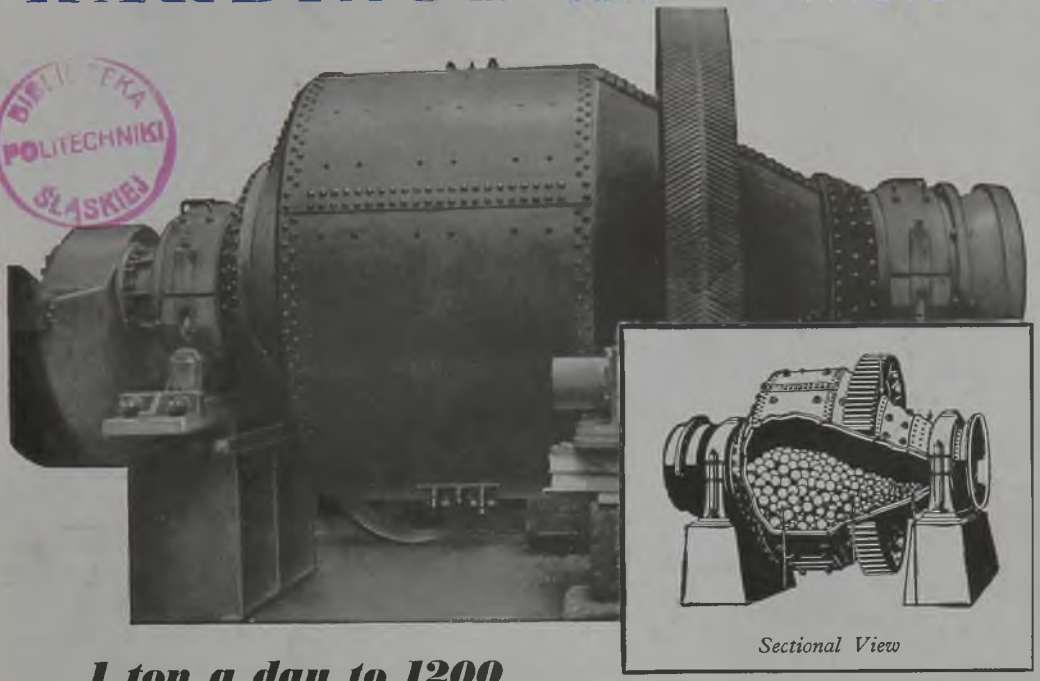
The Mining Magazine

VOL. LXXV. No. 6. LONDON, DECEMBER, 1946. PRICE ONE SHILLING

BIBLIOTEKA POLITECHNIKI ŚLĄSKIEJ

HARDINGE CONICAL BALL MILLS



Sectional View

1 ton a day to 1200 tons a day capacity

Hardinge Mills are operating throughout the world, grinding a larger proportion of minerals than any other make of mill.

No fewer than 34 sizes are actually installed and in use, grinding felspar, ores, minerals and synthetic compounds.

Hardinge Mills are designed for wet or dry dustless grinding, the size of the finished product ranging from 10 mesh to 95%—10 M.U.

The Technical Staff of International Combustion Ltd. are always ready to bring their exceptional experience to any grinding problem.

34 SIZES ACTUALLY INSTALLED AND IN USE

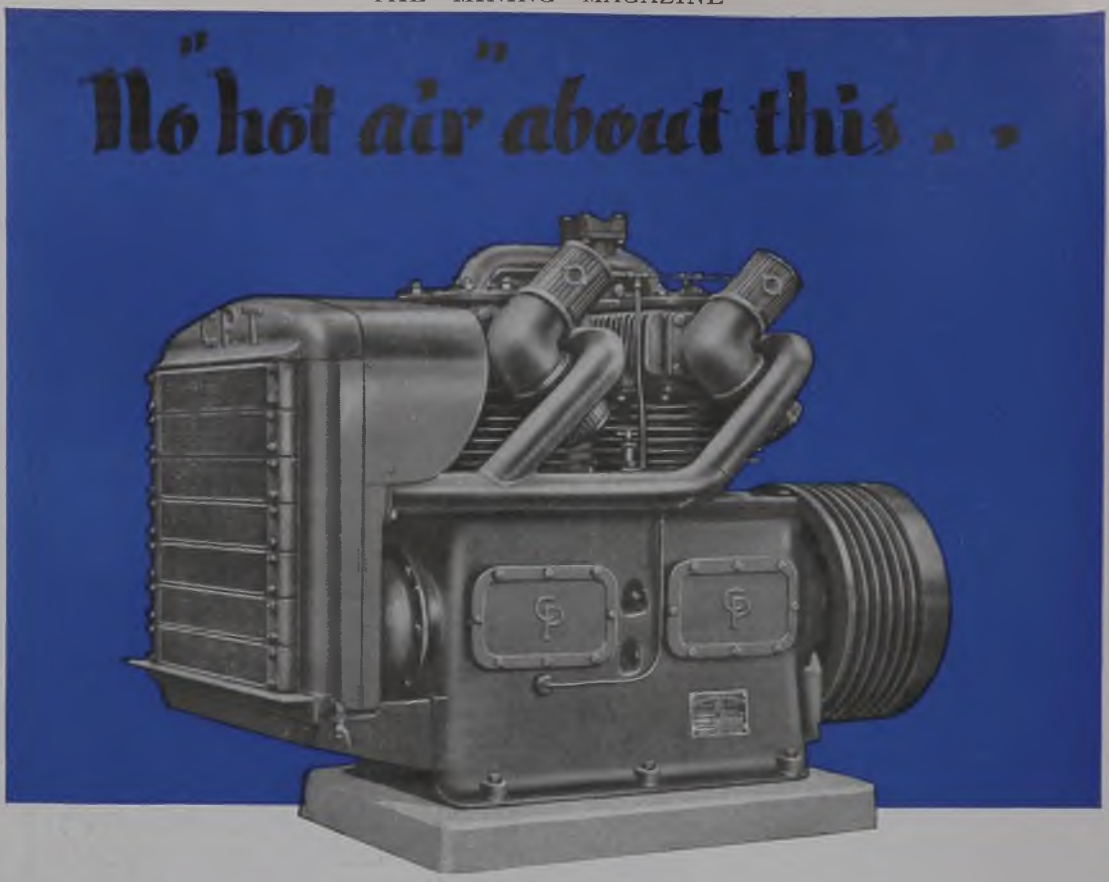
ft.	in.	ft.	in.	ft.	in.
3	× 8	6	× 22	8	× 30
3	× 18	6	× 36	8	× 36
3	× 28	6	× 48	8	× 48
4½	× 13	6	× 54	8	× 54
4½	× 16	6	× 72	8	× 60
4½	× 24	7	× 22	8	× 72
4½	× 36	7	× 36	10	× 36
5	× 22	7	× 48	10	× 48
5	× 36	7	× 54	10	× 60
5	× 48	7	× 60	10	× 72
6	× 16	8	× 22	10	× 84
				10	× 96

INTERNATIONAL COMBUSTION LTD

NINETEEN WOBURN PLACE, LONDON, W.C.1

C22

"No hot air" about this . .



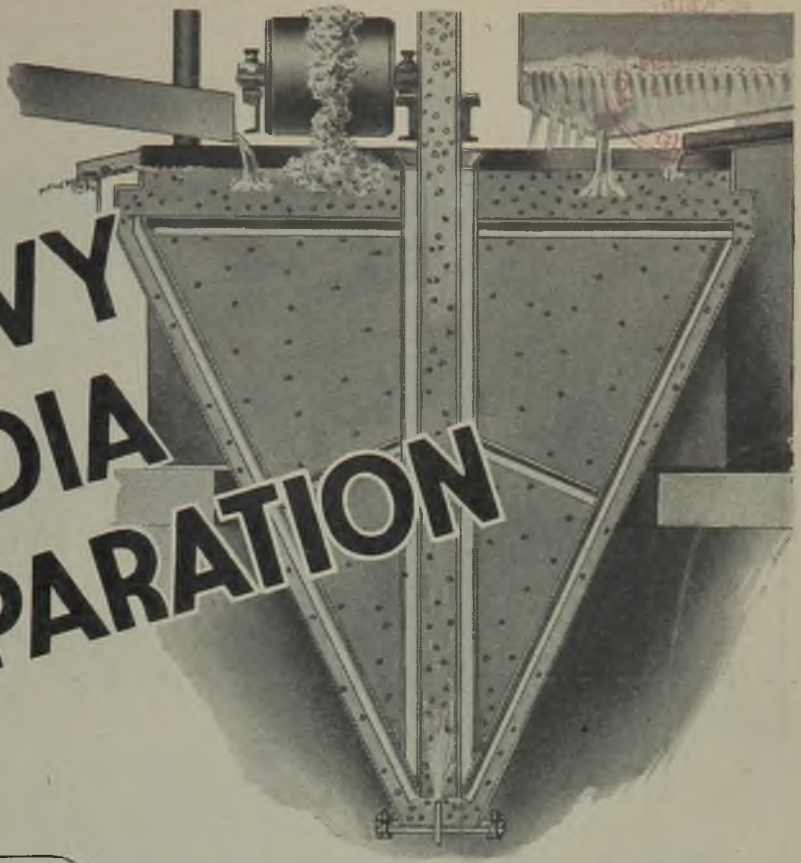
There's certainly no hot air about this CP Compressor in the vitally important compression stages . . . the two stage system and efficient intercooler ensure that no power-reducing temperatures are built up.

This intercooler, served by a high-efficiency fan, enables air to be delivered to the high pressure cylinder only a few degrees above the intake temperature . . . and the final discharge is approximately 200° F. lower than from a single stage machine at 100 pounds pressure.

CONSOLIDATED PNEUMATIC TOOL CO. LTD.
232 DAWES ROAD LONDON S.W.6.

AIR COMPRESSORS · PNEUMATIC TOOLS · ELECTRIC TOOLS · DIESEL ENGINES · VACUUM PUMPS · CONTRACTORS' EQUIPMENT · ROCK DRILLS · DIAMOND DRILLS · OIL WELL TOOLS

CP14



HEAVY MEDIA SEPARATION

This Heavy Media Separation process will treat ores of:

IRON, ZINC,
SILVER-LEAD,
MAGNESITE,
FLUORSPAR,
TIN, GARNET,
Etc., Etc.

Many million tons of ore, metallic and non-metallic, are at present being treated by this process.

By arrangement with Cyanamid Products, Ltd., a Pilot Test Unit is available at our works, the test results from which can readily be converted into a full scale plant design.

The treatment of products from Heavy Media Separation can, if necessary, be followed by froth flotation, cyanidation, or by other ore dressing methods.

Our world wide experience in the treatment of ore is at your disposal.

FRASER & CHALMERS ENGINEERING WORKS

Proprietors : The General Electric Co. Ltd.

ERITH, KENT. **LONDON OFFICE: MAGNET HOUSE, KINGSWAY**

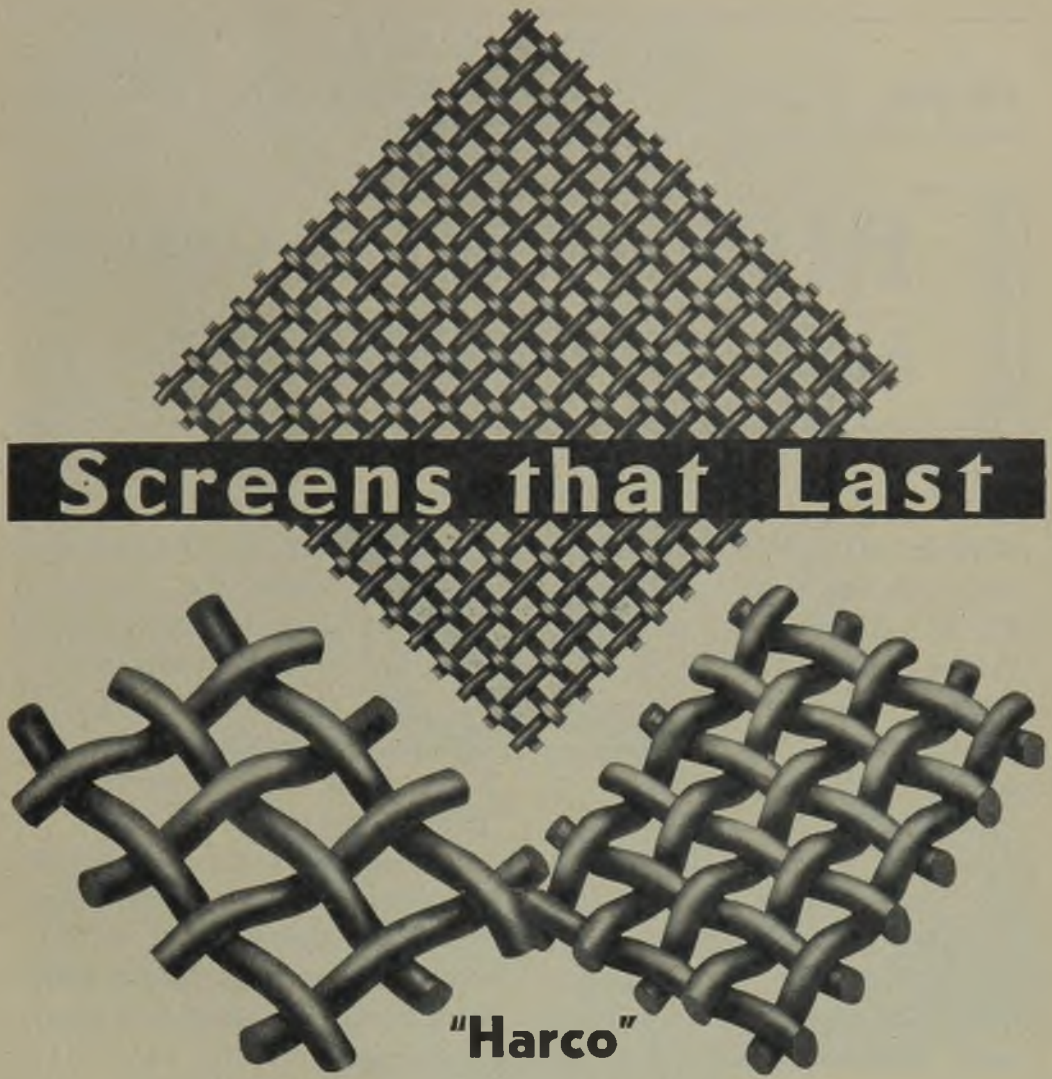
M.S.3 e/R

ANSWERED ALREADY

It often happens that our advice is sought on questions that have been answered in advance, and we have only to send our enquirer one of the numerous technical publications which we have issued during the past fifteen years. Of course, many other problems never reach us because our publications are already at hand. You too can have the answer on your shelves.

THE MOND NICKEL COMPANY LTD

GROSVENOR HOUSE PARK LANE LONDON W1



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Manufactured from specially toughened steel to resist abrasion and fracture, "Harco" Screens last longer. Let us quote you for Screens that will reduce your maintenance costs and give you increased output with trouble-free service.

Catalogue M269 sent on request.

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'RUBBER NEWS'
FROM THE B.T.R.—SILVERTOWN GROUP
MANUFACTURERS OF TYRES · HOSE · BELTING · LININGS · MOULDINGS · COVERINGS

B·T·R - Silvertown
SERVICE TO INDUSTRY

Transport

Whether you travel by road, rail, sea or air, B.T.R. - Silvertown - Palmer products make valuable contributions to comfort, safety and speed.

On cars, buses, lorries and bicycles, B.T.R. Gilt-edged and Palmer tyres are obvious examples. Less noticeable are the B.T.R. fan and dynamo belts, radiator connections and body components (such as rubber engine mountings) which have done so much to improve the modern vehicle.

For railways, the Silvertown Company provides primary batteries to operate signals, hose which is a vital component of the Westinghouse brake system and train-lighting belts.

On aircraft, Palmer equipment has made "happy landings" for more than thirty years; at sea, every ship contains rubber and ebonite products—including many developed in the ten factories of the B.T.R./Silvertown Group. Truly, *transport depends on rubber!*

THE B.T.R.—SILVERTOWN GROUP

British Tyre & Rubber Co. Ltd.; The India Rubber, Gutta Percha & Telegraph Works Co. Ltd.; The Palmer Tyre Ltd.

HERGA HOUSE, VINCENT SQUARE, LONDON, S.W.1

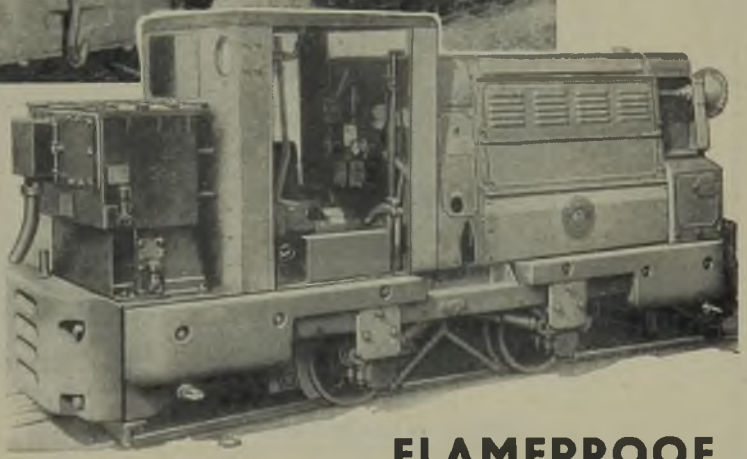
For Haulage in

MINES & QUARRIES

All round operation is the keynote of the Ruston Oil Engined Loco. Under the most arduous conditions the Ruston machine has proved its ability to give satisfaction, whether it be on the surface or for underground use, for narrow or standard gauges.

The Loco is made entirely by Ruston—there being no divided responsibility.

Ask for descriptive Catalogue.



FLAMEPROOF MINE LOCO

All gauges 1 ft. 6 in. to 3 ft. 6 in.

I.C.E. approval No. 1 of the British Mines Dept.

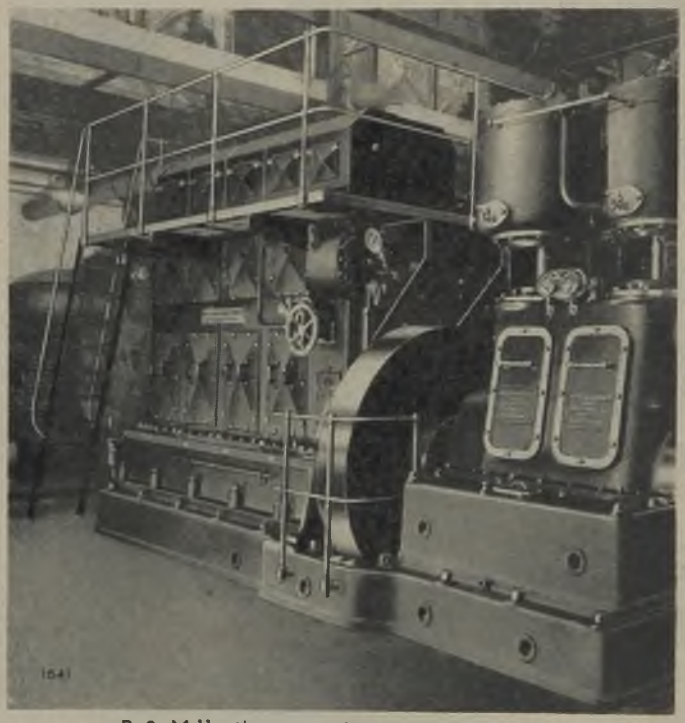
RUSTON OIL ENGINED LOCOS

RUSTON & HORNSBY LTD. • LINCOLN

Associated with DAVEY, PAXMAN & CO., LTD., COLCHESTER

"B & M" OIL ENGINE DRIVEN COMPRESSORS

INSTALLED BY MANY MINING COMPANIES TO ENSURE A CONTINUOUS AND ECONOMICAL SUPPLY OF COMPRESSED AIR



"B & M" oil engine driven air compressor.

Other manufactures

Steam Engines.
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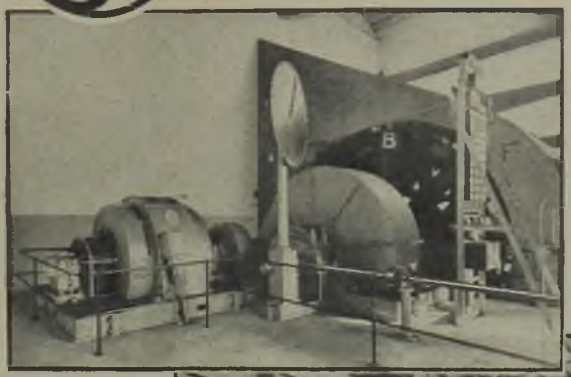
BELLISS & MORCOM LTD

BIRMINGHAM 16, ENGLAND

B T-H Electric WINDING EQUIPMENT

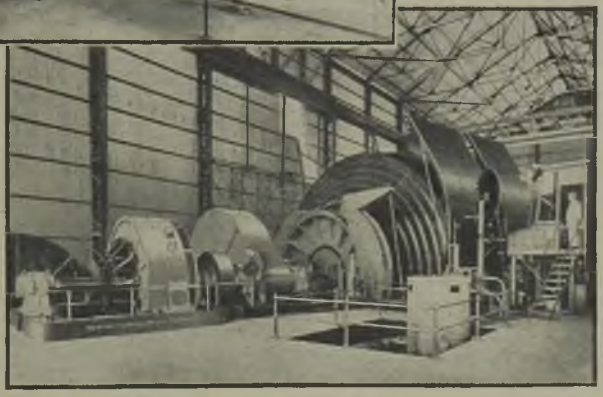


A.C. EQUIPMENT at a SCOTTISH COLLIERY

Designed for winding 305 long tons per hour from a depth of 1,845 ft.

Motor: 1,950/3,900 H.P. 423 r.p.m. 6,600 volts.

Control: Reversing Contactors Liquid Controller



WARD-LEONARD EQUIPMENT at a SOUTH AFRICAN GOLD MINE

Designed for winding 225 short tons per hour from a depth of 6,000 ft.

Motor: 2,938/7,345 H.P. 200 r.p.m.

Flywheel Motor Generator Set with BTH commutator type slip regulator.

BTH products include all kinds of electric plant for service ABOVE or BELOW GROUND

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THE BRITISH THOMSON-HOUSTON COMPANY LIMITED, RUGBY, ENGLAND. A3705

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Melbourne: Australian General Electric Proprietary Ltd., G.P.O. Box 538-F.

NEW ZEALAND. Wellington: National Electrical & Engineering Co., Ltd., P.O. Box 1055.

CHINA. Shanghai: Inniss & Riddle (China) Ltd., 43, Yuen Ming Yuen Road.

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SOUTH AFRICA. Johannesburg: Wilson & Herd Ltd., P.O. Box 7733.

Capetown: Wilson & Herd, Engineering (Pty.), Ltd. P.O. Box 1459.

WEST AFRICA. Sekondi, Gold Coast Colony: The West African Electrical Co., P.O. Box 8.

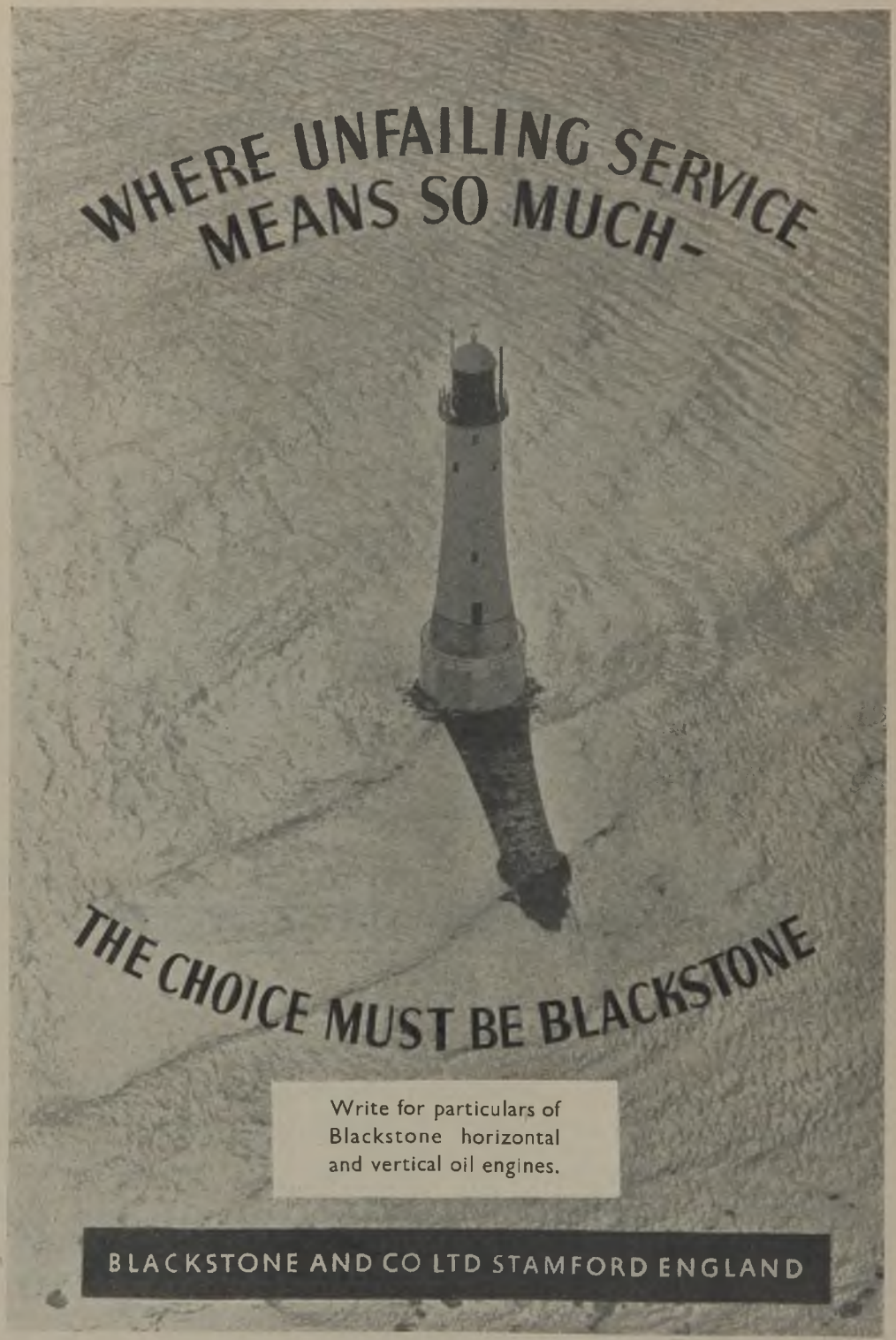
KENYA, UGANDA, TANGANYIKA.

Nairobi: R. G. Vernon & Co., P.O. Box 124.

Nairobi: British East Africa Corporation (1939) Ltd., P.O. Box 182.

Dar-es-Salaam: Lehmann's (Africa) Ltd. (for lamps only), P.O. Box 163.

and others throughout the world.


WHERE UNFAILING SERVICE MEANS SO MUCH-
THE CHOICE MUST BE BLACKSTONE
Write for particulars of Blackstone horizontal and vertical oil engines.
BLACKSTONE AND CO LTD STAMFORD ENGLAND

INCREASED OUTPUT
INCREASED SAFETY

Metrovick thrustors operating main and auxiliary brakes (Mesh & hand wheel cut away to show thrustor)

A 125 hp. Metrovick motor driving a man-riding haulage

Increased safety with consequent increased output is assured in this Beckett & Anderson man-riding haulage, through automatic control by main and auxiliary brakes. Each brake is operated by a FLAMEPROOF electro-hydraulic thrustor which applies the necessary pressure smoothly, rapidly and with full reliability.

The main driving motor is a Metrovick 125 h.p., 2,200 v. type FW machine. It is a Slipring Induction motor with totally-enclosed fan-cooled enclosure certified as fully FLAMEPROOF.

METROPOLITAN Vickers ELECTRICAL CO., LTD.
TRAFFORD PARK · MANCHESTER 17

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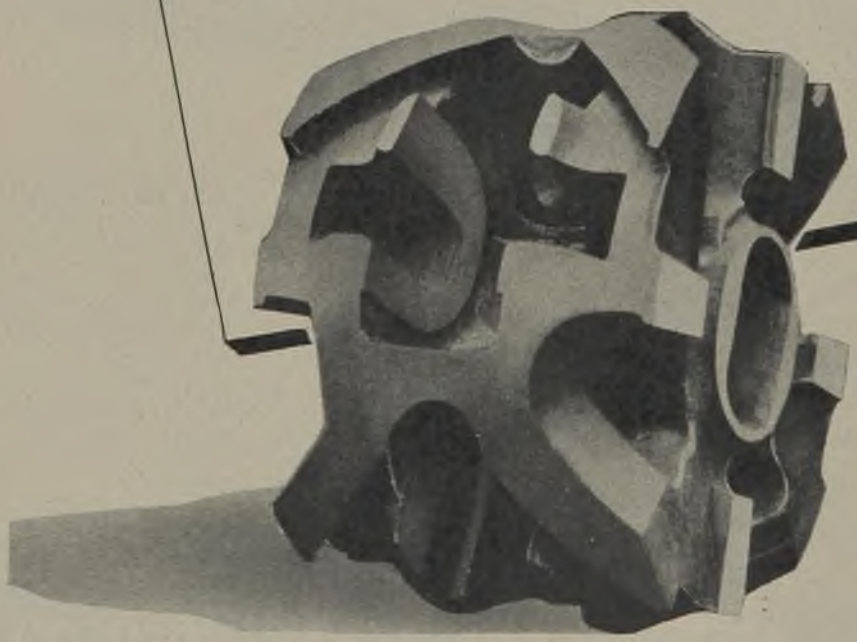
FIRTH BROWN

SPECIAL
HARDWEARING STEELS
for QUARRYING MACHINERY



THOS FIRTH & JOHN BROWN LTD SHEFFIELD

BEAR BRAND XANTHATES

UNIVERSAL ADAPTABILITY

Years of extremely diversified operating experience have conclusively demonstrated that optimum economic and metallurgical results are achieved by the use of Bear Brand Xanthates.

Time and experience have demonstrated the universal adaptability of these outstanding reagents to the successful flotation treatment of practically all sulphide ores, as well as some oxydized ores and certain ores containing native metal.

Extremes in climatic conditions do not adversely affect the quality and usefulness of Bear Brand Xanthates.

GREAT WESTERN DIVISION

THE DOW CHEMICAL COMPANY

SAN FRANCISCO • CALIFORNIA

Seattle Los Angeles

pioneer producers of Xanthates for metallurgical use

DOW

CHEMICALS INDISPENSABLE TO INDUSTRY AND AGRICULTURE

THERMAL LINKAGE

CUTS BOTTLE WASHING FUEL COSTS BY 50%

In many plants the heat in spent process liquors which was formerly wasted is now being successfully recovered, thus effecting substantial savings of fuel.

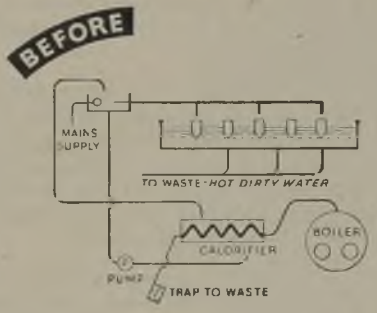
The simplicity of the method of recovering waste heat is shown by the experience of a firm with a bottle-washing plant requiring a supply of water at 140°F.

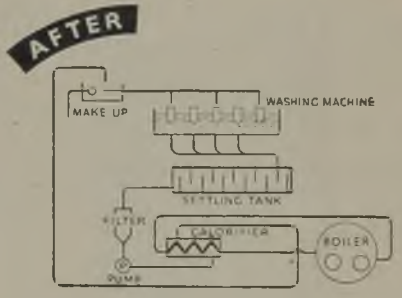
Originally the hot water was obtained by passing mains water through a calorifier where it was heated by a steam supply. Both the condensate from the steam and the hot dirty water were allowed to run to waste. (See Diagram "Before.")

The first step was to replace the steam supply to the calorifier by a closed circuit hot water supply, thus returning the cooler water to the boiler and reducing considerably the fuel requirements.

Next, filtering arrangements were installed for the water leaving the washing machines. This dirty water was passed through a settling tank and finally a filter, the clean water being pumped back through the calorifier into the tank feeding the washing machines. (See Diagram "After.") The small amount of make-up water required was negligible and it was found possible to maintain a temperature at the calorifier inlet of 100°F.

Results: Fuel requirements reduced by 50%. Water wastage eliminated.





PUT WASTE HEAT TO WORK IN YOUR PLANT

Have you investigated the economies you could effect in your plant by applying the principles of Thermal Linkage? If you are undertaking a reconstruction or plant conversion scheme see that Thermal Linkage is fully considered. In your own interests you should go into the matter now.

Substantial savings may be possible for a relatively trifling capital outlay. For general information see Fuel Efficiency Bulletin No. 21 (The Construction of a Factory Heat Balance). For specific advice consult in your Region the Office of the Ministry of Fuel and Power.

ISSUED BY THE MINISTRY OF FUEL AND POWER

ALLIS CHALMERS

Producer of the World's Widest Line of Major Industrial Equipment . . . over 1,600 Different Products that Further Good Living!

Giant ore crushers like this 54-inch Allis-Chalmers Superior McCully Gyratory speed-up primary and secondary reduction of ores all over the world. These crushers have greater feed area and considerably greater capacity than conventional jaw type crushers, are low in operating and maintenance cost. Available in both primary and fine reduction types in sizes from 2 to 60-inch receiving openings.

ALLIS-CHALMERS MANUFACTURING COMPANY offer products of quality and integrity as the builders of the world's widest range of major industrial equipment. For Allis-Chalmers builds *complete* power generation, distribution and control equipment—pumps—motors—V-belt drives—crushing, cement and mining equipment—flour—milling, food and chemical processing equipment—in all, over 1,600 different products that aid industry and further good living! Your enquiries for information or literature will receive prompt attention from—

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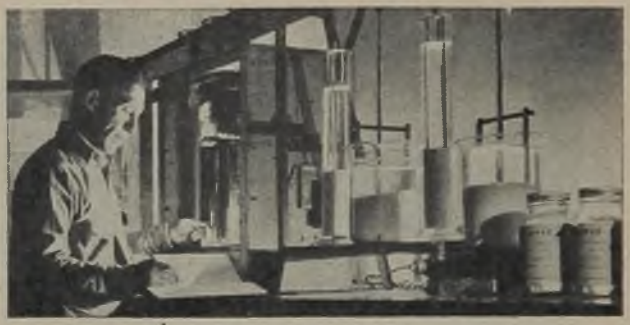


INVESTIGATION

EQUIPMENT

DORRCO

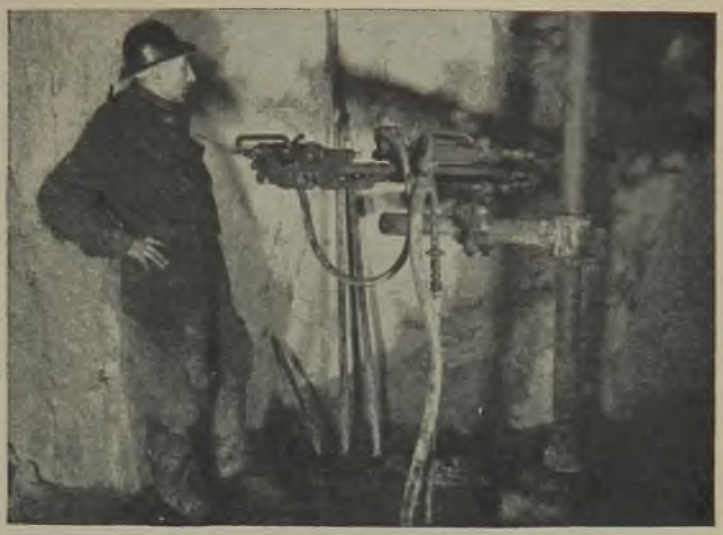
Careful testwork for which our laboratory has been specially developed enables the most suitable type of equipment to be installed at a minimum cost. Adequate testwork and sound machine design—these are two factors which we recognise as supremely important — and the third, equally essential :—

SERVICE :—*by Engineers with long specialised experience.*

INVESTIGATION — EQUIPMENT — SERVICE

ENGINEERS

ABFORD HOUSE, WILTON ROAD, LONDON, S.W. 1



4 in. per drill greater penetration

A group of mines carried out extensive tests under normal conditions with drill steels of the same composition made by two large manufacturers, one of whom was Edgar Allen & Co. Limited. The tests were extended over two months to obtain decisive results. Stag Brand mining drill steel gave an average of 4 in. per drill greater penetration than the other steel of identical composition.

★ STAG MINING DRILL STEELS

(solid or hollow in all the usual standard sections)

are made by Edgar Allen & Co. Limited, by the metal core process, with its admitted advantages.

To Edgar Allen & Co., Limited.
Imperial Steel Works,
Sheffield, 9.

Please post your
MINING DRILL STEEL BOOK to

Name .....

Firm .....

Address .....

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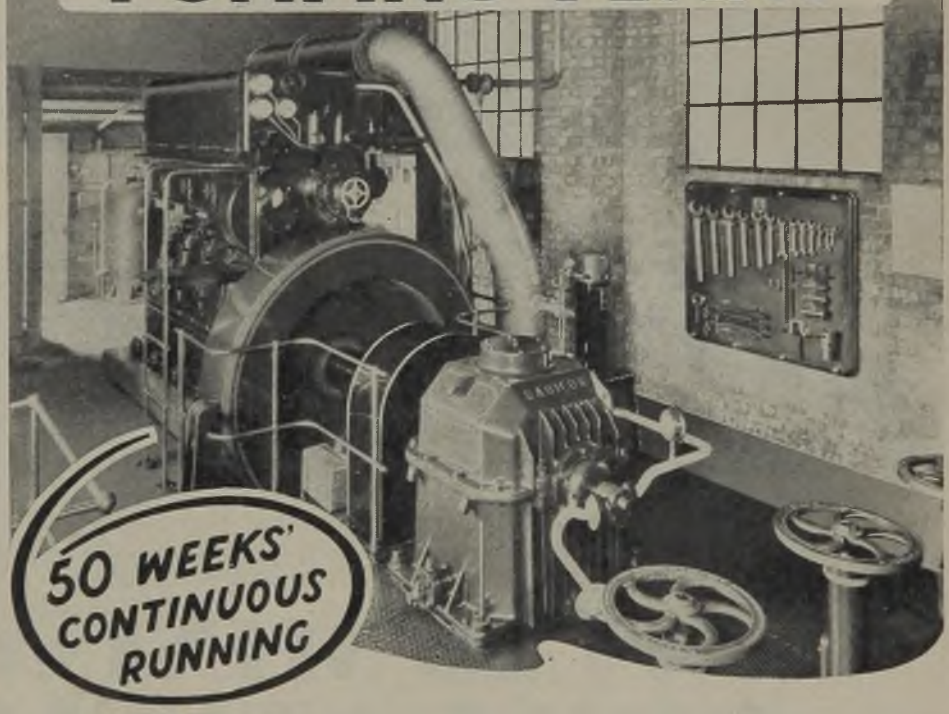
EDGAR ALLEN & CO, LIMITED.
IMPERIAL STEEL WORKS:– SHEFFIELD.9

ALLEN

DIESEL ENGINE-DRIVEN PUMPING PLANT



THE plant illustrated is installed in the Essendon Pumping Station of the Barnet District Gas and Water Company, and comprises an Allen combined two-stage borehole pump and a five-stage force pump, driven through bevel speed increasing gears by an Allen 4-cylinder engine, having a 12-hour rating of 200 b.h.p. at 300 r.p.m.

Owing to shortage of staff to carry out normal maintenance this engine completed a **50 WEEKS' NON-STOP RUN** from 24th February, 1945, to the 10th February, 1946, and was at work again after a short interval for decarbonising and the usual routine inspection, which revealed negligible wear and no necessity for replacements.

We are indebted to the Directors of the Barnet District Gas and Water Company for permission to use this information.

W. H. ALLEN, SONS & Co LTD

BEDFORD **ENGLAND**

DUNLOP

DUNLOP Face belts delivering to Gate belt at the Manchester Colliery Company's Workings

The Conveyor Belts with a future

DUNLOP RUBBER CO. LTD., GENERAL RUBBER GOODS DIVISION, CAMBRIDGE STREET, MANCHESTER
London : Clerkenwell House, Clerkenwell Green E.C.1. Birmingham : Dunlop House, Livery Street, 3.
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46/GRG/27A

PEGSON

Up to 250,000 gallons per hour

Pegson-Marlow portable pumps are made in sizes to deliver in almost any hourly capacity from 1,500 gallons per hour. They combine the advantages of centrifugal pumping with the ability to prime themselves dependably. There is no 20 per cent. loss through recirculation. Pegson-Marlow pumps will handle water containing up to 25 per cent. of solids. They keep going efficiently delivering their rated capacity where other types have failed. We claim that they will deliver more water than any comparable pump. With a Pegson-Marlow portable pump you are in a position to move water quicker and at less expense. Write now for facts and figures which prove these claims to the full. Ask any questions you like about these—the simplest, most efficient pumps on the market.

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Iddesleigh House, Caxton St., Westminster, London, S.W. 1.
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Works : Coalville, Leicestershire.

PUMPS

Over 1,500,000 feet of contract core drilling

. . . have been executed by the Craelius Company in all parts of the world; their specialised technical experience is at your disposal.

CONTRACTORS FOR . . .

- Diamond Core Drilling
- Blast Hole Drilling
- Cement Injection
- Water Drilling
- Geophysical Surveys

SUPPLIERS OF . . .

- Diamond Core Drilling Equipment
- Diamond Bits
- Hard Metal Bits
- Pressure Grouting Equipment
- Percussion Rigs
- Bore-hole Pumps
- Geophysical Survey Equipment

Craelius

CRAELIUS COMPANY LTD., 12, CLARGES STREET, LONDON, W.1

Telephone : Grosvenor 1378/9. Telegrams : Craelius, London.

Longyear Thumb Nail Sketches on Diamond Core Drilling

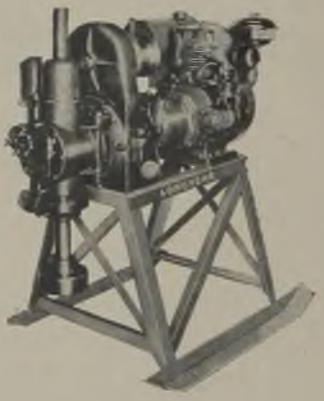
6. Various Drill Models—Longyear core drills are manufactured in a variety of sizes and capacities for either surface or underground drilling. For surface work, drills are mounted on a steel frame and usually powered by petrol or Diesel engines. Capacities range from 100 ft. to 8,500 ft. for the largest model. Underground models are mounted on either single or double columns for setting up in drifts or raises. They are either air or electrically driven. Selection may be made from a number of models ranging in capacity from 100 ft. to 900 ft.

These are all fast, fully powered drills of modern design. Prices are definitely within your reach.

The LONGYEAR Prospector—
For Shallow Drilling from Surface

If your job calls for 300-ft. holes, the petrol-driven Prospector is recommended for your purpose. It is light, compact, mounted on a steel frame and easily moved in the field. Without the drilling head the drill can be carried by two men or it can be " knocked down " in a few minutes. You will find it useful in sinking standpipe, fishtailing, or core drilling to moderate depths.

There is a spool hoist and a 3-speed transmission. High bit speeds permit the use of bortz bits which reduce drilling costs. Write for further information.

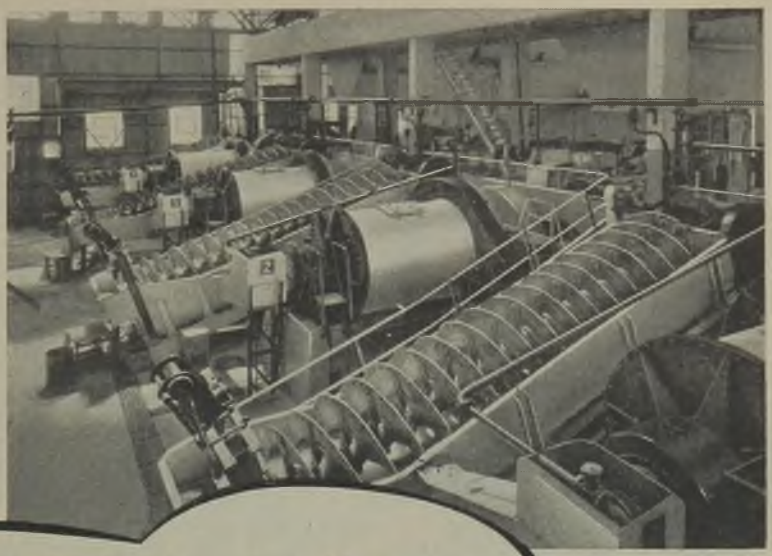


CANADIAN LONGYEAR, LIMITED, North Bay, Ontario, Canada

LONDON REPRESENTATIVE

AUSTIN HOY AND COMPANY, LIMITED, 39, St. James Place, S.W. 1

Other representatives in Oslo, Norway; Helsinki, Finland; Johannesburg, S.A.; Perth, Western Australia; Wellington, New Zealand.



The illustration shows an installation of 4–54 in. high-weir Akins Classifiers in South Africa.

Modernise your classification with "Akins CLASSIFIERS"

These machines, operating in America, Africa, Australia, Spain, and other countries, have given such superior performance that mill managements throughout the mining world are turning to Akins Classifiers for economic classification. In large or small plants the Akins ensures reduction in operating costs, increased tonnage, and improved classification. Send for our Catalogue and examine some of the evidence for yourself.

WE ALSO MANUFACTURE NISSEN STAMP MILLS, BALL AND TUBE MILLS, DRYERS, ETC.

HEAD, WRIGHTSON & Co. Ltd.

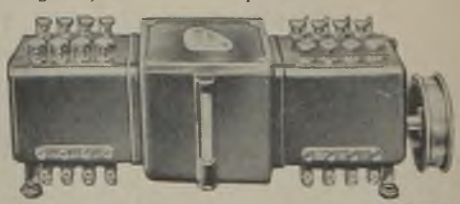
STOCKTON FORGE, STOCKTON-ON-TEES

17-W

Masterpieces

In the field of Architecture St. Paul's was undoubtedly Wren's Masterpiece

In the Engineering field of today the TECALEMIT "Brentford" Mechanical Pump—one of a series designed to meet all the lubricating requirements of industry—can justifiably be designated, in its own sphere, a Masterpiece of engineering ingenuity and craftsmanship.



TECALEMIT

AUTOMATIC MECHANICAL LUBRICATION

Hydraulic & Mechanical, Designing & Manufacturing Engineers

GREAT WEST RD., BRENTFORD, MIDDLESEX

PHONE: EALING 6661 (16 lines)

REDUCE THOSE CRUSHING COSTS . . .

