

The Mining Magazine

Managing Director and Editor: W. F. WHITE. Assistants: ST. J. R. C. SHEPHERD, A.R.S.M., D.I.C., F.G.S.; F. HIGHAM, A.R.S.M., M.Sc., F.G.S.

PUBLISHED on the 15th of each month by MINING PUBLICATIONS, LIMITED,

AT SALISBURY HOUSE, LONDON, E.C. 2.

Telephone: Metropolitan 8938. Telegraphic Address: *Oligoclase*. Codes: *McNeill*, both Editions, & *Bentley*.
 BRANCH OFFICES { New York: Amer. Inst. M. & M.E. SUBSCRIPTION { 12s. per annum, including postage.
 { Chicago: 360, N. Michigan Blvd. { U.S.A., \$3 per annum, including postage.

Vol. XLII. No. 5.

LONDON, MAY, 1930.

PRICE
ONE SHILLING

CONTENTS

	PAGE		PAGE
EDITORIAL		Brisbane	292
Notes	262	Queensland Mining Industry; The Coal Stoppage; Mount Isa Mines; The Mining Trust at Lawn Hills; Oil Prospecting; Geophysics in Tasmania; Minerals in Central Australia; Gold Mining in Western Australia; Effect of Low Metal Prices.	
Flotation Reagents; Tin Producers' Association; The Future for Pyrites; Honorary Degrees of Witwatersrand University; A New Refrigerant; Air Transport to Bulolo Goldfield; Camborne Holiday Course; Quarrying and the Countryside.		Ipoh	295
The Position of Metals	262	F.M.S. Mining; Costs; Mining Plant.	
Causes of present low prices for metals examined, together with the outlook.		Vancouver	296
Mining Methods	264	Britannia Beach; Portland Canal; Consolidated Mining and Smelting Report; Boundary.	
At the April meeting of the Institution two papers on Mining Methods were presented and are here outlined, together with the scope of a recent book on the subject.		Toronto	299
The Education of the Engineer	265	Sudbury District; Porcupine; Kirkland Lake; Rouyn; Patricia District; Manitoba; Chibougamou District, Que.; Canadian Institute's Annual Convention.	
A subject discussed last month is further considered.		Camborne	302
REVIEW OF MINING	266	South Crofty; East Pool and Agar; Geevor; Cornish Tin Output; Mining Leases; Prospecting.	
ARTICLES		PERSONAL	303
Mineralized Zones in East Africa <i>Stanley C. Bullock</i>	269	TRADE PARAGRAPHS	304
The author describes conditions relating to mining and prospecting in East Africa, together with the methods of transport, accessibility of different regions, and suggestions as to outfit.		A New Pressure Gauge for Mines	306
The Third (Triennial) Empire Mining and Metallurgical Congress	277	METAL MARKETS	307
From Cape Town to Johannesburg.		STATISTICS OF PRODUCTION	309
Aerial Ropeways <i>Harrison Roe</i>	281	PRICES OF CHEMICALS	311
The author gives an account of some recent developments in mechanical transporting practice.		SHARE QUOTATIONS	312
BOOK REVIEWS		MINING DIGEST	
Hayward's "An Outline of Metallurgical Practice"	287	The Valuation of Ore Reserves <i>Prof. S. J. Truscott</i>	313
<i>E. O. Courtman</i>		Metallurgical Practice at t'e Leeuwpooort Tin Mine <i>W. J. Gau and J. I. Jameson</i>	318
Ries' "Economic Geology" <i>Dr. C. G. Cullis</i>	287	Electrolytic Cadmium at Great Falls <i>W. F. Mitchell</i>	323
Smart's "The Economics of the Coal Industry"	288	The Hayden Plant of Nevada Consolidated <i>W. I. Garms</i>	325
<i>K. Neville Moss</i>		Flotation of Oxidized Silver Ores	325
Gmelin's "Handbuch der Anorganischen Chemie: Eisen"	289	Treatment of Manganese Ore by Volatilization	325
<i>Dr. M. S. Fisher</i>		SHORT NOTICES	326
LETTERS TO THE EDITOR		RECENT PATENTS PUBLISHED	326
The Education of the Engineer <i>John A. Agnew</i>	289	NEW BOOKS, PAMPHLETS, ETC.	327
Another Change <i>H. C. Bayldon</i>	290	COMPANY REPORTS	327
NEWS LETTERS		Champion Reef Gold Mines of India; City Deep; Kagera (Uganda) Tinfields; Malaya Consolidated Tin Dredging Mysore Gold Mining; Rezende Mines; St. John del Rey South Crofty; Sungei Kinta Tin Dredging.	
Johannesburg	290	DIVIDENDS DECLARED	328
Transvaal Platinum Metallurgy; Rand's Low-grade Ore Problem; Geological Survey; Recovering Gold from Dumps; Radio-active Ores; Rhodesian Vanadium.		NEW COMPANIES REGISTERED	328

EDITORIAL

COMMENCING with this issue we include in our prices of chemicals, in the statistical section of the *MAGAZINE*, quotations for certain commonly required flotation reagents not hitherto mentioned, notably cresylic acid, pine oil, and some xanthates.

AT the meeting of the Tin Producers' Association held last month the new scheme, by which members of the Association will restrict their production for 1930 to 80% of that for 1929, was approved. The necessity for loyal co-operation among producers was emphasized.

SOME unpleasant truths for pyrites producers were reiterated by Sir Auckland Geddes at the Rio Tinto Company's meeting last month. An increasing amount of by-product sulphur is being made commercially available in the form of brimstone, which is likely to lower the price of the latter commodity to such an extent as to render the production of sulphur from pyrites unremunerative.

DURING the Johannesburg session of the Empire Mining Congress the honorary degree of Doctor of Science in the University of Witwatersrand was conferred on Mr. P. M. Anderson, president of the Transvaal Chamber of Mines, on Dr. S. W. Smith, chief assayer to the Royal Mint, on Professor S. J. Truscott, of the Royal School of Mines, and on Mr. H. A. White, consulting metallurgist to the Union Corporation group.

A NEW refrigerant has been discovered in America which because of its properties promises to have an important application in the cooling of mine air, if it survives the tests now being conducted by the United States Bureau of Mines. The material is fluoro-chloro-methane (CF_2Cl_2) and is a highly volatile yet non-inflammable and non-toxic liquid suitable for use in refrigerating machines in place of ammonia or sulphur dioxide.

A FURTHER extension of the use of aircraft to aid the mining engineer is revealed by the intention of the Bulolo Gold Dredging Company to transport their plant by this means from the coast of New Guinea to the property, situated about 30 miles inland. The area is a gold placer,

and the dredges to be employed are being sectionalized so that no part weighs more than $3\frac{1}{2}$ tons. Two specially built all-metal monoplanes are to be used. It is stated that production will be commenced 18 months sooner than if operations were contingent on the construction of a road, which for topographic reasons would have to follow a circuitous route.

THE Holiday Course in Economic Geology, which has been held at the Camborne School of Mines by Mr. E. H. Davison since 1919, has been arranged for the six weeks from July 7 to August 15. This course has proved acceptable to many students from the universities and colleges of this country and abroad and to engineers and geologists home on leave, and is recognized by the Board of Education. Work will occupy five days a week—two days in the laboratory and lecture room and three days' field work, including geological excursions, visits to mines, and field mapping. Applications to join the course should be made to the Secretary, School of Metalliferous Mining, Camborne.

THE formation of a company to quarry the Whin Sill in the neighbourhood of Shields-on-the-Wall, Pell Crag, and Housesteads has raised an outcry in the Press on the old score of damage to the beauty of the countryside. In the *MAGAZINE* for November last comment was made on similar opposition which arose against wholesale quarrying in the Malverns. In addition to what we then stated, it should be remembered that all stone is not equally good for road work, a basic rock, such as that of the Whin Sill, being by far the most suitable, whilst the ugly equipment present during actual quarrying is not of a permanent nature, and, provided that the Roman Wall is well guarded, the ravages created by man's needs will soon be removed.

The Position of Metals

The drop in metal prices during recent months has been so severe and so widespread that an explanation which is common to all of them is naturally sought. Primarily, the cause has been overproduction, but overproduction is itself an effect as much as a cause, and the real reasons would appear to lie deeper and farther back. Temporary

factors, such as the collapse of the Stock markets in America and, to a lesser extent, in London, have played their part, but it would seem that bigger and wider movements are mainly responsible. For instance, the shortfall of gold production has been working towards lower prices for a long time past, not only of metals, but of all commodities. The effects of this, however, would be gradual and could not entirely account for the collapse. Since the War science has been very busy on behalf of mines and smelters, discovering new and steadily improving old metallurgical processes and practices with a view to cheapening and expanding production, whilst a notable feature is the widespread mechanization of industry. Of late, however, co-incidentally with this movement towards reducing costs and enlarging output, has grown what may be termed a syndication complex. The theories of amalgamation, rationalization, and syndication may have much to commend them, but in practice the big trusts have misused their power, the almost universal result being attempts to maintain prices at unwarranted levels. Producers, indeed, wanted "to get it both ways"—a cheaper cost of production, which encouraged output, coupled with the maintenance of high selling values. High values of any metal invariably tend to restrict its industrial use, which fact applies to the post-war world equally with other generations. Blinkered by temporary advantages, producers have persisted too long in their delusion that prices can be pegged at almost any level, with the result that, instead of a gentle pressure, the pent-up forces of irresistible economic influences have had an almost catastrophic effect on commodity values. It is more than possible that, having been delayed, the decline has been overdone, but difficult times would appear to be ahead before conditions settle down with metals on a rational price basis.

To turn from the general to the particular, the case of copper can be cited as one where the cause of the recent precipitate decline undoubtedly was the fact that a syndicate of producers believed that it could achieve what it termed "stabilization" on a level of 18 cents per lb. in America. Output was to be restricted to meet the reduced rate of consumption (partly due to the high price), but the drop in the rate of absorption of the metal was greater than anticipated and during the twelve months in which they

maintained their 18 cent figure the stock of refined copper increased by no less than 200,000 tons, and now, despite the inevitable break in prices, still constitutes a serious financial burden and is likely to prove a severe hindrance in marketing new production for many months to come. Tin is suffering from the effects of the high prices prevalent a few years ago, which encouraged the exploitation of fresh areas and built up a productive capacity in excess of the world's needs, whilst subsequent efforts to maintain or raise the price merely delayed and aggravated the decline. The remarkable success of the flotation methods of treating zinc and lead ores has done much to reduce the production costs of these two metals, besides enabling much lower grade ores to be used. Both metals, but more particularly spelter, have suffered from attempts of associations of producers to uphold prices when economic conditions decreed a downward movement. Silver, being largely a by-product metal, has suffered from the sins committed in other metals, apart from having its own particular troubles in the tendency for silver currencies to be displaced by currencies on a gold basis.

Having dealt with the slump in values, the next consideration is the possibility of a recovery. If the dictum that high prices restrict consumption is correct, its reverse—low prices encourage consumption—also should hold good. Once prices give signs of having touched bottom there is undoubtedly a good deal of buying to be done, many orders having been delayed until what was felt to be the lowest level had been reached. With the bubble of share speculation pricked and cheap money available throughout the world, enterprise should be stimulated and consumption of metals generally encouraged. It will be as well to bear in mind, however, that low prices seem to have done surprisingly little to curtail production, and, although an increase in consumption from year to year should be forthcoming, it is probable that a point will be reached when the percentage increase diminishes rather than expands. It may, perhaps, be conceded that prices have fallen too low and that some recovery is probable, but with so many factors working towards lower commodity values it seems quite possible that post-war ideas of metal prices may have to be revised and a lower level accepted as that which is likely to prevail, during the next few years at any rate.

Mining Methods

Various methods of mining underground ore-bodies have, in virtue of three recent publications, rather come to the fore during the past month. In the first place there is Mr. C. A. Mitke's textbook¹ on this subject and both the papers presented at the April meeting of the Institution dealt with specific aspects of it. Mr. E. G. Lawford, in his "Notes on Some Unusual Stopping Problems in Mexico," writes of his experience in that part of the world, and Mr. E. G. Wilson, in his paper "Bottom-slicing Applied to Mining a Large Irregular Replacement Deposit in Limestone," describes practice on a hematite mine in Southern Spain. The second paper, in the author's absence, was presented by Professor B. W. Holman.

The unusual stopping problems discussed by Mr. Lawford were present on two Mexican mines—the Dos Carlos and El Bordo properties of the Cia. Santa Gertrudia S.A.—during the years 1924 to 1926. In the case of the former, the ore was being taken from a virgin vein, whilst in the latter the problem concerned the mining of blocks of old filling and caved ore. On the Dos Carlos the stopping of the ground above the top level was interesting in that cut-and-fill methods having been decided upon, and there being no level above at the time, it was necessary for the waste filling required to be broken from rises driven in the hanging-wall. In consequence of this procedure, other problems arose. The ground was heavy, but extensive excavations in the hanging-wall made it more so. In addition, as there was no level above, all material required had to be hauled from the level below. Finally, high temperatures and humidity, combined with low air velocities, resulted in mining conditions which did not conduce to high labour efficiency. During the discussion several speakers inquired why filling from the foot-wall had not been attempted, but the author showed the nature of the lode walls favoured the hanging-wall system. As for the actual method of mining adopted, it was pointed out that the development of the Dos Carlos vein had to be carried out at great speed, as the production called for a daily output of 1,000 tons within 18 months of the first discovery of the vein on the 16th level. The 14th level was accordingly driven and it was assumed that at the most the ore would extend only 25 metres above the back of

this level, although it was subsequently found that some stopes had to be carried up to well over 50 metres above that level. The early assumption, however, led to the conduct of all operations from a drive on the vein rather than from a counter-drive on the foot-wall. Ore was then won in 2.5 metre lifts and hanging-wall rises supplied waste-filling, which was never allowed to lag more than 2 or 3 metres behind the ore cut. The vein, striking E.-W. and dipping S. at 45° to 50°, varied in width from about 2 metres on the eastern and western sections, while in the centre it bellied out to over 16 metres. The actual stopping methods were accordingly adapted to local conditions, narrow, untimbered, cut-and-fill, flat-back stopes being used on the narrow portions, while square-set cut and back-fill breast stopes were used where the ground demanded it. On the El Bordo mine the problems concerned the mining of old caved material and/or filling left by former owners. The texture of the material was sandy, being sufficiently loose as sometimes to require breast boards and side-spiling as well as top-spiling. Occasionally large boulders of waste or solid ore were encountered. The dip of the block was about 80° to 85°, the wall being a fairly solid andesite. Where square-set spiling and back-fill breast stopping was used the general lay-out was much the same as on the wide stopes in the Dos Carlos mine. In other stopes, however, underhand square-set back-fill and breast stopping was used and in these stopes the block was attacked from a counter-drive in the foot-wall. An interesting development of this method of mining was credited to Mr. W. C. White, of the El Bordo mine, and was called filled-top-slice stopping. This was a modification of the top-slicing method which has been previously described and was considered to be well suited to the El Bordo problem. The mining methods outlined by the author were well adapted to conditions which rendered ordinary mining difficult, and the situation appears to have been met with considerable skill.

The bottom-slicing method described in Mr. Wilson's paper seems similar to that in use at the Athens mine in Michigan. The ore-body itself was about 600 ft. long by 250 ft. wide, extended vertically for about 250 ft., and was mined by taking horizontal slices, starting from the bottom and working upwards, the space left by each slice being filled before taking the succeeding one. The

¹ *Mining Methods*. By Charles A. Mitke. London and New York: McGraw-Hill. Price 15s.

filling material adopted was limestone waste from neighbouring opencast workings, which was eminently suitable for building packs and walls. In one place gravel was used as filling, and was found to be superior to limestone, being easier to handle. The procedure at the Alquife mines was well shown by the author and subsequent criticism of the paper was confined solely to details, perhaps principally to the wisdom of using articulated trucks.

The literature devoted to methods of mining is already extensive and it has been estimated that there are upwards of 150 methods of stoping. Mr. Mitke, in his recently published book, already referred to, has shown that most of these so-called specialized methods are merely variants of others already well-known and he has made a careful examination of modern mining practice in an endeavour to formulate a simple classification which would include only those fundamental methods from which the many differing forms of procedure have been derived. It has been shown by Sperr that all methods of mining may be classed under two heads—supported stopes and caved stopes. Further, supported stopes are of two kinds, those which remain open—either naturally or by the support of ore-pillars, rock-walls, or stulls—and those which require filling. From these preliminary subdivisions the author derives nine standard groups of methods, to which all other modifications can be directly attributed. The author's summary and classification is admirably clear and he may be congratulated on the manner in which he has clarified the subject.

The Education of the Engineer

Since the last issue of the *MAGAZINE* there has been a rather striking commentary from an unexpected quarter on the attitude we ventured to adopt in referring to the education of the engineer, which must be our excuse for again mentioning the subject. It will be recalled that an opinion was expressed as to the possible weaknesses in what was called the primary education system prevailing in this country, which might be said to incline in some quarters in the direction of inculcating an indulgent attitude toward idleness, coupled with a sense of superiority which tended to make hard work a thing to be regarded as derogatory. It is easy adversely to criticize

school and college systems in the light of individual experiences of certain inherent shortcomings. Much of this criticism—and there has been a good deal of it since the War—arises from imperfectly understood psychological reasoning, which can scarcely be better described than "high falutin." A different attitude will, however, be adopted towards an interesting scheme outlined at the end of last month to a number of prominent industrialists, professional men, and educationists. Broadly speaking this scheme argues that there is a demand for some intermediate stage between the school-cum-university training period and the time for the actual commencement of a business life. The sponsors include Lord Luke, a member of council of the London Chamber of Commerce since 1891, Dr. Alington, the Headmaster of Eton, Sir Felix Pole, the chairman of the largest electrical manufacturing organization in this country, and Sir Josiah Stamp, the eminent economist, thus being representative of diverse spheres of activity. Their deliberations have arisen out of a growing sense that there is a fundamental and urgent need for closer relation between education and business.

It may be asked what bearing this has on the training of mining engineers. It is to be found in the fact that it is definitely of interest to learn that others on the threshold of life are also possessed of certain characteristics and qualities of which, that they may be better fitted for their part in the battle of life, they must perforce be "unlearned." The man who is destined for life in commerce is henceforth to have an opportunity of undergoing a brief but intensive training which will be specially designed to change some of his preconceived notions and in which he will gain a conception of what is required of him when he comes to apply his talents to the performance of office routine or the elucidation of work-a-day problems. Much of this learning is encompassed in the one word "discipline," and it is here that engineers have admittedly some advantage over their brothers in other walks of life, if they will but seize it. Their training provides opportunities for employment in vacation time in mines and works and the more "manual" the nature of this work the greater the experience gained. Let the young engineer, therefore, see to it that, while he is learning his job, he takes every opportunity that presents itself of widening the scope of his activities.

REVIEW OF MINING

Introduction.—The Budget was received with mixed feelings and, although it was appreciated that its proposals might have been much worse, it is evident that it has done nothing to improve the immediate outlook. Copper, which had for so long been the one stable metal, received a severe setback towards the middle of last month when the Copper Exporters' Association reduced the price of electrolytic copper by 4 cents to 14 cents, and the metal has since shown continued weakness.

Transvaal.—The output of gold on the Rand during April was 831,996 oz., and in outside districts 36,610 oz., making a total of 868,606 oz., as compared with 889,370 oz. in March. At the end of April the number of natives working in the gold mines was 202,434, as compared with 200,134 at the end of March.

At the meeting of the Central Mining and Investment Corporation, to be held at the end of this month the directors will recommend a final dividend of 8s. per share and a bonus of 4s., making a total distribution for the year of 20s. per share. This is the sixth successive year that the directors have been able to make such a payment.

The 1929 reports of the mines controlled by the Anglo-American Corporation were issued last month. At the Brakpan the tonnage milled was a record, as also were the amount of gold produced, the ground broken, and footage developed. Working costs, however, were higher, mainly owing to the larger fathomage stoped, the increased development, and expenditure in the reduction department. During the year 1,028,300 tons of ore was milled for a recovery of 399,245 oz. gold. The working profit was £660,530, as compared with £639,755 in 1928, dividends totalling 9s. 9d. per share absorbing £497,250. The ore reserves at the end of the year were estimated to be 2,531,440 tons, averaging 7·89 dwt. over 54·08 in., as against 2,938,000 tons, averaging 8·21 dwt. over 57·61 in. at the end of 1928. Payable ore developed during 1929 amounted to 741,520 tons.

At the Springs Mines, as at the Brakpan, the working costs were higher in 1929, mainly owing to increased development, winding, pumping, and reduction costs. The increased winding costs were due to the replacement of some of the boiler plant at

No. 2 shaft. The tonnage milled during the year was 825,600 for a recovery of 398,968 oz. gold. Working profit at £785,456 compares with £853,852 in 1928 and dividends totalling 7s. 3d. per share absorbed £543,750. At the end of the year the ore reserves were estimated to be 3,250,238 tons, averaging 9·3 dwt. over 50·49 in., as compared with 3,008,641 tons, averaging 9·1 dwt. over 52·5 in., at the end of 1928.

On the West Springs the tonnage crushed was increased considerably with a beneficial effect on working costs amounting to 1s. 6d. per ton. While the yield per ton was lower, this was largely counteracted by the increased milling capacity. During the year 763,500 tons of ore was crushed, as compared with 647,300 tons in 1928, and the yield of gold was 221,896 oz. The working profit was £248,483, as compared with £260,565 in the previous year, and dividends totalling 2s. per share absorbed £179,300. The ore reserves at the end of 1929 were estimated to be 2,752,680 tons, averaging 6·34 dwt. over 57·26 in., as compared with 2,695,520 tons, averaging 6·80 dwt. over 61·16 in., at the end of the previous year. The rearrangement of the flow-sheet at the reduction plant has proved satisfactory, costs being reduced from 3s. 3d. to 2s. 10d. per ton, while extraction efficiency has improved.

The report of the Union Corporation for 1929 shows a net profit of £418,034, as compared with £428,582 in 1928, to which was added £116,595 brought forward, making a total of £534,629. Dividends of 5s. 6d. per share absorbed £385,000, the same as in 1928. Much of the revenue of the company was derived from the Modderfontein Deep Levels and Geduld Proprietary Mines, whose reports were summarized in our last issue.

A circular to shareholders of the Village Deep, the amalgamation of which with the Robinson Deep was announced in the March issue of the MAGAZINE, states that the reduction in the nominal value of the shares from £1 to 14s., approved at extraordinary general meetings held in Johannesburg, has been confirmed by order of the Supreme Court of the Union of South Africa. Accordingly a return of 6s. per share will be made to the shareholders.

At the annual meeting of Simmer and Jack mines, held in Johannesburg, it was stated that the sinking of another sub-incline

shaft from the 46 level, West Metropolitan fault, was under consideration. This, it was hoped, would enable the management expeditiously to open up a large area where there was likelihood of intersecting the good ground met with in the eastern section of the old Jupiter mine. Estimates of costs for the proposed shaft are in preparation.

It is announced that the pilot plant of the Potgietersrust Platinums at the Potgietersrust section is to be closed down, due to the fall in the price of the company's product.

Southern Rhodesia.—The gold output of Southern Rhodesia for March was 45,511 oz., as compared with 43,385 oz. in February and 47,388 oz. in March of 1929. Other outputs in March were: Silver, 7,106 oz.; copper, 162 tons; coal, 81,726 tons; chrome ore, 22,003 tons; asbestos, 3,078 tons; mica, 24 tons; tin, 6 tons.

Northern Rhodesia.—Shareholders of the Rhodesian Congo Border Concession have been informed of more complete results from bore-hole N.E. 17. This hole entered ore at 988 ft. and to 1,093 ft. the ground assayed 6.48% copper. A second hole, N.E. 10, situated approximately 2,300 ft. from the N'Changa boundary, passed an upper ore horizon averaging 4% copper between 1,160 ft. and 1,182 ft. and has now entered a lower horizon at 1,660 ft. and at 1,702 ft. was still in ore, the 42 ft. of ground averaging approximately 6.7% copper. Yet a third hole, N.E. 20, near the N'Changa boundary, entered the upper ore-horizon at 145 ft. and for 30 ft. averaged approximately 5% copper.

Results of a bore-hole on the Mindola property of the Bwana M'Kubwa Company are interesting in that a complete chain of bore-holes has now been completed along the N'Kana and Mindola ore-bodies. The last hole, No. 24, showed 4.04% copper over a true width of 15 ft. The completed series of bore-holes is held finally to establish a continuity of payable ore over a distance of 12 miles.

The seventh progress report of the Rhodesia-Katanga Company summarizes the development work done on the mine up to the end of February, and is accompanied by plans. Underground sinking and driving at the end of the month amounted to 26,470 ft. and diamond drilling to 18,150 ft. The reefs in the Eastern and Western groups, trending north-south with steep dips, vary in width up to 22 ft. and in the upper portion of the mine they are bordered by copper-

bearing country rock which is sometimes rich enough to form payable ore. In addition to the reefs there is the replacement ore on the upper dolomite-schist contact and also a series of pyritic graphite-schists of considerable aggregate thickness which carry up to 5% copper.

The report of the Selukwe Gold Mining and Finance Company states that the board of the Kafue Company have secured the services of Mr. D. W. Bishopp, who will make an examination of the company's concession with a view to commencing diamond drilling operations on the Sable Antelope, or other of the company's properties.

Gold Coast.—At an extraordinary general meeting of Alluvial Diamonds (Gold Coast), Ltd., held on May 1, it was decided to divide the present capital of £100,000, in 1,000,000 Ordinary shares of 2s. each, into Ordinary and Preferred Ordinary shares, the 350,000 shares at present unissued to become 8% Preferred Ordinary shares.

Arrangements have been made for the West African Diamond Syndicate to acquire from Morkwa, Limited, five of its leases on which a million carats are stated to have been proved, together with an option over a further 10 square miles of undeveloped territory, the purchase price being £105,000, payable in shares.

Australia.—Gold producers in Australia have requested the Federal Government to grant a bounty of £1 per oz. on all gold mined in Australia, which, if acceded to, will it is estimated cost the Government £600,000 a year.

The announcement of an important gold discovery in Western Australia, between Edjudina and Pingin, in the North Coolgardie field, is a reminder of pre-war days. The new find is stated to comprise a large hematite-quartz lode which outcrops near Lake Carey.

The strike of a new ore-body by diamond drilling has been announced by Great Boulder Proprietary. It is stated that the new body was struck at a point 138 ft. west of the company's boundary and that it was 4½ ft. wide and assayed 63 dwt. gold per ton.

Shareholders of the Zinc Corporation have been informed that, owing to the absence of Mr. W. S. Robinson in Australia, it has been decided to postpone the annual general meeting until July. At the same time it is emphasized by the directors that the profits of the company are likely to be much less

in the current year with the metal prices now ruling and that in consequence the final dividend would be reduced to 2s. per share.

Three of the principal companies operating on the Broken Hill field, New South Wales—the North Broken Hill, Broken Hill South, and Zinc Corporation—propose to enter into an arrangement under which as from June 30 next their zinc concentrates will be purchased by the Electrolytic Zinc Company of Australasia and the Imperial Smelting Corporation. The existing contract for the purchase of the Broken Hill zinc concentrates by the British Board of Trade will expire at the end of June.

The technical committee of Mining Trust, Ltd., in a progress report states that at Mount Isa the proved ore reserves amount to 28,000,000 tons, with a gross value of £80,000,000, and that these are in only three of the numerous ore-bodies being worked. The first mill unit of 2,000 tons daily capacity is expected to start in August and the profits from this, with present low metal prices, are estimated at £695,000 per annum.

New Guinea.—On the property of the New Guinea Goldfields the main ore-zone is stated to have been traced for 7,000 ft. and driving for 1,184 ft. has shown values of 84s. 2d. per ton over 41 in. In the lower area one of the flat beds is estimated to contain 100,000 tons of ore assaying 103s. per ton.

India.—The strike which occurred on the Kolar goldfield at the beginning of April has been settled and work has been resumed.

Burma.—A circular to shareholders of the Consolidated Tin Mines of Burma contains the report of Mr. Ross Macartney arising from his recent visit to the property. The programme of equipment and development initiated by Mr. Macartney is expected to be completed by the end of June, when it will be possible to extend the sphere of operations and increase the output of mineral, while production costs should be lowered. An output of 2,000 tons of mixed concentrates is anticipated in the year 1930–31.

Siam.—A company under the title of Puket Tin Dredging was registered during April to acquire mining rights in Siam and elsewhere. Further details appear in the report of the Waihi Gold Mining Company for 1929, where it is announced that the Waihi company and Tronoh Mines, Ltd., are both interested in the new company,

as stated in the MAGAZINE for May, 1929. Control of the undertaking has been relegated to a committee of four members, two nominated by each company, and a dredge has already been ordered.

Panama.—In the fifteenth progress report of the Panama Corporation Mr. Hugh F. Marriott states that further work on the strike of the Mina Blanca lode has shown this lode to be present 5,000 ft. north of Tunnel No. 2 and that 40 miles away in the Chiriqui Concession a lode having similar characteristics has been discovered. Streams draining the area indicate continuous gold mineralization along this belt. The corporation has recently issued another 250,000 shares at par.

British Guiana.—On May 19 shareholders of the United Diamond Fields of British Guiana are to be asked their views as to whether the business of the company is to be continued or wound up and the assets distributed. The settlement reached as the result of the recent litigation gave the company £325,000 in cash, in addition to which it holds shares in the Bartica Company.

