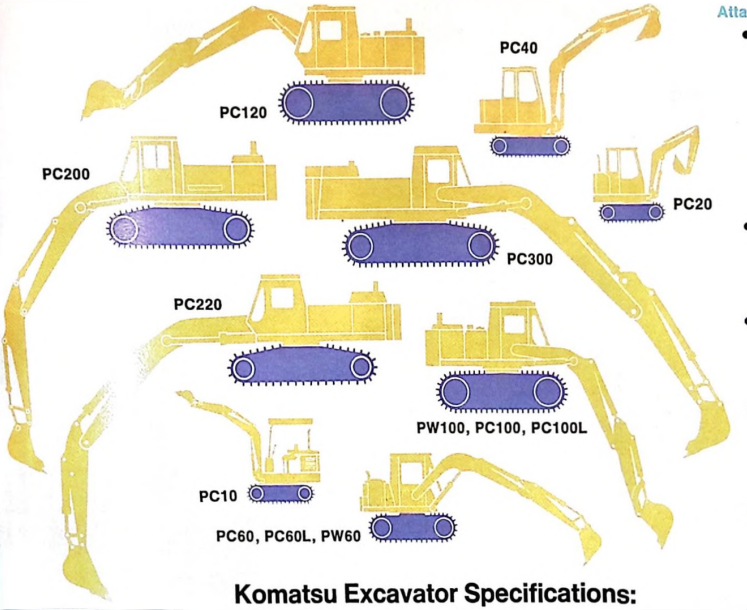
At Hamburg Airport, a quick-witted D500 hammer owner noticed that parking-meter posts were being installed by the time-consuming process of removing the asphalt and concrete using pneumatic breakers, excavating a hole, inserting a pre-cast concrete block, fitting the post, filling and compacting the cavity and making good the concrete. He subsequently completed the job using the hammer method: holes were punched through the asphalt, concrete and subsoil in 30 seconds and the posts quickly inserted with grouting. Across the world, a growing number of owners are today finding similar opportunities, for big and small jobs.

Reliable hydraulics

Power for the hammer motions, and also for the creeper drive used to move the machine slowly when working, is provided by a hydraulic pump driven from the 60-bhp (45-kW) General Motors Bedford diesel engine. For highway travel, the engine drives the front wheels through a conventional clutch and gearbox, giving a road speed of up to 48km/h. Because the machine is self-propelled, it can quickly be moved to other site locations out of the way of passing construction plant, and when its work is complete it can be driven to another site. A trailer can be towed to convey equipment and materials.

Rear-wheel steering aids manoeuvrability and, like the braking, is power-assisted. A fully-insulated heated cab can be provided, and the driver enjoys power-assisted finger-tip controls and an anti-vibration seat. ●


Hydraulic Excavators
"The Komatsu Reliables



Attachments Available:

- Backhoe buckets
- Trapezoidal buckets
- Slope finishing bucket
- Ripper bucket
- Clamshell bucket

Komatsu Excavator Specifications:

	Operating Weight	Flywheel Horsepower	Bucket Capacity	SAE Heaped Capacity
PC10	1990 kg (4,390 lb)	15.5HP(12KW)/1900RPM	0.02-0.05m³ (0.03-0.07 cu.yd.)	0.02-0.06m³ (0.03-0.08 cu.yd.)
PC20	2600 kg (5,730 lb)	20HP(15KW)/2200RPM	0.03-0.08m³ (0.04-0.10 cu.yd.)	0.03-0.1 m³ (0.04-0.13 cu.yd.)
PC40	4335 kg (9,565 lb)	35HP(26KW)/2250RPM	0.05-0.12m³ (0.07-0.16 cu.yd.)	0.06-0.14m³ (0.08-0.18 cu.yd.)
PC60	6200 kg (13,670 lb)	50HP(37KW)/2400RPM	0.08-0.30m³ (0.10-0.39 cu.yd.)	0.09-0.34m³ (0.12-0.44 cu.yd.)
PC60L	6700 kg (14,770 lb)	50HP(37KW)/2400RPM	0.08-0.30m³ (0.10-0.39 cu.yd.)	0.09-0.34m³ (0.12-0.44 cu.yd.)
PW60	6650 kg (14,660 lb)	50HP(37KW)/2400RPM	0.08-0.30m³ (0.10-0.39 cu.yd.)	0.09-0.34m³ (0.12-0.44 cu.yd.)
PW100	10600 kg (23,370 lb)	81HP(60KW)/2100RPM	0.16-0.50m³ (0.21-0.65 cu.yd.)	0.17-0.56m³ (0.22-0.73 cu.yd.)
PC100	10500 kg (23,150 lb)	81HP(60KW)/2100RPM	0.16-0.50m³ (0.21-0.65 cu.yd.)	0.17-0.56m³ (0.22-0.73 cu.yd.)
PC100L	12700 kg (28,000 lb)	81HP(60KW)/2100RPM	0.16-0.50m³ (0.21-0.65 cu.yd.)	0.17-0.56m³ (0.22-0.73 cu.yd.)
PC120	11500 kg (25,350 lb)	90HP(67KW)/2400RPM	0.16-0.55m³ (0.21-0.72 cu.yd.)	0.17-0.61m³ (0.22-0.80 cu.yd.)
PC200	18500 kg (40,790 lb)	105HP(78KW)/2350RPM	0.45-0.90m³ (0.59-1.2 cu.yd.)	0.48-1.02m³ (0.63-1.33 cu.yd.)
PC220	22000 kg (48,500 lb)	136HP(101KW)/2350RPM	0.7 -1.1 m³ (0.9 -1.4 cu.yd.)	0.78-1.26m³ (1.01-1.65 cu.yd.)
PC300	29000 kg (63,930 lb)	180HP(134KW)/1850RPM	1.2 -1.4 m³ (1.6 -1.8 cu.yd.)	1.11-1.56m³ (1.45-2.04 cu.yd.)

We are referring to our PC series. They range in horsepower and weight from 16HP (12kw) to 180HP (134kw), 1990kgs (4390 lbs) to 28,000kgs (61,730 lbs) respectively. Each is equipped with the same type of Komatsu or Cummins diesel engine fitted to our bulldozers and other heavy equipment, so naturally parts interchangeability is assured. But interchangeability goes further than that: Track parts, undercarriage, and filter elements are also interchangeable. This fact, coupled with our excellent worldwide parts supply network, means less on-the-job downtime.

Quality and reliability you can depend on.

Our experience in bulldozer and other construction equipment manufacture, has been incorporated into our PC excavators. Their quality and reliability are guaranteed by our manufacturing methods. Most key components are designed and produced right in our own plants. Our standard of quality is high but it pays off in the strength and reliability of equipment like our PC excavators.

After service you can depend on.

As the demand for our products has increased, so our after service network has expanded. Today Komatsu equipment, like our PC excavators, are backed by a solid after-sales, service and spare parts network. Currently it includes distributors in more than 100 countries—and it's still growing. For more information about the PC excavator series—or about any of our full equipment range—contact the Komatsu distributor in your country.

A range of equipment you can depend on.

Many contractors prefer to use a 'one-brand' range of equipment. That's why for many years we've been gradually building up a full range of earthmoving and construction equipment. Today we have that full range, so think carefully before you build a 'one-brand' equipment range . . . You'll find Komatsu a name to be reckoned with.

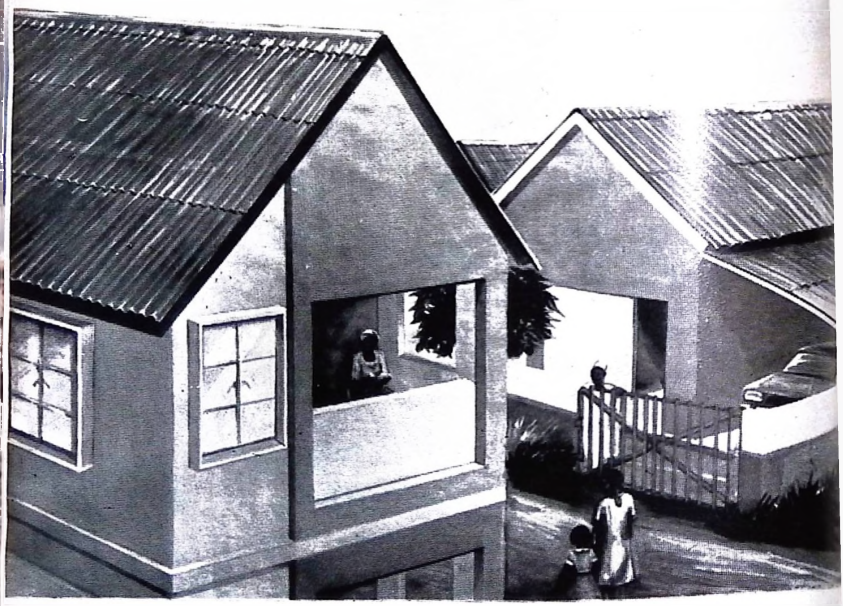
Komatsu Equipment Range:
● Bulldozers ● Dozer Shovels ● Pipelayers ● Dump Trucks ● Motor Scrapers ● Towed Scrapers ● Motor Graders ● Wheel Loaders ● Soil Compactors ● Vibratory Rollers ● Diesel Generator Sets ● Portable Air Compressors

Area Distributors: ●**Ivory Coast** Sanaci (Phone 35-6863) ●**Kenya** Panafrican (Phone 556560) ●**Liberia** Montraco (Phone 221231) ●**Nigeria** Complant (Phone 46504-6) ●**Tanzania** K J. Motors (Phone 63621) ●**Zambia** Turnpan (Phone 4571) ●**South African** Sigma Power (Phone 36-6331)

KOMATSU LTD.
Tokyo, Japan

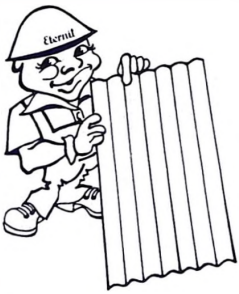
Circle No. 253 on enquiry card

Eternit®
SuperLightWeight
for protection



The beauty of a house lies in its roof. If a roof is tough enough to withstand the horrors of the windiest night, the burning heat of the hottest day and the severe beatings of the heaviest rain, then the house is solidly and beautifully protected. That's the special protection you get under.

ETERNIT SuperLightWeight roofing. SuperLightWeight roofing sheets are specially manufactured from a perfect combination of the highest quality cement and rock fibres, so they're extra tough and extra rigid.



They've been scientifically tested and proved to be waterproof, rust- proof, rot- proff and water- proof They won't burn and can be painted to taste. Come rain or shine, ETERNIT SuperLightWeight protects beautifully.

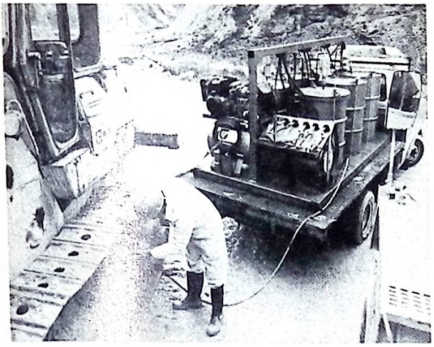
Eternit®

Quality roofing and ceiling sheets

ETERNIT LIMITED,
P.O. Box 483, Sapele.
Tel: 054 413111.
Telex: 42265 ETEROK NG.

Circle No. 276 on enquiry card

On-site servicing



The introduction of a new comprehensively equipped servicing unit has been announced by **Unit Garage Equipment Co Ltd**, a member of the Telcalm Group of Companies.

Known as the Lubemaster "Standard", it is a complete mobile servicing unit designed for the on-site maintenance of vehicles and plant working in remote areas or in difficult terrain where down-time is at its most expensive. It is designed to suit the Ford Transit, Bedford CS or similar chassis.

There are six pumps, to handle any combination of grease or lubricating oils through a bank of hose reels and an air pressure supply for tyre inflation and oil spraying. Power is provided by an engine-driven compressor put together in a compact unit that can be truck-mounted to go anywhere at any time. Lifting points are provided at each corner of the platform. *Circle No. 11*

Motor mixers

Braham Millar has devoted considerable research to the particular problems involved in the precise mixing of mortars to the standard demanded by modern technology. The first result of these researches was an 85l machine with a compulsory mixing action capable of handling mortar of all kinds as well as the many forms of plaster.

The machine also proved capable of dealing satisfactorily with a variety of "difficult" materials, such as the synthetic mixture used for tartan running tracks, and so came very much into popular demand.

Further technical refinements have recently been made

and a larger mixer, capable of handling 170 litres, has been added to the range. Both machines are now offered on the market under the namestyle of the Braham Millar "Mortarmix".

For situations in which a very high degree of accuracy and consistency of mix is required such as in the production of mortar for load-bearing walls or floor screeds bearing high point loads, accurate weighgear can be supplied as an option with either machine. There is a choice of static, mobile and fast-towing models in each case. *Circle No. 13*

Water pump

Atalanta Engineering Limited of the UK introduce the Gull 76mm by 76mm industrial air-cooled petrol or diesel engine driven self-priming centrifugal water pump.

This robust and lightweight, low-cost portable pump is capable of delivering large volumes of water for a variety of applications, including the transfer of liquids containing sand or small solids of up to 10mm-diameter in suspension. It has excellent priming characteristics, the engine developing ample power to operate the pump throughout the whole duty curve; capable of suction lifts up to 7m, and can generate heads in excess of 30m. The variable speed facility enables the alteration of pump duty to suit the application. The Gull is available in four models ranging from 3kW to 3.3kW output and tank capacities of 2.9l to 4l. The casing is cast in aluminium alloy and totally protected by heat-cured epoxy coating. The impeller is a semi-open vane-design; and runs against an abrasion-resistant replaceable wear-plate, ensuring simple maintenance. *Circle No. 14*

Temperature controller

A new "electronic temperature controller" introduced by **Walker Crosweller** is claimed to overcome the problems associated with conventional approaches to the accurate, economical and safe control of the temperature in blended water recirculating systems. Called the Rada 32 RM, the unit will maintain circulating temperature to within 2°C regardless of the level of draw-offs, and employs a new technology involving electronic temperature sensing and motorised control of hot and cold inlet supplies.

The new Rada 32 RM is intended for use with a recirculating pump that will provide a minimum flow rate of 10l (2.5 gals) per minute. An LED display on the controller housing gives a readout of mixed water temperature accurate to within 0.5°C, thereby providing an easy and positive means of setting the circuit.

The function of the Rada 32 RM is to break down high temperature water from a boiler to a safe showering or hand-washing temperature and keep a circuit at that temperature in, for example, schools, hospitals, leisure facilities, factories or institutions. Other applications include the accurate control of the temperature of the recirculating water systems used in a variety of food, chemical, cosmetic and horticultural processes. *Circle No. 12*

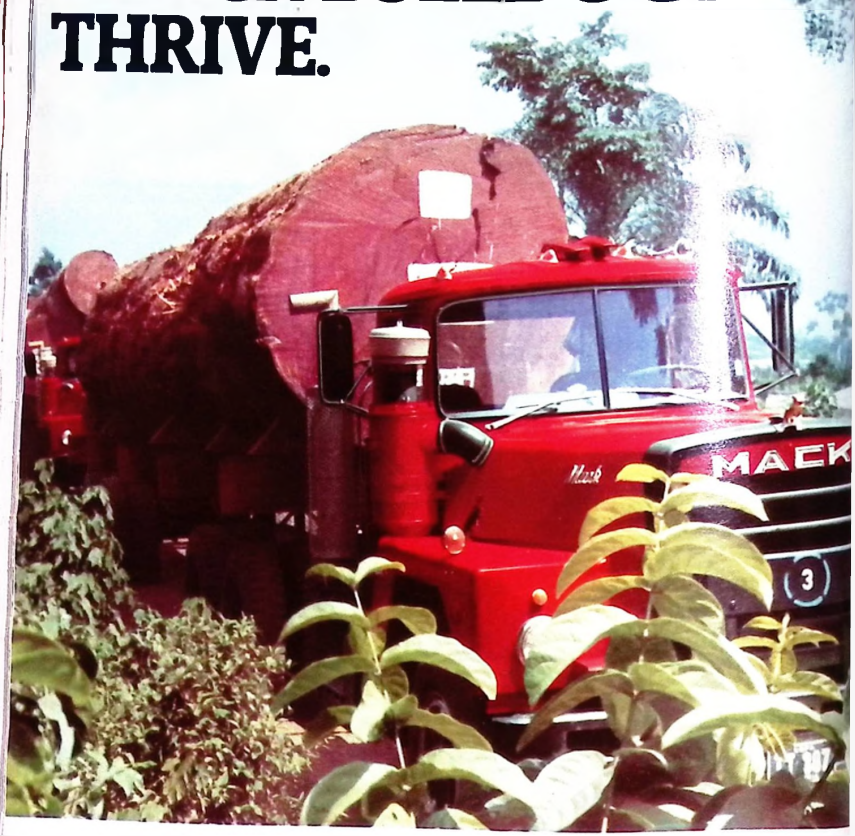
Splice protector

Unfinished telephone splices can be temporarily protected from moisture, dirt and other substances with new, reusable 4436, 4437 and 4438 Temporary Covers from **3M's Tel-Com Products Division.**

The envelope-shaped covers of black 20 mil vinyl are draped over unprotected work and edges are quickly and easily locked with Scotchmate hook 'n' loop fasteners. Covers can be used on vertical pole riser cables as well as for typical underground, buried or aerial applications. They also prevent UV damage to aerial CR boots. *Circle No. 15*

For further information please circle appropriate number on card facing inside back cover.