Trouble-free machines can help

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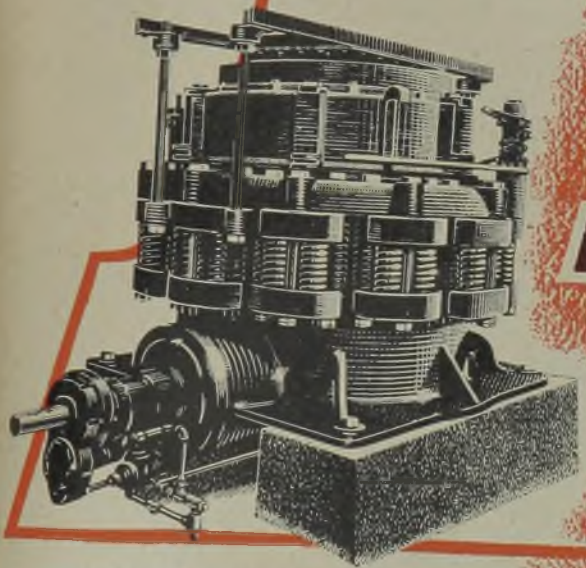

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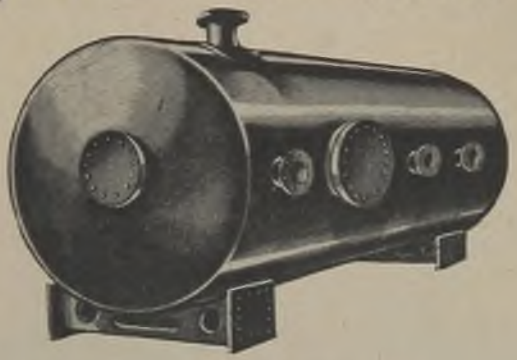

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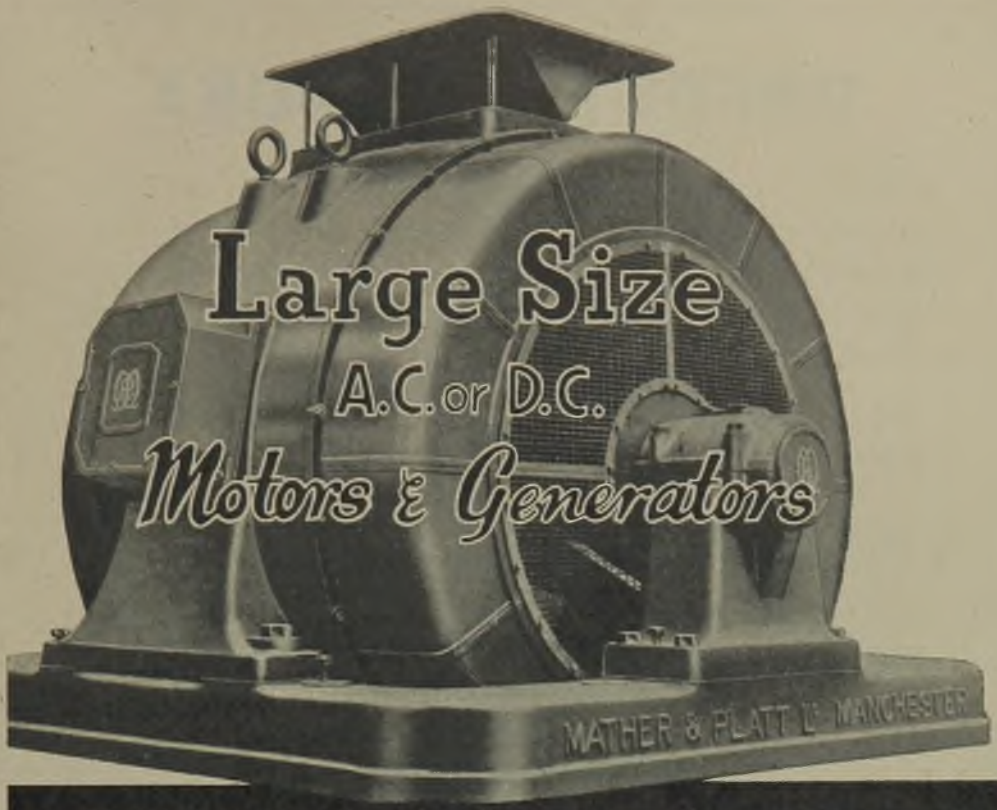

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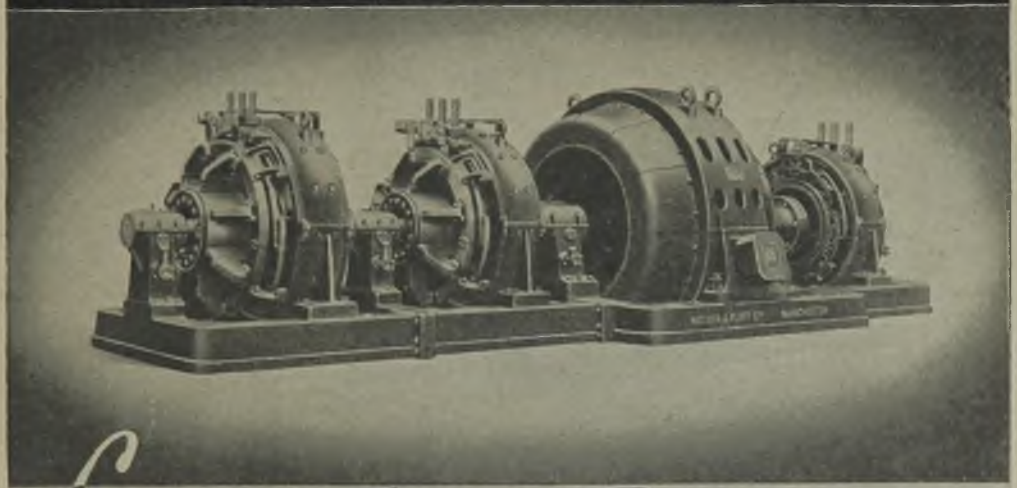

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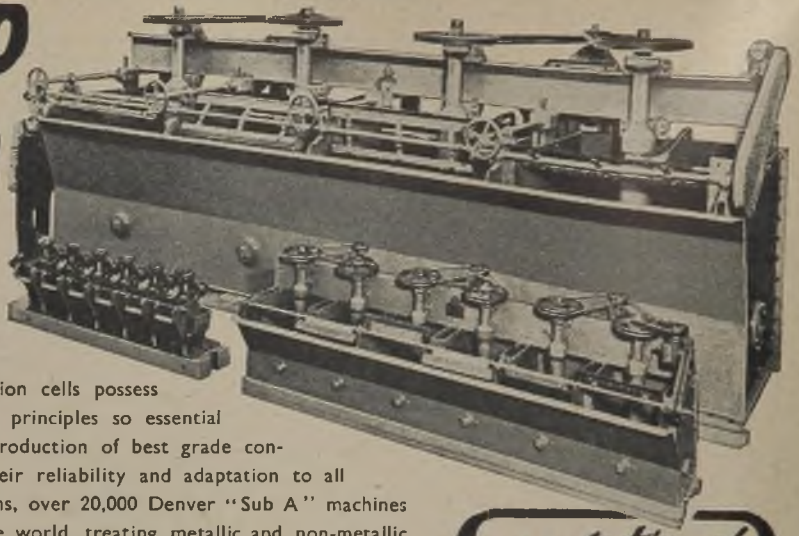

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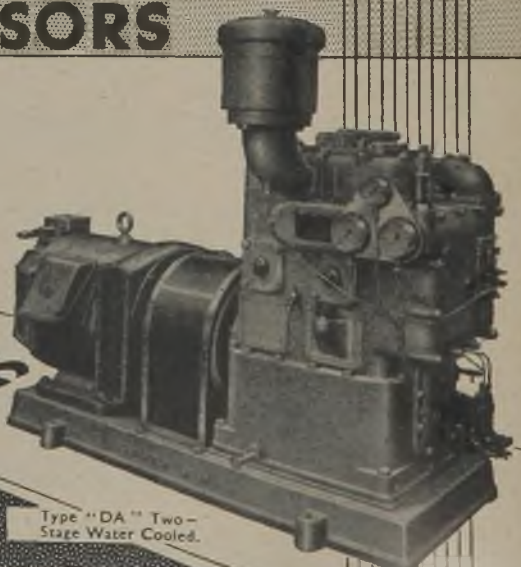

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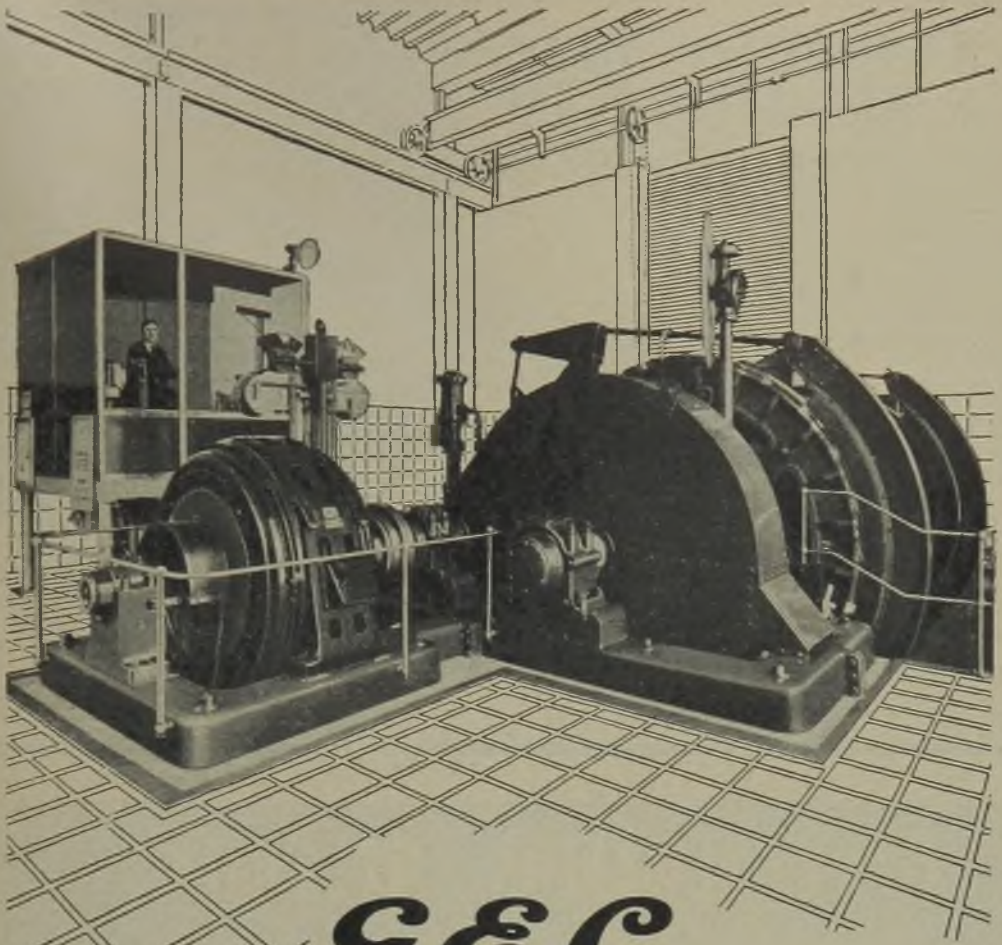

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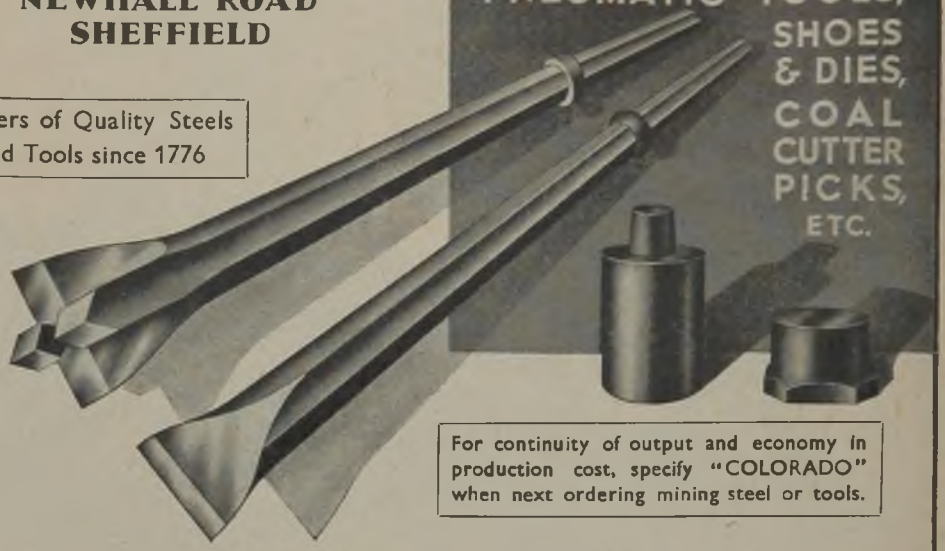

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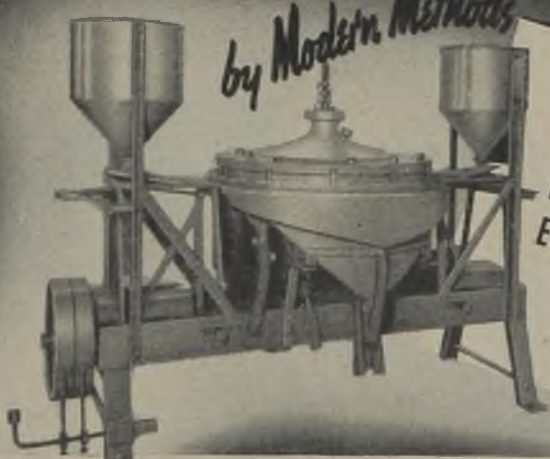

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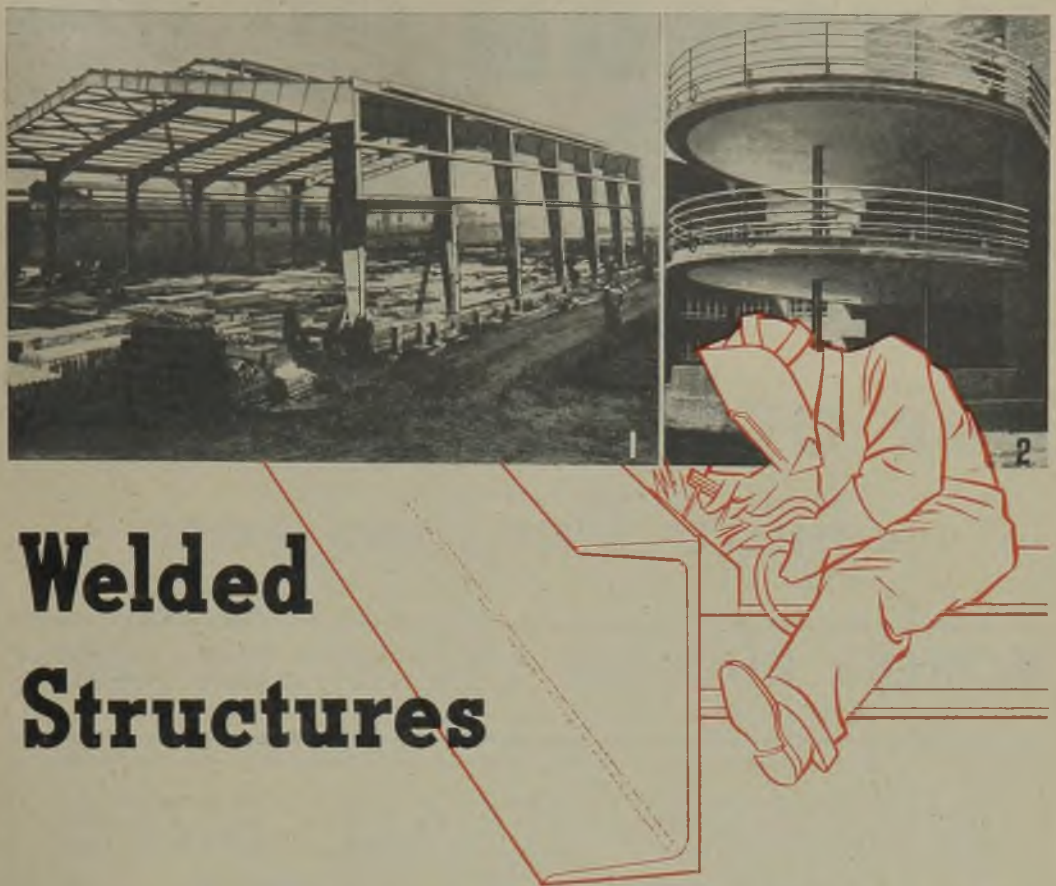

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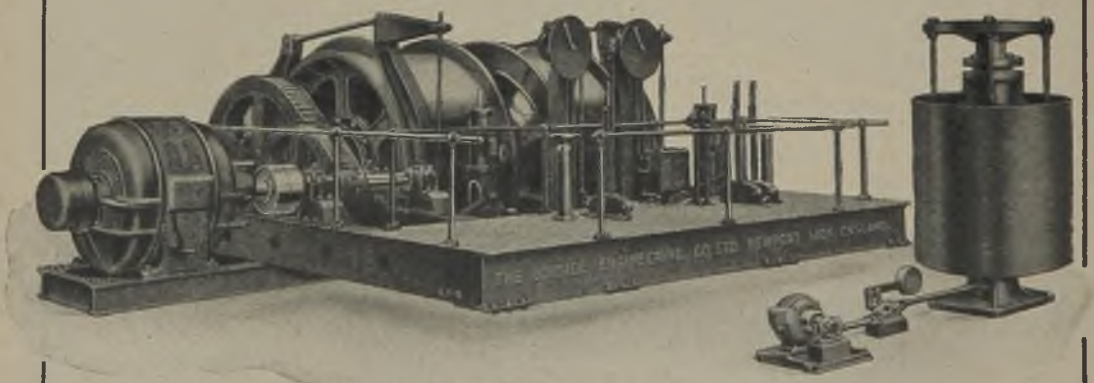

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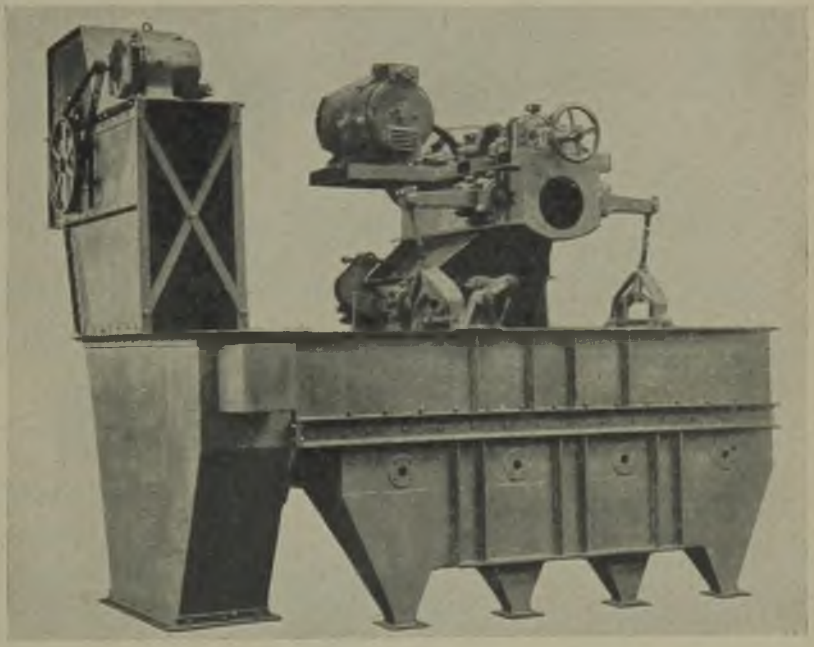

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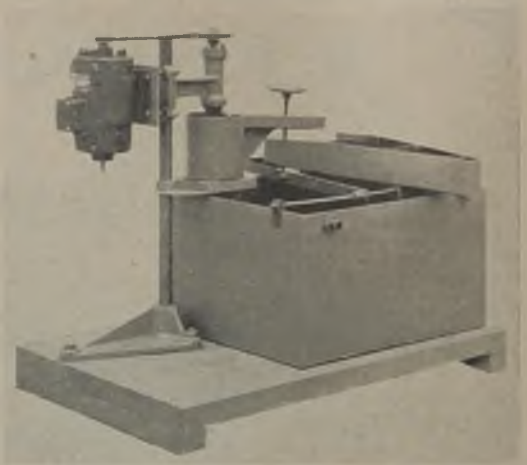

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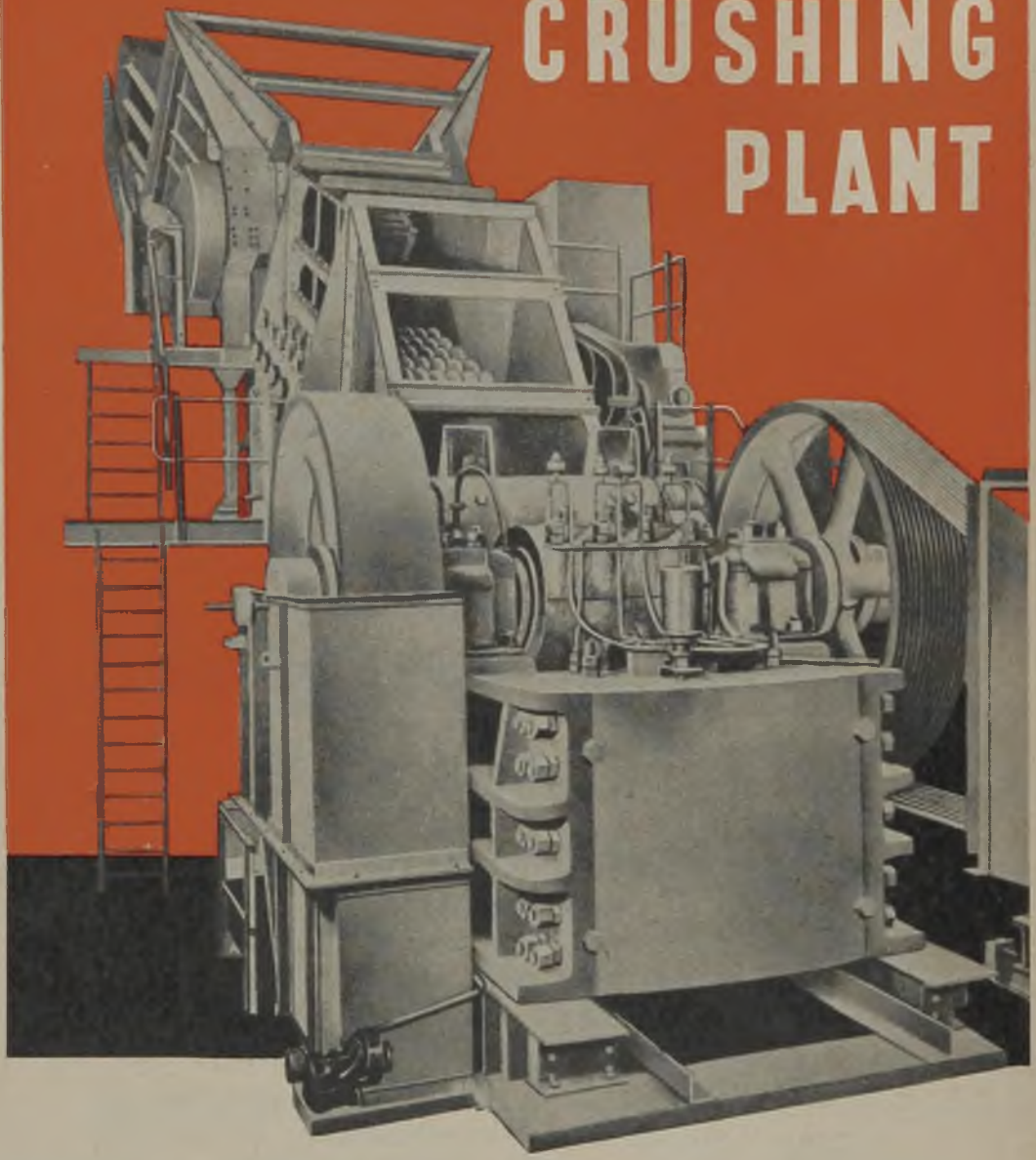

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CONTENTS

EDITORIAL

FOR some time past the cost of producing THE MINING MAGAZINE has been steadily rising and, as readers will probably be aware, printing operatives recently secured an additional wage increase and reduced working hours. In consequence the proprietors now find it necessary to take a step long considered but previously avoided—that is, to raise the subscription rate. With the January issue, therefore, this is to be increased from 12s. to 16s., post free to any part of the world, while the new price per copy is to be 1s. 6d.

REPLYING to a question in the House of Commons last month the Minister of Fuel and Power, Mr. Shinwell, announced that the primary vesting date for the transference of the coal mines to national ownership would be January 1 next.

ACTIVE preparations are being made, it is announced, for the issue of a third edition of the "World List of Scientific Periodicals". The last edition of this work, issued in 1934 and covering the years 1900–1933, is now out of print. Librarians are being asked to co-operate by sending particulars to: The Secretary, World List of Scientific Periodicals, c/o The Zoological Society of London, Regent's Park, London, N.W. 8, from which office further information may be obtained.

AS we go to press details have become available regarding a Memorandum on Colonial Mining Policy issued by the Colonial Office. It is hoped to make further reference to this matter in a subsequent issue; here it must suffice to say that the principles expressed in the Memorandum seem to be framed to ensure that local Governments receive maximum benefit from minerals occurring within their territories, without disregarding the necessity for efficient exploitation of units of economic size.

ELECTRONICS is becoming an everyday word in applied science these days, when measuring devices using electronic control are finding their place in countless processes. During the war the development of the science has been remarkable and the more notable since it is not yet 50 years ago that the electron was discovered by Sir Joseph Thomson. Next year, however, will see the 50th anniversary of this far-reaching discovery and to mark the jubilee, and to demonstrate the tremendous influence such an advance in pure physics may have on the life of the community, the Institute of Physics and the Physical Society are jointly arranging a series of meetings and other functions to take place on September 25 and 26, 1947, in London. A special exhibition, which is to remain open to the public for several weeks, will be held at the Science Museum, South Kensington, and will show the development of the vast range of modern industrial equipment from its earliest experimental origins.

SPEAKING at the recent annual meeting of the Consolidated Gold Fields of South Africa, the chairman, Mr. Robert Annan, took note of the effect of rising labour costs on the Rand, where, he said, labour now absorbed about 35% of the value of the product—that is, about double the average ratio for manufacturing industry. While, he said, direct comparison with other mining fields had to be made with caution it was remarkable how little variation there was in this ratio, irrespective of locality or of the type of labour employed. Manufacturing industry was highly mechanized, the raw material being brought to the factory and an assembly line frequently bringing the work to the worker. In mining, however, conditions were, Mr. Annan said, just the reverse. The raw material lay far underground, men and material had to be transported long distances to the working places through openings made for the purpose and machinery had constantly to be moved to keep up with the working face as it retreated. There was, in consequence, a limit to the amount of mechanization which was economically possible. He thought it should be widely realized that mechanization was not a cure-all and that mining, whatever the product, must always depend on manual labour to a far greater degree than was the case with many other forms of industry. In mining costs the output per man-shift was the vital factor.

At the meeting of the Institution of Mining and Metallurgy last month it was announced that Professor W. R. Jones had been elected president for the 1947–8 session. Dr. Jones, who occupies the University of London Chair in Mining Geology at the Imperial College of Science and Technology, is the Dean of the Royal School of Mines and a vice-president of the Mineralogical Society. Trained at the Royal College of Science and the Royal School of Mines he was for the three years ended 1915 Chief Assistant Geologist to the Federated Malay States and the Straits Settlements. In the period of acute wolfram shortage in the 1914–18 war he was managing director in Burma of the High Speed Alloys Mining Company, a combination of 26 of the chief British steel manufacturers formed to purchase and operate wolfram mines. From 1920 to 1926 he was engaged in consulting practice and visited mining fields in various parts of the world. In 1926, however, he rejoined the geological staff of the Royal School of Mines and was later appointed to the Chair he now occupies, following the retirement of Professor C. G. Cullis. Professor Jones is the author of " Tinfields of the World " and numerous other scientific publications and will long be remembered for his researches into the mineral content of silicotic lungs. He is adviser to the Board of Trade on certain mining industries, chairman of the China-Clay Working Party, and a member of the Minerals Development Committee recently appointed by the Ministry of Fuel and Power.

Recovery in Malaya

Progress towards the rehabilitation of the great industries of Malaya—rubber and tin—is being anxiously studied in this country. In a world painfully recovering from a devastating war Britain, shorn of most of her foreign investments, sacrificed no less to the Allied cause than to her own, badly needs American currency to provide the means for her own resuscitation. In this connexion Malaya can provide rapid help while acting as a " dollar factory ". It is thus imperative that every means be provided, as far as is possible, to aid Malayan recovery and reports emanating from the Far East continue to be watched for evidence that the swing back to pre-war virility remains unhampered. In a recent issue of *Tin*[1] a memorandum on the work of the Malayan Mines Department by Mr. A. Bean, Chief Inspector of Mines, is reviewed and some of the evidence of progress made in reviving the tin industry it presents might well be considered here.

It is apparent in the light of this memorandum that the tin-mining industry of Malaya was in a deplorable condition at the time of liberation. Machinery, including dredges, operated by the Japanese had been run to a standstill and much of the remainder destroyed or looted, while many Chinese mines remained flooded during the entire occupation. By the end of 1945, it is stated, only 45 Chinese mines and no European companies were operating. When the Civil Government resumed control in April, 1946, these figures had been increased to 63 Chinese mines and 10 European and been further improved to 144 and 22 respectively by June 30 last. According to figures issued by the Statistical Office of the International Tin Research and Development Council the number of dredges at work on September 30 had risen to 14, with 24 being rehabilitated, and a total of 181 mines were at work, the 3,052 tons of tin in ore produced in the six months from January to June being matched by 2,378 tons for the September quarter. In spite of this greatly improved position the Chief Inspector's memorandum shows that great difficulties have still to be overcome, the main factors impeding more rapid progress being the high cost of materials, food, and wages that results from a general shortage of supplies. It is pleasant to note, however, that essential parts are now reaching Malaya in greater volume and that in future there will be less call on the Japanese dumps now under the control of the Custodians of Enemy Property, although these have proved of inestimable value in restarting both European and Chinese properties. It is comforting, indeed, that in the view of Mr. Bean, prospects for the resumption of production are brightening and it is evident that the Mines Department, forced to undertake a great deal of work additional to its normal duties, has played no small part in engineering the recovery made to date. It can be noted, for instance, that the Department acts as technical advisers to the Chinese Tin Mines Loans Committee, which is assisting many operators

[1] November, 1946.

to find their feet under the ægis of the Colonial Office and the Ministry of Supply.

As compared with pre-war days the control of the Malayan Mines Department has been greatly extended. It now covers all Malay States, both Federated and Unfederated, within the Peninsula, as well as Malacca. It is natural, therefore, that the present staff position should be acute. In this connexion it can be noted that the supervisory posts of "Inspectors under the Mineral Ores Enactment" have now been redesignated "Inspectors of Mines, Mineral Ores, and Statistics", thereby enabling this section to be completely incorporated with the Mines Department proper, with the added advantages of interchangeability of staff and consequent increase in efficiency. As minimum essential requirements, it is stated, the principal posts concerned are Inspectors of Mines, Mineral Ores, and Statistics, for (*a*) the Malayan Union, (*b*) the "Northern" Zone, to cover the States of Perak, Kedah, Perlis, Trengganu, Kelantan, and Penang, and (*c*) the "Southern" Zone to cover the States of Selangor, Pahang, Johore, Negri Sembilan, and Malacca, the two first-named being existing posts and the third a new one. A unified system of statistical returns, applicable throughout all States of the Union, is to be established and is now in course of final consideration. It is evident, indeed, from the text of the memorandum under review that the position of the tin industry in Malaya is far from discouraging and, what is more, that the Mines Department has shown gratifying skill, while it continues to play a notable part in aiding rehabilitation.

Copper Supplies

It was at one time feared that when the war was over the stocks of copper accumulated for its prosecution might very well flood the market and depress the price accordingly. So far the danger seems remote, for there is, indeed, at present a serious shortage of the metal and since the beginning of 1946 a steady rise in copper values. In his statement accompanying the report of Roan Antelope Copper Mines, Ltd., the chairman, Mr. A. Chester Beatty, suggests that this increase has been due to a number of factors, some of them unexpected. For instance, he says, the United States has remained almost as large an importer of copper as during the war, the continent of Europe has again become a substantial buyer, and scrap has not returned to the market in the quantities expected, "although the reasons for this are not yet entirely clear." These factors have combined to bring about a shortage which shows no signs yet of alleviation.

In this connexion some comments offered by Lt.-Col. the Hon. R. M. Preston, the chairman of the Council of the Copper Development Association, at the recent annual general meeting provide interesting reading. Col. Preston expressed the view that the present difficult copper supply position was likely to last for a considerable time. Referring to the recent formation of Rhodesian Copper Refiners, Ltd., he said that such production developments are some distance ahead and that, in the meanwhile, every ton of copper produced throughout the world is going straight into production, the total being insufficient to meet present requirements. Stocks in all countries had fallen and scrap, he said, was being absorbed without any apparent influence on the market. This strong demand for copper, he considered, would last for two years or so, until the back-log of work that could not be undertaken during the war was completed, but he believed that, far from there being any falling off in the demand for copper when deferred work had been completed, the curve of consumption of copper was likely to continue steadily upwards.

In regard to the Association itself Col. Preston said the offices and workshop at Kendals Hall were now in full operation, the move to larger premises having been made none too soon, for the demand for the Association's services had been higher than ever before and was mounting daily. The principal publications of the Association, he said, were being dispatched at the rate of about 40,000 per annum, a figure that would be considerably higher if larger supplies of paper were available. These increased activities and the additional work undertaken had required substantial additions to the staff. Developments in the electrical, building, ship-building, and motor-car industries were such as to lead to the belief that copper was likely to be in increasing demand and it seems evident that the Association will have plenty of time to develop those lines of research that may be needed if supplies ever become over abundant.

MONTHLY REVIEW

Introduction.—Evidence of a greater degree of Allied concord emerging from the conference of Foreign Ministers at present being held in New York and the settlement of the American coal strike have served to strengthen business confidence, even though there are signs that the export drive has lost some of its initial momentum. With the home market screaming for supplies, however, there are no signs of any halt in the production programme, even in the present critical fuel situation.

Transvaal.—The output of gold from the Rand mines for October was 1,001,924 oz. and from outside districts 24,092 oz., making a total of 1,026,016 for the month. The number of natives employed in the gold mines at the end of October was 288,285, as compared with 292,246 at the end of the previous month.

A recent circular to shareholders of VAN DYK CONSOLIDATED MINES states that No. 5 Shaft, being sunk to open up the southern portion of the mine, is now making good progress. The board has decided that it will be in the best interests of the shareholders to suspend dividend payments for the time being in order to conserve profits for the financing of the shaft and initial development therefrom.

The report of RAND LEASES (VOGELSTRUISFONTEIN) GOLD MINING for the year ended June 30 last shows a profit of £982,375 and a total of £1,232,937 available, of which £450,000 was required for dividends totalling 30%. In the year 2,229,000 tons of ore was crushed and 431,012 oz. of gold recovered. The available ore reserves at June 30 last were estimated to be 3,625,000 tons, averaging 4·45 dwt. in value over 42·3 in.

WITWATERSRAND NIGEL reports a profit of £27,085 for the year to June 30 last, the accounts showing £248,678 available and an unappropriated balance of £247,830 carried forward. The 102,700 tons of ore milled in the year yielded 29,877 oz. of gold. At June 30 last the ore reserves were estimated at 316,000 tons, averaging 4·76 dwt. in value over 36·9 in.

The accounts of GLYNN'S LYDENBURG for the year to July 31 last show a profit of £50,897 and a total of £105,837 available, of which £35,000 was required for dividends totalling 20%. In the year the 121,600 tons of ore milled yielded 32,957 oz. of gold. The available ore reserves at the year end were estimated to be 283,300 tons, averaging 6·4 dwt. in value over 19·7 in.

At the extraordinary meeting of the GENERAL MINING AND FINANCE CORPORATION held in Johannesburg earlier this month it was approved that the capital be increased to £2,000,000 by the creation of 500,000 new £1 shares.

At the annual meeting of KLERKSDORP CONSOLIDATED GOLDFIELDS held last month it was stated that a new issue was contemplated as soon as circumstances were thought favourable in order to raise capital for further development.

ROOIBERG MINERALS DEVELOPMENT reports a profit of £32,261 for the year ended June 30 last, £20,000 of the £52,443 available being required for dividends totalling 10%. In the year 26,752 short tons of ore and 18,869 tons of alluvial material were treated and 500 long tons of tin concentrate recovered.

With the recent dividend notice shareholders of the RAND SELECTION CORPORATION were informed that the profit for the year to September 30 last was £454,500.

The directors of NEW ERA CONSOLIDATED have announced that to meet needs of expanding business they have authorized the creation of £250,000 4% debentures, for the whole of which the ANGLO AMERICAN CORPORATION of SOUTH AFRICA has agreed to subscribe at par.

EAST RAND CONSOLIDATED reports a profit of £87,190 for 1945.

Orange Free State.—Shareholders of the FREE STATE DEVELOPMENT AND INVESTMENT CORPORATION have been informed that bore-hole D.L.1 on the farm Dolly 804, approximately 3 miles north of Odendaalsrust, drilled by the company on joint account with WESTERN HOLDINGS, LTD., had been stopped at a depth of 5,095 ft. "A" Reef was intersected at 4,470 ft. and assayed 13·6 dwt. over 10·8 in. A fault was encountered at 4,750 ft. and the bore-hole passed into measures considered to lie in the foot-wall of the Basal Reef.

Southern Rhodesia.—The GOLD FIELDS RHODESIAN DEVELOPMENT COMPANY recently announced that consent of the Treasury had been obtained to the issue of 3,200,000 shares of 5s. each in MOTAPA GOLD MINING, of which 1,508,532 were to

be offered at par to shareholders of the first-named company.

WANDERER CONSOLIDATED GOLD MINES reports a profit of £38,284 for the year to June 30 last. A dividend equal to 6% has been declared. In the year 417,000 tons of ore was milled and 37,649 oz. of gold recovered. The total ore reserves at June 30 last were estimated to be 392,000 tons, averaging 2·1 dwt. in value.

The report of CAM AND MOTOR GOLD MINING for the year ended June 30 last shows a profit of £226,903, of which £84,375 was required for dividends totalling 2s. 3d. per unit. A total of 289,000 tons of ore was milled in the year and 63,600 oz. of gold recovered. Ore reserves are estimated at 1,713,400 tons, valued at 7·3 dwt.

The accounts of SHERWOOD STARR GOLD MINING for the year ended June 30 last show a loss of £253. With £5,000 transferred from reserve and other items there was a total of £8,258 available, of which £6,250 was distributed as a dividend equal to 5%. In the year the 101,800 tons milled yielded 12,404 oz. of gold. The mine's reserves, it is stated, are now depleted and all ore that can safely be extracted is being mined prior to the suspension of operations.

The accounts of GOLD FIELDS RHODESIAN DEVELOPMENT for the year to May 31 last show a profit of £174,878 and a total of £189,885 available, of which £69,141 is required for a dividend equal to 10%.

Northern Rhodesia.—ROAN ANTELOPE COPPER MINES reports a profit of £296,239 for the year ended June 30 last, the accounts showing £482,452 available, of which £274,624 is required for a dividend equal to 6d. per stock unit. Copper production for the year totalled 53,489 long tons of blister, shortage of coal having affected operations. The estimated ore reserves at June 30 last were 100,316,041 short tons averaging 3·28% copper. Work has been started in connexion with opening up the Roan Extension ore-body, which is to be mined in conjunction with the Roan basin.

Gold Coast.—The report of ARISTON GOLD MINES (1929) for the year to September 30, 1945, shows a profit of £184,262 and a total of £236,124 available. Dividends equal to 20% require £105,077. The ore milled in the year was 240,000 tons and the gold yield 86,743 oz. Ore reserves are estimated as 2,702,167 tons, averaging 6·62 dwt. In his review accompanying the report and accounts the chairman refers to the development of the Broomassie area, where it is envisaged that a new mine will eventually be opened and a company formed to work it. The Ariston company, GOLD COAST SELECTION TRUST, and MARLU GOLD MINING will own the share capital.

GOLD COAST MAIN REEF has recently reported good development results on the main lode at the most southerly working.

The chairman's review accompanying the report and accounts of MARLU GOLD MINING AREAS for the year to September 30, 1945, refers to the resumption of mining operations in May last and states that some 20,000 tons of ore are now being treated monthly.

The accounts of GOLD COAST SELECTION TRUST for the year to September 30, 1945, show a credit balance of £542,868 carried forward. Since the publication of the accounts judgment has been given in the company's appeal to the Court of Appeal against the additional assessments for income tax in respect of the years 1934–8. The appeal was dismissed. Having regard to the important question of principle involved, it is stated, application was at once made to the Court for leave to appeal to the House of Lords and this was granted.

No. 3 dredge of BREMANG GOLD DREDGING started work in July, 1945, the total throughput for the three dredges for the whole of 1945 being 4,167,700 cu. yd., which yielded 18,012 oz. of gold. The accounts show a profit of £14,161 and an unappropriated balance of £31,751 carried forward. The dredgable reserves at December 31 last were calculated to be 74,895,700 cu. yd., with an average value of not less than 3 grains.

A recent circular to shareholders of ASHANTI-ADOWSENA (BANKET) GOLDFIELDS reports the commencement of underground operations on October last, the work initially contemplated being to develop No. 2 ore-shoot in an endeavour to build up ore reserves that would warrant re-starting the mill.

Nigeria.—In his statement accompanying the report of JANTAR NIGERIA for the year to September 30 last the chairman gives the output as 422 tons of tin concentrates and 315 tons of columbite concentrates. Operations resulted in a profit of £23,150, of which £18,563 is required for a dividend equal to 25%.

The accounts of EX-LANDS NIGERIA for 1945 show a profit of £46,604. Dividends totalling 20% require £24,666. The year's output was 721 tons of tin concentrates. The

proved ore reserves at December 31, 1945, stood at 4,240 tons, an increase of 68 tons on last year's figures. This tonnage was contained in 10,052,500 cu. yd., averaging 0·95 lb. per cu. yd.

NARAGUTA EXTENDED AREAS reports a profit of £8,384 for 1945, of which dividends equal to 6% require £6,220. In the year 123 tons of tin concentrates was produced.

The accounts of NARAGUTA KARAMA AREAS for 1945 show a profit of £10,949. Dividends totalling 5% require £4,000. The year's production totalled 267 tons of tin concentrates and 3 tons of tantalite.

The operations of SOUTH BUKERU AREAS for 1945 resulted in a profit of £3,947, of which £2,500 is required for dividends equal to 9%. Production for the year totalled 77 tons of tin concentrates.

Tanganyika.—The accounts of KENTAN GOLD AREAS for the year to September 30 last show a profit of £1,693, which reduces the debit brought in to £511,021.

Australia.—LAKE VIEW AND STAR, LTD., reports a profit of £311,817 for the year to June 30 last, the accounts showing £348,871 for appropriation. Dividends equal to 40% require £123,200. In the year 383,081 tons of ore was milled and 92,961 oz. of gold recovered, while 669,167 tons of tailings re-treated yielded 11,715 oz. The ore reserves at June 30 last were estimated to bc 3,949,100 tons, averaging 4·93 dwt. in gold.

Since January last production in the Main mine of WILUNA GOLD MINES has ceased, subsequent production being confined to the Happy Jack area, which on the basis of 10,000 tons treated per month is expected to sustain operations until the end of the current year. WILUNA GOLD CORPORATION reports a loss of £7,988 for the year to March 31 last, an amount which has been written off against share premium account.

The MOUNT LYELL MINING AND RAILWAY COMPANY announced last month that the profit for the year to September 30 last was £13,153. No dividend is to be paid.

New Guinea.—At the annual meeting of BULOLO GOLD DREDGING held in Vancouver last month the chairman stated that the Upper Baiune 2,800-h.p. hyro-electric plant was expected to be in operation by the end of November and it was anticipated that four of the company's dredges would be in commission by the middle of 1947, provided that certain motors were completed according to present promises and that there was no delay in their shipment to New Guinea.

Malaya.—It was recently announced that No. 6 dredge of MALAYAN TIN DREDGING had completed its trials and was proceeding towards the Northern Boundary area. SOUTHERN MALAYAN TIN DREDGING subsequently informed shareholders that No. 4 dredge had completed its trials and started normal dredging on November 22.

India.—Messrs. John Taylor and Sons stated last month that as a result of local communal disturbances many of the workmen of the MYSORE and CHAMPION REEF mines had absented themselves from work and that operations had been at a standstill since November 12 and 13. OOREGUM and NUNDYDROOG mines had been not so far affected.

Burma.—The secretary of the ANGLO-BURMA TIN COMPANY recently announced that the resolutions submitted to shareholders and 6% debenture holders for the purpose of authorizing the creation of an issue of £80,000 4% prior lien debenture stock had been duly passed. Letters of Rights for 6% debenture holders and Letters of Application for shareholders in respect of an initial amount of £40,000 of this stock were to be issued at an early date.

Portugal.—With the recent dividend notice shareholders of BERALT TIN AND WOLFRAM, LTD., were informed that mining operations in Portugal were resumed in the middle of November and that a contract had been concluded for the sale of the company's output of wolfram at a satisfactory price. The accounts for the year to March 31 last are expected to show a balance at credit for the year of £27,359, which, with the amount brought forward, will make a total of £66,942. It is proposed to reserve £9,500 for taxation and the dividend and bonus will require £27,307 net, leaving £30,135 to be carried forward.

Consolidated Gold Fields of South Africa.—The profit of the Consolidated Gold Fields of South Africa, Ltd., for the year to June 30 last was £339,437, the accounts showing a total of £349,110 available. An ordinary dividend of 2s. 6d. per share requires £240,625 of this amount and after providing for the preference dividends there was a balance of £9,673 to be carried forward.

Imperial Smelting Corporation.—With the dividend notice shareholders of the Imperial Smelting Corporation were informed that the accounts for the year to June 30 last show a profit of £150,086.

London Tin Corporation.—The accounts of the London Tin Corporation for the year to April 30 last show a profit of £92,663 and a total of £242,254 available. A dividend equal to 4% requires £79,601, leaving a balance of £162,652 to be carried forward.

Sulphide Corporation.—The SULPHIDE CORPORATION reports a profit of £24,621 for the year ended June 30 last. A dividend of 5% on the Preference shares has been declared.

NEW COMPANIES REGISTERED

Dolcoath Syndicate.—*Capital :* £1,000 in £1 shares. *Objects :* To acquire mines, mine workings, etc.

El Oro Mining and Exploration.—*Capital :* £1,149,995 in 3s. 6d. shares. *Objects :* To acquire the assets and undertaking of the El Oro Mining and Railway Co., Ltd. *Office :* Finsbury House, Blomfield Street, London, E.C. 2.

New Consols Mines.—*Capital :* £50,000 in £1 shares. *Objects :* To acquire mines and mining rights, etc.

Streamside Mineral.—*Capital :* £2,000 in £1 shares. *Objects :* To acquire fluorspar, limestone, and other quarries, etc. *Directors :* E. B. Nixon and J. F. Humble. *Office :* 2, Paradise Street, Sheffield 1.

Wit Extensions (incorporated in South Africa).—*Capital :* £200,000. *Objects :* To acquire certain option and prospecting contracts, etc. *British Office :* River Plate House, London, E.C. 2.

DIVIDENDS DECLARED

* Interim. † Final.

(Less tax unless otherwise stated.)

†**Amari Mines.**—5%, payable Dec. 20.

†**Anaconda Copper.**—$1·00.

†**Beralt Tin and Wolfram.**—10% and 5% bonus, payable Dec. 31.

†**British Guiana Consolidated.**—5%, payable Jan. 10.

†**Bushtick Mines (1934).**—2½%, payable Dec. 18.

***Central Mining and Investment.**—4s. 6d., payable Dec. 6.

†**Consolidated African Selection Trust.**—35%.

***Consolidated Tin Smelters.**—Pref. 3½%, payable Feb. 14.

†**Daffo (Northern Nigeria) Tin Mines.**—8%.

†**Electrolytic Zinc Co. of Australasia.**—7½%, payable Dec. 11.

***Fresnillo Co.**—$0·54½, payable Dec. 20.

***Frontino Gold Mines.**—Pref. 2¾%, ord. 2%, free of tax, payable Jan. 1.

***Homestake Mining.**—40 cents.

†**Imperial Smelting Corporation.**—5%, payable Dec. 28.

†**Jantar Nigeria Co.**—25%, payable Dec. 20.

†**Kleinfontein Estates.**—10%, payable Dec. 13.

***McIntyre Porcupine.**—50¼ cents.

†**Malayan Tin Dredging.**—5%, payable Dec. 20.

†**Mount Coolon.**—6d. (Australian), payable Jan. 10.

Naraguta Extended Areas.—†3% and *2%, payable Dec. 17.

†**Naraguta Karama Areas.**—2%, payable Jan. 7.

†**Nigel Van Ryn Reefs.**—6d.

***Placer Development.**—25 cents, payable Dec. 18.

†**Rand Selection Corporation.**—2s., payable Jan. 23.

†**Rhodesian Anglo American.**—10%.

†**Rhokana Corporation.**—9s., payable Dec. 19.

South Bukeru Areas.—†4% and *3%, payable Dec. 10.

†**South West Africa Co.**—1s. 6d., payable Jan. 1.

†**Southern Malayan Tin.**—5%, payable Dec. 19.

Sulphide Corporation.—Pref. 5%, payable Jan. 15.

†**Tin Fields of Nigeria.**—3½%, payable Jan. 16.

†**Transvaal and Delagoa Bay Investment.**—4s. and 2s. bonus.

†**United African Explorations.**—6¼%.

†**Van Ryn Gold Mines Estate.**—1s., payable Feb. 13.

***Victoria Falls and Transvaal Power.**—Pref. 7%, Ordy. 4½%, payable Jan. 1.

†**Wankie Colliery.**—5%, payable Dec. 7.

***West Witwatersrand Areas.**—6d., payable Feb. 14.

***Zinc Corporation.**—Pref. 2¾%, Ord. 2s., payable Jan. 1.

METAL PRICES

Aluminium, Antimony, Copper, Lead, Nickel, Tin, and Zinc per Long Ton ; Platinum per standard oz. ; Gold and Silver per fine oz. ; Wolfram per unit.

	£	s.	d.
Aluminium (Home)	72	15	0
Antimony (Eng. 99·6%)	125	0	0
,, (Crude 70%)	100	0	0
Copper (Electro)	98	0	0
Lead (Soft Foreign)	55	0	0
Nickel (Home)	£190–£195		
Tin	380	10	0
Zinc (g.o.b.)	55	0	0
Platinum (Refined)	18	0	0
Silver		4	7½
Gold	8	12	3
Wolfram (Buying f.o.b.)	3	2	6
,, (Selling, Delivered)	3	7	6

War-Time Inventions

By S. T. Madeley

A review of the work facing the Royal Commission on Awards to Inventors.

Introduction

Following the precedent set after the 1914–1918 war the Crown has now appointed a Royal Commission on Awards to Inventors who have helped the recent war effort. The present Commission has as its chairman a Lord Justice of Appeal, Sir Lionel Leonard Cohen. Other members of the Commission are : Sir John Henry Maitland Greenly, Sir James Rae, Sir Albert George Lee, Sir William Arthur Stainer, Mr. Kenneth Raydon Swan (the well-known K.C. who is chairman of the Board of Trade Departmental Committee on patents), and Mr. George Macdonals Bennett. A Claimant is thus assured of a hearing by Commissioners who are legally and technically well equipped for the job.

Sir Charles H. Sargant, the eminent Chancery Judge, with great experience in patent cases, was the chairman of the earlier Commission which also contained Lord Rayleigh and Mr. W. Temple Franks (the Comptroller-General of Patents), Sir J. J. Dobbie, Mr. G. L. Barstow, Sir H. J. Mackender, Mr. A. Clayton, and Mr. R. F. Young and could grant up to £50,000, *plus* outlay etc. This Commission sat for 15 years. With the spate of invention which the present war brought forth it would be idle to conjecture how long the present one will function and how much it will award.

Factors Governing Awards

As in the case of its predecessors the new Commission will have to hear and decide on applications under Section 29 of the Patents Act, which states that " A patent shall have to all intents the like effect as against His Majesty the King as it has against a subject " and then goes on to make certain provisions when this is not so. These amount in effect to giving the patentee the right to compensation or remuneration for Crown use, as against the right of prevention which he has against another subject.

Section 58a (which relates in a similar manner to registered designs) also comes within the ambit of the Commission's activities, according to the Royal Warrant. So do unpatented inventions etc. which have helped the war effort and so do cases coming within the 1946 agreement between this country and the United States relating to " Interchange of Patent Rights and Information."

The Commission is authorized to sit in two divisions, as the chairman may determine, and to call in remunerated assessors to assist. Also the Commission may call for spoken and written evidence, books, and so on. They may visit and inspect places where expedient. From time to time matters before the Commission may be adjourned. The powers and privileges of the Commissioners are exercisable by them individually. The Arbitration Act does not apply. From time to time the Commission is to report their proceedings to the Treasury and may do so to the Crown.

Past Principles

As it is not outside the range of possibility that the principles which guided the old Commission with its work, and under which for example they awarded £1,500,000, may find favour with the new Commission it will be of interest now to summarize these principles.

The old Commission started with the premise that under Section 29 the Claimant had to establish the validity of his patent and a Crown user which would in effect be infringement if it were not for the proviso of the section. This was, in fact, the procedure adopted, except where the dispute was not very serious and the Claimant and the Crown had been willing that this strict procedure should be waived. The price was not to be extortionate so as to exploit the needs of the Nation, but the Crown had to pay an adequate price, although the inventions might only be useful for military and naval operations and so on, which would have restricted customers to Government Departments.

Under the Section the Crown, through its Departments and Contractors, took the position of a statutory licensee, although of course, most advantageously, because the Crown could exercise the license at its option when and to such an extent as it desired, and the times of user the Crown could have settled to cover the past or the future. Properly

interpreted the section meant that such a price should be fixed as would be fair and reasonable and arrived at between a licensor and a licensee both willing to bargain on equal terms.

A royalty usually forms the basis of private bargaining and is calculated on one or more units according to the kind of article in question. In the case of a very large quantity the royalty may be much diminished. The patentee's profit may bear little relationship to the technical merit of the invention. Great importance may be attached to exceptional use of an invention. The amount of the royalty percentage on the patented article is affected by many factors—for example, the advantage or saving over competing devices in its use, its cost, and its relationship to the remainder of the construction.

The above considerations applied to a normal and simple case, where the patent was valid and the patentee stood in no special relationship to the Crown, but there were other cases where this was not so. Deduction had to be made in cases where there was doubt as to the validity of the patent or the user, or to both these factors, because there was a risk of the patentee not being able to establish these points. Often the inventor was in the Services or was employed by the Air Ministry or by the Ministry of Munitions. Special regulations applied to such people, Departmental representatives being joined as patentees. Strictly such inventors were not patentees. Remuneration had to be decided by the Admiralty, the Army Council, or the relevant Ministry.