Trinidad.—An agreement has been concluded between Trinidad Leaseholds and the Venezuelan Consolidated Oilfields under which the rights of the latter company in the Palo Seco and Siparia areas have been acquired on behalf of a new company to be formed under the administration of Trinidad Leaseholds. This will be called the Siparia Trinidad Oilfields and will have a capital of £500,000 in £1 shares.

Russia.—The Lena Goldfields concession has been annulled and the chairman of the company states that they are carrying on until they can hand over to the Russian Government.

Anglo-Oriental Mining Corporation.—The accounts for the year ended February 28 last show a net profit of £96,466 and there is a final balance available of £179,959, as compared with £220,228 the year before. Dividends absorb £72,917 and, after allocations to investment and taxation reserves, £82,043 is carried forward.

Chemical and Metallurgical Corporation.—At the meeting last month the position of the company was fully discussed, a committee comprising Mr. Frank C. Heley, Mr. Frederick Charles Thomas Lane, Mr. Francis Moore, Mr. Harold John Morland, Mr. William Henry Tapp, and Mr. Edward Hooper being ultimately appointed to confer with the board.

MINERALIZED ZONES IN EAST AFRICA

By STANLEY C. BULLOCK, M.I.M.M.

The author describes conditions relating to mining and prospecting in East Africa, together with the methods of transport, accessibility of different regions, and suggestions as to outfit.

Dar-es-Salaam, the capital of Tanganyika Territory, was chosen by the writer for the port of entry into East Africa, and it was discovered that the customs authorities levied considerable toll on camp outfit, guns, etc. Anyone taking outfit of any description into the country is advised, if it be new, to use it sufficiently beforehand to show some kind of wear in order to prove that it has been used and is not for sale. This applies equally to cutlery and cooking utensils, as well as to camp beds, tents, etc. If this is done the levy will not be quite as high. The New Africa Hotel, the chief hotel in German times, is still the one usually frequented by Europeans and the inclusive charges are from 18s. to 20s. per diem. No one stays there longer than can possibly be helped. There is another European hotel—the Palace—but it is in rather an inconvenient quarter of the town. Rickshaws are still the most common means of conveyance and are much cheaper than the cars in Mombasa where rickshaws are practically non-existent.

For the purpose of travelling throughout this country, a car or lorry is advisable and for the writer's trip a specially designed "safari" body was built on to a Chevrolet truck chassis. This cost £250 complete with spares in Dar-es-Salaam and was railed up to Tabora—a distance of 841 kilometres—at a cost of about £18, the first-class fare being just under £8 to the same place. At Tabora good servants were obtained, a cook boy receiving 40s. and personal boy 30s. per month, plus posho or food allowance which amounts to about 8s. per month more.

From Tabora the road to Mwanza was taken via Nzega and Shinyanga, the latter town being about 120 miles by road from Tabora and the first place of mining interest to be visited. It is a Government station with a District Officer and other Government officials, but for mining purposes it comes under the Inspector of Mines resident at Mwanza.

About eight miles before Shinyanga is reached some small quartz veins in schist country were opened up for gold during German times and samples taken by the

writer showed a few colours in the pan. The prevailing rocks from Tabora to Mwanza are granites and granitic gneisses, but schists and banded ironstones occur in places as in the Shinyanga occurrence. At Kisumbi Hill, about two miles south of Shinyanga, there is a dolerite-granite contact and it is in the vicinity of this that kimberlite has been found. Diamonds were first discovered here in late 1927 or early 1928, occurring in a ferruginous gravel a few feet deep lying on the top of a rock of doleritic nature. Associated with the diamonds are ilmenite—locally known as carbons—and garnet. Kisumbi Hill stands out as a very prominent landmark from the surrounding plain of laterite, or "murram" as it is known locally. Although definite pipes of kimberlite containing diamonds have been discovered in the vicinity, the stones have been so few and small that work on them has been abandoned and only the gravel is now being worked by a few prospectors who are still finding diamonds. About six miles to the north of Shinyanga by road, at a place called Usogoro, another area was extensively pegged and worked for diamonds but few, if any, were ever found and it was abandoned.

Following the Mwanza road again for about sixty miles Mabuki village is reached and it is just past this village that the Tanganyika Diamonds Company have their workings. Before describing this mine, a few words are necessary in regard to the road from Shinyanga which, after it leaves the Tabora Province at the Village of Seke passes through a long stretch of thorn bush with black clayey soil (locally known as black cotton soil) and which, in wet weather, becomes a veritable quagmire and where a car will sink up to its axles. No metalling had been done at the time of the writer's journey, and road making consisted of heaping up this soil a foot or so above the surrounding country for a width of a little more than that of the wheel track, the consequence being that as soon as the rains commence the road becomes impassable.

The diamond workings at Mabuki consist of a large but comparatively shallow open-cut about 20 ft. deep, from which the gravel in

which the diamonds are found is trammed up an incline and discharged into elevators feeding screens or trommels, and washing pans, from which the concentrates go to hand-sorting tables. At the time of this visit about 600 loads per day were being treated and about 70 carats were being recovered, the output per month then being in the neighbourhood of 2,000 carats. This amount is now reduced, according to the official gazette.

The gravel in which the diamonds are found lies on the top of a bedrock of schist. It is ferruginous in character, often quite angular, and is composed mainly of quartz, which shows little or no sign of having travelled

The usual rate of pay is from 15s. to 20s. per month plus posho, which consists of from $1\frac{1}{2}$ to 2 lb. of maize meal per man per day. This meal costs from 16s. to 20s. per bag of 200 lb. weight.

The road through this part of the country originally had a good stone foundation as the Germans intended bringing in their railway on this route and had already partly built the permanent way. This has been allowed to get into a bad state of repair, full of holes and ruts which make travelling at more than five or six miles an hour an impossibility, unless springs and ignition coils are broken. The more or less level plain alongside the road proper is usually used as a track.



DIAMOND PADDOCK AND WASHING PAN, MABUKI DISTRICT.

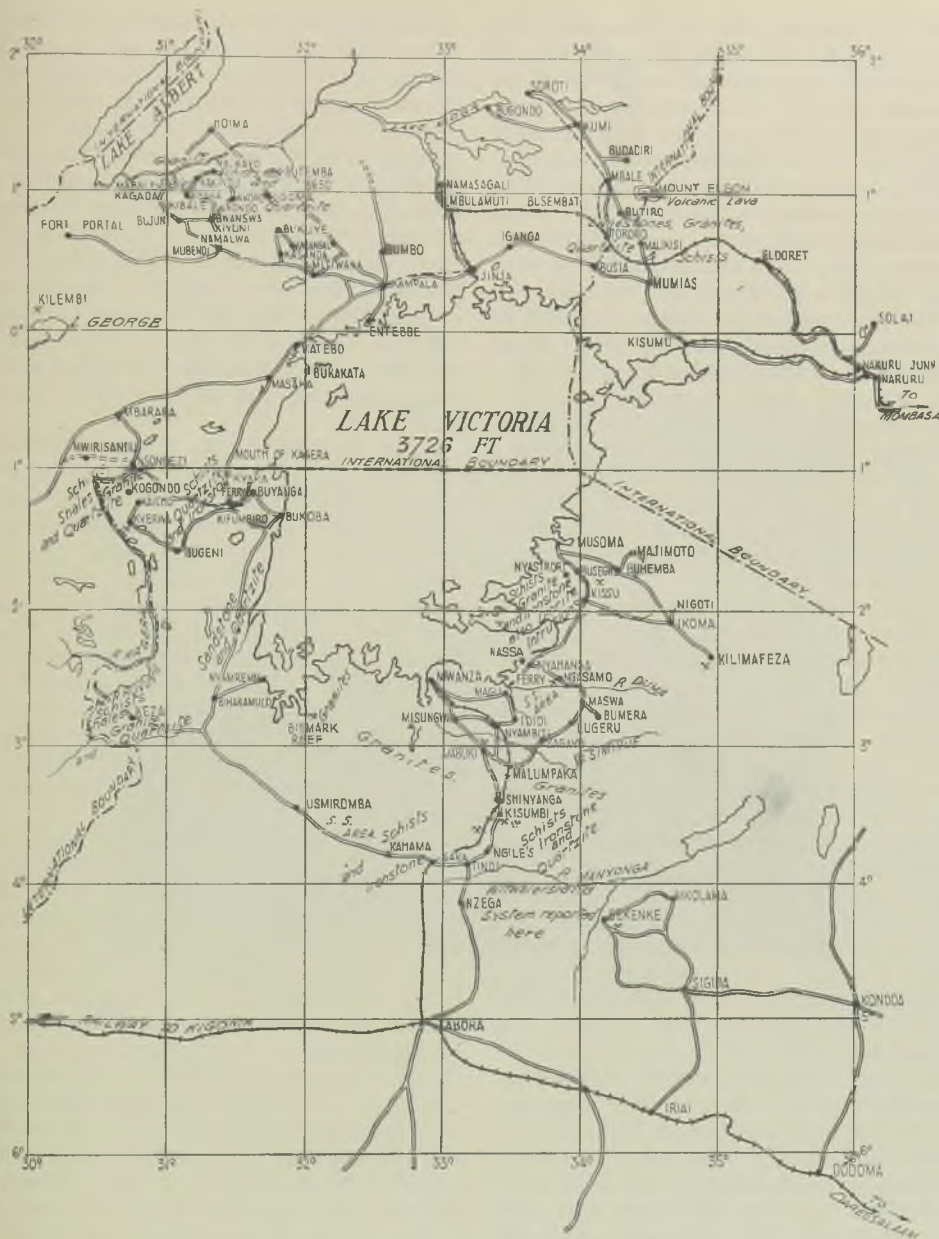
any great distance. A shaft which was sunk to a depth of over 100 ft. disclosed a rock of schistose nature which was called "kimberlite," but few, if any, diamonds were discovered within it.

Mabuki itself stands upon rising ground about two miles from the Magogo River, the country all round being a treeless plain with granite outcropping about three miles to the north in the direction of Lake Victoria. A granite-schist contact occurs to the north-east, underlying the gravel. The schist is often chloritic and sometimes has chlorite-quartz veins running through it. The chlorite resembles serpentine in appearance, and in many ways is like thuringite.

Labour here is scarce at times when sowing or harvesting take place as the natives then all want to go back to their cultivations.

Just past Mabuki the Magogo River is crossed, the ford being a concrete drift which becomes flooded during heavy rains and practically cuts the mine off from the outside world. Further on again, an attempt at drainage has been made by putting in "Armco" culverts. These have been covered with only a few inches of gravel or soil, and after one or two lorries loaded with cotton have passed over them the iron is broken and they become an absolute danger to passing traffic.

Twenty-six miles from Mwanza the village of Misungwi is passed and from here on the road improves, but the traffic is too much for a gang of natives with only a light hand roller to keep the surface in good condition. Here too, the plain, which practically stretches from Tabora, is left and the granite hills,



SKETCH-MAP ILLUSTRATING THE ROUTE TRAVERSED BY THE AUTHOR.

which surround Mwanza, are encountered, and these form a welcome relief after the monotonous dry and arid aspect of the Mabuki plains between the months of May and November. During the wet season, when travelling becomes difficult, if not impossible, the country is beautifully green and large quantities of duck are met which form the main source of food for some of the Europeans living in that area.

Mwanza itself is prettily situated at the south end of Lake Victoria. It is the seat of the Provincial Commissioner and the Inspector of the district lives there also. There are several Indian shops, so that provisions and petrol, etc., can be obtained, while the Lake steamers call once a fortnight, one going west and the other east, via Bukoba and Musoma respectively to Kisumu, the Lake terminus of the Kenya and Uganda Railway.

East of Mwanza, the road runs out to Musoma and Ikoma and it is in this district that several promising gold occurrences are situated. For the first forty miles from Mwanza the country rock exposed is granite and the road is fair, the streams having been bridged or drifts made and it is not until just before the Simiyu River is reached that a bad patch of black soil is met, which is at present impassable during the wet season. At the time of the writer's visit, the old canoe ferry used for crossing the Simiyu, had broken down and a deviation across country had to be made, the lorry becoming bogged in one place. At this point, however, the river driven through was luckily only about 2 ft. deep. The crossing was accomplished with the aid of about twenty natives pulling on a 1½ in. rope to help the engine. Usually the sand or mud bank on each side of the river causes the greatest trouble as the lorry sinks up to the axle.

A little over sixty miles from Mwanza, the village of Nassa is reached. This lies alongside Lake Victoria and has a good anchorage and wharf where dhows or small lighters can unload. From here also a branch road runs south through Ngasamo, where there is a promising gold occurrence, to Maswa, Shanwa and Malumpaka where it connects with the Tabora-Mwanza railway. The mine at Ngasamo was opened up and equipped with a five-stamp battery during German times, but lay idle for about fourteen years, as it was in the sleeping sickness area and it has only now been opened up again. The ore occurs in quartz veins containing a considerable amount of iron and some copper pyrites and the gold seems to be about half free and the other half locked up with the pyrites, but it can be treated satisfactorily by cyanide. The country rock is mainly a schist which is sometimes chloritic. There is a basic intrusive, probably diorite, nearby, with granite outcropping not more than a mile away. Ngasamo hill itself, which lies just to the east of the workings, is mainly of banded ironstone. Very little work has been done so far, but it looks a very promising proposition as the quartz lodes, of which there are several, appear to be continuing at depth while the grade of ore, from the milling results obtained to date, seems to average from 10 to 12 dwt., the tailings, of which there are over 3,000 tons, averaging over 4½ dwt.

The main road, which continues to the east from Nassa, passes over a plain of black

clayey soil before it reaches the Ruwana River and this plain becomes impassable during the wet season. It is also a tsetse fly area and is simply teeming with game, part of it having now been made into a reserve. The Ruwana River has to be driven through, as there is no bridge, but is dry except during the wet season. The main difficulty in crossing is caused by the extremely steep banks which have to be climbed, but these can be overcome by sloping them off where necessary and laying down a corduroy track of brushwood. In addition, it is advisable to collect as many passing natives as possible to help to push or pull.

After the Ruwana River had been crossed, outcrops of granite were encountered at Ikissu while further on, along the Musoma road, schists, ironstone, and intrusions of dolerite and diorite were seen. In this district there are quite a number of gold occurrences, among the best known being Nyasirori, Maji Moto, Buhemba, Simba, Nigodi and Kilimafeza, the latter being now closed down. At Maji Moto galena is found associated with the gold ore, and this is very similar to the ore at the Sekenke gold mine which produced considerable quantities of gold in German times and is now being opened up again.

Recently the country on each side of the Simiyu from Lake Victoria up to the village of Sagayu and the hill of Sansui was visited and, until the latter was reached, practically nothing but granite, gneiss and diorite were seen. Most of the country is overlain with laterite, or ironstone. At Sagayu gabbro occurs and schists are found in the vicinity, while at Sansui Hill itself, serpentine is found. Nearly all this country has been considered within the sleeping sickness zone and abounds with game, but is almost entirely uninhabited, partly because there appears to be no water during the dry season, except that in the Simiyu River itself.

From Ngasamo eastwards and northwards there is a very large area of country over which gold has been found in many places, but except possibly at Kilimafeza, no development at depth has been attempted, although in many places the character of the ore-bodies justifies such development.

To the west of Mwanza at the southern end of the Emin Pasha Gulf, there is another occurrence of gold called by the Germans the Bismark Reef. This is situated on a hill some two or three miles distant from the

Lake at an elevation of about 800 ft. above lake level. The quartz lodes containing the gold run through what appears to be aplite, though banded ironstone seems to be the chief rock of the hill. Before reaching the site, most of the safari from the lake was over granite country overlain by the usual ironstone. Some more work has been done recently on this deposit and in the writer's opinion both it and the surrounding country are well worth further investigation. Grab samples taken from some of the dumps gave quite good values in the pan. The veins exposed on the hillside are several hundred

feet above lake level and if gold does occur in economic quantities an excellent mill site is available and transport by lake to within a comparatively short distance of the mine could eventually be arranged. The writer chartered a small steam launch from Mwanza to reach the locality, but it can also be reached by native track from Biharamulo which lies further to the west.

province and the seat of the Provincial Commissioner, most of the European population being Government officials, although there are two banks and a few European trading firms where petrol, etc., can be obtained and other stores ordered if necessary. In addition there are the usual Indian traders dealing in provisions, etc., An Inspector of Mines has also recently been stationed there.

Cassiterite was first found near the village of Kyerwa which can be reached by road, a very bad one even for Tanganyika, from Bukoba, a distance of some 110 miles and it is



LORRY BOGGED ON THE MWANZA-MUSOMA ROAD.

After the Mwanza district had been investigated, a lake steamer, run by the Kenya and Uganda Railways, was taken to Bukoba, a twelve hour run to the west. At present the steamer anchors some distance off shore and all cargo, motor-cars, etc., have to be taken off by lighter, the landing arrangements at the wharf being very crude and leaving much room for improvement, hoisting tackle being apparently non-existent.

Bukoba is a small town, the capital of the

here that the Bukoba (Tanganyika) Tinfields were operating. A remarkable feature of this cassiterite is its purity and colour, almost pearl-grey. It is found principally in the river bed and in gravel alongside the creeks only a few feet below the surface. Some, but very little, has been found on the hillside. Kyerwa is situated not far from the Kagera River, where the latter forms the boundary between Belgian and British mandated territories and lies about twenty miles south of where the Kagera takes a big bend to the east. Travelling north from here, past the village of Kaisho, into the Ibanda district, the country rocks encountered all belong to the Karagwe-Ankolian series of phyllites, shales, and quartzites, the hills forming a watershed draining into the Kagera to the west. It is in the gullies running down the hill-

sides that tin has been found over quite a large area, but in very small quantities, and nearly always only a few feet below the surface. In Ibanda itself, a good deal of the tin oxide is found on the hillsides just below surface and here quartz veins occur which carry fairly large crystals of tin, but with such a wide distribution that they are not of economic importance. The same occurs at Kikigati on the Uganda side of the Kagera where the Ankole Tinfields company are operating, although there are larger quantities of eluvial and detrital cassiterite on this field. It almost appears

The main deposit, however, seems to be in veins of muscovite and kaolin through which the cassiterite is most irregularly distributed as blebs, crystals, and large masses. The large quantities of cassiterite which were originally found on the hillside almost certainly came from some or all of these occurrences. There appears to be no well-defined lode of tin and no important associated minerals.

At a little distance from this deposit granite occurs, but the surrounding rocks are quartzites and phyllites, the latter usually being schistose in character. It



CROSSING THE RUWANA RIVER, MWANZA-MUSOMA ROAD.

as though these quartz veins really account for the origin of the cassiterite and that it is from them that the mineral has been weathered, finding its way into the sand and gravel on the hillsides and into the gullies where the present deposits are found.

The only tin deposit so far discovered which has proved of any economic value either in Tanganyika or Uganda Territory is that at Mwirasando which is being operated by the Kagera (Uganda) Tinfields. This deposit is probably unlike any other discovered so far in any other part of the world. The mineral occurs as crystals of varying size in irregular quartz bodies of almost lens-like formation generally lying in conformity with the phyllites which form the country rock. It also occurs in the pegmatite which forms irregular masses and lenses between the quartz and the phyllites.

has yet to be proved whether ore values continue at depth and the irregular occurrence of the cassiterite makes systematic sampling and valuation of the deposit practically impossible.

The extraordinary fact about the whole of the cassiterite deposits in this area of south-west Uganda and north-west Tanganyika is that no alluvial tinstone worth mentioning has so far been discovered. Apart from Mwirasando, cassiterite has been found in small quantities only as detrital or eluvial material over a comparatively large area of country draining into the Kagera River, and undoubtedly denudation and erosion have taken place over a considerable geological period so that alluvial tin must have been deposited somewhere. The outstanding question is to where has it been transported, and has sufficient con-

centration taken place to form deposits of commercial value. This is what Mr. E. J. Wayland of the Uganda Geological Survey very appositely calls the "Kagera Problem."

Various hypotheses have been put forward as to whether the Kagera River has not completely changed its course or even reversed its flow, but even were this to be the case the river has, presumably, flowed in its present direction for a considerable geological period. It is, therefore, reasonable to assume that the cassiterite has, quite normally, been carried down to some point or points, between the present known deposits and Lake Victoria. Whether it will be found in payable quantities, if it is there, has yet to be proved, and work for this purpose is now being carried out. Should alluvial not be found in payable quantities, however, the future of Uganda as a tin-producing country appears extremely doubtful.

The only other part of Tanganyika so far where cassiterite has been found is in the Keza area which lies slightly south of west from Biharamulo, an old German military post and now a district headquarters about 110 miles by road to the south of Bukoba. It is through Biharamulo to Kahama, a distance of over 150 miles by road, that Tabora and Mwanza can be reached by road from Bukoba, but bad tsetse fly country must be passed through, and the road is only passable in dry weather. The writer drove through in October, 1928, but had difficulty. The road is fairly good from May to October.

The village of Keza lies about 80 miles by road from Biharamulo over rough country and frail wooden bridges. It was on this road that a rope block and tackle proved invaluable in hoisting the lorry out from a collapsed bridge.

The discovery of cassiterite took place in 1927 near a place called Nshiri about 15 miles to the west of Keza village in the vicinity of the Ruvuvu river which joins the Kagera about 50 miles further down. The tinstone found here was truly alluvial, well water-worn, but though quite a considerable amount of prospecting and drilling was done in the neighbourhood by various companies nothing of importance was found. The rocks are the usual Karagwe-Ankolean series, but tourmaline, which is of frequent occurrence in the Karagwe district, is almost completely absent here. The country is open and well watered so that had

cassiterite been found there would have been no difficulty in regard to dressing.

In motoring from Tanganyika to Uganda, the Kagera River is crossed at Kyaka, or Chaka as it is named on some maps, about 35 miles from Bukoba. There is now quite a good ferry there, but up to 1928 only a platform on canoes was used which had to be poled upstream about 100 yards and then paddled across, the current being very strong. The present ferry works with a steel cable and only a few minutes are occupied in crossing.



GRANITE OUTCROP NEAR TORORO.

After the river is crossed there are still some 20 miles of Tanganyika Territory to traverse before Uganda is reached, the boundary being unmistakable on account of the enormous improvement noticeable in the road surface once the latter territory is reached. Whereas Uganda undoubtedly has a thoroughly well-organized system of road upkeep and repair, in Tanganyika there seems to be no system, no central control, little supervision, and wasteful and ignorant expenditure of what little money they have for road maintenance. On many roads in Tanganyika unless a car is driven at a comparatively low speed—15 to 20 miles per hour—one is continually in danger of accident on account of the

abominable road surface and bad construction of bridges and culverts.

Quite a considerable amount of prospecting has been done in Uganda but except in Toro at the Kilembi copper deposit, which Tanganyika Concessions are developing, and the Mwirasando deposit of cassiterite, nothing of value has so far been found. The Mubende area, which seemed of great promise, has been superficially searched, but except for the discovery of small quantities of a new mineral, bismuto-tantalite, the commercial value of which has yet to be proved, nothing has been reported.

Around Mubende itself the rocks are mainly granites, but to the north-west, quartzites, phyllites, shales, and schists occur and both copper and tin have been reported as being discovered in this area, but further investigation has, as yet, proved fruitless and it is doubtful whether the specimens produced ever came from that area.

Up to the present, Buganda, the Northern Province and the Eastern Province have proved disappointing, especially the latter, where both granite-limestone and granite-schist contacts occur in the neighbourhood of Tororo and Mount Elgon, the latter being mainly volcanic, but gold has been reported by Government officials. There is still room for much closer investigation, and if minerals in economic quantities are discovered, the splendid road system will add considerably to the ease with which such deposits may be opened up. Coal, though sought by the Geological Survey Department, has not been discovered, but there are many places where hydro-electric power can be generated and if the Kilembi copper deposit proves of value it may be possible to produce electrolytic copper on the spot.

From what the writer has seen of the two territories, and many thousands of miles have been traversed by car and on foot, together with the information that he has been able to acquire from people who have been in other parts of the country, there appear to be more possibilities in regard to the discovery of minerals in economic quantities in Tanganyika than in Uganda. The country as a whole is extremely difficult to prospect, grass growing to great heights, completely hiding rock outcrops, and it is only during the months of August and September, when bush fires take place,

that it is at all possible to make thorough search off the beaten tracks.

A gun and rifle are necessities as in many places the only meat procurable is what one shoots while buffalo and rhino, both of which have a nasty habit of charging at sight, can only be successfully interviewed with the latter arm and hard-nosed bullets, and both animals seem to have an especial predilection for places where minerals are to be discovered. Lions also have to be reckoned with and these abound in the Simiyu River district, and also in the Kagera Valley. Quite recently near Nzongezi, one of the men out shooting for meat, ran into a "pride" of lions, shot the male first, a mistake, and the lioness was upon him and had him down before he could shoot again. Luckily he had a good "boy," who attacked the lioness with a spear, making her leave the man for her new assailant, the former then being able to shoot her. He was bitten through the arm and badly clawed about the body, but was lucky to get off so lightly. It will be realized, therefore, that it is necessary to be prepared for all emergencies.

As regards camp equipment, a good tent with bathroom extension at the back and a sunproof fly extension at the front add considerably to the health and comfort of the occupant. In the matter of food, eggs and chickens can generally be obtained cheaply at the villages, the former being from 25 to 50 for a shilling, and the latter two to three for a like sum. Milk can also often be obtained for from 10 to 20 cents per pint. Tea, sugar, rice, and flour always have to be carried, and a good cook can always make excellent bread.

As far as clothes are concerned, it is best to have them made in the country and khaki safari jumper tunics and shorts with puttees or canvas leggings seem to be the most suitable for the country and climate. It will also be found convenient to leave cabin trunks at the coast, buying small painted galvanized iron boxes which can be obtained at from 4s. to 8s. each and packing everything into them, two of these boxes holding almost as much as a cabin trunk. They are convenient for safari porters and for general transport work and can be discarded at the end of the tour, whereas if full-sized trunks are taken it is not only very difficult to get porters to carry them, but they are more or less ruined when the tour is finished.



EMPIRE MINING AND METALLURGICAL CONGRESS

Held in South Africa during March, April, and May, 1930

FROM OUR OWN CORRESPONDENT

FROM CAPE TOWN TO JOHANNESBURG

Cape Town, the Mother City and Parliamentary Capital of the Union of South Africa, is not a mining centre, but many of its citizens are interested in diamond, gold, platinum, and copper companies operating "up in the north", and this fact

section of the community, including the Governor-General, the Earl of Athlone, and his gracious consort, Princess Alice, members of the Cabinet and Parliament, which was in session, heads of municipalities, and others, seemed bent on showing the



HOUSE OF ASSEMBLY AND GOVERNMENT AVENUE, CAPE TOWN.

may have accounted in some measure for the remarkable cordiality of the welcome which the delegates to the Third Empire Mining and Metallurgical Congress received when they arrived in Table Bay on March 24. All members of the party will agree that from the very beginning of their pilgrimage in South Africa they were overwhelmed with kindness and hospitality. Every

visitors that the people of the Union were determined to make the visit a thoroughly successful and happy one.

Those who had not previously seen Cape Town will not forget the first sight of Table Mountain; the visit to the centuries-old Castle, Groot Schuur, once the home of that great Imperialist John Rhodes and now the Parliamentary residence of the Prime

Minister of the Union ; the National Botanic Gardens at Kirstenbosch ; the Cape Peninsula's picturesque villages ; and last, but not least, the 100 mile drive along the coast of this South African Riviera, with its delightful Camp's Bay, Hout Bay, Cape Point, and other seaside holiday resorts. Small wonder that Sir Francis Drake when he first set eyes on this part of Africa was moved to describe it as "the fairest Cape in all the world."

Bidding a regretful *au revoir* to Cape Town, the members left for Kimberley by special trains *de luxe*, which were found to be

some of the travellers admired a remarkably fine piece of railway engineering and panoramic views of exceptional grandeur. It was recalled that these mountains have played an important part in the history of South Africa, because for many years they constituted an effective barrier to the occupation of the interior by Europeans.

After ascending the mountains the trains entered the great plateau of the Karroo, where for miles only stunted vegetation is to be seen with great flocks of sheep. The travellers were told that there are twenty million sheep on this great tableland.



CITY HALL, JOHANNESBURG.

veritable homes on wheels. Though the gauge of the line is only 3 ft. 6 in., the compartments of the corridor coaches are ample in dimensions, and ease and comfort characterize the sleeping berths, furnishing, and equipment. Racks and electric light, with reading lamps in the sleeping berths, are installed and there is a shower bath in each coach. The cuisine was excellent and equally so the service. As an aid to further study of the country traversed an observation coach was attached to each train.

As the tourists were borne rapidly northwards in the Cape Province they passed through first a fruitful and picturesque countryside covered with the vineyards of the wine districts and orchards which produce some of the finest fruit in the Union. During the ascent of the Hex River Mountains, which occupied several hours,

The journey from Cape Town to Kimberley occupied about 24 hours, and here the delegation remained throughout the following day, a technical session being held the morning after arrival. The great "glory holes" of the Diamond City and other features of the mining industry there appealed strongly to the imagination of some of the ladies of the party, one of whom was, not unnaturally, heard to suggest that the diamonds in the ring she wore "probably came out of that very hole."