WHERE FEW SURVIVE, MACK BULLDOGS THRIVE.



We know what logging can do to trucks.

So we build our Mack R's and DM's with a backbone that won't rack or twist. Its 758MPa min. yield strength steel stays true. Whatever the load. However rough the ride.

We know how much power it takes to pull a logging truck over long distances, often up steep grades, at economical road speeds. So we offer powertrain options from 155 to 375 hp (SAE) including Mack's own outstanding Maxidyne® diesel engines and Maxitorque® transmissions.

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It's all part of the Mack plar keep you running. Because in the harsh, competitive world we live i you just can't afford to stand still.

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The Greatest Name in Trucks

Mac TRUCKS

Circle No. 249 on enquiry card

One of The Signal Co

Which are best for the job – electric or combustion engine powered fork lift trucks? M. L. Quinn considers*

THE POWER CHOICE

*M. L. Quinn – Regional Manager for Africa for Eaton International Inc., USA.

RISING ENERGY costs are primarily responsible for the increased acceptance electric fork lift trucks, even though the initial investment in internal combustion engine (ICE) fork lift trucks is lower.

ICE trucks include equipment powered by petrol, LPG or diesel fuel and offer broader application and more familiar maintenance and operating procedures. While electric trucks cost an average of 170 per cent of the cost of ICE (including the battery and battery-charger), energy costs, increased attention to environmental factors and recent technical improvements are making electric fork lift equipment more and more attractive to users.

Until the 1940s, electric trucks dominated the industrial truck industry, but the internal-combustion engine quickly emerged as the primary power source for the counter-balanced rider truck because it could go faster, farther and more efficiently over almost any surface – even up and down steep inclines. At that time, fuel was cheap and readily available.

Recent advances in components and controls, however, have helped to bring electric truck performance up to that of comparable internal-combustion trucks. Solid state controls, for example, gave electric-driven trucks the same mobility as internal-combustion trucks, better inching capability than internal-combustion, and made it possible to consume power more efficiently. Operating voltage and drive unit component selections now permit the adjustment of electric truck performance to fit the speed requirements of each application.

Capacity doubled

Manufacturers of batteries and chargers, over the last 20 years or so, have improved their designs so that capacity is doubled for the same physical cube. Electric trucks are now suitable for most material handling applications, since the lift speed, travel speed and gradeability of counterbalanced electric riders now rival ICE-powered trucks.

Electric trucks are able to compete in all key categories and from a performance standpoint, with diesel and petrol-powered trucks on a duty-cycle basis.

New models are available with pneumatic tyres, as well as cushion tyres, for application indoors and out. They are clean, quiet, energy-efficient, and are low on maintenance.

Labour costs, as well as the higher expense for energy, have been factors in increasing the acceptance of electric trucks. There is still, however, a strong case for internal-combustion trucks in certain situations.

- Where the capital to invest is limited the initial cost of an ICE truck is substantially lower than an electric.
- Even though more electric-powered pneumatic-tyre trucks for outdoor work

continued on page 115

Let Hyster take the load.

Rugged. Manoeuvrable. Dependable. Hyster lift trucks have the power and the performance you need for fast, efficient materials handling.

They're engineered from the ground up to ensure exceptional reliability.

And ergonomically designed to achieve the highest levels of driver efficiency and productivity.

And they're packed with exclusive features. From exclusive Monotrol single pedal control to uniquely robust steer axles.

With a range of over seventy models from one tonne to thirty seven tonnes, Hyster can handle everything – right up to a fully loaded forty foot container.

So, if you have a materials handling problem, talk to us.

Let Hyster take the load.

Hyster B.V.
Africa & Middle East Division,
P.O. Box 136,
NIJMEGEN,
The Netherlands, Telex 48112.

continued from page 113

are on the market, there is a wider range of internal-combustion pneumatic-tyre models available, especially in capacities of 2,700kg and above.

- Generally speaking, ICE trucks are better for applications requiring continuous operation, long runs and high travel speeds (up to 27km/h for pneumatic-tyre models compared to 18km/h for pneumatic-tyre electrics).
- For operation on grades of 10 degrees or more, ICE trucks are preferable to electrics.
- For rough terrain operation, diesel pneumatic-tyre trucks are still used exclusively, since noise and emission considerations are not as important outdoors. The power needed on unimproved surfaces by electrics would be substantial and excessive.
- In hoisting, internal combustion trucks generally offer faster lifting and do not run the risk of losing power, which can occur with electrics.
- Internal-combustion trucks are more adaptable to [illegible] hydraulic attachments, because the hydraulic pump is engine-driven; electrics which provide current from the battery in some cases could not complete a shift without downtime for a battery charge when a multi-function attachment is being used.

Cost

Since performance characteristics of electric and internal-combustion trucks are now generally comparable, the primary criterion for a choice of truck types is cost. There are, of course, other factors in making a purchase decision. In certain food plants, for example, the risk of product contamination would rule out ICE models; on the other hand, an electric truck would not be practicable in applications requiring high flotation tyres, very rough terrain, continuous ramp operation or when higher speeds are required over long distances.

Longer life

Generally speaking, studies show that electrics have lower maintenance requirements and that in long-use and heavy-duty applications they usually have a longer life expectancy than internal combustion trucks. Even for low-running-hour or intermittent use electric trucks could be more economical because of a shortage of mechanics, high labour costs or severe environmental restraints.

Electrics have a longer life primarily because of the mechanical simplicity of the electric traction system and other electric-powered systems. Another factor is the lack of vibration, which reduces the wear and tear on parts; electric trucks have fewer moving parts, so there are fewer parts to wear out.

In short, the cost of maintenance for electrics is sufficiently low to offset the initial higher ownership cost of internal-combustion trucks.

There is no suggestion that electric fork lift trucks are much more efficient users of energy than engine-powered trucks, which typically use only one-third of engine power to do useful work. (Another third of the energy in the fuel is thrown into the exhaust heat, and a third ends up in the cooling system.)

Diesel trucks are still used exclusively for rough terrain work.

Electric trucks, on the other hand, use energy only when the power components are turned on and only draw current when the controls are actuated. The electric truck is over five times as efficient as petrol trucks when running and moving materials on a fairly intensive work cycle.

As energy costs continue to increase dramatically, electric power will normally cost less. In addition, battery maintenance continues to be reduced as technology advances; some batteries today are almost maintenance-free.

For users concerned about air-pollution, particularly indoors, electric trucks help to prevent that problem and their use eliminates the need for alterations to buildings or new ventilation equipment. Another advantage of electrics relates to noise levels, which are limited, if not eliminated, when such equipment is used.

Internal combustion trucks equipped with low emission carburation or catalytic exhaust scrubbers help to reduce air pollution and lift truck manufacturers are continually working to minimise air and noise pollution in engine-powered trucks.

An authority on productivity and industrial energy management, Dr Wayne C. Turner (Oklahoma State University, USA), notes that: "Actions taken to improve productivity tend also to improve energy management." Materials handling decisions have a direct effect on energy consumption, as well as on proven utilisation measures in the use of fork lift trucks.

Energy supply and cost will have much to do with the position of electric trucks in the world materials handling industry. In any event, electrics have emphatically regained a prominent place for the fork lift truck users. ●

For indoor use, electric trucks reduce noise and pollution problems.

Crawler dozer

International Harvester, Construction Equipment Group, introduce a new crawler dozer, the mid-size International TD-12. With its fully modular drivetrain, any major TD-12 component engine, torque converter, transmission, steering system or final drives, can be exchanged as a one-piece unit with no disassembly of adjacent modules required.

Powered by an inline 6-cylinder International 466B diesel engine, the International TD-12 features a gross rating of 82 net kW (110 whp) at rated speed. This direct-injected engine offers fast cold weather starts and good fuel economy. The single stage torque converter and full power-shift 3F-3R countershaft transmission transmit power to an oil-cooled steering module, which includes integral pinion and bevel gears, multiple disc steering clutches and self-adjusting multiple disc brakes.

Circle No. 21 on enquiry card.

Roller bearings

Blackwell Bearings Ltd solid roller bearings with solid inner and outer races are standard components in Duke & Ockenden Ltd's Dando 800 water-well percussion drilling rig.

This rig is designed for use under a broad range of atmospheric conditions in remote areas where maintenance and repair facilities are not easily available. The design calls for reliable, easily-maintained components and Blackwell bearings are used in the rig's mast assembly on two shafts which carry, respectively, the sand sheave and the calf sheave.

The line from the sand sheave carries a bailing bucket for removing spoil from the borehole as drilling progresses. The calf sheave is used to lower lengths of tube to line the walls of boreholes. In both these applications, direction of rotation alternates, speed varies and loading is intermittent. Typical maximum loadings in the course of normal operation are 5,000kg for the calf sheave bearings and 3,000kg for the sand sheave bearings (two bearings per shaft).

Circle No. 23 on enquiry card.

Crushing equipment

The Process Machinery Division of **Rexnord Inc.** introduce two new products for the portable crushing plant market.

The new equipment includes a low profile portable stacking conveyor and a versatile, lightweight cone-type crusher designed for portable crushing.

The Process Machinery Division manufactures gyratory crushers, cone crushers, screens, grinding mills and mine hoists, as well as impact, jaw and hammermill crushers and portable crushing plants.

Circle No. 24 on enquiry card.

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Order the number one line from the number one supplier. Order Johns-Manville from Nigerian Ropes.

The number one line

Johns-Manville manufactures industry's most diverse line of energy-efficient thermal insulations. Our comprehensive product range includes fiber glass insulation, fiber glass ducts, and pipe insulation, along with mechanical packings and gaskets, filter aids and functional fillers, and a variety of general building and industrial products. All designed for efficient, reliable performance.

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Nigerian Ropes is the largest distributor of Johns-Manville products in West Africa. From a single source of supply you can select the right J-M product for a wide range of industrial, commercial and residential applications. For more information on the advantages of working with Johns-Manville and Nigerian Ropes, contact Nigerian Ropes Ltd. 66/68 Eric Moore Road, Iganmu Industrial Estate, Lagos.

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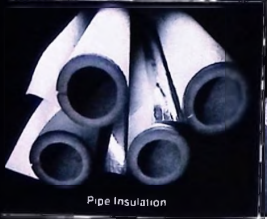

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Castables and Fire Brick

MICRO-AIRE® and J-FLEX

Packings

Filtration and Filter Products

Circle No. 238 on enquiry card

PRODUCT LITERATURE

300-D Modular Dragline

A new bulletin that illustrates and describes the new 300-D four-crawler dragline is now available from **Bucyrus-Erie Company.** The brochure describes how the modular 300-D is designed to provide low erection/ moving costs, amazing mobility for a large crowler machine, and maximum productivity on the job.

The bulletin describes how major components are pre-assembled at the factory in shipping-sized modules (bolted together instead of welded), a design that greatly reduces initial erection costs and substantially lowers future disassembly and shipping time and expense.

Unique four-crawler design provides high overall mobility, reduces maintenance costs, increases productivity. It also improves flotation, load distribution, and the ability to manoeuvre on rough, uneven terrain. *Circle No. 25*

Mine Hoist Catalogue

A new, 24-page catalogue describing both vertical and slope Nordberg Mine Hoists is available from the Process Machinery Division of **Rexnord Inc.**

The four-colour brochure features selection data on drums and wire ropes for all types of service. Details on drives and braking systems are also included.

Computer calculated graphs provide step-by-step procedures for preliminary hoist selections. *Circle No. 26*

Schrader Bellows catalogue

Schrader Bellows announces the release of a new catalogue, VAL-12, describing the Check-mate (R) dual inline three-way valve.

The Check-Mate valve contains an integral electronic digital logic monitor. Non-contact sensors in monitor detect position of valve indicator pins for comparison with position called for by command signals to valve pilot solenoids.

Neither valve nor monitor require any additional logic circuitry. Press control circuitry requires only 120V, 60Hz input power and a command signal. *Circle No. 27*

Trucks and trolleys

Sentor Engineering Limited of Eastleigh have released a leaflet on their new range of materials handling trucks and trolleys.

These practical trucks have been designed and manufactured by Sentor to suit a wide variety of applications. The rugged tubular frame is lightweight yet durable, and the 18g steel full-braced base accommodates a maximum distributed load of 500kg (½ tonne). The wheels are 5in-diameter solid nylon type, comprising two fixed and two swivels. Overall finish is in quality high gloss synthetic paint. *Circle No. 28*

Food Processors Institute

The Food Processors Institute has developed a new audio-visual presentation designed to teach cannery retort operators the methods for safe heat preservation of foods.

"For The Retort Operator" includes 50 slides, a tape-recorded commentary and a script/discussion guide booklet. This new, revised presentation reflects the most recent revisions in Good Manufacturing Practice regulations for low-acid canned foods.

The presentation stresses the important role of retort operators and cookroom supervisors in protecting the excellent safety reputation of low-acid canned foods and outlines key principles in thermal processing. *Circle No. 29*

Condor avon flexitank leaflet

Conder Hardware Limited now has available a leaflet on the recently announced Conder Avon Flexitank instant bulk fluid storage system.

Conder Avon Flexitanks are a long-life, low-cost alternative to static tanks for permanent or temporary storage of most types of fluids, including drinking water.

Flexitanks, which are available with a capacity up to 100,000 litres, have been designed and developed by the Flexible Fabrications Division of Avon Industrial Polymers Limited and are being marketed by Conder Hardware Limited.

The Flexitank leaflet is available free of charge from Conder Hardware Limited. *Circle No. 30*

New Product catalogue

The newly released issue of **The Ridge Tool Company's** full-line producer catalogue has been completely reorganised and restructured to include new products, replacement parts, more technical specifications, metric measurements and easy-to-use information for customer convenience.

Major product sections of the catalogue include pipe working tools, hand tools, power tools, and drain cleaning equipment.

Incorporated in the new format is product identification in the Industry-Standard, five-digit nomenclature (Nidasida System) to make ordering easier.

Ridge is a subsidiary of Emerson Electric Company, and is a leading world-wide manufacturer of high-quality products for the plumbing, electrical and industrial markets. *Circle No. 31*

Soil moisture and density testing

The new four-page **Soiltest** Speedy Moisture Tester bulletin gives the reader information on the Speedy's use in detecting and measuring unwanted moisture in materials used in construction, manufacture, and agriculture. There is also information on the CN-940 Eley Volumeter, used for fast measurement of the field density of undisturbed soils.

The Speedy is a calcium carbide gas-pressure moisture tester (acetylene gas). Materials are weighed, put into the Speedy and tested. In moisture tests of most materials the readings can be taken in 30 seconds to 3 minutes and are accurate to within 0.2 per cent. The different Speedy models test moisture content ranging from 0-2 per cent to 0-50 per cent.