When the Commission, by agreement, were asked to fix the remuneration they took into consideration the conditions, regulations, inventive merit, the claimant's position, and Departmental assistance, the reward being regarded as discretionary. Any benefits to the claimant arising out of permission given by the Department to the inventor to exercise patent right for his own purposes had also to be considered.

Other cases arose where the inventor did not take out a patent, either because of a request by a Government Department or because of public policy. The inventor was then treated as if he had taken out a patent, with possible modification of his position for reasons above indicated.

Diminution of the Award was made where the claimant, though not in the Services or in the employment of the aforesaid ministries, yet had special facilities or assistance for apprehending and solving a problem during his employment under the Crown.

Where patents had lapsed or expired before or during Crown user they were not recognized as conferring any right to claim for user after the patent had lapsed or expired.

Where there was an agreement or pending agreement as to the terms of user between the Government Department and the patentee, when so requested, the Commission gave its approval to the agreement after satisfactory inquiry that the agreement had been made and was a proper one.

The Commission also considered unpatented inventions—namely, those in which inventions, designs, drawings, and processes enjoyed no statutory right to compensation for Crown user, yet appeared to entitle the author, inventor, or owner to some remuneration for the said user by way of bounty of the Crown. This bounty was entirely within the discretion of the Crown. Here the subject matter was less strictly defined than in the case of patented inventions. Furthermore the duties and powers of the Commission in these cases only arise at the Treasury's request. Unless these cases were referred to the Commission by some Government Department they were first of all sifted by an Investigating Committee, constituted initially by the chairman and the secretary of the Commission. A preliminary examination was made on available written materials.

A request for a personal hearing before the Committee was never refused. Actually, of the 1,834 applications made to the Commission, 369 were dealt with by the Commission directly and 1,465 were dealt with in the first instance by the Investigating Committee. Of these latter 846 were withdrawn or abandoned, 75 were referred to and heard by the Commission, 544 were rejected by the Committee, and in 200 cases the claimant made personal appearance.

The Commission actually heard 444 cases. The claimant had to prove in respect of an unpatented invention requirements analogous to real invention—utility and sufficiency of description—that is to say, there had to be some definite degree of novelty and inventive merit and trifling utility (such as slight or partial adoption of the invention) was of little avail. In addition the idea had to be definitely reduced to practical working shape. It was important, when there were several claimants, for the claimant to show that a

link in the chain of causation leading to the use of the main invention was formed by his device or invention.

Although extent of use was an important consideration others were also taken into account—such as, the difficulty and importance of the problem in question, the effort and time required for the solution, the inventive merit shown, and any reward which the inventor got from other sources. It would scarcely be possible for unpatented inventions to receive higher remuneration than those which are patented.

An inventor's claim was affected by his position relative to the Crown, especially if he were in a branch connected or interested in the relevant subject matter. Particularly was this the case with permanently-commissioned officers, who had more facilities and opportunities for inventing and developing a needed device than an outsider had. As a rule, of course, the more the officer by reason of his service was brought into contact with the subject matter with which the invention was concerned the greater the allowance that was to be made for this. A Government contractor also might have his invention discounted for reasons of a similar nature. In addition he probably made more profit on existing contracts or obtained others on account of his invention. There was less occasion for exercising the Crown's bounty when a service inventor had been allowed to commercialize the invention for his own benefit.

Discount was also allowed where an independently-discovered invention was developed with the aid of a Government Department financially or with the help of the Departmental Staff. Each case was dealt with in the light of all its circumstances.

Colombian Survey

By N. W. Wilson, A.R.S.M., Assoc. Inst. M.M.

(*Concluded from the November issue, p. 292.*)

Geology

In spite of the labours of Dr. Robert Scheibe and his scientific commission between 1917 and 1933 the geology of Colombia is still so little known that it can be discussed only in general terms. With respect to the age of the rocks, a subject which is controversial, a table outlining the relationships is given in Table 6.

The Plutonic intrusions of Palæozoic times (strongly represented in the Sierra Nevada de Santa Marta) were succeeded by effusions which continued until the end of the Mesozoic age. To this period may possibly be attributed the platiniferous basic intrusions and effusives in the Cordillera Occidental.

Towards the close of the Upper Cretaceous, as a part of the Andean orogenic processes, trough faulting began which has continued until the present day. Three main trough faults are distinguishable ; these are :—

(1) The San Juan–Atrato trough.
(2) The Cauca–Patía trough.
(3) The Magdalena–Cesar trough.

These subsidences have divided what was, in its inception, a single mountain massif into four ranges : The Cordillera Oriental and Cordillera de Perijá ; the Cordillera Central with the Cordillera Nevada de Santa Marta and the mountainous Peninsula of La Goajira ; the Cordillera Occidental, and the Cordillera Chocó. The faults bounding the troughs were lines of least resistance for the ascent of the effusives poured out at intervals since the close of Cretaceous times and it is not surprising therefore that vulcanism was, and is, most intense near the Cauca valley and towards the southern end of the Magdalena valley where agglomerates, tuffs, and ash cover large areas. The most important eruptive rocks in this period of igneous activity are acid or intermediate and it is near them that most of the Colombian gold and silver deposits occur. Repeated periods of uplift have resulted in successive reconcentrations of the heavy minerals in alluvial gravels with important economic consequences.

Except for the region about the Sierra Nevada de Santa Marta and parts of the northern end of the Cordillera Oriental, in the departments of Santander, the Magdalena

Table 6

Tectonic Features	*Age*	*Local Nomenclature of Series*	*Lithology*	*Thickness (ms.)*	*Eruptives*
Geoanticlinal phase.	Recent, Quarternary, and Pliocene.	Piso de la Sabana.	Glacial and lacustrine deposits.	0– 300	Neovolcanic group and related instrusives : Basalts, andesites, dacites, rhyolites, trachytes, tuffs.
		Discordance.			
	Upper Miocene.	Discordance. Piso de la Tilata.	Conglomerates, clays, and shales.	0– 50	
Transition from geosynclinal to geoanticlinal phase ; uplift and trough-faulting began.	Middle to Lower Miocene.	Discordance. Piso de Bogotá.	Sandstone and shales.	700	Monzonite.
	Oligocene to Eocene.	Piso de Guaduas.	Shales, coals, sandstones and slates.	500– 800	
Geosynclinal phase.	Upper Cretaceous.	Piso de Guadalupe.	Sandstones and shales, some coal.	700–1,200	Paleovolcanics and related intrusives :
	Middle Cretaceous.	Piso de Villeta.	Slates, sandstones with anthracite.	1,000–1,200	Diabase, melaphyre, porphyries.
	Lower Cretaceous.	Piso de Girón.	Sandstones, slates, schists, and quartzites with basal conglomerate.	3,000	Diorites, gabbros, peridotites, granites, syenites.
	Permian.	Piso de Soapaga.	Red schists more or less phyllitic, red conglomerate.	200	Nickeliferous serpentines.
	Upper Carboniferous.	Piso de Gachalá.	Limestone, grey and red sandstones, slates.	?	
	Cambrian.	Serie de Guetame.	Chlorite schists, quartzites, and conglomerates.	?	
	Pre-Cambrian.	Pre-Cambrian.	Amphibolite and hornblende schists, gneiss, etc.	?	?

trough fault may be taken as the approximate eastern limit of the crystalline complex. This complex forms the backbones of both the Cordillera Central and the Cordillera Occidental. Exposures of crystalline rocks are, however, more common in the Cordillera Central, in which the volcanic covering is not so thick and widespread, than in the Cordillera Occidental. The core of the Cordillera Central is essentially granite with the schists more prominent on the flanks.

The Cretaceous rocks are extensively developed east of the Magdalena River and make up the greater part of the Cordillera Oriental. They extend westwards across the valley and are found on the lower eastern slopes of the Cordillera Central as a band which is in places wide.

A Cretaceous age has been ascribed to the sediments flanking the Cauca valley on either side, but it seems more probable that these are tertiary.

Tertiary strata occur chiefly on the slopes of the western side of the Cordillera Occidental ; in the Cordillera Chocó where ferruginous conglomerates and sandstones predominate ; in the Cauca and Magdalena valleys ; in an inland belt parallel to the Caribbean coast, where limestones are prominently represented, and in the Oriente.

The Quarternary age is represented by the river terraces that are particularly well developed along the Magdalena and its tributaries ; the sediments along the lower courses of the rivers, and the beds of pebbles, sands, and clays of marine origin along the Caribbean coast.

Mineral Deposits

Gold

Although close to intrusions and effusions of rocks belonging to the Neo-Volcanic group gold and silver deposits occur in sediments of all ages ; they are commonest in the Pre-Cretaceous group. The greatest number is therefore found in the Cordillera Central in the departments of Antioquía, Caldas, Tolima, and Huila. In the Cordillera Occidental, departments of El Valle, Cauca, Nariño, and the Chocó fewer mineralizations are known. However, in the Chocó, between 1861 and 1928, about 2,300 precious-metal mines were proclaimed of which 25% were vein deposits. The apparently lesser degree of mineralization may possibly be explained by the thick mantle of tuffs and the dense vegetation which must have hindered prospecting. It seems probable that much of the gold in the Chocó-Nariño placers is derived from stockworks. Mineralizations also occur in the

Cordillera Oriental near Bucaramanga and Pamplona in the Department of Santander. In the Sierra Nevada de Santa Marta, composed mainly of Palæozoic eruptives, gold mineralization, although it exists, has little practical significance.

Two ages of gold mineralization have been distinguished, the first predominantly auriferous, yielding gold with a fineness of 700 or more, the second and later, predominantly auro-argentiferous, the fineness of the gold being less than 700. In the table below is given the sequence of mineralization at a mine at which gold of both ages is said to be present :—

(*Old*)	(1) Dolomite and ankeritic carbonates.
	(2) Quartz + sulpho-salt minerals of base metals + gold 700 fine or more. Most of gold is in solid solution in base-metal minerals ; some is free.
	(3) Quartz.
	(4) Ankeritic carbonates, galena and blende.
	(5) Quartz, stibnite, tellurides, arsenopyrite, and gold. The gold is usually but not necessarily less than 700 fine ; the majority of it is in solid solution in the base-metal minerals.
(*Young*)	(6) Calcite.

The universal application of this distinction in Colombia remains to be established. It is quite possible that the two ages of gold mineralization are not separated by a long interval of time, but are pene-contemporaneous or even coincident.

Ores ascribed to the first period of mineralization usually occur in Palæozoic schists and granite as quartz lenses connected by thin stringers. The lenses are usually more persistent in depth than in strike. Mineralization is thought by some to have occurred during Palæozoic times, but the invariable proximity of the deposits to intrusions of monzonite or to dykes and extrusions of dacite and andesite belonging to the Neo-Volcanic group makes a Tertiary age more probable. Ores attributed to the second period of mineralization, which is undoubtedly Neo-Volcanic or Tertiary, generally occur as persistent veins, ranging in thickness up to 20 m., but averaging 1 to 2 m., in sediments and volcanic rocks. In both types of mineralization the wall rocks are usually auriferous for varying distances from the quartz lenses. Respecting susceptibility to cyanidation and amalgamation ores of the second period of mineralization are considered to be more refractory than those of the first. Though occurrences in Palæozoic rocks are often associated with graphitic schists (as at the Timmins Ochali mine) the solution of the problems set by the graphite which consequently appears in the ores seems to be comparatively easy.

The gold occurs, as in other parts of the world, chiefly in shoots and continuous strikes of payable values are exceptional. However, in auro-argentiferous types of mineralization it is quite common for the silver and base-metal values to persist throughout, although the gold is localized in shoots. Blende and tetrahedrite in unusual concentrations often herald exceptional gold values. Auriferous ore-bodies in general are of a size which justifies a mill with a capacity of not more than 100 tons daily.

Weathering and softening of the country rocks usually extend downwards for from 50 to 60 metres, but oxidation of the sulphides in the ores is often much shallower. Outcrops of large veins are frequently masked or completely hidden by dense undergrowth and thick overburden. Secondary enrichment, possibly because of the abundance of carbonates, is conspicuous by its absence.

Placers.—Reconcentration of placer deposits by successive periods of uplift and consequent rejuvenation of streams is the secret of the richness of Colombian alluvial gold and platinum. Its effects are particularly marked in the valley of the Cauca and its tributaries.

Placers may be classed as :—

(1) Old placers.
(2) Recent placers derived from (1).
(3) Recent placers not derived from (1).
(4) Eluvium.

The older placers that have not been reconcentrated—as, for example, those in the Cauca valley below Valdivia—are usually too poor to be worked. Gold is distributed from the surface downwards, but is chiefly located in paystreaks near bedrock. In the Porce River gravels (class 2) the bulk of the gold is found in narrow channels up to 25 ft. wide within a few feet of bedrock. The depth of gravel may be from 40 ft. to 70 ft., the average diameter of the boulders being 4 ft.

Table 7

Sample No.	% *Au*	% *Ag*	% *Pt*	% *Os, Ir*
1	86·1	2·0	0·5	0·1
2	86·6	8·5	0·8	0·1
3	86·5	8·8	0·7	0·2
4	85·1	8·4	0·5	0·2
5	90·1	8·2	0·4	—
6	90·0	8·7	0·5	—

Nuggets are fairly common and auriferous quartz boulders are often crushed and milled. The fineness of the gold is from 600 upwards. In Nariño the metal is usually associated with small quantities of the platinoids as shown by the analyses given in Table 7.

Unoccupied claims are scarce even in the San Juan-Atrato valleys and, in general, it is a waste of time for the engineer to examine small streams. Larger streams, in which the bedrock is deep and inaccessible, without machinery, may, however, contain commercially significant deposits some of which may even be virgin. At present expansion in the gold industry has ceased, as, on account of the uncertain future of the metal and the difficulty in importing machinery, investors are unwilling to put capital into new enterprises.

Silver

Silver is at present chiefly recovered as a by-product from gold mining. It is usually associated with gold in galena, zinc blende, pyrite, and chalcopyrite, but sometimes occurs as silver minerals—*e.g.*, argentite, proustite, stephanite, cerargyrite, etc.—that are visible to the naked eye. In Northern Tolima—notably, at the Frias mine near Guayabal—ore-bodies were formerly worked for silver. It is said that after a long abandonment they have been revived to satisfy the American demand for silver as a substitute for tin.

Platinum

So far only the alluvial occurrences in the Chocó have been worked. The immediate sources of the platinum are low-grade gravels known as *caliche* that form a belt in the foothills of the Cordillera Occidental. Streams that have cut down through this *caliche* have reconcentrated the black sands it contains, thus raising the content of platinum to a payable level. The ultimate source of the platinum is probably the basic volcanics and intrusives of the Cordillera Occidental. Minerals commonly associated with the platinum which occurs as rounded grains and nuggets weighing up to 3 lb. are chromite and magnetite. The crude platinum contains in general 85% platinum, 5 to 8% iron, 0·5 to 1% palladium, 1·4 to 3·5% rhodium, and 0·5 to 1·5% osmiridium. About 45% of the platinum is won by native washers with the batea ; the remainder is dredged from beds of gravel, with depths up to 30 ft. in the larger streams.

Other Minerals

Copper.—At present copper deposits in Colombia are only worked on a very small scale to supply local demand. Ore-bodies are of two types :—

(1) Auriferous quartz veins carrying chalcopyrite, chalcocite, and bornite.

(2) Disseminations and impregnations in sandstones, fault breccias, and basic igneous rocks.

The tonnage available from the first type of occurrence is limited and the information about the second type does not permit its commercial importance to be assessed. An auriferous quartz vein rich in copper might make a profitable small mine if there were facilities for smelting and a big enough local demand for copper.

Lead and Zinc.—Colombian lead-zinc deposits are of two types :—

(1) Auriferous quartz veins carrying blende and galena.

(2) Bodies of galena formed by replacement of limestone.

About neither of these types is there sufficient information to permit any conclusions of value to be drawn. The economic significance of the deposits depends upon whether there is a big enough demand for base metals in Colombia to justify the erection of a smelter. At present a deposit of galena is being worked at Ubaté on a small scale for the production of white lead for paint. An occurrence of zinc blende at Cachetá, Cundinamarca, is being exploited also on a small scale as a source of zinc oxide (zinc white).

Tin.—Although cassiterite has been observed in the auriferous gravels of Ocaña no attempt has yet been made to recover it.

Mercury.—There is a discontinuous belt of cinnabar ores extending from Santa Rosa in Antioquía to Miraflores in Tolima. Occurrences are also known near Iscuandé in Nariño. At Quindío in Tolima and at Iscuandé in Nariño cinnabar occurs with quartz and carbonates as stringers in chloritic and graphitic schists and phyllites near bosses of monzonite and andesitic and trachytic dykes. Values at Quindío average about 0·27% mercury. Mining has been attempted and abandoned at both Quindío and Iscuandé. As the vegetation at Quindío is very dense it is quite possible that a loaming campaign might discover richer deposits than those that have been exploited.

Fig. 5.— The Colombian Coalfields.

Chromite and Manganese.—Though deposits of these metals exist they are unlikely to be worked for many years to come as they are situated too far from the sea.

Emeralds.—Emeralds occur with calcite and ankerite in black carbonaceous sediments of lower Cretaceous age. These sediments are distributed over large areas in the Sabanas de Bogotá. Mining is the prerogative of the Government and is concentrated round a few points : Nemocón, Somondoco, and Coscuez. At Muzo the quarries have been abandoned and are rapidly caving and becoming overgrown. Production of emeralds is intermittent as the Government wishes to maintain the price of the stones at a profitable level. For every emerald about seven times as many colourless or off-colour beryls are found. It is thus possible that Colombia may become an important source of beryllium, if it has not done so already.

Iron.—The small comparatively low-grade deposits of iron ore (principally sedimentary) in Colombia are badly situated for export. On the other hand, the internal demand for iron and steel is probably too small at present to justify the establishment of a Colombian steel industry except in the exigencies of war-time. Nevertheless production may be continued in peace-time for political reasons.

Salt.—The working of salt mines is a prerogative of the Government. Deposits of rock salt and brine springs are numerous.

Graphite, Asbestos, and Mica.—All these minerals are known in Colombia and unsuccessful attempts have been made to work the mica from time to time. Very little information is available about the occurrence or qualities of Colombian base minerals. The Spanish prospector is proficient in the search for minerals which are heavy or have a

metallic lustre : in minerals without these qualities he is little interested.

Coal.—Coal occurs in strata of Eocene and Oligocene age. The chief producing mines are near the towns of Cali, Bogotá, Medellín, Zipaquirá, and Titiribí. Large but inaccessible areas on the eastern flank of the Andes in the basin of the Putumayo may be underlain by coal ; excluding this source, reserves are estimated at 18,000,000,000 tons. Annual consumption averages at present about 300,000 tons yearly. Its smallness may be ascribed to the use of wood for household fuel, to generation of power hydro-electrically or with the aid of oil, and to difficulties over transport. Proximate analyses of Colombian coals are given in Table 8. Details about anthracites of Cretaceous age that are said to occur are lacking.

Table 8

			Rio Taraza.	
% *Content.*	*Palmichal.*	*Sitioviejo.*	(1)	(2)
Moisture	11·02	1·40	13·6	15·36
Volatiles	44·03	35·58	38·1	47·41
Fixed carbon	43·75	58·54	44·4	32·67
Ash	1·20	4·48	3·8	4·56
Sulphur	·07	·46		0·55
B.Th.U.	9,608	14,145		

Mining

Most of the gold mines worked by the Spaniards were abandoned when the bottom of the zone of weathering was reached or when the recovery from the ores in the sulphide zone was no longer payable. As a consequence there is a good chance of finding payable mines below caved ground if the heavy initial cost of exploration can be borne and if there is enough capital available to finance the erection and transport of modern mills capable of treating refractory ores successfully. Most of the crude native mills are content with recoveries of 50 to 60%, but Timmins Ochali Mining Co. have shown that modern methods can recover 90% and more of the gold. In order to determine whether crude methods with small capital outlay and poor recovery or modern methods with big expenditure and high recovery shall be employed, all the factors involved must be very carefully studied and evaluated. Costs of exploration might at some prospects be considerably lessened by loaming, a technique which seems to be unknown in Colombia or, in any event, to be little used.

For the working of alluvial gold and platinum deposits dredging and hydraulicking are the methods favoured by companies. Dredging is practised in the Chocó and in Nariño. In the Chocó power is generated hydro-electrically. Hydraulicking is being increasingly employed in the Cauca Valley and is particularly effective for high values and great depths of gravel such as are found in the Cauca tributaries. Exceptionally "deep leads" are mined by driving in the Australian fashion.

The Cordillera Oriental, which consists mostly of Cretaceous and post-Cretaceous sediments, is not particularly favourable to the occurrence of extensive mineralizations. Nevertheless, as transport improves prospectors may discover areas in which the volcanic rocks responsible for ore deposition outcrop.

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Miner's Anæmia

By W. Schweisheimer, M.D.

The author discusses the incidence and prevention of the hookworm diseases.

The cause of miner's anæmia was clarified in 1882 when Perroncito discovered that it was due to an infection with hookworm or ankylostoma. This is a thread-like blood-sucking worm which attaches itself to the walls of the intestines by hooklets and sucking disks on its head. The worms destroy part of the red blood cells, as well as their vital hæmoglobin or red colouring matter. A miner seriously affected looks pale and bloodless—" anæmic."

There are two kinds of ankylostoma—*ankylostoma duodenale*, the European kind, and *ankylostoma americanum* or *necator americanus*, the American variety. The two varieties cause the same troubles after they have invaded the human body. The eggs are discharged in the stools of an infected person and the larvae, when hatched out, get into water.

Infection generally takes place through the skin. If a miner treads on infected ground with bare feet, or gets larvae, etc. on his hands, they begin to bore through the skin, particularly between toes or fingers. A local inflammation is produced, which is called " ground itch ". The larva enters a blood vessel and in this way comes to the stomach and small intestines, where it grows and develops to a hookworm. Several thousand worms may be clinging to the intestines in severe cases—which, fortunately, are not frequent.

Anæmia in the History of Mining

One of the most striking epidemics of hookworm's disease occurred among Italian workers labouring in the St. Gotthard tunnel. It affected thousands of workers and has been estimated to have caused 10,000 deaths from anæmia about 1882. At that time it was called tunnel disease. The infections occurred, however, only in the absence of necessary precautions and not a single case occurred later among the 25,000 workmen employed in tunnelling the Simplon.

Miner's anæmia is a very old disease; it was well known in antiquity. In ancient Roman scriptures the pallor of miners has frequently been mentioned. This was attributed partly to the poor ventilation of the mines in connexion with their foul air, but G. Rosen has emphasized that the paleness of the Roman slave-miners in Spanish mines was probably due to ankylostomiasis. Even to-day it is endemic in Spain and was probably just as frequent in ancient times.

The miners at that time disposed of their excrements in the galleries and since they went barefoot while at work, they were particularly exposed to hookworm infection.

In 1822 Ph. Patissier described anæmia as a disease which attacks coalminers. For 11 years, he said, all the miners in a certain gallery of a pit at Anzin, near Valenciennes, were attacked epidemically. The signs presented by the miners were at first violent colic, pains in the abdomen, flatulence, passage of blackish-green fæces, difficulty in breathing, palpitation of the heart, and general prostration. The face became swollen and the miner was covered with sweat. This acute stage was usually followed by a chronic stage which lasted several months and was characterized by general weakness and loss of weight. Part of the cases had a fatal end.

The description given by Patissier is so clear that Rosen has no doubt that the disease was ankylostomiasis. The disease was quite frequent at that time. It had appeared in Hungary where 1,200 miners were attacked and in several coal mines in France. In 1860 Kuborn, in a study of Belgian miners, regarded anæmia as the most frequent occupational disease. In England, in 1906, ankylostomiasis was included in the list of miners' diseases provided for by the Workmen's Compensation Act. In mines of the United States the disease has been studied by a joint investigation by Marine Health and Hospital Service and the Bureau of Mines. The Bureau has reported its presence among some southern coal-mine workers, but miners in most districts of the United States have been but little affected. A special opportunity for spread of the disease is supposed to be in mines where ladders are used, to which may stick infected earth which has been brought by boots.

Symptoms and Prevention

The main symptom of the disease is anæmia; the skin looks pale and the body starved. Pain in the stomach and intestines is frequent, although sometimes a perverted appetite is observed which leads to eating of earth, clay, or paper. The hæmoglobin percentage may fall as low as 30% of normal. In severe cases of miner's anæmia breathing is difficult and the heart is affected. Children sometimes show very severe symptoms, "hence the importance of eradicating the disease, whether in a mining or other community" (G. S. Rice). An exact diagnosis can be made only by the discovery of eggs of the worms in the discharges of the bowels, an examination which can be carried out only with the aid of the microscope.

The adult worm is about 10 to 20 mm. in length. The larvae come from the egg, hatching in one or two days under favourable conditions of air, heat, and moisture, into the tiny worm. They develop easily when they fall upon warm soil.

Here are some preventive measures which have proved to be effective. The Rockefeller Foundation has inaugurated a world-wide campaign against hookworm disease, which, in several countries, has produced satisfactory results. Proper sanitary precautions in and about mines and homes are necessary; in this connexion Rice mentions the compulsory use underground of portable sanitary latrines, which must be daily cleaned and disinfected on the surface. In mines where ankylostomiasis is found lime should occasionally be sprinkled along roadways, gangways, or entries as a disinfectant and the resting places where lunches are eaten should be whitewashed. In collieries, Rice says, calcium chloride will answer the same purpose and be of assistance in compacting coal dust.

Other preventive measures include the use of shoes or boots without cracks or holes and leather gloves, cleaned frequently with antiseptic solutions. There is a widespread belief that many cases in the Southern States of America, where the disease is common among the bare-footed population, could be prevented if the South would go shod.

Fortunately mild cases of ankylostomiasis are most common; they show less definite signs. The disease yields comparatively easily to proper treatment. In some cases, however, prolonged treatment with several drugs is necessary before healing has been attained. A number of drugs are used for destroying the worms—such as, thymol, santonine, malefern, oil of chenopodium, and others. As in other infectious diseases, some miners may be infected in such a mild degree as not to produce any signs of illness, although they are harbouring larvæ or worms. They are "carriers" and are very well capable of infecting other people with whom they come in contact. The disease may be confused with other causes of anæmia, or may be mistaken first for simple malnutrition; microscopic examination of the stools alone will bring about the decisive diagnosis.

The Three Point Problem

By E. A. Eveleigh-Smith.

The author expounds a solution less tedious than others in common use.

Introduction

The solution of the well-known "Three Point Problem" given here is based on a graphical method used by navigators to obtain a fix by horizontal sextant angles when it is either inconvenient or impossible to use a Station Pointer.

So far as the writer is aware no previous attempt has been made to work out an analytical solution along these lines and the only motive for such an investigation is that of finding a solution less tedious than those in common use. It is claimed that this method is, in fact, slightly less tedious than either Bessel's method, or the Auxiliary Angle method, while it has the additional advantage over the latter of requiring a knowledge only of those formulae which are normally used in the solution of triangles.

Method

The method is based on the fact that the position line given by the observation of the horizontal angle subtended by two points is the segment of the circle which contains this angle and that the necessary fix is given by the intersection of two such position lines.

Referring to the accompanying figure, A, B, and C are points whose co-ordinates are known; the observer is at P and the observed angles are θ and ϕ; the corresponding position lines are the segments of the circles whose centres are O_1 and O_2 and whose radii are r_1 and r_2 respectively.

It can be easily proved that :—

$$r_1 = \tfrac{1}{2} AB \text{ Cosec } \theta$$
$$r_2 = \tfrac{1}{2} BC \text{ Cosec } \phi$$
$$\text{Angle } O_1BA = 90° - \theta$$
$$\text{Angle } O_2BC = 90° - \phi$$

and hence that

$$\text{angle } (\alpha + \beta) = A\hat{B}C + \theta + \phi - 180°$$

Then in the triangle O_1BO_2, since the two sides and the included angles are known and since the line joining the centres of two circles bisects the common chord at right angles :—

$$\text{Tan } \tfrac{1}{2}(\alpha - \beta) = \frac{r_1 - r_2}{r_1 + r_2} \text{ Cot } \tfrac{1}{2}(\alpha + \beta)$$

or if $r_2 > r_1$

$$\text{Tan } \tfrac{1}{2}(\beta - \alpha) = \frac{r_2 - r_1}{r_2 + r_1} \text{ Cot } \tfrac{1}{2}(\alpha + \beta)$$

Whence α can be determined and BP $= 2r_1 \text{ Cos } \alpha$

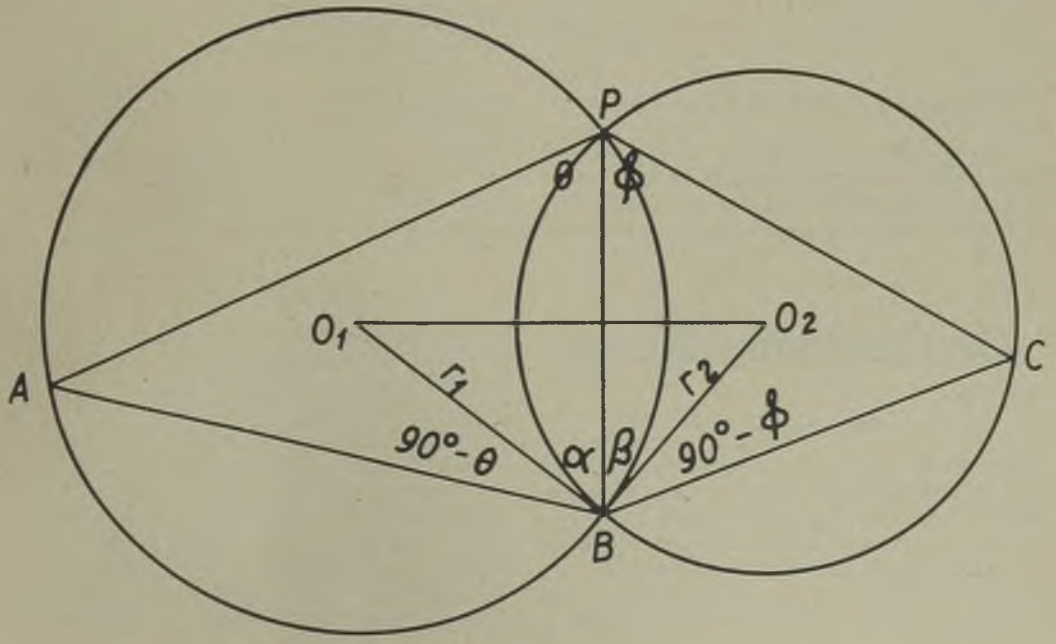


Table 1

Line.	*Length.*	*Bearing.*		*Hor. Angle.*
AB	3068·49	186° 44′ 15″		
BC	2896·36	210° 50′ 41″		204° 06′ 26″
	90° − θ	28° 47′ 50″		
	90° − ϕ	53° 23′ 43″		
	Sum	82° 11′ 33″		
	$\hat{A}BC$	204° 06′ 26″		
	Diff. $(\alpha + \beta)$	121° 54′ 53″		
	$\frac{1}{2}(\alpha + \beta)$	60° 57′ 27″	L. Cot.	9·744511
$\frac{1}{2}$ AB 1534·25 Log	3·185896			
θ. 61° 12′ 10″ L Cosec	10·057333			
	3·243229	r_1 1750·77		
$\frac{1}{2}$ BC 1448·18 Log	3·160823			
ϕ. 36° 36′ 17″ L Cosec	10·224542			
	3·385365	r_2 2428·64		
		Sum 4179·41	Colog	6·378885
		Diff. 677·87	Log	2·831147
$\frac{1}{2}(\beta - \alpha)$	05° 08′ 47″		L. Tan	8·954543
$\frac{1}{2}(\beta + \alpha)$	60° 57′ 27″			
α	55° 48′ 40″		L. Cos	9·749676
90° − θ	28° 47′ 50″	$2r_1$ 3501·54	Log	3·544259
Bearing BA	06° 44′ 15″	BP	Log	3·293935
Bearing BP	91° 20′ 45″		L Cos	8·370829
			L Sin	9·999880
	D. Lat.	46·21	Log	1·664764
	Dep.	1967·05	Log	3·293815
	Co-ordinates of B	2486·70	1485·00	
	Co-ordinates of P	2440·49	3452·05	

Bearing BP = Bearing BA + (90° − θ) + α

The co-ordinates of B are known and the length and bearing of BP are known, hence the co-ordinates of P can now be calculated.

For the sake of greater clarity a numerical example has been worked out in Table 1 from the following data :—

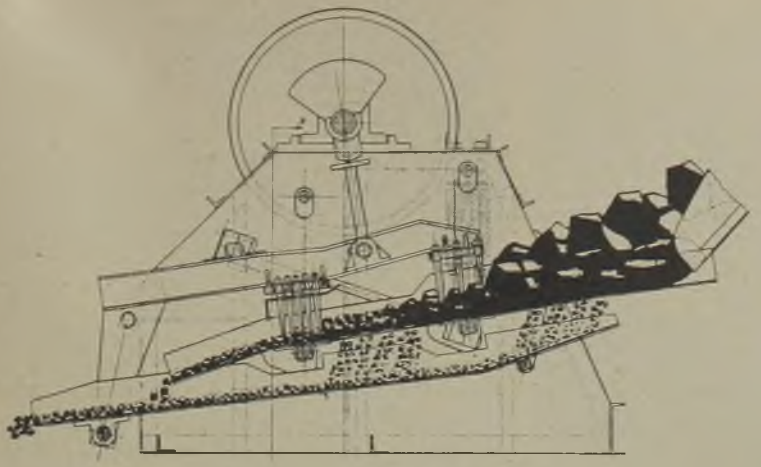
Co-ordinates of B = 2486·70 N. 1485·00 E.
Angle APB = θ = 61° 12′ 10″
Angle BPC = ϕ = 36° 36′ 17″

Ore-Dressing Notes

(23) *Coal.*

Breaking to Size

Up to 20 years ago the custom of trade was to demand large lump coal and to reject fines. The free market of those days had developed a long range of sizes and qualities to suit various trades and this, in turn, led to the invention of machines which could break down the lump material with a minimum production of fines. With coal methods of breaking for size are possible which cannot be applied to hard rock. This gap in our equipment will doubtless be filled some day, but for the present the demands of those needing ballast of certain sizes can be met by screening selection, while breaking to desired shape remains more or less beyond our technical ability. One of the oldest methods of breaking down coal was the toothed roll, single or double, and the sledging roll. In Belgium a variation of



Jigger-Type Coal Breaker.

the Chilean mill was used, with spiked instead of smooth rollers. The Germans used a hinged arrangement, the moving upper grid being armed with teeth. Thus some machines applied a localized crushing force, rolled on to the coal, and some added a stabbing impact.

Since the objective is coal with a minimum of fines and a maximum of material broken to the desired size the wrenching and shearing forces generated by any crushing point which changes its direction after the piece of coal has been seized between it and the anvil are undesirable. What is needed is a clean disrupting thrust applied normal to the surface upon which the work-piece lies, applied with sufficient force to overcome the tensile resistance of the material and at a point so as to minimize powdering and encourage cleavage. One such machine, illustrated here, developed in Britain feeds the coal on to smooth and down-sloping plates over which it can spread without meeting resistance. While it rests there a framework carrying the breaking picks is driven down. Two groups of picks are used, the first reducing raw feed to 10-in. cube and the second being adjustable to suit the work. Between blows the coal is carried forward by a reciprocating conveyor and finished material falls through to a second conveyor below either ahead of the coarse group of picks or between it and the second set. The reciprocating conveyor, which supports the coal during its breakage, is cradled on springs which yield when a stone or other uncrushable body is fed to the machine, thus avoiding damage.

(24) *Flotation.*

Cell Design

In a recent discussion of size in flotation machines E. H. Rose [1] has some penetrating things to say concerning what might almost be called the " bigger and better " ideology of these times in the field in which he is an outstanding expert. Taking for a text Professor Bailey's " Battle of the Squares and the Cubes " he reminds us " that there is one optimum size for every moving thing of this earth, be it animal or be it machine, for a given species or function under a given set of conditions." The temptation to replace several small units by one large one can be very tempting and the economic arguments for doing so formidable. Control is simplified, various components of running cost go down, and so on, but when we consider the flotation machine in terms of its function the case for mere bigness is not so simple. A cell functions in terms of air-swept volume of pulp. This involves the three dimensions of space and a fourth—dwelling time. If we consider a square cell there is a fairly sharp practical limit to its horizontal cross-section, imposed by considerations of impeller speed. Wear is proportional to the 6th power of peripheral speed, while aeration varies as the square of the diameter for a given speed. Increase beyond certain limits of impeller diameter is accompanied by reduced aeration per unit of power. Thus, Rose comments, " the battle of the squares and the cubes is at work."

There remains the third dimension of the

[1] *Eng. Min. Journ.*, June, 1946.

cell's volume—its height. The deeper the cell, the greater the volume it can aerate for a given diameter of impeller. This is sharply limited in its turn by the fact that one function of the impeller is to keep the pulp in circulation and it does this by throwing out a horizontal stream of material by centrifugal-pump action. The more vertical load we impose above this agitated stratum the less efficiently can it cope with the business of deploying its forces at right-angles to the plane of ejection. Yet power must be used to maintain the dance of the particles, so that once a sufficiently thick super-stratum has been provided to ensure effective bubble-search there seems but little point in further technical increase, while power is being wasted.

During the past few years there has been an increase in the use of a series of mechanical units in a single tank. This is not quite the same thing as an increase in single-cell size and it sets up certain difficulties. If a single long tank is used the possibilities of short-circuiting of the transient feed can only be avoided by giving it adequate length, but most of the flotation will be done on the first few feet, leaving the later units but lightly loaded. If the tank is transversely partitioned it becomes a variation on the bank of square-sectioned cells, with rather less possibility of individual control than is possible with the latter arrangement. The size of a flotation machine is not the major determinant of its flotative capacity any more than of running cost. It is fitness for the job in hand which has the last word. Without altering the size or number of cells it is always possible to improve grinding preparation, conditioning treatment, or conservation of reagents, and, by obtaining a faster float or greater specificity in reaction, to increase throughput without metallurgical back-sliding.

The relation between linear, square, and cubic dimensions in their effect upon function is one to which designers in all engineering fields must bow. The whole world to-day seems bemused by this " bigger must be better " complex.

(25) *Sizing.*

Screens vs. Classifiers

The closed circuit in wet-grinding practice is nearly always shut by a mechanical classifier. Such a tool has many obvious advantages. It can tolerate and smooth out surging. It contains its own motive power for re-elevating the oversize to the mill launder. It is a convenient conditioning tank for the addition of such things as *p*H-control chemicals. It has no fussy or delicate parts to wear out, break with rough handling, or demand highly-skilled operating control. The screen is lacking in most of these advantages. It is easily blinded, corroded, or perforated. It cannot re-elevate its oversize to the mill launder, condition a pulp, handle mild surging, or work to high capacity if the entering feed is not carefully spread across it. Working wet on ore which predominates in fairly fine sands it has the further disadvantage that once the water carrying the solid fraction of the pulp has drained through screening action ceases. This last disadvantage has now been overcome by the manufacturers, who produce a re-pulping

Mill Buildings at a Cornish Tin Property.

screen in three sections, so that the drained solids come into the searching zone of two sets of sprays as they proceed over the second and third section of screen-cloth.

In spite of the rather formidable list of things which the classifier can do and the screen cannot do there is one outstanding item on the other side of the balance sheet. The screen is a sizing appliance, while the classifier is a sorting tool. The commercial limit of wet screen sizing is of the practical order of 65 mesh for rectangular-mesh screens. One set of screen analyses given by W. M. Stephen in a recent paper[1] for a stainless-steel cloth with 0·0168-in. aperture and 0·018-in.–0·025-in. wire (mesh 31 by 8) shows 22·08% + 65 m. in the undersize and 84·20% in the oversize. If the concentrator is able to tolerate such a size analysis there is a case for weighing the relative merits of screen and classifier in cases where the ore consists of a relatively tough and light gangue with a heavy and friable sulphide.

Stephen makes the significant point in his paper, which should be studied together with his earlier one,[2] on the same subject :—

"' . . . the softer a high specific-gravity mineral is, the greater the amount of overgrinding it will get going through the usual ball- or rod-mill. This is, of course, true when a mill is operating in closed circuit with a classifier ; but what happens in the mill itself when not under the influence of a classifier ? . . . I will make the rather broad statement that, in a given pass through a rod-mill . . . there is no preferential grinding of the soft sulphide minerals over the harder rock minerals. Its basis is indicated by the data in Table No. 4.[3]

The result, obtained under full-scale operating conditions, is highly significant. It is not sufficiently developed in presentation for the full importance to be seen, as one would wish to know also how the assay values in the screen fractions of the mill tailings came out in the case of any specific flow-sheet.

The immediate importance affects our concept of grinding action in the wet mill. By screening, the returned fraction of the mill discharge has been representative not of the size modified by the density of the returns but of size alone and, as a result, the closed-circuit circulating load produced by screening is truly representative, in this instance, of run-of-mine mill feed. Hitherto the selective action in classification which arises from density differences has influenced us to believe that the more friable nature of the sulphide was the cause of overgrinding. In the instance cited this is not the case and it opens the possibility of a new approach to the problem of " scalping " heavy material out of the circulating load.

[1] *Can. Min. Met. Bull.*, Sept., 1946; THE MINING MAGAZINE, Nov., 1946.
[2] A.I.M.E. Tech. Pub. 901.
[3] THE MINING MAGAZINE, Nov., 1946, p. 329.

Gold Dredge in New Zealand.

The author's table is limited to a rod-mill product and it is, of course, a special virtue of rod-mills, worked low-discharge, that they apply their grinding action to the coarsest rock in the mill with marked selectivity. By the nature of its shape and action a ball cannot exercise a similar degree of selection when grinding, but it is a legitimate possibility, in the light of modern knowledge of the ball-mill, that a fair measure of selectivity does exist and that the ball-mill is being blamed for selective overgrinding of the sulphides when part of that blame should properly rest with the classifier.

(26) *Plant Detail.*

The Plug Cock

However much we know about milling there always remains considerably more to learn, even in a mill with which one is personally familiar. Take a simple thing like a plug cock. Of old one just took it for granted, save for the infrequent occasions when the local Hercules was called on to move it in its rusty seating. The modern cock is a highly tailored affair and made in sizes from a fraction of an inch to several feet, controlling pressures up to hundreds of

pounds per square inch. It can have quite a number of accurately machined parts and the result is a valve which can be relied on to turn freely and to do its job effectively when the emergency arises, meantime waiting quietly without deteriorating however neglected it may be.

Engineering Log

In the old days prospectors had to be he-men, proof against desert heat, sub-zero cold, and other terrors. Now, it appears, they can work dangling comfortably in the cabin of a helicopter. The "sport" is called gamma-hunting and the chief armament is a magnetometer. The intensity of the earth's magnetic field varies from about 25,000 gammas near the equator to some 70,000 at the magnetic poles, but wherever there is a big enough deposit of rock bearing such ferro-magnetics as magnetite, this field concentrates through the neighbourhood and these "anomalies" can be detected by an instrument robust enough to be air borne. The air-borne magnetometer was developed as a submarine detector during the war and is now finding a place in geological mapping. Using a continuous-film camera to tie the survey to the ground, a plane capable of flying low and hovering, and the continuous magnetic profile recorded by the magnetometer, changes of only a few gammas can be plotted rapidly and cheaply—one figure being 750 square miles in six hours. The helicopter can land on ice, water, or bog, if an anomaly justifies ground investigation.

* * *

An American news item reports that FIDO has been put to work at Arcata, California, which enjoys the reputation of being one of the foggiest places in the world. The cost, once deemed prohibitive save under war conditions, has been slashed by the use of diesel oil at high pressure, which comes instantly into action instead of needing a long and expensive warm-up. A pressure of 1,500 lb. is used, with remotely controlled electric ignition, and the cost is $15 a minute. Fog as high as 3,500 ft. above Arcata Field has been rapidly cleared.

* * *

With silver at its present price interest has re-awakened in the abandoned mines of the Cobalt area. Several mines have re-opened and a new electric smelter is under construction. From being a by-product to the all-important silver of the early years of this century cobalt itself now has a place in industry and is worth up to a dollar a pound. It enters into stellite, heat-resistant alloys, powder metallurgy, magnets, and the dye industry. Cobalt was the cradle of the modern Canadian mining industry and nursed the pioneers who were to open up such places as Kirkland Lake and Porcupine. Silver was discovered during the construction of the T. & N.O. railway, in 1903, probably during actual railway work. A rush followed in September, but by 1904 things had quietened down, the real boom beginning as claims "proved up" during 1905. Peak production—nearly 30,000,000 oz. of silver—came in 1911, but a decline set in in 1913, until only the O'Brien was left of some 600 operating companies. To-day the ghost town is stirring again, but it is not expected to regain its ancient stature. Much of the power used round the mines comes from a hydraulic compressor on Ragged Rapids, with a 351-ft. vertical shaft giving 10,000 h.p. at 125 lb. pressure at a total labour cost of two men.

* * *

Production of the new "Airohs" is now under way. These mass-produced aluminium houses are one of the switch-over products from aeroplane building. They are made in four sections, with wiring and plumbing complete and ready for connexion and the plan gives built-in wardrobes, cupboards, and combined hot water and heating from coal, gas, or electricity. It is planned to produce 4,500,000 of these temporary homes to replace one-third of those destroyed in the war. With care they should last 30 years, a somewhat heavy amortization rate on a building costing well over £1,000 to make. Erection takes two hours on prepared sites 32 ft. by 21 ft.

* * *

This year's inaugural lecture of the academic year of the Imperial College of Science and Technology was given by Professor Ritchie, who dealt as a metaphysicist with the distinction between the last two nouns in the I.C.'s title. To some the boundary between science and technology is confused, while to others the scientist is pictured as sitting in an ivory tower from which he views with austerity the oil-smudged labours

Old Stamps, Basset Mines.

of the technician. Science is concerned with fundamentals, while technology is concerned to keep a given job running. The lecturer illustrated the divergence by tracing the technology of illumination, with empiric attempts to improve candles, oil lamps, batswing gas, the carbon arc, incandescent gas, and the filament lamp, each in its turn supplanted to a great extent by a totally unexpected new technique. The scientist reviewing these series of changes would not look for better gas, oil, or electrical resistance, but for the source of visible light, and the manner in which it becomes manifest. He would thus find the common factor uniting the tallow dip and the electron neon tube—the quantum emission from the suitably-agitated electron shell of an atom—and thus would signpost the road for the research technologist, while at the same time adding to the knowledge of nuclear physics. Here we come to the dilemma of the modern world. Where does the responsibility of the pioneer end, if his discoveries have an anti-social possibility when put into wrong hands. The question was not answered—indeed, it is a fine thing that such a question can be seen clearly enough to be formulated. If art, religion, law, politics, and administration are all branches of technology then the time is ripe for their integration by fundamental science, looking ahead as well as astern, and given the conditions where life can be seen steadily and whole.

* * *

Torpedoes are expensive things and special precautions are used when they are given trial runs before use. When on test they are designed to float with nose in air at the end of the run. Should the arrangement fail a device is now available which releases a master float anchored to the submerged torpedo. The float is imprisoned behind a disc of slowly soluble plastic material, which dissolves after a pre-determined period of submersion, after which the marker buoy is forced out.

* * *

In April, 1942, the problem of devising a pipeline between England and France was set by the military authorities. It was eventually met by the construction of two new types of oil pipe. A 3-in. pipe working at 1,500 lb./sq. in. was already on service in Iran and it was suggested that a continuous length of pipe laid cable-fashion might get over the difficulties of war operation in narrow tidal waters. A trial length of "Hais" pipe (Hartley, Anglo-Iranian, Siemens) having withstood tests work proceeded. The pipe finally used was a lead tube, coated and covered with two layers of tape (left-hand lay) one of bitumenized cotton tape, four of mild-steel strip (right-hand lay), a serving of tarred yarn, a sheath of galvanized steel wire, and two final servings of tarred yarn, opposed lays. This arrangement avoided twisting of the cable in service. Success in laying this cable, filled with water at 100 lb. pressure, permitted work to go ahead on six 35-mile lengths of cable, weighing 63 tons per nautical mile when charged with water. Altogether 710 miles of Hais cable were made, 140 of them in America. Special couplings were evolved which could couple two lengths together at

sea in 20 minutes. Although the operating pressure was to be 1,250 lb./sq. in. tests showed that cable bent six times round a 6-ft. diameter drum has a bursting pressure of 3,500 to 4,000 lb. A German bomb dropped during tests at Swansea proved that depth charges at 100 ft. distance would do no harm. In April, 1942, work was also begun on Hamel steel pipe (Hammick, Ellis). This was finally laid from large floating drums (H.M.S. *Conundrum*), although nothing was known as to how welded steel pipe would lie in a tideway. Still, at that time the Hais cable was also unknown and lead was scarce. Each drum was 90 ft. long and 40 ft. in diameter and could carry 70 miles of 3-in. steel pipe, a total load of 1,600 tons, the low-carbon mild-steel pipe weighing 20·21 tons per nautical mile. The 70 miles allowed a single lay to stretch from the Isle of Wight to Cherbourg, if handled by two large towing tugs and one small one astern for steering. At Sandown, Isle of Wight, 16 reciprocating pumps and two centrifugals were installed, and at Shanklin eight reciprocating and two centrifugals. At Dungeness, for the short Boulogne crossing, 30 reciprocating and four centrifugals were used. Practice was given in handling by linking the Isle of Wight installations to the mainland across the Solent. Secrecy was maintained throughout, the shore installations being put by night into existing houses. Actual laying had to await the capture of Cherbourg and clearing of sea-mines, but began on August 12, 1944. The Cherbourg lines were soon shut down, our advance along the coast making the Boulogne delivery all-important. Eventually 11 Hais and six Hamel lines were in, delivering 1,000,000 gallons daily with a reserve capacity of another 350,000 gallons.

* * *

In order to minimize corrosion during the annealing of stainless-steel wire a bath of molten glass is sometimes used. The wire emerges from this with a protective layer of glass covering it. As the temperature falls the difference in contraction rates causes the covering to break and fall off, but by this time the wire is cool enough to be free of the risk of excessive oxidation.

* * *

As radio communication assumed increasing importance in the war it became necessary to keep watch on the sun, so as to know when electronic storms would probably silence or hamper either Allied or enemy signals. This was done by an instrument called the coronagraph, which was set up at Fremont, Colorado. By blacking out the sun's disc it is possible to observe the much feebler corona and correlate its emanations with the earth's ionosphere—an ionized high layer of gases normally capable of reflecting wireless waves back to ground-level, a necessary condition for short-wave transmission.

* * *

A magnet weighing only a pound and having a diameter of $1\frac{1}{4}$ in. with a vertical lifting capacity of 25 lb. is now available for fishing out broken drill bits from drill-holes.

* * *

One large aircraft firm is now making "pre-fab" bungalows specially designed for tropical and "bush" conditions. Novel ventilation is built in and the packing cases become floor units on site.

* * *

A few straws in trade winds of to-day: The Coal Charges Account, set up in June, 1942, which levies 15s. a ton on all British collieries was £33,580,000 in debt at March 31, 1946. Over £16,000,000 were advanced by the Ministry of Fuel Fund in 1944–5, when the levy was raised to its present height from 12s. in order to bring down the outstanding charges, but this has only reduced them by £1,000,000, so that coal production is far from self-supporting at present.