From Kimberley, the city of diamonds, to Johannesburg, the city of gold, is a journey of a little over 300 miles through typical high veld. The trains crossed the Vaal River at Vereeniging, not far from the great dam from which Johannesburg's water supply is drawn. Along the banks of this river for many miles are old diggings

from which were produced some of the finest diamonds in the world. More diggings were to be seen stretching for miles into the western Transvaal and among them are the towns of Bloemhof, Klerksdorp, and Potchefstroom, the latter the old capital of the Voortrekkers.

Potchefstroom was soon left far behind and early on Sunday morning, March 30, the western end of the Rand's 70 mile line of black smoke stacks and white tailings dumps came into view. Randfontein's mines were passed, then came the West Rand Consolidated, Luipaard's Vlei, Langlaagte Estate, and Crown Mines, constituting the

municipality of Johannesburg is sixty millions sterling. A halt was made at the Zoo, one of the largest and finest collections of animals in the world, and also at the Country Club, another institution of which the people of Johannesburg have every reason to be proud. At Cape Town the tourists were inclined to complain of the heat; at Kimberley they were troubled by dust; and at Johannesburg they marvelled at the sudden and sharp changes of temperature which are experienced there in the autumn at an altitude of 6,000 ft. above sea level.

The delegates have admitted that their eight days' stay in Johannesburg was a



CONGRESS DELEGATES AT JOHANNESBURG RAILWAY STATION.

western half of the world's greatest goldfield, and a few minutes later the train ran into the Johannesburg railway station, where passengers were greeted by a large number of the Rand's leading mining men, among whom were many old friends. The visitors were driven to Johannesburg's largest and finest hotel, the Carlton, which was their home for the ensuing eight days.

The afternoon was spent in sight-seeing. Private motor cars conveyed the members of the Congress and the ladies of the party through streets lined with tall and handsome buildings, past flashing electric traffic signals, and into some of the city's hundred odd suburbs, containing miles of beautiful gardens and comfortable homes. "Some mining camp this," an American delegate exclaimed, when told that the rateable value of the

thoroughly profitable and enjoyable one. At the conclusion of the Johannesburg session on April 7 Mr. Charles McDermid, the secretary-general, characterized the gathering as a brilliant success. To quote the words of Mr. Wainwright, representing the Australasian Institution of Mining and Metallurgy: "It has been an exceptional opportunity for technical men from overseas to see at first hand the mines of South Africa, but, more important still, it has enabled them to get into contact with the high-grade brains that have developed the gold industry of the Rand. My trouble is that I have not been able in the time to see all I wanted to see." Mr. Wainwright at the Union Government's banquet put forward the invitation that the next Congress in 1933 should be held in Australia, and he had the

satisfaction at the final session of hearing the Congress applaud the intimation of the acting chairman, Mr. P. M. Anderson, that the Council had decided to accept it.

Professor Moss, of Birmingham University, also expressed appreciation of the high standard of the papers presented. "From the Rand," he said, "emanated many new ideas for the advancement of mining. It was difficult to say where rule of thumb methods in mining began, and where the principles of science ended, but both were

all the papers, but they would be read again and discussed at the meetings of the constituent bodies, and all would now know, from personal contact with the authors, where to write for any fuller information that was required. The Council of the Congress had decided to develop a more adequate and prominent organization for the rapidly increasing work of the Council. The proposed review of the mineral resources and industries of the Empire had been discussed at length, and the scheme was



NATIVE WAR DANCE AT CITY DEEP, IN HONOUR OF CONGRESS DELEGATES.

indispensable to the industry, and in that respect the Rand led the world. South Africa had shown the visitors from overseas a good deal and many of them would have liked to stay a month or more longer in order that they could appreciate to the full all that was being done. But in going they took with them happy memories of the people they had met, and they knew where to seek information in the future, and that was of great value."

Dr. P. M. Anderson said such a wide range of subjects had been brought before the Congress that justice had not been done to

for the constituent bodies of the Congress in each Dominion to form a committee to consult with their Governments and request them to assist in making a survey of mineral resources, development, economics, consumption, export, and cognate subjects. The Council had approved a project for a central home in London for the Empire Council and its constituent institutions would be housed as tenants and the members of all the oversea bodies would enjoy all the services, whether members of the Home institutions or not, by virtue of their being constituent members of the Empire Council.

AERIAL ROPEWAYS

By HARRISON ROE

The author describes some recent developments in mechanical transporting practice.

Since 1923, when a previous article dealing with aerial ropeways appeared in the March issue of the *MAGAZINE*, considerable development has been made in the design and construction of aerial ropeways and similar mechanical plants in which steel-wire ropes are used as the transporting or moving medium. Higher speeds and heavier capacities, the application of automatic loading devices, arrangements for transferring trams on and off ropeway

The scope of this article is, therefore, not to deal with automatic appliances so much as with the application of up-to-date plants to the mining industry. Aerial ropeways installed at mines, with the exception of those of comparatively short length, are usually designed in the simplest and most straightforward manner compatible with economy in working costs, and that these latter have appreciably decreased in the past few years may be gathered from examples

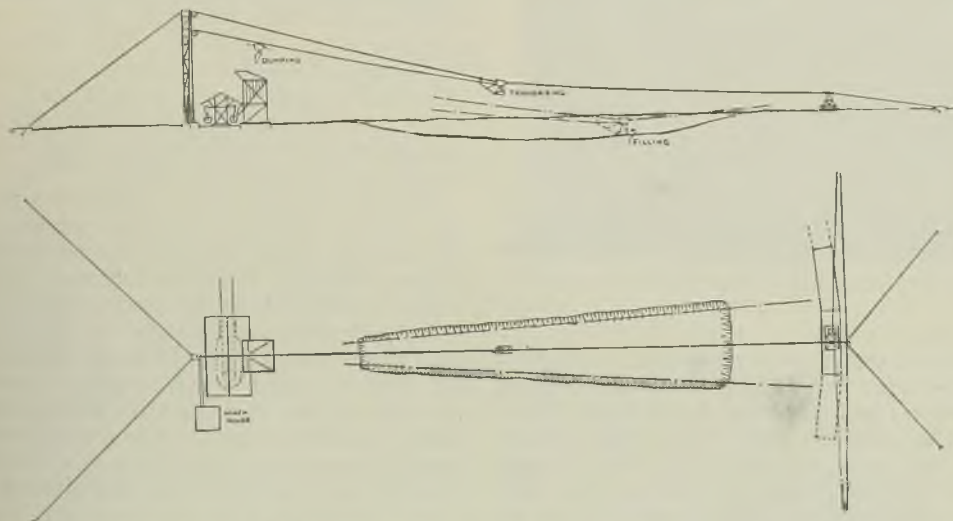


FIG. 1.—ARRANGEMENT OF DRAGLINE EXCAVATOR WORKED IN CONJUNCTION WITH ROPEWAY.

carriers, and similar devices, have all tended to widen the field of application of such plants.

Intensive automatic action in a plant such as a ropeway or cableway can never, in the writer's opinion, appeal to the metalliferous mining engineer in the same way that it does to those responsible for the operation of collieries and in industrial works generally, where skilled mechanics are always available. Generally speaking, where a ropeway is installed on a mine there is no alternative means of transport. Automatic appliances need a certain amount of skilled attention to ensure that the somewhat intricate mechanisms used are in good working order. Skilled mechanics are often not available on a mine, and, if available, it is at a cost which would probably be greater than unskilled labour employed as an alternative to automatic appliances.

given later. These remarks apply equally to the bicable as to the monocable system of ropeways.

One of the most recent of such applications is in connexion with sand stowing, and by a combination of dragline excavators feeding into the loading hoppers of aerial ropeways remarkable savings have been achieved as compared with previous costs of conveying sand for this purpose. A typical lay-out of such an installation is shown in Fig. 1, while Fig. 2 shows a dragline bucket in the act of filling. Draglines can be used either for collecting sand, gravels, or similar matter in an unconsolidated state, or for distributing such material over a given area. In the former service they are used as a combined digger or shovel, conveyor and elevator, and in the latter as a scraper conveyor. The operation in the former case consists of running out, over a heavy main



FIG. 2.—BUCKET OF DRAGLINE EXCAVATOR DIGGING.

cable and under its own gravity, a specially-formed open type of shovel, and dropping it where required to dig by slacking off the main or carrying cable. With the cable in its slack state the shovel is then dragged back by a secondary or hauling rope, and when full the main cable is wound in on its drum until taut, whilst the shovel is still being dragged or hauled in. Automatic tipping at any desired point and height can, within limits, be effected by means of a

tipping stop fixed to the main cable, and by arranging the mast at a suitable height. A double-drum winch of sturdy construction, in which the drums can be coupled or worked independently of each other, is the standard form of gear adopted and, where electric power is not available, a steam or oil engine can be used with equal success.

As a distributor, or scraper, a specially shaped pan is operated to and fro, tipping its contents at one or both ends of its travel. The height and depth of cut, or scrape, is regulated by the tension or sag in the main cable. One man only is required to operate such a plant and, being necessarily of sturdy construction, they are very efficient and economical in operation. To allow as big an area as possible to be covered without altering the position of the main mast, the tail tower is usually mounted on radially placed rails, over which it may be traversed by means of a rope and winch.

The cost of operating a standard type of plant is from about $\frac{3}{4}$ d. to $2\frac{1}{2}$ d. per cu. yd. of material excavated and delivered into hopper, varying with the location of the plant and the nature of material handled.

The advantages of a dragline as compared with the ordinary mechanical shovel are :—*(a)*, that its range is considerably greater ; *(b)*, that it can unload at a higher point ; and *(c)*, that it is much cheaper in first cost. Against these advantages is the fact that the capacity of draglines is usually limited to about 60 cu. yd., say 80 tons, per hour, over an average digging distance of about 300 ft., so that, where heavy capacities have to be handled, the general practice is to instal two machines.

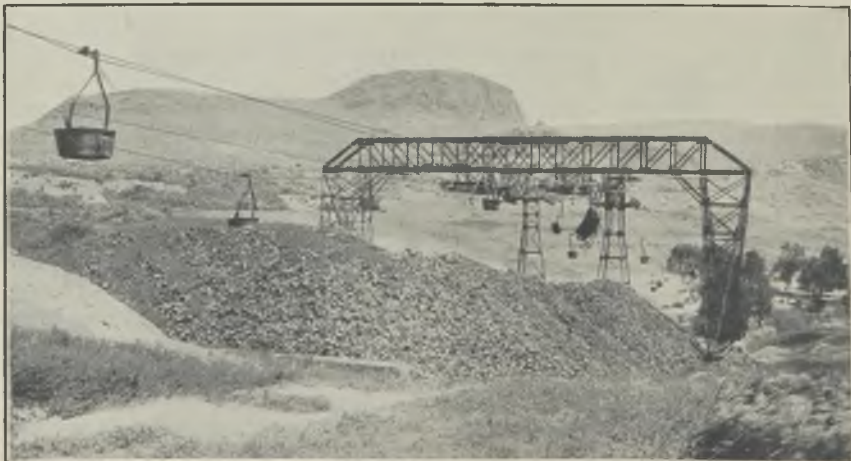


FIG. 3.—BUCKETS TIPPING AUTOMATICALLY OVER STOCK PILE.

At the Hollinger Mines in Ontario a monocabable ropeway, fed by an electrically operated shovel, is working over a distance of $3\frac{1}{2}$ miles, carrying sand for filling purposes at the rate of 135 tons per hour. By suitably grading the shunt rails at the stations, labour is only required for filling the buckets and for righting them after tipping at the unloading point immediately in front of the return terminal. The buckets are automatically tipped while passing through a moving tripping device arranged as shown in Figs. 3 and 4. This ropeway is operating for 22 hours per day, and for 7 days a week. The total all-in running costs of the ropeway are 6.5 cents per ton for the whole distance, made up as follows:—

	Cents per ton.
Labour	2.15
Renewals (including ropes, stores, maintenance, etc.)	2.60
Power and supervision	1.75
	6.50

This works out at just under 1d. per ton-mile, while the cost of operating the shovel, which fills the buckets, is about 3 cents per ton.

Cableways, or blondins as they are sometimes called, are now much more frequently used for open-face workings than was formerly the case, although their application in slate and granite quarries dates back many



FIG. 4.—BUCKET TIPPING ON ROPEWAY IN INDIA.

years. As it is difficult to operate a grab from a cableway (although this is sometimes done) it is general practice to load the trays or buckets by some other means as, for example, a steam shovel as shown in Fig. 5. This photograph illustrates a cableway having a span of about 400 yards and lift of 70 ft., the normal load being 5 tons nett.



FIG. 5.—ROPEWAY WORKING IN CONJUNCTION WITH STEAM SHOVEL.

By the introduction of a secondary snatch block, the load handled can be double this amount, although the lifting speed when handling a 10 ton load must obviously be only half that when dealing with 5 ton loads. The loads are automatically dumped at any desired point along the line and, worked in

this being the general practice adopted in the construction of dams, or where only a comparatively narrow width along the travelling length has to be served. Fig. 6 shows the tail mast of a radially arranged cableway operating in an iron-ore quarry in Spain.



FIG. 6.—TAIL MAST OF RADIAL CABLEWAY OPERATING IN IRON-ORE QUARRY IN SPAIN.

conjunction with an aerial ropeway, this operation is usually performed over grizzlies or direct into a hopper from which the buckets would be fed. Cableways are made with fixed masts, with the main mast fixed and the tail mast moving radially, or both masts of the entire plant can be made to move at right-angles to the central axis. A further modification is to allow one or other of the masts to luff in either direction,

The capacity of a cableway varies naturally with the length of travel and with the height from which the load has to be lifted, but taking an average length of 400 yards and assuming a lift of 70 ft., the capacity, with a 5 ton load, would be about 80 tons an hour operating from a point two-thirds of the distance from the discharge end. Working with a traversing speed of 800 ft. a minute and hoisting at 200 ft. the power

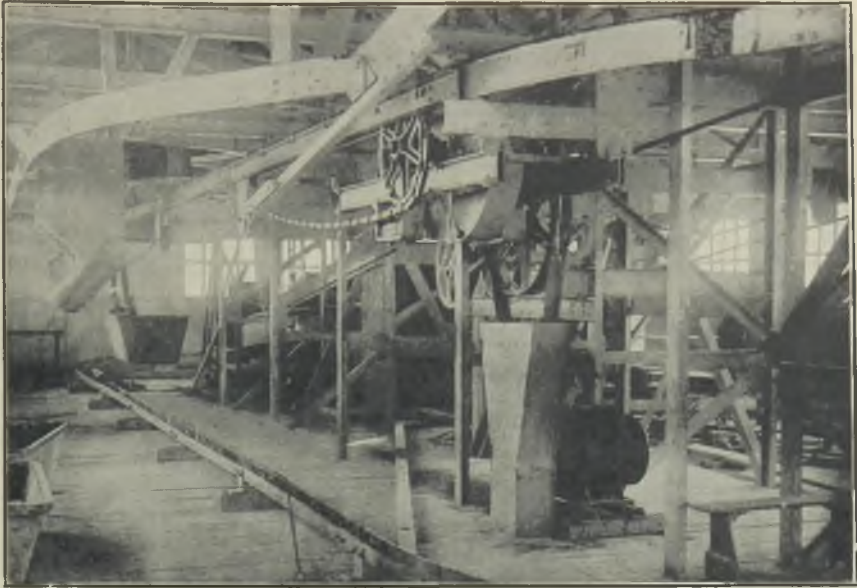


FIG. 7.—AUTOMATIC SHUNT RAIL.

required to operate under these conditions would be 80-100 b.h.p.

As with draglines, the cableway is essentially a one-man plant, but where the operating cabin cannot be installed in such a position as to give the engineman a free view over the plant to the loading point, a further hand is required for signalling purposes.

Among the many advantages accruing

from the introduction of a cableway for open-pit or mine work are :—

(a), that any point can be served without hindrance to the operation of loading by inclined roads, moving ropes and suchlike ;

(b), that any terrace or step in the pit can be attacked with equal ease ; and

(c), that the possibility of accidents due to trams running back on inclined planes is eliminated, and that the workmen can, as



FIG. 8.—LONG SPAN ON ROPEWAY IN FRANCE.

a rule, be kept in drier spots during wet weather than would otherwise be the case, as it is unnecessary to operate from the lowest point as when inclined planes are adopted.

The cost of operating a cableway varies from about $\frac{1}{2}$ d. per ton lifted and carried to $1\frac{1}{2}$ d. per ton, depending on loading arrangements, cost of power, and similar factors.

On a long and heavy capacity ropeway constructed some few years ago for dealing with the output of large quarries in France,

operations intimated in a previous paragraph this plant contains several automatic devices. At the loading terminal the buckets are arranged to run around a series of hoppers 100 ft. in length, and from which they are loaded through any of nine chutes. To accomplish this with the minimum of labour, the chutes are all electrically operated from one central point, while the buckets travel on a similar type of automatic rail to that used on the angles. Buckets are stopped for

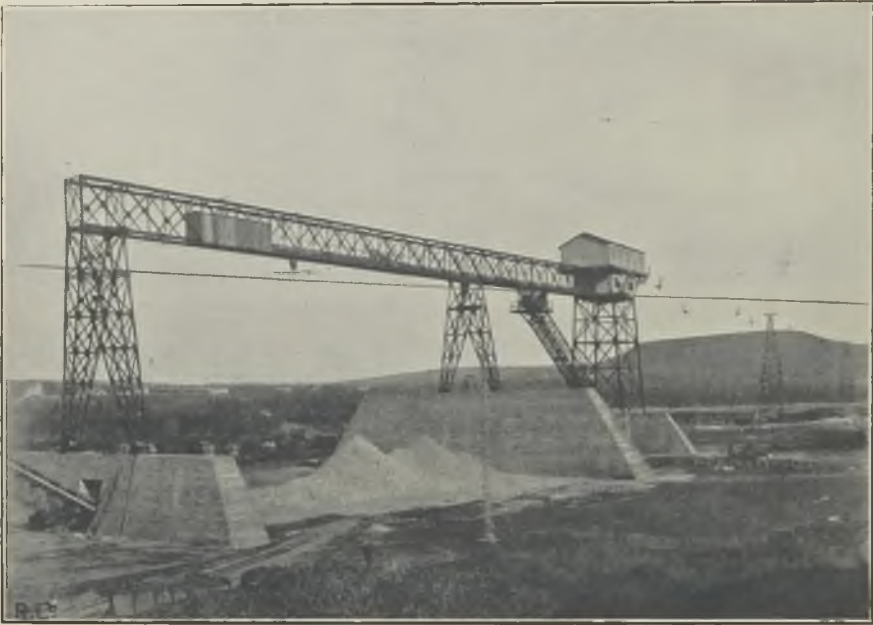


FIG. 9.—UNLOADING TERMINAL OF ROPEWAY. STOCK-PILE FORMED BY BELT AND THROW-OFF GEAR.

the route followed necessitated the introduction of several angles, and as some of these were of considerable length it was there deemed advisable to make these angles positively automatic by the introduction, on the straight portions of them, of a type of movable shunt rail, the curved portion of the shunt rail being graded to allow of the buckets running by their own momentum from one portion of the rail to the other. Fig. 7 shows this automatic rail, as it is called, and also a switch rail, which is used to load buckets when occasion requires, at this angle. This type of rail can be equally applied to a return terminal, so making the same entirely automatic.

This ropeway, which is illustrated in Fig. 8, is carrying limestone at the rate of 150 tons per hour, working 20 hours per day. Contrary to the usual practice for heavy mining

loading in front of any given chute by the operator dropping a forked stop in front of the carrier head. This retards the passage of the carrier while allowing the rail to continue travelling under the wheels of the carrier, which idly revolve until the stop is raised. By this means one man only is required to operate all the chutes, although one further attendant is required for spacing the buckets at the required intervals and sending them from the shunt rail on to the main rope. At the unloading end of this ropeway a large stock of limestone is formed by means of belt conveyors, the ropeway buckets tipping through a hopper chute on to the conveyor. Fig 9 shows such an arrangement.

Where only light capacities are required as, for example, in prospecting work, or in the initial projection stages of a mine, and the

distance over which ores or the like have to be conveyed is comparatively short, a "jig-back" or "to-and-fro" type of ropeway is generally the most economical means of transport. In these plants two carriers only are employed, one being fixed to the top and one to the bottom end of the same, and the plant is worked alternatively in opposite directions. Thus when one bucket is at the top end being loaded the other is at the unloading point being discharged, and

vice versa. As usually the mine is at a higher altitude than the point of discharge these ropeways are generally automatic in action and require no power. On account of their simplicity they are admirably fitted for work of a temporary nature as they can generally be taken down and re-erected on other sites without the necessity of re-designing the whole plant, and by means of a suitable tripping arrangement at the unloading end can be operated with only one attendant.

BOOK REVIEWS

An Outline of Metallurgical Practice.

By CARLE R. HAYWARD. Cloth, octavo, 612 pages, illustrated. Price 30s. London: The Library Press.

This book, as its title clearly indicates, covers the subject of metallurgical practice in outline and in an elementary manner. It is written with the object of providing a ready reference book on modern practice for engineers and also of giving a review of a subject with a wide literature for students who are taking a metallurgical course. As a summary for students it is a guide which can accompany them in their studies rather than a very elementary text-book of brief, general and simple descriptions. This gives the book a greater value than an ordinary elementary treatise, in spite of the fact that some parts—for example, the chapter on non-ferrous alloys—will not be understood without further reading or instruction.

The volume, which consists of about six hundred pages, and is divided into twenty-three chapters, embraces a very wide field. The longest chapter, of over one hundred and twenty pages, is on copper and in it certain operations common to many metals are described. Over one hundred pages are devoted to iron and steel, while lead and gold are each treated in about fifty pages. An excellent outline is given of each metal and the necessarily brief descriptions are supplemented by numerous illustrations. In the chapter on tin the illustrations are not of modern furnaces, but this is due to the almost entire lack of information about the details of present-day furnaces and smelting operations. With certain illustrations the student may require some assistance in order to understand them fully, and in all cases they require careful study if the full value is to be obtained from them. They will prove, however, most enlightening even to the

experienced engineer and metallurgist. The extraction of each metal is given in outline from the ore to the refined market product and this description concludes with the physical and mechanical properties of the metal. Under iron and steel, in addition to the well-known production processes, sections are devoted to iron foundry practice, the iron-carbon equilibrium diagram, heat-treatment of steel, and the working of steel. In all cases the matter has been most carefully selected and the descriptions, although short, are concise and clear. At the end of each chapter is a useful list of books and periodicals for supplementary reading.

The work fulfils in a highly satisfactory manner what it is designed to do, and the author is to be congratulated on having prepared such a useful volume. It can be strongly recommended as a reference book to engineers, metallurgists and chemists and as a most helpful outline of metallurgical processes to the student.

E. O. COURTMAN.

Economic Geology. By Dr. H. RIES. 6th edition. Cloth, octavo, 860 pages, illustrated. Price 30s. London: Chapman and Hall, and New York: John Wiley and Sons.

Dr. Heinrich Ries, Professor of Geology at Cornell University, Ithaca, New York, has prepared a sixth and revised edition of his well known work on "Economic Geology." Previous editions appeared in 1905, 1907, 1910, 1916, and 1925. The volume as now published is of almost exactly the same size as those of 1916 and 1925, the author's object having been "to bring the subject matter and statistics as nearly up to date as possible without materially increasing the size of the book."

This aim of preventing the work from becoming too large and expensive has been attained by omitting a good deal of the less

essential matter of former editions—e.g. the list of illustrations and plates, running to twelve pages—and substituting for it material of a more instructive character. Similarly, while the number of text figures and plates remains just as before—the majority being identical with those of earlier issues—a certain number of fresh ones are introduced, but only by substitution for older ones. Wherever possible, statistics of production and consumption, exports and imports, etc., have been brought up to 1927, or, in a few cases, even later; and the same is true of the references to literature, publications as late as 1929 being included in many instances. Thus, while no fundamental modification of the book in scope or structure has been essayed, an attempt has been made to bring it reasonably abreast of the times. This revision is reflected in the price, which has been raised from twenty-five to thirty shillings.

From the point of view of the student of mining and mining geology the book ranks among the most useful because of the variety of raw materials it deals with and of the judicious selection of the data given concerning them. The bibliography following the consideration of each mineral or metal is particularly valuable since it provides abundant references from which more detailed information may be obtained if necessary. The work is mainly descriptive. It does not set out with any introductory statement of underlying principles, but plunges at once into the consideration of the several geological materials with which it deals. It is divided into two parts, the first designated "Nonmetallics," the second "Ore-Deposits." Under the former title are included coal, petroleum and natural gas, water, building stones, clay, limes and cements, salines, gypsum, fertilizers, abrasives, and a number of lesser minerals, e.g. asbestos, graphite, precious stones, etc. The section on ore-deposits begins with an introductory chapter on occurrence and origin in general, and then proceeds to others dealing with the several metals, precious and useful, major and minor. The range covered is thus very wide, and a great deal of useful information is packed into the 860 pages of the volume.

The presentation is mainly from the American point of view, the bulk of the text and most of the figures relating to occurrences within the United States. Attention has been given, however, to many fields other

than American, notably those of Canada; but the student of European, Asiatic, African, Australasian, or South American centres of mining would generally require to consult other works for adequate information as to deposits in those continents. By way of illustration it may be mentioned that the copper deposits of Chile are dismissed in half-a-dozen lines, while those of Northern Rhodesia are not referred to at all. The silver-lead-zinc deposits of Bawdwin, Burma, are listed in the index under zinc only, and are given two lines of small print in the text stating that the "mines are looked upon by some as a coming great producer." The descriptions of the American fields, on the other hand, are good, and, for this reason at least, the book may be recommended to all who are interested in mineral deposits, but more especially to those who are seeking for epitomized and reliable information concerning the deposits of the United States.

C. GILBERT CULLIS.

The Economics of the Coal Industry.

By R. C. SMART. Cloth, octavo, 268 pages, illustrated. Price 12s. 6d. London: P. S. King and Son.

By an unfortunate oversight Mr. Smart claims to be a vice-president of the National Association of Colliery Managers which he is not. This results in people outside the industry attaching too much weight to his views and, what is just as unfortunate, provokes an outburst of resentment culminating in ridicule from within the industry itself. Mr. Smart is not lacking in courage to write upon so intricate a subject which few men of far wider experience would dare to tackle. He pulls his own industry to pieces and lashes it with severe and dogmatic criticism. His views seem a little biased against this country and this has resulted in some unfair criticisms. Some of his statements with regard to the comparison of wages paid to miners in Germany with those paid in this country are incorrect and operate unfairly against our industry. Wages in the Ruhr are lower and yet on page 160 he states "the costs of production (in Germany) are similar to good practice in this country." In his reference to the Polish coal industry it is stated that the costs of production are 30 to 40% less than in Great Britain, but he does not point out that the average wage rate is about 60% below that paid to British miners.

The book is divided into the following six chapters: Industrial Architecture; The British Coal Industry; The Domestic Market; The European Coal Industry; Partners in Industry; and Industrial Research Work.

On the whole the book is not objectionable, in fact it is advisable for every mining engineer and member of colliery boards of directors to give consideration to the truth contained in some of it. It is an attack on individualism, and no one can afford to ignore such a viewpoint. The author could, however, have couched his attack in such a manner that the industry would have been willing to consider the merits of his theories instead of justifiably resenting them.

K. NEVILLE MOSS.

Gmelins Handbuch der anorganischen Chemie: Eisen. Teil B, Lieferung 2, pp. 313-512. Paper covers, illustrated. Price 32 marks; to subscribers 25 marks. Berlin: Verlag Chemie.

Part B of the "Iron" volume of Gmelins Handbuch will, when completed, be a unique reference book on the chemistry of iron, because the subject is treated in it in greater detail than has ever been attempted before. It deals, however, only with the chemical compounds of iron. All data connected with the metallurgy of iron, e.g. the alloys and even "intermetallic" compounds such as carbides and tellurides, have been allotted to Part A.

The scope of the publication was described in a review of the first section of Part B, in the February issue of the *MAGAZINE*. The section now issued contains a full description of all the compounds of iron with bromine, iodine and sulphur (156 pages). There are a few short paragraphs on the "chemical" (as distinct from the "intermetallic") compounds of iron with selenium, tellurium and boron, and the remaining 33 pages are devoted to the iron carbonyls and ferrous carbonate. This part already extends to 512 pages, and only 11 elements have been dealt with. The remaining compounds will be described in forthcoming sections, which will appear at intervals of about a month.

M. S. FISHER.

LETTERS TO THE EDITOR

The Education of the Engineer

SIR,—I have read the article in the April issue with interest. For years I have held the view that, while the students at the Royal School of Mines received a splendid education in the technology of the various subjects dealt with, the atmosphere in which this training is received is distinctly disadvantageous to the student. I am not sure whether such is to be attributed to the teaching staff, to the students themselves, or to the fact that a high percentage of the latter come from a class where the incentive to make good is not nearly so strong as is the case among the students of many other training institutions where the poorer classes are drawn upon, but the fact remains that by far the majority of the men turned out seem to be imbued with the idea that being of British nationality they start off in competing for important positions with a very big advantage over men of other nationality.