The Eley Volumeter is used like a piston sampler, and in combination with the Speedy, it allows direct determination of density and moisture content with only one weighing of the sample. *Circle No. 32*

Undercarriage maintenance

A 12-page booklet called *Manual of undercarriage maintenance* may be obtained from **Centurion Industries, Inc.**

It covers procedures and equipment necessary to service the following components: rollers, idlers, sprockets, track chain and grouser plate. Included are estimated cost savings possible through the remanufacturing of worn parts. Other advantages specified are improved parts availability and more efficient machine operation resulting from a continuing programme of maintenance.

Information is important to owners and operators of all types of crawler equipment, especially where a large fleet of vehicles is concerned. *Circle No. 33*

New wire guide

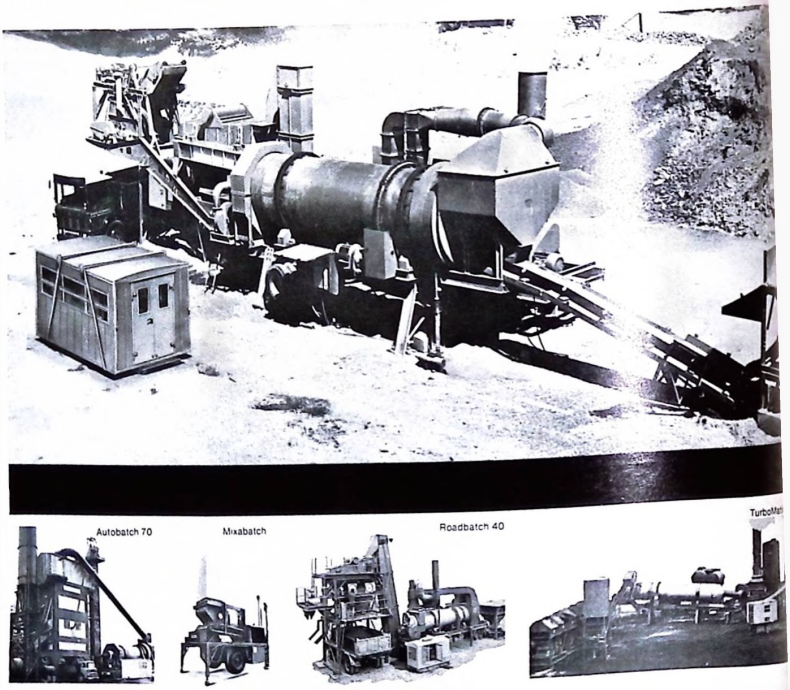
A new Wire Guide has just been published by **Tinsley Wire (Sheffield) ltd.** This pocket-sized publication contains details of all the industrial wires manufactured by the company plus packaging and presentation information.

The guide covers preferred metric sizes, decimal equivalents and has a section of conversion tables on imperial and metric measurements and weights. *Circle No. 34*

For further information please circle appropriate number on card facing inside back cover.

GOODWIN

Fixed and mobile asphalt plant



Autobatch 70

Mixabatch

Roadbatch 40

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Mixabatch a mobile batch coating plant bringing versatility, economy and reliability to patching and small-area paving work.
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At Goodwin Barsby we do everything a little better, from design right through to parts and service support, earning for our asphalt plants a reputation for maintaining peak production of top quality mixes with low-cost operation. For your next project find out how Goodwin engineering strength and proven know-how can benefit you.

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Circle No. 269 on enquiry card

Welding torch

Ferrex International, Inc, Export Managers for **Tweco** Products, announce the launching of "Tweco's" new No. 1 "Mig-Torch" for welding with wire sizes from .023 to .045in (.564 to 1.14mm).

It features a new "remove-adjust" front end that permits adjusting the position of the front end upon the mere loosening of the coupling nut, thus providing top, bottom or side positioning of the torch trigger switch. It uses a self-insulated nozzle which eliminates the need for a separate nozzle insulator.

"Tweco's" patented "Cablehoz", a single, highly flexible coaxial assembly, housing the copper conductor wire strands, control wires, gas hose and welding wire, is available in lengths of 3.05, 3.66 and 4.57m (10, 12 or 15ft).

"Mig-Kwik" connectors are available that comprise the specific wire feed adapters required by the make and model of wire feeder used. Once selected and installed at the end of the "Mig-Gun Cablehoz", the connection to the wire feeder can be made or broken in seconds. A locking pin that engages the "Mig-Kwik" connector plug prevents accidental disconnecting while in operation.

Circle No. 5

Access platform

ACS Engineering Ltd introduce the Acklift 9000T, a trailer-mounted hydraulic access platform.

Easily towed by van or car, the Acklift 9000T achieves a working height of 9m, a maximum outreach of 4.75m and a safe working load in all boom positions of 160kg.

A variety of power packs are available for this model; petrol or diesel engine, mains electricity or battery pack with integral charger. And for operating in areas of high fire risk, such as chemical plant or oil refineries, an air power pack is available.

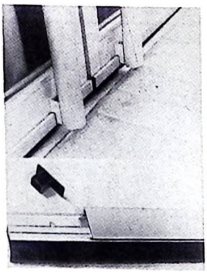
One of the major advantages of the Acklift 9000T is the ability to fit a range of power outlets in the personnel basket. Hydraulic, pneumatic and electrical outlets can be provided, enabling the operator to work with powered hand tools at any height up to the 9m maximum.

Circle No. 6

Door seal

A special seal for the bottom of doors has been developed by **Kleeneze Industrial Ltd.**

Known as "Shamal", it is for domestic and commercial use both inside and out, where appearance is important. It is designed specifically for anodised aluminium doors and is available in three finishes – aluminium, black and gold – to suit any décor.



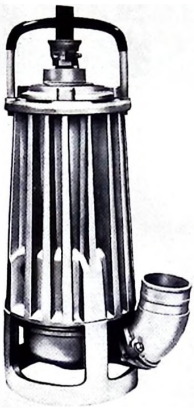
The seal comes in two parts – a strip brush assembly which is screwed to the bottom of the door and a separate cover plate which is slid over the fixing panel to hide the screws and give an attractive finish.

The seal is made of nylon brush filaments. It forms an effective barrier against draught, dust, smoke and noise, while pests such as beetles, ants, flies, cockroaches, mice and rats will not attack the nylon.

Circle No. 7

Sludge pump

Weda C550 is a new sludge pump, weighing only 65kg (143lb) and driven by a 6.5kW (8.8hp) motor. A lightweight pump in compact design with remarkably high capacity: 1,100l/min (286 US gpm) and pressure heads up to 27m (90ft).



Weda C550 can handle liquids containing solids up to 60mm (2⅜in) in diameter. This is the right pump to use, when the job is too tough for conventional contractor pumps.

Circle No. 8

Silencers

A fully comprehensive range of industrial intake and exhaust silencers providing an overall noise reduction of 30dd B(A) are introduced by Noise and Vibration Control Engineers **Isophon Ltd** of the UK.

The silencers have been designed primarily for internal combustion engine exhaust noise emission control, and to control pulsation from the intake or discharge of compressors, high-pressure blowers, vacuum pumps and diesel engines.

Twelve standard types of reactive, absorptive and spark arrestor silencers are available to suit most diesel engines with bore sizes rated between 38mm–1,200mm.

All silencers are constructed in M.S. plate as standard, but high carbon steel or stainless steel can be used to suit customers' specific requirements.

Circle No. 9

Screw injection moulding machine

Recently introduced by **Austin Allen** is the new "S" version of their Gnat 250PRT fully automatic small injection moulding machine.

The "S" designation indicates the incorporation of a self-contained electrically-driven screw injection unit.

The Gnat has become the established low cost, small automatic machine for cost effective injection moulding. However with the expansion of the range of engineering type plastics and the reduction of the availability of self-coloured compounds has come an ever increasing demand for an injection unit with its own mixing and plasticising facility. The Gnat 250PRT "S" answers this need.

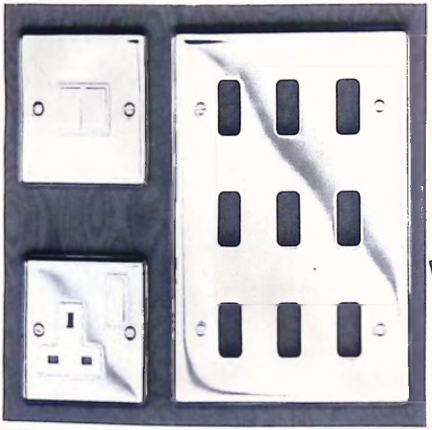
It is particularly suitable for in-house moulding and high volume custom moulding of small components in a wide range of plastic materials. It is especially suitable for production line working as the base is of cantilever design allowing a conveyor system to be placed under the platen for fast movement of finished components.

Circle No. 10

For further information please circle appropriate number on card facing inside back cover

NEW FROM DELTA

Introducing the Delta Highly Polished stainless steel Range



We are proud to introduce the new Delta Metalclad Highly Polished Range. The sheer perfection and mirror finish of this new range is the ultimate in luxury and good looks.

Because, as the name implies, this new range of products is in meticulously polished stainless steel it combines outstanding good looks with durability.

For full details and a copy of our full colour illustrated leaflet write to:

Delta Electrical Accessories Limited

Export Dept., Broadway, Chadderton, Whitegate Works, Oldham, England. Tel: 061-6[illegible] Telex: 669904.

DELTA

CW265

Circle No. 202 on enquiry card

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BIDAT knows the role of quality T-shirts in advertising and promotions. This is why we come to town with some of our repeat customers. And they are still insisting on quality T-Shirts for their advertising and promotions. It is what you get as a Bidat customer—QUALITY. Contact our Sales Manager now for your corporate requirements.

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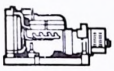
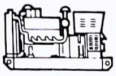
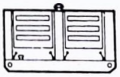
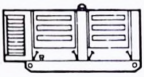
ALL THE POWER OF THE GENSET

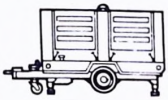
A complete range of generator sets from 15 to 800 kVA.


For permanent indoor installation


For installation under temporary cover


For outdoor use


Sound Proofed generating set


Mobile unit on trailer

TYPE		LBA 1	LBA 2	LCA 3	LDA 5	LDT 8	LGA 9	LDA 10	LGT 11	LGT 13	LPT 16	LPT 18	LPR 20	LPR 22	LVR 25	LVR 27	LVR 30	LSR 35	LXT 43	LXR 51	LYT 58	LYR 63	LYR 72
P.* kVA *at 50Hz	Continuous use	15	21	38	55	80	90	–	115	130	160	180	200	225	250	275	300	350	430	510	580	630	720
	Emergency use	16,5	23	42	60	88	100	100	130	150	180	200	225	250	275	300	330	390	470	570	640	700	800

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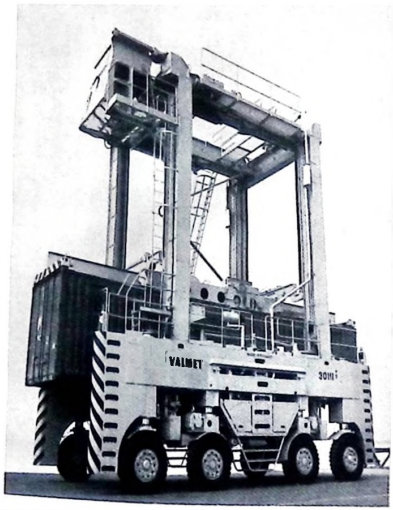


Materials handling equipment

Valmet Oy is Finland's second largest industrial concern, comprising of numerous factories and shipbuilding yards.

The production of materials handling equipment is centred in Valmet's Tampere Works. The chief products of the range are: fork lift trucks, with lifting capacities from 8 to 40 tons; industrial straddle carriers, with transport capacities from 10 to 60 tons; container handling equipment, container trucks, ro-ro trucks and straddle carriers, container stacker carriers and mobile cranes.

Valmet is able to manufacture suitable machinery for handling goods or containers onto ships at harbour terminals, container terminals as well as for the needs of industry and the storage handling of timber. All these machines have rubber tyres which means flexibility in usage for any transport or transfer systems based on them.

The *medium weight lift trucks* have a lifting capacity of 8 to 22 tons. They are suitable for all types of goods handling at terminals, harbours and in industry. The visibility in all directions is good and most of the models have a double command driver's cab. The open mast is available in place of the ordinary lift mast which gives better forward visibility than previously. These machines can handle empty or fully loaded containers, usually of 20ft in length. For that reason either side lift or top lift equipment can be installed to the lift truck's lifting gear.

The range of the *heavy duty fork lift trucks* begins with the 25 tons lifting capacity type and ranges to the 40 tons lifting capacity type. The latter being the largest forklift truck manufactured by Valmet at present.

These models are suitable for container handling as well as the handling of the heavy loads in the steel industry. Double-command driver's cabs are standard equipment in these. This means that the driver's seat and the controls rotate through 180° in the driver's cab, thus even when reversing the driver faces the direction he is driving to. This has been found to be the best solution when considering safety, speed of operation and comfort. For countries with hot climates the driver's cabs are equipped with air-conditioning.

Valmet is the largest manufacturer of *straddle carriers* for industrial use in Europe.

The container straddle carriers can handle 20–40ft containers in the terminal area and stack containers up to three high. These can be used for lifting containers from trucks or railway cars. The lifting capacities vary from 30 to 40 tons depending on the customer's requirements.

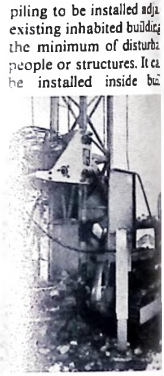
Valmet mobile gantry cranes which can stack containers in several layers are also suitable for similar work. The lifting capacities vary from 22–32 tons according to the model. These have also been made for use in container vessels, in which case they operate on the upper deck of the vessel.

The heavy duty and the medium heavy lift trucks have aroused keen interest in the African countries. Valmet lift trucks have been delivered to Morocco, Algeria, Senegal and other countries. All heavy container work in the harbour of Lome, Togo is handled by Valmet trucks. *Circle No. 37*

Low-noise piling rigs

Designated models DPR 1, 2 and 4, the crawler-mounted rigs introduced by **Dowsett Piling & Foundations Ltd**, are of modular construction and can install 300mm, 380mm and 450mm diameter piles with maximum safe working loads of up to 80 tonnes, using the Prepakt Pakt-in-Place system. This entails boring into the soil with a continuous flight auger to the required depth and pressure-injecting a specially formulated mortar through the hollow stem of the auger. Pressurised injection of mortar continues until the auger, with its load of soil, has been removed and the pile completely filled with mortar. Reinforcing rods are then inserted, if necessary, and the mortar left to set.

Advantages over conventional impact pile driving systems include the virtual elimination of vibration and a big reduction in noise le auger system is thus p larly suitable for use in b urban areas and in u sub-soil conditions, e piling to be installed adja existing inhabited building the minimum of disturba people or structures. It ca be installed inside bui



g a small rig specially d for the purpose.

Circle N.

Nut formers

National Machinery rece announced the introduction new line of Nut Formers sp ning a wide range of capac and offering a four-die form method which provides versatility and the produc performance the industry ma These new Nut Formers co bine high-speed production w low maintenance, simplicity operation and ease of adj ment.

The 84, 124 and 164 N Formers make 8, 12 and 16 (5/16, ½ and ⅝in) high-qual nut blanks respectively fro coiled, round wire in four dies 330, 250 and 200 parts p minute.

Four-Die Nut Formers ha a feed system which incorpo ates a four-roll feed box provi ing a number of advantage For example, reduced feed ro pressures result in less chan for wire distortion. Also, t increase in available pulli power makes large coils easi to handle which can result i fewer coil changes. A new high speed feed latchout syste eliminates short or partial fee from latchout. *Circle No. 3*

For further information please circle appropriate number on card facing inside back cover

FOCUS ON BENUE CE

by Fred Vanger, Pub

HISTOR

The histor[illegible] of what is now one of Africa's large[illegible]ingle and most modern plants – The [illegible]enue Cement Company Ltd (BCC) – d[illegible]es back to the 1960s.

Although [illegible]many years back, traces of Limestone had been strongly suspected in the area now known as Benue State, the present limestone deposit, located some 11km north-west of the agricultural training centre, Yandev, was discovered by the Nigerian Geological Department in 1963.