World consumption of rubber is expected to rise from the pre-war 1,000,000-ton figure to $1\frac{1}{4}$ or $1\frac{1}{2}$ millions for 1947. From October only natural rubber is to be used for tyres and imports of the synthetic variety have stopped.

Civilian population of the United Kingdom at December, 1945, was 45,278,000, against 45,996,000 in June, 1940, with 5,000,000 more women than men.

About one third of our exports, which were £91,900,000 in July, go through the Suez Canal. Our best customers were India, with £19,000,000, South Africa, with £16,000,000, and Australia, with £14,000,000.

Eire beat the U.S.A. at £8,900,000, while Egypt and New Zealand each topped £6,000,000. Although prices were up to 230% of 1938's figure for July the volume was only up 120%. Steel, being produced

to capacity, is one bottleneck between this figure and the target—175%. The Board of Trade sees signs of a slow-down in the seller's market which has ruled since the war. We could still sell coal at a high price, if we had any to sell.

News Letters

REDRUTH

November 4.

Shortage of Labour.—In all the Cornish mines the man-power shortage has now reached serious proportions and output is being badly affected ; indeed, it is apparent that the mines may be unable to continue operations much longer unless considerable additional labour can be found. Now that the Trades Unions have given their consent to the employment of Polish labour in British industry it is to be hoped that the sorely-needed labour will be forthcoming at an early date.

The reluctance of Cornishmen to go underground at the present time is partly due to the general man-power shortage throughout the country, which makes it easy to obtain high wages in surface employment, but also to certain local considerations which have brought mining into temporary disrepute. Furthermore, when, as at the present time, the future is clouded with uncertainty the best men tend to emigrate, or to enter other industries where employment seems more secure.

In view of the great potentialities still latent in the remaining mines it is profoundly to be hoped that the Committee set up by the Minister of Fuel and Power will take some immediate action to clarify the position and thus arrest the disastrous drift of labour away from the mines. Given some measure of official encouragement the industry would quickly respond, but the present uncertainty concerning the authorities' future attitude towards metalliferous mining in Britain is having serious consequences.

South Crofty.—By reason of the labour situation during recent months development at this mine has had to be greatly curtailed, but a high percentage of the limited amount of work done continues to yield very satisfactory results. The most important discovery during the current year has been the location at the 315-fathom level in the Cook's section of the important No. 4 Lode of Robinson's section, which has been extensively worked in the eastern part of the property from the 260-fathom level down to the 335-fathom or bottom level of that part of the mine. This lode was intersected by the Cook's section 315-fathom cross-cut at a point 830 ft. west of the most westerly developments on it in the Robinson's section. Subsequently 500 ft. of driving has been

The New Shaft, Castle-an-Dinas.

done on it in the Cook's section, the greater part of which has disclosed excellent tin values over an average lode width of more than 6 ft. Incidentally the presence of mineral pitch has been observed in the eastern drive. Cross-cutting for this lode is now in progress at the 340-fathom level and were labour available the 290-fathom cross-cut would be extended simultaneously.

A further development of the greatest interest, which has had to be suspended for want of labour, is the exploration of the very unusual "Complex" lode which has been cut in the deepest level of the Robinson's section. Notwithstanding the fact that this unique ore-body exists 2,020 ft. from surface, or approximately 900 ft. below the slate-granite contact, the last 175 consecutive feet of driving on it have disclosed more than 3% of wolfram, very high arsenical values, and a moderate tin content over a lode width of 3·3 ft. The lode has every appearance of increasing downwards both in width and value and together with other indications in the deepest levels is strongly suggestive of a new zone of mineral deposition at greater depths. The possibilities of such a development are obvious and in the national interest it would seem well worth while that the company should have assistance to carry out much deeper exploration in the area.

(Photo: George W. F. Ellis.)

Stope at No. 5 Level, Castle-an-Dinas.

The continually increasing cost of coal and the additional pumping burden thrown on South Crofty by the abandonment of the neighbouring East Pool mine has compelled a thorough review of all pumping problems. Under the altered circumstances now prevailing it is clear that a centralized electrically-driven plant would effect great economies in comparison with the two Cornish pumps at South Crofty and a third at East Pool which the South Crofty company now has to maintain in order to keep its own mine unwatered. A scheme for the centralization of all pumping by electrically-driven pumps in the Cook's Kitchen shaft is now being worked out. If brought to fruition this will be the most powerful electrical pumping plant ever installed in a Cornish mine.

East Pool.—Notwithstanding the present acute shortage of labour it is generally felt that this is only a passing phase and that the time may not be far distant when unemployment again becomes a serious factor in the principal industrial area of Cornwall. It was therefore with a great deal of satisfaction that the news was received that East Pool and Agar, Ltd., was to be reconstructed with a view to carrying out an extensive development scheme in the eastern part of the property. The renowned "Tolgus Tunnel" lode, containing high tin and wolfram values, which was intersected in this part of the mine in 1920, has, through a combination of circumstances, since lain dormant, but it is generally considered that its development offers prospects of success. Consequently it was heard with dismay that the Capital Issues Committee had refused the company's application for permission to raise new capital. It is understood that the interests concerned in the proposed reconstruction of the company have offered to take over the Treasury's debenture in the company, but without success.

Basset Mine Dumps.—An extensive but only partly-completed milling plant erected at the old Basset Mines a few years ago, has been taken over by the British Malayan Tin Syndicate, Ltd., with a view to crushing the very large dumps existing on these mines. A further large dump proposition in the Camborne area is under consideration, the proposal there being to crush the ore on a large scale in an existing mill which is at

Rich Narrow Wolfram Lode, No. 5 Level, Castle-an-Dinas.

(Photo: George W. F. Ellis)

present standing idle. It is hoped to be able to give further details of this scheme in the near future.

Castle-an-Dinas.—Although also seriously affected by the prevailing shortage of labour the development of this unique wolfram mine in the St. Columb area is being continued. The ore-body consists of a lengthy quartz vein containing wolfram and löllingite. The lode, which intersects a prominent hill composed of " killas " or clay slate, is itself intersected and completely obliterated in its centre portion by a large granite intrusion. At the No. 7 or deepest level, over 400 ft. from surface, a drive has been extended 1,200 ft. through the granite with a view to intersecting the downward continuation below adit level of the northern part of the ore-body. A rise above the No. 7 level has just passed out of the granite and come right up into the lode, the latter having maintained the same dip below adit level as above. Where exposed in the rise, more than 100 ft. below adit level, the lode contains encouraging wolfram values, but a considerable quantity of water has also been cut and additional pumping equipment will have to be installed in the near future.

New Consols.—It is understood that the old mine in the Stoke Climsland area of

Derelict Machinery at New Consols.

Old Pumping Engine, New Consols.

Eastern Cornwall, which has been variously known as New Consols, New Great Consols, Great Wheal Martha, etc., is to be re-opened and unwatered forthwith. The workings, which extend down to a depth of 96 fathoms, are principally on a single lode which occurs in killas rock north of the Kit Hill granite boss. The ore is complex, containing copper, tin, and arsenic, the latter predominating. Collins records that the mine was worked on a fairly extensive scale up to 1877, the treatment of the ores being carried out by a combined mechanical and chemical process in the course of which a little silver and gold were also obtained. About 30 years ago a mill was erected and the extensive dumps left by the old workers successfully treated for their mineral contents.

The mine was for long an object of much curiosity to all interested in the evolution of mining machinery, for, by some means, the old plant of 1877 had escaped the hand of the scrapper and it remained almost intact until broken up shortly before the commencement of the recent war. Among the interesting machinery to be seen there was a large jaw-breaker (said to be the first introduced into Cornwall), a beam winding engine dating from the pre-wire-rope days and having chains coiled on its drums, powerful Cornish pumping and stamping engines, both of unusual design, and extensive horizontal and vertical calciner equipment for the roasting of the arsenical ores.

Although shallow the mine is reputed to be heavily watered ; it is probable that much of the influx comes through the lode fissures from the River Tamar which is only a few hundred yards east of the principal shafts.

VANCOUVER

November 2.

Canadian Institute Western Meeting.—The 28th Annual Western Meeting of the Canadian Institute of Mining and Metallurgy is to be held in Vancouver on November 13, 14, and 15. The programme is the largest ever planned for such a convention ; it includes four sessions for coal mining, two each for mining practice, geology, and metallurgy, and one session each for prospecting and physical metallurgy. The last-named session, as in former years, is to be held jointly with the B.C. Chapter of the American Society for Metals. Three luncheons scheduled during the meeting are to be addressed successively by Mr. W. B. Timm, Director of the Mines and Geology Branch, Ottawa ; the Hon. N. E. Tanner, Minister of Lands and Mines for Alberta, and Mr. Geo. S. Hume, Geological Survey of Canada. Special attention is being paid to the social amenities for the first time in several years. In addition to the president and secretary of the Institute, Messrs. R. J. Ennis and E. J.

Carlyle, respectively, the Hon. J. S. McDiarmid, Minister of Mines for Manitoba; Mr. H. C. Rickaby, Deputy Minister of Mines for Ontario; Mr. C. A. L. Hogg, Deputy Minister of Mines for Saskatchewan; Mr. R. J. Jowsey, president of God's Lake Gold Mines, Ltd., and Mr. A. D. White, general manager of the Tacoma smelter, have indicated their intention of attending.

Atlin.—Net current assets of $250,213, against liabilities of $84,897, are revealed in the first annual report of Taku River Gold Mines, Ltd., for the year ended April 30, 1946. Operation of the mine was resumed July 18, 1946, despite the labour shortage, lack of transport facilities, and the extreme difficulty in obtaining delivery of supplies and equipment. Following an examination of the Polaris-Taku mine in September, 1946, Dr. W. F. James, consulting geologist, reported in part as follows:

> Extensions beyond known points are made only to 25 ft. The present ore-reserve figure, including a sure, possible, and broken reserve, is about 330,000 tons grading 0·343 oz. gold per ton. It is my opinion that an adequate exploration programme might easily multiply this figure by two or three. The mine, though developed to a stage where 300 tons or more could be mined daily, is far from being thoroughly developed even at existing levels. Possibilities for discovery of further ore exist in the direction of the strike of the vein zone and laterally. There seems no reason to doubt that the present vertical range of the deposit (1,000 ft.) may be extended to a considerable depth. Currently the gold content of the ore is recovered by smelting arsenical concentrate produced at the mine. This process involves considerable expense and tailing loss that can be obviated by complete metallurgical treatment at the property.

Portland Canal.—Mr. W. B. Milner and his associates have exercised an option to purchase 200,000 shares of capital stock of Big Four Silver Mines, Ltd., more than six months before the time designated in the agreement. This brings to $115,000 the funds advanced by this group in the past few months for the development of the Silverado-Silver-Range-Prosperity-Porter Idaho group of claims, near the town of Stewart.

Skeena.—A cross-cut being put in to investigate ore occurrences indicated in diamond-drill holes has, on the 13-level of the Pugsley mine of Surf Inlet Consolidated Gold Mines, Ltd., intersected a vein 8 ft. wide assaying 1·41 oz. of gold per ton. The discovery was made much nearer than the anticipated objective and is at a depth of 400 ft. below any previous development in this section of the mine. The Surf Inlet company has acquired the McVicar group of claims adjoining the Britannia mine on Howe Sound. The group, on which there is evidence of intense alteration and silicification, covers a strike along a broad shear zone for a distance of approximately four miles and from elevation 800 ft. to 4,500 ft. Mr. Charles Mentzel, New York consulting geologist, recently examined the property.

Alberni.—Privateer Mine, Ltd., Zeballos district gold producer, has advanced the drive on the 1,700-ft. level of its recently-acquired Pandora property at Tofino from 146 ft. to 226 ft. The intervening 80 ft. was entirely in ore averaging 1·62 ft. in width and 1·12 oz. of gold per ton in grade. The last face carried 1·9 oz. across 1·7 ft. It is hoped to resume production at Privateer mine during the current month.

Victoria.—Inability to obtain sufficient power has compelled Twin " J " Mines, Ltd.,

Limestone Pillar, Hat Creek.

to defer resumption of full-scale milling until spring. Meanwhile attention is being concentrated on the development of a section of virgin ground between the Richard III and Tyee mines, in which a 12-ft. diamond-drill intersection has yielded assays of 0·45 oz. of gold, 5·83 oz. of silver, 4·2% copper, and 15·6% zinc per ton. Cut samples from an 8-ft. face east of the Winze at the Richard III portal have shown values exceeding $30 in contained metals at present prices. The Richard III shaft is being unwatered to permit development from both directions.

Clinton.—Three veins have been opened on the Hido property by Pellaire Gold Mines, Ltd., a subsidiary of the Quebec Gold Mining Corporation. Adits have been collared on the 3, 4, and 5 veins and 80 ft. of drive has been driven on the 3 vein. Samples across 3-ft. sections for an aggregate of 21 ft. have shown—0·12 oz.; 1·68 oz.; 0·56 oz.; 0·58 oz.; 0·28 oz.; 0·16 oz., and 0·82 oz. of gold per ton. The full width of the vein has not been determined, as both walls are in ore. On the 4 vein surface sampling across 5·5 ft. averaged 0·56 oz. of gold per ton and on the 5 vein a sample across 20 in. yielded 1·6 oz. per ton.

Quesnel.—Dredging of its extensive leases at Beavermouth on the Quesnel River was commenced on October 1 by the newly-incorporated Beavermouth Dredging Co., Ltd. The operation is equipped with a 2½-cu. yd. Lima dragline dredge and a 3,000-cu. yd. floating washing plant. All properties and equipment were acquired through the services of Collins Pacific, Ltd. The company is financed by Seattle and Portland interests.

Omineca.—The first 160 ft. of diamond-drill core recovered by Copper Island Mining Co., Ltd., from its Babine lake property has indicated the presence of copper to the extent of 1·25%. The company was recently organized privately to develop the Richmond and Robin Hood groups. Mr. B. I. Nesbitt, the consulting geologist, states :

> The potential tonnage to a depth of 500 ft. is 55,000,000 and the deposit is amenable to low-cost open-pit mining methods. The present programme calls for a systematic diamond-drilling campaign designed to test the copper content of 35,000,000 tons of host rock. Should this meet with success, there will result a large-tonnage open-pit copper-mining operation of great importance to northern British Columbia.

Duthie Mines (1946), Ltd., is to resume milling in the near future, despite the fact that development headings will be unable to reach the sources of new ore for some time. Mr. J. G. Turgeon, president, states that the diamond-drilling programme has indicated ore valued at $1,000,000 to a depth of 300 ft. and that hole No. 11 has cut the same body at 425 ft. Lt.-Col. C. B. North, the resident manager, has urged the directors to resume milling from ore taken from old stopes while the drive is on to the Canary and Humming Bird claims on which the new ore has been found.

Osoyoos.—Hedley Amalgamated Gold Mines, Ltd., has accepted a payment of 15 cents per share for 20,000 shares and extended to December 15 the time in which the optionee may take up the balance of 80,000 shares at the same price. The option to purchase 100,000 shares at 40 cents per share has been extended from December 31, 1946, to May 31, 1947.

Greenwood.—Highland Silver Mines, Ltd., is developing a group of nine claims in the vicinity of the Highland Bell mine. Reclamation of former shallow workings, if completed before snowfall, will permit the initiation of a projected diamond-drilling programme this winter. The company is newly incorporated and was formed by prominent interior British Columbians, almost all of whom were identified with the successful operation of the Highland Bell mine.

Slocan.—The management of Zincton Mines, Ltd., has effected agreement with the International Union of Mine, Mill, and Smelter Workers whereby the Zincton mine was re-opened on November 1. An initial crew of 45 men is expected to double in the near future. The lead-recovery circuit will not be fully equipped to commence concentration until early in 1947.

Agreement has been reached by Western Exploration Co., Ltd., and its employees whereby 25 men returned to work late in October. All men have been placed on a contract basis with the necessary incentive to advance headings as rapidly as possible. No attempt to resume milling will be made until at least 75 men are on the payroll.

Golden.—Base Metals Mining Corporation, Ltd., has announced indefinite suspension of further operation of the Monarch and Kicking Horse mines on account of the unsettled labour conditions obtaining in British Columbia.

Yukon Territory.—A public offering of an issue of $650,000 first-mortgage 5% ten-year bonds is being made by Yukon Explorations, Ltd. The company was recently organized by Messrs. W. B. Milner and associates to

acquire all assets in Yukon of Sunshine Mining Company, leading Idaho lode-mine operator. The dredging ground consists of 5·5 miles on Sixtymile River and two miles on the tributary (Big Gold Creek), on both of which partial exploration has indicated proved reserves of 3,100,000 cu. yd. averaging 58 cents per cu. yd. In addition Yukon Explorations holds 8·0 miles of completely unexplored ground on the Sixtymile River. Equipment consists of 3½-cu. yd. bucket-line dredge, five heavy-duty tractors, three diesel engines attached to centrifugal pumps, hydraulic pipe, and 30 monitors. Mr. Franklin L. C. Price, managing director, states :

The main sections of the property have been drilled using Hillman placer-drilling rig and standard 6-in. casing. Open holes were drilled in the frozen ground and volumes were calculated by water-displacement measurements. This is the standard practice used in evaluating placer deposits of this type. In calculating the average value of the drill holes and dredging ground a fineness of 800 was used for gold. A composite sample of the gold recovered from Big Gold creek during the testing operations was analysed and showed a fineness of 850. This is regarded as an additional safety factor in calculating gold values. If a fineness of 850 is obtained from the gold recoveries, it would have the effect of increasing the recoverable value of the reserves by $115,000.

Brown McDade Gold Mines, Ltd., has been incorporated by the Karl Springer-W. B. Milner-W. F. James interests to finance the development of a gold-silver lode about 100 miles north of Whitehorse. Preliminary work by Yukon Northwest Explorations, Ltd., has established a strong zone of shearing and indicated a main mineral zone 900 ft. long, approximately 15 ft. wide, carrying values of 0·4 oz. of gold and 3·0 oz. of silver per ton. A second vein, 6 ft. wide and yielding similar values, parallels the main vein for 200 ft. A diamond-drilling programme and 2,000 ft. of underground development are planned. The new company is capitalized at 3,000,000 shares of which 600,000 shares are to be sold at 50 cents each to provide immediate funds.

TORONTO

October 30.

Gold Production.—The Ontario bullion production for August included 149,925 oz. of gold and 20,820 oz. of silver, valued at $5,267,175, from 600,896 tons of ore milled. For September the figures were 146,883 oz. of gold and 29,241 oz. of silver, worth $5,165,102, obtained from the 575,097 tons of ore treated. For the various producing districts the returned values were, for August and September respectively : Porcupine, $2,631,297 and $2,596,509 ; Kirkland Lake-Larder Lake, $1,676,784 and $1,651,005 ; Matachewan - Sudbury, $110,363 and $139,946 ; North-Western Ontario, $848,731 and $777,642.

Figures for the first nine months of the current year now released by the Ontario Department of Mines show that in the period gold bullion valued at $49,221,340 was produced. The industry milled 5,387,910 tons of ore, which contained 1,314,636 oz. of gold and 214,848 oz. of silver. Daily average statistics show that the grade of ore treated during September rose to $8·98 from a low of $8·59 in July and $8·77 in August. Recovery of gold at 4,896 oz. per day was slightly higher than during August, while silver recovery at 975 oz. was a new record for the year. The production recorded for September includes the returns from 41 operating mines. A return was received from Jason Mines, Ltd., in the Casummit Lake area, but as no purchases covering that mine production were reported by the Mint this output is not reported. During the first nine months of the year an all-time record number of mining claims filed with the Mining Recorders was reported. Altogether 17,497 mining claims have been filed during the period. This exceeds the all-time annual record established in 1936 of 17,280 mining claims.

Gold production for the whole of Canada for August totalled 231,200 fine oz., valued at $8,901,200. The output for the month included 197,643 fine oz. from auriferous quartz mines and 33,557 oz. from base-metal mines. The output from auriferous quartz mines and placers rose 11·9% over August, 1945, and production from base-metal mines rose 4·4%. Employees in producing auriferous quartz mines, including both salaried employees and wage-earners, numbered 17,053 in August, 1946 ; the corresponding total for active non-producing mines was 625. Employees in non-ferrous metal mines, smelters, and refineries totalled 27,023 during the month under review.

Porcupine.—Dome Mines reports an output of $451,017 for August, from 49,100 tons of ore milled.

The new shaft at Malga Porcupine Mines has now passed the 100-ft. mark on its way to its objective at 450 ft.

Goldhawk Porcupine, having completed

its shaft to 650 ft., is now opening up levels at 350 ft., 475 ft., and 600 ft. Ore reserves indicated by drilling are estimated at 200,000 tons, averaging $10·15 over 4·2 ft.

Paymaster Consolidated reports an August output of $94,041 from 11,830 tons of ore milled.

Kirkland Lake.—A new company—Baldwin Consolidated Mines—has been formed to link up a number of properties in Eby, Teck, and Grenfell townships.

The August output of Macassa Mines is reported as $101,650 from 7,432 tons of ore milled.

Shareholders of Kirkland Lake Gold Mining have been informed that development between the 4,600-ft. and 5,450-ft. horizons continues to yield good results.

Teck-Hughes Gold Mines reports earnings of $371,153 for the first eight months of the current year. In the period 65,902 tons of ore was milled for a recovery valued at $695,167.

North-Western Ontario.—As has been recorded earlier in this letter Jason Mines, in the Casummit Lake area, recently resumed operations, the plant commencing work on September 2. The capacity is expected soon to reach over 100 tons per day, the mill feed being at present supplied from the sixth level.

Beaulac Red Lake Mines has been formed to take over the assets of the Beaulac Red Lake Prospecting Syndicate.

Manitoba.—In addition to Sherritt Gordon Mines two other companies—Bankfield Consolidated and Towagmac Exploration—are investigating the Lynn Lake area. Following preliminary dip-needle surveys magnetometer and geological work are now in hand.

Wekusko Consolidated has completed its shaft to 560 ft. on the Herb Lake property and new levels have been started at 275 ft., 400 ft., and 560 ft. At the 275-ft. horizon a vein 5 ft. wide is reported as carrying visible gold.

Shaft sinking has been resumed by Ogama-Lockland Gold Mines. In 1942 the work was taken down to 117 ft., the 4,121 tons of ore removed yielding bullion worth $145,109.

Quebec.—The gold output of Quebec Province for July is reported as 52,766 oz. and that for the first seven months of 1946 as 379,818 oz. The July silver output was 397,968 oz. and that for the seven-month period 1,285,235 oz.

Sigma Mines reports an August output of $145,708 from 25,544 tons of ore milled.

The shaft at Hosco Gold Mines is reported as having reached its objective of 530 ft. and station cutting is under way.

The profit of Lamaque Gold Mines for the first eight months of 1946 is given as $239,997, which compares with $415,318 for the corresponding period of the previous year. The output for the 1946 period was $966,830 from 105,148 tons of ore milled.

Following a geophysical survey recently completed over the property of Courageous Gold Mines, in the Louvicourt area, drilling has been recommended.

It was recently announced that a new well-mineralized vein showing visible gold had been cut during shaft-sinking operations at Harricana Gold Mines. The shaft is now past the 650-ft. mark on its way to 1,000 ft.

MELBOURNE

November 20.

Aberfoyle Tin.—The mine of Aberfoyle Tin, N.L., at Rossarden, Tasmania, is the most important producer of lode tin in the Commonwealth. Operations for the year ended June 30, 1946, were profitable; net profit was £20,899 (Aust.) and £14,062 was paid in dividends.

The property contains a number of parallel lodes, most of which can be profitably worked. The country rocks are Cambro-Ordovician slates and quartzites, intruded by Devonian granite. The lodes occur in the Cambro-Ordovician rocks, the strike being east of north and the dip south-west. Part of the stanniferous zone has been down-thrown by a major fault and lies under some 50 ft. of Permo-Carboniferous beds. The lodes are up to 3 ft. wide and are several hundred feet in length. They consist of white quartz with veinlets and patches of cassiterite, wolfram, pyrite, and sphalerite with some fluorspar and pinite, the cassiterite being generally associated with the last mentioned.

The mine is worked from a vertical shaft which has been sunk below 600 ft. from surface and six levels have been opened out. Development during the year amounted to 2,650 ft., the ore-bodies exposed having widths of 14 in. to 35 in. at the Nos. 5 and 6 levels. In addition, 2,913 ft. of diamond drilling was carried out from these two levels. Ore reserves are estimated at: Positive ore, 126,097 tons; probable ore, 14,405 tons; total reserves, 140,502 tons.

The new mill is in operation and during

the year treated 21,443 tons of ore for the recovery of 341 tons of tin concentrate and 59 tons of wolfram concentrate. The recovery of tin was 85%. The ore is stage crushed in rolls and ball-mills and concentrated on jigs and tables. Concentrate is passed through flotation cells for the removal of sulphide minerals and the mixed cassiterite-wolfram concentrate is then treated in a magnetic separator for the production of two clean products for market.

As soon as sufficient labour is available, the main shaft is to be sunk to 120 ft. below No. 6 level and No. 7 level opened up. Working costs, exclusive of development and head office, were 59s. per ton. The company's housing scheme is proceeding as fast as the supply of materials will permit; married employees are helped to build their own homes by cash advance, repayable on easy terms, the men usually giving their own labour in their own time.

Broken Hill South.—Since the inception of operations 61 years ago Broken Hill South, Ltd., has treated 12,932,178 tons of ore to December 31, 1945. For the year ended on that date, 305,160 tons of ore was mined; men employed numbered 854 and ore reserves totalled 1,930,000 tons. Stoping methods are: Flat back cut-and-fill, or open stope, in good ground; a similar method with square-set support for the back in weak ground, and under-hand square-set stoping in broken ground and for working up under level bottoms. Filling is used in all stoping methods.

The company has pioneered pneumatic and hydraulic stowing of filling on the Broken Hill field. Hydraulic filling has proved very successful and all stope filling is now placed by this method. After each 8-ft. cut the stopes are filled with deslimed mill residues, which are classified on leaving the mill, stored at surface, and drawn from the pile by a conveyor-belt running in a tunnel below the sand pile and discharging into the main underground mullock pass. At the 725-ft. level there is a group of three sand-pulp mixing cylinders at the pass and from these the pulp is distributed through 4-in. diameter pipe-lines to the stopes. Total drainage water from all sources amounts to 1,100,000 gallons per week, which is settled in sumps, and pumped to surface from the 1,570-ft. and 2,050-ft. levels.

Zinc Corporation.—Ore production by this Broken Hill company since its inception in 1911 has amounted to 9,811,218 tons. At the present time 1,536 men are employed. Production for the year ended December 31, 1945, was 426,943 tons of ore and the ore reserves were estimated at 4,479,000 tons. Stoping methods are flat back cut-and-fill, either open, or with square-set timbering. Underhand square-set mining is employed in the extraction of the level pillars.

In the upper levels dry sand filling is used, distribution being either by hand trucking or by compressed-air operated blowers and 4-in. diameter reinforced rubber hoses. In the lower levels hydraulic filling, as developed in the Broken Hill South mine, is standard and is to be extended throughout all new levels.

For the use of employees the company has provided a mess hall on surface and cafeteria, which are used by surface workers, and the hall is available for recreational purposes. There are also two sports' ovals, a swimming pool, and a polo ground. South of the mine plant 60 acres of trees and shrubs have been planted to break the prevailing wind and minimize the sand drift; this area includes 17 acres of orchard, which is very productive. In common with many arid regions the soil is very fertile if sufficient water is available to maintain growth.

North Broken Hill.—North Broken Hill, Ltd., shows the largest ore reserves of the three big mines of the field. The estimate at December 31, 1945, was 5,182,462 tons; men employed numbered 1,500 and the output of ore for that year was 325,393 tons. The total production of ore throughout the life of the mine is 15,700,000 tons. The mine is in three sections—the North, British, and Junction—the North mine itself containing two ore-bodies, the Southern and the Northern. Generally the North mine ore-bodies are rather higher in lead, silver, and zinc than are those of the British and Junction mines. The average grade of ore produced from the North section during 1945, and that of the British section, was:—

	Lead.	*Silver.*	*Zinc.*
	%	*oz.*	%
North section	15·3	8·3	11·9
British section	12·1	6·1	10·3

Mining methods have been evolved to meet the peculiarities of the ore-bodies. In the Southern ore-body the system is alternate stope and pillar, the strike lengths being 10 sets and 5 sets respectively, a set being 6 ft. 4 in.; the stope length is therefore 63 ft. 4 in. and the pillar length 31 ft. 8 in., giving a section length of 95 ft. There are

two cross-cuts per stope and one for pillar extraction, usually driven later. Cross-cuts are driven at 33 ft. 8 in. centres. On the 2,450-ft. level stopes are 5 sets and pillars 3 sets long. Only one cross-cut is required per stope and this can be used for later pillar extraction; cross-cuts are driven at 54 ft. centres. On the 2,600-ft. level stope and pillar dimensions and cross-cut spacing will be the same as at the 2,450-ft. level, but stopes will be opened out at 30 ft. above rail level and connected with drives and cross-cuts by rises for ore-passes put up through a bridge of solid ore. Rises for pillar extraction will be put up later. Pillars are mined by underhand square-set method, starting from a vertical winze sunk as near the hanging-wall as possible.

The ore is mined in a series of restricted vertical blocks, the hanging-wall section being worked out first, and retreating to the foot-wall. Sollars are laid at the base of each vertical block and filling is placed above the stoping party. The block of filling is 30 to 40 ft. deep and four fillings are necessary between levels. Deslimed mill tailings are used for stope filling. Distribution from the main sand passes to the lode winzes is by conveyor-belts. When the conveyor gangways collapse to an extent that it is impossible to maintain the belts pneumatic methods of distribution are used. By pneumatic methods filling can be distributed over a distance of 1,000 ft.; average distances are 300 ft. to 400 ft. and approximately 50 cu. yd. of sand can be placed per shift.

In the financial year ended June 30, the North Broken Hill Company treated 357,743 tons of ore, as compared with 330,225 tons in the previous year. The British and Junction sections contributed 21·62% of the output, as compared with 19·15%, the remainder being won from the North section. The output is considerably below that obtained in the early years of the war, the highest total being 526,892 tons in 1940. Although metallurgical work is of a very high order recoveries continue to improve. The recoveries in the past year are compared below with those for 1940.

Year	*Lead.* %	*Silver.* %	*Zinc.* %
1940 . . .	95·5	88·1	86·5
1946 . . .	97·0	91·5	86·5

Lead recovery is effected partly by gravity, using jigs and concentrating tables, with flotation for fine lead recovery. Tailings from the lead section pass to the zinc flotation section. Residues are sent underground for filling.

The ore reserves are estimated at 5,111,000 tons, which is a slight decrease on the previous year's estimate of 5,183,000 tons. On the financial side profit increased to £461,670 (Aust.) from £268,884 in 1945 and was due to the increased production, higher prices ruling for metals, and to improved recoveries. There was a corresponding increase in expenses, including provision for taxation and royalty, which amounted to £393,000. Value of the mine production increased from £1,529,355 in 1945 to £2,221,059 in the past year and expenditure rose from £1,103,539 to £1,361,996.

The company gives liberal support to the social and welfare movements of Broken Hill and gave the sum of £12,500 for the foundation of a chair of metallurgical research at the University of Melbourne and for the erection of an engineering building at the Broken Hill Technical College. During the year dividends totalling 2s. per share were paid, the amount distributed being £385,000. Since the close of the year a further dividend and bonus of 1s. 9d. per share has been declared.

The company is participating with Broken Hill South, Ltd., in the examination of the Zeehan silver-lead field, on the west coast of Tasmania, and an extensive programme of diamond drilling is to be carried out there.

Mining at Tennant Creek.—There is increasing activity on the Tennant Creek goldfield in the Northern Territory. Adelaide and Melbourne interests have been securing options and it is likely that several properties will be equipped as soon as machinery becomes available. One of the most promising areas, comprising the Rising Sun and Noble's Nob mines, from which 13,000 tons of ore has been milled for a return of 20 dwt. gold per ton, is now being tested and it is expected that mining operations will be commenced by the beginning of 1947. These mines are situated on the principal shear zone on the field. At the opposite end of the line the Red Ned mine has been taken up under option and is considered to be a mine of some promise. The productive Eldorado mine, in which workings have reached a depth of 300 ft., is situated between these areas.

Men are slowly returning to the field and a number of party-owned mines are being re-opened. Their ore will be milled at the Government plants, of which there are three, although only one is working so far

due to absence of sufficient labour and to shortage of water.

The total production of the field is 147,379 tons of ore for the recovery of 125,688 oz. of gold. During the period of the war, only one mine, the Eldorado, continued in operation.

Deborah Gold Mine.—The Deborah mine is one of the leaders on the Bendigo goldfield and was actually one of the pioneers of the revival of activity in the 1930's. It is situated on what was a neglected line of reef, which assumed great importance with the success of the mine. The Deborah company developed one of the best oreshoots ever discovered in Bendigo, situated on the inner reef at the 500-ft. level where payable gold has been won for a distance of some thousands of feet. The company intends to explore the property at greater depth and work is to be commenced below the 1,000-ft. level and will be continued to a possible depth of 2,000 ft., within which limit it is hoped to locate the next payable horizontal zone. Above and below the 1,000-ft. level there are large tonnages of ore worth approximately 5 dwt. gold per ton, which will be drawn on during the exploratory period which is expected to cover about 18 months. There is some evidence that payable gold shoots occur at vertical intervals of 500 ft. to 600 ft. and there are some indications that important possibilities may exist at the 1,500-ft. horizon.

Personal

P. K. Aldous is returning from Chile.

G. Keith Allen is now in West Africa.

Alexander Anderson has left for the United States.

L. H. Bartlett has left for India.

A. J. Bensusan is to visit Southern Rhodesia on his way home from Western Australia.

H. H. W. Boyes is now in Nigeria.

A. Burnotte has returned to Belgium from the Congo.

J. T. Chappel has left for Malaya.

A. H. Cretch has left for Malaya.

H. Cundy has returned to Siam as manager of the Bangrin Tin Dredging Co., Ltd.

E. W. Dawson is now in Ireland.

J. E. Denyer, now released from the Army, has joined Mawchi Mines, Ltd., in Burma.

E. Ferreyros has left Peru for the United States.

G. Finlayson is returning from Nigeria.

Frank A. Forward has returned to British Columbia from Formosa.

Donald Gill, recently home from the Middle East, has been appointed Technical Adviser to Transjordan Phosphate Mines, Ltd. Mr. Gill has been awarded " La Cravate de Commandeur du Nichan-Iftikhar " by the Tunisian Government.

J. T. Hanvey has left Bolivia for the United States.

H. C. Herbert has returned to India.

V. T. Hockin is now Chief Inspector of Mines, Tanganyika Territory.

J. H. Jackson has left for Northern Rhodesia.

H. T. James has returned to British Columbia from Fiji.

A. E. Jones has left for Northern Rhodesia.

R. J. Lemmon is now in Gold Coast Colony.

Douglas H. McCall is about to leave for India.

J. B. McConnell is now mill superintendent at Duthie Mines (1946), Ltd., British Colombia.

H. Martin has left the Congo for Southern Rhodesia to join Rhodesia Chrome Mines, Ltd.

L. C. Millett has left for the Gold Coast.

T. P. Patterson is resigning his secretaryships, while remaining on the Board of several companies.

W. Pulfrey is home from Kenya.

R. H. Skelton, of Pellew-Harvey and Co., informs us that after December 20 his office will be 236, Salisbury House, E.C. 2.

John Tohill is home from the Gold Coast.

E. A. Walker has left for India.

A. J. Walton has returned to South Africa.

H. J. R. Way is home from Swaziland.

E. J. Wayland is here from South Africa.

John D. Williams is home from Colombia.

THE INSTITUTION OF MINING AND METALLURGY

Elections and Transfers

Member.—Reginald Erskine Wylde Hughes (*Johannesburg, reinstatement*).

Associate to Member.—Frank Hutchin, A.C.S.M. (*Camborne, Cornwall*).

Associate.—Constantinos Anthony Jacouris (*Mbarara, Uganda, Brit. E. Africa*); Thomas Oliver Morgan (*Mwanza, Tanganyika Territory*); Eugene Roderic Carrington O'Connor (*Maraisburg, Transvaal, S. Africa*); James Henry Rowe (*Oruro, Bolivia, S. America*); David William Watson (*Jos, N. Nigeria, reinstatement*).

Student to Associate.—Matthew Graeme Cullen, *M.B.E.*, A.C.S.M. (*Randfontein, Transvaal, S. Africa*); Peter Audley Delmé-Radcliffe, A.C.S.M. (*Aldbourne, Wiltshire*); Tom Edwards, A.R.S.M., B.Sc. (*London*) (*Johannesburg, Transvaal, S. Africa*); Francis Robert Kay, A.R.S.M., B.Sc. (*London*) (*Chalfont St. Peter, Buckinghamshire*); David McCormick, *M.C.*, B.Sc. (Geol.) (*New Zealand*), B.E. (Min.) (*New Zealand*) (*Nelson, New Zealand*); Donald Francis Monro, A.R.S.M., B.Sc. (Eng.) (*London*) (*London*); Charles James White Wilson (*Gatooma, S. Rhodesia*).

Student.—Brian Bartlett (*Reading, Berks.*); Kenneth Arthur Edmund Bath (*Gillingham, Kent*); Colin Campbell Cave (*London*); Peter Anthony Champness (*Ewell, Surrey*); David Hay Davidson (*Sevenoaks, Kent*); William Anthony Prosser Dayson (*Birmingham, Warwick*); John Gordon Dennis (*London*); Mehmet Yusuf Dizioglu (*London*); Wojiech Domzalski (*London*); David Gibson (*Bexhill-on-Sea, Sussex*); Alfred Allen Grondijs (*London*); Bronislaw Grun (*London*); Abdul Mannan Khan (*Croydon, Surrey*); A. Enver Kilic (*London*); John Henry Knapp (*Camborne, Cornwall*); Peter George Linzell

(*Coulsdon, Surrey*); David Martyn PARKES (*Braintree, Essex*); Geoffrey Edwin PEARSE (*Croydon, Surrey*); Adrian John ROBERTS (*Matlock, Derbys.*); John William SEMMENS (*Southall, Middx.*); Donald John SIMMONS (*London*); John Rudolph STANDERS (*Selukwe, S. Rhodesia*); Arnold TAYLOR (*London*); Martin WATTS (*Dover, Kent*); Peter Thomas WEEKES (*Camborne, Cornwall*); Jack WILLIAMS (*Hayle, Cornwall*); John Corner WILSON (*Leeds, Yorks.*); Oliver Barker WINSTANLEY, B.Sc. (*Manchester*) (*Manchester, Lancs.*); Stanley Raymond WORTHY (*Camborne, Cornwall*).

Trade Paragraphs

High Speed Steel Alloys, Ltd., of Widnes, devote the greater part of their *Alloy Metals Review* for September to an article on molybdenum in cast iron, including the methods of adding.

Ransomes and Rapier, Ltd., of Ipswich, have compiled a folder describing their 4-in. self-priming water pumps. These are mounted on steel or pneumatic road wheels and are available in light and heavy sizes respectively for 25,000 gallons and 37,000 gallons per hour, the former being equipped with a Ford 10-h.p. engine and the latter with a Morris M.E.B. unit.

Edgar Allen and Co., Ltd., of Sheffield, in their *Edgar Allen News* for November include a note on a jaw-crusher of their manufacture which is said to be the first crusher for use underground in a British colliery. It was specially designed to go down the pit shaft, the frame being split horizontally for the purpose. The machine is 36 in. by 24 in. in size and will take material of 30 in. by 20 in. cube at the rate of 35 tons per hour and crush to a product of 2½ in. It is used for pit stone, the product being required for filling worked out parts of the mine.

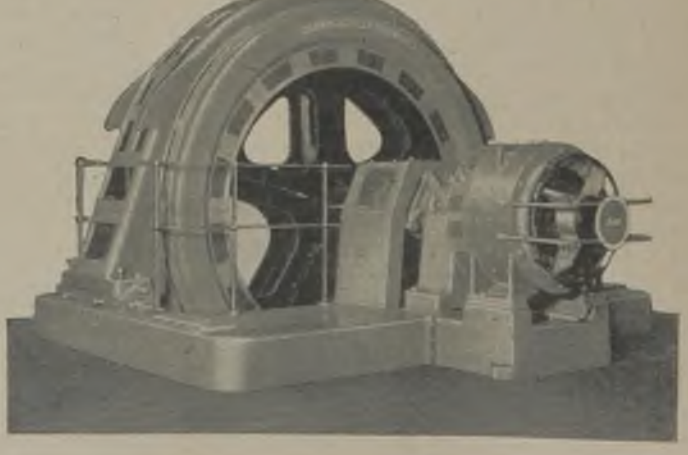
Mond Nickel Co., Ltd., of Grosvenor House, Park Lane, London, W. 1, in the *Nickel Bulletin* for September include abstracts on standard tests for metal powders, nickel catylists in gas purification, precipitation-hardening copper alloys containing nickel and manganese, effect of antimony additions in stainless steels, etching of ferrous and non-ferrous materials for the microscope, and determination of tungsten, titanium, and columbium.

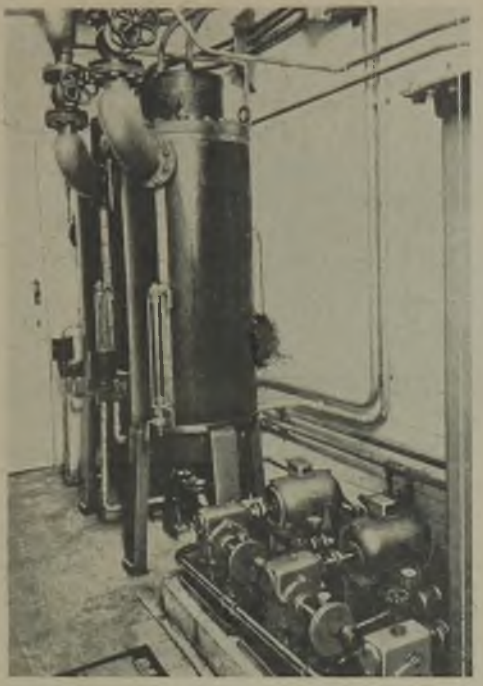
Ferodo, Ltd., of Chapel en le Frith, announce the opening in this country of two new depots at Ferodo House, 84–90, Hanover Street, Edinburgh, and Ferodo House, 67, St. Matthew Street, Ipswich. Mr. W. S. Mowat, formerly depot manager at Aberdeen for the past 23 years, has been appointed manager of the new depot at Edinburgh and the manager at Ipswich is Mr. E. C. Berry, now returned from service in the Royal Navy. Mr. Berry is already well-known in the district having been the Ferodo representative in the Eastern Counties since 1930 and will now be much better equipped for rendering adequate service to the trade. Mr. Mowat has been succeeded at Aberdeen by Mr. W. H. Wyse, who has recently rejoined the company on release from the Army.

General Electric Co., Ltd., of Magnet House, Kingsway, London, W.C. 2, issue some notes on a large salient pole synchronous induction motor for mine ventilation in South Africa. A view of this motor is given in the accompanying illustration; it was made to the order of the Johannesburg Consolidated Investment Company, Ltd., and is designed to replace a steam engine which drives a large ventilating fan in a gold mine on the Rand. The motor is rated at 1,500 h.p. (unity p.f.) 120 r.p.m. and is supplied direct from a 2,200-v. three-phase 50-cycle system. It will be recalled that this type of machine combines the high efficiency of the normal salient pole synchronous motor with the additional advantage of a high torque-current ratio at starting. This is obtained by the use of a variable resistance connected to three-phase windings in the pole faces. The starting gear is very simple, consisting of an oil-immersed stator switch and a liquid starter.

Bastian and Allen, Ltd., of 11, Bedford Square, London, W.C. 1, issue some particulars of small electric steam and hot water boilers, with capacities up to, say, 3,000 lb. of water evaporated or 4,000,000 B.Th.U. provided per hour. The advantages of the electrically-operated boiler include, it is suggested, low net operating costs, continuous operation at 97 to 98% thermal efficiency, very small size and weight with absence of foundations,

G.E.C. Motor for the Rand.





extreme flexibility in operation (starting up and closing down in a few minutes), safety, easy automatic control, lack of scale formation, and elimination of troubles involved in the use of fuel. Electrode boilers for steam generation are in standard sizes, all of the vertical type, within the range of 25 to 1,000 kW., corresponding to an evaporation to steam of 75 to 3,000 lb. of water per hour, up to, say, 120 lb. per sq. in. gauge (tested to 250 lb.), for a.c. 346 to 440 volts 3-phase 50 cycles. A complete set of mountings is also provided—including safety valves, stop valves, blow-down cock, gauge glasses, pressure gauge, adjustable automatic steam pressure regulator, self-contained motor-driven feed pump, wall-mounted control panel, with ammeter and adjustable load control, motor starter with overload protection, and a main iron-clad triple-pole circuit-breaker having three instantaneous overload trips and no-volt releases. If current is available at a reasonable figure—such as, 0·5 to 0·9d. per unit—operation for many smaller installations up to about 3,000 lb. of steam per hour is no more expensive than ordinary fuel.

Evershed and Vignoles, Ltd., of Acton Lane Works, London, W. 4, have issued a booklet with the arresting title: "A Factory at War." The following notes as to its contents are submitted by the publishers: The book has not been written as publicity, but as a firm's tribute to its employees—the men and women who kept the wheels of production turning for the supply of essential equipment to the fighting services. It is for private distribution only and will be a memento prized by those who faced together a common danger, there being a complete list of names and duties performed by all the firm's Civil Defence and Home Guard members, each of whom has been presented with a copy. Happily the author was not without a sense of humour, for there are illustrations of "broomstick" Home Guard parades, and of trying on the first uniforms; an early attempt at sandbag filling has not been forgotten. But there are also grimmer facts to tell of works' shelters becoming homes for employees and their families, and the training of the factory defence organization to meet each new device of the enemy. It recalls, too, the changeover from a purely defensive to an offensive spirit, the factory at the same time recording an increased output. A tribute to the Home Guard is paid by Lieut.-Col. F. M. Salsh, M.C., commanding the 7th County of London Battalion, in which Evershed's had their own unit. There are stories of spotters and wardens of the firm's N.F.S. unit and the work of fireguards and first-aid detachments. One is reminded how production continued during raid alerts, and of the rapid reconditioning of buildings damaged by the enemy. It is a record of how the company's workers triumphed over difficulties and played their part in winning the final victory.

International Combustion, Ltd. (Grinding, Screening, and Filtering Division), of 19, Woburn Place, London, W.C. 1, report the following among orders recently received:—Home: Three Raymond laboratory mills; 24 L.M.18 Lopulco mills for grinding coal for pulverized fuel in power stations; two 250 sq. ft. Rovac rotary vacuum "Endflow" filters (repeat order) for coal slurry; one 200 sq. ft. Rovac rotary vacuum filter for 2 tons per hour of alkaline pulp; one 150 sq. ft. Rovac rotary vacuum "Endflow" filter; two 35 sq. ft. and two 17 sq. ft. Rovac rotary vacuum "Endflow" filters to handle benzidine monohydrochloride; two 4-in. Vacseal pumps (repeat order) for *minus* $\frac{3}{16}$-in. sand *plus* 100-mesh material from quarry washery; three Ro-Tap testing sieve shakers with motors and automatic time switches; one 18-in. Ty-Lab tester complete with motor, automatic time switch, and testing sieves for power station laboratory, and a series of some 17 Syntron electric vibrators, etc. For abroad: Two 4 ft. by 8 ft. type 600, two-surface, Ty-Rock screens for run-of-mine coal at $\frac{1}{4}$ in. separation; one 3 ft. by 6 ft. type 300, one-surface, Ty-Rock screen, with square mesh cloths for gravel and sand at various meshes; one No "0" Raymond pulverizer for conditioning hydrated lime; one No. "0000" Raymond pulverizer for grinding clay for the manufacture of abrasives; two Raymond laboratory mills; one 200-sq. ft. Rovac filter for air-dry grass; eight 200-sq. ft. Rovac "Endflow" filters as primary and secondary chalk filters; one FM.1–25 Syntron feeder machine; one rapid laboratory elutriator, and one 2-in. acid type Vacseal rubber-lined pump to deliver 7·2 English tons per hour of dust and liquor, having a specific gravity of 1·3 against a total head of 62 ft. The liquor contains 3% of vitriol at 25%. 13°. Temperature 40° C. Specific gravity of dust 6.

Geo. Monro, Ltd., of Ingos Works, Waltham Cross, Herts, have prepared a leaflet giving information on their Muledozer, which is illustrated. This is a development, as far as the mounting is concerned of their Rotaped tracks to which attention was drawn in the MAGAZINE for August, 1944. In some notes the makers point out that the blade is of electrically-welded construction, strongly reinforced, and has an interchangeable cutting edge. It runs in phosphor-bronze bearings and its weight is counterbalanced; this makes the setting of the blade easy. The precision screwjack is

Monro Muledozer.

totally enclosed and by the use of ball bearings and suitable lubricating arrangements long life and easy handling are ensured. The blade is 6 in. wide, and its lift above ground is 15 in. and the drop below ground is 6 in. The Rotaped tracks give the necessary traction which is required to make the fullest possible use of the blade itself. The particular tracklaying action, which anchors the tracks link in the ground and gives a positive grip, allows full use to be made of the engine power available and the tractive effort of the Fordson tractor fitted is approximately 5,000 lb. The specific ground pressure is only 7 lb. per square inch approximately and special extensions are available which reduce this by about 50%. All track pins and their bearings are case hardened and ground to fine limits, thus ensuring long life. The main sprocket is made of high-grade manganese steel, heat treated to give maximum wear resistance. All parts subject to wear are easily and cheaply replaceable. Apart from their use as traction means for the Bulldozer blade the tracks give the necessary traction required for pulling heavy trailers over soft ground and for all heavy haulage jobs, including the towing of lorries which become bogged on soft ground. The Fordson Major tractors fitted with Rotapeds have pulled, with ease, 10-ton water trailers over loose sand.

David Brown and Sons (Huddersfield), Ltd., of Huddersfield, have released some notes on factory lighting. Some extracts from these appear in what follows :—It is interesting to observe the immediate effects of a planned colour scheme now proceeding at the main works of the company. All that group's seven works—tool and machine shops, foundries, forges, drawing offices, administration blocks, and printing plant—will be decorated in a carefully-considered plan which has been worked out in a three-cornered consultation of engineers, psychologists, and paint specialists, and the work now in hand at the extensive Park Works (which will have taken a full 12 months to complete) will act as a guide in the schemes for the other factories. Broadly the considerations of the scheme were : (1) Elimination of the drab appearance of machines by enamelling them in light hues ; (2) prevention of

Fig. 1.