I can best illustrate what I mean by contrasting what I term the atmosphere at the Royal School of Mines with that of some of the larger American mining schools. The latter draw on all classes for their students and young men are early imbued with the knowledge that on leaving the schools they will be subjected to keen competition in the search for positions of importance, and therefore it is not only necessary to obtain a very sound training on the technical side, but they must look forward to a period, long or short, in which they have got to get down to real hard work in order to demonstrate their fitness to fill a position of even moderate importance. Lots of these men, from their station in life, are well-fitted to accept and face the latter possibility with equanimity and start out with the knowledge that they have still to win their spurs.

I speak with years of experience, after having been responsible for the reception of a great number of post-graduates from the Royal School of Mines and finding in the vast majority of cases that the latter took on the task of gaining practical experience with the expectation of being put into something good within a very short period of their leaving the School. In a great number of instances the disillusionment of the idea that because they were British they were therefore much better than the foreigner meant so much by way of dis-

☛ Copies of the books, etc., mentioned under the heading "Book Reviews" can be obtained through the Technical Bookshop of *The Mining Magazine*, 724, Salisbury House, London, E.C.2.

NEWS LETTERS

JOHANNESBURG

April 2.

couragement as to cause them either to seek some other line or to be content with holding a very mediocre position; all incentive was lost and it was nobody's interest to attempt to arouse it again in them. The normal work of those in authority is sufficiently heavy to prevent managers from taking much interest in men who have lost almost all interest in themselves.

I may say that I formed these ideas very strongly many years ago in Australia and I have seen nothing in my experience since in London and in other parts of the world to cause me to change them; indeed, recent experience when we sought diligently for men of British nationality for two highly important and responsible positions without success and had to take Americans has gone far to strengthen my belief that there is something radically wrong in the training of the British mining engineer. I may not have put my finger on the trouble as above indicated, but I feel very strongly that there is something in my views.

I have not the least desire to belittle the work of the Royal School of Mines, realizing as I do that many eminent men have received their training there, and that the School does provide for teaching students in a very fine manner.

JOHN A. AGNEW.

49, Moorgate,
London, E.C. 2.
April 29.

Another Change

SIR,—The moderately-worded criticism on the proposed submergence and transference of the Institution of Mining and Metallurgy which appeared in your March issue will probably have been read with interest and mixed feelings by the majority of your mining engineer readers. Apparently we are, as it were, to dilute our identity and become one in a herd in return for advantages and benefits more imaginary than useful.

The edifice which is to be our shelter is a most imposing structure and no one will complain that those responsible lack ambition. Nevertheless most engineers will ask how does all this strengthen the status of their profession, and how does it meet the desire of members to see themselves once again housed in a building in the City.

H. C. BAYLDON.

Richmond, Surrey.
April 9.

Transvaal Platinum Metallurgy.—An article by Mr. W. J. Cayzer, published in the *South African Mining and Engineering Journal*, indicates that the Transvaal has recently made marked progress in platinum metallurgy. Until recently it had been held that the only practicable method of treating norite ores was by flotation concentration. Gravity methods were regarded as applicable merely for scavenging purposes, following after flotation. Last year, however, the Waterval (Rustenburg) Company created some surprise by tackling oxidized norite ore with gravity methods alone. There was, in some quarters, considerable doubt as to whether the anticipated extraction of 50% would be realized. In the course of a few months, however, it was proved that such an extraction could be regularly secured on a commercial scale. It has since been found that similar results are possible with sulphide ores and that quite half the platinum group content of either type of norite ore, or of pyroxenite ores, can readily and cheaply be obtained in the form of "metallics." The outstanding step to this achievement has been the development of the shaking corduroy table, a small and cheap appliance with a high tonnage capacity, capable of handling a pulp containing as much as 50% solids. The product which this table turns out, when finally dressed and cleaned up with acid, is the most desirable end-product for shipment to refiners, for in addition to containing upwards of 60% of platinum group metallics and being suitable for transmission by parcels post at quite a low cost, it is so cheaply produced. Cost per oz. of platinum, in this form, is a question of grade of the original ore, but there is reason to expect that on the average grade of Rustenburg ore the figure will be at least in the neighbourhood of £4, and possibly less. Gravity concentration, as a result, moves up into the position of primary process and will now be followed by flotation. In the latter process, considerable changes have also taken place, as the result of which the bulk of the concentrates produced, instead of being in the neighbourhood of 5% of the original ore, can now be reduced

to less than $\frac{1}{10}$ of this amount. Although half the precious metal contents will have been removed in the gravity section, the value per ton of the final flotation will be very much greater than hitherto allowed for, and this puts the final extraction problem in a new light. The same journal says "The chlorination process, the result of extremely able and successful local metallurgical research, is now to be called upon to treat a very much smaller tonnage of much richer material. It is as yet not possible to say whether this is likely to introduce any special problem, or whether it may influence the economics of the process, favourably or otherwise. Assuming, however, that chlorination is the process in use, as will be the case as far as our leading platinum enterprise is concerned, there is reason to expect that the average cost of platinum for Rustenburg ores, as delivered to refiners overseas, will not exceed £6 per ounce." My own information indicates that the Potgietersrust Platinums Company's average costs will probably not exceed £5 per oz.

Rand's Low-grade Ore Problem.—An interesting debate has taken place in Parliament on a motion moved by Sir Robert Kotze, late Government Mining Engineer, for the appointment of a select committee to report on the question of working the lower-grade ore of the Rand. Sir Robert, in the course of his speech, mentioned some striking facts and figures. He said that there were 440,000,000 tons of ore containing between $4\frac{1}{2}$ and $3\frac{1}{2}$ dwt. of gold per ton lying fallow. If they could reduce the working costs by 1s. a ton they could bring a tremendous amount of that ore into payable range. They would be able to work a further $3\frac{1}{2}$ million tons of ore every year, and to employ 20,000 white people and 100,000 natives. In addition, the State would derive £400,000 a year and the railways and harbours a little more. If the costs were reduced by 2s. a ton those figures would be doubled, and if by 4s. a ton, they would be quadrupled. Those figures showed what tremendous resources were lying neglected on their very doorstep. He did not propose now to suggest a remedy. That stage would be reached when the select committee was appointed, and he would then put forward his suggestions. The debate resulted in the adoption of an amendment to the effect that the time had arrived for the Government to appoint a commission to inquire into the

position of the low-grade mines. It was announced by the Minister of Justice, in the absence of the Minister of Mines, that the Government considers that the appointment of a select committee at the present time would serve no good purpose. The question of the low-grade mines has already been fully investigated and a select committee would probably not be able to advance the position any further. The Government, however, is prepared to conduct a thorough investigation into the whole position and is considering the appointment of a commission or a departmental committee to go into the matter. In this connexion the Government will consult its technical advisers, and the views of the gold mining industry will be ascertained before a decision is taken.

Geological Survey.—At the annual meeting of the Geological Society of South Africa, Dr. Leopold Reinecke, the retiring president, deplored the poor support given by the Government to the Union Geologists and dwelt on the need of further geological survey of the country. "At the present time," he said, "only one-half of the area of the Union has been mapped geologically and much of that had to be done very rapidly, that is at the rate of 3,000 square miles a year. The reason for this is that the Geological Survey receives an appropriation, including salaries, of about £12,000 a year as against a direct annual income to the country of between five and six million pounds from mining. A further reason for the discrepancy is that technical men in the mining industry do not realize the value of such work, and do not draw the attention of the Government to the necessity of having it done. With a Geological Survey adequately supplied with funds, it would be possible to push this important work ahead, to furnish the necessary technical assistance to industry in the way of surveys of structural materials and other non-metallic minerals, and to commence topographic surveys of important areas." Dr. E. T. Mellor, Consulting Geologist to the Central Mining-Rand Mines Group, was, however, inclined to take a more optimistic view of the situation than Dr. Reinecke, and said there had been a considerable improvement in the outlook before the geologist. He also referred to the 60 geologists working in surveying Northern Rhodesia, and described this as the greatest piece of geological work undertaken in any country.

Recovering Gold from Dumps.—It is reported that one of the Rand's metallurgists has evolved a new process for recovering gold from the tailings dumps, and that some of the big houses are watching tests which are taking place at some of these dumps. It is estimated that the Witwatersrand's 60 miles of dumps contain something like £100,000,000 worth of gold. The new method of recovery is a sulphur cyanide process, and while the inventor estimates conservatively only a 30% recovery basis, he is, nevertheless, personally convinced that the actual recovery will be between 50% and 60%. A local syndicate has taken charge of the invention by arrangement with the inventor, and it is said that independent assay reports indicate an extraction of from 30% to 50% for the method. The syndicate proposes to have six plants working shortly and treating from 250,000 to 300,000 tons monthly. The results will be watched with widespread interest. So far, it is claimed, all the laboratory tests are greatly in its favour, but how it will work out on a large scale is the question which is interesting metallurgical authorities at the moment.

Radio-active Ores.—Samples of radio-active ore from a recently discovered deposit in Gordonia, Cape Province, have been tested by one of South Africa's leading experts. It is stated that the samples have proved under test to be more strongly radio-active than any pitchblende yet discovered in the Union or South-West Africa. Prospectors are at present developing test pits along 16 miles of the new reef, which extends along the northern foot of the Noap Hills from Aries Kop to Narugas. These hills lie 10 miles to the north of the Orange River and in the angle which the river makes with the border of South-West Africa. It is admitted that the samples sent to Capetown and Johannesburg for analysis may not be representative of the whole or even part of the pitchblende deposit, but the geologists and prospectors now on the spot will soon be able to present an authoritative statement. For the past five years there have been small finds of radio-active uranium oxide round Cyndas, 30 miles north of Kakamas. A mine was developed in the neighbourhood, but the pitchblende recovered, it is stated, showed low radio-activity.

Rhodesia Vanadium.—It is announced that the Rhodesia Broken Hill Development Co. has decided to proceed with the erection and operation of the ferro-vanadium plant

which was embodied in the original scheme of equipment and production. The experimental work done by the pilot plant resulted in the successful development of methods, since covered by patents, for precipitating the vanadium in the ore, and producing a high-grade vanadium product, suitable for treatment in the electric furnace for the production of ferro-vanadium. It is expected that the ferro-vanadium to be produced from the new plant will contain from 30 to 40% vanadium metal, and much less than the usually specified limits of such impurities as sulphur and phosphorus. The annual output is estimated to reach 630 tons of ferro-vanadium.

BRISBANE

March 17.

Queensland Mining Industry.—The mining industry of Queensland, like that of other of the Australian States, has, from various causes, been declining for a number of years. Between 1918 and 1928 the value of the mineral output dropped from nearly £3,750,000 to £1,387,000. About a year ago the Government appointed a Royal Commission to inquire into the state of the industry generally, and to advise as to the best means of resuscitating it. This commission has now made its report. It is recognized, as was emphasized by a number of witnesses who gave evidence, that a revival of mining must depend on operations upon large low-grade deposits, worked by economical methods on an extensive scale, such as is being done at present at Mount Isa. In the opinion of the commission, there are mineral deposits in Queensland already known, and probably more that will be discovered of a scale and grade suitable to attract the capital necessary for their development. This means the expenditure of large sums of money, the bulk of which, as in the case of the Mount Isa mines, must come from overseas, and the commission has made a number of recommendations specially intended to attract such capital. Special stress is laid on the necessity of substantially relieving the industry from the existing harassing taxation, on which many witnesses held very pronounced views. Other changes in the law urged are in the direction of making the taking up and holding of mineral leases easier, simpler, and less expensive; while it is suggested that labour conditions attached to such

leases should be relaxed and contract work encouraged. The working hours recommended for men engaged in the industry are 44 a week for underground and 48 for surface work. There is also an important recommendation regarding the Queensland Geological Survey, which has been admittedly very much under-staffed for years. This recommendation involves the appointment of a Director of the Survey, directly responsible to the Minister, and the reinforcement of the survey staff to a sufficient extent to enable it to undertake a systematic geological survey of the State as well as special geological work relating to mining, water supply, and prospecting for new ore-deposits. The personnel of the commission includes such experts as Mr. A. A. Boyd, M.I.M.M., for many years General Manager of the old Mount Morgan Company and also connected with the present one; Dr. H. C. Richards, Professor of Geology and Mineralogy in the University of Queensland; and Mr. C. F. N. Jackson, B.E., M.I.C.E., State Mining Engineer, with a member of the Board of Trade and Arbitration, Mr. T. A. Ferry, as chairman.

The Coal Stoppage.—Yet another stage has been reached in what, it is hoped, will be the beginning of the end of the disastrous coal stoppage in New South Wales, which has now lasted over a year. Once more, a conference was called between colliery owners and representatives of the mining unions, but this body broke up a few hours after it met, because the unionist members would not listen to any proposal for a reduction of wages, which the owners say is necessary. Following on the conference, however, an announcement has been made to the effect that the Northern Collieries Association, the mines of which are those involved, has decided to offer work to former employees in all their mines. This offer is on the terms of the compromise agreed to by the owners and miners' representatives at a conference held in November, but afterwards refused by different unions when submitted to them. These terms involved a reduction of 9d. a ton, instead of 1s. originally asked for, in the collective rate of pay to the miners. It is said that if members of the Miners' Federation do not respond to the call, which was made a few days ago, steps will be taken to man the mines with free labour. Representatives of the combined coal miners' unions asserted that the men were determined to stand

firm to resist any wage reduction, but there are indications that this would not be the case if there were signs of any of the collieries being re-opened, either by unionist or free labour. By March 14 sufficient labour had been offered to make possible one or two of the larger mines to start work, while the most significant result of the call for labour has been that most of the mine deputies unconditionally applied for work. An event of the past month has been the sudden death of Mr. John Brown, the coal mining millionaire, who, it was believed, had arranged to re-open the Richmond Main, one of the largest collieries in the Northern district. It is now stated that his plans will be carried out by Mr. Armstrong, a relative, who has managed the J. & A. Brown interests for many years. The latest information, published to-day, is that, although it is not admitted by officials of the Miners' Federation, it is said to be beyond doubt that throughout the Northern fields the response by members of that federation to the coal owners' call for labour is already 25%, and that several collieries, including the Richmond Main and Pelew Main, owned by the John Brown interest, are assured of sufficient labour to ensure their re-opening. It is expected that the two mines named, which are capable of producing 6,000 tons of coal a day, will be the first to open, and the owners feel satisfied that they will shortly be able to work the mines to their full capacity.

Mount Isa Mines.—All anxiety as to the water supply at the Mount Isa mines was removed by a copious downfall of rain in February. In the north-western parts of Queensland, where these mines are situated, rainfall in any quantity can only be looked for in what is known as the wet season, which usually comes, if at all, in January or February. Early last year heavy rain occurred at Cloncurry, which is less than 70 miles in a direct line east of Mount Isa, but practically missed the latter place and the new dam at Rifle Creek, which was then finished, only caught a small quantity of water. This year, however, flood rains have occurred over practically all of the dry areas of north-west Queensland, as well as in other parts of the State, and the Rifle Creek dam is nearly full. This reservoir, with an estimated capacity of 1,400,000,000 gallons, is calculated to store enough water to last for three years or more. The quantity at present in the dam is about 960,000,000

gallons, but, besides this source of supply, there are already a number of artesian wells which are supplying quantities of water sufficient to meet present needs at the mines. The boring of additional wells is also in progress. So copious has been the rain that the flood waters washed away a railway bridge between Cloncurry and Mount Isa and for a few days the people at the latter place suffered from a shortage of food. The break in the railway has also caused a shortage of coal on the mining field and as a consequence work at the mine had to be stopped for two or three weeks.

A second mishap, more serious than the first, has since occurred on the Cloncurry railway which will probably cause more delay at Mount Isa. This was the collapse, following on floods, of a bridge over Eastern Creek, causing a serious break on the main railroad about 70 miles east of Cloncurry. There has also been further rain at Mount Isa, causing the Leichhardt River, on the western bank of which the mines are situated, to rise higher, and probably filling the Rifle Creek dam, 20 miles up the river, to overflowing. Mr. Frank Hambridge, of Sydney, a director of the Mount Isa Mines, Ltd., and representative in Australia of the Mining Trust, Ltd., has lately visited Mount Isa, and has now gone on to New Guinea in connection with the Mining Trust's interests there. He returned to Brisbane before the accident to the Eastern Creek bridge, and said even then that the railage and other unforeseen delays would make it impossible to start production in August, as it had been expected to do according to the original programme. Mr. Hambridge stated that the mines had encountered enormously increased quantities of water, and that, pending the installation of additional pumps and power, progress in mining work had not been so rapid as anticipated. A feature of the water coming from the mine is its remarkable purity—probably purer than that of any city in Australia. The laying of the pipe-line from the mine to the Rifle Creek dam has now been carried a distance of over 14 miles, and the work is expected to be finished in May. The four-weekly report of the Superintendent at Mount Isa (Mr. G. J. Gray), for the period ended February 22, states that, owing to the dislocation of the railway service and consequent shortage of coal, operations had been suspended till March 16. In the air shaft (No. 46) water was making at the rate of

15,000 gallons per hour, and had retarded progress. In the diamond drilling campaign, No 11a borehole had been deepened 123 ft. to a total of 906 ft. in shale, with pyrites veins and bands of ore. Core assay averages were as follows:—

	Lead.	Zinc.	Silver.
	%	%	oz. per ton.
From 677-737 ft. .	6·3	6·1	2·6
From 807-822 ft. .	7·9	17·8	2·8
From 842-857 ft. .	19·3	19·3	9·6

Progress in mill, smelter and power house construction included the erection of 94 tons of steel-work and sheeting in the crushing plant, 430 tons to date in storage bins, 66 tons in the Dwight-Lloyd plant, and 482 tons to date in the power house. Further progress has also been made in the erection of the No. 6 Genter thickener and Symons crusher, while the foundations for the Hardinge mill have been finished.

The Mining Trust at Lawn Hills.—

With regard to the concession held by the Mining Trust at Lawn Hills, in the Burke district of Queensland, the field is now being rapidly surveyed by the geological party sent out by the Trust. Last month the first diamond drill to be used for prospecting purposes was despatched from Mount Isa, which is about 200 miles south of Lawn Hills and this month two more are on their way to the field. With these three drills at work it is expected to have some interesting results by the middle of the year. The road between Mount Isa and the new concession is passable in dry weather, which usually prevails the greater part, and sometimes the whole, of the year.

Oil Prospecting.—The Federal Government decided early this year to alter its scheme for assisting oil prospecting in Australia. Instead of subsidizing deep drilling, as heretofore, it is intended from the beginning of the next financial year to grant subsidies to assist in conducting geological surveys and scout boring in approved areas—preliminary operations which are regarded as necessary to precede deep drilling. The Federal Government will also send the Commonwealth Geological Adviser (Dr W. G. Woolnough) to America, to study conditions and methods on the principal oilfields of that country. The geologist was in Queensland earlier in the year, and is expected shortly to give a report on oil developments there. There are at present 10 companies operating on 12 oil prospecting

bores in Queensland. Eight months ago the number of the companies so at work was 19 and 21 wells were being sunk. Although the Government has been taking steps to cancel prospecting permits where operations are not in progress in accordance with the conditions of those permits, there are still 305 nominally in force—only 97 less than in July last. The companies which have ceased working have done so either through their wells having reached bedrock or for financial reasons. A number of the bores sunk have shown indications of oil, but in no case has it yet been found in commercial quantity. Dr. Woolnough, however, considers that ultimate success is assured—presumably if sufficient money can be found to continue the search. He is also of opinion that prospects for oil are promising in Western Australia. With regard to oil prospects in Papua, Dr. Woolnough says that investigations in the Mandated Territory have led to negative results, but that surveys suggest that much more favourable structures exist in the neighbourhood of the Dutch border.

Geophysics in Tasmania.—The Imperial Geophysical Survey Committee recently carried out certain tests in the Dundas district of Tasmania. This has been followed by development work by the department, and the result has borne out what the tests indicated. The development work was done at places marked by geophysical survey officers, with results that have shown the accuracy of the surveys and the suitability of the various types of instruments used. In this work there were discovered four copper-nickel ore-bodies, all of which gave promise of economic importance. While there were no outcrops of the ore-bodies on the surface, the survey indicated that they would be found, and at a shallow depth.

Minerals in Central Australia.—Last year there was reported a find of minerals at Jervois Range, in Central Australia. First accounts, which were almost of a sensational character, were soon afterward discounted, but a later report indicated that the country is rich in copper and silver-lead ore. A company is now being formed in Sydney to exploit the find.

Gold Mining in Western Australia.—Progress in connexion with the application of a combination of the flotation and roasting methods for the economical winning of gold on a large scale at the Wiluna and Lake View and Star Mines, Western Australia, is being watched with much interest. These two

mines are spending £60,000 a month on development work. All preliminary operations are expected to be finished by next year, when, as a result, it is reckoned that the annual output of gold in the State will be increased from about £2,000,000 to £4,000,000. Wiluna Gold Mines, Ltd., has a capital of £1,000,000, and already has spent £750,000 in development work. The State Government has also built a railway to the mine at a cost of £450,000.

Effect of Low Metal Prices.—The continued decline in the London market for lead, silver, and zinc is causing anxiety as to its effect on the principal mines producing these metals in Australia. Particularly is this the case with regard to some of the mining companies at Broken Hill, New South Wales. The Broken Hill Pty. Co. has already warned its staff that, unless there is a substantial rise in the price of metals before September 1, the mine will have to be closed on that date. For the Broken Hill Block 14 the position is also said to be serious, but the company has not yet reached a decision to suspend work. After having been closed for two years, these mines re-opened towards the end of 1929, when lead was at a profitable figure. It is understood that the agreement entered into by these two companies for their ore to be treated at the Central mill of the Sulphide Corporation, Ltd., expires on September 1 next. Low working costs and the use of the newest methods, however, place the North Broken Hill, South Broken Hill and the Zinc Corporation, as well as the Sulphide Corporation, out of the present danger of closure.

IPOH

March 15.

F.M.S. Mining.—The heavy fall in the price of tin since the beginning of the present month is causing anxiety to many of those working open-cast mines with gravel pumps. For some of these the limit has been approached below which it is not possible to work profitably, and restriction has not had time to show beneficial results. Referring first to the monthly bulletin of statistics for January we find it recorded that the decrease from all mines restricting was pikuls 6,161 or nearly 367 tons; but the total production was still considerably above that for the corresponding month in either of the two previous years. From

other local compilations it appears that the F.M.S. production for February shows a decrease of 1,360 tons, indicating the now appreciable effect of restriction. The Tin Producers Association have estimated that restriction already assures a reduction of at least 24,000 tons in world output. If the other weak factors in the market position have now been fully discounted, it seems reasonable to expect that the price of the metal may soon harden, but the situation is not yet clear.

It may be well to remember that there is a beneficial side to afflictions such as the present. Sanely financed undertakings and genuine professional work suffer less than the products of stunt finance and interested reports. In valuation of mineral properties great injury may be done by mere slackness without fraudulent intention, but the responsibility remains on the valuer. It would save not a few of the unwary from trouble if the precaution were taken to require the data on which a valuation is based or a sufficient summary of them, to be submitted in due course, so as clearly to demonstrate that the price or opinion given is not a mere guess or statement but a reasonably founded judgment.

Costs.—In the F.M.S. it is difficult to determine the real nett working costs and profits of most Chinese managed mines. Their methods make it so, and there are indirect sources of profit such that in the past it has been said that the adventurers consistently made money in cases where the proceeds of ore sold would by themselves have shown losses.

Mining Plant.—In view of the conditions of work in Great Britain the large proportion of American plant, other than electrical, in use on this mining field is worthy the most serious consideration by British makers. There is also recently an increasing use of prime movers manufactured on the Continent. The reasons for the large proportion of foreign plant seem to be failure by British makers to suit the particular needs of this mining field and difficulty in getting spares.

There is often need of centrifugal pumps for use against total heads of say 150 to 200 ft. and capable of dealing with water often containing much fine silt and even sand. Easy and quick access to all wearing parts is essential, it is often necessary that renewals of wearing parts must be done by Asiatics very urgently and without European supervision or assistance. Workshops with

power driven machine tools are only to be found on the larger installations and in centres of industry. The most familiar type of pump on the field is the "gravel pump" which, with all its liners and spares, can be turned out by many of the local foundries; and these are largely used in pumping water containing nothing coarser than sand, for which they are very inefficient, and they have to be used in successive lifts for many of the deeper workings.

VANCOUVER

April 10.

Britannia Beach.—The Howe Sound Company, the holding company for the Britannia Mining and Smelting Company, made a record production from both its British Columbia and Mexican properties in 1929, and wound up the year with the handsome surplus of \$14,269,339. The balance shows assets amounting to \$20,194,768, of which \$8,330,875 are current chiefly in Canadian and United States bonds, and \$11,449,199 in mines, mineral claims, water-power rights, and plant, buildings and machinery at cost less reserve for depreciation of \$4,612,341. The company's net earnings for the year were \$3,662,475, of which \$2,480,190 was disbursed in dividends and bonuses. The metal production was 14,252 oz. gold, 2,973,016 oz. silver, 43,032,641 lb. copper, 75,276,511 lb. lead, and 53,455,920 lb. zinc. The whole of the gold and copper and about 212,000 oz. of the silver came from the Britannia mine. The value of the total production was \$16,346,100; mining cost was \$3,745,020; transport, \$482,428; milling, \$1,109,739; marketing, \$6,158,568; and administration, \$200,400. The Britannia mill treated 1,928,159 tons, despite a shortage of power in December owing to the prolonged drought which necessitated curtailment. Notwithstanding record productions at both British Columbia and Mexican properties, more new ore was developed than reserve ore extracted, and the indications at properties in both countries are that the reserve will be still further increased during the current year. Explorations at the Britannia mine below the 2,700 ft. level, the present bottom mining tunnel, has not yet advanced sufficiently to determine whether or not the 4,100 ft. haulage tunnel shall be extended into or under, as the case may be, some of the

chief ore zones, but it is expected that a decision will be reached during the current year.

Portland Canal.—Despite the decrease in the price of silver, the Premier Gold Mining Company was able to pay its customary dividend of 6%, covering operations for the first quarter of this year. The dividend brought the company's total disbursement up to \$14,563,117 in a period of 10¼ years. The company's annual report for 1929, which recently has been issued, states that 266,972 tons of ore, assaying 9.37 oz. gold and 9.1 oz. silver per ton, was mined, and that at the end of the year the combined

development in other parts of the mine were fairly successful, considering the few remaining favourable areas to be explored. Several new stopes of moderate extent were opened up, more particularly on the foot-wall side of what was the main ore-body. Operating expense was reduced from \$3.39 per ton in 1928 to \$3.20, but unfortunately this saving was more than lost by the reduction in the grade of the ore from 0.48 oz. gold and 9.45 oz. silver per ton in 1928 to 0.37 oz. gold and 9.10 oz. silver. The ore reserve at the end of the year was estimated at 303,172 tons, averaging 0.34 oz. gold and 9.95 oz. silver, broken in stopes and 115,864 tons, averaging



GLORY-HOLING AT BRITANNIA MINE, B.C.

broken and unbroken ore reserve was 37,167 tons less than at the end of 1928. This means that 229,805 tons of new ore was developed, which compares favourably with the exploration work in 1928 when 97,477 tons of new ore was developed and 275,811 tons of ore was extracted. By extending No. 5 level a body of ore averaging 10 ft. in width was opened for a length of 80 ft., and as this ore gave indications of persisting below the level, No. 6 level has been, and is being, extended, but so far only sporadic bodies too small to be stoped economically have been found. Drilling, cross-cutting, and diamond drilling are being continued and it is possible a minable body of ore may yet be found on this level. Exploration and

0.43 oz. gold and 9.61 oz. silver, of assured and probable ore down to No. 6 level. The total reserve at the end of 1929 was 419,036 tons valued at present metal prices at \$11.24 per ton, which compares with a reserve of 456,203 tons, containing 0.41 oz. gold and 11.88 oz. silver at the end of 1928. Development was continued throughout the year at the company's Prosperity mine, and during November and December 1,584 tons, averaging 0.02 oz. gold, and 69.28 oz. silver, was shipped at a profit of \$10,727. This profit was not included in Premier earnings, but credited to Prosperity development fund. Up to the end of last December the company had spent \$232,871 on the development and equipment of the Prosperity group. This

amount is to be repaid to the Premier company plus 6% interest out of the first earnings, after which the company will receive 76% of the earnings and the Prosperity syndicate will receive the remaining 24%. From now, shipments at the rate of rather more than 1,000 tons monthly may be expected from the Prosperity mine. During the year 2,213 ft. of development driving was done, but only a small additional ore-body was found. Owing to the small sizes and irregular shapes of the several ore-bodies it has been impossible as yet to make an estimate of the amount and value of ore reserve. On the Porter-Idaho property 1,316 ft. of driving, rising, and cross-cutting was done, with disappointing results. Development during the current year may be expected to determine whether or not any substantial tonnage can be developed in the mine. Development on the Silverado property was disappointing. The cross-cut tunnel was extended 636 ft., and several shear zones containing no commercial ore were cut. Driving on what is believed to be the downward continuation of No. 1 level vein, a few bunches of lead ore were found in which the low ratio of silver to lead indicated that the horizon was too low to expect commercial ore. A rise was put up 200 ft. and a drive was run 450 ft. showing better mineralization but below commercial grade. The rise was extended on the vein 145 ft. and No. 1 level, 205 ft. below the surface, was driven 148 ft. without finding commercial ore; the rise was, therefore, put up another 100 ft., and a drive at this point disclosed low-grade ore of narrow width. The first commercial ore was found at 145 ft. below the surface, the vein, however, is only 2.2 ft. wide. The rise will be continued to the surface, but development shows that values diminish so rapidly with depth that the probability of finding an important tonnage of commercial ore is small. Since the report was written development has been stopped. During the year the Premier company had considerable correspondence with the chairman of Selukwe Gold Mining and Finance Company in an endeavour to arrange some basis whereby the Premier company's personnel and plant can be used to operate B.C. Silver Mines property, adjoining the Premier mine on the north, but so far no basis acceptable to Selukwe and at the same time beneficial to Premier has been reached. Selukwe controls B.C. Silver Mines and Premier holds approximately 38% of the

stock in it and is desirous of realizing on its investment.