Encouraged naturally for economic reasons, among which is the perpetual rise in demand for cement in fast developing Nigeria for infrastructural development, the then Benue Plateau State Government organised for a more detailed geological survey and later commissioned a preliminary feasibility study for a cement plant in the location.

While the Benue Plateau State Government was grappling with the attending teething problems of such an arduous task, the federal (at that time military) government also began to step up its interest in the cement industry.

By 1974, the Federal Government had become ripe with interest and had initiated a current report on the setting up of a modern cement factory near Yandev with an initial annual output of 600,000 tonnes of portland cement.

Cementia Holding AG, a Zurich based European cement concern was chosen among other consultants as Technical Partners to work hand in hand with the Federal Government on the gigantic viable venture.

The Technical Partners submitted a report on the proposed cement plant in early 1975. But the report was ready only at the time w[illegible] cement in the cour[illegible] a rate of approxin[illegible] cent per annum.

Consequently, [illegible] noting the increase [illegible] for a revised propo[illegible] two-line cement [illegible] output of 900,000

Cementia subm[illegible] which also embrac[illegible] financial aspects o[illegible] later in the year.

Abdullahi Adamu,

CEMENT PRODUCTION AT BCC

Benue Cement Company Ltd uses the dry process to make LION BRAND Portland cement. The factory presently occupies an area of about a half square kilometre.

The most imposing structures are the Heat Exchange Tower and the Cement Storage Silos complexes. The Heat Exchange Tower complex encompasses the Kiln systems where the raw meal is burned into clinker; the Raw Mill systems for fine grinding of the raw mix prior to burning, the Cement Mill system used for final cement production; the Heat Exchange Cyclones for transferring the Kiln exit gases heat to Kiln entering raw meal; the process effluent gases final filtration system; the Raw Meal Homogenising and Storage Silos and other related systems. The Cement Silos complex includes not only the Cement Storage Silos but also all necessary systems for packing and loading cement despatched into bags or bulk containers. Other structures that house all other equipment and machinery used in the process are carefully located on the site to form two parallel and continuous production lines.

Depending on the process progress, the material transport system may be pneumatic, belt conveyors, bucket elevators, gravity assisted air slides, gravity alone, screw conveyors, drag chain systems, travelling grates, cell conveyors or pumps. The factory's two independent production lines are cross-connected at some points in the process flow.

Production at Benue Cement Company factory begins at the Quarry where clay, high and low grade limestone are obtained. Two crushers, each rated at up to 600 tonnes per hour are the starting points of the two production lines and they are used to crush Quality Control determined mixtures of clay and limestone. The crushed material is transported by conveyor belts from the crushers to either one or both Raw Mix Stockpiles that are contained in two large circular structures with dome-shaped roofs. An automatic stacker-reclaimer device in each of these structures stacks the crushed m a high circular pile, further mi withdraws the material through matic weighing system, the feeder, that accurately measu material withdrawn per hour. Hi limestone is also separately crus conveyed to the Crane Hall, a re lar storage building next to the R Stockpiles. Gypsum and other ac are prepared and also stored Crane Hall. Each material in the Hall is withdrawn through a feeder.

Quantities of high grade lim and addi es in the Crane Ha material the Raw Mix Stockp withdraw as required in strict pliance the directives of C Control, fed into the Raw systems grinding into raw me conclude raw material prepar the Raw is then transported Raw Mea omogenising and Si Silos whe rther blending takes p

Raw M is fed from the Raw Silos into Kiln systems for bu into clinke a process called sint or clinker tion. The Kilns are horizontal, wly rotating, large c drical stee tubes which are 4,400m in diameter and 63,685m The heat for sintering is derived burning heavy fuel oil. Clinkerisatio sintering is one of the most cr procedures in the whole process. It to be done at a precise tempera usually between 1,200°C and 1,50 in order to produce clinker of consis good quality. The exact temperatu determined by many variables, on

DESIGN

Designed for the dry process, the factory has two identical production lines each with an annual capacity of 450,000 tonnes.

The design which is universally one of the most modern in the cement industry has provisions for further extension of up to six kilns which, when installed would increase the factory's production capacity to three million tonnes of cement per year.

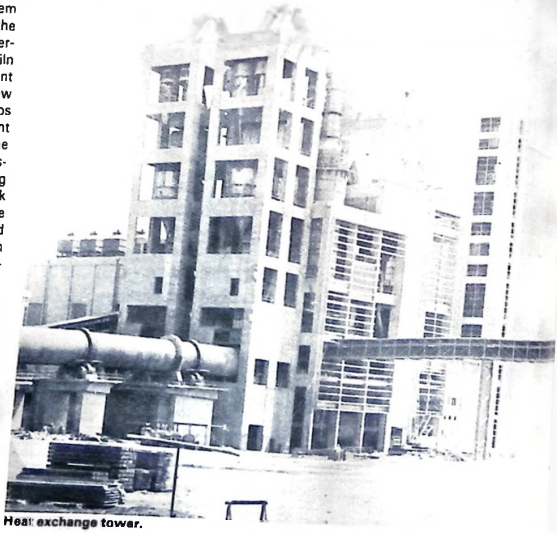
It is hoped that such a wholesome expansion would amply and jointly take adequate care of future increases in demand for better quality Portland cement for the building industry in Nigeria and neighbouring West African countries.

rail connections with other parts of the country.

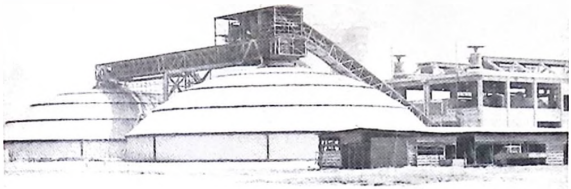
According to findings of some local and foreign teams of competent geological surveyors, the volume of limestone and shale deposits in the area is palpably enormous and adjacent.

The cement plant is only 72km from Makurdi, the Benue State capital widely used for its railway and highway connections of the southern with northern parts of the country.

In addition, River Benue has continually been a convenient waterway, linking some major towns east and west of northern Nigeria with the Atlantic Coast through its confluence with the River Niger, more especially during the rainy seasons.



Heat exchange tower.



Clinker sto[illegible] ilos.

which is G[illegible] Control input. Too low a temperat[illegible] for a particular feed produces [illegible]fficiently sintered large lumps wh[illegible] oo high a temperature results in [illegible]n mass or glass. Both of these pro[illegible] are valueless for cement purposes.

The re[illegible]t clinker drops from the Kiln into a[illegible]r cooler where the clinker is cooled [illegible] regulated volumes of air before bein[illegible] transported into one of two clinker stock piles for storage. The Clinker Storage facilities are similar in shape to the Raw Meal Stockpile structures. With the clinker stored, the clinker preparation stage ends.

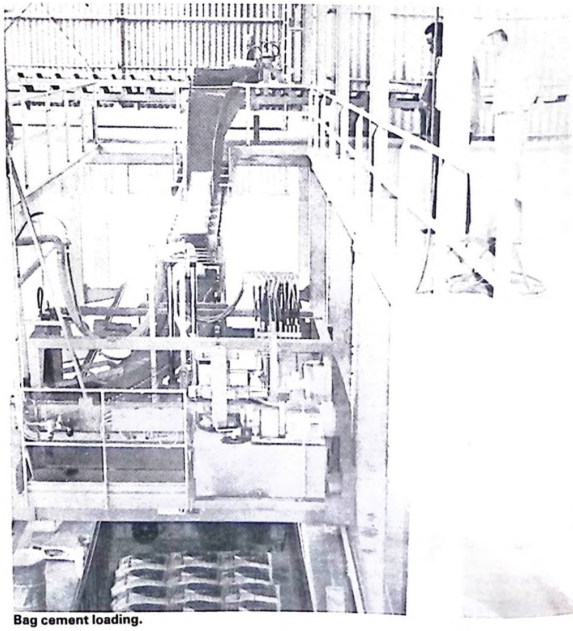
Because of the temperatures required for sintering in the Kilns, large quantities of fuel oil is consumed. There are, therefore, two heat economy systems incorporated in the burning processes. First, the raw meal to be fed into the Kilns is initially elevated to the top of the Heat Exchange Tower. From here, the raw meal is dropped into the Heat Exchange Cyclones in counter flow to the existing Kiln hot gases. The raw meal intimately mixes with the hot gases and by the time it gets into the Kiln entrance, it is heated up to about 800°C. This recuperates much of the heat energy that would have had to be supplied by burning more fuel oil. Secondly, the air used in cooling the clinker in the Cooler is drawn into the Kiln and used as combustion air. Since this Cooler air is already heated, some fuel oil that would otherwise be burned to heat ambient air to its temperature is saved. Thirdly, when the Kiln and Raw Mill are running simultaneously, some Kiln hot gas is drawn off and used to dry the raw mix going into the Raw Mill. However, if the Raw Mill has to be run without the Kiln being in operation, an auxiliary oil fired heater is used for this purpose.

During the final stages of the production of LION BRAND Portland cement, measured proportions of clinker and gypsum are withdrawn from the Clinker Stockpiles and the Crane Hall respectively and transported by conveyor belts to the Cement Mills. Here, they are finely ground into cement. The fineness of cement particles gives cement some fluidlike characteristics that allow it to be pumped from the Cement Mills to the Cement Silos.

At the Cement Silos and Packing Plant complex, this cement is stored in any one of the four Cement Silos or in any one of the two Bulk Delivery Silos. Cement is moved from these Silos into any one of the four smaller Packing Silos from which cement is fed into four packing machines that load 50km of LION BRAND Portland cement into each bag. Since finished cement is, in effect, stored in all Silos here, the interior environment of each Silo is controlled by an aeration system which also keeps the cement fluid and thus more easily withdrawn as required. Each packing machine is served by a loading system that terminates at the loading dock. This terminal point consists of an automatic trailer loading machine and a standby manual loading system. The total capacity of the four loading systems is rated up to 8,000 bags per hour. There are two lanes for loading cement into bulk containers for delivery to large quantity users like constructors of large projects. For such users, bulk delivery offers a lot of advantages one of which is reduction of costs.

The Benue Cement Company factory is, short of computerisation, as fully automated as is practicable. A network of dust collection systems makes the working environment considerably free of the dust that is associated with cement factories. Furthermore, an Electrostatic Precipitator controls air pollution.

We feel it is safe to say that the Benue Cement Works is one of the most modern and largest single works in the country.



Bag cement loading.

PETER HUBER
Technical Controller

Forty-five year old Peter Huber is the Technical Controller of the Company. A Swiss Mechanical Engineer, he has worked mostly in South America before coming to Nigeria.

He worked with the Cimentos Barroso Cement Works of Brazil as Chief Engineer.

He also worked in Costa Rica as Chief Resident Engineer of the INCSA Cement Works.

Mr Huber later sojourned in Mexico as Chief Resident Engineer at the Cimentos Mexicano Cement Works.

He was again in Brazil as Assistant Works Manager of Ciminas Cement Works before coming over to Nigeria.

Mr Huber is married with two children.

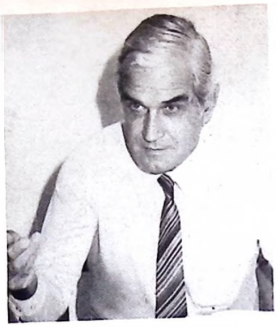
JONATHAN ICHAVER
Management Accountant

Mr Jonathan Ihomwua Ichaver is a management accountant with the company. An old boy of Government College Keffi where he obtained his Ordinary and Advanced Level certificates, Mr Ichaver obtained a diploma in Accounts at the Ahmadu Bello University, Zaria, and later studied at the London School of Accountancy where he graduated as a chartered accountant having obtained the ACCA.

He started his accounting career with Nigeria Airways as a senior accounts clerk for one year and was an accountant for two years with the Ahmadu Bello University, Zaria.

Mr Ichaver who had also worked with Juladaco Ltd, Jos as a senior accountant and the London office of Panell Fitzpatrick joined the Benue Cement Company in September, 1979.

He is married with three children.



ROBERT BRENNEISEN
Managing Director

Mr Robert Brenneisen, the Managing Director of the company is a Swiss National. He received his formal training in Zurich, Switzerland, where he qualified as a Mechanical Engineer in 1950. His first major engineering experience was with Messrs Von Roll, a leading Swiss Cement Machinery Manufacturers where he served as an engineer for four years.

Mr Brenneisen joined Cementia Holding of Zurich (Technical Partners in BCC) in 1954, working in their Cement Factory in Bamburi, Kenya until 1975 in various senior management positions.

He was reassigned to Nigeria in 1975 as Project Manager for Benue Cement Company and served in that capacity until 1978. From 1978 to September, 1980, Mr Brenneisen was General Manager of Cemento Audino in Venezuela.

He left Venezuela to come back to Nigeria to assume responsibility at Benue Cement Company Limited as Managing Director. He is married with two children.

MR E.D. ADZAUGBAH BSc (Econs)
Sales Manager

Emmanuel Dickson Adzaugbah joined BCC early this year as Sales Manager.

Prior to this, he has held several sales and management positions with Lever Brothers (Nig) Ltd.

A graduate of Ahmadu Bell University, Zaria (he holds a BSc (Hons) in Economics, Mr Adzaugbah joined the Lever Brothers in 1971 and before his voluntary retirement from the company, was its Area Manager (North West) based in Kano.

A squash raquet and tennis enthusiast, he is married with two children.

MR D L MA[illegible]LINSON
Production [illegible]anager

Born 19[illegible]ay, 1936, Mr Mallins[illegible] served in t[illegible] Royal Force and an[illegible] discharge, [illegible]tuated BSc (Hons) Aberdeen U[illegible]rsity, Scotland. He la[illegible] served with [illegible] Colonial Overseas C[illegible] Service from[illegible]59 to 1968.

In 1968, [illegible]joined the East Africa Portland Ce[illegible]t Company as Qua[illegible] Manager an[illegible]s promoted to Produ[illegible] tion Manag[illegible]n 1973 and in 197[illegible] became Gen[illegible] Manager of a Joint Ea[illegible] African Cem[illegible] and Bamburi Portla[illegible] Cement Gyp[illegible] Exploration and Mini[illegible] Company.

Mr Mallins[illegible] came to Benue Ceme[illegible] in 1975 as Pr[illegible]uction Manager and h[illegible] served as Site [illegible]anager in the establis[illegible] ment and cons[illegible]uction phases.

SIMON PETER SARWUAN GUSAH, A.C.I.S., A.M.N.I.M., F.R.Econ.S.
Commercial Controller

Mr S. P. S. Gusah is the Commerci[illegible] Controller of the company. Born i[illegible] 1933, Mr Gusah attended Katsina Al[illegible] Middle School, Government College Keffi and College of Commerce, Live[illegible] pool England between 1948 and 1964. He also attended several managemer[illegible] intensive courses in Nigeria and Europ[illegible] between 1966 and 1979 in accounting[illegible] finance, marketing and general man[illegible] agement.

Until joining the Benue Cemen[illegible] Company Ltd in April last year, he wa[illegible] the Benue State's Director of Budge[illegible] and Special Adviser on Budgetar[illegible] Affairs. He was also Finance/Admini[illegible] stration Director of Pioneer Meta[illegible] Products Company Ltd and marketin[illegible] manager, Nigmarship Agencies Lt[illegible] between 1974 and 1979. He served i[illegible] private practice as Chartered Secretar[illegible] and Management Consultant from 197[illegible] to 1977.

buyers' guide

A guide to services and supplies for buyers in West Africa

Organisations involved in supplying or servicing industry, government or commerce may be listed in this guide for a period of 12 months at: Naira 100, Cedes 150, Leone 125, $140, or equivalent per listing.

CLASSIFIED INDEX

Full addresses listed alphabetically on following pages.