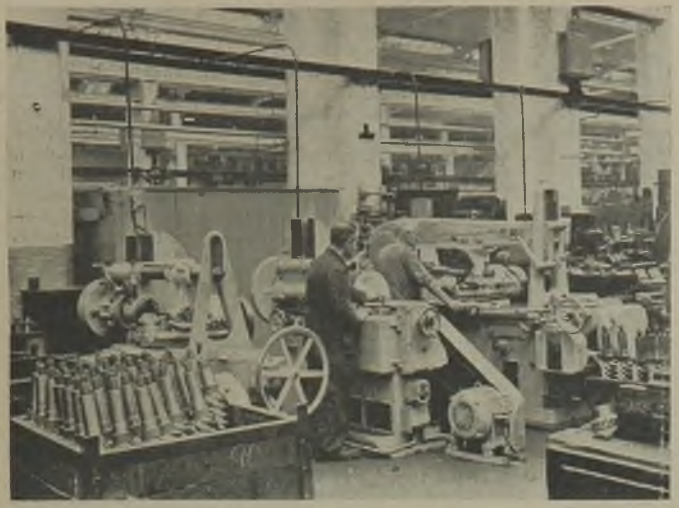


Fig. 2.

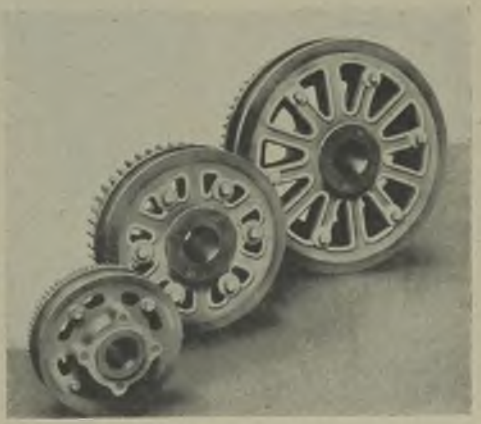
eye strain by provision of light-reflective colours on walls, ceilings, and fixtures ; (3) establishment of a more cheerful atmosphere by the blending of these colours in harmony ; (4) improvement of visibility, and (5) by relieving the monotony of drab colours and whitewashed walls to reduce accident proneness and to increase production—to provide physical, mental, and social advantages.

Walls, ceilings, stanchions, and overhead cranes are painted " semi-alert " cream, with, on occasion, a dado of reseda green to reduce distance, machines are enamelled cream and green with " alert " orange on operational points, and service boxes and casings for power, water, and compressed air are picked out in orange. In the forges and foundries the predominant hues will be yellow, green, and aluminium. The effect on " seeing " conditions, as distinct from the actual intensity of illumination, is marked and the appearance of the shops is immeasurably brighter and more cheerful. White lines on the shop floors to demarcate gangways assume a new importance and are well defined and somewhat broader for added decorative interest. In Fig. 1 is given a view of a bay in the heavy engineering shops before painting. Although lofty and well lighted by previous standards it nevertheless appears gloomy. Fig. 2 shows a corner of the machine shop after painting, the effect being self evident.

Hadfields, Ltd., of Sheffield, announce an experiment in manganese steel for crane and telpher wheels, as a result of the necessity for the frequent renewal of such wearing parts. The following is compiled from the maker's notes :—The initial problems once solved, the success of the experiment exceeded the most sanguine expectations and where wheels shod with high-grade shrunk tyres were in some cases requiring renewal on account of wear or looseness after only 3 to 4 months manganese-steel wheels have endured for 3 years and give promise of many years' life before needing replacement. Owing to the peculiarly intractable nature of manganese steel from the point of view of machining the design of a successful crane wheel presented certain problems. The ultimate solution is a wheel in which body and tread are cast as a single piece and finished to profile by grinding, thus eliminating all question of tyres stretching and calling for renewal on account of looseness, a trouble of frequent occurrence with normal designs in which a tyre-steel rim is shrunk into position on a cast-iron or steel centre.

In order that drilling for the attachment of driving gears can be carried out insets of mild steel are cast in at the appropriate points and the gear is correctly positioned by means of a ground spigot. Manganese steel is, in its toughened condition, comparatively soft until it becomes work hardened in service, with the result that in early life the tread and flanges take an excellent surface, which, hardening itself in the process of forming, possesses outstanding qualities of endurance. This tread is kindly to the track and exhibits less tendency to seize on the rail and to cause the crane to " wind " than the normal tyred wheel.

Many patterns are in existence ranging from 36-in. diameter on tread with bronze axle bushes for 75–100-ton cranes to 18-in. diameter with roller bearings for 12-ton telphers operating on sharp curves feeding furnace charging machines, while designs are also available with dead centres for live axles. Satisfied by extensive experience in their own works as to the outstanding success of this



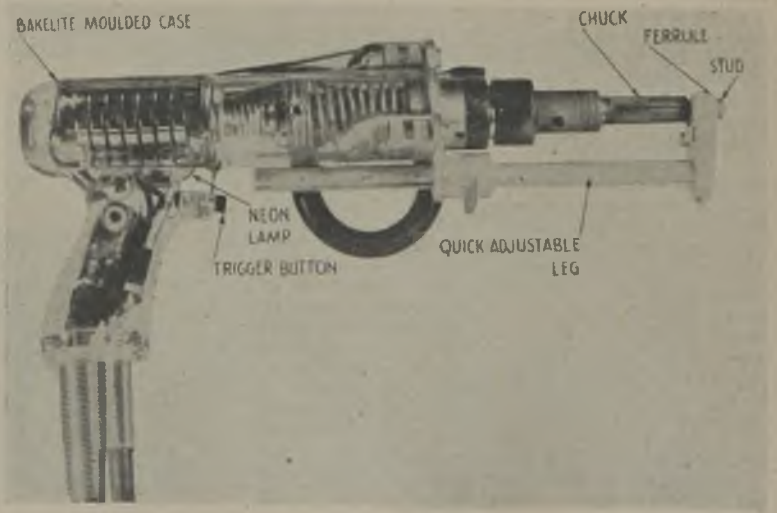
innovation the company are now prepared to supply manganese-steel wheels both to crane makers and to users and point out that they can be made interchangeable with existing wheels, thus involving no alteration to standard designs or expense in adaptation. These wheels are also suitable for rail-borne excavators, particularly those of the type that operate from a fixed centre with a circular supporting track.

Visco Engineering Co., Ltd., of Stafford Road, Croydon, have prepared a catalogue describing their rotating self-cleaning air filters suitable for use where the atmosphere is heavily laden with dust. These are of two types—one with oil bath cleaning of the filter cells and one with oil spray cleaning, where the air is exceptionally dirty. The standard arrangement of a single section self-cleaning filter consists of a number of filter cells containing special sinuous plates, evenly spaced and covered by a thin film of "Viscinol" oil. The air in its passage between the plate is buffeted from side to side and the solid particles of dirt impinge on and are retained by the oil-film-covered plate surfaces. The filter cells are provided at each end with three guide pins and sliding-in guides. The guide pins of the lowest cell engage with a sprocket wheel which supports the whole filter bank in position. By rotating a cranked non-reversible operating handle a rack and pinion action takes place and the lowest and dirtiest cell is permitted to drop into an oil bath. The cell remains suspended in the bath by its upper pins until it is lifted out of the bath into the draining position. When reaching this position the chain travel is automatically arrested. The gearing is so designed that the cleaned cell moves to the top of the filter bank in the same time that the lowest dirty cell is moved down and allowed to drop into the bath. When so falling the cell receives a swinging motion and as the filter plates are vertical to the oil surface a vigorous rinsing action takes place. When lifted out of the bath the basket takes up a full charge of oil which, when draining, carries with it the dust collected on the plates. If the filter is used in accordance with the simple working instructions supplied there is no possibility of oil being carried along with the air stream. As a safeguard against misuse, however, a set of louvres is fitted on the clean air side. The oil bath is fitted with an oil level gauge and drain cock. In some localities—in rolling mills, for instance—the dust saturation of air is exceptionally heavy. The filter has then to function more as a dust collector than a filter and in consequence collects so much dust that the standard washing operation of the filter cells becomes insufficient and the oil tank too quickly filled with sludge. In these cases it is advisable either to have some preliminary filter to eliminate the coarsest dust or to incorporate the other design of oil spray washing to the cells. With this design, the lowest cell in the filter column is not dropped into a bath of oil. It is allowed to drop into a position where it is subjected to pressure oil spraying, attacking the cell both from the top and side. This removes all accumulated dust.

Cooke and Ferguson, Ltd., of Victoria Street, Openshaw, Manchester, issue details of the Nelson electric-arc stud welding process. This is a means of welding studs automatically and directly on to metal surfaces with complete fusion, without the necessity for drilling, tapping, or hand welding. The following is extracted :—The standard type of equipment includes a pistol grip hand tool and a control box, which automatically controls the complete welding cycle. This standard unit is capable of welding studs or pins varying in diameter from 10 s.w.g. to $\frac{3}{4}$ in. Adjustment to the timing control for various diameters of studs is easily accessible and can be set in a few seconds. The studs are flux loaded and ferrules are used to control the arc and also control the fillet of metal which is raised on the plate round the base of the stud during welding. This fillet of metal considerably reinforces the mechanical strength of the weld, but can be removed if necessary and adequate strength still remains.

In use the Nelson stud welder is coupled to a d.c. welding generator and cables up to 300 ft. can be extended to work area. The operator loads the stud in the appropriate size chuck and slips a ferrule, which is gripped by steel fingers, over the stud. The welding operation is then ready to take place.

Nelson Stud Welder.



The pointed end of the stud is positioned on the parent metal surface and pressure is maintained against a spring which is loaded into the hand tool, until the ferrule bears against the surface of the plate. On pressing the trigger button the weld cycle takes place. No welding experience is necessary as the cycle is completely automatic after the control timing device has been set for the appropriate diameter of stud.

A short description of the action during the welding cycle is as follows :—(1) When stud makes contact with base metal a current flows through the complete circuit and is indicated visually by a small neon tube on the pistol grip hand tool. This serves two purposes : First, it gives a definite indication to the operator that he is making good electrical contact with the base plate and is ready to push the button and commence the weld. Secondly, this small current is sufficient to burn through a layer of paint, red-lead, rust, or light scale, and make good initial contact to the base plate, enabling an arc to be struck when the welding cycle starts. (2) When the button is pressed the main contactor is closed, causing the main welding current to flow between the stud and the plate. This current energises an electromagnet which is moulded into the hand tool. This lifts the stud from the plate a limited distance and draws an arc. (3) The timing device holds the contactor closed for a pre-determined time, depending on stud diameter, and then opens the contactor, quenching the arc. This timer is pneumatically operated, no separate electrical supply being necessary to operate the control box. (4) When the contactor opens and current ceases to flow through the electromagnet coil the stud, under the action of the spring, is forced into the molten pool of metal and the weld is complete. The pistol grip tool is illustrated.

Metal Markets

Copper.—The two major items of news during the month have been the decision to abandon price control over a wide range of items in the United States and the raising of the official maximum quotation for copper from £84 to £98 a ton, delivered, in the United Kingdom. The immediate effect of the former announcement was to lift the American domestic quotation from the "ceiling" figure of 14·375 cents to 17·50 cents per lb. With the discontinuation of the Government's purchasing programme, however, the 4 cent import duty has again been imposed, with the result that first Phelps Dodge and subsequently other producers, have since raised their copper price to 19·50 cents per lb. This latter figure is equivalent to a sterling value of nearly £108 10s. a ton. With regard to the British Government's purchases of Canadian copper, these are now understood to amount to 140,000 short tons, for delivery over the whole of 1947. Precise information on the price or prices to be paid is lacking at the moment, but for the first six months it is believed that sales will be made on the basis of 17·50 cents per lb. f.a.s. Atlantic Ports, with figures yet to be arranged for the third and fourth quarters. Meanwhile the demand for copper throughout the world remains as strong as hitherto and it is apparent that United States requirements will necessitate that country remaining a substantial importer for some time. Unfortunately the strike at the big Braden property in Chile continues, with a resultant loss of available supplies.

U.K. official maximum price electrolytic, November 30, £98 a ton delivered.

Tin.—Following the deliberations of the International Tin Conference in London early in October and the rise in the official maximum price in the United Kingdom the general tin situation has shown little change. Consumers, while unable to obtain all the metal they would wish, are nevertheless receiving sufficient quantities under the present allocations scheme to ensure the execution of their important orders. There is, however, not much possibility of supply catching up with demand for, say, another two years. In the Far East operations continue to be hampered somewhat by labour, machinery, and equipment difficulties, but outputs are registering a steady improvement. Malayan production of tin during the third quarter amounted to 2,378 tons, making for the first nine months of the year a total of 5,424 tons. In the United States the abandonment of price control has had the effect of raising the price from the previous "ceiling" of 52 cents to 70 cents per lb., at which level it is not unduly out of line with the official quotation at present ruling in Britain. This development has removed the anomalous position whereby the United States Government purchased metal at 70 cents per lb. and sold it to consumers at 52 cents. The Administration there has stated that present control will continue until the first quarter of 1947, although the Industrial Advisory Committee has requested the Government to continue apportioning supplies during the whole of next year in order that equitable distribution may be ensured.

U.K. official maximum price, November 30, £380 10s. a ton delivered.

Lead.—A good deal of surprise was expressed in lead circles when the Ministry of Supply failed to advance the official price in Britain when copper and zinc were raised recently. The possibility of a rise in the near future is freely discussed, however, since with the abandonment of price control in America the quotation there has risen from its "ceiling" level of 8·25 cents to 11·80 cents per lb. New York, or about £65 15s. a ton in sterling. The re-institution of the American import duty of over 1 cent was responsible in large measure for the latest advance. Meanwhile the lead supply position throughout the world remains extremely acute and in Britain consumers continue to receive but a portion of their total raw metal requirements. Imports rose sharply during October, amounting to 20,104 tons, as compared with a meagre 8,702 tons the month before. Total imports so far this year amount to 124,346 tons.

Official U.K. price for soft foreign lead, November 30, £55 a ton delivered.

Zinc.—During the month the Ministry of Supply in this country further advanced the official maximum quotation by £5 a ton, whilst in America the removal of price control resulted in the domestic quotation there being raised to 10·50 cents per lb. The United States export figure is now in the neighbourhood of 11 to 11·50 cents. The general situation throughout the month has changed but little, with consumers able to cover themselves adequately, although there still remains a necessity for increasing imports. On the Continent fuel and

labour difficulties continue to hamper the attainment of increased outputs.

Mean U.K. price g.o.b. foreign zinc, November 30, £55 a ton delivered.

Iron and Steel.—The iron and steel industry in this country has remained very active throughout the month and with makers very fully booked for some months to come a certain amount of delivery delay has become apparent. Current output is very readily absorbed and with home requirements heavy and taking a good deal of priority it has remained necessary to "prune" exports. Overseas inquiry, however, remains as strong as hitherto. Rail transport hold-ups have adversely affected the movement of supplies, while the coal strike in America has further obscured the outlook. Tight conditions continue to prevail so far as the availability of semi-finished material is concerned and despite the fact that official attempts are being made to obtain tonnages from America there is little hope of re-rollers being fully covered for some months. United Kingdom pig-iron production during October was at the annual rate of 8,102,000 tons, as compared with 7,660,000 tons the month before and 7,598,000 tons in October, 1945. Steel output was also up at an annual rate of 13,226,000 tons.

Iron Ore.—The situation here is that home-produced ironstone is at a low level, although substantial imports of good-quality foreign ore are ensuring a steady output of iron and steel.

Antimony.—Smelters in Britain remain fully occupied, but are still unable to cater for total requirements. In the United States, following decontrol, the price of antimony has risen to 23½ cents per lb. f.o.b. Laredo. For 99% English regulus the official price remains £125 per ton delivered.

Arsenic.—There has been no falling off in the demand for white arsenic throughout the month and supplies continue to fall short of current requirements. Leading sellers, however, maintain their quotation at £38 6s. 3d. per ton, ex store, for 10-ton lots. For parcels under one ton £41 6s. 3d. per ton is asked.

Bismuth.—For commercial quantities dealers continue to quote 9s. per lb.

Cadmium.—The price of cadmium was advanced 1s. per lb. during the month so that for minimum 1-cwt. lots dealers now quote 8s. 6d. per lb. Firmer conditions prevail on the Continent; France has contracted to take the Belgian export surplus, the price there at the moment being around 11s. 3d. per lb.

Cobalt Metal.—The current price shows no alteration at 9s. to 9s. 1d. per lb.

Cobalt Oxides.—For black and grey oxides sellers continue to ask 6s. to 6s. 6d. per lb. respectively.

Chromium.—There has been no change in the position with 4s. 5d. to 4s. 8d. per lb. still quoted for 98% to 99% metal. Demand for chromium is well maintained, but a certain amount of delivery delay is in evidence.

Tantalum.—Sellers in this country continue to quote about £18 to £19 per lb.

Platinum.—The price of platinum on the London market has remained at £18 per troy oz. throughout the month. There has been some improvement in the supply position, but demand has shown little or no increase, consumers being content to cover their requirements as they arise.

Palladium.—The palladium quotation has been steadily maintained at £5 15s. to £6 per oz. for some considerable time and a steady demand is reported at this level.

Osmium.—Supplies of osmium have virtually disappeared from the London market, so that at around £20 to £25 an oz. the current price is purely nominal.

Iridium.—Here also rather quiet conditions prevail, with the quotation nominal at about £30 to £35 an oz.

Tellurium.—The current quotation shows no change at 7s. per lb.

Selenium.—Leading sellers maintain their selling price at around 8s. per lb.

Tungsten Ore.—Only a moderate amount of business is passing at the present moment, but for the usual 65% concentrates 62s. 6d. to 67s. 6d. per unit of WO_3 c.i.f. continues to be asked.

Manganese Ore.—Consumers in this country find little difficulty in covering their requirements at the present time. United Kingdom imports during October amounted to 16,340 tons, making a total for the year so far 112,852 tons. The current quotation is 1s. 4½d. per unit of metal c.i.f., on the basis of pre-war freight and insurance rates *plus* 50%.

Aluminium.—Considerable quantities of secondary material continue to be absorbed in the Government programme for building 54,000 aluminium houses by next autumn. The requirements of this scheme are tying up a good deal of the country's rolling and extrusion capacity, with the result that a number of ordinary consumers are finding difficulty in obtaining rolled and extruded supplies. For 99% virgin metal £72 15s. per ton, delivered, continues to be quoted.

Copper Sulphate.—Official sources in this country continue to report a very substantial export inquiry. For 98% to 100% material £37 10s. per ton f.o.b., less 2%, is the current quotation, the rise having been brought about by the recent advance in the official price of copper.

Nickel.—While the quotation in the United States has recently registered an increase the price in Britain remains at £190 to £195 a ton, depending on quantity.

Chrome Ore.—Users in Britain remain able to meet their requirements fairly easily, although on the Continent rather difficult conditions continue to prevail. For Rhodesian and Baluchistan metallurgical grades £10 a ton remains the official quotation.

Quicksilver.—Free-trading and price-fixing arrangements were brought into effect as from November 7 and as a result dealers and consumers are now able to import metal on private account, either directly or through an agent. For the time being supplies are available from the Government store at the recently-reduced price of £25 per bottle and this is the quotation for spot metal. For forward supplies—say, for delivery in two months time—around £20 15s. per bottle f.o.b. is quoted. A British Empire agent, with offices in London and Australia, has recently been appointed to handle sales for the Italo-Spanish combine "Mercurio Europeo."

Molybdenum Ore.—Around 45s. to 47s. 6d. per unit of MoS_2, f.a.s., remains the current quotation.

Graphite.—The current price remains largely a matter of negotiation.

Silver.—The London quotation has remained steady throughout the month at 55½d. per oz.

Statistics

TRANSVAAL GOLD OUTPUTS

	October*		November*	
	Treated Tons.	Yield Oz.	Treated Tons.	Yield Oz.
Alpine (Barberton)	5,411	1,369	—	—
Blyvooruitzicht	27,000	23,204	—	—
Brakpan	109,000	£185,639	105,000	£184,115
City Deep	82,000	20,907	80,000	20,405
Cons. Main Reef	215,000	29,373	189,000	27,784
Cons.Murchison (T.V.L.)	8,500	£22,768	8,600	£22,795
Crown Mines	275,000	57,805	270,000	55,031
Daggafontein	161,000	£376,674	160,000	£373,243
Dominion Reefs	25,220	3,645	24,700	3,535
D'rb'n Roodeport Deep	180,000	33,681	167,000	31,639
East Champ D'Or	29,000	£48,038	26,000	£48,736
East Daggafontein	89,500	£195,535	86,500	£191,403
East Geduld	162,000	45,198	156,000	43,543
East Rand P.M.	210,000	42,157	205,000	42,377
Geduld	111,000	23,387	107,000	22,492
Geldenhuis Deep	56,000	7,395	55,000	6,302
Glynn's Lydenburg	10,300	2,795	10,000	2,701
Government G.M. Areas	236,000	£353,903	230,000	£337,048
Grootvlei Proprietary	166,000	42,568	160,000	40,960
Langlaagte (In Liq.)	16,000	£47,347	—	—
Luipaards Vlei	88,000	18,277	84,000	17,448
Marievale Consolidated	55,000	16,465	54,000	16,193
Modderfontein B	62,000	9,159	60,000	9,071
Modderfontein Deep	32,000	5,205	31,000	4,959
Modderfontein East	101,000	19,339	126,000	18,5: 5
New Kleinfontein	130,000	15,313	98,000	14,773
New Modderfontein	88,000	11,549	84,000	10,574
New State Areas	118,000	£177,121	109,000	£173,450
Nigel Gold	43,000	10,361	41,000	10,021
Nourse	73,000	13,880	73,000	13,694
Rand Leases	191,000	£306,336	183,000	£290,421
Randfontein	350,000	£383,149	342,000	£376,981
Rietfontein Consolid't'd	28,000	5,742	26,000	5,501
Robinson Deep	106,000	20,299	102,000	19,635
Rose Deep	74,500	11,146	69,000	10,934
Simmer and Jack	140,000	25,378	130,000	24,251
S. African Land and Ex.	87,500	£144,522	88,500	£145,274
Springs	121,000	£185,868	120,500	£182,341
Sub Nigel	69,000	34,593	66,500	33,176
Transvaal G.M. Estates	22,400	4,925	21,200	4,200
Van Dyk Consolidated	103,000	20,313	100,000	19,644
Van Ryn	59,000	£59,729	59,000	£59,546
Venterspost Gold	112,000	23,552	110,000	23,054
Village Main Reef	25,900	£34,555	26,000	£34,589
Vlakfontein	24,000	10,056	23,500	9,870
Vogelstruisbult	76,500	18,752	75,000	18,387
West Rand Consolidated	222,000	£347,773	218,000	£338,448
West Springs	60,000	£101,460	60,000	£96,459
Western Reefs	79,000	£166,780	79,000	£166,826
Witw'tersr'nd (Knights)	83,000	£94,255	81,000	£91,265
Witwatersrand Nigel	9,100	£22,209	9,100	£22,559

* Gold at 172s. 6d. per oz.

COMPARATIVE TRANSVAAL GOLD FIGURES

	1943	1944	1945	1946
	Oz.	Oz.	Oz.	Oz.
January	1,074,754	1,029,398	1,029,384	1,016,458
February	1,011,672	969,017	965,569	946,577
March	1,108,789	1,038,414	1,036,443	877,449
April	1,075,363	995,915	1,028,544	994,988
May	1,096,195	1,058,875	1,030,990	1,049,195
June	1,064,572	1,038,331	1,024,796	1,018,543
July	1,089,708	1,039,851	1,032,717	1,047,599
August	1,059,932	1,053,954	978,097	1,014,081
September	1,054,980	1,024,341	1,002,716	984,174
October	1,060,198	1,024,574	1,058,283	1,001,924
November	1,056,979	1,006,986	1,020,990	—
December	1,046,879	997,572	1,005,016	—
Total	12,800,021	12,277,328	12,213,545	—

PRODUCTION OF GOLD IN THE TRANSVAAL

	Rand	Elsewhere	Total
	Oz.	Oz.	Oz.
November, 1945	999,212	21,778	1,020,990
December	981,168	23,848	1,005,016
January, 1946	996,175	20,283	1,016,458
February	923,468	23,109	946,577
March	855,832	21,617	877,449
April	974,434	20,554	994,988
May	1,026,007	23,188	1,049,195
June	995,767	22,778	1,018,543
July	1,024,830	22,769	1,047,599
August	990,357	23,724	1,014,081
September	961,425	22,749	984,174
October	1,001,924	24,092	1,026,016

NATIVES EMPLOYED IN THE TRANSVAAL MINES

	Gold Mines	Coal Mines	Total
November 30, 1945	298,406	27,195	325,601
December 31	292,408	27,028	319,436
January 31, 1946	298,756	27,533	326,289
February 28	306,719	27,640	334,359
March 31	310,446	27,746	338,192
April 30	310,923	28,012	338,935
May 31	307,190	27,768	334,958
June 30	303,822	27,695	333,517
July 31	299,599	27,671	327,270
August 31	295,788	27,738	323,526
September 30	292,246	27,955	320,201
October 31	288,285	27,374	315,659

COST AND PROFIT ON THE RAND, etc.

Compiled from official statistics published by the Transvaal Chamber of Mines

	Tons milled	Yield per ton	Work'g cost per ton	Work'g profit per ton	Total working profit
		s. d.	s. d.	s. d.	£
Nov., 1945	4,926,100	34 8	23 6	10 10	2,622,409
Dec.	4,780,500	35 1	24 1	10 7	2,526,770
Jan., 1946	4,884,100	34 9	24 5	10 4	2,514,880
Feb.	4,464,000	35 2	25 3	9 11	2,225,680
Mar.	4,224,600	34 6	28 0	6 6	1,364,982
April	4,744,400	35 1	25 2	9 11	2,356,640
May	5,007,600	34 11	24 11	10 0	2,506,332
June	4,814,600	35 0	24 11	10 1	2,436,942
July	5,016,700	34 9	24 10	9 11	2,497,347
Aug.	4,896,900	34 10	25 8	9 2	2,225,715
Sept.	—	—	—	—	1,843,218
Oct.	—	—	—	—	2,270,085

MISCELLANEOUS METAL OUTPUTS

	4-Week Period To Nov. 9		
	Tons Ore	Lead Concs. tons	Zinc Concs. tons
Broken Hill South	22,050*	3,372	4,395
Electrolytic Zinc	9,823	649	5,748†
New Broken Hill	4,687	470	1,081
North Broken Hill	29,027*	5,679	5,897
Zinc Corp.	42,223	7,065	7,550
Rhodesia Broken Hill	—	—	—

* To Nov. 2. † Metal.

PRODUCTION OF GOLD AND SILVER IN RHODESIA

	1945		1946	
	Gold (oz.)	Silver (oz.)	Gold (oz.)	Silver (oz.)
January	47,829	7,444	45,261	7,961
February	46,009	7,518	42,089	7,440
March	48,166	8,547	44,969	8,094
April	49,072	8,622	45,982	7,156
May	47,797	7,554	45,958	7,711
June	46,998	7,772	47,245	7,997
July	47,972	8,705	46,939	8,462
August	47,666	7,846	47,027	8,190
September	47,995	8,100	—	—
October	47,550	8,471	—	—
November	45,567	7,687	—	—
December	45,620	7,707	—	—

RHODESIAN GOLD OUTPUTS

	October		November	
	Tons	Oz.	Tons	Oz.
Bushtick	13,300	1,878	12,800	1,881
Cam and Motor	22,800	£42,897	18,000	£40,429
Globe and Phœnix	6,200	3,048	—	—
Rezende	20,000	£19,787	20,500	£21,458
Sherwood Starr	—	£1,324	—	£1,064
Thistle-Etna	6,400	848	5,800	830
Vubachikwe	3,100	£5,504	—	—
Wanderer Consolidated	—	—	32,000	2,923

WEST AFRICAN GOLD OUTPUTS

	October		November	
	Tons	Oz.	Tons	Oz.
Amalgamated Banket	27,477	1,872	—	—
Ariston Gold Mines	23,000	£64,378	—	—
Ashanti Goldfields	16,500	17,350	16,500	17,350
Bibiani	22,500	6,421	22,500	6,411
Bremang	—	1,567	—	—
Gold Coast Main Reef	9,383	4,125	9,402	4,179
Konongo	9,120	4,209	—	—
Marlu	25,040	2,876	24,000	2,479
Taquah and Abosso	25,000	5,820	25,000	5,816

WESTRALIAN GOLD PRODUCTION

	1944	1945	1946
	Oz.	Oz.	Oz.
January	36,796	41,508	42,471
February	33,196	35,947	37,523
March	38,885	38,855	39,855
April	26,806	35,134	41,297
May	37,762	34,202	46,312
June	40,973	36,591	44,527
July	36,582	39,861	50,987
August	60,193	59,414	87,563
September	39,475	33,578	55,123
October	37,331	34,108	55,002
November	36,156	41,590	—
December	42,107	39,760	—
Total	466,362	468,548	—

WESTRALIAN GOLD OUTPUTS

	4-Week Period			
	To October 15		To November 12	
	Tons	Oz.	Tons	Oz.
Boulder Perseverance	9,673	2,790	9,363	2,750
Central Norseman	8,650	3,955*c*	9,110	3,365*b*
Comet Mine	—	—	—	—
G.M. of Kalgoorlie	12,186	2,359*e*	12,146	2,587*b*
Golden Horse Shoe	—	932*d*	—	600*c*
Gt. Boulder Prop.	32,798	7,485	33,180	7,656
Kalgoorlie Enterprise	4,613	1,448	4,499	1,396
Lake View & Star	46,063	11,480	46,037	11,489
Morning Star (G.M.A.)	1,302	502	1,233	751*b*
North Kalgurli	11,740	3,495	11,918	3,561
Paringa	8,020	1,804	8,557	2,017
Phœnix Mine	—	—	—	—
Sons of Gwalia	8,548	2,716*e*	—	—
South Kalgurli	7,463	1,313	—	—
Tindals Gold	—	—	—	—
Waronga (Emu)	—	—	—	—
Wiluna	12,678	2,200*d*	—	—
Yellowdine	—	—	—	—

b 4 weeks to Nov. 26. *c* Nov. *d* Oct. *e* 4 weeks to Oct. 29.

PRODUCTION OF GOLD IN CANADA

	1945		1946	
	*Output oz.	*Total value $	*Output oz.	*Total value $
January	233,210	8,974,350	238,450	9,180,325
February	212,351	8,175,513	229,099	8,820,311
March	228,687	8,804,450	248,403	9,563,516
April	223,737	8,613,875	238,216	9,171,316
May	217,556	8,375,906	240,339	9,253,052
June	212,163	8,103,086	234,383	9,023,745
July	210,209	8,093,046	239,554	8,384,390
August	211,754	8,152,529	231,200	8,901,200
September	211,529	8,143,866	—	—
October	229,550	8,837,675	—	—
November	220,755	8,499,067	—	—
December	239,749	9,230,337	—	—
Total for Calendar Year	2,651,250	102,004,700	—	—

* Subject to revision.

ONTARIO GOLD AND SILVER OUTPUT

	Tons Milled	Gold Oz.	Silver Oz.	Value Canad'n $
October, 1945	539,554	130,320	20,458	5,023,191
November	556,671	136,974	19,724	5,279,708
December	589,792	145,493	51,752	5,622,718
January, 1946	589,148	144,509	22,600	5,574,375
February	551,813	134,485	21,155	5,190,366
March	623,327	146,055	27,229	5,643,975
April	594,266	141,230	16,673	5,449,639
May	630,000	149,549	27,904	5,776,929
June	597,494	149,785	28,436	5,779,609
July	625,359	152,215	20,790	5,374,170
August	600,896	149,925	20,830	5,267,175
September	575,097	146,883	29,241	5,165,102

CANADA'S LEADING MINERAL PRODUCTS

		July,* 1946	August.* 1946
Asbestos	Ton	45,733	53,688
Cement	Brl.	1,352,373	1,231,148
Clay products	$	1,221,741	1,180,902
Coal	Ton	1,152,994	1,346,087
Copper	Lb.	31,008,539	29,947,283
Lead	Lb.	31,659,550	30,094,381
Nickel	Lb.	16,240,647	15,437,106
Silver	Fine oz.	1,266,925	1,185,906
Zinc	Lb.	39,550,943	39,162,797

* Subject to revision.

GOLD OUTPUTS, KOLAR DISTRICT, INDIA

	October		November	
	Tons	Oz.	Tons	Oz.
Champion Reef	9,830	5,208	2,200	1,750
Mysore	16,128	4,119	7,383	1,997
Nundydroog	13,750	3,561	—	—
Ooregum	8,617	2,091	8,642	2,157

MISCELLANEOUS GOLD AND SILVER OUTPUTS

	October		November	
	Tons	Value £	Tons	Value £
Blackwater (N.Z.)	—	—	—	—
British Guiana Cons.	—	486*	—	524*
Emperor Mines (Fiji)	—	—	34,602	12,059*d*
Frontino Gold (Colombia)	7,900	35,867	—	—
Geita Gold (Tanganyika)	7,685	1,704*	—	—
Martha Gold (N.Z.)	10,701*c*	2,393* / 16,571†	10,179	2,795* / 19,952†
New Goldfields of Venezuela	3,242	3,593*	—	—
Rosterman (Kenya)	2,800	891*	—	—
St. John d'el Rey (Brazil)	—	126,500	—	121,500
Tati Goldfields (Bech'land)	4,200	230*p*	—	—
Victoria Gold (Vic.)	—	750**b*	—	573*d**
Yukon Consolidated	—	$238,000	—	$117,000

* Oz. Gold. † Oz. Silver.
b Period to Nov. 9. *d* Period to Nov. 26. *p* Profit. *c* To Oct. 12.

OUTPUTS OF TIN MINING COMPANIES

In Long Tons of Concentrate

	Sept.	Oct.	Nov.
Amalgamated Tin Mines	485	520	—
Ampat Tin	19½	29	—
Bisichi	36	48¼	—
Ex-Lands	47	50	—
Fabulosa	87	—	—
Geevor	38	41	—
Gold and Base Metals of Nigeria	—	—	—
Jantar Nigeria	35	31	24
Jos Tin	—	—	—
Kaduna Prospectors	5½	5	7
Kaduna Syndicate	43	45	53
Kagera	—	20	—
Kamunting	76	70	—
Keffi Tin	53	57	—
Kuchai Tin	22	10½	—
Naraguta Tin Mines	43¾	48½	—
Naraguta Karama	27	29	—
Naraguta Extended	13½	16½	—
Nigerian Consolidated	—	—	—
Pahang Consolidated	—	—	—
Rahman Hydraulic	—	—	—
Rawang Concessions	50½	71	—
Rawang Tin	17	29	—
Rihon Valley	—	—	—
Rukuba Tin Mines	2¾	2½	—
South Bukeru	6½	10½	—
Southern Kinta	—	39½	—
Southern Malayan	8½	33	—
Sungei Kinta	21½	40	—
Tin Fields of Nigeria	5	4¾	42¾
United Tin Areas	—	—	—

QUOTATIONS OF OIL COMPANIES' SHARES

Denomination of Shares £1 unless otherwise noted

	Oct. 8, 1946	Nov. 8, 1946	Dec. 6, 1946
	£ s. d.	£ s. d.	£ s. d.
Anglo-Ecuadorian	1 16 3	1 16 6	1 18 7
Anglo-Egyptian B.	3 13 9	3 10 0	3 11 3
Anglo-Iranian Ord.	4 17 6	4 15 0	4 18 9
" " 1st Pref.	1 17 6	2 0 3	2 2 6
" " 2nd Pref.	1 18 9	2 1 3	2 5 9
Apex Trinidad (5s.)	1 10 9	1 12 0	1 17 0
Attock, India	2 6 3	2 0 0	2 0 9
British Borneo Pet. (6s.)	1 10 3	1 10 0	1 11 9
British Controlled ($5)	4 3	4 5	4 6
" " Pref. (£)	13 9	13 5	14 6
Burmah Oil	3 6 9	3 6 3	3 8 9
" " Pref.	2 1 0	2 2 2	2 6 6
Canadian Eagle Ord.	1 10 0	1 12 6	1 12 3
" " 7% Pref. ($3)	13 3	12 9	12 9
" " 8% Pref.	1 11 0	1 15 0	1 15 9
Kern (3s. 4d.)	5 0	6 9	7 6
Lobitos, Peru	3 5 0	3 5 3	3 6 3
London and Thames Haven	17 3	16 9	17 0
Mexican Eagle Ord. (4 pesos)	14 9	15 6	15 3
" " 8% Pref. (4 pesos)	15 3	15 6	15 6
" " 7% Pref. (")	8 9	8 6	8 6
Phœnix Roumania	5 0	4 6	4 9
Premier (Trinidad) (2s.)	3 3	3 6	3 9
Royal Dutch (100 fl.)	30 15 0	30 5 0	30 0 0
Shell Transport Ord. (Units)	4 8 9	4 10 0	4 14 3
" " 5% Pref.	1 8 3	1 11 3	1 13 6
" " 7% Pref.	1 17 9	2 1 6	2 3 0
Steaua Romana	5 0	5 9	5 3
Trinidad Central (10s.)	1 1 0	1 2 6	1 6 3
Trinidad Cons. (4s.)	6 3	6 3	6 6
Trinidad Leaseholds	5 10 0	5 18 0	5 13 9
Trinidad Pet. Dev.	5 5 6	5 10 0	5 13 9
Ultramar (10s.)	3 7 6	3 10 0	3 11 9
United British of Trinidad (6s. 8d.)	1 8 9	1 8 3	1 8 6
V.O.C. Holding (13s. 4d.)	3 13 9	3 15 0	3 16 3
" 7% Pref. (13s. 4d.)	3 13 9	3 15 0	3 16 3

Prices of Chemicals

Chemical stocks and prices are generally under control and the figures given below represent those last ruling.

		£ s. d.
Acetic Acid, 40%	per ton	25 12 0
" " 80%	"	49 10 0
" " Glacial	"	59 0 0
Alum	"	16 0 0
Aluminium Sulphate, 17 to 18%	"	11 10 0
Ammonia, Anhydrous	per lb.	2 0
Ammonium Carbonate	per ton	42 0 0
" Chloride, 98%	"	22 10 0
" Nitrate	"	19 0 0
" Phosphate (Mono- and Di-)	"	69 0 0
Antimony, Sulphide golden	per lb.	1 11
Arsenic White, 99/100%	per ton	40 0 0
Barium Carbonate (native), 94%	"	6 15 0
" Chloride	"	19 10 0
Barytes	"	9 3 6
Benzol	per gal.	2 6
Bleaching Powder, 36% Cl.	per ton	11 5 0
Borax	"	30 0 0
Boric Acid (Comml.)	"	52 0 0
Calcium Chloride, solid, 70/75%	"	5 15 0
Carbolic Acid, crude 60's	per gal.	3 9
" " crystallized	per lb.	11
Carbon Bisulphide	per ton	39 0 0
Citric Acid	per lb.	1 7
Copper Sulphate	per ton	37 10 0
Creosote Oil (f.o.r. in Bulk)	per gal.	8
Cresylic Acid, 98%	"	4 2
Hydrofluoric Acid, 59/60%	per lb.	1 1
Iron Sulphate	per ton	3 17 6
Lead, Acetate, white	"	72 10 0
" Nitrate	"	72 10 0
" Oxide, Litharge	"	70 0 0
" White	"	84 0 0
Lime, Acetate, brown	"	19 0 0
" " grey, 80/82%	"	23 10 0
Magnesite, Calcined ex W'h'se	"	Nominal
" Raw	"	9 7 6
Magnesium Chloride, ex W'h'se	"	27 10 0
" Sulphate comml.	"	13 0 0
Methylated Spirit Industrial 66 O.P.	per gal.	3 0
Nitric Acid, 80° Tw.	per ton	25 0 0
Oxalic Acid	"	102 10 0
Phosphoric Acid (S.G. 1·750)	per lb.	1 1
Pine Oil	per cwt.	4 7 0
Potassium Bichromate	per lb.	7½
" Carbonate (hydrated)	per ton	51 10 0
" Chlorate	per lb.	Nominal
" Chloride, 98%	per ton	16 10 0
" Amyl Xanthate	per lb.	1 3½
" Ethyl Xanthate	"	8
" Hydrate (Caustic) solid	per ton	65 10 0
" Nitrate	per cwt.	3 16 0
" Permanganate	"	7 19 3
" Sulphate, 90%	per ton	Nominal
Sodium Acetate	"	41 0 0
" Arsenate, 58–60%	"	Nominal
" Bicarbonate	"	11 0 0
" Bichromate	per lb.	6½
" Carbonate (crystals)	per ton	Nominal
" " (Soda Ash) 58°	"	8 0 0
" Chlorate	"	46 0 0
" Cyanide 100% NaCN basis	per lb.	8½
" Hydrate, 76/77%	per ton	16 4 0
" Hyposulphite, comml.	"	16 0 0
" Nitrate	"	17 5 0
" Phosphate (Dibasic)	"	29 10 0
" Prussiate	per lb.	9½
" Silicate	per ton	8 10 0
" Sulphate (Glauber's Salt)	"	5 5 0
" " (Salt-Cake)	"	4 11 0
" Sulphide, flakes, 60/62%	"	21 17 6
" Sulphite, comml.	"	13 0 0
Sulphur, American, Rock (Truckload)	"	12 10 0
" Ground	"	16 10 0
Sulphuric Acid, 168° Tw.	"	6 12 6
" free from Arsenic, 140° Tw.	"	4 11 0
Superphosphate of Lime	"	5 10 0
Tartaric Acid	per cwt.	15 8 0
Tin Crystals	per lb.	Nominal
Titanium white, 70%	per ton	37 10 0
Zinc Chloride	"	22 0 0
" Dust, 95/97%	"	56 0 0
" Oxide (White Seal)	"	54 5 0
" Sulphate	"	28 0 0

Share Quotations

Shares are £1 par value except where otherwise stated.

GOLD AND SILVER:	Nov. 8, 1946. £ s. d.	Dec. 6, 1946. £ s. d.
SOUTH AFRICA:		
Blyvooruitzicht (10s.)	8 15 0	8 17 6
Brakpan (5s.)	13 9	14 3
City Deep	2 2 6	2 3 9
Consolidated Main Reef	1 13 9	1 15 0
Crown Mines (10s.)	5 0 0	5 5 0
Daggafontein (5s.)	3 0 0	3 1 3
Dominion Reefs (5s.)	5 0	5 3
Durban Roodepoort Deep (10s.)	3 6 3	3 13 9
East Daggafontein (10s.)	2 4 3	2 8 9
East Geduld	8 18 9	9 7 6
East Rand Consolidated (5s.)	12 0	13 0
East Rand Proprietary (10s.)	1 17 6	2 0 0
Geduld	6 3 9	6 2 6
Geldenhuis Deep (15s.)	1 10 0	1 8 9
Government Gold Mining Areas (5s.)	1 3 0	1 2 6
Grootvlei	6 10 9	7 3 9
Klerksdorp (5s.)	5 0	5 6
Lace Proprietary (5s.)	1 2 0	1 3 9
Libanon (10s.)	1 7 0	1 4 3
Luipaards Vlei (2s.)	19 0	18 9
Marievale (10s.)	1 7 6	1 7 6
Modderfontein B (5s.)	8 3	8 9
Modderfontein East	2 15 0	2 16 3
New Kleinfontein	1 5 0	1 5 9
New Modderfontein (10s.)	8 3	8 9
New State Areas	1 6 3	1 6 3
Nigel Gold (10s.)	1 3 9	1 5 0
Nourse	1 5 0	1 7 6
Rand Leases (10s.)	2 10 0	2 10 0
Randfontein	1 2 6	1 3 3
Rietfontein Consolidated (5s.)	14 3	14 3
Robinson Deep B (7s. 6d.)	13 6	12 0
Rose Deep	1 2 6	1 2 6
Simmer and Jack (2s. 6d.)	9 6	10 0
South African Land (3s. 6d.)	1 18 9	1 17 6
Springs (5s.)	12 6	12 3
Sub Nigel (10s.)	4 6 3	4 7 6
Van Dyk (10s.)	12 9	11 0
Van Ryn (10s.)	17 9	18 9
Venterspost (10s.)	2 2 0	2 3 3
Vlakfontein (10s.)	1 5 0	1 3 9
Vogelstruisbult (10s.)	1 2 6	1 2 6
West Driefontein (10s.)	4 7 6	4 6 3
West Rand Consolidated (10s.)	1 11 3	1 13 9
West Springs	1 0 9	1 0 9
West Witwatersrand Areas (2s. 6d.)	6 11 3	6 15 0
Western Holdings (5s.)	3 17 6	4 5 0
Western Reefs (5s.)	1 18 9	1 18 9
Witwatersrand Gold (Knights)	1 7 6	1 7 6
Witwatersrand Nigel (5s.)	6 3	6 6
RHODESIA:		
Bushtick (10s.)	4 0	3 9
Cam and Motor (12s. 6d.)	1 10 0	1 8 9
Globe and Phœnix (5s.)	1 3 0	1 2 0
Rezende (1s.)	5 0	5 3
Sherwood Starr (5s.)	3 3	3 3
Wanderer	8 6	7 0
GOLD COAST:		
Amalgamated Banket (5s.)	6 9	6 9
Ariston Gold (2s. 6d.)	12 0	13 3
Ashanti-Adowsena (2s.)	2 6	2 6
Ashanti Goldfields (4s.)	2 18 6	2 18 6
Bibiani (4s.)	1 9 0	1 9 3
Bremang Gold Dredging (5s.)	4 6	4 6
Gold Coast Banket Areas (2s.)	3 6	3 6
Gold Coast Main Reef (5s.)	11 6	13 3
Gold Coast Selection (5s.)	1 11 6	1 12 0
Konongo (2s.)	6 9	6 6
Kwahu (2s.)	1 11 3	1 11 9
London & African Mining Trust (5s.)	9 0	9 3
Marlu (5s.)	7 3	7 9
Nanwa	4 0	4 0
Offin River Gold (5s.)	4 6	4 3
South Banket Areas (2s.)	2 3	2 3
Taquah and Abosso (4s.)	1 6 6	1 6 6
AUSTRALASIA:		
Blackwater Mines, N.Z.	8 9	8 9
Boulder Perseverance (4s.), W.A.	9 0	9 3
Gold Fields Aust. Dev. (5s.), W.A.	4 3	5 0
Gold Mines of Kalgoorlie (10s.)	9 0	9 0
Golden Horse Shoe (3s.), W.A.	2 3	2 3
Great Boulder Propriet'y (2s.), W.A.	8 3	8 3
Lake View and Star (4s.), W.A.	1 5 6	1 7 0
Martha Gold (5s.), N.Z.	4 3	3 9
Mount Morgan (2s. 8d.), Q.	6 6	6 0
North Kalgurli (1912) (2s.), W.A.	1 1 6	1 1 6
Paringa (1s.), W.A.	3 6	3 6
Sons of Gwalia (10s.), W.A.	1 6 0	1 5 6
South Kalgurli (5s.), W.A.	19 0	19 3
Wiluna Gold, W.A.	13 0	13 9

	Nov. 8, 1946. £ s. d.	Dec. 6, 1946. £ s. d.
INDIA:		
Champion Reef (10s.)	18 9	19 3
Mysore (10s.)	9 6	9 9
Nundydroog (10s.)	15 0	13 9
Ooregum (10s.)	8 3	7 6
MISCELLANEOUS:		
Fresnillo	1 15 0	1 14 3
Frontino, Colombia	1 7 6	1 5 0
Kentan Gold Areas (10s.), E. Africa	6 9	6 3
New Goldfields of Venezuela (5s.)	1 3	1 3
Rosterman (5s.), Kenya	6 9	6 9
St. John d'el Rey, Brazil	1 12 6	1 10 0
Yukon Consolidated ($1)	7 6	8 0
COPPER:		
Esperanza Copper and Sulphur	3 6	3 6
Indian (2s.)	7 9	7 0
Messina (5s.), Transvaal	18 6	1 1 0
Mount Lyell, Tasmania	17 0	17 0
Nchanga Consolidated, N. Rhodesia	3 7 6	3 8 9
Rhodesia-Katanga	5 0	4 9
Rhokana Corporation, N. Rhodesia	8 12 6	10 12 6
Rio Tinto (£5), Spain	15 0 0	17 5 0
Roan Antelope (5s.), N. Rhodesia	13 0	14 0
Tanganyika Concessions	16 0	16 6
Tharsis (£2), Spain	1 18 9	1 18 9
LEAD-ZINC:		
Broken Hill South (5s.), N.S.W.	1 6 3	1 6 3
Burma Corporation (9 rupees)	10 6	8 9
Electrolytic Zinc, Tasmania	2 8 9	2 7 6
Lake George (10s.), N.S.W.	9 3	9 6
Mount Isa, Queensland	1 6 9	1 7 6
New Broken Hill (5s.), N.S.W.	1 9 3	1 11 6
North Broken Hill (5s.), N.S.W.	2 8 9	2 13 9
Rhodesia Broken Hill (5s.)	11 6	12 3
San Francisco (10s.), Mexico	19 3	1 1 6
Sulphide Corporation (15s.), N.S.W.	8 6	9 6
Zinc Corporation (10s.), N.S.W.	3 16 9	4 8 9
TIN:		
Amalgamated Tin (5s.), Nigeria	13 0	13 6
Beralt (5s.), Portugal	8 3	9 0
Bisichi (10s.), Nigeria	9 3	9 9
Ex-Lands (2s.), Nigeria	5 9	6 0
Geevor (5s.), Cornwall	6 0	6 0
Gold & Base Metals (2s. 6d.), Nigeria	3 9	3 9
Jantar Nigeria (3s.)	8 0	7 6
Jos Tin Area (Nigeria) (5s.)	10 6	10 6
Kaduna Syndicate (2s.), Nigeria	9 3	9 0
Mawchi Mines (4s.), Burma	1 6 9	1 5 9
Naraguta (10s.), Nigeria	7 9	7 9
Nigerian Consol. (2s.)	4 0	4 0
South Crofty (5s.), Cornwall	4 3	4 3
United Tin Areas (2s. 6d.), Nigeria	4 0	3 9
DIAMONDS:		
Anglo American Investment	2 17 3	2 19 9
Consol. African Selection Trust (5s.)	1 13 0	1 14 0
Consolidated of S.W.A. (10s.)	2 11 3	2 11 0
De Beers Deferred (£2 10s.)	20 10 0	20 15 0
West African Diamond (5s.)	2 3	2 6
FINANCE, ETC.:		
African & European	7 17 6	8 7 6
Anglo American Corporation (10s.)	5 7 6	6 0 0
Anglo-French Exploration	1 10 9	1 11 3
British South Africa (15s.)	1 15 3	1 16 0
British Tin Investment (10s.)	13 9	13 6
Broken Hill Proprietary	1 15 0	1 18 9
Camp Bird (10s.)	10 9	11 9
Central Mining (£8)	21 10 0	22 15 0
Central Provinces Manganese (10s.)	2 15 6	2 17 0
Consolidated Gold Fields	3 11 3	3 16 3
Cons. Gold Fields of N.Z. (4s.)	4 3	3 9
Consolidated Mines Selection (10s.)	2 3 9	2 5 0
Eastern Trans. Consolidated (5s.)	8 0	8 3
General Mining and Finance	6 3 9	6 6 3
Gold Ex. and Fin. of Australia (10s.)	10 3	10 3
Gold Fields Rhodesian (10s.)	12 9	12 6
H.E. Proprietary (10s.)	1 17 6	2 0 0
Henderson's Trans. Estates (4s.)	10 3	11 6
Johannesburg Consolidated	4 11 3	4 13 9
London & Rhod. M. & L. (5s.)	5 9	6 3
London Tin Corporation (4s.)	5 6	5 3
Marsman Investments (10s.)	12 0	12 0
Minerals Separation	5 5 0	5 5 0
New Central Witwatersrand (5s.)	16 3	16 3
Oroville Dredging (4s.)	17 3	19 3
Rand Mines (5s.)	6 8 9	6 15 0
Rand Selection (5s.)	2 3 9	2 8 9
Rhodesian Anglo American (10s.)	1 6 3	1 9 0
Rhodesian Corporation (5s.)	7 0	7 3
Rhodesian Selection Trust (5s.)	18 0	1 0 0
Selection Trust (10s.)	2 0 9	2 5 0
South West Africa Co. (13s. 4d.)	1 2 6	1 2 6
Union Corporation (12s. 6d.)	12 11 3	13 5 0
Venture Trust (6s. 8d.)	5 0	5 9
West Rand Ind. Trust (10s.)	1 19 3	2 0 0
Zambesia Exploring	1 4 6	1 4 0

THE MINING DIGEST

A RECORD OF PROGRESS IN MINING, METALLURGY, AND GEOLOGY

In this section abstracts of important articles and papers appearing in technical journals and proceedings of societies are given, together with brief records of other articles and papers; also notices of new books and pamphlets and lists of patents on mining and metallurgical subjects.