It is rumoured that negotiations are under way between the Premier company and the Buena Vista Mining Company for the former to treat the ore from the Big Missouri mine. The Consolidated Mining and Smelting Company of Canada holds 53% of the stock in the Buena Vista Mining Company and the Big Missouri Mining Company holds the remainder. In the recently issued annual report of the Consolidated company, the president, Mr. J. J. Warren, states that the Big Missouri is one of the most promising prospects that his company has under development and adds: "Exploratory work indicates the existence of considerable quantities of commercial ore over minable widths, but more work must be done before the extent of the ore-bodies can be definitely gauged and a policy of permanent equipment for the property determined. It is probable that a small concentrating plant will be installed on the property this year in order to sample the ore-bodies accurately, as hand sampling cannot be relied on because of the erratic deposition of the metals." During last year Consolidated advanced \$127,000 for development on the Big Missouri, and bonds of Buena Vista for that amount are being issued in Consolidated's favour. It seems not unlikely that Premier could be induced to become interested in Buena Vista on some form of ore-treatment basis, especially if it fails to reach an agreement with Selukwe for the operation of B.C. Silver.

Consolidated Mining and Smelting Report.—The annual report of the Consolidated Mining and Smelting Company of Canada for 1929 shows the company to be in an exceedingly prosperous condition, with liquid assets amounting to \$14,989,266, \$13,767,657 invested in mines, mineral claims, and shares in other companies after providing for depletion, \$14,633,481 in mining, smelting, refining, and concentrating plant after providing for depreciation, \$5,507,141 in ores, metals, and smelter products on hand and in transit, and \$3,969,007 in stocks. After providing for current development, depletion of property, depreciation of plant, fire insurance reserve, and employees' pension fund, the company made a net operating profit of \$10,129,339, which compares with a profit, similarly computed, of \$10,341,162 in 1928. Capital expenditure, amounting to \$6,121,183, was unusually large and indicates the expansion

of operations in several directions, and the co-operation of the company with other large concerns in developing mines and mineral lands in Canada and the United States. Additions to the Sullivan mill cost \$1,001,206, and additions and extensions at the smelter \$2,868,121. The company has joined Ventures in acquiring an 11% interest in a large copper refinery under construction at Sudbury, Ontario, by the International Nickel Company and the American Metal Company. Negotiations for the erection of an electrolytic zinc plant in co-operation with Ventures in eastern Canada are still in progress. In view of the association with International Nickel, 10,000 shares in its stock has been acquired. The 110,000 £1 shares in Henry Gardner & Company have been exchanged for 176,000 £1 shares in Amalgamated Metals. The directors have authorized an additional sulphuric acid plant of 335 tons daily capacity and an ammonia plant of 47 tons at an estimated cost of \$7,500,000. To preserve the company's strong treasury position, which otherwise would be weakened by this heavy outlay, the directors recommend making a stock issue of one share for every 20 now outstanding, and the shareholders will be asked to sanction this issue at the coming general meeting. The authorized capital of the company is 600,000 shares at \$25 par, of which 510,048 have been issued, so the new issue will consist of 25,502 shares, and there still are 89,952 old shares in the treasury. The report does not state at what price the new shares will be issued. The present market quotation is around \$250, or 10 times their par value. The shareholders will be asked to ratify the appointment of Mr. W. M. Archibald, vice-president in charge of mines, Mr. T. W. Bingay, vice-president in charge of finance, and Mr. W. S. Rugh, vice-president in charge of sales, and an increase in the number of directors from 11 to 14. Subject to such ratification the board has invited the Hon. R. R. Bruce, Lieutenant-Governor of British Columbia; Mr. A. C. Flumbefelt, of Victoria; and Mr. Blake Wilson, of Vancouver, to join the board, and all have accepted.

Boundary.—The little group of small mines on Wallace Mountain, near Beaverdell, on the Kettle Valley Railway, are able to maintain production, despite the drop in the price of silver. A recent shipment of 52 tons from the Highland Lass brought a smelter return of 1,732 oz. gold, 19,236

oz. of silver, and 12,471 lb. of lead, and netted the syndicate which owns the property \$142.84 per ton after freight and treatment charges had been paid. The ore contained also 12.6% of zinc, but this was not paid for. Recently, the Kelowna syndicate, which owns the Highland Lass, bought the Bell mine for, it is understood, \$200,000, of which 10% was cash. The Bell has been operated steadily for 15 years and is said to have yielded a profit of \$50,000 to \$80,000 yearly to Mr. Duncan McIntosh and his various partners. The Wellington also is shipping steadily. The ore from all the mines on Wallace Mountain is shipped directly without any dressing and little sorting. There is little waste. Some of the ore shipped from the Bell and Sally mines has carried more than 650 oz. of silver per ton.

TORONTO

April 17.

Sudbury District.—The mining activities of this field will be greatly stimulated by an arrangement which the Provincial Hydro-Electric Power Commission has entered into with the Abitibi Power and Paper Company for securing an adequate supply of power. The Abitibi Company will commence development-work estimated to cost \$23,000,000 on the Abitibi River 65 miles from Cochrane and the Commission contracts to take 100,000 h.p. of the power for a term of 40 years and will expend \$3,500,000 in the construction of a transmission line to Sudbury where it will be available to mining companies and others at an annual rate of \$22 per h.p. The work is expected to be completed for the delivery of power before the close of 1931. The companies more especially benefited will be International Nickel, Falconbridge, and Sudbury Basin, and many enterprises now in abeyance will become economically possible. The new smelter of the Falconbridge is operating satisfactorily and is treating an average of 275 tons of ore daily. The matte produced averages approximately 24% copper, and 54% nickel and shipments are being made to the company's nickel refinery at Kristiansand, Norway. Exploration work is being continued by diamond drilling to ascertain mineralized conditions below the 1,000 ft. horizon. During the winter the Towagmac Exploration Company brought in over the ice the heavy material and equipment for the 50 ton concentrator

on its Lake Geneva property, work on which will be started as soon as weather permits. Power will be supplied by a motor-driven Diesel engine. Diamond drilling by the Sudbury Offsets has indicated a considerable extension of its known ore-bodies, holes put down in a new section having cut 28 ft. of good copper-nickel ore. McVittie-Graham has taken over the Sultana property under option and will undertake an expensive campaign of diamond drilling. Other companies which are conducting explorations are Copper Zinc Mines of Sudbury Ltd., Walmur Copper-Nickel Mines Ltd., Delta Mines Syndicate, and Nickel Hill.

Porcupine.—The production of bullion from the gold mines of this field during March was valued at \$1,464,947, as compared with \$1,589,601 in March, 1929. The annual report of the Hollinger Consolidated for 1929 indicates that the company occupies a strong position. During the year the mill treated 1,549,157 tons of ore averaging \$6.33 per ton, with a net recovery of \$9,433,767, as compared with \$10,712,821 from 1,778,470 tons in 1928. Net operating profits amounted to \$3,638,606, while \$3,198,000 was paid out in dividends, leaving \$440,060 to be added to the surplus account. The ore reserves suffered some depletion during the year and stood at 3,871,748 tons with a gross value of \$35,965,829. No definite information is obtainable in regard to the rebuilding of the mill of the Dome Mines, Ltd., the management being extremely reticent. It is understood, however, that underground operations at depth have been successful in opening up ore of a higher grade than the general run of the mine. At the McIntyre, development on the lower levels continues to show excellent results, important new ore-bodies having been opened up on the 3,625 and the 3,875 ft. levels. In view of the steady additions which have been made to the ore reserves, it is expected that a new mill will be built. The mill of the Coniaurum during the first quarter of the year treated 300 tons of ore a day realizing a small profit. There is sufficient ore broken and in sight to keep it in operation for about two years. The continuation of a vein found on the 1,000 ft. level is to be followed by the sinking of a winze for 1,000 ft. The Vipond produced \$211,800 from 28,336 tons of ore milled during the three months ended March. New ore has been encountered between the 900 and 1,000 ft. levels, and

the mill is operating at the rate of 300 tons per day, with an average recovery of about \$8 per ton.

Kirkland Lake.—The six producing mines of this field yielded bullion in March to the value of \$1,487,216, as compared with \$1,196,959 in March, 1929. Additions to the mill of the Lake Shore, which will bring its capacity up to 2,000 tons per day, are progressing steadily and will be completed in a few weeks. Ore at the lower levels appears to show improvement in grade, the deposit showing greater consistency. Everything is in preparation for the increased scale of operations necessary to meet the requirements of the mill enlargement. Lateral work on the new levels now being opened up on the Teck-Hughes, between the 2,250 and the 3,000 ft. levels, is proceeding satisfactorily, and the improved mineral conditions fully warrant the proposed mill extensions of two additional units of 300 tons each. A new vein showing good gold content has been encountered on the 2,500 ft. level. The mill at the Wright-Hargreaves is operating steadily at the rate of 500 to 550 tons per day, mill heads running in the neighbourhood of \$13 per ton. Preparations are being made for the installation of new equipment, including a bowl classifier and arrangements for re-grinding a portion of the ore, which will be kept in longer contact with the solutions. The Sylvanite is driving on a vein coming in from the Wright-Hargreaves on the 500 ft. level, carrying about \$15 to the ton. It has also been opened up on the 625 ft. level. The Kirkland Lake gold mine during March produced \$43,000 as compared with \$36,500 for the previous month, the improvement being due to the higher grade of ore taken from the lower levels. It is proposed to conduct operations on a larger scale. The Amity Copper in the Boston Creek area is opening up good ore on the 1,000 ft. level, the improvement of conditions at depth being regarded by the management as sufficient to warrant the erection of a concentrator. The new 50 ton mill of the Telluride is almost ready to start operations with a supply of ore sufficient to keep it running for at least two years.

Rouyn.—The workings of the Noranda are being deepened, No. 4 shaft having been sunk to a depth of 1,557 ft., and the work of opening up four new levels below the 975 ft. level is under way. No. 3 shaft is being put down to 1,500 ft. Exploration

will be conducted on what is known as the Chadbourne property, lying west of the present workings, where encouraging gold values have been encountered. The Waite-Ackerman-Montgomery is opening up a good body of ore on the 500 ft. level and cross-cutting at the 700 ft. level to leave the downward continuation of the deposit, the gross value of the copper content being about 7%. The concentrator of the Amulet has gone into operation, and is working satisfactorily, making this property the third producing mine of the district. The next on the list will probably be the Granada where good progress is being made with the construction of the mill, which will shortly

8 hours daily sufficient ore to keep the mill running day and night. Development work on an extensive scale is planned on the property of the Ontario Woman Lake, which holds some 400 acres in the Woman Lake area, where commercial ore has been encountered by diamond drilling. A mining plant is to be brought in. The Central Patricia has put down a shaft on its Crow River holdings to a depth of 125 ft., the objective being 250 ft. On the completion of the shaft, four levels will be established. The company has greatly enlarged its holdings in the district having acquired the Springer and other groups formerly held by E. M. Connell.



THE NORANDA SMELTER.

go into operation with an initial output of about 60 tons daily. Diamond drilling at the Abana has indicated a considerable extension of the known ore body, and development is being aggressively pushed in order to put the property on a productive basis at an early date. Other properties where operations are being carried on more or less successfully are the Aldermac, Newbec, Mabell, and the Siscoe Gold mine.

Patricia District.—The hopes of mining operators that the industry would be assisted by improved transport facilities have been disappointed, the bill authorizing the proposed railway being for the second time defeated in the Ontario Legislature. The Howey gold mine in the Red Lake area has reached the production stage but it will take some time to attain its capacity of 500 tons. A continuous supply of ore is assured, with stopes prepared for heavy demand and a hoist capable of raising in

Manitoba.—The Hudson Bay Mining and Smelting Company will require to raise between \$2,000,000 and \$3,000,000 to complete construction work. It is expected that power from the development at Island Falls will be available in July, enabling production to be started before the end of the year. Sherritt-Gordon has suspended exploration work and is now developing the known ore-bodies in preparation for production. On the Ook claim No. 3 shaft has been put down to the 500 ft. level, which is being opened up. The Gold Pan claims at Elbow Lake will be aggressively developed, a mining plant having been ordered. Samples from test pits have yielded high gold values. The Clan Mining Company have taken over the Waverley group of eight claims on Beaver Lake on which promising showings of copper, silver, and gold have been disclosed and will conduct a diamond drilling campaign. The Cold Lake,

which recently proved the extension of the mineralized zone of the Sherritt-Gordon to its property, has been compelled to suspend operations owing to the failing of a brokerage firm which was largely interested in the company. The Manitoba Flin Flon is preparing to carry out a diamond drilling campaign on its property where a promising gold bearing vein has recently been encountered. A Minneapolis syndicate headed by Thomas Young is preparing to develop the Hobson Smith group of six claims near Neso Lake where promising surface showings of copper and gold have been encountered.

Chibougamou District, Que.—This new goldfield, which has been made accessible by the use of aircraft, is attracting much attention and development will be carried on by many companies during the coming season, more particularly in the Opemiska Lake area where important discoveries of copper and gold have been made. Among the companies interested are the Consolidated Mining and Smelting Co.; Ventures, Ltd.; Le Roy Mines, and Moffatt Hall. Several properties have recently changed hands, at high figures.

Canadian Institute's Annual Convention.—The notable expansion of the Canadian mining industry during the past few years was reflected in the interest taken in the annual convention of the Canadian Institute of Mining and Metallurgy held at the Royal York Hotel, Toronto, March 5-7. It was officially opened by Alderman Chisholm, who welcomed the guests on behalf of the city. The Hon. Charles McCrea, Ontario Minister of Mines, spoke on the outlook for the mining industry, and Dr. C. V. Corless read the Barlow Memorial Prize paper on the "Frood Ore Deposit, a Suggestion as to Its Origin." On the second day of the convention C. H. Gunning presented a paper, recommending early prospecting for copper in the area surrounding Nimpkish Lake on Northern Vancouver Island, discovery of rich copper deposits in this district having resulted in 200 claims being staked in the last two years. The district from a mining viewpoint is easily accessible. The growth of the Gowganda silver area was the subject of a paper given by Angus D. Campbell, manager of the Castle-Trethewey Mines, and D. C. Sinclair, Chief Inspector of Mines for Ontario, spoke of the progress made in late years in the prevention of mining accidents. On the third day the Hon. Charles Stewart,

Minister of Mines, was presented with a medal, given by the Hon. Randolph Bruce, for valuable services to the mining industry. In his address acknowledging the honour, Mr. Stewart enlarged upon the vast mineral resources awaiting development in the Yukon and the North West Territories. Later, a method of burning pyrites at Shawinigan Quebec, to make sulphur dioxide gas economically for use in pulp mills, was outlined by Horace Freeman, chemical and metallurgical engineer. Two papers on the Noranda mines were presented, one describing the smelter, by W. B. Boggs, superintendent, and J. N. Anderson, technical assistant, and the other on concentrating iron ores, by C. C. McLachlan, mill superintendent. The convention closed with a banquet, the principal speaker at which was Premier Howard Ferguson of Ontario.

CAMBORNE

May 5.

South Crofty.—The accounts for the financial year ended December 31 show a profit of £7,838 on the year's working, and cash in bank and in hand £46,627. The ore crushed was 75,668 tons, which yielded 795 tons of black tin, 258 tons of refined arsenic and 17 tons of wolfram, together realizing £121,510. It is fortunate that, at South Crofty, other products are available to compensate the present extremely low price of tin. The wolfram realized about £110 a ton, and a contract has been entered into to supply 200 tons at a remunerative price. Wolfram is seldom found associated with tin at the deeper levels now being mined at South Crofty, but the Castle-andinas mine (owned by the company) has recently been placed in excellent working condition, after some five or six years of suspension while wolfram prices were very low. The contract relates to the Castle-andinas output.

East Pool and Agar.—The accounts for the financial year ended December 31 show a profit of £7,404, of which £5,000 was carried to the reserve account which previously stood at £10,000. The ore crushed was 90,500 tons, yielding 1,029 tons of black tin and 420 tons of arsenic, the total receipts amounting to £130,116.

Geevor.—The Geevor financial year ended on March 31, and, at the time of writing, full particulars are not at hand. A very

interesting preliminary report, however, was issued by the directors promptly on the termination of the financial year. This gives the tonnage of ore crushed as 57,867 tons, the sales of black tin as 818 tons, and the amount realized as £94,540. An interim dividend of 5%, absorbing £8,212, has been paid, and in addition the company has redeemed one-fourth of its credit note at a cost of £3,935. The available cash and liquid assets at the end of the financial year amounted to £27,800.

Cornish Tin Output.—In 1929 the output of black tin was 5,612 tons, as against 4,812 tons in 1928 and 519 tons in 1922, when mining operations throughout the county were in a state of practical suspension. At the present time production is restricted in the Cornish mines, because of the adoption by them of the Tin Producers' Association scheme. Owing partly to this, and partly to suspension of operations, unemployment figures have recently been increasing. Taking the mining areas of Camborne, Redruth, St. Just and Perranporth (including St. Agnes) the number of unemployed at the present time is 1,960, as against 1,289 a year ago.

Mining Leases.—Considerable interest is manifested in the High Court action taken by Lady Caroline Grenville against the London Tin Corporation with respect to "a tin mine in Cornwall" of which she is lessor. The defendants ceased pumping without giving notice of their intention to do so, and allowed water to rise to adit level. The plaintiff seeks to have the mine freed from water and so ascertain the extent of any damage suffered. There was evidence that it would cost £6,000 to unwater the mine. Under the circumstances the lessees were willing to give back the mine. Direction was given for a speedy trial of the action. The mine referred to is Wheal Vlow, in the parish of Perranzabuloe. Mining leases usually provide for a notice of intention to suspend operations, thus given a certain period during which the owner may have opportunity to arrange for continuing operations.

Prospecting.—During the last two years, a good deal of carefully organized work has been done in the west in testing river-beds and foreshores for tin, both alluvial and wastes from former mines. It has recently been stated that the Consolidated Goldfields of South Africa is ready thoroughly to test the Tamar, with a view to establishing an extensive scheme of dredging. The Board of

Trade and the Admiralty have approved of the scheme, and Duchy rights have been granted, but the Duke of Bedford's fishing rights in the Tamar form a present obstacle to the progress of the scheme. Test operations for china-clay on Dartmoor have been proceeding for some time, with a view to the extension of china-clay working on the moor. These have met with opposition on the grounds that scenery is spoiled and rivers polluted by china-clay working. An announcement has recently been made to the effect that the Whitehall Securities Corporation have decided not to proceed further with this Dartmoor china-clay proposition. The present may not be the most opportune time to seek the extension of either the tin or the china-clay industry, for in the one case there is already serious over-production, and in the other the demand, though better than it was, does not yet exhaust the "dry" capacity of the Cornish works. Note should nevertheless be taken of the increasing tendency of the non-working sections of the community to place obstacles in the way of the workers, in spite of the prevailing unemployment and its lamentable consequences.

PERSONAL

NOEL BARBER is home from West Africa.

ARTHUR J. BENSUSAN has returned from West Africa.

J. A. C. BERGNE has left for Northern Rhodesia.

JAMES P. BEST is returning from Nigeria.

H. C. BOYDELL has left for Toronto.

SMITH BRACEWELL is returning from Tanganyika Territory.

R. P. BRODIE has returned to Nigeria.

J. M. CAIRNS is home from India.

F. B. CHAMPNESS has left for India, where he will represent Fraser and Chalmers Engineering Works at Calcutta.

L. MAURICE COCKERELL has returned from the Gold Coast.

P. C. COLLINS has left for West Africa.

J. DOUGLAS DIXON has returned from India.

V. J. EDWARDS is home from Nigeria.

C. GRACE is returning from East Africa.

S. B. HENDERSON is home from Nigeria.

J. A. HEPPEL is returning from West Africa.

MALCOLM MACLAREN has returned from Egypt.

HUGH MARRIOTT is home from Panama.

JOHN REED is home from Bolivia.

A. MICHAEL ROBINSON has left France for Queensland.

W. H. RUNDALL has returned from South Africa.

F. J. RYELAND is returning from Russia.

W. E. THORNE has been appointed the consulting engineer to the British International Exploration Syndicate.

W. H. TREWARTHA-JAMES is leaving this week for Western Australia.

T. WEIR is returning from Nigeria.
 T. A. WELLSTED is returning from India.
 H. J. WINCH is returning from India.
 L. A. WOOD has left for Siberia.

J. MORROW CAMPBELL has died at Mergui, Burma, from blackwater fever, aged 67. In 1917 he contributed an article to the *MAGAZINE* on Laterite, which formed the subject of his thesis for his D.Sc. degree in Glasgow University.

TRADE PARAGRAPHS

Blackstone and Co., Ltd., of Stamford, inform us that their unchokeable pumps, to which reference was made here in March, beside being made in standard sizes of 1 to 8 inches are also made in sizes up to 16 inches and larger if required.

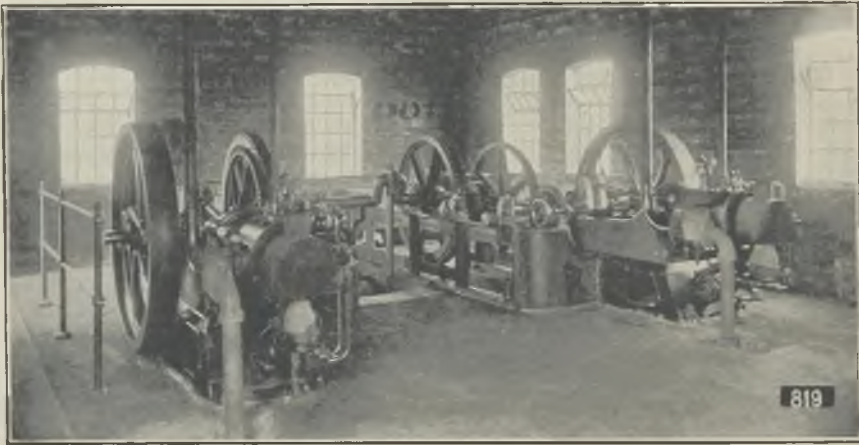
Sullivan Machinery Co., of Salisbury House, London, E.C. 2, write us further with regard to the

making machinery. They also issue leaflets devoted to "Stag" air separators for classification in dry grinding and to bucket elevators of different types.

Ruston and Hornsby, Ltd., of Lincoln. In writing of this firm's exhibit at the British Industries Fair reference was made to the first successful oil engine sent out by the firm's Grantham works which has been in service since 1892. We now reproduce a photograph of this and a similar engine as they were originally installed in the waterworks at Fenny Stratford.

Price's Patent Candle Co., Ltd., of Battersea, London, S.W. 11, send us a booklet which contains a reproduction of a series of articles published in *Gas and Oil Power* comprising a survey of Diesel and semi-Diesel practice or the history of the heavy-oil engine. It is accompanied by a leaflet giving particulars of some of their lubricants.

Westinghouse Electric International Co., of 2, Norfolk Street, London, W.C. 2, issue a series of leaflets devoted respectively to small power



EARLY RUSTON OIL ENGINES AT FENNY STRATFORD WATERWORKS.

increasing interest being taken in scraper loading. This applies more particularly to colliery operations and they give further examples of the usefulness of this method of handling coal.

British Engineering Standards Association, of 28, Victoria Street, London, S.W. 1, have published an index list of specifications to date. This covers 35 pages and contains particulars of 38 different specifications.

Monel-Weir, Ltd., of Cathcart, Glasgow, issue a pamphlet which indicates the many applications of monel metal and malleable nickel in the process industries. The metals are available in the form of rods, sheet, plate, strip, wire, angles, tubes, forgings and castings, ingots, wire cloths, any machined parts, rivets, nuts and bolts, and springs.

Leonard Hill (Advertising), Ltd., of 231-232, Strand, London, W.C. 2, issue the 6th edition of *Chemical Engineering and Chemical Catalogue*. This is a catalogue of heavy and fine chemicals, raw materials, machinery, plant, and equipment applicable to the production industries and covers some 400 pages, fully illustrated.

Edgar Allen and Co., Ltd., of Imperial Steel Works, Sheffield, inform us that they have acquired from **Ord and Maddison, Ltd.**, of Darlington, that portion of their business relating to rotary screens, rolls, stone breakers, and such like road

motors of $\frac{1}{2}$ to $\frac{1}{4}$ h.p., magnetic brakes for alternating current motors, linestarters, surface condensers and magnetic starters. Also some particulars of their arc welding plant and of high-pressure steam economies.

International Combustion, Ltd., of Africa House, Kingsway, London, W.C. 2, inform us that they have received a contract for the complete boiler plant, comprising boilers, air preheating equipment, coal pulverizing plant and all auxiliary machinery for the Bwana M'Kubwa Copper Mines. Most of the equipment will be manufactured at the firm's Derby works.

The Bureau of Information on Nickel of the Mond Nickel Co., Ltd., of Imperial Chemical House, London, S.W. 1, have published a new edition of their pamphlet dealing with nickel-copper alloys containing more than 50% nickel. This is amplified with photographs, drawings, and curves. Other new publications include one devoted to nickel-copper alloys with less than 50% nickel, one to the case-hardening of nickel steels and their uses, and one to the practical application of nickel in cast iron.

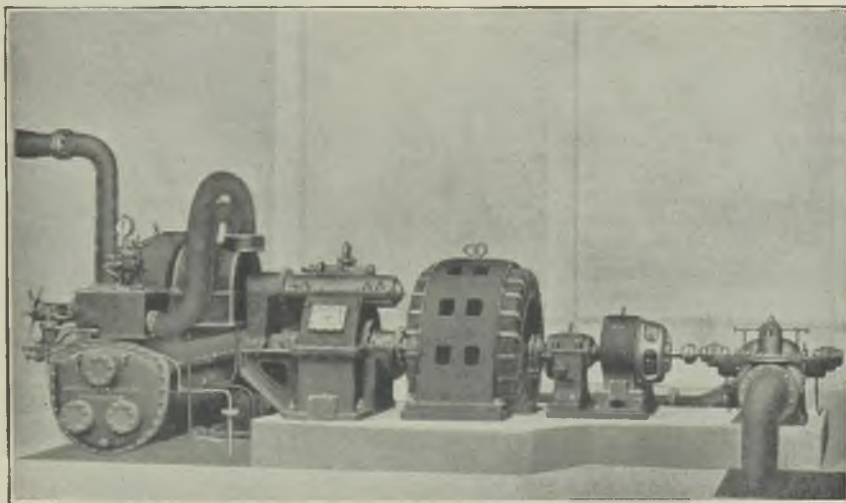
Macinlop, Ltd., of Manchester, have published a booklet attractively bound which comprises a handbook of transmission belting. All aspects of belt drive are covered and there are sections on care

of belts, centrifugal tension, endless belts, the relation of plies in a belt to the diameters of the pulleys, power which can be transmitted, and valuable tables and formulae. A full description of the manufacture of belting by this firm is given from the preparation of the cotton and rubber to the final compression and curing.

Mining and Industrial Equipment, Ltd., of 11 Southampton Row, London, W.C. 1, report that new orders have been received for the following equipment:—For England: One 4 ft. by 7 ft. type 39, Hummer screen for coal; one 3 ft. by 5 ft. type 39, Hummer screen for starch; one No. 00 Raymond pulverizer for soap flakes at 360 lb. hr. to 88%—180 mesh; and one R.L. 7 R-Lopulco mill for slack coal at 4,000 lb. hr. to 90%—100 mesh commercial sieve. For Italy: One 4 ft. by 5 ft. type 39, Hummer screen for foundry sand. To shake out steel moulds from green sand at 4-5 tons per hr. For Germany: One 4 ft. by 7 ft.

suction-gas plants in four units each rated at 350 h.p. with overload up to 450 h.p. and five Premier gas engines, four of 300 b.h.p. at 187.5 r.p.m. (4-cylinder horizontal) and one of 225 h.p. at 150 r.p.m. Complete details of running practice and performance are given.

Metropolitan-Vickers Electrical Co., Ltd., of Trafford Park, Manchester, issue pamphlets devoted to the determination of the efficiency of a polyphase induction motor from test results and to flameproof induction motors, both squirrel-cage and slip-ring types. The February issue of their *Gazette* contains the first part of an illustrated article describing the 5,000-12,500 h.p. electric winder at City Deep No. 4 shaft, to which reference has been made in the *MAGAZINE* before. There is also some reference to the new high-tension research laboratory which was recently opened by Sir Ernest Rutherford, to which more extended reference will be given in a later issue. They also send us a booklet



1000 k.w. METROVICK SELF-CONTAINED TURBO-GENERATOR SET.