Abrasives

Bisolu Enterprises Ltd, Apapa
Landmark Industrial Supplies Limited
Reiss & Co. (nig.) Ltd, Ebute-Metta

Accounting Machines & Systems

GBO BEAM (a Division of UAC of Nigeria Ltd), Lagos
Leventis Technical [illegible] Lagos

Adhesives

Bostik Ltd, Leicester, UK

Aerial Photography

Kenting Africa Reconnaissance Service Ltd, Lagos

Agricultural Equipment

Afrocommerce (W.A.) Ltd, Lagos
Afrotec Technical Services (Nigeria) Ltd, Isolo
J. Allen & Co. Ltd, Apapa
Bewac Limited, Apapa
Blackwood Hodge (Nigeria) Ltd, Apapa
R. T. Briscoe (Nigeria) Ltd Agricultural Equipment Group, Kano
Camplant, Apapa, Nigeria
Dizengoff, W.A. (Nigeria) Ltd, Apapa
Elof Hansson Ltd, UK
Hallam Graders, Leicester, UK
Incar (Nigeria) Ltd, Lagos
KAH Engineering Services Ltd Members of Homzegroup, Apapa
Leventis Motors Ltd, Apapa
Morpol Industrial Corp. Ltd, Apapa
NITECO, Apapa
Nigerian Motors, Apapa
Phoenix Motors Ltd, Lagos
Henry Stephens Engineering Co. Ltd, Ilupeju
Scoatrac (Nig) Ltd, Isolo
Tractor & Equipment (Division of UAC Nigeria Ltd), Lagos
UTC Technical, Isolo-Mushin
UTC Hardware Division, Apapa
Waateco Ltd, Technical Division, Lagos

Agricultural Services

Cidpag Nigeria Ltd, Calabar

Agrochemical Fertilisers

A/S Cheminova, Denmark

Air Cargo Services

IMNL International Messengers (Nigeria) Ltd, Lagos, Kano, Ikoyi, Kaduna, Port Harcourt, Zaria
Nigeria International Air Services Ltd, Apapa
Triana Ltd, Apapa

Air Compressors & Pneumatic Plant

Blackwood Hodge (Nigeria) Ltd, Apapa
R. T. Briscoe (Nigeria) Ltd, Technical Department, Mator – Oshodi
R. T. Briscoe (Nigeria) Ltd, Lagos
Brossette (Nigeria) Ltd, Apapa
Guthrie (Nigeria) Ltd, Lagos
Holman Brothers (Nigeria), Apapa
Joy Manufacturing Co. USA
Phoenix Motors Ltd, Lagos
Reiss & Co. (Nig.) Ltd, Ebute-Metta
Scoatrac (Nig) Ltd, Isolo
Waateco Ltd, Technical Division, Lagos
Wayne (West Africa) Ltd, Apapa
C. Zard & Co. Ltd, Lagos

Air Conditioning & Refrigeration

Dizengoff, W. A. (Nig.) Ltd, Apapa
Drake & Scull (Nig.) Ltd, Lagos
Equip Home (A Division of SCOA Nigeria Ltd), Lagos
Equip Ind, Scoa (Nig.) Ltd, Ogba
Hademec Ltd, Lagos
Haven Nigerian Computer Co, Lagos
Holt Engineering Ltd, Apapa
ITT Nigeria Ltd, Yaba
James Kilpatrick (Nigeria) Ltd, Ilasamaja
Leventis Technical Ltd, Lagos
Mandilas Limited, Apapa
Nigeria Engineering Works Ltd, Port Harcourt
Norman Industries Ltd, Ikeja
Morpol Industrial Corp. Ltd, Apapa
Patterson Zochonis & Co. Otd, Lagos
R. & A. Services (Division of UAC Ltd), Lagos
VYB (Nigeria) Ltd, Apapa
Waateco Ltd, Technical Division, Lagos

Air Courier Services

IMNL – International Messengers (Nigeria) Ltd, Lagos, Kano, Ikoyi, Kaduna, Port Harcourt, Zaria
Redcoat Express Ltd, Surrey, UK
Triana Ltd, Apapa

Aircraft Test/Aid Equipment and Accessories

Intermaco (Ghana) Ltd, Accra

Air Tools

Reiss & Co. Nigeria Ltd, Ebute-Metta

Aluminium Doors & Windows

Alumaco, Apapa
Brossette (Nigeria) Ltd, Apapa
Cego (Engineering) Ltd, Essex, UK
Crittal-Hope Nigeria Limited, Ikeja
Flag Aluminium Products
Fawaz – Tealwood & Chemicals (Kano) Ltd, Kano
Metraprod Industries Ltd, Ikeja
Metalum Ltd, Isolo
Steel Works Ltd, Ibadan, Nigeria

Aluminium Cookware

Alumaco, Apapa
Tower Aluminium (Nigeria) Ltd, Ikeja

Aluminium Extruded Sections

Cego (Engineering) Ltd, Essex, UK
Metraprod Industries Ltd, Ikeja
Nigalex – Nig. Aluminium Extensions Ltd, Oshodi
Tower Aluminium (Nigeria) Ltd, Ikeja

Aluminium Roofing & Cladding

Alumaco, Apapa
Flag Aluminium Products
Metalum Ltd, Isolo

Arc Welding Equipment

Alumaco (Aluminium Manufacturing Company of Nigeria Limited), Apapa
R. T. Briscoe (Nigeria) Ltd, Technical Department
Gas & Welding (Nigeria) Ltd, Mushin
Industrial Gases Ltd, Apapa
Mator – Oshodi
Nigeria General Motors Ltd, Lagos
Nigerian Hardware Industries Limited, Apapa
UTC Technical Division, Isolo-Mushin

Architectural Services

Cidpag Nigeria Ltd, Calabar

Asbestos Cement Building Materials

Eternit Ltd, Sapele
Mandilas Enterprises Ltd, Lagos
Turners Building Products (Emene) Ltd
Scoatrac, Ikeja, Lagos

Asbestos Manufacturers

Giwarte Ltd, Kano

Asphalt Plants

Afrotec Technical Services (Nigeria) Ltd, Isolo
Blackwood Hodge (Nigeria) Ltd, Apapa
M. & E. (a Division of UAC of Nigeria) Ltd
Morpol Industrial Corp. Ltd, Apapa
Nigerian Motors Industries Ltd, Apapa
Reiss & Co. (Nig.) Ltd, Ebute-Metta
Scoatrac (Nig) Ltd, Isolo
Tarpaulin Industries (WA) Ltd, Apapa

Audio Visual Equipment

Beam (Division of UAC Nig. Ltd), Lagos
Controls and Automation, Apapa
Grette Communications (Nig) Ltd, Lagos
Ihekoke International Concern (Nig) Ltd, Jos

Automotive Parts

J. Allen & Co. Ltd, Apapa
Leventis Motors Ltd, Apapa
Morpol Industrial Corp. Ltd, Apapa
NITECO, Apapa
Phoenix Motors Ltd

Bearings – Ball Roller & Needle

R. T. Briscoe (Nig) Ltd, Apapa

Bearing Metals

Makeri Smelting Co. Ltd, Jos

Bitumen Boilers & Distributors

Blackwood Hodge (Nigeria) Ltd, Apapa
M. & E. (a Division of UAC of Nigeria) Ltd
Morpol Industrial Corp. Ltd, Apapa
NITECO, Apapa
Scoatrac, Ikeja, Lagos

Block Making Machinery

Adamog (Nigeria) Ltd, Ibadan
Afrotec Technical Services (Nigeria) Ltd, Isolo
John Finlay (Engineering) Ltd, N. Ireland
M. & E. (a Division of UAC of Nigeria) Ltd
Reiss & Co. (Nig.) Ltd, Ebute-Metta
UTC Technical – Isolo-Mushin

Borehole Drilling

West African Water Drilling and Allied Services Co. Ltd, Lagos

Boilers

Brossette (Nigeria) Ltd, Apapa
VYB (Nigeria) Ltd, Apapa

Bitumen Boilers

Scoatrac (Nig) Ltd, Isolo

Bread Ovens & Equipment

Sears Lumsden Ltd, Essex, UK

Building & Civil Engineering Contractors

Alakija & Alakija Contracting Services Ltd, Lagos
Alhaji M. R. Shitu & Sons Ltd, Lagos
Costain (West Africa) Ltd, Lagos
Cubitts Nigeria Limited, Lagos
Fuad Lekan Enterprises, Lagos
Foundation Construction Ltd, Iganmu
Foundation Engineering (Nigeria) Ltd, Lagos
Fuad-Lekan Ent., Lagos
Italo Builders Co. Ltd, Ebute Metta
James Kilpatrick (Nigeria) Ltd, Ilasamaja
Alhaji M. R. Shuttu & Sons Ltd, Lagos
Remco Nigeria Ltd, Calabar
Sears Lumsden Ltd, Essex, UK
Samek Construction Company Ltd, Lagos
Structor, Apapa
Taylor Woodrow of Nigeria Limited, Lagos
George Wimpey & Co. (Nigeria) Ltd, Lagos

Building Construction

Inter-Beton (Nig.) Ltd, Ikeja

Building Materials

Apex Paints Ltd, Ikeja
Bewac Limited, Apapa
Bisolu Enterprises Ltd, Apapa
Brossette (Nigeria) Ltd, Apapa
Chelleram's Building Materials Department, Apapa
Dizengoff, W. A. (Nigeria) Ltd, Apapa
Dunlop Nigerian Industries Ltd, Ikeja
Fibreglass Reinforced Plastics Co. Ltd, Abeokuta
Gottshalcks Building Materials, Lagos (A Division of UAC Nig. Ltd)
Leventis Stores, Lagos
Lyntraco, Sweden & Donefor
Nigerian Commercial & Industrial Enterprises Limited, Lagos
Henry Stephens Builders' Merchants, Apapa
Turners Building Products (Emene) Ltd, Enugu
C. Zard & Co. Ltd, Lagos
Minister Technical Services (Nigeria) Ltd, Kano
UTC – Hardware Div., Apapa
(General Metal Products) Hilti Ltd, Apapa

Burglary Alarms Equipment

Jos Hansen & Sochne Ltd, Lagos

Business Consultants

Cidpag Nig. Ltd, Calabar

Business Travel Agents Business Services Recruitment

Air Marketing International Group of Co's, Crawley, UK
All Counties Business Agency, UK

Capacitors – AC Motor Starting & Electrolytic

Daly (Condensers) Ltd, Dorset, UK

Carbon Brush Manufacture

H. F. Schroeder (WA) Ltd, Iganmu (under licence from Morganite UK)

Cargo Airlines

Redcoat Cargo Airlines, UK

Catering Equipment

Electrolux Mandilas Ltd, Ikeja
Equip Home (a Division of SCOA Nigeria Ltd), Lagos
Leventis Technical Ltd, Lagos
Nirexim GmbH, Vienna
F. Steiner & Co. Ltd, Lagos
VYB (Nigeria) Ltd, Apapa

Cement Manufacturers

Calabar Cement Co. Ltd, Calabar
Nigerlink Industries Ltd, Lagos

Chemical Engineering
Heplac Nigeria Ltd, Lagos
Shegbola Techniteonics Inc., Lagos

Charter Operations
Nigerdelta Shipping Agencies Ltd, Lagos

Civil Engineering Contractors
Inter-Beton (Nig.) Ltd, Ikeja

Civil Services
Cidpag Nigeria Ltd, Calabar

Civil, Electrical & Mechanical Engineers & Constructors
Hademec Ltd, Lagos
James Kilpatrick (Nig.) Ltd, Lagos
Remco Nig. Ltd, Calabar

Cold Stores
Alumaco, Apapa
Phoenix Refrigeration (UK) Ltd

Commercial Painting & Maintenance
Fuad-Lekan Ent., Lagos

Compactors
Afrotec Technical Services (Nigeria) Ltd, Isolo
Blackwood Hodge (Nigeria) Ltd, Apapa
Holman Brothers (Nigeria) Ltd, Apapa
Holt Engineering (a Division of J. Allen & Co. Ltd, Oregun Village)
Leventis Motors Ltd, Apapa
Metro Technical, Ikeja and Agbara
Morpol Industrial Corp. Ltd, Apapa
Nigerian Motor Industries Ltd, Apapa
NITECO, Apapa
Henry Stephens Engineering Co. Ltd, Ilupeju
Scoatrac, Ikeja
Tractor & Equipment (Division of UAC Nigeria Ltd), Lagos
UTC Technical, Isolo-Mushin

Computers & Related Services
GBO BEAM (a Division of UAC of Nigeria Ltd), Lagos
Haven Nigerian Computer Co, Lagos
Infodata Ltd, Lagos
International Computers (Nigeria) Ltd, Lagos, Nigeria
Leventis Technical Ltd, Lagos
Rimax Computer Services, Surulere
Tractor & Equipment (Division of UAC Nigeria Ltd), Lagos

Concrete Machinery
Adamoj (Nigeria) Ltd, Ibadan
Afrotec Technical Services (Nigeria) Ltd, Isolo
Holman Brothers (Nigeria) Ltd, Apapa
M. & E. (a Division of UAC of Nigeria) Ltd
Morpol Industrial Corp. Ltd, Apapa
Henry Stephens Engineering Co. Ltd, Ilupeju Industrial Estate
Reiss & Co. (Nig.) Ltd, Ebute-Metta
Structor Technique
UTC Technical, Isolo-Mushin

Concrete Reinforcement
Nigerian Wire Industries Ltd

Construction Equipment
Blackwood Hodge Nigeria Ltd, Apapa
Camplant, Apapa, Nigeria
Joy Manufacturing Co. USA
Incar (Nigeria) Ltd, Lagos
Landmark Industrial Supplies Ltd, Lagos
Metro-Technical, Ikeja and Agbara
Scoatrac (Nig) Ltd, Ikeja
Henry Stephens Engineering Co. Ltd, Ilupeju
Tractor & Equipment (Division of UAC Nigeria Ltd), Lagos

Consultancy Services
Cidpag Nigeria Ltd, Calabar

Containers & Tanks
Fibreglass Reinforced Plastics Co. Ltd, Abeokuta

Copy/Duplicating Machines & Products
GBO BEAM (a Division of UAC of Nigeria) Ltd, Lagos
Leventis Technical Ltd, Lagos

Corrugated Boxes
Nigerian Carton & Packaging MFG. Co. Ltd, Ikeja
Polythene Enterprises (Nigeria) Ltd, Ikeja

Couplings
R. T. Briscoe (Nig) Ltd, Apapa

Cranes, Ropes & Hydraulic Excavators
Afrotec Technical Services (Nigeria) Ltd, Isolo
Blackwood Hodge (Nigeria) Ltd, Apapa
Camplant, Apapa, Nigeria
Conveyancer (Nigeria) Ltd, Apapa
Holman Brothers (Nigeria) Ltd, Apapa
Holt Engineering Ltd, Apapa (a Division of J. Allen Oregun Village & Co. Ltd)
Holt Engineering (a Division of J. Allen & Co. Ltd), Oregun Village
Jones Cranes Ltd, UK
Leventis Motors Ltd, Apapa
Metro Technical, Ikeja & Agbara
Morpol Industrial Corp. Ltd, Apapa
Nigerian Motors Industries Ltd, Apapa
H. F. Schroeder (W.A.) Ltd
Henry Stephens Engineering Co, Ltd, Ilupeju
Stronghold (Nigeria) Ltd, Engineering Services Division, Ikeja
Scoatrac (Nig) Ltd, Isolo
Tractor & Equipment, Ebute-Metta
Wanteco Ltd, Technical Division, Lagos

Crown Wheel & Pinions (for commercial vehicles)
Gajra Gears, Malaysia

Cutting & Bending
Afrotec Technical Services (Nigeria) Ltd, Isolo
UTC – Hardware Div., Apapa

Decoration & General Joinery
Northern Sawmill & Furniture Manufacturing Co. Ltd, Kano

Dewatering Wellpoint Equipment and Services
Morpol Industrial Corp. Ltd, Apapa
Mandilas Enterprises Ltd, Lagos

Diesel Generating Plant
Afrotec Technical Services (Nigeria) Ltd, Isolo
Blackwood Hodge (Nigeria) Ltd, Diesel Sales and Service Division, Apapa
R. T. Briscoe (Nigeria) Ltd, Technical Department, Maton-Osbodi
Camplant, Apapa, Nigeria
Clausen Eng., Co., Kano
E. D. G. (Nigeria) Ltd, Kano
Holman Brothers (Nigeria) Ltd, Apapa
Holt Engineering (a Division of J. Allen & co. Ltd, Oregun Village)
ITT Nigeria Ltd, Yaba
Leventis Technical Ltd, Lagos
M. & E. (a Division of UAC of Nigeria) Ltd
Nigerian Motors Industries Ltd, Apapa
Nigerlink Industries Ltd, Lagos
NITECO, Apapa, Nigeria
Phoenix Motors Ltd, Oregun, Lagos
Powermaker Generators (Technical Division Tarpaulin Inc. (WA) Ltd), Apapa
Reiss & Co. (Nig.) Ltd, Ebute-Metta
Scoatrac, Ikeja
Stokvis Nigeria Limited, Ebute Metta
Stronghold (Nigeria) Ltd, Engineering Services Division, Ikeja
Structor Technique, VYB (Nigeria) Ltd, Apapa
Tractor & Equipment (Division of UAC Nigeria Ltd), Lagos
UTC Technical, Isolo-Mushin
Wanteco Ltd, Technical Division, Lagos
Wartsila Nigeria Ltd, Apapa
C. Zard & Co. Ltd, Lagos