Orange Free State Gold

The following notes on the delineation of the gold-bearing areas of the Orange Free State are taken from a summary of a paper by A. Frost, R. C. McIntyre, E. B. Papenfus, and O. Weiss recently given before the Geological Society of South Africa that appears in the *South African Mining and Engineering Journal* for October 12.

The St. Helena property is described as being situated some 70 miles from Western Reefs mine at Klerksdorp, which is the nearest point at which Witwatersrand rocks are known to outcrop. The intervening distance is covered by younger formations, Karroo and Ventersdorp rocks, which completely obscure the geology of the older formations. The St. Helena discovery, therefore, was entirely new and did not depend on tracing the Witwatersrand beds from places where they were known to exist. In this sense it can be called the only entirely new gold discovery made in Witwatersrand formation since the Rand Bankets were first found in 1886.

Interest in the Free State was stimulated by the good bore-hole results obtained by Western Reefs. Following these, large areas of ground south of the Vaal River were taken under option by mining companies and investigation of the areas started in 1936. Union Corporation investigated areas by geophysical methods, followed by drilling, to a point 16 miles north of Odendaalsrust. No discoveries of possible economic importance were made beyond an extension of the Western Reefs occurrence immediately south of the Vaal River.

In 1933-34 a bore-hole was put down on the farm Aandenk No. 227, 8 miles north of Odendaalsrust, by Mr. E. Jacobson and Mr. A. Roberts, who founded the Witwatersrand Extensions Company. Interesting though unpayable values were encountered which encouraged the view that this particular area justified closer investigations. Further exploration was undertaken by Dr. Hans Merensky, followed by the Anglo American Corporation, and then by Western Holdings. It is interesting to note that although most of this ground is underlain by the Basal Reef the prospecting operations mentioned were unsuccessful and only within the last two years has the Basal Reef been proved on the original Western Extensions ground by the Anglo American Corporation.

Western Holdings was registered on February 19, 1937. The extent of its option holdings has varied from time to time and it has also been interested with other companies in options around Odendaalsrust. The early results obtained by other companies gave little incentive to further investigations, but it was decided to do preliminary geophysical work. The torsion balance gave remarkable results which had to be followed by drilling and it was decided to put down a bore-hole.

This bore-hole was St. Helena No. 1 and three intersections carrying interesting gold values were obtained. This supplied the necessary stimulus to continue the work, as well as providing something of a sensation in the gold-mining world. Data obtained from the geophysical work and the initial bore-hole successes led to further discoveries. Had it not been for this sequence of events it is doubtful if any drilling would have been carried out by the company, for in 1937 and 1938 there was a slump in Johannesburg, followed by "Black Friday," and money for speculative drilling was not easily obtained unless a fairly strong case could be made out.

Bore-hole No. 1 of St. Helena proved that quartzites and gold-bearing conglomerates existed on this farm at a moderate depth. This stimulated further companies to take up large areas under option and examine them. As far as Western Holdings was concerned it was decided to carry out a systematic drilling campaign. This was undertaken to prove whether the formation being explored was actually of Witwatersrand age. After this question was settled further work was undertaken in the hope that it might be possible to identify and explore the known economic horizons.

St. Helena No. 3, the fifth bore-hole drilled by the company and started on August 11, 1938, was the first to penetrate what was then called the Upper Elsburg Reef Zone. Subsequent work showed that various marker horizons could be traced within the Upper Elsburg Reef Zone and the successions within this zone were worked out. The names Leader Reef and Basal Reef were chosen for the most consistent economic horizons and the names have persisted to the present time.

Geophysical Work

Geophysical methods played a decisive rôle in opening up the new Free State goldfields. The initial work was started by Union Corporation and Western Holdings and was followed by other mining

companies and individuals, the result of the combined efforts being lasting proof of the value of individual enterprise in the national economy. The first steps were taken in 1937 when Western Holdings set out to try to discover areas where Upper Witwatersrand quartzites and conglomerates could be expected to occur at relatively shallow depths. The pioneering mining companies had been discouraged at the great thickness (5,000 to 7,000 ft.) of the Ventersdorp system intersected in bore-holes. At the end of 1937 the chances of finding new goldfields in the Free State appeared very remote.

At this stage Union Corporation confirmed the fact that the Eotvos torsion balance could detect areas where Ventersdorp basic lava was thick and where consequently the Witwatersrand quartzites and conglomerates were deep. After careful examination Western Holdings decided to use the Eotvos torsion balance in the hope that this gravimetric method of prospecting could justify the elimination of land where the thickness of the Ventersdorp system was relatively great. It was felt that not only would large sums of option money be saved, but that the available resources of the company could be used to the best advantage on comparatively small areas where, because of the shallow depth of the Witwatersrand system, drilling, exploration, and eventual future mining could reach conclusive results more quickly and at lower cost. These expectations were fully realized and it was the systematic planning of the exploration work that makes the discovery of the Western Holdings unique in the history of gold mining.

The flat ground of the Free State was specially suited for torsion-balance surveying and the uniform Karroo surface formation made it possible to recognize geophysical details which could not possibly be expected in areas where the surface was formed by dolomite or Ventersdorp lava. These geophysical surveys showed that a small area around St. Helena farm had exceptionally clear and definite gravity anomalies, which indicated a large mass of low-density rocks surrounded by heavier rocks. The data obtained made it possible to predict that while the heavy rocks on the west formed a steeply-dipping contact, probably a fault, in the east the contact between the low and high-density rock dipped to the east at a much flatter angle. It was therefore recommended that a bore-hole should be located in the central low-gravity zone of St. Helena and it was suggested that this hole would intersect Upper Witwatersrand quartzites at a shallow depth. In this manner bore-hole St. Helena No. 1 was sited in October, 1937, and drilling started in the middle of February, 1938. The hole went into Upper Witwatersrand quartzites at a depth of 991 ft. and the first pay values in the Odendaalsrust area were intersected in May, 1938.

After the initial geophysical results had been confirmed by drilling it was decided to cover the whole option area in detail with torsion-balance stations. The purpose of these geophysical investigations was to reduce as far as possible the number and depths of the bore-holes. The work was done in detail and although some of the conclusions had to be modified in the light of the accumulated data the main features of the geological structure were successfully outlined by the torsion-balance results. It was possible for the company to trace the line of contact between the light Witwatersrand quartzites and the heavy Ventersdorp beds and to get an idea of lateral displacements attributed to faulting. It was also possible to suggest that the areas north of the company's area were considered excessively deep and to some extent the conclusions drawn from the geophysical survey have been substantiated by subsequent boring operations.

The gravity results indicate the area in which drilling could profitably be done and by 1940 sufficient drilling had been done on what is now called the St. Helena Lease area to warrant underground development. The results of this are well known, followed as they were by the formation of the St. Helena Gold Mining Co.

Geology

Dealing with the geology of the area the authors state that the geophysical results obtained by the torsion balance and the magnetometer presented an unusually clear picture of what appeared at first to be a shallow elongated dome with a north and south axis extending through the farm Prairie in the south to Theronia in the north—a distance of 4½ miles. The centre of this apparent dome was relatively light, with heavier bodies to the east, west, and north.

The Karroo beds were known to occupy the surface and were expected to vary in thickness from 300 to 1,500 ft. The variation in thickness was not considered sufficient to account for the main gravity anomalies and the Karroo beds were certainly not responsible for the magnetic anomalies. Having decided this the problem was to fit the sub-Karroo geology to the geophysical results. The only interest was whether or not the Witwatersrand and Ventersdorp systems, which were being sought after, could be fitted.

The working hypothesis was formulated that the magnetic heavy body might be the lower Witwatersrand system of magnetic shales and quartzites; the centre light body might be the Upper Witwatersrand system of quartzites and conglomerates, and the eastern heavy body might be the Ventersdorp system of indeterminate to basic lavas and sediments, the latter being massive conglomerates, quartzites, and shales.

It was necessary to confirm this hypothesis by drilling. Bore-holes were sited at various points which are indicated in plates attached to the paper. On the farm St. Helena No. 642 a succession of typical Upper Witwatersrand quartzites and conglomerates were encountered and were correlated as the Kimberley-Elsburg series. The discovery of this series, carrying possible payable reefs, was something of a sensation at a time when other investigators in the Free State were abandoning options and seriously considering closing down operations on account of lack of discoveries.

The bore-holes drilled in the Western Holdings area up to 1940, when drilling was temporarily suspended due to the war, fell naturally into four groups. The central group was St. Helena 1, 2, 4, and 6 and Prairie No. 5. The west group was Kaalpan No. 1, Wolvepan No. 1, La France No. 1, Weltevreden No. 1, Katboschdraai No. 1, and Theronia No. 1; the Prairie group consisted of Prairie Nos. 1, 2, and 4, and the eastern group consisted of Theronsrust No. 1, Toronto Nos. 1, 2, 3, and 4, Vlakplaats Nos. 1, 2, 3, 4, 5, 6, and 7, St. Helena Nos. 3, 5, 7, 8, 9, 10, and 11 and Prairie No. 3.

The result of the drilling in the four groups is summarized in the paper and logs of all the bore-holes, with interesting assay values, are shown in

accompanying plates. Details of the reef zone are given in each case. The results indicate successful collaboration between geophysical and geological investigation in an area where a knowledge of the sub-Karroo geology can best be obtained by means of a geophysical survey confirmed by drilling. The chances of finding this exact spot by wild-cat drilling only, with practically the whole of the northern and north-western Free State as a reasonable area within which to search, would have been very slim indeed.

Gold Occurrences

It was found that gold occurred throughout the reef zone and erratic values were found in the Ventersdorp basal conglomerates, but two horizons in the reef zone have so far yielded practically all the payable values. These, as has been mentioned, were named the Basal Reef and the Leader Reef. The Basal Reef was found to occur somewhere at the base of the reef zone and appears to rest on an unconformity which is probably local. The Leader Reef is more consistent and occurs from 30 ft. to 50 ft. above the Basal Reef. In the view of the authors most of the other reefs appear to be lenticular in habit, but pay zones may occur in them and it will, therefore, be necessary to explore the whole zone from the Basal Reef to the base of the Ventersdorp basal conglomerates by means of underground development.

Two major north-west to south-east normal faults divided the area into three zones—west, central, and east. The southern portion of the east fault was indicated by gravity anomalies and has been proved on the farm Prairie, between bore-holes 3 and 5, and on Adamson's Vlei 655 to the south.

The general dip in the eastern zone is 25° to 30° to the east. The bore-hole data indicates a simple dip to the eastern boundary in the central section, but minor faulting and folding are to be expected. The central zone is considered to be a horst which has been faulted up 3,000 ft. to 5,000 ft. This horst pitches to the north, so that the Ventersdorp beds come into the north but not to the south. It is suggested that the St. Helena Reef Zone may thin out in the north-west portion of the west. It has definitely thinned out to the west and does not occur in the Theronia and La France bore-holes. Dips vary in the central zone from about 30° to nearly vertical.

The structure in the western zone is suggested in an accompanying plan, but the authors point out that it may have to be altered as data accumulate.

The paper contains a schedule giving all the interesting gold values from all the bore-holes. The bore-holes are arranged in the order in which they were drilled to illustrate how the story was unfolded. Values are divided into three groups—the Leader Reef, the Basal Reef, and other reefs. From this schedule it can be seen that an appreciable amount of gold occurs throughout the whole area and several horizons, in addition to the Leader and Basal Reefs, merit underground investigation. Twenty bore-holes which were sited to intersect the St. Helena Reef Zone between the Ventersdorp beds did so, excepting St. Helena No. 10 and Toronto No. 2, which were stopped before reaching this zone. Seven bore-holes intersected the Leader and Basal reefs and mine intersected the Leader Reef only. The Basal Reef was faulted out of three bore-holes and the Leader and Basal reefs were faulted out of two bore-holes.

Concrete Shaft Linings

In the *Journal* of the South African Institution of Engineers for September there is a paper by E. G. P. Rayner on "Concrete Lining of Circular and Elliptical Shafts Using Moving Steel Shuttering." As was stated in the introduction the author was dealing here with circular and elliptical mine shafts of depths in the order of about 5,000 ft., the circular shaft being some 22 ft. in diameter and the elliptical shaft 30 ft. by 15 ft. on long and short axes. It was pointed out that in sinking shafts of this type it is usual to employ a galloway stage.

However, as the author said, during the sinking of a 20-ft. diameter circular ventilation shaft at the Sub Nigel, Ltd., which was being lined with precast concrete blocks, it occurred to him that the use of moving shuttering might prove less costly than using blocks or conventional steel tubing and that it would also effect a considerable saving in steel plate.

In 1920, he said, he was engaged on the design of the coastal grain elevators for Cape Town and Durban and moving shuttering was employed. In the work of lining the mine shafts dealt with the experience obtained was applied.

The method was first tried out on the final 200 ft. of the 20-ft. diameter shaft at Sub Nigel after the remainder of the shaft had been lined with precast blocks.

The method adopted for lining this shaft, using moving shuttering, was as follows :—

The shuttering, made of ¼-in. thick mild-steel panelled plates, suitably ribbed and bolted together, was 6 ft. in depth and 20 ft. diameter. An internal lip was formed at the upper end for the prevention of spillage, ease of filling of concrete, and for the support of the shuttering by the platform. This lip, with the support from the platform, provided a further stiffening to the shuttering.

The platform, with the shuttering attached, was raised by means of turnbuckets having a travel of 5 ft. The upper ends of the turnbuckets were attached to chains anchored to eyebolts driven into holes in the shaft walls some 80 ft. above the platform when at its lowest concreting position. Any slack in the platform ropes was taken up periodically by the winding-engine driver.

It will be appreciated that, with one sinking hoist and one platform hoist in operation, it is necessary, in case of electric power failure, that an alternative source of power be provided. Therefore at Sub Nigel, Ltd., the sinking hoist was electrically-driven and the platform hoist was driven by compressed air, with a large reserve of receiver capacity in the form of a long pipe-line.

This initial experiment, carried out on a 200-ft. length of circular shaft, was considered sufficiently

successful to justify the adoption of such moving shuttering for the lining of a 30-ft. elliptical shaft about to be sunk at Vlakfontein G.M. Co., Ltd. In this shaft it was necessary to provide two chases in which to build, on completion of lining, a dividing wall providing two-thirds of the shaft area for upcast air and one-third for downcast air.

Included in the Vlakfontein design were certain improvements: A shutter was fabricated consisting of ¼-in. plate panels suitably flanged and stiffened with 3-in. by 4-in. webs. The panels are 6 ft. deep and 28 panels make up the periphery of the ellipse. Two sets of panels make up a full 12-ft. depth of shutter, which for reasons given later, was considered necessary. The major and minor axes of the shutter, when erected, are 30 ft. 0½ in. and 15 ft. 0½ in., respectively, at the upper edge, while the lower edge is reduced to 30 ft. and 15 ft., thus giving a slight uniform taper over the depth of the shutter, making for easier upward movement.

To form chases in the lining for the keying-in of the dividing wall to be erected when sinking is completed fixed forms were used, in vertical lengths of 6 ft. 12 in. wide and 6 in. deep, suitably tapered for withdrawal. These are bolted one on top of the other as the shutter rises and have bolts into the concrete which hold them in position during concreting and prevent them falling out inopportunely when dismantling the shuttering. The forms were located by angle irons welded vertically in pairs on the face of the shutter and arranged to allow the forms to remain in place as the shutter was raised.

The top edge of the shutter is flanged inwards, as in the case of the circular shaft already mentioned, to provide a lip or shoulder which is supported by hinged brackets attached to the platform. In addition, the shutter is stiffened horizontally by two sets of 3-in. by 3-in. by ¼-in. angle braces attached at ⅓ and ⅔ of its depth. Such bracing was not found necessary in the case of the Circular Shaft at the Sub Nigel, Ltd., already referred to, owing to the more rigid circular shape.

In operation ten ⅞-in. long link chains, each 100 ft. long, are hung from a double set of eyebolts placed in holes drilled into the concrete lining of the shaft. These chains are provided with 4-in. diameter 1⅜-in. round links at 5-ft. intervals. Turnbuckles, each having a travel of 5 ft., are attached at their upper ends to suitably placed 4-in. diameter round links above described. Their lower ends are shackled to corresponding suspension lugs riveted to the platform. The platform with the shutter supported on the bracket can then be raised by means of the turnbuckles; the slack in the platform ropes, as stated earlier, being taken up periodically by the engine driver.

In the first application of this method at this shaft a kerb ring 4 ft. 0 in. and ½ in. larger than the finished shaft dimensions on the major and minor axes was provided on which to commence the lining. To prepare for concreting the spoil from the last blast was left in the shaft and levelled off, leaving a loose mat about 4 to 5 ft. deep. The kerb ring shuttering was then set on this, plumbed, and filled with concrete. After allowing time for the concrete to set the kerb ring shuttering was removed, the loose mat removed, and the moving shutter erected on blocking on the shaft bottom inside the concreted ring. The 12-ft. deep shutter thus projected about 4 ft. above the concrete kerb and 4 ft. below it. Concreting with the moving shutter then commenced.

Filling and raising the shutter at the rate of about 15 in. per hour, a period of about 6 hours elapsed before exposures of the new concrete—all placed on the kerb ring—began. This allowed time for the concrete to take an initial set.

Considerable loss of time, however, resulted from this method, due to the installation, the dismantling of the kerb shuttering, the cleaning out of the shaft bottom, and the time which had to be allowed for the concrete kerb to set. It was, therefore, decided to abandon the use of the kerb and to install the moving shutter directly on the levelled spoil in the shaft bottom and to fill it initially with concrete to a depth of 6 ft. The lower 6 ft. of the shutter was coated with old lubricating oil to prevent it binding. After an interval of two hours the shutter was raised slightly (about 1 in.) and a further 2 ft. of concrete placed. Movement then went on at shorter intervals until at the end of 12 hours from the time of first placing concrete the shutter was rising at the rate of 15 in.–18 in. per hour. This rate was thereafter maintained throughout the concreting period—the average rate of filling being about 11 ft. per 8-hour shift.

Some trouble was experienced due to occasional patches of concrete falling out from below the shutter and causing runaways, especially where the body of concrete on the shaft wall was thin. It was then necessary to stop and plug the runaway and allow the concrete to set before again moving. To overcome this difficulty a 6-ft. skirt was added to the bottom of the shutter, increasing its depth to 18 ft. While this arrangement prevented runaways it was found that the added weight of the shutter and the increased friction load on the shaft walls reduced the rate of movement. Space limitations on the platform made it impossible to increase the number of natives working the turnbuckles. The result was a slowing down of the concreting operation. Difficulty was also experienced in preventing some small lateral movement of the shuttering, as, due probably to some small error in manufacture, it persistently crept to one side and had to be pulled back by increasing the tension of the turnbuckles on that side. This condition was unfortunately aggravated by the longer shutter.

At this stage it was concluded that although the use of moving shuttering was a workable proposition it was not a very profitable one from a time cost point of view. The use of moving shuttering in the past had been confined to jobs such as grain elevators, where a large body of concrete had to be placed and the rate of rise of the shutter was consequently slow. One textbook quotes an optimum rate of 5 ft. per 24 hours. Actually, using 1 : 2 : 4 mix of concrete and ordinary Portland cement, the shuttering was being raised in the mine shaft at the rate of about 11 ft. per 8-hour shift or 33 ft. in 24 hours. Rapid-hardening cement was unobtainable in the quantities required and its use was a doubtful saving in that we were concerned with setting time as distinct from hardening time.

The mine's stone crushing plant, delivery of which had been delayed due to war conditions, now came into production and resulted, not only in an improved quality of stone, but made available quantities of crusher sand. This sand was well washed in a sand washing plant and experimental cubes showed an improvement of about 10% in

setting time when compared with cubes made with drift sand. It was accordingly decided to use crusher sand for the shaft concrete and go back to the 12-ft. long shutter. No improvement in concreting time was made, but a marked reduction in runaways resulted and brought about a general saving of time, overall.

While the rate of actual filling was from 15 in. to 18 in. per hour, the overall rate was not comparable with rates of concreting in a shaft on the West Rand, where fixed tubbing was in use in a 22-ft. diameter shaft and where an overall rate of 1 ft. 6 in. per hour was regularly attained.

Discussion with the Director of the Concrete Association of South Africa, who kindly lent the author a brochure entitled *Effect of the Addition of Calcium Chloride to Portland Cement and Concretes*, led to him suggesting improvements in the setting time of concrete by the addition of a solution of calcium chloride to the water used in mixing. Experimental test cubes were made using 2% calcium chloride, 1% calcium chloride, and ordinary concrete without addition. Observation of these blocks showed that the 2% blocks were set in 2 hours, the 1% blocks in about 3 hours, and the ordinary concrete in 4 to 5 hours. Rough tests of crushing strength made with blocks after 4 days showed an increase of 50% in strength in the blocks made with the calcium chloride addition. The percentage of solid fused calcium chloride is by weight of cement used. An addition of 2% calcium chloride was therefore made to the concrete for the shaft lining with immediate results, as it was found that the shutter could be moved initially without risk of runaway as soon as the concrete had been placed in the first 6 ft. at the shaft bottom.

It was found, however, that a 2% addition of calcium chloride made the setting rather too fast and tended to bind the shuttering. A 1% addition was therefore resorted to. This gave ample time for setting and no runaways have been experienced since the calcium chloride has been used.

The speed of concreting has been increased from between 13 ft. to 14 ft. in the first 24 hours of concrete walling to 26 ft. to 29 ft. and the rate per shift of actual filling has risen from an average of 11 ft. per shift to an average of 16 ft. per shift. The overall time has been reduced materially and 100 ft. of shaft has been walled in 63 hours, which is in excess of 1·5 ft. per hour obtained in the 22-ft. diameter shaft referred to previously, in which fixed tubbing was used. The cost of a 1% addition of calcium chloride to 1 : 2 : 4 concrete is 1s. 4d. per yard, as against the increased cost using rapid hardening cement of 3s. 6d.

In comparing the moving shutter with fixed tubbing it may be said at the outset that the finish of the wall is not so good. At best it is comparable with a wood float finish, but in general it does not approximate to this. However, the author is not satisfied that the lack of finish is caused entirely by the moving shutter, as such; other factors contribute, notably the limited space on the platform at present in use, which precludes the employment of sufficient labour for rodding. To offset this use has been made of vibrators attached to the shuttering with good results and these vibrators are, incidentally, of assistance when raising the shuttering.

The method of operation now in use is to level the shuttering on the spoil left from the last blast, pack round the bottom with sand, fill the shuttering to the top, then stop and pull the full 5-ft. length of the turnbuckles. This 5 ft. is then filled and the pulling repeated for another 5 ft. This method again fails to produce a good finish.

The ideal would be to have the shutter raised continuously at a uniform rate. This could be done mechanically and suitable designs have been taken out, but it is not practical to introduce it at this stage—*i.e.*, at a depth of 3,000 ft.—and stop work while the necessary mechanism is fitted to the platform.

The experience gained with moving shuttering suggests the following considerations :—

(1) It is desirable to have more space on the platform and to this end a double-deck stage appears advisable.

(2) It would appear that lining under very wet conditions could be better carried out in the conventional manner with fixed tubbing. In the Vlakfontein shaft water quantities up to 700–800 gallons per hour have been successfully dealt with by tapping fissures exposed during sinking and transmitting the water in pipes embedded in the concrete wall to garlands from which it is piped to pumps situated in the cable pockets 480 ft. apart and thence pumped to surface. In this shaft the bottom is thus generally kept practically dry.

(3) It is necessary to keep a continual close check on the concrete mix, as excessively wet mixes are detrimental both to setting and finish. The mix used has a slump of about ½ in. and close checks are kept on water quantities so that this is not exceeded.

(4) When concreting the mixture should be placed in the shuttering as soon as possible after it leaves the mixer. This requires a little organization, but can be readily accomplished if the man in charge of the mixer does not fill his bucket until the empty bucket has been rung away from the shaft bottom. In order to comply as far as possible with the last two conditions the concrete mixer is always in the charge of a competent mason.

Mention has been made earlier in these notes of the wall which is to divide the shaft into upcast and downcast compartments and which will run the full depth, estimated at 5,200 ft. After some consideration it was decided that the use of precast reinforced concrete blocks would facilitate erection and increase the rate of installation of the wall.

Due to the shortage of steel plate it was decided to experiment with concrete forms in which to cast the blocks. This proved successful. By coating the inside of the concrete form with whitewash, to which a small quantity of soft soap has been added, the form could be parted from the block after casting without difficulty. It was found simpler to fill the box on its side rather than on its edge, but this method required that the block should be turned on edge for transporting to the curing pound. Two 1-in. round holes are accordingly left in the depth of the block for the insertion of pins to turn it on edge after casting. Five other holes are formed on the centre line of the sides, three for slinging and one at each end. These end holes are provided to take bars or jumpers against which wedges may be driven in order to retain in place shuttering strips to hold the grout when beams are being installed in the shaft lining.

The blocks are 19½ in. deep, 9 in. thick, and approximately 14 ft. 3 in. long, and weigh approximately 1 ton each. About 3,500 will be required for the job. Eighteen casting beds have been

provided. Blocks cast from 1 : 2 : 4 concrete (the same aggregate as is used in the shaft wall without calcium chloride) could not be moved until 48 hours after casting, as it was found that the block cracked in the process of turning on edge if moved earlier.

An addition of 1% calcium chloride was then made to the mix and it was found that a block cast in the afternoon could be turned next morning without damage. Therefore the process now is to fill all 18 boxes in one day, strip and remove the blocks to the curing pound on the following day, and also clean and re-assemble the boxes ready again for filling. Thus the blocks are cast three times a week and 54 per week are produced. The addition of calcium chloride has thus considerably speeded up this part of the work.

The author says that another elliptical shaft in the same district, but 33 ft. by 16 ft. 6 in., is also at present being lined by the methods described.

In conclusion, he says, it is of interest to know that in concrete-lined shafts moisture, whether caused by condensation or seepage or from exposed green concrete, when running down the face of the lining tends to roughen the surface by forming a rippled herring-bone pattern. On the other hand where small cavities occur these eventually become partly or wholly filled with the small particles of grit or other solid or leached matter carried down with the water.

Concrete lining of a shaft is desirable where spalling conditions or where waterlogged ground may be expected and also where air velocities are very high. The extra cost of air frictional horse power on fans does not become a serious factor until a high velocity is reached. The dry air conditions obtained with concrete lining may, however, in downcast shafts where air cooling is carried out, justify its installation at much lower air velocities, due to the ultimate saving in refrigeration costs.

Drag Classifiers in the Britannia Mill

In the course of an article descriptive of the classification methods employed at the Britannia mill in British Columbia appearing in the *Canadian Mining and Metallurgical Bulletin* for October, W. G. Hatch states that three 5 ft. by 20 ft. perforated-belt drag classifiers were recently installed on the secondary mill floor. The author says that the principal objective in developing the new machine was to provide a foolproof machine of low cost and sparing in power requirements, maintenance, and operation.

The machines designed, it is stated, are similar in principle to the old drag or Esperanza type, but the multiple belts and short blades of the older machine are replaced by a single wide belt of heavy construction, with drag blades extending, except for clearance, the full width of the classifier. This eliminates the dead spaces where sand accumulated between the small belts of the older type machine. The main feature of the new classifier is in the method of getting rid of the sand which settles on top of the belt as it passes through the settling pool. This is done by cutting holes or perforations in the belt, which enable the sands to pass through to the drag blades below. The belt perforations allow escapement of any finished fines and slimes entrained by the blades and also aid in effecting uniform classifying action in the pool. Water sprays at the point of emergence of the belt from the settling pool flush the sands through the openings in the belt and, in this action, make an effective sands-fines separation at this point. The plan and elevation of the new classifier are shown in the accompanying figure.

Belts.—The belts used are of elevator belt construction, 9 to 11 ply, and the width of the belt is 4 ft. 6 in. for the 5 ft. by 20 ft. classifier. For larger installations single belts can be obtained up to 91 in. wide, the greatest width at present supplied by the rubber manufacturers. However, there is nothing against spot-joining the edges of two or more belts together in a single unit. The total area of the holes or perforations is from 8 to 13% of the total area of the belt. Perforations of from 1 in. to 1½ in. in diameter are satisfactory.

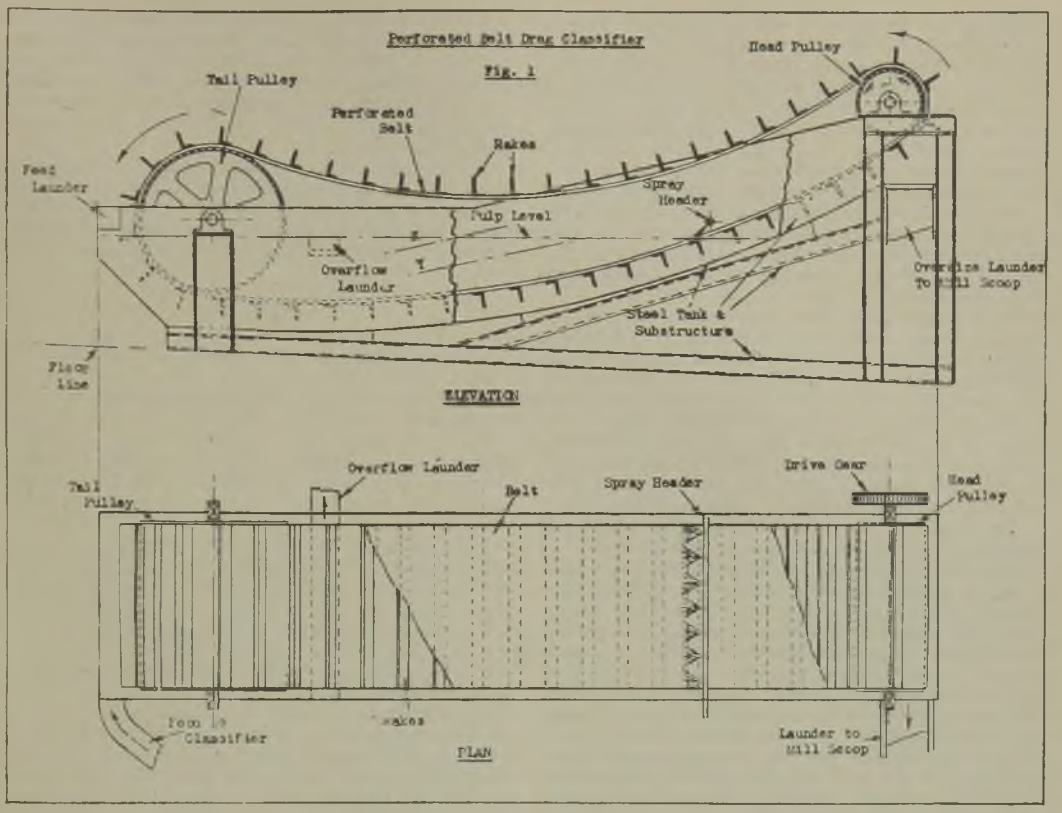
Drag Blades.—The blades or flights for the 5 ft. by 20 ft. classifier are made of 5 in. by 3 in. angle iron, with the 3-in. leg in contact with and bolted to the rubber belt. Wearing plates of cast steel, bolted to and extending 1½ in. beyond the 5-in. leg, make a total blade depth of 6½ in. Each blade, with wearing tips, weighs about 66 lb. and, as there are 64 of them in each classifier, the total weight of the blades exceeds two tons.

The blades may be of any desired depth. With relatively deep blades—say, over 8 in.—the flange of the angle bar which is in contact with the belt may be proportionately wider, but holes can be drilled in this wider flange, coinciding with the perforations of the belt, in order to maintain the uniform distribution of the perforations.

Pulleys.—The classifier pulleys are made up of steel bars welded to circular plate webs, the head pulley having 2 in. by ¾ in. bars spaced 1¼ in. apart and the tail pulley 4 in. by ¾ in. bars with spacings of 2 in. Each pulley has a crown of ⅛ in. to the foot. The diameter of the head pulley is 22 in. and that of the tail pulley 50 in. for the 5 ft. by 20 ft. classifier. In this type of construction machining of pulley rims is eliminated.

Classifier Deck.—The belts are installed intentionally without tension, so that a considerable sag is produced by the weight of the drag blades. The deck, or bottom, of the classifier tank is constructed to conform to the curve of the belt and thus creates a settling pool of larger area and much greater volume (over 50%) than one in which the deck is straight. Any additional sag takes place in the top run of the perforated belt.

Overflow.—The overflow launder is located within the deep extended settling zone afforded by the sag of the belt. The effect of this sag in increasing the depth of the settling pool at the overflow launder may be seen by a comparison with the depth



obtained if the belt should extend in a straight line between the pulleys, as indicated by the dot-dash line at X (see figure) and the lower edges of the blades moving along a corresponding straight path at *Y*.

This type of classifier, with its comparatively large area and volume of pool, permits the use of multiple weirs so as to reduce the rate of flow over the lips, thus resulting in a finer mesh overflow than is possible with other types of classifiers of similar widths.

The water sprays are located transversely across the classifier at the line where the belt emerges from the settling pool. These cause the sands to pass through the holes in the belt and the thorough washing obtained results in a clean sand product. The low-pressure spray water used to flush the sand through to the blades and wash the belt clean is only a part of the total water needed for satisfactory classification, so that no control of the operation is sacrificed by this addition.

Power

Power for the classifiers is obtained from a 2-h.p. motor, through a *V*-belt drive, reduction gear, to a pinion and gear drive on the head shaft. The speed of this size of classifier belt, for the Britannia ore grind, is in the range of 20 to 23 ft. per minute. The motor and reduction gear are mounted on a bracket on the side of the classifier, but may be located above the head pulley to minimize space requirements.

The power consumed in the normal operation of classifiers is, of course, less than that of the motor rating, the additional power being needed for starting and for overloads. Theoretically, with friction excluded, less than $\frac{1}{6}$ h.p. is required to elevate each 1,000 tons through 3 to 4 ft. in 24 hours, to close-circuit the classifier-ball-mill unit. The power actually consumed in the operation of the perforated-belt classifier is approximately one-third that of the rake or spiral type handling similar tonnages. The effective washing that is possible in this type of classifier obviates the need of a long drainage incline, thus economizing on power and minimizing wear on rake tips.

Performance

A substantial portion of the sands is carried out of the pool on the upper surface of the rubber belt, thereby reducing considerably the drag load on the blades while submerged in the pool. The drag load increases slightly above the pool, but most of the fines are removed by the washing sprays. In overloads, this part of the belt rises slightly as it emerges from the pool, due to the slackness of the belt, while after the incoming feed is reduced accumulated sands are gradually removed. A serrated wearing tip on one of the blades, extending slightly below the normal blade path, aids in this operation and prevents the bed of the classifier from becoming hardened. The classifier always starts up without unloading and with no apparent

effort after unexpected shut-downs, so that no lifting device of any kind is required.

As in the operation of other classifiers, the desired classification is controlled by the various governing factors—the area and depth of the pool, speed of the rakes, slope of the deck, and pulp density. When desired to close-circuit large ball-mill-classifier units the grade of the incline can be considerably steeper in the belt drag type without sacrificing the other common advantages. For handling larger tonnages the need for multiple raking units, with their higher equipment cost and added wearing parts, is eliminated in the perforated-belt classifier.

The special slat-rim construction of the tail pulley, coupled with the slowly moving belt and rakes, provides sufficient agitation to prevent any appreciable amount of finished fines to be entrained by the rakes. Fines settling on the belt in the quiescent overflow zone are washed out of the sands as the belt emerges from the pool. The blades and perforations provide, without surging, the necessary agitation in the overflow zone to ensure against excessive settlement of finished fines.

The tanks of the three 5 ft. by 20 ft. drag-belt classifiers now in service were made of wood. If constructed of steel it is estimated that the total weight of each classifier would be 12,000 lb., as compared with about 18,000 lb. for a Dorr heavy-duty classifier of similar size. The initial cost of the installation, using new material, is about one-third of the Dorr or Akins equivalent. Wear on the drag blades after eight months' service is negligible. Exceptionally long life for the belts is assured under the wet conditions and service involved. As a matter of interest in this connexion the belts installed in the new classifiers have already seen eight to nine years' service in the heavier elevator classifier operation and show no apparent wear or deterioration. As stated, the classifier belt cannot be stalled by overloads. The special rim construction of the head pulley serves positively to prevent any belt slip under overload conditions. There is no lateral movement of the belt; the slight curvature of the angles corresponding to the pulley crown holds the belt true under all operating conditions.

Table 1 gives conservative estimates of the raking capacities of various widths of classifiers for three different depths of drag blades. These figures are based on a belt speed of 20 ft. per minute, with the space between the blades only 50% full.

Table 1

RAKING CAPACITIES IN TONS PER 24 HOURS

Depth of Blades	*Width of Classifier*			
	5 ft.	*6 ft.*	*7 ft.*	*12 ft.*
6 in. . .	2,050	2,460	2,870	4,920
8 in. . .	2,733	3,280	3,826	6,560
10 in. .	3,416	4,100	4,782	8,200

The action of the perforated-belt drag classifier allows the installation of a simple signalling device for indicating sand overloads. As mentioned previously, when the tonnage in the grinding circuit is too high the greater load of sand being washed to the drag blades through the perforations of the belt as it emerges from the settling pool causes a slight upward thrust of the belt as this point. This movement is utilized to actuate a lever arm of an electrical switch, which, on contact, flashes a light or other signal. While this is only a warning device it is possible that some means may be found whereby it can be used to adjust the amount of original feed to the unit or the amount of water added to the classifier.

Open-Pit Copper from New Mexico

An article by L. A. Luther in the *Compressed Air Magazine* for November reviews the operations of the Chino Mines Division of the Kennecott Copper Corporation at Santa Rita, New Mexico. Santa Rita is in what is generally referred to as the "Silver City Mining Area," which comprises a section of about 33 square miles and which has a mean annual rainfall of 14 in. In addition to copper the district produces considerable quantities of lead, zinc, and silver and some iron ore has been shipped to the Colorado Fuel and Iron plant at Pueblo. The area even had a brief gold rush in 1903, when yellow metal was discovered in Gold Gulch. The Kennecott copper pit is at an elevation of 6,235 ft. With a depth of 400 ft. it now has the appearance of a miniature Grand Canyon, the exposed strata of its benches having a coloration somewhat like that of the Painted Desert in Arizona. The deposit was the scene of active surface and underground mining for many years before it was opened with steam shovels in 1910.

Exploration with churn drills preceded the opening of the Santa Rita pit and charting of the ore-body is still in progress. Overburden ranges from a few feet to 150 ft. deep and one area has been found where material containing chalcocite and metallic copper continues to a depth of 1,300 ft. Two 3½-yd. railroad-type steam shovels with which to start operations were ordered prior to 1910. The fact that makers of all kinds of mining and milling equipment were at some pains to keep pace with company officials' concepts of capacity is evidenced by the evolution of the shovels in the Santa Rita shops from rail to self-propelled caterpillar type and from steam to full electric drive. Eight of the latter class are now employed there, seven being of 5-yd. and one of 8-yd. capacity. There are 35 miles of standard-gauge track at the pit, with rail of 90 lb. and 130 lb. section. Haulage was originally done by steam locomotive, but has been electrified and thirteen 85-ton, 1,000-h.p., overhead-trolley locomotives, using direct current of 750 volts, are in service to-day.

Open-Pit Tracks

Construction and maintenance of track are important phases of open-pit operation, for track must be assembled and periodically shifted considerable distances on the benches. So that this may be done expeditiously track is prefabricated with screw spikes in complete panels of one rail

length, in which form it is hauled to location, set in place, and tied to contiguous members by joint bars. Where a shift must be made sections are similarly lifted and moved, one at a time, by boom-equipped tractors with special slings. To further mechanize the work a 315-c.f.m. self-propelled compressor supplies air to operate such track tools as tie tampers, cut-spike drivers, screw-spike drivers, joint-bolt wrenches, a rail drill, and a wood borer. Adjacent to rail entrance into the pit is a large modern shop provided with machine tools, cranes, and other essentials for the maintenance and complete overhaul of all rolling stock, power shovels, trucks, etc., as well as for conditioning drill-steel and detachable bits.

Maximum grade of track in the pit is 2·5%. Train movement is controlled by telephone, with some semaphore signals from a central tower. This is possible because the good visibility prevailing at Santa Rita usually makes observation of equipment moving in the pit as accurate from the tower as from an illuminated chart in a centralized traffic-control station. Roadways lead to all parts of the pit and some use is made of track motor cars. Buses pick up and drop employees at working places and several long routes are maintained for the convenience of those living beyond a company-built residential section above the main mine offices in Santa Rita.

The average height of the benches is 50 ft. and principal production drilling is done by churn drills equipped with 9-in. bits. Holes are spaced in accordance with the formation, on an average 16 ft. apart, and are drilled 5 ft. below grade. Around 650 lb. of powder is used per hole, with an average breakage of 45 tons per foot. The character of the ground and the moisture content influence the choice of explosive from among different types of bag powder and glycerine. Where required to secure grade toe holes are put down with tripod-mounted drifters and considerable blockholing is done with hand-held drills, air being piped to all workings from a compressor house adjacent to the shop and containing two synchronous-motor driven units.

Waste Leaching

A very substantial contribution to the Santa Rita copper output is made by leaching the vast waste dumps. Water varying from 1,500 to 2,000 g.p.m. is circulated long distances over large areas at maximum heads of around 350 ft. and issues at the bases of the dumps as brilliant-green seepage or sulphate-laden springs. Better than a 99% recovery of the contained copper is effected in a central leaching plant consisting of a series of rectangular concrete vats at graduated levels. These vats are charged by a clamshell with ferrous scrap composed largely of shredded tin-can residue from detinning plants, there being nearly a pound-for-pound replacement of iron with copper. Water draining from the vats is recirculated. The red precipitate, which gradually turns black as it is dehydrated to an approximate 25% moisture content, is loaded by a clamshell into cars and shipped to a smelter at Hurley where, before smelting, it is dried in a gas-fired roaster. An average of 1½ million pounds of copper per month is thus produced.

Ore is loaded at Santa Rita into 80-ton cars which are made up by electric locomotives into 38-car trains in the mine assembly yard. The Santa Fe Railroad hauls these some 10 miles over its tracks to the Hurley material yard where it maintains a switcher 24 hours a day to move cars into the mill. Cars of ore, each carrying on an average 70 dry tons, are weighed on a track scale at Hurley and emptied by a Wellman car dumper on to a set of grizzlies in the crusher pit.

Ore-Dressing

Ore from run-of-mine to 1 in. is crushed in two stages by an 84 in. by 66 in. jaw-crusher and by three Symons standard cone-crushers; secondary crushing, taking ore from 1 in. to ¼ in. size is done by 72 in. by 20 in. rolls in a closed circuit with screens. Transfer of material between crushing stages is effected by rubber belt-conveyors and storage bins with an aggregate capacity of 12,000 tons are provided between primary and secondary crushing and between secondary crushing and the ball-mill department. Below the bins are feeders which regulate the flow to subsequent points of operation. Dust-control equipment, consisting of suction fans discharging into dust collectors, are installed in both crushing buildings as a health measure, a total of 155,000 c.f.m. of air with entrapped dust being removed.

Grinding the ore to make flotation practicable is done at Hurley in ball-mills in two stages—primary-stage mills employing 3-in. balls and secondary 2-in. balls, the daily consumption of 20 tons of balls being cast in a foundry on the property. The mills are in a locked circuit with drag-type classifiers and the end product, averaging 6% *plus* 65 mesh, is ready for flotation. The first chemical reagent—milk of lime—is added to the ball-mill feed, the lime rock from which it is made being mined locally and burned and processed in the plant. The function of lime is twofold: To provide an alkaline circuit for flotation and to render freshly-ground iron-sulphide particles non-floatable. The output of the ball-mills is sent to thickening tanks, which remove some of the excess water used in classification. The discharge is returned to the mills and distributed to conventional Southwestern-type flotation machines supplied with agitating air at 1½ lb. pressure by rotary blowers. Reagents for the flotation circuit, in addition to lime, are butyl xanthate as the collector and pine oil as the frother. A fuel oil of light grade serves for the flotation of molybdenite.

Two valuable minerals are concentrated at Hurley: Copper sulphide, which is predominantly chalcocite, and molybdenite. Non-valuable iron sulphide in the form of pyrite, the quantity of which is several times larger than that of copper minerals, is rejected in tailings. The two most important characteristics of the ore-body that determined the flow-sheet and the type of reagents that would best meet requirements are the partial oxidation of the sulphides and the very intimate association of the copper and iron minerals. To float the tarnished sulphides it is necessary to use a strong collector. At times the oxidized portion reaches a value of 11% of total copper. Fine grinding is essential in order to liberate the copper and the iron sulphides, permitting the one to be recovered and the other rejected.

To achieve this end and to reduce the percentage of the material that must be finely ground a preliminary rougher concentrate is produced that is reground and refloated. The resultant concentrate contains both chalcocite and molybdenite and must again be separated. This is done by boiling the

entire concentrate tonnage with live steam and subjecting it to flotation. In this final stage only those reagents are employed that float molybdenite, the copper minerals remaining in the tailings of the molybdenite recovery plant. The molybdenite concentrate is shipped in this form, while the mill's principal values, the copper minerals in the tailings, are sent to a filter plant where they are dried and loaded in cars for delivery to the smelter.

Waste material, or tailings, is impounded in ponds each about 100 acres in extent, a total of 1,000 acres being set aside for this purpose. At the present rate of production 10 acre-feet of solids are deposited daily. It is of prime consideration that the method of impounding be such as to permit maximum water recovery, because the supply for the entire operation comes from wells remote from the plant. The mill uses approximately 10,000 g.p.m. and, as the total available supply for Hurley amounts to about 4,000 g.p.m., the deficit must be made up from water recovered from thickening tanks and tailing ponds.

Power

A power-house at Hurley generates all the electric current for the contiguous mill and smelter, the Santa Rita pit and underground workings, the deep-well pumps which handle the water, the domestic lighting circuits in both towns, and for other purposes. An interesting feature of the plant is that it was built in 1910 to serve a 5,000-ton mill the capacity of which has been quadrupled since that time. Steam is generated by five low-pressu boilers and one high-pressure unit. The latter is of 3-drum construction with a water-cooled furnace and floor and operates at 450 lb. pressure, 770° F. maximum steam temperature. Its maximum capacity is 320,000 lb. per hour; the average current output of 180,000 lb. per hour representing about 65% of the plant's steam consumption. When combined with steam from smelter waste-heat boilers it suffices to carry the normal load.

Natural gas from the Hobbs Field in eastern New Mexico reaches the mill at 400 lb. pressure and is reduced in three stages to 15 lb. at the burners. Boilers also are equipped for oil firing for emergency purposes. Feed water for the high-pressure boiler is 100% evaporated water, which is heated to 219° and delivered to it and to two waste-heat boilers by four 400-g.p.m. 5-stage centrifugal pumps, one of which is motor-driven and three are turbine-driven units. Feed water is treated first with a lime-soda ash retard automatic softener and then with zeolite.

Three-phase 60-cycle current at 6,600 volts is developed by a 10,000-kW. turbo-generator using 450-lb. steam and by a 7,500-kW. unit using 180 lb. steam. For the production of 3-phase 60-cycle current at 480 volts there are two turbo-generators, one of 2,000 kW. and the other of 6,000 kW., both using 180-lb. steam. Steam is fed by automatic extraction from the one high-pressure unit to the low-pressure generators, along with steam from other sources.

All turbines run condensing, being equipped with single-pass surface condensers of suitable capacity. Cooling of condenser circulating water is accomplished in a 2,000,000-gallon open spray pond and by a 6-section, induced-draught, double-flow cooling tower that was added in 1944. To maintain carbonate balance the water is treated by a cold-process softener of milk of lime, sodium aluminate, and soda ash having a capacity of 600 g.p.m. Chlorine serves to control algae growth, with an occasional application of copper sulphate in the cooling tower for the same purpose. Water reclamation averages 60%.

Electric power is transmitted to the mine at Santa Rita at 24,000 volts and is stepped down to 750 volts for haulage and to other required voltages. Motor drives in mill and smelter use 440-volt current. Compressed air for general purposes in the mill and smelter is supplied by two 18 and 10¼ in. by 14 in. compressors with flat-belt drive from electric motors and by two 29 and 16 in. by 20 in. machines that are steam driven.

Smelting

Prior to 1938 the concentrate was hauled to El Paso for smelting. To-day the smelter adjacent to the Hurley mill, which was blown in in 1939, handles concentrate from the mill and precipitate from the leaching plant. These products are mixed and, together with lime rock, are carried by an electric vibratory conveyor from charging bins to a reverberatory furnace, which is charged seven times in an 8-hour shift. It is fired with natural gas from the Hobbs Field and uses pre-heated air. Matte drawn from the furnace is transported in ladles by 45-ton cranes and delivered to Pierce-Smith 13 ft. by 30 ft. converters, where it is blown to blister copper with air at controlled pressures averaging 13 lb. per square inch. The air is supplied at maximum pressure of 18 lb. by two turbo-blowers, each having a capacity of 25,000 c.f.m. These units are installed in the power plant and are remote controlled by air-pressure governors located at the operating stations in the smelter, the air being carried a distance of 1,580 ft. through two 36-in. lines.

Each converter has an output of 60 to 70 tons of 99·4% to 99·6% blister copper which, in molten form, is discharged into ladles by rotating the converter and moved by crane to a gas-fired refining furnace. There it is further treated with compressed air to scorify impurities and then green pine logs are burned to reduce the oxygen content to the desired degree. From the latter furnace the copper is cast into bars and shapes of several types. The multiple moulds used for this purpose are of copper and are carried on an electrically-driven Walker-type casting machine that rotates somewhat after the manner of a carousel, with moulds in place of seats. This machine automatically reverses the moulds, spilling the partially-cooled bars into a water bath. The removal of the castings is facilitated by spraying the moulds with a bone-ash suspension, much like a housewife greases her cake pans. Upon emerging from the cooling vat on a metal conveyor the product is inspected and much of it loaded directly into cars for shipment. Around 200 tons of copper is produced per day.