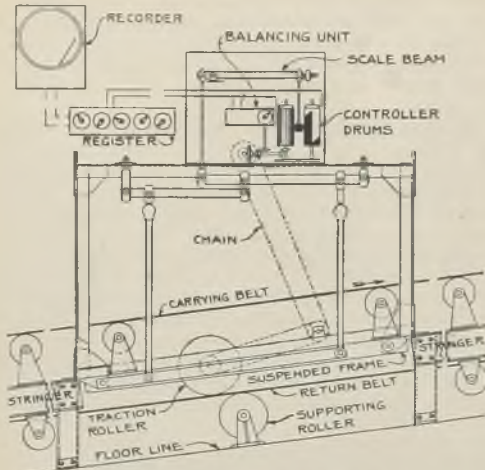
type 39, Hummer screen for coal at 60-70 tons per hour. Separation at 4 mm.

Hadfields, Ltd., of Sheffield, send us a copy of the customary illustrated reprint of the chairman's speech at their annual general meeting held in March. The speech as usual covers a very wide field, and it is only necessary here to call attention to one or two points. Referring to the visit of Mr. W. B. Pickering to Rhodesia, Sir Robert Hadfield spoke of the installation of primary crushing plant at Bwana M'Kubwa Mines of their manufacture, and of how entirely satisfactory it was to the engineers using it. He referred also to an installation of Hadfield crushing plant in connection with the construction of the Canvery Metur Dam in the Madras Presidency, and to the extended use of their hollow drill steel.

Premier Gas Engine Co., Ltd., of Sandiacre, near Nottingham, and **Crossley Bros., Ltd.**, of Manchester. The operation of the products of these two allied manufacturers were the subject of a paper by Messrs. Durham and Wallace at the Empire Mining and Metallurgical Congress. The authors presented some notes on gas power plants in Southern Rhodesia referring specifically to an installation comprising Crossley wood fuel

describing self-contained turbo-generators which is fully illustrated with photographs and sectional drawings. Alternating current sets are made from 200 to 6,250 k.w. and d.c. from 200 to 2,000 k.w. The compactness of the set is seen in the accompanying illustration which shows how by making the bottom half of the turbine cylinder integral with the condenser shell and by mechanically driving the circulation and extraction pumps the entire set can be arranged on one floor without basement or foundation piers.

John Chatillon and Sons, of 85 Cliff Street, New York, send us particulars of a new automatic conveyor scale for continuously weighing material. The machine consists of a steel frame, the lower part of which is a suspended type of scale. Two carrying idlers are mounted on a platform over which the belt travels with the load. The weighing mechanism consists of a scale beam which is balanced by calibrated springs. Beneath the end of the beam is the integrating mechanism. The latter consists of two drums which revolve towards each other at a speed proportional to that of the belt. The left hand drum surface has a succession of cams, while the right hand drum has a smooth surface, one half of which is metallic and the other half non-conducting.



TELEPOISE CONVEYOR SCALE.

As the drums revolve, a contractor is vibrated rapidly against the surface of the drum on the right and, if brought into contact with the metallic surface of the right drum, opens and closes an electric circuit. The impulses operate an electro-mechanical device which is geared to a continuous register at a ratio to convert the impulses into pounds, tons, barrels or other units as desired. The register operates a 24-hour chart recorder. The register and recorder may be installed at any distance from the machine or from each other. Other features include a balancing unit, electrically controlled, arranged to indicate whether or not the machine is in balance, and if not, what adjustment to make. The machine which is known as the Telepoise has been specifically designed for weighing materials in transit on a conveyor belt.

A NEW PRESSURE GAUGE FOR MINES

The statoscope is an instrument by means of which it is possible to compare the static and dynamically influenced atmospheric pressure prevailing at any particular place with a standard pressure, which may be that noted at some other place nearby. In order to maintain systematic observation of the atmospheric conditions existing in a mine, these pressure readings are indispensable. Indications of the approach and departure of depressions and their varying movements at different times of day and at different seasons can only be obtained by keeping check on every change in temperature and humidity and by taking constant readings of atmospheric pressure as well. The statoscope illustrated in Fig. 1 has given excellent results in the course of numerous tests carried out by Mr. Ernst Stach, Engineer, Instructor at the Mining School of Bochum (cf. "Glückauf" 1927, p. 1746 and 1929 pp. 525 and 557). It offers the great advantage, as compared with the hypsometer commonly used, of furnishing immediate readings at any time. Another great convenience is that no auxiliary apparatus or spare parts need be carried with it. The instrument has been continuously developed and embodies many improvements on the earlier models that were subjected to exhaustive tests.

The possibility of setting the instrument roughly to the pressure to be expected at a definite depth below ground enhances its usefulness very considerably. Whatever the depth at which the instrument is to be used, the range of the scale for fine readings is limited to a variation of 5 mm. ($\frac{1}{4}$ in.) of mercury or 65 mm. ($2\frac{5}{16}$ in.) of water either way. The range of measurement within which the scale can be set at will extends from 2,600 m. (8,530 ft.) below to

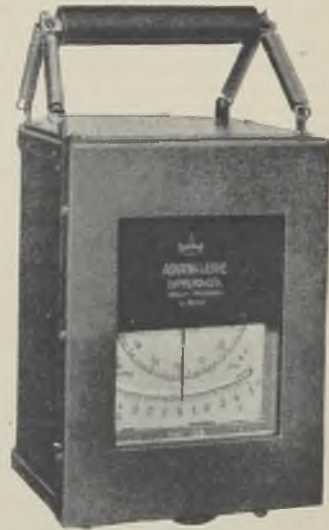


FIG. 1.

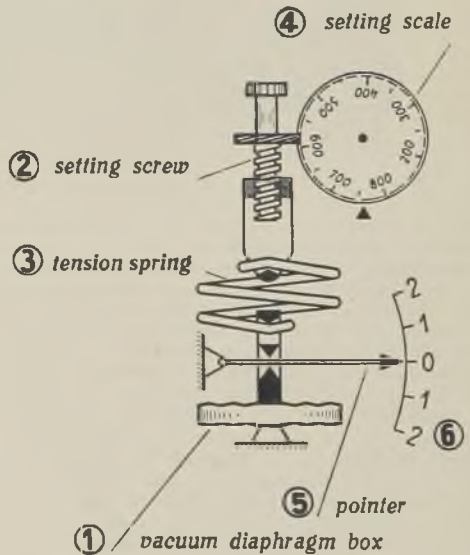


FIG. 2.

1,400 m. (4,593 ft.) above sea level. The sensitivity of the instrument is so great that pressure variations of no more than 0.1 mm. ($\frac{2}{35}$ in.) of mercury can be observed with ease.

The sensitive element of the instrument is a system of diaphragm boxes protected by patent (see Fig. 2). The air pressure acting upon the boxes is balanced by a tension spring. By adjusting the

large milled-head screw seen on the front of the instrument, the spring tension can be altered so as to equalize any air pressure met with at any depth or altitude varying from 2,600 m. (8,530 ft.) below to 1,400 m. (4,593 ft.) above zero. The required altitude is set according to a scale calibrated in millimetres of mercury. This scale is placed on a disc which rotates with the milled-head screw. A pointer, which like the scale is visible on the front of the instrument, indicates the depth or altitude to be reached. The scale is provided with graduations to right and left of the centre, covering 5 mm. ($\frac{3}{8}$ in.) of mercury each way. A mirror placed below the pointer provides the possibility of very fine setting without parallax. The value set at the start of operations is reached when the pointer hovers over the zero mark on the scale. The pressure readings of the statoscope are reduced to a temperature of 0° C. at the time of calibrating. As the instrument is thoroughly compensated for temperature, it is not necessary to make any allowance for temperature in the readings. The instrument itself, like the model widely used in aerial navigation, is encased in an aluminium box fitted with a window and a carrying handle connected by means of springs. The statoscope is well insulated from sudden fluctuations in temperature by means of a cushion of air and rubber sponge so that sudden changes in temperature will not affect the accuracy of the readings. The sprung handle absorbs the shocks occasioned by descending into the mine, so that the instrument itself, unlike the type designed for fitting on board aeroplanes, requires no special shock-absorbers.

The instrument is made by Askania-Werke A.G. of Berlin-Friedenau.

METAL MARKETS

COPPER.—The dull and mediocre tenor of the copper market was rudely disturbed about the middle of April by the drastic reduction in the price of electrolytic copper in New York from 18 cents to 14 cents. per lb. This was followed by a temporary sharp burst of buying, but quiet conditions soon supervened as consumers took stock of the situation and decided that prices might possibly be reduced further. The fact remains that by their price policy in the past, producers have very seriously antagonized buyers, the latter having in many cases definitely transferred their attention to alternative metals. In view of the fact that they are burdened with immense stocks of surplus copper, the position of producers is not enviable at the present time, especially as there are no signs yet of any permanent improvement in demand.

Average price of Cash Standard Copper: April, 1930, £62 3s. 3d.; March, 1930, £69 5s. 10d.; April, 1929, £81 2s. 7d.; March, 1929, £89 4s. 4d.

TIN.—The tendency of values continued rather easy during April. The market has been most unfortunate during the last year or so, as prices have been consistently weak despite the fact that large sums have been expended on keeping supplies off the market, in "bullish" propaganda, and in creating the Tin Producers' Association. Although producers have now decided to tighten up their control of output, this has not yet had any appreciable effect on the statistical position and the surplus stocks in this country alone, at about 18,000 tons, are about equal to the world's total

visible supply nearly two years ago. Demand from consumers is fairly good, but it is probably not as good as it was this time last year, in view of the industrial setback in America and meanwhile world visible supplies are tending to increase further rather than shrink. Although the price now looks comparatively cheap, a further reduction is very possible as there are still no signs that a general industrial recovery is imminent.

Average price of Cash Standard Tin: April, 1930, £162 14s. 7d.; March, 1930, £164 19s.; April, 1929, £206 19s. 7d.; March, 1929, £220 17s. 4d.

LEAD.—As a result of a further decline, lead prices receded during April to a lower level than had ever been seen since the slump year of 1921. Nor does the situation encourage any hope that an early improvement may be expected. Arrivals of metal this year into this country have been much heavier than in 1929, month for month, whereas consumption has probably deteriorated. The Lead Producers' Association is doubtless finding itself saddled with increasing stocks, with only the poorest prospects of being able to dispose of them in the immediate future. On the Continent the industrial situation is gloomy, so that the market is not likely to receive much immediate assistance from that direction.

Average mean price of soft foreign lead: April, 1930, £18 6s. 9d.; March, 1930, £18 17s. 5d.; April, 1929, £24 11s. 10d.; March, 1929, £25 9s. 11d.

SPELTER.—This market did not escape the easiness apparent on other non-ferrous metal markets and prices were marked down further. The situation remained discouraging, as although production was apparently being further curtailed under the pressure of economic forces, supplies continued to be in excess of demand, which latter was very disappointing in volume. It is possible, however, that the drop in copper prices, by stimulating the brass trade, may eventually have a favourable effect on the spelter position. Meanwhile, progress in connexion with the negotiations respecting the proposed re-establishment of the Spelter Cartel is but slow, and it is somewhat doubtful whether anything will be achieved.

Average mean price of spelter: April, 1930, £18 1s. 11d.; March, 1930, £18 11s. 1d.; April, 1929, £26 13s. 8d.; March, 1929, £27 3s. 5d.

IRON AND STEEL.—Conditions in the Cleveland pig-iron trade, which had opened the year quite favourably, became substantially worse during April and towards the close of the month it was decided to blow out some furnaces. As regards foundry material, prices remained steady at the minimum figures, No. 3 G.M.B. being quoted at 67s. 6d., but in hematite there was fierce competition and East Coast Mixed Nos. realized barely 74s. 6d. per ton. In finished iron and steel, the position of the British Mills was by no means favourable, although prices were kept steady, export demand being particularly dull. Continental steel was stagnant, and the Belgian, Luxemburg, and German works were running with very thin order books.

ANTIMONY.—At the close of April, English regulus was realizing £40 to £46 10s. per ton. A moderate business was passing in Chinese regulus on spot, ex warehouse material being priced at about £29 per ton while for shipment from China around £26 per ton c.i.f. was quoted.

IRON ORE.—The demand for pig-iron has been very slow, and the call for iron-ore negligible.

LONDON DAILY METAL PRICES

Copper, Tin, Zinc, and Lead per Long Ton; Silver per Standard Ounce; Gold per Fine Ounce.

	COPPER.						TIN.				ZINC (Spelter).		LEAD.		SILVER.		GOLD.	
	STANDARD.			ELECTRO-LYTIC.	BEST SELECTED.	CASH.		3 MONTHS.		CASH.		SOFT FOREIGN.	ENGLISH.	CASH.	FORWARD.	S. D.		
	CASH.	3 MONTHS.				CASH.	3 MONTHS.	CASH.	3 MONTHS.	CASH.	3 MONTHS.							
April	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	
10	68 7 6	67 7 6	83 0 0	83 0 0	—	166 5 0	168 2 6	18 0 0	18 11 3	18 11 3	19 15 0	19 15 0	19 15 0	19 15 0	19 15 0	19 15 0	84 11 1/2	
11	67 12 6	66 6 3	83 0 0	83 0 0	73 15 0	167 10 0	169 11 3	18 3 9	18 12 6	18 12 6	19 15 0	19 15 0	19 15 0	19 15 0	19 15 0	19 15 0	84 11 1/2	
14	67 7 6	66 5 0	83 0 0	83 0 0	—	165 12 6	167 15 0	18 2 6	18 13 9	18 13 9	20 0 0	20 0 0	20 0 0	20 0 0	20 0 0	20 0 0	84 11 1/2	
15	63 15 0	63 2 6	82 0 0	82 0 0	69 0 0	164 11 3	166 13 9	18 1 3	18 13 9	18 13 9	20 0 0	20 0 0	20 0 0	20 0 0	20 0 0	20 0 0	84 10 1/2	
16	58 17 6	58 6 3	65 10 0	65 10 0	—	164 8 9	166 11 3	17 18 9	18 11 3	18 11 3	20 0 0	20 0 0	20 0 0	20 0 0	20 0 0	20 0 0	84 11 1/2	
17	58 18 9	58 17 6	65 10 0	65 10 0	—	165 1 3	167 6 3	17 16 3	18 6 3	18 6 3	19 10 0	19 10 0	19 10 0	19 10 0	19 10 0	19 10 0	84 10 1/2	
18	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
21	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
22	55 10 0	55 2 6	65 10 0	65 10 0	60 0 0	162 3 9	164 11 3	17 10 0	18 1 3	18 1 3	19 10 0	19 10 0	19 10 0	19 10 0	19 10 0	19 10 0	84 11 1/2	
23	54 6 3	54 6 3	65 0 0	65 0 0	—	160 15 0	162 18 9	17 6 3	17 15 0	17 15 0	19 5 0	19 5 0	19 5 0	19 5 0	19 5 0	19 5 0	84 11 1/2	
24	54 1 3	53 13 9	65 0 0	65 0 0	—	160 12 6	162 15 0	17 5 0	18 0 0	18 0 0	19 10 0	19 10 0	19 10 0	19 10 0	19 10 0	19 10 0	84 10 1/2	
25	52 8 9	52 1 3	65 0 0	65 0 0	59 0 0	159 3 9	161 6 3	17 6 3	18 0 0	18 0 0	19 10 0	19 10 0	19 10 0	19 10 0	19 10 0	19 10 0	84 11 1/2	
28	52 11 3	52 7 6	64 0 0	64 0 0	—	157 3 9	159 8 9	17 2 6	17 18 9	17 18 9	19 10 0	19 10 0	19 10 0	19 10 0	19 10 0	19 10 0	84 11 1/2	
29	52 1 3	51 15 7 1/2	64 0 0	64 0 0	60 0 0	156 11 3	158 16 3	17 0 0	17 15 0	17 15 0	19 5 0	19 5 0	19 5 0	19 5 0	19 5 0	19 5 0	84 11 1/2	
30	50 8 0	49 16 3	64 0 0	64 0 0	—	153 2 6	155 1 3	16 17 6	17 15 0	17 15 0	19 5 0	19 5 0	19 5 0	19 5 0	19 5 0	19 5 0	84 11 1/2	
May	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1	50 17 6	50 8 9	62 0 0	62 0 0	—	151 11 3	153 11 3	16 12 6	17 8 9	17 8 9	19 5 0	19 5 0	19 5 0	19 5 0	19 5 0	19 5 0	84 11 1/2	
2	51 1 3	50 13 9	62 0 0	62 0 0	59 10 0	150 6 3	152 8 9	16 7 6	17 5 0	17 5 0	18 15 0	18 15 0	18 15 0	18 15 0	18 15 0	18 15 0	84 11 1/2	
5	49 12 6	49 11 3	61 0 0	61 0 0	—	148 16 3	150 17 6	16 5 0	17 0 0	17 0 0	18 10 0	18 10 0	18 10 0	18 10 0	18 10 0	18 10 0	84 11 1/2	
6	48 11 3	48 8 9	59 10 0	59 10 0	56 19 0	142 8 9	144 6 3	16 0 0	17 1 3	17 1 3	18 10 0	18 10 0	18 10 0	18 10 0	18 10 0	18 10 0	84 11 1/2	
7	48 8 9	48 3 9	57 10 0	57 10 0	—	145 7 6	147 2 6	16 2 6	17 5 0	17 5 0	18 15 0	18 15 0	18 15 0	18 15 0	18 15 0	18 15 0	84 11 1/2	
8	50 0 0	49 18 9	58 0 0	58 0 0	—	145 12 6	147 6 3	16 8 9	17 10 0	17 10 0	19 0 0	19 0 0	19 0 0	19 0 0	19 0 0	19 0 0	84 11 1/2	
9	51 6 3	51 4 4 1/2	58 0 0	58 0 0	56 0 0	145 3 9	146 13 9	16 18 9	18 0 0	18 0 0	19 10 0	19 10 0	19 10 0	19 10 0	19 10 0	19 10 0	84 11 1/2	

Most ironmasters are overbought and overstocked, and are not open to take ore at any price. Best Bilbao rubio is nominally about 20s. 6d. per ton c.i.f., but there are no buyers.

ARSENIC.—Cornish white remains at £15 17s. 6d. to £16 per ton ton f.o.r. mines for 99%.

BISMUTH.—A very fair inquiry is reported at the official price of 5s. per lb. for merchant quantities.

CADMIUM.—Demand has not been particularly good just recently, and, with more American metal offering in Europe, quotations have eased to about 3s. 9d. to 3s. 10d. per lb.

COBALT METAL.—Officially the price remains at 10s. per lb., but demand is slack and concessions are made for good contracts.

COBALT OXIDES.—Quotations are unaltered at 8s. per lb. for black and 8s. 10d. for grey.

CHROMIUM.—Platers are still in the market for fair quantities at about 2s. 6d. per lb., but it is interesting to note that chromium plating has been listed as a "dangerous trade" and regulations are being drawn up for factories where it is used.

TANTALUM.—The current value remains between £40 and £50 per lb. according to quantity.

PLATINUM.—Supplies recently have been markedly in excess of demand, and prices have given way further, refined metal now standing at about £8 10s. to £8 15s. per oz. Producers are understood to be conferring in the hope of reaching some agreement whereby steadier and more remunerative prices can be obtained.

PALLADIUM.—Prices are rather easier in sympathy with platinum, current quotations being about £5 5s. to £5 10s. per oz.

IRIDIUM.—With very little demand quotations have tended to ease, sponge and powder now being quoted at £28 to £32 per oz.

OSMIUM.—This metal keeps pretty steady at £13 15s. to £14 10s. per oz.

TELLURIUM.—There is an entire absence of demand, and prices are purely nominal at 12s. 6d. to 15s. per lb.

SELENIUM.—A steady demand continues in evidence at 7s. 8d. to 7s. 9d. per lb. ex warehouse Liverpool.

MANGANESE ORE.—It is very difficult to find any bright spots in the gloomy outlook for this mineral. Many of the smaller mines are finding production difficult at current quotations and some have had to close down. Meanwhile, supplies are more than sufficient to meet consumers' requirements, and prices are none too firm at the quoted levels of 1s. 1 1/2d. per unit c.i.f. for best Indian and 1s. 0 1/2d. to 1s. 1d. for washed Caucasian ore.

ALUMINIUM.—Demand has been on a distinctly small scale recently, but prices are without change at £95 delivered, less 2% for ingots and bars.

SULPHATE OF COPPER.—The fall in the price of copper has naturally led to lower quotations for this material and English sulphate is now offering at £24 10s. to £25 per ton, less 5%.

NICKEL.—A fairly good demand continues at £170 to £175 per ton.

CHROME ORE.—Business has been on a moderate scale, with prices steady at £4 2s. 6d. to £4 7s. 6d. for good average 48% Rhodesian ore.

QUICKSILVER.—Very little inquiry has been met with recently, and spot material is now obtainable at about £22 12s. 6d. per bottle, full terms.

TUNGSTEN ORE.—There has been an almost complete absence of demand, and sellers have gradually reduced their ideas to the present level of 24s. per unit c.i.f. for forward shipment from China.

MOLYBDENUM.—Buyers are showing no interest and quotations are somewhat nominal at about 32s. 6d. to 33s. 6d. for 80% American concentrates.

GRAPHITE.—Somewhat easier prices are ruling in certain directions, although some mines are still firm in their ideas. Madagascar 85 to 90% raw flake might be called about £25 to £26 c.i.f., with Ceylon 90% lumps around £24 to £25 c.i.f.

SILVER.—The market was very featureless during April, the undertone being if anything a trifle firmer. There was no marked pressure to sell, but on the other hand buyers took only very moderate quantities. Spot bars, which were 19 7/8d. on April 1, had appreciated to 19 3/8d. on April 15, touched 19 1/2d. on April 23, and closed at 19 3/4d. on April 30.

STATISTICS

PRODUCTION OF GOLD IN THE TRANSVAAL.

	ELSE-WHERE.		TOTAL.
	RAND.	Oz.	
April, 1929	836,474	35,649	872,123
May	858,991	38,607	897,598
June	821,352	34,677	856,029
July	853,370	36,110	889,480
August	850,852	38,649	889,501
September	814,707	34,846	849,553
October	853,609	35,081	888,690
November	827,952	33,641	861,593
December	813,374	37,560	851,134
January, 1930	848,245	34,556	882,801
February	783,086	35,102	818,188
March	852,089	37,281	889,370
April	831,996	36,610	868,606

TRANSVAAL GOLD OUTPUTS.

	MARCH.		APRIL.	
	Treated Tons.	Yield Oz.	Treated Tons.	Yield Oz.
Brakpan	90,000	£141,009	84,500	£134,034
City Deep	97,000	25,647	93,000	25,063
Cons. Main Reef	60,000	21,023	56,500	20,483
Crown Mines	237,000	75,710	229,000	74,349
D'r'n Rooopoort Deep	41,200	13,681	40,200	13,638
East Rand P.M.	150,000	40,987	145,500	39,795
Geduld	86,000	27,310	82,500	26,224
Geidenhuis Deep	64,900	15,148	64,500	15,303
Glynn's Lydenburg	6,400	2,224	6,300	2,196
Government G.M. Areas	203,000	£389,179	194,000	£377,066
Kleinfontein	54,000	11,607	52,000	11,397
Langlaagte Estate	81,000	£118,819	77,000	£114,957
Luipaard's Vlei	26,500	6,387	26,300	6,426
Meyer and Charlton	17,600	£19,919	17,200	£19,816
Modderfontein New	154,000	72,729	149,000	71,173
Modderfontein B	72,500	25,940	67,500	24,012
Modderfontein Deep	44,200	22,763	42,800	22,354
Modderfontein East	70,000	20,493	68,500	19,496
New State Areas	78,000	£151,128	75,000	£151,991
Nourse	63,500	18,789	59,500	18,668
Randfontein	218,000	£224,162	195,000	£214,305
Robinson Deep	132,000	35,742	137,000	35,859
Rose Deep	82,000	12,281	87,000	12,468
Simmer and Jack	78,000	29,286	73,300	20,785
Springs	69,000	£143,855	66,000	£139,273
Sub Nigel	29,200	22,746	28,700	23,580
Transvaal G.M. Estates	14,620	5,115	14,450	4,325
Van Ryn	42,000	£42,472	40,500	£40,791
Van Ryn Deep	65,000	£108,580	64,900	£102,856
West Rand Consolidated	60,000	£78,640	58,500	£99,461
West Springs	68,000	£78,205	65,000	£78,102
Witwatersrand (Knights)	55,900	£52,001	53,000	£50,780
Witwatersrand Deep	44,200	12,260	38,000	11,347

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.
February, 1929	2,403,720	s. d. 28 6	s. d. 20 3	s. d. 8 3	£ 690,942
March	2,581,600	28 3	20 0	8 3	1,062,331
April	2,006,420	28 1	19 11	8 2	1,068,103
May	2,694,610	28 0	19 10	8 2	1,100,461
June	2,543,550	28 3	19 10	8 5	1,065,191
July	2,649,560	28 1	19 8	8 5	1,112,246
August	2,661,800	28 1	19 9	8 4	1,111,834
September	2,530,370	28 2	19 10	8 4	1,056,839
October	2,658,100	28 1	19 8	8 5	1,115,744
November	2,559,450	28 3	19 11	8 4	1,071,199
December	2,528,000	28 3	19 11	8 4	1,058,231
January, 1930	2,618,600	28 2	19 9	8 5	1,103,718
February	2,421,100	28 5	20 0	8 5	1,019,482
March	—	—	—	—	1,121,216

NATIVES EMPLOYED IN THE TRANSVAAL MINES.

	GOLD MINES.	COAL MINES.	DIAMOND MINES.	TOTAL.
April 30, 1929	197,412	15,900	5,554	218,866
May 31	195,733	15,852	5,473	217,058
June 30	192,595	15,928	5,029	213,552
July 31	190,031	15,914	4,845	210,790
August 31	190,062	15,867	5,071	211,000
September 30	190,567	15,733	4,814	211,114
October 31	189,739	15,533	4,555	209,827
November 30	186,941	15,320	4,561	206,822
December 31	184,280	15,326	4,811	204,417
January 31, 1930	190,663	15,288	5,889	211,840
February 28	196,752	15,495	6,584	218,831
March 31	200,134	15,350	7,002	222,386
April 30	202,434	15,109	5,565	223,108

PRODUCTION OF GOLD IN RHODESIA.

	1927		1928		1929		1930	
	oz.	oz.	oz.	oz.	oz.	oz.	oz.	oz.
January	48,731	51,356	46,231	46,121	46,231	46,121	46,121	46,121
February	46,461	46,286	44,551	45,385	44,551	45,385	45,385	45,385
March	50,407	48,017	47,388	45,511	47,388	45,511	45,511	45,511
April	48,290	48,549	48,210	—	48,210	—	—	—
May	48,992	47,323	48,189	—	48,189	—	—	—
June	52,910	51,762	48,406	—	48,406	—	—	—
July	49,116	46,960	46,359	—	46,359	—	—	—
August	47,288	50,611	46,473	—	46,473	—	—	—
September	45,838	47,716	45,025	—	45,025	—	—	—
October	46,752	43,056	46,923	—	46,923	—	—	—
November	47,435	47,705	46,219	—	46,219	—	—	—
December	49,208	44,772	46,829	—	46,829	—	—	—

RHODESIA GOLD OUTPUTS.

	MARCH.		APRIL.	
	Tons.	Oz.	Tons.	Oz.
Cam and Motor	24,000	10,896	24,000	11,078
Globe and Phoenix	6,048	5,572	6,008	5,748
Lonely Reef	6,200	3,905	5,600	3,903
Lui Gold	1,480	£3,000	1,427	£3,364
Rezende	6,400	2,718	6,400	2,714
Sherwood Star	5,000	£11,920	5,000	£12,476
Wanderer Consolidated	12,200	3,256	15,000	3,854

WEST AFRICAN GOLD OUTPUTS.

	MARCH.		APRIL.	
	Tons.	Oz.	Tons.	Oz.
Ariston Gold Mines	7,019	£11,617	—	—
Ashanti Goldfields	10,517	11,772	10,648	12,162
Taqaah and Abosso	9,310	£15,615	9,400	£15,872

AUSTRALIAN GOLD OUTPUTS BY STATES.

	Western Australia.		Victoria.		Queensland.	
	Oz.	Oz.	Oz.	Oz.	Oz.	Oz.
April, 1929	39,166	—	—	617	—	—
May	28,026	3,018	—	493	—	—
June	33,139	2,368	—	465	—	—
July	28,086	1,421	—	1,203	—	—
August	37,032	2,178	—	567	—	—
September	32,751	1,739	—	381	—	—
October	35,445	—	—	789	—	—
November	28,460	—	—	473	—	—
December	33,650	1,459	—	1,636	—	—
January, 1930	25,472	952	—	209	—	—
February	31,307	1,354	—	350	—	—
March	27,946	—	—	—	—	—
April	36,652	—	—	—	—	—

AUSTRALASIAN GOLD OUTPUTS.

	MARCH.		APRIL.	
	Tons.	Value £.	Tons.	Value £.
Associated G.M. (W.A.)	5,282	9,114	5,282	7,301
Blackwater (N.Z.)	3,507	6,127	3,100	5,596
Boulder Perseve'ce (W.A.)	6,616	15,839	6,501	15,604
Grt. Boulder Pro. (W.A.)	10,044	24,285	9,232	24,160
Lake View & Star (W.A.)	7,137	18,846	—	—
Sons of Gwalia (W.A.)	13,924	13,829	13,462	12,939
South Kalgurlu (W.A.)	8,638	16,300	8,360	14,350
Waihi (N.Z.)	18,027	{ 6,623* 34,106†	{ — —	{ — —

* Oz. gold.