Diesels – Industrial and Marine
Blackwood Hodge (Nigeria) Ltd, Apapa
R. T. Briscoe (Nigeria) Ltd, Technical Department, Apapa
Equip Home (a Division of SCOA Nigeria Ltd), Lagos
Holt Engineering Ltd (a Division of J. Allen & Co. Otd, Oregun Village)
Levenis Technical Ltd, Lagos
M. & E. (a Division of UAC of Nigeria) Ltd
Morpol Industrial Corp. Ltd, Apapa
Nigerian Motors Industries Ltd, Apapa
Nigerlink Industries Ltd, Lagos
Scoatrac (Nig) Ltd, Ikeja
Henry Stephens Engineering Co. Ltd Ilupeju Industrial Estate
Stokvis Nigeria Limited, Ebute-Metta
Tarpaulin Industries (WA) Ltd, Apapa
Tractor & Equipment (Division of UAC Nigeria Ltd), Lagos
Tractor & Equipment, Ebute-Metta
UTC Technical Division, Isolo-Mushin
Wartsila Nigeria Ltd, Apapa

Dispensing and Bulk Pumps
Reiss & Co. (Nig.) Ltd, Ebute-Metta
Wayne (West Africa) Ltd, Apapa

Doors & Windows
Aluminium Manufacturing Company of (Alumaco), Nigeria Limited Apapa
Bisiolu Enterprises Ltd, Apapa
Crittall-Hope Nigeria Limited, Ikeja
General Metal Products, Apapa
Steel Works Ltd, Ibadan, Nigeria

Dredging & Reclamation Contractors
Ham Dredging (Nig.) Ltd, Ikeja
Nigerian Dredging & General Works Ltd, Apapa
Westminster Dredging (Nig.) Ltd, Lagos

Dumpers
Afrotec Technical Services (Nigeria) Ltd, Isolo
Camplant, Apapa, Nigeria
Conveyancer (Nig.) Ltd, Apapa
Holman Brothers (Nigeria) Ltd, Apapa
Levenis Motors Ltd, Apapa
M. & E. (a Division of UAC of Nigeria) Ltd, Lagos
Morpol Industrial Corp. Ltd, Apapa
Nigerian Motors Industries Ltd, Lagos
Reiss & Co. (Nig.) Ltd, Ebute-Metta
Scoatrac, Ikeja
Henry Stephens Engineering Co. Ltd, Ilupeju
Structor Technique
UIC Technical, Isolo-Mushin
Tractor & Equipment (Division of UAC Nigeria Ltd), Lagos

Earthmoving Equipment
Afrotec Technical Services (Nigeria) Ltd, Isolo
Bewac Ltd, Apapa
Blackwood Hodge (Nigeria) Ltd, Apapa
R. T. Briscoe (Nigeria) Ltd, Lagos
Camplant, Apapa, Nigeria
Greenham Plant Hire (a Division of UAC of Nigeria Ltd), Ikeja
Holman Brothers (Nigeria) Ltd, Apapa
Holt Engineering (a Div. of J. Allen & Co. Ltd, Oregun Village)
Conveyancer (Nigeria) Ltd, Apapa
Hallam Graders, Leicester, UK
Holman Brothers (Nigeria) Ltd, Apapa
Joy Manufacturing Co, USA
Leventis Motors Ltd, Lagos
Metro Technical, Ikeja & Agbara
Nigerian Motors Industries Co. Ltd, Apapa
Scoatrac, Isolo
Stronghold (Nigeria) Ltd, Engineering Services Division, Ikeja
Tractor & Equipment (a Division of UAC of Nigeria Ltd), Lagos

Electrical Contracting Materials
Clausen Engineering, Co Ltd, K
Cutler-Hammer Nigeria Ltd, Ya
Holt Engineering Ltd (a Divisio
Allen & Co. Ltd, Oregun Villa
Pan Electric, Apapa
Remco Nigeria Ltd, Calabar
West African Engineering Co.
Ltd, Apapa

Electrical/Electronic Equipment
R. T. Briscoe (Nigeria) Ltd, Tec
Department, Maton – Osbod
Cutler-Hammer Nigeria Ltd, Ya
EMS (a Division of UAC of Nig
Ltd), Apapa
Fado Engineering Co. Ltd, Ebute
Grette Communications (Nig) Ltd
Lagos
Haven Nigerian Computer Co, L
Holt Engineering Ltd (a Divisio
Allen & Co. Otd, Oregun Villa
Leventis Technical Ltd, Lagos
Nat Engineering Co. Ltd, Lago
Nigerian Computer Co. Lagos
OECO, Apapa
Okosala Electric Company
(Nigeria) Ltd, Apapa
West African Engineering Co. (N
Ltd, Apapa

Electrical Engineering Contractors
Aluminium Wire & Cable Co. Lt
Bruce Engineering Ltd, Yaba
Clausen Engineering Co. Ltd, Ka
Electric Cable & Overhead Cond
Bennet Babs Electrical Co, Ikeja
Isaac & Scull (Nig.) Ltd, Lagos
J. G. (Nigeria) Ltd, Kano
John Green & Co. Ltd, Ibadan
Hademec Ltd, Lagos
Heplac Nigeria Ltd, Lagos
James Kilpatrick (Nigeria) Ltd, Ilasamaja
Lilleker Brothers (Nig) Ltd, Zaria
Marryat Daniel (Nigeria) Ltd, Lag
Mofat Engineering Co. Ltd, Lagos
Technical Constructions (Nigeria)
Lagos

Electric Fans
Nigeria Engineering Works Ltd, Po
Harcourt
Reiss & Co. (Nig.) Ltd, Ebute-Met

Electric Generating Sets
Lanre Bhadmus Ind. Ltd, Lagos
Phoenix Motors Ltd, Lagos
Scoatrac, Ikeja, Lagos
Tractor & Equipment (Division of
Nigeria Ltd), Lagos

Electrical/Mechanical Contractors
Lilleker Brothers (Nig) Ltd, Zaria

Electrical Services
Afrotec Technical Services (Nigeria
Ltd, Isolo
Bennet Babs Electrical Co., Ikeja
Cidpag Nigeria Ltd, Calabar
Reiss & Co. (Nig.) Ltd, Ebute-Met
H. F. Schroeder (WA) Ltd, Ijaniki

Electric Pumps
Morpol Industrial Corp. Ltd, Apap
Reiss & Co. (Nig.) Ltd, Ebute Met
Tractor & Equipment (Division of
Nigeria Ltd), Lagos

Electrolytic Capacitors
Daly (Condensers) Ltd, Dorset, UK

Electronic Communication Equipment
GTE Nigeria Ltd, Lagos
Grette Communications (Nig) Ltd, Lagos
Jos Hansen & Soehne Ltd, Lagos

Electronic Kits ("do it yourself")
Steen Bolbroe A/S Denmark

Engineering Services
Cutler-Hammer Nigeria Ltd, Ikeja
Drake & Scull (Nigeria) Ltd, Lagos
James Kilpatrick (Nigeria) Ltd, Ilasamaja

Engineering Laboratory Services
Artec Engineering Ltd, Yaba
Foundation Engineering (Nigeria) Ltd, Lagos

Excavators (Hydraulic)
Camplant, Apapa, Nigeria
Metro Technical, Ikeja & Agbara
Scoatrac, Ikeja, Lagos
Henry Stephens Engineering Co. Ltd, Ilupeju
Tractor & Equipment (Division of UAC Nigeria Ltd), Lagos

Feed, Mill & Grain Storage Systems
Lolita Nigeria Ltd, Enugu

Fencing
Nigerian Wire Industries Limited

Fibreglass Specialists
Pilkington Glass (Nigeria) Ltd, Apapa

Filters
Morpol Industrial [illegible] Ltd

Fire-fighting Equipment & Vehicles
Guthrie (Nigeria) [illegible] Lagos
Leventis Motors [illegible] Lagos
Omot Fire Protection Eng. Ltd, Ikeja
Preussag Drilling [illegible] Engineers Ltd, Maiduguri
SIDES
Stronghold (Nigeria) Ltd, Security & Safety Services [illegible]an, Ikeja

Fire Protection Equipment & Systems
Omot Fire Protection Eng. Ltd, Ikeja
Intermaco (Ghana) Ltd, Accra
Reiss & Co (Nigeria) Ltd, Lagos

Flow Meters
Wayne (West Africa) Ltd, Apapa
West African Engineering Co. (Nig.) Ltd, Apapa

Food Processing Equipment
Henry Stephens Engineering Co. Ltd, Apapa
UTC Technical, Isolo-Mushin

Fork Lift Trucks
Adamog (Nigeria) Ltd, Ibadan
Afrocommerce (W.A.) Ltd, Lagos
Afrotec Technical Services (Nigeria) Ltd, Isolo
Bewac Limited, Apapa
R. T. Briscoe (Nigeria) Ltd, Technical Department, Apapa
Conveyancer (Nig.) Ltd, Apapa
Engineering Services Division, Ikeja
Leventis Motors Ltd, Lagos
Lyntraco Sweden (Nig) Ltd, Ikeja
Nigerian Motors Industries Ltd, Apapa
NITECO, Apapa
Henry Stephens Engineering Co. Ltd, Ilupeju
Tarpaulin Industries (WA) Ltd, Apapa
Tractor & Equipment (a Division of UAC of Nigeria Ltd), Lagos
Waateco Ltd, Iganmu

Foundation Works
Foundation Construction Ltd, Iganmu
Raymond Constructors (Nigeria) Ltd, Lagos
Trevi Foundations Nig. Ltd, Oshodi

French Windows and Doors
Crittall-Hope Nigeria Ltd
Steel Works Ltd, Ibadan
General Metal Products, Apapa

Full and Split Charter Operations
Air Marketing International Group of Co's, Crawley, UK
Triana Ltd, Apapa

Furniture
Beam (Division of UAC Nig. Ltd), Lagos
Nigerian Office Stationery Supply Stores Ltd, Apapa

Garage Equipment
Landmark Industrial Supplies Ltd, Lagos
Pump Services Nigeria Ltd, Lagos
Reiss & Co. (Nig.) Ltd, Ebute-Metta
Stokvis Nigeria Limited
VYB (Nigeria) Ltd, Apapa
Wayne (West Africa) Ltd, Apapa
C. Zard & Co, Ltd, Lagos

General Building Contractors
Fuad-Lekan Ent., Lagos

Generating Sets
Holman Brothers (Nigeria) Ltd, Apapa
Incar (Nigeria) Ltd, Apapa
Lillcker Brothers (Nig) Ltd, Zaria
Reiss & Co. (Nig.) Ltd, Ebute-Metta
Tarpaulin Industries (W.A.) Ltd, Apapa

Glasshouses
Makin Ltd, Ilupeju
General Metal Products, Apapa

Glass/Mirrors Processors
Pilkington Glass (Nigeria) Ltd, Apapa

Graders
Blackwood Hodge (Nigeria) Ltd, Apapa
Camplant, Apapa, Lagos
Holt Engineering Ltd (a Division of J. Allen & Co. Ltd, Oregun Village)
Metro Technical, Ikeja and Agbara
Morpol Industrial Corp. Ltd, Apapa
Nigerian Motors Industries Ltd, Apapa
Scotrack, Ikeja, Lagos
Tractor & Equipment (Division of UAC Nigeria Ltd), Lagos

Graphic Arts Requisites
A.M. Faltas (West Africa) Ltd, Lagos

Hand & Power Tools
Landmark Industrial Supplies Limited
Reiss & Co. (Nig.) Ltd, Ebute-Metta
UTC – Hardware Div., Apapa

Hemodialysis Systems
Intermaco (Ghana) Ltd, Accra

Hoses
Akan Ltd, Kano
Tractor & Equipment (Division of UAC Nigeria Ltd), Lagos
Equip Home (a Division of SCOA Nigeria Ltd), Lagos
A.M. Faltas (West Africa) Ltd, Lagos
Fawaz Steelwood & Chemicals (Kano) Ltd, Kano
Nirexim GmbH, Vienna
Ihekoke Int. Concern Ltd, Jos
Scoaltrac, Ikeja, Lagos
F. Steiner & Co. Ltd, Lagos
UTC Technical, Isolo-Mushin

House Furniture
North Sawmill & Furniture Manufacturing Co. Ltd, Kano

Ice Plants
Phoenix Refrigeration (UK) Ltd, Lagos

Identity Cards
Veritas & Co. (Nig.) Ltd, Lagos

Importers/Exporters
G.N.A. Hamzer & Co. (Nig.) Ltd

Industrial Electrical Installations
H. F. Schroeder (W.A.) Ltd

Industrial Engines & Accessories
Landmark Industrial Supplies Ltd, Lagos
Reiss & Co. (Nig.) Ltd, Ebute-Metta
Scoatrac, Ikeja, Lagos
Tractor & Equipment (Division of UAC Nigeria Ltd), Lagos

Industrial Gases
Gas & Welding (Nigeria) Ltd, Ikeja
Industrial Gases Ltd, Apapa

Innoculation Apparatus
Intermaco (Ghana) Ltd, Accra

Instrumentation
Brossette (Nig) Ltd, Apapa

Insecticides
A/S Cheminova, Denmark

Insurance Brokers & Consultants
Interbroker & Co

Interior Decorating
Fuad/Lekan Ent., Lagos

Intruder Detection & Alarm Systems
Reiss & Co. (Nigeria) Ltd, Lagos

Ironmongery & Locks
UTC – Hardware Div., Apapa

Irrigation Equipment
Afrotec Technical Services (Nigeria) Ltd, Isolo
Brossette (Nig.) Ltd, Apapa
Guthrie (Nigeria) Ltd, Lagos
Jos. Hansen & Sochne (Nig.) Ltd, Lagos
I.I.D.C., New York
Landmark Industrial Supplies Ltd, Lagos
Leventis Technical Ltd, Lagos
Stokvis Nigeria Limited, Ebute-Metta
Tractor & Equipment (Division of UAC Nigeria Ltd), Lagos
U.T.C. Engineering Division Lagos

Kitchen Cabinets
Steel Works Ltd, Ibadan, Nigeria

Laboratory Chemicals/Reagents
Ihekole International Concern (Nig) Ltd, Jos
The Twilights Nigeria Ltd
Intermaco (Ghana) Ltd, Accra

Laboratory Furniture
Fawaz Steelwood & Chemicals (Kano) Ltd, Kano
Ihekole International Concern (Nig) Ltd, Jos
Intermaco (Ghana) Ltd, Accra
Nirexim GmbH, Vienna

Laundry Equipment
Electrolux Mandilas Ltd, Ikeja
Equip Home (a Division of SCOA Nigeria Ltd), Lagos
F. Steiner & Co. Ltd, Lagos
VYB (Nigeria) Ltd, Apapa

Library Equipment
Ihekole International Concern (Nig) Ltd, Jos
Nigeria Engineering Works Ltd, Port Harcourt

Lift/escalator installations/maintenance
Nigerian Motors Industries Ltd, Otis Division
H. F. Schroeder (WA) Ltd, Iganmu

Light Fittings
Contex (Nig.) Ltd, Lagos

Liquid Storage Tanks
Braithwaite Dept. Gottshalcks Building Materials, Apapa
Reiss & Co. (Nigeria) Ltd, Lagos