About 230 men are employed in the 3-shift operations at the smelter and refinery; approximately 770 men are engaged at Santa Rica in mining, in the shops, and at the leaching plant; and the mill and powerhouse have some 600 additional, making. Kennecott's aggregate pay roll in the Silver City area more than a quarter-million dollars monthly. The casual visitor finds it interesting to contemplate how great an outlay in man-hours and in out-size equipment at pit, mill, power plant, and smelter is required to keep a stream of red bars pouring from the furnace conveyor for a number of hours out of each 24.

Dust from Leyner Drills

A paper by R. J. Craig and T. M. Waterland to be presented at the annual Western meeting of the Canadian Institute of Mining and Metallurgy and entitled "Reducing Dust from Leyner Drills" is reproduced in the *Western Miner* for October.

The authors point out that careful observation has shown that the main sources of dust during drilling operations with a Leyner are :—

(1) The dust produced during the collaring of the hole ;

(2) the dust produced by the shank of the steel rubbing against the side of the hole, and

(3) the dust liberated by entrapped bubbles of air which feed down the axial hole in the drill-steel with the water and permit some of the drilling to be done under dry conditions.

The latter is undoubtedly the worst source of fine dust and the quantity produced varies considerably with different types and makes of machines. The air is compressed air which has leaked out of the cylinder of the machine. It may have leaked past the piston and along the flutes to the chuck cavity or else along the axial hole past the annular clearances between the water tube and the piston. Some machines were designed with a tapered water needle so as to allow a jet of air down the steel when the piston was in the forward position. This helped to aerate the sludge of drill cuttings in the bottom of the hole and machines that had this feature were known as good "mudders."

A machine was developed in South Africa, it is stated, with vents in the front head which allowed any air under pressure in the chuck cavity to escape to the outside air rather than pass down the water tube. This is known as the vented front head type of machine, although in some districts it has been called a dustless machine. In some Ontario mines dust samples, taken while drilling with machines of this type, have shown very gratifying results ; dust counts of 300 p.p.c.c. and, in some instances, as low as 200 p.p.c.c., have been reported. Comparative results from standard Leyner drills showed counts of 500 p.p.c.c. to 1,500 p.p.c.c.

The development of the combined air and water throttle, or what has come to be known as the New York back head, has also helped to reduce dust counts during drilling operations. The water and throttle valves are so combined that the water is always turned on immediately prior to the air. This insures that all holes are collared wet and also makes it impossible for the miner to shut off the water while the machine is in operation to aerate the sludge on the bottom of the drill hole.

Table 1

Tests Made in 45/024 Drive West

Machine A, equipped with Vented Front Head :	
28 Samples—Average Dust Count	1,122 p.p.c.c.
28 Samples— ,, ,, ,,	731 ,,
28 Samples— ,, ,, ,,	1,076 ,,
Machine B, equipped with Vented Front Head :	
28 Samples—Average Dust Count	690 ,,
28 Samples— ,, ,, ,,	484 ,,
Machine B, equipped with Standard Non-Vented Front Head :	
28 Samples—Average Dust Count	784 p.p.c.c.

Tests Made in 39/020 Drive West

Machine A, equipped with Vented Front Head :	
76 Samples—Average Dust Count	960 p.p.c.c.
28 Samples— ,, ,, ,,	1,053 ,,
Machine B, equipped with Vented Front Head :	
28 Samples—Average Dust Count	1,033 p.p.c.c.
Machine B, equipped with Standard Non-Vented Front Head :	
28 Samples—Average Dust Count	1,277 p.p.c.c.
20 Samples— ,, ,, ,,	1,103 ,,

Table 2

Test I.—Machine C, Standard Non-Vented Front Heads
Tests made in Drill Test Station, 20/29 Drive West

Lugged Chuck Front Head		*Tappet Chuck Front Head*	
10 Samples	819 p.p.c.c.	28 Samples	254 p.p.c.c.
24 ,,	629 ,,	8 ,,	506 ,,
28 ,,	612 ,,	28 ,,	189 ,,
Av. of 62 Samples	622 ,,	Av. of 64 Samples	257 ,,

Test II.—Machine C, Standard Non-Vented Front Heads
Test run in regular 6ft. by 7ft. Development Heading, 23/24 Drive

Lugged Chuck Front Head		*Tappet Chuck Front Head*	
22 Samples	1,781 p.p.c.c.	28 Samples	871 p.p.c.c.
20 ,,	1,749 ,,	26 ,,	1,091 ,,
28 ,,	1,697 ,,	Av. of 54 Samples	979 ,,
Av. of 70 Samples	1,738 ,,		

Tests in Canada

Different types of vented machines were tested at the mines of the Britannia Mining and Smelting Co., Ltd. They did not prove very satisfactory. It was found that the vents released water as well as air, causing a great deal of discomfort to the miners and chucktenders in the development heading. Some difficulty was experienced in drilling down holes in the softer rock because the machines did not mud properly. Furthermore the chuck parts of the machine were cut out quickly because it was impossible to maintain adequate lubrication in the front end.

In 1942 two power-feed machines were purchased having vented front heads. These were 3½-in. machines from different manufacturers equipped with the lugged chuck front head and the New York back head. They were the first power feed machines at the property having an expected 20% to 30% increase in overall drilling efficiency. It was hoped that this increased efficiency might overcome the several disadvantages caused by the so-called dustless features. They were introduced into a development heading immediately and were kept under observation.

The results of dust tests made in the headings where these machines were in use were as shown in Table 1. These samples were taken during normal drilling operations and were taken while drilling with different lengths of steel. The results of the dust tests were quite discouraging, to say the least. Why burden the miners with the disadvantages of a vented machine if it did not measurably reduce the dust count in the face ? Could the fact that the Ontario machines were equipped with tappet chuck front heads, instead of lugged chuck front heads, account for the difference in the dust count ?

Early in 1944 a thorough comparative test was made between Leyner drills equipped with lugged chuck and tappet chuck front heads. The object of the test was twofold :—

(1) To check the comparative drilling speeds of the two different types of chuck. Previous tests on older model machines had indicated that a machine equipped with a lugged chuck had a 15% advantage in drilling speed over a similar model equipped with a tappet chuck.

(2) To test the relative concentration of dust produced by the two types of machine.

A new machine was obtained for the test equipped with standard non-vented lugged chuck and tappet chuck front heads. The test was made under closely-controlled conditions and sufficient data was obtained to average out minor differences.

The data from over 200 tests was tabulated and carefully analysed. This proved that, under the conditions of the test, the lugged chuck had less than an 8% advantage in drilling speed over the tappet chuck. The dust samples taken during these tests showed a decided advantage in favour of the tappet chuck. They indicated that the latter type produced only one-half as much dust as the lugged chuck. Table 2 shows the results of these dust tests.

If Leyner machines, drilling with straight shanked steel, produced 50% less dust than when drilling with lugged steel and at the same time maintained almost the same speed, then there appeared little doubt but that a change to the former would be justified. Among the factors influencing such a change would be :—

(1) Steel breakage would be reduced because of 85% of the lugged steel breakage occurred at or near the lug where it had been distorted at the time of the shanking operation.

(2) Shanking costs would be reduced because shanking lugged steel is much slower and more specialized work.

(3) Mine nipping would be simplified if both Leyner and Stoper drills used the same type of steel.

(4) Less "rivetting" of steel in the machine front heads would occur.

In order to make further dust comparisons a vented tappet chuck front head was purchased for Machine "A" (note Table 1). Of particular note is the large water tube which, because of its size, permitted an unusually large quantity of water to enter the steel and also, because of small clearances, allowed almost no compressed air to escape to the front end of the machine. A number of observations was made with this machine in a development heading. The dust samples were taken while the machine was drilling with different water pressures. This data is shown as Table 3.

These results in Table 3 bore out earlier observations which had indicated that tappet chuck machines produced much less dust than the lugged chuck machines and that dust counts more in line with those reported from Ontario could be obtained. The effect of varying water pressures on the amount of dust produced was also of particular interest. Correlating the data from Tables 2 and 3 it was thought that it might be possible to obtain a satisfactory reduction in dust concentrations during drilling operations by using a non-vented tappet chuck machine if sufficient water was supplied to the steel. It was accordingly decided to make a thorough test to determine the relative amount of dust produced by machines equipped with a vented lugged chuck, vented tappet chuck, and a non-vented tappet chuck fronthead.

Method of Testing

In order to eliminate all possible variables a special test station was constructed at a location where reasonably uniform ground conditions could be expected and a steady and high water pressure was assured. A section of 6 ft. by 7 ft. tunnel was sealed off by a tight brattice at one end and a wall at the opposite end which had an entrance door and a 6 in. by 8 in. testing aperture.

The same machine was used for all three tests except that the front heads were changed for each test as indicated. The test machine was set up within the enclosure and a large number of parallel horizontal holes were collared. The entire enclosure

Table 3

Machine A.—Tappet Chuck, New York Back Head and Large Water Tube

Thomas Sill—1050 Level.

60 Dust Samples—Water Pressure :	140 lb.	322 p.p.c.c.
13 ,, ,, ,,	80 lb.	332 ,,
No. 3 Powder Blast, 20/29 Stope.		
22 Samples—Water Pressure :	43 lb.	658 ,,

Table 4

Test 3.—Lugged Chuck Vented Front Head—1·89 g.p.m.

Hole 1–6	Samples . .	366 p.p.c.c.
,, 2–6	,, . .	354 ,,
,, 3–6	,, . .	345 ,,
,, 4–6	,, . .	247 ,,
,, 5–6	,, . .	311 ,,
,, 6–6	,, . .	355 ,,
Avge. 36	,, . .	330 ,,

Test 4.—Tappet Chuck Non-Vented Front Head—1·8 g.p.m.

Hole 1–6	Samples . .	235 p.p.c.c.
,, 2–6	,, . .	281 ,,
,, 3–6	,, . .	316 ,,
,, 4–6	,, . .	208 ,,
,, 5–6	,, . .	260 ,,
,, 6–6	,, . .	183 ,,
,, 7–6	,, . .	225 ,,
Avge. 42	,, . .	244 ,,

Test 5.—Tappet Chuck Vented Front Head—1·8 g.p.m.

Hole 1–6	Samples . .	247 p.p.c.c.
,, 2–6	,, . .	255 ,,
,, 3–6	,, . .	172 ,,
,, 4–6	,, . .	262 ,,
,, 5–6	,, . .	287 ,,
Avge. 30	,, . .	245 ,,

was next thoroughly wet down and ventilated. This procedure was repeated after each hole was drilled. All dust samples were taken of the air escaping through the small aperture. Each hole was drilled with a 2-ft., 4-ft., and 6-ft. steel. A definite time interval of 2½ minutes was allowed between drilling with each length of steel to give the drill operator adequate time to change steel and line up his machine. Samples were taken of the air immediately before drilling commenced and after the drill had been running for one minute. An interval of ten minutes was allowed between the drilling of each hole to permit wetting down and ventilating the chamber.

As in all previous tests referred to the dust samples were taken with the Kotze circular Konimeter, manufactured by Devers in South Africa. This instrument takes a 5 c.c. sample of air and impinges the dust on an oil-coated glass slide. Each slide has a capacity of 29 samples around the circumference of the ring.

After collecting the samples the slides are heat-treated in an electric muffle furnace at a temperature of 1,000° F. This burns off the oil and any carbonaceous material. After heating the slides are immersed in a 50% solution of hydrochloric acid for 3 minutes to dissolve any soluble material. The acid is washed off with alcohol and the slide again heated to 1,000° F. to drive off the alcohol residue. The dust spots are counted under a microscope equipped for dust counting with 150 magnification, using dark-field illumination.

Preliminary tests indicated that a water pressure of 80 lb. per sq. in. was the most practical. At this pressure a flow of 1·8 gallons per minute passed through the machine. Table 4 shows the results of this carefully-conducted test.

Conclusions

As a result of the tests a power-feed machine with a standard tappet chuck, non-vented front head, and a New York back head, has been adopted as the standard Leyner drill.

A large number of subsequent tests has been made with this type of machine under operating conditions. The results have been very gratifying. The following, taken with two machines drilling in a 6 ft. by 7 ft. heading, are typical :—

33/23 X.C. North.

8 Samples . . .	337 p.p.c.c.
8 ,, . . .	308 ,,

The low dust count, without the several disadvantages of the vented front head, is proving a decided advantage to the drill operators who are now becoming more adept in handling the straight shanked steel. The chain steel puller which utilizes the power feed motor has proved of value.

Although it was determined that all makes of machines equipped with standard tappet chuck front heads do not give equally favourable dust counts the writers are convinced that with slight changes they can be made to do so.

Blasting Switches

A report by M. S. Peterson and F. E. Cash, published by the U.S. Bureau of Mines as Information Circular 7372, deals with electric blasting switches in underground mines of the Lake Superior district. The report describes six electric blasting-switch arrangements in use by three large iron-ore mining companies in the area and it is hoped that descriptions of these arrangements, which are a result of considerable thought and effort on the part of the mining companies, will enable other operators to benefit by their experience. The report covers blasting from power lines only.

The authors remark that explosives have been used in ever-increasing amounts since gunpowder was invented. For hundreds of years only low explosives of the deflagrating type were used and they were fired by means of a flame or hot object. The discovery and introduction of high explosives of the detonating type and the invention of the fulminate of mercury blasting cap about the middle of the 19th Century provided the needed impetus for inventors to develop means of firing the cap by electricity. The original high-tension igniter was discarded in favour of a low-tension igniter, in which the detonating compound was ignited by a heated wire. The past two decades have seen considerable improvement in the design and construction of electric detonators to make them safer and more efficient, yet in spite of the improvement it is estimated that less than 50% of the explosives used in industry to-day are ignited or detonated electrically. The trend, however, is toward the use of electric methods. In recent years numerous mining companies have introduced electric blasting exclusively at their mines as a means of improving safety and efficiency.

The Federal Bureau of Mines for many years has advocated the use of electric methods of detonating explosives, because the Bureau believes it is the safest method when properly conducted. This belief is shared by most explosives manufacturers, who in their handbooks recommend electric blasting under difficult conditions.

A study of electric blasting practices in the Lake Superior region reveals that the blasting procedures and equipment in use, although similar, are not standard, even in mines operated by the same company. One factor contributing to this condition is that suitable electric switches are not manufactured and each local electrical department is forced to assemble and remodel existent switches or build its own switches to fit the particular requirements. As a result several operating companies have developed their own designs and arrangements of switches.

RECENT PATENTS PUBLISHED

☛A copy of the specification of the patents mentioned in this column can be obtained by sending 1s. to the Patent Office, Southampton Buildings, Chancery Lane, London, W.C.2, with a note of the number and year of the patent.

15,615 of 1942 (581,004). General Electric Co., Ltd., and A. Bloch, London. Magnetic or electrostatic separators in which the feed to the energized field is by means of a conveyor-belt.

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12,203 of 1944 (580,987). Hanson-Van Winkle-Munning Co., Matawan, New Jersey. Tin ores are fused with caustic alkali and soluble salts extracted as aqueous alkali-metal stannates from which stannic acid is precipitated and used to restore the strength of the caustic alkali solution in an electrolytic cell.

13,399 of 1944 (581,034). Imperial Chemical Industries, Ltd., London. Solution used for the electrodeposition of tin comprises stannous compounds to which an alkali metal ferricyanide or ferrocyanide has been added.

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17,504 of 1944 (581,549). Mond Nickel Co., Ltd., and L. B. Pfeil, London. Plating anodes of electro-deposited nickel in which the suspension hooks are also of nickel spot welded to the anode.

17,681 of 1944 (581,610). R. G. Jackson, C. B. W. Willson, and Imperial Chemical Industries, Ltd., London. A stream of crushed mineral particles falling on to a drum rotating at high speed is separated into fractions of different specific gravities.

18,064 of 1944 (581,625). Soc. Anon. pour L'industrie de L'aluminium, Valais, Switzerland. Construction of the conducting bottom of furnaces for the electrolytic production of aluminium.

NEW BOOKS, PAMPHLETS, ETC.

☛Publications referred to under this heading can be obtained through the Technical Bookshop of *The Mining Magazine*, 482, Salisbury House, London, E.C.2.

British Standards Institution : 1946 Yearbook. Paper covers. Price 2s. London : British Standards Institution.

Lead-Zinc-Copper Mining in the Harz and Lead-Zinc Mining in the Ruhr Coalfield. B.I.O.S. Final Report No. 654, Item No. 21. Paper covers, 164 pages, typescript, illustrated. Price 23s. 6d. London : H.M. Stationery Office.

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Geology of the Country Between Nanyuki and Maralal, Geological Survey of Kenya Report No. 11. By Dr. R. M. Shackleton. Paper covers, 54 pages, illustrated, with map. Price Shs. 2/50. Nairobi : Mining and Geological Department.

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Geology and Ground-Water Resources of Scotts Bluff County, Nebraska. U.S. Geol. Survey Water-Supply Paper 943. By L. K. Wenzel, R. C. Cady, and H. A. Waite. Paper covers, 150 pages, illustrated. Price 25 cents. Washington : Superintendent of Documents.

Selected Index to Current Literature

This section of the Mining Digest is intended to provide a systematic classification of a wide range of articles appearing in the contemporary Technical Press, grouped under heads likely to appeal to the specialist.

* Article in the present issue of the MAGAZINE. † Article digested in the MAGAZINE.

Economics

†**Gold, South Africa :** *Discovery, O.F.S.* The Odendaalsrust Gold Field. A. FROST *et al., S.A. Min. Eng. Journ.*, Oct. 12, 26, Nov. 2, 1946.

Gold, South Africa : *Industry, Future.* Gold Industry Facing a Crisis. G. CARLETON JONES, *S.A. Min. Eng. Journ.*, Nov. 2, 1946.

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***Resources, South America :** *Mineral, Colombia.* Colombian Survey. N. W. WILSON, THE MINING MAGAZINE, Nov., Dec., 1946.

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COMPANY MEETINGS AND REPORTS SECTION

CONSOLIDATED GOLD FIELDS OF SOUTH AFRICA, LTD.

Directors : Robert Annan (*Chairman*), S. Christopherson, W. H. Geikie, G. Carleton Jones, W. A. Mackenzie, M. Maclachlan, Sir Dougal O. Malcolm, The Hon. R. M. P. Preston, Sir Cecil H. Rodwell, Sir G. S. Harvie Watt, Bart., M.P., Brig.-Gen. Sir Samuel H. Wilson. *Manager :* E. C. Leaman. *Secretary :* R. Carr Taylor. *Office :* 49, Moorgate, London, E.C. 2. *Formed* 1892. *Capital :* £6,500,000 in £1 shares.
Business : Finance of and investment in mining ventures in various parts of the world.

The ordinary general meeting of members of the Consolidated Gold Fields of South Africa, Ltd., was held on December 5 at the Chartered Insurance Institute, 20, Aldermanbury, London, E.C., Mr. Robert Annan presiding.

The chairman said : I propose to deal first with the accounts of the operating company—New Consolidated Gold Fields. In the profit and loss account the dividends and profits on sales, etc., amount to £1,447,742—an increase of £477,500 over the previous year, mainly due to the opportunities for profitable sales of investments which occurred during the year. On the other side, management costs show an increase of £21,000 over the previous year's figure, which was considerably lower than normal owing to certain exceptional receipts. While this year's figures also reflect the return of staff from the Services and increased salaries, the total is still below normal. Other items show little change and the balance of £1,392,094 carried to appropriation account, together with £262,570 brought forward, brings the total available to £1,654,664, which is £476,049 greater than in the previous year. Preference Dividends have required £98,812, compared with £102,219, as D.I.T. Relief is no longer set off and the full standard rate was deducted in the latter half of the year. South African tax is higher by £35,000 and U.K. Taxation by £63,000. Following our usual custom £100,000 has been reserved for depreciation of investments and in view of conditions on which I shall have more to say shortly £400,000 has been transferred to General Reserve, bringing that account up to £1,500,000. Out of the balance a dividend of 12½% less tax has been declared on the ordinary shares, being the same rate as last year. Owing to deduction of tax at the full standard rate, this will absorb £240,625 compared with £253,386 in the previous year, and leave £256,578 to be carried forward.

The accounts of the Consolidated Gold Fields of South Africa, Ltd., call for little comment, the dividends receivable from the operating company being balanced by those paid or recommended.

At our last meeting I ventured to draw your attention to the need of the mining industry to reduce operating costs and to make good the war-time deficiency in the development necessary to replace the depletion of existing mines. Since that time the industry has operated under conditions which are in some respects so abnormal and contradictory that I propose to devote my remarks to-day to a general review, in which I shall try to put things in their proper perspective. While I shall be speaking with special reference to the Witwatersrand, where our principal interests lie, much of what I shall have to say is equally applicable to gold mining in other fields and some of it to mining for other metals.

The outstanding features of the period have been first, the continued rapid rise in the costs of production and of developing and equipping new properties, and, secondly, the wave of speculation which accompanied the new discoveries in the Orange Free State and spread to the mining markets in general. The speculative position has already called forth a warning from Dr. de Kock, the President of the South African Reserve Bank. More recently Mr. Carleton Jones, in his capacity as President of the Transvaal Chamber of Mines, has drawn attention to the continued rise in operating costs and the danger which this threatens to the industry, particularly to the low-grade producers.

As one of the prime producers of natural wealth, the mining industry must continue and the question is one of adjustment to changing economic conditions.

Two factors are fundamental to any discussion of this kind :

The first is that rich mines are exceptional and that in any section of the industry the majority of producers work on a comparatively slender margin of profit. It is the marginal producers which are the first to influence the volume of production and employment and, in the case of base metals, the trend of metal prices.

The second factor is that mines are wasting assets and that the search for new deposits to replace those in process of exhaustion must be continuous if production is to be maintained. They must also be expected to return the investment within their productive life.

Let us turn now to the question of where an improvement in present conditions may be sought. The position of the marginal producers can be improved either by an increase in the price of the product or by a decrease in the costs. In the case of base metals, adjustment of price is normal practice and it is only desirable that the pendulum should not swing too far either way and thus cause cycles of over-production and scarcity. Sufficient attention has not been given in the past to the rôle of the marginal producer and its influence on the course of metal prices. In the case of gold the price is fixed by agencies outside the industry itself and it is interesting to trace its relationship to production costs over recent years, the significant figure being the cost per oz. of gold produced rather than the cost per ton of ore treated. In the period just before 1932, while gold remained at the old price of 85s., costs of production on the Rand absorbed on the average about 14 dwt. out of each oz. of gold produced. This proportion fell to 11 dwt. on the increase in the price of gold which then took place, but the costs immediately began to rise and in spite of a reversal in 1939 and 1940, when further increases in the price of gold took place, they have continued to do so until to-day when once more they absorb over 14 dwt. out of each ounce produced. Thus the margin of working profit in terms of gold is now no greater than it was in 1932, in spite of the fact that

the sterling price of gold has doubled. Capital expenditure and taxation have to come out of this margin and the dividends paid to Rand shareholders now represent little more than 2½ dwt. out of each oz. of gold produced. If past experience is a guide, any further increase in the price of gold would tend to be followed by a further rise in costs and thus the relief would not be permanent. In any case, a change of price is outside the control of the industry and in all the circumstances as we can see them to-day, it would be most unwise to count upon an increase at the present time.

Turning to costs, by far the most important item is the cost of labour. To-day the cost of labour on the Rand absorbs about 35% of the value of the product, which is about double the average ratio for manufacturing industry. Direct comparison with other mining fields must be made with caution but it is remarkable how little variation there is in this ratio irrespective of locality or of the type of labour employed. Manufacturing industry is highly mechanized, the raw material is brought to the factory and frequently an assembly line brings the work to the worker. In mining, conditions are just the reverse. The raw material lies far underground, men and material must be transported long distances to the working places through openings made for the purpose and machinery must be constantly moved to keep up with the working face as it retreats. There is, in consequence, a limit to the amount of mechanization which is economically possible. It should be widely realized that mechanization is not a cure-all and that mining, whatever the product, must always depend on manual labour to a far greater degree than is the case with many other forms of industry. In mining costs, the output per man-shift is the vital factor.

Stores constitute another large item of expense, the cost of which is still rising. This will be felt more acutely when the large stocks carried during the war and acquired at lower prices have been worked off, but it is a factor beyond the control of the industry, which in the recent years of scarcity, has been practising every possible economy.

The situation is difficult and it is by no means confined to the Rand. In all gold-mining areas it threatens the richer mines with reduced profits and the marginal mines with stoppage, with all that this would entail in loss of employment and of national revenue both direct and indirect. A study of the factors involved indicates plainly enough that there is no simple remedy and that the interests most concerned—that is, labour, government, and capital, to name them in the order of their participation in the proceeds—must combine in an effort to check the rise in costs by all means in their power. As in all other forms of industry the standard of living and wage structure can only be maintained by an increase in productivity. Government assistance is needed to check general inflation in cost of commodities and services and in reduction of the level of taxation generally and not on the mines alone so as to provide a greater incentive to effort and some relief from the burden of the cost of living. The industry must improve its methods, equipment, and the conditions of labour wherever possible. The Rand already sets a very high standard in this respect but there is no doubt that, with the co-operation of all concerned, still further advances in efficiency can be secured. While the price of the product remains fixed it is clear that the gold-mining industry, either on the Rand or elsewhere, cannot be subjected to further burdens without serious effect on the marginal producers and, through them, on employment and the economy of the countries concerned. More than this, the present ratio of production to expenditure must be improved by all possible means.

Now let us consider the needs of future development for, in an industrial age so completely dependent on the use of metals, the exhaustion of known deposits is going on with increasing rapidity while the rate of discovery tends to diminish. With ever-improving means of transport, there are few areas left in the world into which prospectors have not penetrated and it is evident that the discovery of new ore deposits by purely visual search is coming to an end. Future metal supplies must depend to an increasing extent on the discovery by scientific means of ore-bodies which do not show at the surface, and on the development of new methods for the exploitation of deposits formerly considered unworkable on economic or technical grounds.

Exploration for hidden ore deposits is now a matter of careful geological survey aided, where conditions are suitable, by geophysical methods, and followed by drilling and development of selected areas. This involves the employment of highly-trained technical staff and the gradual testing of large areas by process of elimination. It is, in consequence, a lengthy and expensive process. As there seems to be some misunderstanding on the matter I should point out that there is no geophysical method in existence to-day which will give direct indication of payable ore. Under favourable conditions these methods give most valuable guidance in selecting areas for further testing and in discarding less favourable ground, but the actual presence of ore can only be proved by subsequent drilling and development.

No better illustration of this process could be found than the recent exploration in the Orange Free State where no surface indications of the gold-bearing reefs exist and where the search has been guided entirely by geological and geophysical methods. I cannot give the exact figures for to-day, but recent returns showed that the mining interests concerned held options over an area of more than 8,500 square miles on which £220,000 per annum was payable as option money in addition to the actual costs of exploration. Up to now there has emerged from this a well-defined reef-bearing zone with present extent of about 200 sq. miles, depending for proof on just over 100 completed boreholes, or one hole to every two square miles. Actually these holes are not evenly distributed and parts of the area up to 15 sq. miles in extent have not been drilled at all. The area proved in this way will certainly provide a number of new mines. It seems likely that some of these will be rich, it is certain that more will be of moderate or marginal grade, and the final number brought to production will depend on economic considerations. It is, of course, possible that further reef-bearing areas will be discovered.

The discoveries already made are of the greatest importance to the mining industry of South Africa, but they must be regarded as a much needed replacement of older mines now approaching exhaustion, and unless new mines in this area are brought to production as rapidly as possible there

may well be a set-back in production and employment in the meantime.

The cost of this extensive campaign of exploration has been heavy and has been financed entirely by private enterprise within the mining industry. The point I wish to make is that all expenditure on ground outside the proved area is non-productive, and unless the subsequent return from the proved area is sufficient to compensate for this, the game ceases to be worth the candle and these costly schemes will not be undertaken. In the report of the South African Committee on Mine Taxation it was suggested that as mines are wasting assets they should bear a higher rate of tax than that applied to other industry. We contend that the reverse is the case and that a higher return is required on mining investments not only to provide for return of capital with interest but also to compensate for the proportion of unproductive expenditure which must be incurred in the process of replacement. The revenue from mines brought to production is the only source from which the losses inherent in exploratory work can be recovered and over-taxation is the strongest deterrent to the adventure of capital in the search for new mines. Though I have used the Orange Free State as an illustration, these considerations apply with equal force to all mining fields. We believe that the British Government is formulating a policy on Colonial Mineral Rights and we cannot emphasize too strongly, first, that the capacity of the industry to produce and to give employment is conditioned by the marginal producers and not by the exceptional rich mines and, second, that exploration of new fields will be discouraged if the prospect of ultimate reward is diminished by over-burdensome taxation or terms of tenure.

The case for participation by the State in the produce of its mineral wealth is unassailable, but it should take the form of an appropriate share of the profit. Taxation by royalty or other form of levy on the gross value of the product is the most unsuitable of all methods. By increasing the pay limit it prevents the working of low-grade ores, with a consequent waste of natural resources. It bears most unfairly on the marginal producers and by reducing the margin of profit it is just as much of a threat to labour as it is to capital. It is to be hoped that a system now almost universally discredited will not be perpetuated in our Colonies, the prosperity of which depends to so large an extent on the mining industry.

Let me now deal briefly with some of our principal interests, more complete details of which can be found in the consulting engineers' report and in the proceedings of recent annual meetings, all of which are available at the company's office.

In South Africa, the producing mines have all suffered from shortage of labour, strikes, and mounting costs and every effort must be made to secure economies. Some improvement in the rate of development has been possible in the past year ; the scale of operations has shown an increase during recent months at Venterspost and it is hoped to increase the rate of output at Luipaards Vlei and Vlakfontein. In our developing properties, the chief interest centres in West Witwatersrand Areas, Ltd., and its subsidiaries. Requirements may in turn involve the provision of further capital for West Witwatersrand Areas, Ltd. West Witwatersrand Areas, Ltd., has also taken options on further ground west of the Mooi River to protect the situation in an area where the position of the reef is not yet clearly defined.

The question of terms upon which leases can be secured for mines upon which the future of the industry depends is one of supreme importance and we feel that nothing could be less appropriate than an attempt to assess them on a purely opportunist basis.

Participation by the State in leased mines is in two parts, the first consisting of a share of the earnings on a sliding scale. This scale remains unaltered throughout the life of the mine and the resulting share is chargeable against the earnings before arriving at the income subject to taxation. The second part is the normal tax, also on a sliding scale, which may be varied in any Budget. It is, therefore, clear that to increase the rate of the State's participation under the leases in the case of new mines will serve to deprive them of much of the benefit which would accrue from any decrease in normal taxation. The effect of lease terms on the future of new mines is a subject which calls for careful examination in considering the means by which the State can assist the industry.

Our Free State Exploration Co. has continued active prospecting during the year, but so far without tangible success. Up to the end of November the company had completed 20 boreholes, of which 13 were drilled jointly with other companies. Options on large blocks of ground have been abandoned after investigation and the total area now held under option is about 648 sq. miles. Certain areas acquired during the year appear to hold possibilities and prospecting is being concentrated on areas adjacent to the proved fields. Five boreholes are at present in progress and three more will be started shortly.

In the Gold Coast the concentration scheme, under which four of the producing mines were closed down, has come to an end. Permission to resume work was given last March, the final payments for care and maintenance were made in August and progress is now being made towards full-scale production.

In other fields there is nothing which calls for particular comment. Our petroleum interests are in a satisfactory position.

To sum up, the past year has seen a continued rise in the costs of production and of equipment which constitutes a threat to marginal producers and a deterrent to new development, and it is obvious that the mining industry, in common with most others, must undergo a process of economic adjustment. It would be foolish to ignore this, but it is not the first time that such a situation has arisen and I can see no reason to doubt that the necessary adjustment will be successfully accomplished.

The mining industry overseas has always been an important element in the foreign trade of this country, but it is one which can only be maintained by continued enterprise in the search for new deposits. In this we intend to take an active part, but, as I have tried to show, it requires time, money, and an increasingly elaborate organization. We therefore hope that our efforts will not be frustrated by any unduly short-term policy in the matter of foreign exchange. No one can promise immediate results or even a high proportion of success, but the need for this work is becoming ever more pressing and it is greatly in the national interest that this part of our external assets should be rebuilt.

The report and accounts were adopted.

LONDON TIN CORPORATION, LTD.

Directors : J. Ivan Spens (*Chairman*), T. E. Baring, G. F. A. Burgess, Rt. Hon. W. S. Morrison, Richmond Temple, A. M. Weber-Brown. *Secretary :* S. J. Weedon. *Office :* 55–61, Moorgate, London, E.C. 2.
Formed 1925. *Capital issued :* £3,618,236 in 4s. shares.
Business : Finance of and investment in ventures related to the tin industry.

The twentieth ordinary general meeting of the London Tin Corporation, Ltd., was held on November 18 at the Chartered Insurance Institute, 20, Aldermanbury, London, E.C., Mr. J. Ivan Spens presiding.

The chairman, in moving the adoption of the report and accounts for the year ended April 30 last, said : The outstanding events of the year under review, so far as your company is concerned, were the re-occupation of Malaya and Burma, the re-entry into Siam, and the end of selective uneconomic mining in Nigeria. In every country where we operate, or have interests, we are faced with a formidable task in rehabilitation and reorganization, though in some instances the position is less severe than we had at one time feared.

The early stages of rehabilitation in the Far East are being undertaken by the industry as a whole with zeal and determination and there is every reason to be satisfied with the progress made, but progress must inevitably be slow and must be influenced by many factors. The fortunes of tin-producing companies may be expected to bear a strong relationship to the fortunes of the countries in which their properties are situated. The rate at which food and commodities can be acquired and distributed, and mining equipment can be delivered to the mines, may continue to be vital factors for some time.

Shareholders of this corporation will appreciate that an immediate improvement in income cannot be expected and that it is important to approach our problems with an open mind, anticipating as far as possible the probable difficulties and dangers.

The Accounts

The accounts for the year show a profit of £92,663, after bringing in tax suffered less tax recovered. The interim dividend of 4%, less tax paid on June 21, 1946, took £79,601, leaving a balance of £13,062, making with the sum of £149,591 brought forward, a sum of £162,653 to be carried forward.

I would remind shareholders that London Tin Corporation, Ltd., is a finance company and that therefore it is necessary for the capital of the company to be intact to admit of the payment of a dividend. As it was clear that the capital of the corporation was intact again at April 30, 1946, the directors—being mindful that shareholders had been without a dividend since 1941—declared and paid an interim dividend, so that shareholders would not have to wait until the present accounts were completed. In announcing the interim dividend, however, the directors stated that the profits for the year were not likely to admit of the recommendation of a final dividend.

The material changes in the balance-sheet items are consequent on the application of the reserve for war contingencies of £300,000, referred to in the directors' report. After reviewing the information thus far received, it has been possible to define, on broad lines, those assets against which provision should be made. It was therefore deemed desirable to make such provision at once from the war contingencies reserve in order to clarify the situation as early as possible, with the thought in mind that, should our assessment of the situation prove too conservative, the benefit will reveal itself in profits in future years as each position becomes finally adjusted.

I think it is convenient for me to refer now to the corporation's French representative, Monsieur L. Dautresme, who, up to the middle of 1940, was also a director of this corporation representing the French shareholders. Shareholders will be aware that the shares of this corporation held by French nationals have been requisitioned by the French Government for repatriation to this country. Accordingly Monsieur Dautresme will not rejoin the board and there is no longer any need for the corporation to have a French representative.

Management Subsidiaries

I wish now to touch on our management subsidiary companies, on which falls an increasing burden of responsibility. In the directors' reports issued during the war we have been able to refer to the able manner in which the management, staff, and African employees of A.O. Nigeria, Ltd., surmounted the trials of intensive and selective mining and achieved the maximum possible production from the mines under their management. Their more recent task of reorganizing the mines on a sound economic basis is scarcely less arduous. The work is proceeding well and the directors desire again to record their appreciation of the results achieved. I must express my personal appreciation of the help and support we had from Col. Boyes and Mr. Cothay as joint general managers of A.O. Nigeria, Ltd., during the past seven very difficult years.

This year it affords me special pleasure to be able to refer to the work of Anglo-Oriental (Malaya), Ltd., after a lapse of more than five years. The organization has been re-established under the chairmanship of Mr. W. M. Warren who, with Mr. G. Seddon, the Perak superintendent for Anglo-Oriental (Malaya), Ltd., were members of the inspection party which entered Malaya in September, 1945, to inspect and report on the condition of the mines and equipment.

Anglo-Oriental (Malaya)

Anglo-Oriental (Malaya), Ltd., is responsible *inter alia* for the management of 57 dredges in Malaya, Siam, and Burma. The pre-war European staff numbered some 250 persons, of which 130 were either imprisoned or interned by the Japanese, and the remainder who got free and those on leave at the time engaged themselves in war work or joined the Services. Altogether 24 died or were killed in action and four are still missing, and I take this first opportunity to record the board's deep sympathy with their families. The surviving European prisoners-of-war and internees were repatriated to their homes and the corporation, on behalf of Anglo-Oriental (Malaya), Ltd., has done everything possible to assist them to re-establish

themselves and their domestic affairs and, in their absence, to assist their dependants. The cost of these compassionate payments has, of course, been substantial; it was very necessary and has been greatly appreciated. I am pleased to say that many of those concerned have already returned to Malaya and those remaining are anxious to return and will be called as soon as they are required and accommodation is available. The European staff already re-engaged from all sources numbers 140.

I must express to the members of the Asiatic staff the board's sympathy for the hardships endured during the Japanese occupation and admiration for the loyalty shown by so many. I am glad to be able to say that a large proportion have returned to the service of Anglo-Oriental (Malaya), Ltd. As soon as Mr. Warren's work with the inspection committee was finished he proceeded to assemble the staff and re-establish the organization in order to proceed without delay to the rehabilitation of the properties under Anglo-Oriental (Malaya) management. The first dredge started production in April, 1946, and since then six other dredges have been brought in.

Good Work in Difficult Conditions

The directors record their high regard for the work so far accomplished in difficult circumstances; with a labour force in a condition much below par and short of food, and transport and transit facilities disorganized and in short supply; and extend their congratulations to Mr. Warren and all the staff and employees concerned on their achievements.

The work of preparing claims for compensation and programmes of rehabilitation, to enable the directors of the various mining companies concerned to formulate their future policy, is an additional and important task which is making good progress, especially when it is remembered that it includes Siam and Burma as well as Malaya.

Mr. Coates, who for many years was manager of Anglo-Oriental (Malaya), Ltd., under the late Mr. Henggeler, and who was interned by the Japanese, has retired, but we are fortunate not to lose the benefit of his long experience as he has consented to represent us in Australia, where he has recently arrived, to set up a suitable organization to expand our present interests in that country.

Mr. Waring, a director of Anglo-Oriental (Malaya) before the war, who was a prisoner-of-war, has rejoined Mr. Warren in Malaya and will be director of finance and administration. Mr. B. M. Cameron, the secretary of Anglo-Oriental (Malaya), Ltd., who was interned by the Japanese, has now returned to Malaya and has been appointed a director of Anglo-Oriental (Malaya), Ltd.

Mr. Read, who was on leave in Australia when the Japanese invaded Malaya, and did such admirable work for us there in looking after the many dependants of our imprisoned and interned staff, has now returned to Kuala Lumpur as deputy-secretary of Anglo-Oriental (Malaya), Ltd. There are many more who I might name for the valuable services rendered to this corporation and Anglo-Oriental (Malaya), Ltd., not only in the early stages of planning the start of rehabilitation, but ever since the re-occupation of Malaya.

Before passing from this subject I would like to pay tribute to the close co-operation and goodwill which exists between the staff in London, Malaya, Nigeria, and Australia, which ensures to our enterprise and the companies associated with it, that efficiency, keenness, and assurance so necessary in the important tasks that lie ahead.

Price of Metallic Tin

Passing now to the interests of the tin industry as a whole, there are two recent announcements of importance to which I must refer. The first is the price of metallic tin in the United Kingdom, which has been fixed as from July 1, 1946, at £380 10s. per ton, and on this basis an adjusted price in Nigeria and Malaya has been calculated, after allowing for freight and various charges. The indications are that owing to increased costs the margin of profit to be earned with metallic tin at this price will not be greater than it was with metallic tin at the prices ruling before the war. Moreover, it must be appreciated that the high cost of replacements will necessitate a large provision depreciation. Further experience of post-war for operations is needed, however, before any reliable figures can emerge.

So many queries have reached me recently regarding published costs in relation to the price of metallic tin that I feel it is necessary to point out that whereas the price of tin is quoted in £ per ton metal, the costs that are quoted are generally the cost of the actual mining operations required to produce a ton of concentrates, which usually contain from 70% to 75% of metallic tin in Malayan and Nigerian mining. In addition to these costs there must be added overhead charges, royalty, freight, smelting, and depreciation before a direct comparison can be made with the market price of the metal. I should add that there must be, in the case of many operating companies, provision for river, road, or rail deviations, the erection of dams, etc., and prospecting to maintain ore reserves.

International Tin Conference

The second is, as shareholders will have seen in the Press, that there was early in October, in London, an International Tin Conference at which the main producing and consuming countries were represented. Heretofore the regulation of the production of tin in relation to its demand has been in the hands of the International Tin Committee, a body appointed by the Governments of the countries from which the bulk of tin supplies of the world came. This regulation was exercised by means of quotas which were reviewed quarterly. The scheme had as an ancillary a buffer pool designed to cover any period when there occurred fluctuation in demand and a consequent reaction which was too sudden to be dealt with by the quarterly changes in quota.

This agreement worked satisfactorily and effectively until the invasion in the Far East in 1941–42 by the Japanese who overran Malaya, the Dutch East Indies, Siam, Burma, and French Indo-China, producing between them some 60% of the world's total supply of tin.

There remained then only Bolivia, Nigeria, and the Belgian Congo producing any appreciable quantities of tin, and these countries set out on a programme of maximum production, irrespective of its effect on the internal economy of their mining industries, but even so the allocation of metallic tin had to be severely restricted.

Supply Below Demand

The position we are in to-day is that the countries which were overrun are rehabilitating themselves as quickly as it is possible to do so, while those who were producing during the latter years of the war under such great pressure are reverting to normal economical mining. Production is still below potential consumption and supplies may not overtake demand for two years, if estimates of potential production and consumption prove correct.

At the International Tin Conference it was decided by the delegates to recommend to their respective Governments the setting up of an International Tin Study Group and it is hoped that replies from the Governments concerned will be received before the end of this year, so that the new body, if it is agreed to, will be able to commence its activities early in 1947.

The main producers are making every effort to re-equip themselves as quickly as possible, but there are many difficulties and production is already behind the original estimates. Supplies of machinery and stores are not coming forward as quickly as was hoped and in Malaya in particular shortages of rice and clothing are causing labour troubles which can only be overcome by increased supplies of food, clothing, and commodities generally.

From the point of view of the countries consuming tin, their estimates can only be made on many assumptions, including full employment. Since 1942 tin has been in restricted supply and has been issued only where its need has been essential, so that there is no real gauge of present demand. Many substitutes have been in use, but it is confidently expected that the majority of these will give way to tin when this metal is again in free supply.

Present Position

We have, therefore, the position that while the International Tin Committee, formed under an international agreement, which expires at December 31, 1946, had power to regulate production quotas rapidly and drastically, the proposed Study Group will have no such powers. Production is likely to exceed consumption within the next few years and it is essential, in my opinion, that as soon as the proposed Study Group is formed, consideration should be given as to the action which is to be taken to prevent surplus metallic tin being thrown on to an unwilling market and depressing the price below the economic cost of production.

I should add that while the present agreement for research terminates at the end of this year, it is confidently hoped that this essential service will be continued by the conclusion of a further agreement. That concludes my summary of your corporation's activities. I hope I have not overstressed that which is good nor that which is not good. I would like to leave you with the impression that your corporation and its management subsidiary companies are active and virile and, having overcome many difficulties, will overcome the rest.

The resolution was unanimously adopted; the retiring directors were re-elected and the auditors reappointed.

TANGANYIKA CONCESSIONS, LTD.

Directors : Maurice Hely-Hutchinson (*Chairman*), Earl Grey, Gaston Perier, Hon. A. O. Crichton, Godfrey C. Hutchinson (*Managing*), *Secretary :* R. W. Ednie. *Office :* Princes' House, 95, Gresham Street, London, E.C. 2. *Formed* 1899. *Capital issued :* £5,445,461.

Business : Finance of and investment in mining and other ventures.

The annual general meeting of Tanganyika Concessions, Ltd., was held on November 14 at the Chartered Insurance Institute, E.C., Mr. Maurice Hely-Hutchinson presiding.

The following are extracts from the chairman's speech :—

The net revenue of the company for the year under review bears hardly any taxation. According to our estimates it should still be possible to carry forward a loss of approximately £172,600 to be set off against future taxable profits.

Union Minière.—Examination of the Union Minière accounts shows that its very substantial capital requirements during the past ten years have been financed out of net income. Should future capital requirements be financed by means of an increase of capital, larger dividends could be paid if earnings continued on the same scale. At the same time, it would be necessary for Tanganyika Concessions to subscribe its proportion of such increase in order to maintain its relative position in the Union Minière.

Benguela Railway.—Up to the present, the annual payments received by your company from the Benguela Railway have been carried to Capital Account for the purpose of writing down the book value of the Benguela Railway holding, which now stands at a very low figure, having regard to the present and potential value of the railway. If your board consider that future payments from the Benguela Railway need no longer be utilized for that purpose, a substantial part of them could be carried to profit and loss account, thereby increasing the net distributable income of your company.

It is proper to mention at this time that orders have recently been placed by consumers in Northern Rhodesia for supplies of coal to be shipped to Lobito and carried over the Benguela Railway.

Finance.—For these and other reasons it is clearly necessary that your company should be in a position to finance its own future capital requirements which may, under certain circumstances, be substantial. This it is not practicable to do with the present capital structure of your company, except possibly by asking both classes of stockholders to sanction the issue of a prior security, which in your directors' view would be both unsatisfactory and undesirable. It is for this reason, more than for any other, that the directors have formulated the proposals for the conversion of the Preference Stock, foreshadowed at the time of the declaration of dividends. It is hoped that these proposals will be issued shortly with a view to their being carried into effect on July 31, 1947

JOHANNESBURG CONSOLIDATED INVESTMENT CO., LTD.

(Incorporated in the Union of South Africa.)

The ordinary general meeting of the Johannesburg Consolidated Investment Company was held in Johannesburg on November 26, 1946, Mr. H. J. Joel presiding.

The chairman, in moving the adoption of the report and accounts for the year ended June 30 last, said: The profit for the year amounted to £1,155,306, which reflects a slight decrease of £16,637 as compared with the adjusted profit figure for last year. The balance of £300,144 brought forward from the previous year added to the profit for the year gave a total of £1,455,450, from which sum £459,533 was set aside as a provision for taxation, £300,000 was transferred to Reserve Fund, and Dividend No. 54 of 3s. 6d. per share, after deducting United Kingdom income tax at the standard rate of 9s. in the £, absorbed £380,187, leaving £315,730 to be carried forward.

For some years at the annual general meeting of this company it has been our practice to review certain important aspects of the operations of the Witwatersrand gold-mining industry. These reviews have dwelt almost monotonously on the effect of rising costs on the industry and have indicated the likely serious repercussions on the country as a whole.

On the 25th of last month the President of the Transvaal Chamber of Mines made an important statement expressing the views of the Gold Producers' Committee on the subject. This pronouncement dealt clearly and fully with the effects of rising costs and was supported by statistics which are incontrovertible.

I have no hesitation in again stressing the seriousness of increasing costs. Two mines administered by this group have, since our last meeting, closed and as a result much revenue has been lost to the country. The principal reason for the closure of these mines is that working costs increased in the case of Langlaagte Estate and Gold Mining Co., Ltd., between 1938 and 1943 by over 5s. a ton, and in the case of Van Ryn Deep, Ltd., by more than 4s. a ton. These two comparatively small mines were responsible for providing a total spending power of over £2,000,000 a year, the bulk of which helped to maintain the Union's business and industry and thus stimulated employment throughout the country.

Owing to the fact that the industry as a whole has for some time been working under conditions of shortage of both European and native employees, it has been possible to absorb the majority of the employees of these two liquidated companies in other mines and therefore the loss to the community is not apparent. There are, however, other mines which may have to cease operations should costs continue to rise, or indeed not show a reduction, and if the industry is not able to absorb the employees of such mines the effect on the country would soon become evident. All responsible people must fully appreciate the great shock the country would receive under such circumstances, especially if any of the larger mines were among those forced to close.

The President of the Chamber of Mines stated that the most urgent and vital problem that faces the industry is that of rising costs. I would like to emphasize this point. However, a section of the community appears still to think that a reduction of taxation is the cure for all the ills of the industry. While a reduction in taxation is of great importance in attracting capital to the gold-mining industry and the justice of the elimination of discriminatory taxation is obvious, the point stressed by the President is of paramount importance. The immediate problem is to prevent the continued increase of the already colossal tonnages of gold-bearing rock which have been rendered unprofitable by the ever-increasing burdens.

Gold-Mining Companies of the Group.—The following are the principal features of the aggregate results of operations of the gold-mining companies of the group for the six months ended June 30, 1946: Tons crushed, 4,539,000; yield, 716,122 oz.; yield per ton, 3·155 dwt.; working costs, £5,156,966; working costs per ton, 22s. 9d.; working costs per oz. fine gold produced, 144s.; gross profit—including sundry revenue, £1,080,835.

Free State Development and Investment Corporation, Ltd.—Drilling operations in the Orange Free State were continued throughout the year by the Free State Development and Investment Corporation, Ltd. It was decided, in view of the favourable results obtained in the Odendaalsrust district, where up to September 30 last 15 holes had been completed, to purchase the mineral rights over an area of approximately 12,600 morgen proved to be underlain by gold-bearing reefs at depths suitable for mining operations. The prospects of payability are promising in that in eight of these 15 bore-holes the Basal Reef averaged approximately 7 in. in width and gave a result of more than 200 inch pennyweights in either an original intersection or in a deflection of the bore-holes.

Preliminary negotiations have been started by the Free State Development and Investment Corporation, Ltd., with the Mining Leases Board of the Union Government with the object of obtaining satisfactory mining leases over two areas in the Odendaalsrust district, each of which is sufficient for a deep-level gold mine.

The technical and administrative control of the companies which will be formed to work these mines will be vested in your company, which will also have a substantial interest in these companies through its holdings in "Freddies" and through its contractual rights to subscribe for a percentage of the shares.

Platinum.—Production at the Rustenburg Platinum Mines, Ltd., proceeded uninterruptedly during the year.

Copper.—Although production of copper has been slightly interfered with by shortage of coal supplies and, subsequent to the period covered by the annual report, by industrial disputes, the position of the Northern Rhodesian copper companies in which your company is interested remains satisfactory and the outlook is encouraging.

Diamonds.—The diamond industry continues to prosper and the sales for 1946 will exceed the record figure attained last year.

The resolution was unanimously adopted.

LAKE VIEW AND STAR, LTD.