† Oz. silver.

‡ To April 5.

GOLD OUTPUTS, KOLAR DISTRICT, INDIA.

	MARCH.		APRIL.	
	Tons Ore	Total Oz.	Tons Ore	Total Oz.
Balaghat	3,550	2,054	—	—
Champion Reef	8,350	5,595	—	—
Mysore	17,225	8,382	—	—
Nundydroog	11,515	6,968	—	—
Ooregum	13,500	5,707	—	—

MISCELLANEOUS GOLD, SILVER, AND PLATINUM OUTPUTS.

	MARCH.		APRIL.	
	Tons	Value £	Tons	Value £
Chosen Corp. (Korea)	9,560	11,680	9,440	12,340
Frontino & Bolivia (C'bia)	2,500	7,700	2,110	7,857
Lena (Siberia)	—	10,126	—	—
Lydenburg Plat. (Trans.)	3,500	710p	3,350	614p
Marmajito (Colombia)	870	3,554	900	8,043
Fresnillo	85,238	55,945d	—	—
Onverwacht Platinum	3,090	251p	2,862	286p
Oriental Cons. (Korea)	—	96,234d	19,220	97,560d
St. John del Rev (Brazil)	—	46,000	—	39,500
Santa Gertrudis (Mexico)	52,359	109,134d	—	—

d Dollars. p Oz. platinum.

PRODUCTION OF TIN IN FEDERATED MALAY STATES.

Estimated at 70% of Concentrate shipped to Smelters. Long Tons.

July, 1929	5,802	January, 1930	6,128
August	5,610	February	4,768
September	5,332	March	5,763
October	5,966	April	5,407
November	6,135	May	—
December	5,849	June	—

OUTPUTS OF MALAYAN TIN COMPANIES.

IN LONG TONS OF CONCENTRATE.

	Feb.	Mar.	April
Aver Hitam	65½	83½	101½
Batu Caves	16	29	24
Changkat	42	17	50
Chenderiang	28	26	29
Gopeng	68½	62½	62½
Hongkong Tin	113	83½	89½
Idris Hydraulic	26½	26½	29½
Iphoh	29½	17½	40½
Jelapang	29	23	28
Kampar Malaya	45	40	83
Kampung Lanjut	35	43	50
Kamunting	70	100	116
Kent (F.M.S.)	30	30	28½
Kepong	37	33	33
Kinta	24	20	21
Kinta Kellas	29½	29½	18
Kuala Kampar	45	62	70
Kundang	15	12	29
Lahat	13½	1½	15½
Larut Tinfields	40	3½	45½
Malaya Consolidated	44½	66	42
Malayan Tin	142½	113	119
Meru	20½	18	24
Pahang	222	226	225
Penawat	69½	65½	42
Pengkalen	48	45	48
Petaling	202½	190	178½
Rahman	65½	59½	56½
Rambutan	9½	9½	9½
Rantau	15	28	46
Rawang	80	90	90
Rawang Concessions	15	30	30
Renong	76½	40½	50½
Selayang	26	24	24
Southern Malayan	154½	160½	154½
Southern Perak	56½	81½	89½
Southern Tronoh	38½	50	60
Sungei Besi	43	45	45
Sungei Kinta	20½	18½	41
Sungei Way	83½	77½	77½
Taipung	15	19	36
Tanjong	33	33	30
Teja Malaya	21½	10½	43
Tekka	46	48	42
Tekka-Taiping	33	36	51
Temoh	31½	30½	41½
Tronoh	95½	71	72

OUTPUTS OF NIGERIAN TIN MINING COMPANIES. IN LONG TONS OF CONCENTRATE.

	Feb.	Mar.	April
Amari	4½	5	6
Anglo-Nigerian	82½	84	83½
Associated Tin Mines	200	200	200
Baba River	4	5	12
Batura Monguna	1½	2	1½
Bisichi	120	95	65
Daffo	6	3	—
Ex-Lands	55	55	50
Filani	2½	1½	2½
Jantar	30	35	26
Ios	22½	22½	17½
Juga Valley	16	16	16
Junction	6	6	5
Kaduna	27	25½	—
Kaduna Prospectors	21	21½	—
Kassa	15½	15½	15½
London Tin	260	220	220
Lower Bisichi	½	5½	4½
Naraguta	17	20	—
Naraguta Durumi	19	13½	—
Naraguta Extended	7	4	4
Naraguta Karama	—	17½	—
Naraguta Korot	12½	10	—
Nigerian Consolidated	18	18	18
Offin River	7½	7	8
Ribon Valley	15½	16½	21½
South Bukeru	10	10	13
Tin Fields	2½	4½	6½
Tin Properties	16	19	17
United Tin Areas	20	21	21
Yarde Kerri	9	10	10

OUTPUTS OF OTHER TIN MINING COMPANIES. IN LONG TONS OF CONCENTRATE.

	Feb.	Mar.	April
Anglo-Burma (Burma)	12½	13½	—
Aramayo Mines (Bolivial)	241	183	278
Bangrin (Siam)	64½	61½	48½
Berenguela (Bolivial)	—	—	—
Consolidated Tin Mines (Burma)	90	100	94
East Pool (Cornwall)	82½	82½	82½
Fabulosa (Bolivial)	177	147	158
Gevor (Cornwall)	56	75	65
Jantar (Cornwall)	24	31	—
Kagera (Uganda)	20	28	28
Northern Tavoy	25	30	24
Pohigey (Cornwall)	28	32	56
San Finx (Spain)	24*	16½*	—
Siamese Tin (Siam)	134½	158	122½
South Crofty (Cornwall)	54½	65	62½
Tavoy Tin (Burma)	20	20	20
Theindaw (Burma)	5	6	10
Tongkah Harbour (Siam)	40	60	62
Toyo (Japan)	20	—	—
Wheal Kitty (Cornwall)	36	40	38½
Zaaiplaats	22	30	—

* Tin and Wolfram.

COPPER, LEAD, AND ZINC OUTPUTS.

		Mar.	April.
Broken Hill South	Tons lead conc. ..	5,904†	5,058
	Tons zinc conc. ..	5,424†	4,318
Burma Corporation	Tons refined lead.	6,750	6,420
	Oz. refined silver	607,000	610,561
Bwana M'Kubwa	Tons copper oxide	622	587
Electrolytic Zinc	Tons zinc	4,269	4,279
Indian Copper	Tons copper	202	220
Messina	Tons copper	585	515
Mount Lvell	Tons concentrates	3,507	3,119½
Namaqua	Tons copper	161	171
North Broken Hill	Tons lead conc. ..	7,700	—
	Tons zinc conc. ..	6,120	—
Poderosa	Tons copper ore ..	804	—
Rhodesia Broken Hill	Tons lead	—	—
	Tons slab zinc	1,654	1,005
San Francisco Mexico	Tons lead conc. ..	3,750	3,669
	Tons zinc conc. ..	3,252	3,460
Sulphide Corporation	Tons lead conc. ..	2,093	1,776½
	Tons zinc conc. ..	2,725	2,318½
Tetiuhc	Tons lead conc. ..	1,195	1,162
	Tons zinc conc. ..	2,631	2,522
Union Minière	Tons copper	—	—
Zinc Corporation	Tons lead conc. ..	4,862†	—
	Tons zinc conc. ..	3,874†	—

† Four weeks to April 5.

‡ Four weeks to April 23.

§ Four weeks to April 19.

IMPORTS OF ORES, METALS, ETC., INTO UNITED KINGDOM

	Feb.	March.
Iron Ore Tons	409,240	507,185
Manganese Ore Tons	23,002	31,951
Iron and Steel Tons	259,396	280,292
Copper and Iron Pyrites Tons	23,626	52,563
Copper Ore, Matte, and P.ec. Tons	2,964	2,961
Copper Metal Tons	10,710	11,693
Tin Concentrate Tons	6,722	4,412
Tin Metal Tons	1,170	1,244
Lead Pig and Sheet Tons	25,706	26,388
Zinc (Spelter) Tons	11,471	12,389
Zinc Sheets, etc. Tons	2,735	2,447
Aluminium Tons	1,987	1,947
Mercury Lb.	46,650	36,848
Zinc Oxide Tons	782	1,132
White Lead Cwt.	14,282	14,014
Red and Orange Lead Cwt.	4,090	5,340
Barytes, ground Cwt.	39,365	52,185
Asbestos Tons	2,482	1,952
Boron Minerals Tons	964	746
Borax Cwt.	21,440	26,570
Basic Slag Tons	3,854	3,525
Superphosphates Tons	13,224	28,315
Phosphate of Lime Tons	42,541	51,841
Mica Tons	220	206
Sulphur Tons	10,800	4,379
Nitrate of Soda Cwt.	180,220	51,313
Potash Salts Cwt.	264,953	532,019
Petroleum: Crude Gallons	16,234,940	54,526,253
Lamp Oil Gallons	15,541,386	22,504,389
Motor Spirit Gallons	81,351,316	76,884,487
Lubricating Oil Gallons	6,419,067	10,563,442
Gas Oil Gallons	4,257,530	13,716,416
Fuel Oil Gallons	31,776,575	24,832,207
Asphalt and Bitumen Tons	13,565	7,741
Paraffin Wax Cwt.	109,423	126,188
Turpentine Cwt.	12,240	12,834

PRICES OF CHEMICALS. May 9.

These quotations are not absolute; they vary according to quantities required and contracts running.

	£	s.	d.
Acetic Acid, 40% per cwt.	16	6	0
" 80% " "	1	16	6
" Glacial per ton	66	0	0
Alum " "	8	10	0
Alumina, Sulphate, 17 to 18% " "	6	15	0
Ammonia, Anhydrous per lb.			10
" 0.880 solution per ton	15	10	0
" Carbonate " "	27	10	0
" Nitrate " "	24	0	0
" Phosphate " "	40	0	0
" Sulphate, 20.6% N. " "	10	2	0
Antimony, Tartar Emetic per lb.			10½
" Sulphide, Golden " "			7
Arsenic, White per ton	15	15	0
Barium, Carbonate, 94% " "	5	10	0
" Chloride " "	10	10	0
" Sulphate, 94% " "	5	0	0
Benzol, standard motor per gal.	1	7	0
Bleaching Powder, 35% Cl. per ton	6	15	0
Boric Acid " "	13	10	0
Calcium Chloride " "	22	0	0
Carbolic Acid, crude 60% per gal.	5	5	0
" crystallized, 40° " "	2	5	7½
Carbon Disulphide per ton	24	0	0
Citric Acid per lb.			1 8½
Copper Sulphate per ton	25	10	0
Cresylic Acid, 97-99% per gal.	2	2	0
Creosote Oil (f.o.b. in Bulk) " "			1½
Hydrofluoric Acid per lb.			6
Iodine per oz.			1 0
Iron, Nitrate per ton	6	0	0
" Sulphate " "	1	15	0
Lead, Acetate, white " "	38	0	0
" Nitrate " "	32	0	0
" Oxide, Litharge " "	33	10	0
" White " "	41	0	0
Lime, Acetate, brown " "	7	5	0
" grey, 80% " "	15	0	0
Magnesite, Calcined " "	9	10	0
Magnesium, Chloride " "	6	15	0
" Sulphate, comml. " "	3	15	0
Methylated Spirit 64° Industrial per gal.			1 5
Nitric Acid, 80° Tw. per ton	21	0	0
Oxalic Acid per cwt.	1	12	0
Phosphoric Acid per ton	29	15	0
Pine Oil per ton	41	0	0
Potassium Bichromate per lb.			4½
" Carbonate per ton	26	2	6
" Chlorate " "	26	5	0
" Chloride 80% " "	9	15	0
" Ethyl Xanthate per 1,016 kilos	55	15	0
" Hydrate (Caustic) 90% per ton	31	0	0
" Nitrate, refined " "	21	0	0
" Permanganate per lb.			5½
" Prussiate, Yellow " "			6½
" Red " "			1 8
" Sulphate, 90% per ton	11	0	0
Sodium Acetate " "	20	0	0
" Arsenate, 45% " "	26	0	0
" Bicarbonate " "	10	10	0
" Bichromate per lb.			3½
" Carbonate (Soda Ash) per ton	6	0	0
" (Crystals) " "	5	5	0
" Chlorate " "	24	10	0
" Cyanide, 100% NaCN basis per lb.			7
" Ethyl Xanthate per 1,016 kilos	53	5	0
" Hydrate, 76% per ton	14	10	0
" Hyposulphite " "	9	0	0
" Nitrate, 96% " "	10	2	0
" Phosphate, comml. per cwt.			11 0
" Prussiate per lb.			4½
" Silicate per ton	9	10	0
" (liquid, 140° Tw.) " "			8 10
" Sulphate (Glauber's Salt) " "			2 12 6
" (Salt-cake) " "			2 15 0
" Sulphide " "			9 10 0
" Sulphite, pure per cwt.			14 0
Sulphur, Roll per ton	10	0	0
" Flowers " "	12	0	0
Sulphuric Acid, 168° Tw. " "	5	7	6
" free from Arsenic, 144° Tw. " "	4	0	0
Superphosphate of Lime, 33% " "	3	9	0
Tartaric Acid per lb.			1 2½
Turpentine per cwt.	2	2	6
Tin Crystals per lb.			1 2
Titanous Chloride " "			10
Zinc Chloride per ton	12	0	0
Zinc Dust " "	27	10	0
Zinc Oxide " "	39	0	0
Zinc Sulphate " "	10	10	0

OUTPUTS REPORTED BY OIL-PRODUCING COMPANIES
IN TONS.

	Feb.	Mar.	April.
Anglo-Ecuadorian	14,583	17,978	17,416
Apex Trinidad	29,370	31,010	35,770
Attock	2,921	2,855	2,982
British Burmah	5,030	5,559	5,198
British Controlled	23,293	34,376	—
Kern Mex	655	821	789
Kern River (Cal.)	1,100	2,564	3,951
Kern Romana	2,600	3,940	2,998
Kern Trinidad	4,987	5,368	6,410
Lobitos	25,581	28,497	29,229
Phoenix	45,612	45,283	44,544
St. Helen's Petroleum	6,352	6,796	5,495
Steaua Romana	64,870	75,610	73,310
Tampico	2,546	3,331	3,202
Trinidad Leaseholds	28,300	44,450	32,550
Venezuelan Consolidated	4,876	—	—

QUOTATIONS OF OIL COMPANIES SHARES.

Denomination of Shares £1 unless otherwise noted.

	Apr. 10,		May 9,	
	1930.	1930.	1930.	1930.
	£	s. d.	£	s. d.
Anglo-American	2	11 3	3	14 0
Anglo-Ecuadorian	17	6	17	6
Anglo-Egyptian B.	2	11 9	2	10 0
Anglo-Persian 1st Pref.	1	7 6	1	7 3
" Ord.	4	7 6	4	1 9
Apex Trinidad (5s.)	1	3 9	1	3 3
Attock	1	14 3	1	7 6
British Burmah (8s.)	5	9	5	9
British Controlled (5s)	4	3	4	6
Burmah Oil	4	7 6	4	4 3
Kern River, Cal. (10s.)	2	6 0	2	5 3
Lobitos, Peru	2	7 6	2	6 3
Mexican Eagle, Ord. (4 pesos)	14	3	13	0
" 8% Pref. (4 pesos)	13	6	12	3
" Ord.	12	6	11	6
Phoenix, Roumania	34	10 0	33	0 0
Royal Dutch (100 fl.)	4	18 0	4	13 9
Shell Transport, Ord.	9	17 6	10	0 0
" 5% Pref. (£10)	8	9	8	9
Steaua Romana	3	11 9	3	2 6
Trinidad Leaseholds	6	9	6	6
United British of Trinidad (6s. 8d.)	2	15 6	2	15 6
V.O.C. Holding	2	15 6	2	15 6

SHARE QUOTATIONS

Shares are £1 par value except where otherwise noted.

GOLD AND SILVER:		April 10, 1930.	May 9, 1930.
SOUTH AFRICA:		£ s. d.	£ s. d.
Brakpan	3 1 3	2 19 4½	
City Deep	7 0 0	6 0 0	
Consolidated Main Reef	16 6 0	15 3 0	
Crown Mines (10s.)	3 6 9	3 6 9	
Daggafontein	1 3 9	1 2 6	
Durban Roodepoort Deep	11 6 0	10 6 0	
East Geduld	1 15 0	1 16 9	
East Rand Proprietary (10s.)	11 0 0	9 9 9	
Geduld	3 10 0	3 8 9	
Geldenhuis Deep	6 0 0	6 3 0	
Glynn's Lydenburg	2 6 0	2 6 0	
Government Gold Mining Areas (5s.)	1 15 6	1 15 0	
Langlaagte Estate	1 2 9	1 4 0	
Meyer & Charlton	11 3 0	10 6 0	
Modderfontein New (10s.)	4 3 9	4 3 0	
Modderfontein B (5s.)	14 6 0	14 3 0	
Modderfontein Deep (5s.)	1 6 9	1 5 6	
Modderfontein East	1 6 3	1 6 3	
New State Areas	1 13 9	1 15 0	
Nourse	9 6 0	9 0 0	
Randfontein	6 3 0	6 0 0	
Robinson Deep A (1s.)	15 9 0	16 9 0	
" B	8 3 0	8 3 0	
Rose Deep	4 3 0	4 3 0	
Simmer & Jack (2s. 6d.)	3 0 0	2 6 0	
Springs	3 6 3	3 5 0	
Sub Nigel (10s.)	1 18 9	2 0 6	
Van Ryn	6 6 0	6 6 0	
Van Ryn Deep	1 12 6	1 11 9	
Village Deep	8 0 0	2 9 0	
West Rand Consolidated (10s.)	6 3 0	5 9 0	
West Springs	14 6 0	14 3 0	
Witwatersrand (Knight's)	9 0 0	9 0 0	
Witwatersrand Deep	3 6 0	3 6 0	
RHODESIA:			
Cam and Motor	1 4 3	1 1 3	
Gaika	3 6 0	3 6 0	
Globe and Phoenix (5s.)	14 6 0	14 0 0	
Lonely Reef	18 9 0	17 6 0	
Mayfair	10 0 0	10 0 0	
Rezende	1 2 6	1 3 9	
Shamva	1 9 0	1 9 0	
Sherwood Starr	1 0 0	1 0 0	
GOLD COAST:			
Ashanti (4s.)	1 10 3	1 11 3	
Taqaah and Abosso (5s.)	2 6 0	2 6 0	
AUSTRALASIA:			
Golden Horseshoe (4s.) W.A.	2 9 0	2 6 0	
Great Boulder Proprietary (2s.), W.A.	1 3 0	1 6 0	
Lake View and Star (4s.), W.A.	11 9 0	11 3 0	
Sons of Gwalia, W.A.	1 3 0	1 3 0	
South Kalguri (10s.), W.A.	13 0 0	13 0 0	
Waihi (5s.), N.Z.	13 0 0	14 3 0	
Wiluna Gold, W.A.	18 3 0	17 3 0	
INDIA:			
Balaghat (10s.)	3 6 0	3 0 0	
Champion Reef (10s.)	7 9 0	7 0 0	
Mysore (10s.)	11 0 0	10 3 0	
Nundhydroog (10s.)	15 9 0	15 0 0	
Ooregum (10s.)	5 3 0	4 9 0	
AMERICA:			
Camp Bird (2s.), Colorado	1 0 0	1 0 0	
Exploration (10s.)	6 0 0	6 0 0	
Frontino and Bolivia, Colombia	7 6 0	7 6 0	
Mexican Corporation, Mexico	7 3 0	6 9 0	
Mexico Mines of El Oro, Mexico	3 9 0	1 6 0	
Panama Corporation	19 6 0	16 3 0	
St. John del Rey, Brazil	18 9 0	17 6 0	
Santa Gertrudis, Mexico	9 6 0	9 6 0	
Selukwe (2s. 6d.), British Columbia	4 3 0	4 0 0	
MISCELLANEOUS:			
Chosen, Korea	5 0 0	3 9 0	
Eddie (5s.), New Guinea	15 0 0	15 0 0	
Lena Goldfields, Russia	9 0 0	6 0 0	
COPPER:			
Bwana M'Kubwa (5s.) Rhodesia	1 0 3	17 3 0	
Esperanza Copper, Spain	1 1 6	1 1 6	
Indian (2s.)	1 9 0	1 6 0	
Loangwa (5s.), Rhodesia	5 9 0	5 3 0	
Luiti (5s.), Rhodesia	4 6 0	4 3 0	
Messina (5s.), Transvaal	16 6 0	13 0 0	
Mount Lyell, Tasmania	1 11 6	1 6 0	
Namaqua (½2), Cape Province	15 0 0	15 0 0	
N'Changa, Rhodesia	3 0 0	2 18 9	
Rhodesia-Katanga	2 0 0	1 15 0	
Rio Tinto (½5), Spain	45 10 0	40 7 6	
Roan Antelope (5s.), Rhodesia	1 10 0	1 5 6	
Tanganyika, Congo and Rhodesia	2 6 3	1 18 3	
Tharsis (½2), Spain	5 5 0	4 13 9	

LEAD-ZINC:

	April, 10, 1930.	May 9, 1930.
	£ s. d.	£ s. d.
Amalgamated Zinc (8s.), N.S.W.	10 0 9	9 6 0
Broken Hill Proprietary, N.S.W.	1 0 9	19 6 0
Broken Hill North, N.S.W.	3 5 0	3 2 6
Broken Hill South, N.S.W.	2 5 0	2 2 6
Burma Corporation (10 rupees)	14 0 0	12 9 0
Electrolytic Zinc Pref., Tasmania	1 7 6	1 3 9
Mount Isa, Queensland	1 3 9	1 1 3
Rhodesia Broken Hill (5s.)	3 0 0	2 6 0
San Francisco (10s.), Mexico	1 2 9	1 0 6
Sulphide Corporation (15s.), N.S.W.	13 9 0	12 6 0
ditto, Pref.	1 0 6	19 6 0
Zinc Corporation (10s.), N.S.W.	1 7 6	1 6 3
ditto, Pref.	3 8 9	3 7 6

TIN:

Aramayo Mines (25 fr.), Bolivia	1 17 6	1 13 0
Associated Tin (5s.), Nigeria	7 3 0	6 0 0
Ayer Hitam	14 3 0	14 0 0
Bangrin, Siam	1 6 3	1 1 3
Bisichi (10s.), Nigeria	8 9 0	8 0 0
Chenderiang, Malay	1 6 1	1 6 0
Consolidated Tin Mines of Burma	6 0 0	5 6 0
East Pool (5s.), Cornwall	9 6 0	9 6 0
Ex-Lands Nigeria (2s.), Nigeria	2 3 0	1 9 0
Geevor (10s.), Cornwall	5 0 0	4 9 0
Gopeng, Malaya	2 6 3	2 6 3
Hongkong	1 1 9	18 3 0
Idris (5s.), Malaya	11 3 0	9 6 0
Ipoh Dredging (10s.), Malay	1 1 0	1 2 0
Kaduna Prospectors (5s.), Nigeria	8 0 0	7 6 0
Kaduna Syndicate (5s.), Nigeria	15 0 0	13 9 0
Kamunting (5s.), Malay	10 3 0	8 3 0
Kepong, Malay	1 1 3	1 0 0
Kinta, Malay	13 0 0	12 6 0
Kinta Kellas, Malay	9 0 0	8 0 0
Kramat Pulai, Malay	1 15 0	1 7 6
Lahat, Malay	10 0 0	10 0 0
Malayan Tin Dredging (5s.)	1 7 6	1 4 3
Naraguta, Nigeria	10 0 0	10 0 0
Nigerian Base Metals (5s.)	1 6 1	1 3 0
Pahang Consolidated (5s.), Malay	10 0 0	9 3 0
Penawat (S1), Malay	1 6 1	1 6 0
Pengkalan (5s.), Malay	16 3 0	14 0 0
Petaling (2s. 4d.), Malay	13 9 0	11 9 0
Rambutan, Malay	11 3 0	10 0 0
Renong Dredging, Malay	1 5 6	1 2 6
Siamese Tin (5s.), Siam	12 9 0	10 9 0
South Crofty (5s.), Cornwall	4 0 0	3 6 0
Southern Malayan	16 9 0	14 9 0
Southern Perak, Malay	2 7 6	2 2 6
Southern Tronoh (5s.), Malay	9 6 0	8 6 0
Sungei Besi (5s.), Malay	12 0 0	10 9 0
Sungei Kinta, Malay	19 9 0	18 9 0
Tanjong (5s.), Malay	13 0 0	12 0 0
Tavoy (4s.), Burma	9 0 0	7 6 0
Tekka, Malay	1 0 0	19 6 0
Tekka Taiping, Malay	1 2 6	1 1 6
Temengor, Malay	1 5 9	1 2 6
Toyo (10s.), Japan	5 6 0	5 0 0
Tronoh (5s.), Malay	1 2 6	19 0 0

DIAMONDS:

Consol. African Selection Trust (5s.)	1 5 0	1 4 3
Consolidated of S.W.A.	9 6 0	9 9 0
De Beers Deferred (½2 10s.)	9 7 6	9 0 0
Jagersfontein	2 0 0	1 17 6
Premier Preferred (5s.)	5 0 0	4 10 0

FINANCE, ETC.:

Anglo-American Corporation	1 6 6	1 5 0
Anglo-French Exploration	1 0 0	17 6 0
Anglo-Continental (10s.)	8 9 0	7 9 0
Anglo-Oriental (Ord., 5s.)	9 0 0	6 6 0
ditto, Pref.	16 9 0	14 6 0
British South Africa (10s.)	1 19 3	1 18 0
Central Mining (½8)	18 5 0	18 5 0
Consolidated Gold Fields	2 5 6	2 2 0
Consolidated Mines Selection (10s.)	17 0 0	14 9 0
Fanti Consols (8s.)	13 0 0	12 6 0
General Mining and Finance	16 3 0	14 6 0
Gold Fields Rhodesian (10s.)	9 9 0	9 6 0
Johannesburg Consolidated	2 2 9	2 0 6
London Tin Corporation	1 7 3	1 2 0
Minerals Separation	7 2 6	7 10 0
National Mining (8s.)	3 1 0	3 1 0
Rand Mines (5s.)	3 2 6	3 1 3
Rand Selection (5s.)	12 3 0	11 0 0
Rhodesian Anglo-American (10s.)	1 8 9	1 10 0
Rhodesian Congo Border	15 2 6	18 2 6
Rhodesian Selection Trust (5s.)	2 12 6	2 5 0
South African Gold Trust	1 11 9	1 8 9
South Rhodesia Base Metals	1 5 6	1 8 0
Tigon (5s.)	1 8 0	1 4 0
Union Corporation (12s. 6d.)	3 13 9	3 14 0
Venture Trust (10s.)	6 3 0	6 3 0

THE MINING DIGEST

A RECORD OF PROGRESS IN MINING, METALLURGY, AND GEOLOGY

In this section we give abstracts of important articles and papers appearing in technical journals and proceedings of societies, together with brief records of other articles and papers: also notices of new books and pamphlets, lists of patents on mining and metallurgical subjects, and abstracts of the yearly reports of mining companies.

THE VALUATION OF ORE RESERVES

At the Third Empire Mining and Metallurgical Congress a paper was presented by Professor S. J. Truscott on "The Computation of the Probable Value of Ore Reserves from Assay Results." This paper was well illustrated by a complete series of assays from the cross-cuts on the first three levels of the Shamva Mine in Southern Rhodesia and full extracts are given here.

After giving certain preliminary definitions, Professor Truscott goes on to say that ore deposits themselves are those exceptional rock masses wherein valuable metals occur in a relatively concentrated condition. The greater the degree of concentration the greater the exception, this being true between the different deposits as a whole, and also between the different parts of any one deposit. Taking any particular deposit, and assuming the ore exposures along the roads to have been sampled at regular intervals, a number of impartial mine samples is thereby obtained. These mine samples are not samples in the sense of a sample being a reasonably small portion representing the whole; such real samples could only be obtained by breaking down the whole, crushing, mixing, and dividing, until the resultant samples would give results closely agreeing with one another, each result being, within the errors of observation, a measurement of the same magnitude, namely, the value of the reserves or of a block of the reserves, but mine samples are impartially collected specimens of the reserves or of a particular block, and they vary widely in value.

If any sufficient series of the assay results of mine samples be arranged in order of magnitude, and the series be then divided into groups, each succeeding group covering a range of value higher than that covered by its predecessor by a convenient increase of value, an increase kept constant throughout the series, it will be found that, starting with the group of the lowest value, the next group will be a larger one and may be the largest within the series. In any case the largest group, that is, the one containing the largest number of assays, is soon reached, and from that point onwards the groups will be smaller and smaller, till eventually all those assays above a limiting high value particular to each case will form the smallest group of all. Such a distribution of values when plotted with percentage frequencies as ordinates and the increasing units of value as abscissae, would form an asymmetrical frequency curve, steep up to the ordinate of greatest frequency, the mode of the distribution, and less steep beyond, something like 20% of the assay results being represented by the steep side and 80% beyond (Fig. 1).