Lighterage
Niger Benue Transport Co. Ltd, Warri

Livestock Feed Mills
UTC Technical, Isolo-Mushin

Machine Tools & Woodworking Machinery
Holt Engineering Ltd (a Division of J. Allen & Co. Ltd, Oregun Village
Landmark Industrial Supplies Ltd, Lagos
Leventis Technical Ltd, Lagos
Lyntraco Sweden (Nig) Ltd, Ikeja
M. & E. (a Division of UAC of Nigeria Ltd), Lagos
Nigerian Motors Industries Ltd, Apapa
Stokvis Nigeria Limited, Ebute-Metta
Stokvis-Nigerian Tool & Die Co. Ltd, Ebute-Metta
UTC Technical, Isolo-Mushin
UTC – Hardware Division, Apapa
C. Zard & Co. Ltd, Lagos

Manhole Covers & Gully Gratings
Bisiolu Enterprises Ltd, Apapa
Nigerian Foundries Ltd, Lagos

Mapping
Kenting Africa Resource Service Ltd, Lagos

Marine Engines & Accessories
Allens Marine, Port Harcourt
Blackwood Hodge (Nigeria) Ltd, Diesel Sales and Service Division, Apapa
R. T. Briscoe (Nigeria) Ltd, Lagos
Holman Brothers (Nigeria) Ltd, Apapa
Nigerian Motors Industries Ltd, Apapa
Henry Stephens Engineering Co. Ltd, Apapa
UTC Technical, Isolo-Mushin
Scoatrac, Ikeja, Lagos
Tractor & Equipment (Division of UAC Nigeria Ltd), Lagos

Materials Handling Equipment
Gottschalks Building Materials (a Division of UAC Nig. Ltd), Apapa
Tractor & Equipment (Division of UAC Nigeria Ltd), Lagos

Mechanical Services
Cidpag Nigeria Ltd, Calabar

Mechanical & Electrical Engineering Contractors
Artec Engineering Ltd, Yaba
Equip Iard (Division of Scoa Nigeria Ltd), Ogba
Fado Engineering Co. Ltd, Ebute-Metta
Hademec Ltd, Lagos
Heplac Nigeria Ltd, Lagos
Landmark Industrial Supplies Ltd, Lagos
Marryat Daniel (Nig) Ltd, Lagos
Remco (Nigeria) Ltd, Calabar

Medical Gases & Medical Equipment
Ihekole International Concern (Nig) Ltd, Jos
Industrial Gases Ltd, Apapa

Metal Cutting Machinery
Afrocommerce (W.A.) Ltd, Lagos

Mining Equipment & Quarrying
Holman Brothers (Nigeria) Ltd, Apapa
Joy Manufacturing Co. Ltd, USA
Morpol Industrial Corp. Ltd, Apapa
Scoatrac, Ikeja, Lagos
Tractor & Equipment (Division of UAC Nigeria Ltd), Lagos

Mobile Broadcasting Vehicles
Grette Communications (Nig) Ltd, Lagos

Motor Transport (Trucks)
J. Allen & Co. Ltd, Apapa
R. T. Briscoe (Nigeria) Ltd, Motor Division, Iganmu
Incar (Nigeria) Ltd, Lagos
Leventis Motors Ltd, Apapa
NITECO, Apapa
Phoenix Motors Ltd, Lagos
Henry Stephens Engineering Co. Ltd, Apapa
Waateco Ltd, Iganmu

Motor Spare Parts and Accessories

Gajra Gears, NS SDN BHD, Malaysia
Lanre Ghadmus Ind. Ltd, Lagos
Morpol Industrial Corp. Ltd
Mufbat Brothers, Yaba & Lagos
World Life General Motors (Nigeria) Co. Ltd

Municipal and Specialist Vehicles

World Life General Motors (Nigeria) Co. Ltd

Office Equipment

Fawaz Steelwood & Chemicals (Kano) Ltd.
GBO BEAM (a Division of UAC of Nigeria Ltd), Lagos
Leventis Technical Ltd, Lagos
Nigeria Engineering Works Ltd, Port Harcourt
Nigerian Office Stationery Supply Stores Ltd, Apapa
F. Steiner & Co. Ltd, Lagos
General Metal Products Ltd, Apapa
Steel Works Ltd, Ibadan

Oil – Seals

R. T. Briscoe (Nig) Ltd, Apapa

Oil Tank Calibrators

Caleb Brett & Sons (Nig.) Ltd, Apapa

Ovens

Reiss & Co. (Nig.) Ltd, Ebute-Metta

Oxygen, Acetylene & Special Gases

Gas & Welding (Nigeria) Ltd, Mushin
Industrial Gases Ltd, Apapa

Packaging Materials

Akan Ltd, Kano
Nigerian Carton & Packaging MFG Co. Ltd
Polythene Enterprises (Nigeria) Ltd, Ikeja

Paging & Public Address Systems

Grette Communications (Nig) Ltd, Lagos
Jos Hansen & Soehne Ltd, Lagos

Paints & Varnishes

Apex Paints Ltd, Ikeja
Berger Paints (Nigeria) Ltd, Ikeja
Bisiolu Enterprises Ltd, Apapa
Dulux, ICI Paints (Nigeria) Ltd, Ikeja
Nigerlux Paints, International Paints (West Africa) Ltd, Ikeja
Reiss & Co. (Nig.) Ltd, Ebute-Metta

Paper Converting Machinery

Elof Hansson Ltd, UK

Partitioning

Context (Nig.) Ltd, Lagos

Petroleum Hoses

Wayne (West Africa) Ltd, Apapa

Piling

Foundation Construction Ltd, Iganmu
Raymond Constructors (Nigeria) Ltd, Lagos
Trevi Foundations (Nig.) Ltd, Oshodi

Pipes, Building & Pressure

Akan Ltd, Kano
Bisiolu Enterprises Ltd, Apapa
Brossette (Nigeria) Ltd, Apapa
Dunlop Nigerian Industries Ltd, Ikeja
Interplast Ltd, Accra
Leventis Stores, Lagos
Mandilas Enterprises Ltd, Lagos
Nigerian Foundries Ltd, Lagos
Turners Building Products (Emene) Ltd, Enugu

Plant Hire

Campiant, Apapa, Nigeria
Costain (West Africa) Ltd, Lagos
Greenham Plant Hire (a Division of UAC of Nigeria Ltd), Ikeja
Holman Brothers (Nigeria) Ltd, Apapa
James Kilpatrick (Nigeria) Ltd, Ilasamaja

Plant Protection Chemicals

A/S Cheminova, Denmark

Plastic Processing Equip

Nigerian Office Stationery Supply Stores Ltd, Apapa
Reiss & Co. (Nig.) Ltd, Ebute-Metta

Plumbing Contractors

Akan Ltd, Kano
Artec Engineering Ltd, Yaba
Hademec Ltd, Lagos
Equip Iard – Scoa Nigeria Ltd
James Kilpatrick (Nigeria) Ltd, Ilasamaja
Marryat Daniel (Nig) Ltd, Lagos

Pothole Repair Materials

Roadcare (Nigeria) Ltd, Ibadan

Poultry Feed Distribution Equipment

Afrotec Technical Services (Nigeria) Ltd, Isolo

Printing Machinery

Elof Hansson Ltd, UK

Printing Materials

Makeri Smelting Co. Ltd, Jos
Nigerian Office Stationery Supply Stores Ltd, Apapa
Reiss & Co. (Nig.) Ltd, Ebute-Metta

Road Services

Cidpag Nigeria Ltd, Calabar

Projected Windows

Steel Works Ltd, Ibadan

Protective Coatings

Bostik Ltd, Leicester, UK
General Metal Products Ltd, Apapa

Protective Clothing

Akan Ltd, Kano
Landmark Industrial Supplies Ltd, Lagos

Protective Plant

Roadcare (Nigeria) Ltd, Ibadan

Pumps

Afrotec Technical Services (Nigeria) Ltd, Isolo
R. T. Briscoe (Nigeria) Ltd, Technical Department, Apapa
Brossette Nigeria Ltd, Kano
Jos. Hansen & Soehne Nigeria Ltd, Lagos
Holman Brothers (Nigeria) Ltd, Apapa
I.I.D.C., New York
Landmark Industrial Supplies Ltd, Lagos
Leventis Technical Ltd, Lagos
M. & E. (a Division of UAC of Nigeria Ltd), Lagos
Mandilas Enterprises Ltd, Lagos
Morpol Industrial Corp. Ltd
Nigerian Motors Industries Ltd, Apapa
NITECO, Apapa
Reiss & Co. (Nig.) Ltd, Ebute-Metta
Henry Stephens Engineering Co. Ltd, Ilupeju
Stokvis Nigeria Limited, Ebute-Metta
UTC – Engineering Division, Apapa
UTC – Technical, Isolo-Mushin
VYB (Nigeria) Ltd, Apapa
Waateco Ltd, Technical Division, Lagos

Quarry Plant

Afrotec Technical Services (Nigeria) Ltd, Oshodi
Blackwood Hodge (Nigeria) Ltd, Apapa
John Finlay (Engineering) Ltd, N. Ireland
Holman Brothers (Nigeria) Ltd, Apapa
M. & E. (a Division of UAC of Nigeria Ltd), Lagos
Morpol Industrial Corp. Ltd
Reiss & Co. (Nig.) Ltd, Ebute-Metta
Scoatrac, Ikeja, Lagos
Henry Stephens Engineering Co. Ltd, Ilupeju

Radio Communication Equipment

J. Allen & Company Ltd, Apapa
Comsac Communications Associates of Nigeria Ltd, Ikeja
R. T. Briscoe (Nigeria) Ltd, Telecommunications Department, Apapa
Dizengoff, W. A. (Nig) Ltd, Apapa
GTE Nigeria Ltd, Lagos
Grette Communications (Nig) Ltd, Lagos
ITT Nigeria Ltd, Yaba
Mofat Engineering Co. Ltd, Lagos
Philips (Nigeria) Ltd, Lagos
Plessey (Nigeria) Ltd, Lagos

Radio Distributors

Leventis Technical Ltd, Lagos
Pan-Electric (a Division of UAC of Nigeria Ltd), Ebute-Metta

Radio Telephones

Comsac: Communications Associates of Nigeria Ltd, Ikeja
Grette Communications (Nig) Ltd, Lagos
Mandilas Enterprises Ltd, Lagos

Radio & Television Broadcast Equipment

Grette Communications (Nig) Ltd, Lagos

Refrigeration

ITT Nigeria Ltd, Yaba
Phoenix Refrigeration (UK) Ltd

Refrigeration Gases

Industrial Gases Ltd, Apapa

Repair/Rewinding of Electric Motor/Generators

H. F. Schroeder (WA) Ltd, Iganmu

Reprographic Materials

Veritas & Co. (Nig.) Ltd, Lagos

River Transport

Niger Benue Transport Co Ltd, Warri

Road Making Equipment

Blackwood Hodge (Nigeria) Ltd, Apapa
Holman Brothers (Nigeria) Ltd, Apapa
Joy Manufacturing Co., USA
Leventis Motors Ltd, Apapa
M. & E. (a Division of UAC of Nigeria Ltd), Lagos
Metro-Technical, Ikeja and Agbara
Morpol Industrial Corp. Ltd, Apapa
NITECO, Apapa
Phoenix Motors Ltd, Oregun, Lagos
Henry Stephens Engineering Co. Ltd, Apapa
Scoatrac, Ikeja, Lagos
Tractor & Equipment (Division of UAC Nigeria Ltd), Lagos

Road Repair Products (Instant)

Roadcare (Nigeria) Ltd, Ibadan

Roller Shutter Doors

Crittall-Hope Nigeria Ltd, Ikeja
Steel Works Ltd, Ibadan

Roofing & Cladding Materials

Alumaco (Aluminium Manufacturing Co. of Nigeria Ltd), Apapa
Eternit Ltd, Sapele
Fibreglass Reinforced Plastics Co. Ltd, Abeokuta
Tower Aluminium (Nigeria) Ltd, Ikeja

Ropes

Nigerian Ropes Ltd, Apapa
UTC – Hardwood Division, Apapa

Safety Equipment

World Life General Motors (Nigeria) Co. Ltd

Sales/Installation/Service Electrical Hoisting Equipment

H. F. Schroeder (WA) Ltd, Ioanmu

Sanitary Ware Manufacturers

Armitage Shanks Ltd, Glasgow

Sanitary Ware & Fittings

Bisiolu Enterprises Ltd, Apapa
Brossette (Nig.), Apapa
Gottschalcks Building Materials, Lagos
Leventis Stores, Lagos
Nigerian Foundries Ltd, Lagos
F. Steiner & Co. Ltd, Lagos
Henry Stephens Engineering Co. Ltd, Apapa
Henry Stephens Engineering Co. Ltd, Apapa
Structor, Apapa
UTC – Hardware Div., Apapa
C. Zard & Co. Ltd
Projects Department, Apapa

School Furniture

Ihekole International Concern (Nig.) Ltd, Jos
Fawaz Steelwood & Chemicals (Kano) Ltd, Kano
Steel Works Ltd, Ibadan, Nigeria

Science & Laboratory Instruments

A. M. Faltas (West Africa) Ltd, Lagos
Ihekole Int. Concern Ltd, Jos
F. Steiner & Co. Ltd, Lagos

Screening Equipment

John Finlay (Engineering) Ltd, N. Ireland
Scoatrac (Nig) Ltd, Isolo

Sealants

Bostik Ltd, Leicester, UK

Sewage Treatment Plant

Brossette Ltd, Apapa
R. T. Briscoe (Nigeria) Ltd
UTC – Engineering Division, Apapa

Sewing Machines

Adere Sewing Machines Ind. Co
Lagos
Industrial Sewing Machines

Sewing Threads & Cord

West African Thread Co. Ltd, Apapa

Shelving Systems

Brossette (Nig.) Ltd, Apapa
Twilights Nigeria Ltd
General Metal Products Ltd, Apapa
Gottschalks Buildings Materials (a Division of UAC Nigeria Ltd), Apapa
Steel Works Ltd, Ibadan, Nigeria

Shipping & Forwarding Agents

Air Marketing International Group Co's. Crawley, UK
Sevenseas Shipping Co. Ltd (Harbour), Apapa
Trana Ltd, Apapa
Veritas & Co. (Nig.) Ltd, Lagos

Soil Investigation

Foundation Engineering (Nigeria) Ltd, Lagos
Nigerian Dredging & General Works Ltd, Lagos
Raymond Constructors (Nigeria) Ltd, Lagos
Trevi Foundations Nig. Ltd, Oshodi

Solders

Makeri Smelting Co. Ltd, Jos
Reiss & Co. Nig. Ltd, Ebute-Metta

Stationery

Nigerian Office Stationery Supply Stores Ltd, Apapa

Steel Structures

Nigerian Engineering Works Ltd, Port Harcourt
Steel Works Ltd, Ibadan

Storage & Equipment

Brossette (Nig.) Ltd, Apapa
Dexion Dept.
Gottschalcks Building Materials, Apapa
Leventis Stores Ltd, Lagos
Nigeria Engineering Works Ltd, Port Harcourt
Stronghold (Nigeria) Ltd, Handy Andy Division, Ikeja
General Metal Products Ltd, Apapa

Structural Steelwork – Fabrication & Erection (Roof Trusses)

Grid Index Nigeria Ltd, Suru-Lere
Intermaco (Ghana) Ltd, Accra

Survey Equipment

Atlas (Nig) Ltd, Lagos
Kenting Africa Resources Survey Ltd, Lagos
Ihekoke Int. Concern Ltd, Jos
Plessey (Nigeria) Ltd, Lagos
F. Steiner & Co. Ltd, Lagos

Suspended Ceilings

Context (Nig.) Ltd, Lagos
Gottschalcks Building Materials, Lagos

Swimming Pool Construction & Maintenance

Ojo-Famo Nig. Co., Ikeja
C. Zard & Co. Ltd, Lagos

Technical Management Consultants

Shogbola Technitronics Inc., Lagos

Technology Transfer

Shogbola Technitronics Inc., Lagos

Telephone Equipment

J. Allen & Company Ltd, Apapa
Comsac: Communications Associates of Nigeria Ltd, Ikeja
Grette Communications (Nig) Ltd, Lagos
GTE Nigeria Ltd, Lagos
Jos. Hansen & Soehne Ltd, Lagos
ITT Nigeria Ltd, Lagos
Philips (Nigeria) Ltd, Lagos
Plessey (Nigeria) Ltd, Lagos
Sentrycom Alarms (Nigeria) Ltd, Lagos
Ultra-Modern Electronics Ltd, Surulere

Time Card Clocks & Systems

Bisiolu Enterprises Ltd, Apapa
Jos. Hansen & Soehne Ltd, Lagos
Leventis Technical Co. Ltd, Lagos
F. Steiner & Co. Ltd, Lagos

Towage

Niger Benue Transport Co. Ltd, Warri

Trailer Axles and Components

Shannon Ltd, UK

Tugs & Barge Hire

Nigerdelta Shipping Agencies Ltd, Lagos

Under Water Services

Nigerian Divising Services, Lagos

Water Drilling, Water Sources Prospecting & Water Wells

Atlas Copco, Stockholm, Sweden
Scoatrac, Ikeja, Lagos

Water Treatment Chemicals

Ihekole Conwn (Nig) Ltd, Jos

Welding Equipment

Reiss & Co (Nig.) Ltd., Ebute-Metta.