Directors : G. Goldthorp Hay (*Chairman and Managing*), R. J. Agnew, A. H. Collier, W. H. Geikie, E. C. Leaman, J. Whitehouse. *General Manager :* J. F. Thorn. *Secretary :* R. H. A. Neuschild. *Office :* 49, Moorgate, London, E.C. 2. *Formed* 1910. *Capital :* £560,000 in 4s. shares.

Business : Operates gold-mining properties in the Kalgoorlie district, Western Australia.

The thirty-sixth ordinary general meeting of Lake View and Star, Ltd., was held on December 6 at River Plate House, E.C.

Mr. G. Goldthorp Hay (chairman and managing director), in the course of his speech, said : Before proceeding to review the accounts and the year's operations I want to refer to the loss which the company has suffered by the death of Mr. J. H. Cordner-James, who was one of the original directors of the company. Apart from his intimate knowledge of the company being available to us no longer, we have lost a staunch and able colleague. To fill the vacancy occasioned by Mr. Cordner-James's death we have recently appointed Mr. R. J. Agnew to the Board. Mr. Agnew is a son of the late Mr. John A. Agnew, who up to the time of his death in 1939, was chairman of this company and did much in the building up of its fortunes. Mr. R. J. Agnew has returned to this country after several years' practical experience in the West Australian mining industry ; we therefore welcome the opportunity of being able to draw on his first-hand experience in a sphere so closely concerned with this company's operations. We are able this year to reproduce once more the general manager's abridged report to the board and I feel sure you will have read his illuminating comments with considerable interest. It is not every mine that has been able to weather the war years as we have and we have every reason to be satisfied with Mr. J. F. Thorn's record of his stewardship. Ever since he joined the company his foresight has been one of the outstanding reasons for the success which has been achieved, but never was this more apparent than during the troublous years of the war. I cannot commend to you too highly the work which Mr. Thorn and his able staff, with the backing of the employees both underground and surface have done for the company.

Accounts

Turning to the accounts which are for the 12 months to June 30, 1946, the operating profit amounted to £311,817, compared with £276,549, the increase being due to greater tonnage which was treated. Actually the tonnage treated is still only little more than half our output before the war and I am afraid that it will be some time yet before we can get back to those figures. Meanwhile we feel that we are justified in recommending a small increase in the final dividend for the year to 27½% (namely 1s. 1·2d. per share gross and 7·26d. net) which, with the interim dividend of 12½% paid in June, will bring the total dividend for the year to 40% (namely 1s. 7·2d. per share gross and 10·56d. net), compared with 37½ for each of the five previous years. We propose a transfer to general reserve this year of £35,000, which will bring the total of this reserve to £250,000.

Full provision is made in the accounts for income tax and N.D.C. payable in respect of the profits shown. As you are aware taxation on gold mines in Australia takes the form of a contribution to the Federal Authorities based on the price of gold and therefore Dominion Income-Tax Relief has not arisen for some years. You have doubtless read in the Press of the agreement concluded recently between this country and Australia to give reciprocal tax relief and I should mention that for the reason just stated we shall not be affected by this agreement.

Supplies

Mr. Thorn, in his report, comments on the difficulty in obtaining supplies, a problem which has become a very real one. It is our practice to maintain substantial quantities of stores at the mine, but we have had to draw very heavily on these without being able to replace where there is a short supply due to the universal demand, as, for instance, in the case of cement. We cannot expect to get more than our fair share, but when the shortage is aggravated by labour troubles in times such as these it is very galling that operations on a whole continent can be interfered with by the action of a few, causing, too, the laying off of men who are anxious to get back to steady employment in the mines. As you will see from the accounts, stores at June 30, 1946, had fallen to £106,334 from £171,113 at June 30, 1945 (£201,272 at June 30, 1944), and, of course, with the higher prices ruling for almost all commodities the decrease in the quantities available is proportionately greater.

Development

Development at 14,626 ft. exceeded the previous year by 4,640 ft. It is of interest to note that 310,981 tons of ore were added to the reserve by the 12,039 ft. of development work done in the numerous ore channels, this representing 25·8 tons of ore per foot of development.

A strike in the explosives factory in Victoria caused a suspension of all development on June 13 in order to conserve supplies and normal development was not restarted until September 2, when supplies arrived from overseas.

You will notice that the minor lodes again responded to the development done on them with a total of 3,382 ft. averaging 6·4 dwt. over 56 in. out of the 5,244 ft. sampled. This year it is intended to concentrate work even more on these lodes, particular attention being paid to the Ivanhoe lease, where the small footage done during the year disclosed encouraging results. These minor lodes have been steadily increasing in importance for some years and the present ore reserve in them now amounts to 1,043,300 tons averaging 5·16 dwt. per ton, which is above the average grade for the mine. It can hardly be doubted that these lodes, carrying as they often do considerably better than average values, will continue to prove a large factor in the future of the mine.

Results at the Lake View mine have been encouraging also and you will note that new orebodies in the north-eastern part of the lease were disclosed by cross-cuts from the main lode at the 300-ft. and 500-ft. levels. Development here, as the general manager points out, has not only replaced the 125,000 tons treated during the year, but the present reserves in this mine are now 25,000 tons higher than last year.

Total ore reserves are estimated at 3,949,100 tons,

averaging 4·93 dwt. per ton, made up of positive ore 2,884,200 tons of 4·72 dwt. per ton, probable ore 316,300 tons of 6·36 dwt., and broken ore 748,600 tons of 5·14 dwt. The greater proportion of this year's production will come from positive and broken ore, which total 3,632,800 tons, averaging 4·81 dwt., this tonnage representing 92% of the total ore reserve.

Here I might recall that at June 30, 1942, our ore reserve at 4,200,000 tons, averaging 5·05 dwt. per ton, was the highest we have ever had and it was from then onward that the mine felt the full effect of the reduction in man-power. It speaks highly for the technical efficiency and work of all at the mine that during the ensuing four years, when over 1,330,000 tons were milled, the ore reserve has only fallen by 251,000 tons and 0·12 dwt. in value.

At the Chaffers plant 383,081 tons of 5·1 dwt. ore were milled for an extraction of 90·66%. Costs were higher by 7¾d. per ton, chiefly due to increased cost of supplies and smaller production per man shift. At the re-treatment plant 669,167 tons of residues, averaging 0·83 dwt., were treated. This latter plant has now handled 4,384,357 tons of residues and some twelve months' supply still remains to be treated. This tonnage has yielded a workng profit of approximately £328,000.

Costs

It is, perhaps, not unnatural that after the six years' upheaval of war it is taking a little time to establish just what are the present standards of value and this is forcibly brought out by the claim for revisions in the terms of the existing labour award put forward by the Australian Workers' Union. As this matter is now under consideration it would be out of place for me to offer any detailed comments.

I will confine myself to mentioning the very elementary but important fact that as costs rise so is the life of every mine reduced proportionately. To some any further increase in costs will bring about their closure. This is a very simple truth but for this very reason it tends to be overlooked, as was brought home to me during my visit. Mining in Western Australia is probably the key industry and so if it is to keep that position the possibility of opening up new properties must not be killed by the creation of conditions which result in high costs. I have come back encouraged with the prospects of the industry for the future and for our property in particular, provided all will collaborate on a basis of reasonable give and take.

Porphyry Option

My only further comment is in relation to our interest in the option on the porphyry mine in which we are associated in equal thirds with Wiluna Gold Mines, Ltd., and Gold Fields Australian Development Company, Ltd. Our information so far is that ore reserves of some 750,000 tons averaging between 3¾ and 4 dwt. have been developed and there is every prospect of this tonnage being added to. But at these values the property comes within the marginal category and we have still to know what production costs are likely to be before a decision as to future policy can be reached. The property is certainly not without interesting possibilities.

The report and accounts were adopted.

KLERKSDORP CONSOLIDATED GOLDFIELDS, LTD.

Directors : W. M. Kirkpatrick (*Chairman*), A. H. Moreing (*Managing*), Dr. C. B. Horwood, E. A. Loring, Dr. A. H. R. Wach. *General Managers in South Africa :* Bewick, Moreing, and Co. *Secretaries :* W. H. Stentiford and Co. *Office :* 1, Broad Street Place, London, E.C. 2. *Formed* 1934. *Capital issued :* £595,485 in 5s. shares.

Business : Finance and development of gold-mining properties in the Klerksdorp and Walmaraansstad districts, Transvaal.

The annual general meeting of Klerksdorp Consolidated Goldfields, Ltd., was held on November 29 at 1, Broad Street Place, E.C.

The following is the statement by the chairman, which was issued with the report and accounts for the year ended June 30, 1945 :—

The accounts presented herewith include, under Development Account, the net amount of the first dividend—namely £4,952—received from Dominion Reefs (Klerksdorp), Ltd., in respect of our holding in that company. Two further dividends, both of 5% each, have been declared by that company in respect of the years 1944 and 1945, amounting to £10,399 net, but were not received in time for inclusion in the accounts herewith.

Since the last meeting the board has been actively engaged in preparing plans for the development of the areas in which the company is interested. At the request of the board, Captain Moreing, the managing director, paid a visit to South Africa early this year and a programme has been worked out which, it is believed, will result in the rapid and economical development of the areas.

As I said in my statement last year, the company would require to raise capital for this purpose and arrangements to issue the unissued capital have been completed. In the opinion of the board the recession in the market for gold-mining shares has, however, made it desirable to postpone this issue for the time being, but the directors are closely watching events and will make the offer as soon as circumstances permit.

The report and accounts were adopted.

BREMANG GOLD DREDGING CO., LTD.

Directors : Sir Joseph Ball *(Chairman)*, R. Annan, Hon. K. H. Campbell, Carl R. Davis, H. G. Latilla, S. S. Taylor. *Joint Secretaries :* J. W. Price and G. Houghton Brown. *Office :* Finsbury Pavement House, Moorgate, London, E.C. 2. *Formed* 1936. *Capital :* £1,000,000 in 5s. stock units.

Business : Operating alluvial gold properties in Gold Coast Colony.

The ninth ordinary general meeting of the Bremang Gold Dredging Co., Ltd., was held on December 3 at the Chartered Insurance Institute, 20, Aldermanbury, London, E.C., Sir Joseph Ball presiding.

The following are extracts from the chairman's review, circulated with the report and accounts for the year ended December 31, 1945 :—

I do not think I need comment on any particular item of the accounts and I will content myself with pointing out that, on balance, the year's operations differ little from those of the previous year.

It would, however, be wrong to assume that the Board is satisfied with the year's operations. The main factors retarding progress have been shortage of personnel and interminable delays in obtaining delivery of essential machinery.

During the war years, the Gold Coast Government permitted the mines to employ only the absolute minimum number of Europeans necessary for the continuance of operations, no allowance being made for any possible absenteeism through sickness, and this restriction has remained in force until a comparatively recent date. For many years past there has been a dearth of trained dredge operatives. We have recently engaged a number of young men just out of the Forces, with a view to training them as dredge operators.

That there is a shortage of material is, of course, known and recent experience indicates that it may be some time before all our needs can be fully satisfied.

With regard to dredging operations during the year under review, the output from No. 1 dredge was 1,645,100 cu. yd., a decrease of 26,700 cu. yd. as compared with the previous year. No. 2 dredge gave an increased output of 5,700 cu. yd. at 1,722,000 cu. yd. No. 3 dredge, which was completed and went into commission towards the end of July, 1945, treated 800,600 cu. yd. The total throughput for the year shows a net increase over the previous year of 779,600 cu. yd. at 4,167,700 cu. yd. Total recovery of fine gold amounted to 18,012 oz., an increase over 1944 of 902 oz. There was an improvement in percentage of recovery on both Nos. 1 and 2 dredges and No. 3 dredge gave satisfactory working and showed full recovery. Due to the No. 3 dredge being brought into operation, the total working expenditure was some £10,000 higher than the previous year, but the average mine working costs per cubic yard, excluding duties and realization, were reduced 0·106d. for No. 1 dredge and 0·683d. for No. 2 dredge, the average costs per cubic yard being No. 1 dredge 5·553d., No. 2 dredge 5·349d., and No. 3 dredge 4·376d., an average of 5·096d. Gold premium tax amounting to £18,974 was paid to the Gold Coast Government during the year under review. The completion of No. 3 dredge in July, 1945, allowed preparatory work on No. 4 dredge site to be stepped-up and considerable progress was made with reconstruction, although there was the usual delay in arrival of materials.

The power plant again gave complete satisfaction ; 20,303,590 kW. units were generated, an increase of 689,290 kW. over the preceding year. Generating costs were 0·846d. per unit, a reduction of 0·205d. per unit.

During the period January to September, 1946, a total of 4,236,200 cu. yd. have been treated, yielding 15,493 oz. of gold, a working profit being shown for each month. Progress on the No. 4 dredge continues satisfactory and it is expected that it will come into operation early in the New Year. It is anticipated that expenditure on spares and renewals will, from now on, be much reduced and with the fourth unit operating a reduction in overall working costs should be shown. I both hope and believe that we may look forward with some confidence to a very much improved position from next year onwards.

Owing to existing conditions with regard to plant and personnel it is not yet possible to proceed with the scheme for taking over from the Gold Coast Selection Trust, Ltd., the alluvial properties situated along the Offin and Jimi rivers.

The report and accounts were adopted.

THE BRITISH METAL CORPORATION LIMITED

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GOLD COAST SELECTION TRUST, LTD.

Directors : Sir Joseph Ball (*Chairman*), Robert Annan, Hon. Kenneth H. Campbell, Carl R. Davis, H. G. Latilla, S. S. Taylor, W. A. Mackenzie. *Consulting Engineers :* West African Gold Corporation, Ltd. *Joint Secretaries :* J. W. Price and G. Houghton Brown. *Office :* Finsbury Pavement House, Moorgate, London, E.C. 2. *Formed* 1928. *Capital :* £750,000 in 5s. stock units.

Business : Finance and development of gold mining properties in Gold Coast Colony.

The sixteenth ordinary general meeting of Gold Coast Selection Trust, Ltd., was held on December 3 at the Chartered Insurance Institute, 20, Aldermanbury, London, E.C., Sir Joseph Ball presiding.

The following are extracts from the statement by the chairman, which was issued with the report and accounts for the year to September 30, 1945 :—

The accounts now submitted call for some comments. In the first place the activity of the Stock Market during the year under review afforded the Trust opportunities of realizing a small portion of its holdings, these transactions yielding a profit of £184,139. Adding £33,507 received by way of dividends and interest and £385 net profit on the sale of plant, the total net revenue amounted to £218,031. After allowing for the usual expenses, totalling some £6,387, and appropriations, £129,673, which includes £75,000, the 10% dividend paid on September 28, 1945, the credit balance carried forward on profit and loss account was increased to £542,867 15s. 7d.

As stated in the directors' report, we are forced for the time being, by reason of the tax assessments raised by the Inland Revenue in respect of the years 1934–8, to be rather conservative in our dividend distributions. (Since the directors' report and accounts were printed judgment has been given in the company's appeal to the Court of Appeal against the additional assessments for income tax in respect of the years 1934–8. The appeal was dismissed. Having regard to the important question of principle involved, application was at once made to the Court for leave to appeal to the House of Lords and this was granted.) As, however, the maximum liability in respect of these assessments is unlikely to exceed a quarter of a million pounds, even in the event of our final appeal being completely unsuccessful, the Board decided that dividend payments could properly be resumed on the scale reached prior to the imposition of the Gold Coast concentration scheme—that is, at the rate of 25%, free of tax.

I may here say that we have not disposed of any substantial portion of our investments in any one company and that as a result of the additional shares taken up " as of right " in the Amalgamated Banket and Nanwa companies and the further shares which we propose to take up in the new issue about to be made by the Gold Coast Main Reef, the value of our portfolio of investments taken at Stock Exchange prices ruling to-day is still in excess of £4,000,000.

I now have some up-to-date information to give you with regard to the various companies in which we are interested.

Since re-opening Amalgamated Banket Areas and Marlu considerable difficulties have been experienced in getting together the experienced staff necessary to re-open and run the mines. On Amalgamated Banket Areas over 20,000 tons of ore were milled during September, 1946, but it must be remembered that this company's plant is planned to treat 60,000 tons of ore per month. Meanwhile, development work on the Taquah-Mantraim section of this company's property has given encouraging results. In the case of Marlu Gold Mining Areas, Ltd., over 25,000 tons were milled in October, 1946, and returns for this month show a net mine profit, after deducting gold tax and realization charges, of some £2,500.

Ariston Gold Mines (1929), Ltd., is a well-established mine and regular dividend payments in the future seem well assured.

Operations on the properties of Gold Coast Main Reef, Ltd., which adjoin those of the Ariston company, continue to give satisfactory results.

With regard to Nanwa Gold Mines, Ltd., the directors have accepted an allotment of shares at par in this company, in satisfaction of loans which they had made amounting, with accrued interest, to approximately £40,000. Work on this company's properties had been suspended during the war, mainly owing to lack of finance. Sufficient funds have, however, now been provided to enable a complete survey and development programme to be undertaken and this work is proceeding satisfactorily.

The Bremang Gold Dredging Company, Ltd., in which the Trust has a large holding, has experienced the same difficulties as those which have impeded progress in the case of Amalgamated Banket Areas and Marlu—namely, shortage of experienced staff and long delays and difficulties in obtaining machinery and stores. Three dredges are, however, now in operation. It is expected that the fourth dredge will be operating early in the New Year.

There is one other matter to which I wish to refer—namely, the progress made in driving along the 17th level north from the Ariston company's north shaft to a point under the old Broomassie mine. This work is being carried out by the Ariston Gold Mines (1929), Ltd., in the joint interests of Ariston, Marlu and Gold Coast Selection Trust, and the drive, when completed, will traverse some 9,500 ft., of which some 6,000 ft. have already been driven. It is expected that the drive will be completed towards the end of 1947 and indications are that the possibilities of exposing new ore-bodies in this area are encouraging. Given the success anticipated the results will be highly important to your company, to the Ariston Gold Mines (1929), Ltd., and particularly to the Marlu company, which will probably undertake the development and working of the major part of the areas.

Before concluding I have to express our deep regret at the death of Mr. James H. Batty on January 9, 1946, and to place on record our appreciation of the valuable services which he rendered to this company throughout his long term of office as a director.

The report and accounts were adopted.

MARLU GOLD MINING AREAS, LTD.

Directors : Sir Joseph Ball (*Chairman*), Robert Annan, Carl R. Davis, H. G. Latilla. *Consulting Engineers :* West African Gold Corporation, Ltd. *Joint Secretaries :* J. W. Price and G. Houghton Brown. *Office :* Finsbury Pavement House, London, E.C. 2. *Formed* 1934. *Capital :* £2,000,000 in 5s. stock units.

Business : Owns gold-mining properties in Gold Coast Colony.

The eleventh ordinary general meeting of Marlu Gold Mining Areas, Ltd., was held on December 3 at the Chartered Insurance Institute, 20, Aldermanbury, London, E.C., Sir Joseph Ball presiding.

The following is an extract from the chairman's statement which was circulated with the report and accounts for the year ended September 30, 1945 :—

The net result of the year's accounts shows an increased debit balance carried forward on profit and loss account which now stands at £107,512 16s. 5d.

Members are fully alive to the difficulties confronting industry in this country and they are probably even worse for companies operating overseas. The staffing of the mines has been, and is still, a very serious problem.

Many of the pre-war manufacturers of mining plant, machinery, and ancillary equipment are so booked up with orders for the post-war reconstruction at home and for foreign markets, that they are unable to satisfy our immediate requirements and deliveries are, in consequence, very much delayed.

It is pleasing, however, to report that we are again producing gold. The plant was started up in May last and is running satisfactorily and further improvement may be expected as the new staff gain experience. We are at present treating some 20,000 tons of ore per month and this figure will be stepped-up as speedily as possible. So far the grade of ore treated has been below the average of the reserves. This is due to the lack of shovel and locomotive spares restricting the number of ore-bodies that can be worked at any one time.

Since restarting operations we have had to replace sleepers over more than 20 miles of track. This task has now been completed and, except for replacing worn rails when new ones become available, our tracks are in good condition.

Outside our main sphere of operations we are directly interested in the development work being carried out along the line of strike extending from the Ariston mine right up to our own properties. The Ariston company are continuing the drive of their 17th level to a point beneath the old workings of the Broomassie mine. A distance of more than 6,000 ft. has already been driven and it is hoped to continue this work so that the drive should reach its objective towards the end of 1947. It is too early yet to attempt to assess the possibilities of this work.

The report and accounts were adopted.

NARAGUTA EXTENDED AREAS, LTD.

Directors : H. T. Skipp (*Chairman*), E. A. P. Levett Scrivener, H. Ogle. *Secretary :* G. C. Wilkerson. *Office :* 65, London Wall, London, E.C. 2. *Formed* 1929. *Capital issued :* £103,655 in 2s. shares.

Business : Operates alluvial tin areas in Northern Nigeria.

The seventeenth ordinary general meeting of Naraguta Extended Areas, Ltd., was held on November 28 at Winchester House, E.C., Mr. H. T. Skipp presiding.

The chairman, in the course of his statement (circulated with the report for the year ended December 31 last) stated : Production for 1945 amounted to 123 tons, the reduced output being due to low recovery values and disruption by floods. Of the year's production, 88 tons were recovered from ground outside the sections to which the estimate of proved reserves apply and 35 tons from the latter.

The profit for the year amounted to £8,384 and the directors recommended the payment of a final dividend of 3%, less tax, making a total for the year of 6% and they had also declared an interim dividend of 2%, less tax, for 1946.

The new arrangements made with the Ministry of Supply which applied to the year 1946 provided for fixed prices per ton metal of respectively £340 for the period January–June and £357 10s. for the period July–December. Production for the period January–October of the current year had again been adversely affected by low recovery values and flood damage and also by delayed delivery of urgently needed plant and amounted to 97 tons.

With regard to the future, the proved reserves at December 31, 1945, were estimated at 191 tons, against 243 tons at December 31, 1944, and it is therefore apparent, as pointed out in my last review, that the course of future production and, consequently, of future revenue, depends primarily upon the extent that additional payable reserves are proved. In the latter connexion the prospecting programme mentioned in my last review has since been initiated and will be carried out as expeditiously as circumstances permit, though, in view of the extent of ground to be dealt with, these operations are likely to extend over a fairly considerable period.

The report and accounts were adopted.

NEW MODDERFONTEIN GOLD MINING CO., LTD.

Directors : G. V. R. Richdale (*Chairman*), W. M. Frames, Major C. S. Goldman, G. Carleton Jones, John Martin. *Consulting Engineers :* Central Mining and Investment Corporation, Ltd. *Manager :* G. H. Duggan *Head Office :* Johannesburg. *Secretaries :* Rand Mines, Ltd. *London Office :* 4, London Wall Buildings, E.C. 2. *Secretaries :* A. Moir and Co. *Formed* 1888. *Capital :* £1,400,000 in 10s. shares.

Business : Operating gold-mining properties on the Far East Rand.

The forty-ninth ordinary general meeting of the New Modderfontein Gold Mining Co., Ltd., was held in Johannesburg on November 15, Mr. John Martin presiding.

In moving the adoption of the report and accounts, the chairman said ore milled had totalled 1,219,000 tons, a decrease of 607,000 tons compared with the previous year's figure. At 2·566 dwt. per ton milled, the yield had shown an improvement of 0·38 dwt. and, as a consequence of that and of the increased price received for gold, revenue per ton milled had risen by 3s. 6d. to 22s. 2d. Working costs had been 3s. 1d. per ton milled higher at 21s. and as a result of those variations the working profit had increased by £4,159 to £72,566. Shareholders would have noticed that this figure includes £43,063 resulting from a special declaration of 5,000 oz. of gold derived from clean-up operations, largely at the North Mill. Provision for taxation had amounted to £11,482 while there had been a transfer to the contingency reserve of £25,300.

As shareholders were aware no dividend distribution had been made during the year under review. At the close of the meeting, however, an extraordinary general meeting of the company would be held to consider a special resolution authorizing the return to shareholders of 1s. per share in cash, thus reducing the capital of the company to £1,260,000 divided into 2,800,000 shares of 9s. each. Mr. Martin said that the distribution, if approved, would involve the payment to shareholders of £140,000. It would be necessary to obtain an Order of the Court to implement the special resolution but everything possible would be done to expedite the cash payment. He might add that in the hands of shareholders, returns of capital were not subject to taxation, either in South Africa or in the United Kingdom.

Reduced Tonnage

At the annual meeting last year shareholders had been informed that it was the intention of the board gradually to reduce the tonnage of ore sent to the North Mill so that by the end of 1945 all operations at that plant would have ceased. That programme had been duly carried out and since January last all ore had been sent to the South Mill, which had a maximum capacity of about 95,000 tons a month. As a result of that reduction in tonnage it had been possible to introduce more selective mining methods and to increase the average grade of ore milled. Working costs, however, had also risen sharply and the profit had been consequently 1s. 2d. per ton milled.

Possible Early Closing Down

The possibility of raising the average gold yield any more was doubtful and shareholders would therefore realize that even a relative small further increase in working costs might render mining operations unprofitable. In those circumstances the position was clearly precarious and while they could not estimate with any accuracy the life remaining to the mine it was evident that it might become necessary in the near future to bring operations to a close.

Development undertaken during the year had amounted to 18,686 ft., a decrease of 3,584 ft. compared with the previous year's figure. Ore developed had totalled 156,300 tons of an average value of 3·0 dwt., which was 25,800 tons more than had been developed during the previous year, the value being 0·1 dwt. higher. The ore reserve had been re-estimated at June 30, 1946, to be 773,200 tons of an average value of 3·2 dwt. over a stoping width of 44 in. Compared with the previous year's figure the reserve had shown a decrease of 601,800 tons, the average value being 0·2 dwt. higher, while the stoping width had been 1·4 in. less.

Taxation

In the terms of the agreement between the Bank of England and the South African Reserve Bank the price of gold had been increased by 3d. to 172s. 6d. per fine oz. as from January 1, 1946. As the announcement of that change had not been made until July the small effect of the increase was not reflected in the accounts under review. As from the same date the Government had introduced certain changes in gold-mining taxation. The basic tax of 15% and the special contribution of 22½% had been removed and in their place a material upward adjustment had been made in the formula tax, which was based on the ratio of profit to recovery.

The resolution was adopted.

At the conclusion of the annual meeting an extraordinary general meeting was held, reducing the capital of the company from £1,400,000 divided into 2,800,000 shares of 10s. each to £1,260,000 divided into 2,800,000 shares of 9s. each.

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GOLD AND BASE METAL MINES OF NIGERIA, LTD.

Directors : O. V. G. Hoare (*Chairman*), Sir Joseph Ball, G. F. Hamilton, R. F. Wilkins, Major E. Seaborn Marks. *Joint Secretaries :* G. Houghton Brown and C. J. Hunt. *Offices :* Finsbury Pavement House, 120, Moorgate, London, E.C. 2. *Formed* 1934. *Capital issued :* £300,000 in 2s. 6d. shares.

Business : Owns mining properties in Nigeria.

The twelfth ordinary general meeting of Gold and Base Metal Mines of Nigeria, Ltd., was held on November 15 at River Plate House, London, E.C., Mr. O. V. G. Hoare presiding.

The chairman, in moving the adoption of the report and accounts for 1945, said : Although our year closed on December 31, 1945, we have considered it wise to incorporate in these accounts the capital reorganization scheme approved by special resolution in June and sanctioned by the High Court in July last.

Turning to the profit and loss account, the chief items that differ considerably from last year are, first of all, on the one side the total of the net sales of tin which was down by nearly £23,000 owing to the smaller output, while on the other side the general expenses of tin winning and administration, although reduced, have not fallen equally but only by £16,000. The final result is a balance of profit for the year of £34,600, against £40,400 last year. This sum, as you will see from the figures before you, when added to the balance brought in is sufficient to make provision for taxation of £19,000, pay a 5% dividend and the directors' additional remuneration, if this dividend is passed by our meeting to-day, and leaves us with £45,500 to carry forward, against £41,000 brought in.

Our cash position since the date of these accounts has been further strengthened by the sale of our interest in the Sierra Leone Gold Dredging Venture for a cash payment and a further annual payment for a period of years.

Since the closing of the contract on the " cost plus " basis with the Ministry, we have taken steps to close down any part of our tin operations which were unlikely to show a profit, so that we may be left only with workings on an economically sound basis. To some extent as a result of this, we must look forward to a still falling output, but we hope now that this will be compensated to some extent by falling costs.

As far as we can judge, this will be in the neighbourhood of 700 tons a year for the next year or two, apart from unforeseen events and provided the price of tin remains remunerative. When fresh plant is installed, and this should be within two years, it should result in lower costs and certainly prevent a further fall in output.

We have applied for a concession in Ogoja Province around our Ameeka mining leases for lead and silver. This property to-day, owing to the price of lead and silver, looks very different from what it did in years gone by.

The resolution was adopted.

UNITED TIN AREAS OF NIGERIA, LTD.

Directors : A. Hedley Williams (*Chairman*), Major E. Seaborn Marks, C. W. Parish. *Secretary :* C. J. Hunt. *Office :* Finsbury Pavement House, London, E.C. 2. *Formed* 1925. *Capital issued :* £118,743 15s. in 2s. 6d. stock units.

Business : Operates alluvial tin areas in Northern Nigeria.

The ordinary general meeting of United Tin Areas of Nigeria, Ltd., was held on November 15 at Finsbury Pavement House, E.C., Mr. A. Hedley Williams presiding.

The following are extracts from the chairman's review circulated with the report and accounts for the year ended June 30, 1945 :—

Dealing with the year's operations, it will be noticed that the proceeds from the sale of tin amounted to £62,075, as compared with £55,753, an increase of £6,322, while Nigerian Expenditure has increased by £2,634. The factors responsible for this are increased Labour and Transport charges. However, the net profit for the year at £15,840 shows an increase of £4,132. After providing £7,500 for taxation, as compared with £4,700 in the previous accounts, and bringing into account the balance of £9,512 from the previous year, there remains a balance of £17,851 to be carried forward.

Since the date of these accounts, there has been an issue of 250,050 shares by way of rights to existing shareholders at the price of 3s. 6d. per share which was fully subscribed and provided £43,758. The issued capital is now, therefore, £150,000. Members will recall that the new issue was made to enable the company to participate in prospecting and, if justified, developing with Gold and Base Metal Mines of Nigeria, Ltd., and Ribon Valley (Nigeria) Tinfields, Ltd., extensive mineral areas covering some 1,500 sq. miles in districts Sokoto, Kabba, and Ilesha in the Colony of Nigeria.

Up to December, 1945, your company was working on a cost *plus* profit basis, but since the new issue of capital it has been announced that the price of tin as from January 1, 1946, to June 30, 1946, will be £340 per ton, F.A.S. Nigeria, and from July 1 to December 31, 1946, £357 10s. per ton.

Now that these prices have been fixed, the directors feel that the shareholders should receive an immediate return in respect of both the period covered by the accompanying accounts, and also the year to June 30, 1946, and they therefore propose to declare an interim dividend of 6% free of tax on the whole of the issued capital—namely, £150,000.

Shareholders will recollect that in December, 1944, a Special Resolution was passed converting the company's issued and fully paid shares into stock. The board consider it desirable that the recently issued 250,050 shares of the company, which are now fully paid, shall be similarly converted into stock, transferable in amounts and multiples of 2s. 6d.

KAMUNTING TIN DREDGING, LTD.

Directors : Ernest V. Pearce (*Chairman*), Jack Addinsell, J. R. Farquharson. *Secretaries :* Anglo-Oriental and General Investment Trust, Ltd. *Office :* 55–61, Moorgate, London, E.C. 2. *Formed* 1913. *Capital issued :* £668,750 in 5s. shares.

Business : Owns tin-mining properties in Malaya and Siam.

The thirty-third ordinary general meeting of Kamunting Tin Dredging, Ltd., was held on November 12 at 55–61, Moorgate, London, E.C., Mr. Ernest V. Pearce presiding.

The following is an extract from his statement circulated with the report and accounts :—

Shareholders will note that the report and accounts now presented cover the period July 1, 1945, to March 31, 1946. With regard to the position in Malaya, of the company's four dredges two have been brought into operation ; No. 6, which is our large machine, restarted in April of this year and No. 1, a small machine, in the following month. From these dates both dredges were in full operation until July 3, when there was a strike by the workers for increased wages.

As wages have been standardized throughout the industry in agreement with the local Government there could have been no question of particular hardship. With the exception of the skilled men in the workshop most of the workers had returned by the middle of the month. Due to the strike the No. 1 dredge was closed down and such labour as was available was concentrated on the No. 6 dredge.

Two Dredges Started

Repairs are being carried out as rapidly as possible to our other two dredges, Nos. 4 and 5, but the strike in the workshop has naturally hindered these as well as repairs in the power house. Of the four engines comprising the power plant two are operating, while repairs to the remaining two have still to be completed. Owing to difficulties in procuring spare parts and stores rehabilitation is proving a longer job than had been anticipated. In spite of this our two dredges, Nos. 1 and 6, were among the first in Malaya to restart and our special thanks are due to our managers and engineers in the East for the energy and ingenuity they have displayed under most difficult conditions.

Speaking generally, labour in Malaya, both during the Japanese occupation and since, has been disorganized and underfed. Rice and textiles have been in exceedingly short supply in Malaya since our reoccupation of the country, but as this position improves progress in rehabilitation will doubtless become more rapid. There have been, and still are, delays due to difficulties regarding transport, but here also the position is gradually improving.

Siam

Turning now to Siam, a Government mission was sent to that country to look at the mines and furnish a report. This report was duly received and tentative estimates made of the cost of rehabilitating the dredges there. The damage would not appear to be as great as was experienced in Malaya, but it has not yet been possible to send our representatives to take up their residence on the mines and make out a full inventory of losses and damage. A Siamese Tin Committee has been operating in London and has kept in close touch with the Foreign Office ; it is only lately that companies have been told that they may send their representatives to occupy the mines, as previously the position had not been clear with the Siamese Government as to compensation. It has now been agreed, however, that the return of the staff will not in any way imply any obligations nor prejudice their claims to compensation. Permits have, therefore, been applied for and it is hoped that our staff will be back on the mines in the very near future.

As you are aware the life ahead of our two dredges at Pangnga is only a short one. The Japanese mined this area from which it would appear that they recovered some 600 tons of concentrates and there now remain some 2,300 tons recoverable which will give the dredges a life of approximately two years.

Suggested Tin Study Group

At a World Tin Conference held in London last month, attended by representatives of all the principal tin-producing and consuming countries, it was decided to recommend to the various Governments concerned the formation of a Tin Study Group to be set up on the lines of the Rubber Study Group, which has been in existence for two years.

While under the Tin Control Scheme the power existed to vary production quotas rapidly and drastically, the Study Group will have no such power. Production is likely to exceed consumption within the next three or four years, perhaps sooner, and it is essential, in my opinion, that as soon as the proposed Study Group is formed consideration should be given as to the action which is to be taken to prevent surplus tin being thrown on to an unwilling market and depressing the price below the economic cost of production.

I feel quite sure that the vast majority of the world's producers would have preferred to maintain in being the Tin Control Scheme modified in such a manner as to give consumers adequate representation.

The report was adopted.

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EX-LANDS NIGERIA, LTD.

Directors : Sir Joseph Ball (*Chairman*), S. Fortescue, O. V. G. Hoare, Major E. Seaborn Marks, H. G. Latilla (*Managing*). *Joint Secretaries :* J. W. Price and W. L. Taylor. *Office :* Finsbury Pavement House, Moorgate, London, E.C. 2. *Formed* 1912. *Capital :* £200,000 in 2s. stock units.

Business : Operates alluvial tin properties in Northern Nigeria.

The thirty-fourth ordinary general meeting of Ex-Lands Nigeria, Ltd., was held on December 12, at River Plate House, E.C.

The following are extracts from the chairman's review of operations for the year ended December 31, 1945, which was circulated with the report and accounts :—

Mining operations during the year under review yielded a profit of £46,604, which enabled the directors to declare two dividends each of 10%, less tax, making 20%, less tax, for the year ended December 31, 1945, the same as for the preceding year. After making provision for taxation £22,000, for directors' additional remuneration £1,000, and taking into account the balance of £2,313 brought forward from the previous year, there remained a credit balance of £1,251 to be carried forward to the following year.

The year's output was 721 tons of tin concentrates, averaging approximately 73% metal, a decrease of 79 tons on the figures for the preceding year. After taking into account the 721 tons of tin concentrates produced, the proved ore reserves at December 31, 1945, stood at 4,240 tons, an increase of 68 tons on last year's figures. This tonnage was contained in 10,052,500 cu. yd., averaging 0·95 lb. per cu. yd.

In my review of operations during the preceding year, I stated that we had recently acquired an option over what our manager considered to be a promising new property. I have now to report that although prospecting work on the area under this option was at first distinctly encouraging the ultimate results were not sufficiently promising to justify the heavy expenditure on underground work which would have been necessary, and the option has accordingly been abandoned.

Up to December 31, 1945, this company was under contract to sell the whole of its product to the Ministry of Supply on a cost-plus basis, the "plus" being an agreed figure of profit per ton based on the operating figures for the year ended August 31, 1939. This contract was determined by H.M. Government as from December 31, 1945, and after protracted negotiations, the Ministry agreed to continue to purchase tin from Nigerian producers at the price of £340 per ton metal for the first six months of 1946, and at £357 10s. for the second six months of that year.

Since the close of the year under review, a concrete dam on the Gnar River and a Leat to the deep Yelwa deposits have both been completed. This should result in a lowering of working costs in the areas affected. In addition, a certain amount of drilling has been carried out on the Tenti Areas, with results which are distinctly encouraging.

The report and accounts were adopted.

SOUTHERN TRONOH TIN DREDGING, LTD.

Directors : J. H. Rich (*Chairman*), H. A. Hope, E. V. Pearce, Harry Rich, G. W. Simms. *Acting Secretary :* H. E. Barrenger. *Office :* 73, Cheapside, London, E.C. 2. *Formed* 1927. *Capital :* £200,000 in 5s. shares.

Business : Owns tin-mining properties in Perak, F.M.S.

The nineteenth annual general meeting of Southern Tronoh Tin Dredging, Ltd., was held on November 12 at the office, 73, Cheapside, London, E.C., Mr. J. H. Rich presiding.

The following is an extract from the statement of the chairman, which was circulated with the report and accounts for 1945 :—

A summary of the report by the Tin Inspection Committee on our property was circulated to shareholders on December 20 and showed that both our dredges were classified under Category A while the buildings, with the exception of the European quarters which were non-existent, were in fair order. On subsequent examination it was found that No. 1 dredge had sustained less damage than No. 2 dredge and work was accordingly concentrated on reconditioning this dredge and where necessary using suitable parts off No. 2 dredge.

No. 1 dredge eventually started up on October 1, working 12 hours a day, the fuel position being the restricting factor. After running smoothly for nine days a strike occurred among the engine drivers who demanded an excessive wage increase to enable purchases of rice to be made in the black market. These men are paid the officially recognized rate and the action taken in not acceding to their demands has the approval of the Government Labour Department which is inquiring into the position.

The cost of the work of rehabilitation has hitherto come out of the company's own resources but it is confidently anticipated that it will shortly be reimbursed out of the Government advance which was made available to those mining companies which carried out Government approved reconstruction work on their properties. The sum so obtained will be set off against war damage compensation when settled and the balance only will be treated as a loan.

As to the future, notwithstanding the recent considerable increase in the tin price from £300 to £370 per ton it will be of no appreciable immediate benefit owing to the work of rehabilitation being only partially completed. The ultimate effect of the enhanced price can only be assessed when more stable conditions prevail than at present and until that time arrives it is as well to suspend judgment

The report and accounts were adopted.

FRONTINO GOLD MINES, LTD.

Directors : Sir Hugh O'Neill (*Chairman*), Brig.-Gen. R. C. A. McCalmont, Lord Remnant, Major the Hon. Thos. Cochrane. *Superintendent :* G. A. Syme. *Secretary :* A. E. Gilbert. *Office :* 40, Gresham House, 24, Old Broad Street, London, E.C. 2. *Formed* 1911. *Capital :* £243,963.

Business : Operates gold-mining properties in the Province of Antioquia, Colombia.

The annual general meeting of Frontino Gold Mines, Ltd., was held on November 26 in London, Sir Hugh O'Neill presiding.

The chairman, in moving the adoption of the report and accounts for 1945, said : The balance of profit carried to the appropriation account amounts to £9,457. To this has been added £48,295 brought forward from last year, £10,281 refunded by the Colombian Income Tax authorities, and £22,388 from the receiver of San Nicolas Gold Mines, Ltd., in respect of our holding of debenture stock previously written off. This makes a balance of undistributed profit of £90,421. We have already paid a dividend for the year on both preference shares and ordinary stock of 6% free of tax.

The reasons for the smaller profit for the year were a reduction of over half a dwt. per ton in the grade of the ore milled, to the ever increasing costs of supplies and labour, and to the legal obligations for social services imposed by Colombian law. On the other hand the gold sale price has remained unchanged.

The production for the year amounted to 97,320 tons, compared with 99,460 tons in 1944. The ore reserves in all the mines at December 31, 1945, amounted to 456,600 tons of an average value of 12·26 dwt.

Generally speaking, we are very well satisfied with the way in which the new mines are opening up, but it must be emphasized that apart from Tres y Media they are still in a very early stage of development.

As far as can be predicted at the present time, the results for 1946 will be disappointing and it looks as though there will be little, if any, profit for the year. An interim dividend of 2¾% tax free has recently been declared on the preference shares and 2% tax free on the ordinary stock.

In view of the continuance of restrictions on capital issues imposed by the Treasury and the fact that we are already incurring capital expenditure in opening up the new mines, which cannot in these days of rising costs be borne out of revenue, the board have decided to make an issue of capital at an earlier date than was contemplated at the last meeting. It is therefore proposed to submit to-day a special resolution to increase the authorized capital of the company by £109,427 so that the new shares can be issued when a favourable opportunity occurs.

The resolution was adopted and the increase in the capital approved.

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DECLARATION OF DIVIDEND.

NOTICE IS HEREBY GIVEN that a dividend (No. 1) has been declared of 20 per cent, equal to 6d. per share, payable to shareholders registered in the books of the Company at the close of business on 31st December, 1946.

The dividend is declared in the currency of the Union of South Africa and becomes due on 1st January, 1947. Warrants in payment will be posted from both the Head and London Offices on or about 13th February, 1947.

The dividend will be paid as follows :—

(*a*) from the Head Office, Johannesburg, to :—

(1) Shareholders with registered addresses at 31st December, 1946, in Africa, south of the Equator, other than those who may have given notice under (*b*) 2 below.

(2) Shareholders with registered addresses elsewhere who by written notice received by the Company on or before 31st December, 1946, request that payment be made to an address in Africa, south of the Equator.

(*b*) from the London Office, to :—

(1) Shareholders with registered addresses at 31st December, 1946, elsewhere than in Africa, south of the Equator, other than those who may have given notice under (*a*) (2) above.

(2) Shareholders with registered addresses in Africa, south of the Equator, who by written notice received by the Company on or before 31st December, 1946, request that payment be made to an address elsewhere.

Notwithstanding the provisions of the preceding paragraph the dividend accruing to registered shareholders whose shares are vested in the Custodian of Enemy Property, in terms of the Union of South Africa National Emergency Regulations, will be paid to the Custodian or dealt with in accordance with his instructions from the Head Office, Johannesburg.

The dividend payable from the London Office will be paid in British currency at par provided there is no difference that may be regarded by the Board as material between South African and British currencies on 2nd January, 1947. Should there be any such material difference between the two currencies the London Office will pay on the basis of the equivalent British currency calculated at the rate of exchange ruling on that date.

Warrants despatched from the London Office to persons resident in Great Britain or Northern Ireland will be subject to a deduction of United Kingdom Income Tax at a rate to be arrived at after allowing for relief (if any) in respect of Dominion Taxes.

The Transfer Books and Register of Members will be closed from 1st January, to 7th January, 1947, both days inclusive.

In terms of the Union of South Africa Income Tax Act, 1941, as amended, a Non-resident Shareholders' Tax of 7½ per cent is imposed on dividends payable to (*a*) persons, other than companies, not ordinarily resident nor carrying on business in the Union, (*b*) Companies not registered nor carrying on business in the Union. The Company will accordingly deduct the tax from the dividend payable to shareholders whose addresses in the Share Register are outside the Union.

BY ORDER OF THE BOARD,
G. H. WARD,
London Secretary.

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NOTICE IS HEREBY GIVEN THAT A DIVIDEND of 2s. 6d. per share (12½% actual), less tax at the rate of 9s. in the £, for the year ended 30th June, 1946, has this day been DECLARED by the Company in General Meeting on the Ordinary Shares of the Company PAYABLE to all Shareholders registered on the 14th November, 1946, and to Holders of Coupon No. 60 attached to Share Warrants to Bearer. The Dividend Warrants will be posted on the 16th December, 1946.

NOTICE IS ALSO HEREBY GIVEN to Holders of Share Warrants to Bearer of the above-mentioned Ordinary Shares that Coupon No. 60 will be paid in London at the Midland Bank Limited, Poultry and Princes Street, E.C. 2, and in Paris at Lloyds and National Provincial Foreign Bank, Limited, 43, Boulevard des Capucines, on and after 17th December, 1946.

Coupons must be left at either of the above addresses to permit of eight clear days for examination.

By Order,
R. CARR-TAYLOR,
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NOTICE IS HEREBY GIVEN that dividends have been declared payable to shareholders registered in the books of the undermentioned Companies at the close of business on 31st December, 1946, and to persons presenting the respective Coupons, detailed below, detached from Share Warrants.

The dividends are declared in the currency of the Union of South Africa and become due on 1st January, 1947. Warrants in payment will be posted from both the Head and London Offices on or about 13th February, 1947.

The dividends will be paid as follows :—

(*a*) From the Head Office, Johannesburg, to :—

1. Shareholders with registered addresses at 31st December, 1946, in Africa, south of the Equator, other than those who may have given notice under (*b*) 2 below.

2. Shareholders with registered addresses elsewhere who by written notice received by the Companies concerned on or before 31st December, 1946, request that payment be made to an address in Africa, south of the Equator.

(*b*) From the London Office to :—

1. Shareholders with registered addresses at 31st December, 1946, elsewhere than in Africa, south of the Equator, other than those who may have given notice under (*a*) 2 above.

2. Shareholders with registered addresses in Africa, south of the Equator, who by written notice received by the Companies concerned on or before 31st December, 1946, request that payment be made to an address elsewhere.

Notwithstanding the provisions of the preceding paragraph dividends accruing to registered shareholders whose shares are vested in the Custodian of Enemy Property, in terms of the Union of South Africa National Emergency Regulations, will be paid to the Custodian or dealt with in accordance with his instructions from the Head Office, Johannesburg.

Dividends payable from the London Office will be paid in British currency at par provided there is no difference that may be regarded by the Boards as material between South African and British currencies on 2nd January, 1947. Should there be any such material difference between the two currencies the London Office will pay on the basis of the equivalent British Currency calculated at the rate of exchange ruling on that date. Amounts payable to persons presenting Coupons will be on the same basis irrespective of the date of presentation of the Coupons.

Warrants dispatched from the London Office to persons resident in Great Britain or Northern Ireland will be subject to a deduction of United Kingdom Income Tax at rates to be arrived at after allowing for relief (if any) in respect of Dominion Taxes.

The Transfer Books and Register of Members will be closed in each case from 1st to 7th January, 1947, both days inclusive.

The dividends on the shares included in Share Warrants will be payable on or after 14th February, 1947, to the persons presenting the relative Coupons at :—

The Standard Bank of South Africa, Limited, 63, London Wall, London, E.C. 2.

or

Lloyds and National Provincial Foreign Bank, Limited, 43, Boulevard des Capucines, Paris.

Coupons must be deposited at least FOUR CLEAR DAYS before being paid, and, unless accompanied by Inland Revenue Declarations, they will be subject to a deduction of United Kingdom Income Tax as above.

In terms of the Union of South Africa Income Tax Act, 1941, as amended, a Non-resident Shareholders' Tax of 7½% is imposed on dividends payable to (*a*) persons, other than companies, not ordinarily resident nor carrying on business in the Union, (*b*) Companies not registered nor carrying on business in the Union, (*c*) Holders of Bearer Shares irrespective of whether they are resident within or outside the Union. The Companies will accordingly deduct the tax from dividends payable to shareholders whose addresses in the Share Registers are outside the Union and from all Share Warrant Coupons presented for encashment.

Name of Company (each incorporated in the Union of South Africa)	Dividend No.	Coupon No.	Rate of Dividend	
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By Order of the Board,

G. H. WARD,
London Secretary.

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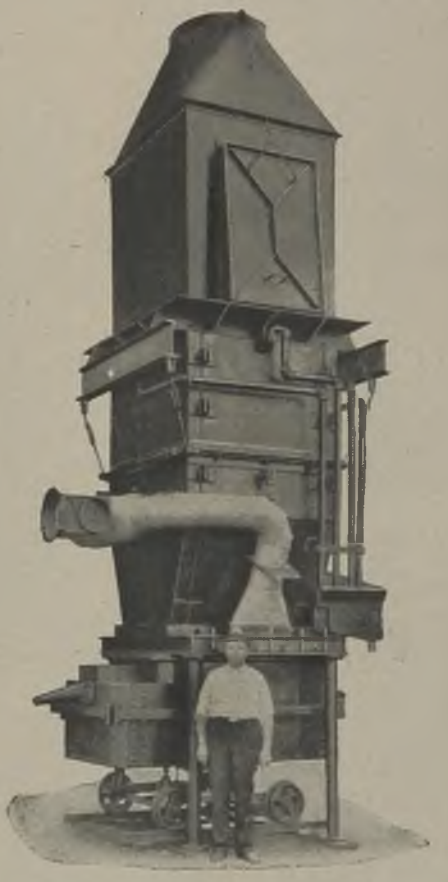

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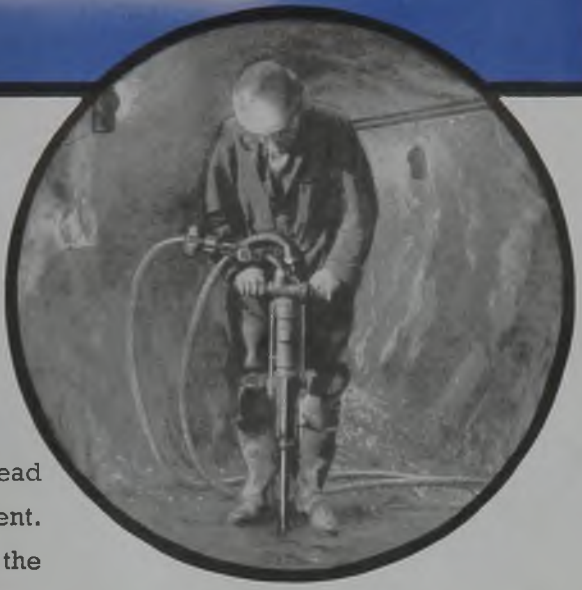

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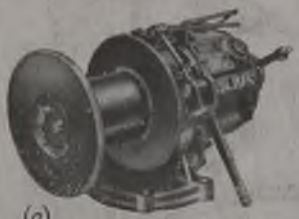

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