ALPHABETICAL LISTINGS

Adamop (Nigeria) Ltd,
NSB/66 Idi-Ape, Iwo Road, POB 910, Agodi Gate, Ibadon. Tel: 61696

Afrocommerce (W.A.) Ltd,
168 Awolowo Road, Ikoyi, Lagos, Nigeria.

Afrotec Technical Services (Nigeria) Ltd,
PMB 1061, Oshodi, Lagos.
Tel: 45656/44706

Akan Ltd,
3 Beirut Road, PO Box 2038, Kano, Nigeria.

Alakija & Alakija Contracting Services Ltd,
6 Ondo Street, West Ebute-Metta, Lagos, Nigeria. Tel: 48286.

Armitage Shanks Ltd, Glasgow,
Tubal Works, Barrhead, Glasgow G78 1NG, UK.

Air Marketing International Group of Co's,
9 Church Road, Lowfield Heath, Crawley, Sussex, UK.
Tel: Crawley 515651. Telex: 877180.

Alhaji M. R. Shittu & Sons Ltd,
41 Oguntola Street, Shomoly, Lagos.
Tel: 44191

All Countries Business Agency,
West House, Slough Lane, Saunderton, Nr. High Wycombe, Bucks, UK.
Tel: 024024 3701. Telex: 837560.

J. Allen & Company Ltd,
PO Box 542, 25 Creek Road, Apapa.
Tel: 47881.

Allens Marine, J. Allen & Co. Ltd,
9–10 Yakubu Gowon Drive, PO Box 282, Port Harcourt, Rivers State, Nigeria.

Aluminium Manufacturing Company of Nigeria Limited (Alumaco),
32 Creek Road, PO Box 60, Apapa.
Tel. 844664/5, 844686.
Cable: PANALPINA.

Aluminium Wire & Cable Co. Ltd,
Port Tennant, Swansea, Glamorgan, UK.

Artec Engineering Ltd,
1 Popo St., Yaba, PO Box 3763, Lagos.
Tel: 42593. Cable: AGRIGBABU, Lagos.

Atlas Copco,
Water Well Drilling Dept/KNS-105 23,
Stockholm, Sweden. Tel: 08/7438000.
Telex: 14090 COPCO S EXDA +

Atlas (Nigeria) Ltd,
Oshodi Scheme, Isolo Industrial Estate, Oshodi Expressway.
PO Box 2120, Lagos, Nigeria. Tel: 848868

Beam (Division of UAC Nig. Ltd.),
H.O. 58 Marina, PO Box 1081, Lagos, Nigeria.
Tel: 661241, 662179, 662197.

Bennett Baba Electrical Co.,
PO Box 444, Ikeja. Lagos.

Berger Paints Nigeria Ltd,
Oba Akran Avenue, PMB 1052, Ikeja.

Bewac Limited,
1 Commercial Road, PMB 1016, Apapa.
Tel: 450955, 41193.

Bisiolu Enterprises Ltd,
1 Warehouse Road, Apapa, PO Box 3214, Lagos.
Tel: 47288. Telex: BEKBEK 21543N.

Blackwood Hodge (Nigeria) Ltd,
15 Burma Road, PO Box 109, Apapa.
Tel: 47107/47049.

Bonds Ltd,
Ulverscroft Road, Leicester LE4 6BW.
Tel: Leicester 50015 Telex: 34675

R. T. Briscoe (Nigeria) Ltd,
Agricultural Equipment Group,
1 Independence Road,
PO Box 3, Kano, Nigeria.
Technical Dept., Mafon & Oshodi & Apapa.
Motor Division: Iganmu.
Telecommunications Dept., Apapa.
Projects Dept., Apapa. Tel: 46471.

British Caledonian Airways,
c/o Central Hotel, PO Box 794, Kano.
Tel: 2040, 4834/5.

British Caledonian Airways,
18/19 Adamdu Bello Way, PO Box 238, Kaduna. Tel: 22029, 22032.

British Caledonian Airways,
10 Beach Road, PMB 2248, Jos.
Tel: 2638/5. Telex: 81365 BCALJ.

Brossette (Nigeria) Ltd,
311 Apapa Road, PMB 1135, Apapa.

Brunette Nigeria Ltd,
Bompai Road, PO Box 2013, Kano

Calabar Cement Co. Ltd,
PO Box 219, Calabar. Tel: 306

Caleb Brett & Sons (Nig.) Ltd,
29/34 NPA Commercial Block "A", Wharf Road, PO Box 52, Apapa.
Tel: 45456, 47015.

Camplant Engineering Sales & Services Ltd,
225 Apapa Road, PMB 1155, Nigeria.
Tel: 846336, 846504/6. Cable Camplantlagos.
Telex: 21324 Lagos.

Cegg (Engineering) Ltd,
Silver Eng, Witham, Essex, UK.
Tel: 0376 83241. Telex: 987425.

Chellaram's Building Materials Department,
19 Wharf Road, Apapa. Tel: 46177.

Cheminova A/S,
PO Box 9, DK-7620, Lemvig, Denmark.
Tel: (01) 83 4100. Telex: 66514.

Cidpaj Nigeria Ltd,
58 Fossberry Road, PO Box 1096, Calabar, Nigeria

Cinere Sewing Machines Ind. Co. Ltd,
5 Badejo Kalesanwo Street, Maturi Ind. Estate, Oshodi-Mushin, Nigeria.

Clausen Engineering Co. Ltd,
Plot 83 Airport Road Ext.
Box 5037 Kano.
Tel: 7674. Telex 77206NG.

Context (Nigeria) Ltd,
21 Danmole Street, Victoria Island, PO Box 1742, Lagos.

Controls and Automation,
270 Herbert Macaulay Street, PO Box 448, Apapa. Tel: 41958.

Conveyaneer (Nigeria) Ltd,
Plot 12, Iganmu Industrial Estate, Iganmu, PMB 1189, Apapa. Tel: 47025.

Comsac Communications Associates of Nigeria Limited,
Block E Industrial Crescent, Ilupeju Industrial Estate, PMB 22129, Ikeja.
Tel: 900304, 900305.

Cable: COMDEC, Lagos.

Costain (West Africa) Ltd,
174 Western Avenue, PO Box 88, Lagos.
Tel: 434774/5/6.

Crittall-Hope Nigeria Limited,
Agege Motor Road, PO Box 28, Ikeja, Lagos Tel: 831508, 845790.
PO Box 231, Kaduna. Tel: 42239.
PO Box 1336, Ibadan. Tel: 61475.
PO Box 398, Port Harcourt. Tel: 21165.

Cutler-Hammer Nigeria Ltd,
5 Eleruwa Street, Ikeja Industrial Estate, PO Box 490, Ikeja.

Daly (Condensers) Ltd,
Granley Works, Granby Ind. Estate, Weymouth, Dorset DT4 9TE, UK.
Tel: 030 2871. Telex: 41476.

Dexion Dept., Gottschalcks Building Materials,
PO Box 321, Burma Road, Apapa.
Tel: 47298-9.

Dizengoff, W. A. (Nigeria) Ltd,
23 Creek Road, PO Box 340, Apapa.
Tel: 42080, 42089.

Drake & Scull (Nigeria) Ltd,
PO Box 2389, 90 Lewis Street, Lagos.
Tel: 631252 and 636549. Telex: 21298.

Dulux, ICI Paints (Nigeria) Ltd,
Adeniyi Jones Avenue, Industrial Estate, Ikeja.

Dunlop Nigerian Industries Ltd,
Oba Akran Avenue, PMB 1079, Ikeja.
Tel: 3165.

E.D.G. (Nigeria) Ltd,
11 Zaria Road, PO Box 243, Kano.
Tel: 5532. Telex: 77129.

EMS,
40 Warehouse Road, Apapa.

Electrolux Masallas Ltd,
Isolo Industrial Estate, PO Box 4065, Ikeja, Nigeria.
Tel: 840058. Telex: 21383 NG.

Elof Hansson Ltd,
32–36 Great Portland Street,
London W1N 5AD, UK.
Tel: (01) 636 1881. Telex: 23133

Etco (Nigeria) Ltd, Engineering & Technical Co,
14 Creek Road, PO Box 337, Apapa.
Tel: 46666 and 42127.

Equip Home (a Division of SCOA Nigeria Ltd),
152/156 Broad Street, POB 452, Lagos, Nigeria.

Equip/Iard (a Division of SCOA (Nigeria) Limited),
Surulere Industrial Road, Ogba.
Ogba Scheme, Ikeja, PMB 21518 Ikeja, Nigeria.
Tel: 962052, 962054.

Eternit Ltd,
PO Box 483, Sapele,
Bendel State, Nigeria. Tel: (054) 41311.

Fado Engineering Co. Ltd,
Phoenix Motors Building,
52/54 Murtala Mohammed Way,
PO Box 35, Ebute/Metta. Tel: 44006.

A.M. Faltas (West Africa) Ltd,
PO Box 1915, 62/64 Campbell Street, Lagos. Tel: Lagos 26774, 23639.

Fawaz Steelwood & Chemicals (Kano) Ltd,
UmaRU Babura Rd., Bompai Industrial Area,
PO Box 980, Kano.

Fibreglass Reinforced Plastics Co. Ltd,
PO Box 206, Ibara, Abeokuta, Ogun State.
Tel: 0362 2246. Cable: Glassplast Abeokuta.

John Finlay (Engineering) Ltd, N. Ireland.
Export Dept., Drumquin Road, Omagh. Co., Tyrone, N. Ireland, UK.
Tel: Omagh (0662) 45127. Telex: 747929

Flag Aluminium Products,
Wesley House, 21/22 Marina, Lagos, Nigeria. Branches: Port Harcourt, Kaduna.

Foundation Construction Ltd,
174 Western Ave., Iganmu, POB2100 Lagos.
Tel: 845090/831393. Telex: 21100 or 21227.
Cable: Foundstouns Lagos.

Foundation Engineering (Nigeria) Ltd,
174 Western Avenue, Iganmu,
PO Box 2100. Tel. 845090/83593.
Telex: 21100 or 21227. Cable: Foundations Lagos.

Fuad-Lekan Ent.
PO Box 50743 Falomo-Lagos, Nigeria,
18 Balogun Street, Ilasamaja, Mushin.

GBO BEAM (a Division of UAC of Nigeria Ltd),
Head Office: 58 Marina, Lagos.
Tel: 20678/51234/23976. Branches: Sales and service throughout Nigeria.

GTE Nigeria Ltd,
PO Box 5154, 2 Tinubu Square, Lagos.
Tel: 636432/658025. Telex: 21518.

Gajes Gears NS SDN BHD,
PO Box 210, Seremban NS, Malaysia.
Tel: 76131/2. Telex: MA 63875 Bajarang.

Gas & Welding (Nigeria) Ltd,
PMB 21551, Ikeja, Nigeria.

General Metal Products Ltd,
Apapa Rd., Iganmu, PO Box 442, Apapa.
Tel: 843651. Cable: Gemsprol.

Gottschalcks Building Materials (a Division of UAC Nig. Ltd),
Dexion Dept., 2 Sapele Road,
PO Box 321, Apapa, Nigeria.

A.D. Green & Co. Ltd,
Electrical Contractors,
346A Dugbe Market Street, Adekunle Fajuyi Road, PO Box 1329, Ibadan. Tel: 23726.

Greenham Plant Hire (a Division of UAC of Nigeria Ltd),
Ilupeju Road, Mushin Industrial Estate, PO Box 8, Ikeja. Tel: 47428.

Grette Communications (Nig) Ltd,
15 Abeokuta Street, Anifowoshe, Ikeja. Tel: 931776/932959. POB 1043 Surulere, Lagos, Nigeria.

Grid Index Nigeria Ltd,
PO Box 3743, Suru-Lere, Lagos State, Nigeria

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PO Box 7585, Lagos. Tel: 43471/2.

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Local M.F. Distributor.

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PO Box 205 Yaba. Tel: 962168.
Cable: Coolth, Lagos.

GNV Hoenser & Co. (Nigeria) Ltd,
34/36 Burma Road, PMB 1047, Apapa, Lagos. Tel: 847873. Cable: Sevnshie.
Telex: 21396 NG.
19 Kofo Avayomi Avenue, PO Box 117, Apapa. Tel: 845858 and 842854.
Telex: 21396. Cable: Galhamzaro.

Jos. Hansen & Soehne Nigeria Ltd,
31/33 Martins Street, POB 141, Lagos.
Tel: 633864, 633721. Telex: 21413.

Haven Nigeria Computer Co. Ltd,
Hamburg House, 31-33 Martins Street.
PO Box 4034, Lagos.
Tel: 636651. Telex: FANHOL 21457.

Heplac Nigeria Ltd,
Head Office, Plot 21, Mile 7½,
Ikorodu Road, PO Box 5498, Marina, Lagos.

Holman Brothers (Nigeria) Ltd,
26 Burma Road, PO Box 81, Apapa.
Tel: 45007/8. Overseas cables: Airdrill, Lagos Inland telegrams: Airdrill Apapa.
Telex: 21502. Branches: POB 293, Harbour Road, Port Harcourt, POB 427. Textile Road, Kaduna South.

Holt Engineering,
Div. of J. Allen & Co Ltd,
Plot 3 & 4 Adewunmi Industrial Estate, PMB 2143, Oregun Village, Ikeja, Lagos.

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Telex: 81344 IHEKOLE NG.
Cable: Ihekole Jos.

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Tel: 843652/843664/843667.
Telex: 21382 Incar, Lagos.

Industrial Gases Ltd,
224 Apapa Road, PO Box 53, Apapa.
Tel: 42041/4.

Oshodi Industrial Estate,
State Highway, Isolo. Tel: 32497.
McDermott Road, PO Box 23, Warri.
Tel: 378.
49 Ijebu By-pass, Oke-Ado Road,
PMB 5327, Ibadan. Tel: 23201.
3 Kachia Road, PO Box 144, Kaduna.
Tel: 43355.
31a Sakpoba Road, Benin City.

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PO Box 6687, Lagos.

Interbroker & Co,
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Cable: Terbrok, Lagos.

Intermacs (Ghana) Ltd,
PO Box M352, Accra.

International Computer (Nigeria) Ltd,
178 Awolowo Road, Ikoyi, Lagos, Nigeria.
Tel: 684957, 684763.

International Messengers (Nigeria) Ltd (IMNL),
Afrijet House, 17 Laide Tomori Street, off Medical Road, Ikeja,
PO Box 2780, Lagos. Tel: 963948.

International Messengers (Nigeria) Ltd (IMNL),
Afrijet House, 360 Sarkin-Yaki Road, Kano.
PO Box 1785.
Tel: 7726. Telex: 77150 (Anopri NG).

International Messengers (Nigeria) Ltd (IMNL),
Afrijet House, 451 Zaria Road, opposite

Plateau Broadcasting Co., Jos.
International Messengers (Nigeria) Ltd (IMNL),
Afrijet House, 22 Ahmadu Beto Way, Kaduna. Tel: 213697. Telex: 71317.
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PMB 1129, Apapa. Telex: 21232.
UTC – Hardware Division,
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29 Ikorodu Road (Jibowu bus stop), Y Lagos, Nigeria.
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Tel: 932018.
London office: World General Motors (Export), 49 Osborne Road, Forest Gl London E7 0PJ, UK.
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