With such a distribution the question arises whether the arithmetic mean would represent the most probable value of the ore obtainable from any particular series of assay results. If by any chance the distribution were symmetrical about the greatest

ordinate, in which case the mode and the arithmetic mean would be identical numerically, the arithmetic mean would be the most probable value, though the probable error of that mean would be greater than with real samples owing to the far greater deviations from the mean. Considerations of tonnage would not require that the higher values should be weighted by any lower tonnages they might represent, because there would be corresponding lower tonnages for the lower values of the same frequency as the higher values and the two adjustments would offset one another. The arithmetic mean would also represent the most probable value obtainable from such an asymmetrical series if assay values were events of themselves, since if higher values were infrequent that infrequency finds expression in the arithmetic

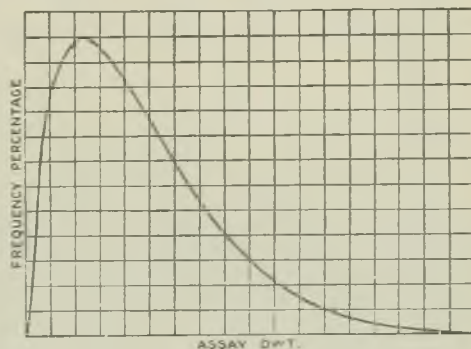


FIG. 1.—SMOOTHED FREQUENCY CURVE OBTAINED FROM A SUFFICIENT SERIES OF ASSAYS.

mean. But assay values in this connexion have no significance apart from tonnage, and tonnage involves volume, that is, extent in three directions. Each assay must accordingly be regarded as pertaining to a hypothetical and elementary rectangular prism of ore, having height, length, and depth.

In the simplest case, namely, that of a narrow tabular deposit yielding one sample across its width at each sampling position, the width may be regarded as the height of the prism. With width varying from position to position the prism height is brought in by using the product of width and assay. The length factor, which may be taken to be the extent of the prism along the road, whether drive or winze, would be brought in by counting all the assay results as holding good for equal lengths. No differentiation in this factor is necessary since frequency along the roads finds its effect in the fact that taking them altogether the different values severally occur in their observed frequencies; in other words, along the length each assay result may itself be regarded as the relative

product of frequency and assay. If these two dimensions sufficed, then the arithmetic mean would be the most probable value obtainable from any particular series of assay results. There is, however, the third dimension, of depth into the block behind the sampled face, to consider. In this direction, normal to the other two, frequency and assay value must also have their respective effects. Here frequency will be represented by the percentage frequency of the particular assay, and assay value by the particular assay itself, the product of these two factors giving the relative depth of which each assay may be counted as extending behind the exposed face. In other words, though in general the less frequent a value the less the probable extent of that value, the fact that a particular value has been found to exist at any particular sampling position is a direct index to the probability of its extension there; if this were not so, re-sampling to confirm previous sampling would have no point, even re-sampling along a stretch. In general, therefore, the less frequent value, wherever it occurred, would hold

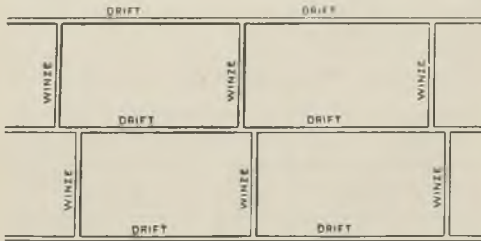


FIG. 2.—NARROW TABULAR DEPOSIT.

good for a smaller elementary area on the plane of the deposit than a more frequent value. The computation of the probable value of ore reserves from assay results demands that each individual result be weighted by the product of itself and its frequency. In the case now being considered, namely, that of a narrow tabular deposit, the frequency is that obtained from all the regular assay results along the drifts and winzes on the plane of the deposit, within and bordering its payable limits. (Fig. 2.)

When at any one sampling position on a narrow tabular deposit different sections of the deposit are sampled separately, the separate results are usually combined, in order to get a single sampling result for each sampling position. Always assuming that the material does not differ in density, then the different sections are combined by taking the arithmetic mean of their products of width by assay.

With wide tabular deposits such as would yield many samples across the width and with which for valuation purposes crosscuts are the sampling roads, samples are generally taken over equal sections across the width. Such a procedure gives to the hypothetical prism one dimension constant of itself. A second dimension would be equal for all assays, because, as before, differentiation in the direction of lower tonnage for lower frequency, and *vice versa*, would come by entering all the results into the computation. While the third dimension, in order to give effect to the play of frequency and value in its direction, must, with each value, be considered as being of a length pro-

portional to the product of its frequency and value. The observed frequency in this case is one across the deposit (Fig. 3). Where, with wide tabular deposits, different sections unequal in width are sampled separately, then the products of width and assay of the different sections would take the place of the simple assay values in the computation.

With massive deposits, where drives, crosscuts, and rises, all at right angles to one another are the sampling roads, and where the road length contributing to one sample is generally uniform throughout, the position is the same as with wide tabular deposits, the most probable value of the ore-reserves being obtained by weighting each assay result with the product of its frequency and assay. The frequency with this group of deposits is one obtained from samples taken in all three directions (Fig. 4).

From the considerations adduced above it is clear that the simple arithmetic mean of a number of assays from a tonnage of ore cannot justifiably be put forward as giving the most probable value



FIG. 3.—WIDE TABULAR DEPOSIT.

of that tonnage obtainable from those assays, since it gives disproportionate weight to the infrequent assays. Further, the infrequent assays being mostly high assays, the arithmetic mean gives results which from the manner of their ascertainment must be too high. All experience confirms this; the actual grade of the ore mined, as subsequently determined from milling or from works sampling, is invariably less than the simple arithmetic mean of the assays of the blocks mined, and though the lowering of the grade due to dilution by waste broken concomitantly is fully appreciated and allowed for, as also may be the lowering of grade by any loss of rich fines, it is nevertheless

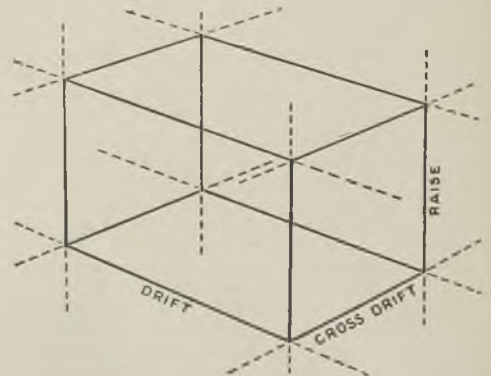


FIG. 4.—MASSIVE DEPOSIT.

additionally the practice systematically to reduce the high assays.

By weighting the assays in the manner outlined above no such empirical adjustment of the high assays is necessary, but each is taken into account at its full value; and the result obtained is the most probable value of the reserves obtainable from those assays. Starting from that value as a base, the grade of the ore which these reserves when mined will deliver can be estimated by correcting for dilution with waste and for loss of rich fines, employing thereto figures from measurement and experience. The actual work of sampling done impartially and reliably by experienced samplers needs no correction; there can be no rational correction for bad sampling.

The suggestion that a high assay value must be taken to represent a smaller area and tonnage in its vicinity was first put forward by Denny,¹ who pro-

magnitude and then dividing them into groups of successive increment of value. The group interval, which is kept constant, should be of a magnitude convenient to the range of values, that is to say, on the one hand it should be wide enough that as many as possible of the groups should find some assays falling within them, while on the other hand it should be narrow enough that each group would be fairly represented by its mid value. Having so arranged and grouped the assays, the numbers of assays falling severally within the different groups, when expressed as percentages of the whole number, are the relative frequencies of the groups, and unless greater refinement is required the group frequency is taken as the frequency of all the assays within the group.

Greater refinement would be achieved if the percentage frequencies were raised as ordinates at abscissae representing the mid values of each group,

TABLE I.—PRELIMINARY GROUPING.

Interval.		Mid Value.	Number of Assays in Group.		Number of dwt. intervals in Group.	Average Frequencies applicable to assays within preliminary Groups.
dwt.	dwt.	dwt.	Actual.	%		
0.0 up to but not including 1	0.5	0.5	45	10.2	1	10.200
1.0 " " "	1	1.5	70	15.8	1	15.800
2.0 " " "	2	2.5	79	18.0	1	18.000
3.0 " " "	3	3.5	60	13.6	1	13.600
4.0 " " "	4	4.5	38	8.6	1	8.600
5.0 " " "	5	5.5	30	6.8	1	6.800
6.0 " " "	6	7.0	27	6.0	2	3.000
8.0 " " "	8	9.0	22	5.0	2	2.500
10.0 " " "	10	12.0	20	4.5	4	1.100
14.0 " " "	14	17.0	17	3.8	6	0.640
20.0 " " "	20	25.0	17	3.8	10	0.380
30.0 " " "	30	35.0	7	1.6	10	0.160
40.0 " " "	40	70.0	6	1.4	60	0.020
100.0 " " "	100	180.0	4	0.9	160	0.006
Totals	260		442	100.0	260	

(The sum of the products of the last two columns reproduces the 100% frequency which all the assays make together. Weighting the mid-value of each preliminary group by the number of assays, percentage or actual, permits the arithmetic mean of the assays, viz. 8.2 dwt., to be reproduced.)

posed to weight the different assay results with empirical tonnage coefficients, the higher coefficient going with the lower value, in order, as he said, to check the tendency of the ordinary arithmetic mean to indicate a higher value than is actual. Equally, Watermeyer² was the first to suggest that frequency must enter the computation a second time. Advancing these pregnant suggestions a step further, the thesis put forward in this paper is that on physical bases the assay, as well as the frequency, should twice enter the computation; in other words, each assay of a series must be multiplied by the product of its frequency and value before any arithmetic mean can be taken. As already indicated, the relative frequencies of assays of different value are obtained by arranging all the assays from the pertinent roads in order of their

and a frequency curve were drawn, since such a curve allows the frequency of any intermediate value to be ascertained by interpolation. Still greater closeness of computation might be afforded by calculating the smooth theoretical frequency curve from the observed frequencies, as was proposed by Watermeyer. Ordinarily, however, a reasonable approximation will be achieved without such curves. It also seems possible that standard distributions for different classes of deposits could be accepted until such time as the actual distribution within the particular deposit has declared itself. For most deposits the distribution is moderately asymmetrical about the most frequent value.

The application of this method of computing ore reserves may be illustrated and checked by taking an actual series of assays. The courtesy of the Shamva Mines, Limited, has made available the assays from the cross-cuts on the first three levels of the Shamva gold mine in Rhodesia, on which levels the sampled ore-body had the following respective lengths and average widths: 740 ft. and 88 ft.; 920 ft. and 110 ft.; 820 ft. and 97 ft. In the accompanying table, this assay series is arranged with the assays in order of their magnitude, the additional assays

¹ G. A. Denny, "Rand Mining Economics," *Journal*, South African Institution of Engineers, April, 1917.

² G. A. Watermeyer, "Application of the Theory of Probability in the Determination of Ore Reserves," *Journal*, Chemical, Metallurgical and Mining Society of South Africa, January, 1919.

in brackets at the high end of the series being the figures to which particular assays were reduced in the endeavour to get an arithmetic mean closer to what might be expected to be the actual value of the resultant reserves. These reductions were made systematically and in accordance with endorsed practice, and, moreover, the system was checked by milling bulk samples. That no regularity in reduction is apparent is because the amount by which each particular assay is reduced is dependent upon the grade of the adjacent assays; a high assay would, for instance, suffer drastic reduction when solitary among a number of low ones, whereas among other high assays it might remain unreduced. Each of these assays, 442 altogether, was taken over a constant cross-cut length of 5 ft. Their arithmetic mean is 8.2 dwt. unreduced, and 5.0 dwt. reduced.

mining and milling. The three levels mentioned were developed by the year 1911, after which the development of the lower levels proceeded, the values immediately below the second level being somewhat higher. Milling began in January, 1914 and thereafter continued regularly and satisfactorily, the ore being mined from the upper levels downwards. In the annual report for the year 1916 it was stated that the value given for the sampled ore-reserves existing at the end of 1915 had on recalculation been reduced from 5.44 dwt. to 5.3 dwt. Similarly, in the annual report for 1917 the value of the previous reserves, consisting in major part of those previously reduced, was on further recalculation again reduced from 5.15 dwt. to 4.64 dwt. These reductions were entirely independent of other reductions necessary to adjust for dilution with lower-grade, but payable,

TABLE II.—SUMMATIONS.

<i>Groups.</i> <i>dwt.</i>	<i>Assay.</i>	<i>Frequency.</i>	<i>Freq. ×</i> <i>Assay.</i>	<i>Freq. ×</i> <i>Assay ×</i>
0.0- 1	26.0	459.00	265	1,107
1.0- 2	100.9	1,106.00	1,594	2,391
2.0- 3	187.3	1,422.00	3,371	8,115
3.0- 4	201.3	816.00	2,738	9,236
4.0- 5	166.3	327.00	1,430	6,285
5.0- 6	158.8	204.00	1,080	5,730
6.0- 8	184.5	81.00	553	3,802
8.0- 10	194.7	55.00	487	4,324
10.0- 14	238.2	22.00	262	3,142
14.0- 20	291.4	10.88	187	3,233
20.0- 30	417.8	6.46	159	3,967
30.0- 40	240.2	1.12	38	1,099
40.0-100	475.5	0.13	10	843
100.0-260	734.7	0.02	4	909
0.0-260	3,617.6	4,510.61	12,178	54,183

Average value of Ore 54,183
represented by the 442 samples 12,178 = 4.45 dwt.

(If frequency alone had been a sufficient weighting factor the most probable average would have been $12,178/4,510 = 2.7$ dwt. While if the arithmetic mean without weighting had sufficed the value would have been $3,617/442 = 8.2$ dwt. The figures in the final column give the relative distribution of the total valuable content among the different assay groups.)

In grouping this series of assays, it is obvious that nothing larger than a group interval of one dwt. would be sufficiently discriminating. Seeing, however, that the highest assay is roughly 260 dwt., and that, accordingly, many of the dwt. intervals within that wide range would find themselves unoccupied by any assay, it becomes necessary, unless a frequency curve be attempted, to make a preliminary grouping of increasing intervals, from which the average frequencies for assays occurring severally within these preliminary groups and yet based on the dwt.-interval may be computed, as shown in Table I.

Frequency being a multiplying factor, to step it out in groups in this manner may occasionally introduce anomalies with assays near the limits of the several groups, anomalies which would be smoothed out by taking individual frequencies from a continuous curve; but, on the whole, these offset one another, and a close approximation for the whole is obtainable. Carrying out the thesis that to get the most probable value each assay must be weighted by the product of its frequency and itself, the summations obtained from the 442 assays are shown in Table II.

Now, to compare this computed value of 4.45 dwt. with the actual value demonstrated by subsequent

ore outside the limits of the original orebody. They can, of course, only pertain in small part to the samples taken on the first three levels, but on the assumption that the system by which high assays were reduced was the same throughout, it would appear that that system still gave an average value for the ore reserves about 10% too high. Deducting this percentage from 5.0 dwt., the reduced assay of the 442 samples would leave 4.5 dwt. as the proved actual value of the ore represented by those samples, a figure with which the 4.45 dwt. computed by the manner of ascertainment here put forward, closely agrees.

After recording his tribute to the management of the Shamva Mines for the preservation of these records, Professor Truscott went on to say that to treat the assay results of impartially taken samples by taking the arithmetic mean is a simple treatment. It has the second advantage that in obtaining the average of adjacent samples, no figures pertaining to any other part of the deposit are introduced, so that under it a rich patch remains a rich patch. The disadvantage is that it credits ore reserves as being richer than experience shows them to be, the discrepancy being greater with greater irregularity among the assays.

The two above-mentioned advantages of the

arithmetic mean are also possessed by the geometric mean, which, at the same, is free from the disadvantage indicated. In any case though the geometric mean probably gives averages which are somewhat low, they are probably closer to the real value than the arithmetic mean, and certainly will be closer to the grade of the ore eventually delivered by the mine.

The geometric mean of a series having n terms is the n th root of the continuous product of the series; thus:

$$G = (\underbrace{x_1 \cdot x_2 \cdot x_3 \cdot x_4 \cdot \dots \cdot x_n}_{n})^{\frac{1}{n}}$$

In logarithmic terms the logarithm of the geometric mean is the arithmetic mean of the several logarithms of the terms; thus:

$$\text{Log } G = \frac{1}{n} \sum (\text{Log } x)$$

Accordingly, in computations for the geometric mean, assays would be represented by their logarithms. There could, of course, be no assays of zero value, or there would be no product at all.

The geometric mean measures variations in

proportion to their ratios instead of in proportion to their differences. Equal ratios instead of equal arithmetic amounts become equivalents. The grouping to obtain frequencies would then be to a constant logarithmic interval, and a frequency curve drawn to such a base would generally approximate symmetry around the ordinate of the geometric mean. The effect would be that with geometric increase in value the weighting factor would be decreased arithmetically, that is, at a slower rate.

The geometric mean is always lower than the arithmetic mean, the greater the divergence between assays the lower still is the geometric mean. This tendency is shown by taking the two assays, 5 dwt. and 2 dwt., the arithmetic mean of which is 3.5, while the geometric mean is 3.16; and then taking the two, 6 dwt. and 1 dwt., which have the same arithmetic mean of 3.5, but the lower geometric mean of 2.45.

Taking the 442 samples mentioned earlier, and

TABLE III.

Assay Value dwt.	No. having same Value.	Assay Value dwt.	No. having same Value.	Assay Value dwt.	No. having same Value.	Assay Value dwt.	No. having same Value.
0.0	6	4.1	3	8.8	1	18.9 (5.4)	1
0.2	1	4.2	4	8.9	1	19.0 (6.0)	1
0.3	1	4.3	1	9.0	2	19.7 (7.8)	1
0.4	6	4.4	6	9.1	2	19.9 (10.4)	1
0.5	1	4.5	5	9.2	1	20.0 (12.9)	1
0.6	10	4.6	4	9.3	1	20.3	1
0.8	14	4.7	2	9.4	1	21.0 (11.4)	1
0.9	6	4.8	3	9.6	1	21.3 (8.3)	1
1.0	9	4.9	2	9.9	2	22.2	1
1.1	3	5.0	9	10.0	1	22.4	1
1.2	14	5.2	9	10.0 (2.8)	1	22.7 (6.0)	1
1.3	1	5.4	4	10.4	1	23.3 (11.0)	1
1.4	8	5.5	1	10.7	1	24.1 (11.6)	1
1.5	6	5.6	2	11.0	1	25.2	1
1.6	11	5.7	3	11.7	1	25.5 (12.5)	1
1.7	2	5.8	2	11.9	1	26.4 (10.8)	1
1.8	11	6.0	2	12.0	2	27.0 (9.0)	1
1.9	5	6.2	3	12.1	1	28.7 (6.6)	1
2.0	21	6.3	2	12.1 (6.0)	1	28.8	1
2.1	2	6.4	2	12.2 (4.2)	1	29.3 (9.2)	1
2.2	9	6.5	3	12.2 (5.1)	1	29.6	1
2.3	1	6.6	1	12.3	1	32.2	1
2.4	12	6.7	1	12.5	2	32.4 (13.2)	1
2.5	12	7.0	3	12.6 (4.9)	1	32.6 (17.6)	1
2.6	7	7.1	2	13.1 (8.4)	1	33.1 (16.7)	1
2.7	5	7.2	1	13.3	1	34.8 (18.7)	1
2.8	5	7.3	1	13.6	1	37.1 (13.2)	1
2.9	5	7.4	1	14.3 (5.6)	1	38.0 (10.5)	1
3.0	12	7.5	1	14.3 (8.4)	1	65.0 (9.3)	1
3.1	2	7.6	1	14.4	1	68.0 (16.2)	1
3.2	9	7.8	2	15.4	1	78.0 (40.0)	1
3.3	3	7.9	1	15.9	1	83.0 (17.2)	1
3.4	13	8.0	3	16.0 (6.0)	1	87.2 (19.8)	1
3.5	7	8.2	1	16.1 (9.1)	1	94.3 (36.4)	1
3.6	5	8.4	1	17.2 (10.0)	1	104.0 (11.0)	1
3.7	5	8.5	2	17.8 (5.8)	1	137.8 (40.0)	1
3.8	4	8.6	2	17.9	2	235.2 (10.0)	1
4.0	8	8.7	1	18.0	1	257.7 (40.0)	1
				18.7	1		

Total Number of Assays . . . 442

$$\text{Arithmetic mean } \frac{3,617}{442} = 8.2 \text{ dwt.}$$

(The figures in brackets are those to which particular assays were reduced; using those reduced figures the arithmetic mean was 5.0 dwt.)

counting the zero results as being 0.1 dwt., the geometric mean of the series is 3.5 dwt. compared with 8.2 dwt., the arithmetic mean.

It is suggested, therefore, that the geometric mean could, with advantage, be used in the earlier

stages of development and until such time as a stabilized frequency for the deposit is determinable.

Assays from the cross-cuts on the first three levels of the Shamva Mine, Rhodesia, arranged in order of magnitude, will be found in Table III.

METALLURGICAL PRACTICE AT THE LEEUWPOORT TIN MINE

Tin mining in South Africa was dealt with at the Third Empire Mining and Metallurgical Congress by Messrs. W. J. Gau and J. Irvine Jameson, who presented a paper on this subject which made particular reference to the metallurgical practice at the Leeuwpoot tin mines in the Transvaal. After making a general survey of the occurrence of tin in the sub-continent the authors gave a brief review of the mining and metallurgical methods adopted at the principal working mines and finally gave a more detailed account of the metallurgical methods adopted at the Leeuwpoot mine.

The economically important tin mines of the Transvaal are situated in the bushveld area north of Pretoria. The tin occurrences are pneumatolytic and are associated with the Red Granite of the Bushveld Igneous Complex and with the felsites and sedimentary rocks of the Rooiberg Series. Of special interest are the remarkable "pipe-like" ore-bodies on the Zaaiploats, Groenfontein, and Mutue Fides properties in the Red Granite and the lode deposits in the quartzites of the Rooiberg Series at Rooiberg, Nieuwpoot and Leeuwpoot.

The ore at the Leeuwpoot mine, as is the case with all the ore from the quartzites, is difficult to treat and requires a somewhat complicated plant. The reduction plant at the mine was originally designed to mill and treat a maximum of 4,000 short tons monthly. The ore originally milled contained approximately 1.7% metallic tin, and the average tonnage milled was, in 1914-15, 3,657 tons per month, and in 1916-17, 4,016 tons per month. The grade of the ore gradually dropped, and, to maintain the output, the tonnage of ore milled was gradually increased, the average monthly figure for the years 1926-1928 was 6,089 tons, and for the first six months of 1929 was still further increased to 6,633 tons per month. The maximum limit for the plant is now about 7,500 tons. Working costs have been reduced from a maximum of 45s. 3d. per ton during 1920 to 26s. 5d. during 1928. This figure has been reduced still further to 23s. 1d. for the quarter ending June, 1929, which is about half of the maximum figure. The actual pulp grade is now approximately 1.0% after sorting. The attached flow sheet (on pages 320 and 321) shows the method of treatment at the mine to-day.

Before proceeding to the explanation of the flow sheet, the position of the mine workings and plant may be briefly described. The workings are rather scattered, consisting of a number of small mines. The principal workings, however, all lie within a rectangular area of approximately $1\frac{1}{2}$ miles long by $\frac{3}{4}$ mile wide, the long axis being roughly north-west to south-east. Two small and relatively unimportant workings lie outside this area. These are the "New Strike" workings on the east and the "Cemetery" workings on the west. To the north, the first working is the "Nek," and following southwards are the "H.G." workings, "Adit" workings, "Cemetery" workings, "West" workings, "Spruit" workings, "South Spruit" extension, "New Strike," "Gap"

workings and "C.N. South" workings, making a total of 10 separate workings. Two of them are actually connected underground, and these are the "Spruit" and "South Spruit" extension. Three other workings, "Cemetery," "Adit" and "H.G." workings, are within 300 and 200 ft. of connexion respectively, but the same lode is not being worked in these ends and consequently no connexion is contemplated at present. All these workings are connected by surface track to a collecting hopper on the top of the hill. Ore is hauled up from the "Nek" workings to "H.G." workings shaft. The ore from these two workings is gravitated to the collecting hopper. Ore is hauled from all the remaining points. A mechanical endless haulage brings the ore from the "Spruit" and "South Spruit" extension. An electrically driven hoist brings the ore from the "Cemetery" and "Adit" workings. The daily tonnage hauled amounts to approximately 300 to 370.

The ore is tipped on to grizzlies at 6 in. spacing, and larger pieces are broken with a sledge hammer. The hopper is simply an excavation in the ground with a chute. Attached to the chute is a Ross chain feeder, which regulates the rate of feed to a conveyor belt—135 ft. by 18 in. at 180 ft. per min. The ore is conveyed to a Lea's patent washing trommel 14 ft. long by 4 ft. diam. with $2\frac{1}{2}$ in. round holes. The fines are washed away to a Hum-mer electric screen; the oversize passes to a wide, slow conveyor sorting belt 59 ft. long by 30 in. at 63 ft. per min., and thence to a Hadfield's jaw crusher, 20 in. by 10 in., set at 2 in. opening. The trommel fines fall on to an electric Hum-mer screen ($\frac{1}{2}$ by $\frac{3}{4}$ in. diameter ton cap screening). The oversize (-2 in. + $\frac{1}{2}$ in.) passes to a lower conveyor belt, 225 ft. by 24 in. running at 85 ft. per min. The fines ($-\frac{1}{2}$ in.) are washed down a launder to a collecting tank. The oversize (-2 in. + $\frac{1}{2}$ in.) previously mentioned, joins the crushed rock from the jaw crusher, and the combined product continues its travel to the top of the mill bin. This oversize is sorted on the mill conveyor belt section, as well as the ore from the crusher. The sorting is chiefly done by native women, and amounts to approximately 21% of the ore sent to the crusher station. The capacity of the mill bin is 420 tons. The stamp battery consists of 15 Californian stamps and two Nissen stamps (1,250 and 1,500 lb. falling weight respectively). Each of the four units has its own separate motor drive. Ton-cap battery screening is in use, the aperture opening from $\frac{1}{4}$ in. to $\frac{3}{8}$ in.

The battery pulp is carried in a launder to two Hum-mer electrical vibrating screens of aperture $\frac{1}{10}$ to $\frac{1}{8}$ in. About 75% of the oversize (+ 10 mesh) product goes to an 8 ft. by 22 in. Hardinge conical pebble mill, and 25% goes to a smaller Hardinge conical pebble mill, 6 ft. by 22 in. (the latter not shown on flow sheet). A circulating load of about 30 to 40% of the total discharge is maintained in a closed circuit. The undersize (-10 mesh) goes direct to the upward current classifiers (Richards-

Janey), making eight classified products and a fines over-flow to the "Dorr" thickeners.

CONCENTRATION.—(a) *Green Side.*—The six coarser classified products are fed to six Wilfley and two Buss tables, and the two finer products to five Isbell vanners. The "Dorr" thickeners spigot product is fed to four Isbell vanners at a lower level. The combined tails of the tables is run to waste on the sands tailings dump. The combined vanner tails are re-treated after de-watering, on three Senn concentrators. The Senn concentrator tails are again re-treated on another single Senn at a lower level. This last tail is run to waste to the slimes dam. Corduroy strips were tried on these final tails, but the recovery of cassiterite in the iron concentrate produced was too low to pay expenses. The over-flow water from the two "Dorr" thickeners is pumped back to the main mill (water supply tanks, together with water recovered elsewhere). Mention should be made of the undersize ($\frac{1}{4}$ in. crusher Hum-mer screen product (original fines)). This product is run to a plain, slightly coned bottom discharge tank; this is necessary, as the crusher station only operates eight hours and is shut down entirely on Sundays, whereas milling and concentrating go on continuously. The water is recovered by de-watering, and the spigot is returned to the battery 10-mesh hum-mer screens and so joins the tube mill circuit.

All the concentrates from the 1st row of tables, 2nd row of Isbell vanners, 3rd row of Isbell vanners, 4th row of Senn concentrators, 5th row single and final Senn concentrator are collected from the boxes and in the case of the bulk of the concentrates, namely, the 1st row Wilfleys and 1st row vanners, are removed to a feed strip by a $\frac{1}{2}$ -ton "mono-rail" suspended tipping truck. The remainder of the concentrates (less than a quarter) are transported by hand labour to the same feed strip. Previously all these concentrates were deposited on the calciner drying floors preparatory to calcination.

The middlings from the Wilfley and Buss tables are pumped to a de-watering cone by a centrifugal sands pump and the spigot discharge re-ground in the small Hardinge tube mill (6 ft. by 22 in.) not shown on flow sheet. The discharge from this mill joins the large Hardinge (8 ft. by 22 in.) discharge and is again pumped to the de-watering cone before the spigot is carried on to the battery Hum-mer screens.

On the floor above that on which the tables mentioned stand there are two James tables which are placed directly below the large Hardinge tube-mill. These tables, which received a classified feed direct from the tube-mill discharge through a U.C. classifier spigot, were used for relieving the load on the first four Wilfley tables. The resulting products of concentrates from these tables received further treatment similar to that given to the product on the first row of Wilfley and Buss tables.

The process described so far has been to collect, elevate, size, wash, crush, mill and concentrate ordinary run of mine sorted (21% sorting) ore of an initial average value of 0.83 to 1.0% of metallic tin to pyritic concentrates containing from 8 to 10% of metallic tin. Until quite recently these pyritic concentrates were calcined in a series of four Merton calciners with three hearths each. The maximum capacity of these furnaces is about 8 to 9 long tons each per day, using wood fuel. The tonnage to be calcined varied from 10 to 22 long tons per day.

One or other furnace of the series was invariably unit and up for repairs, etc.

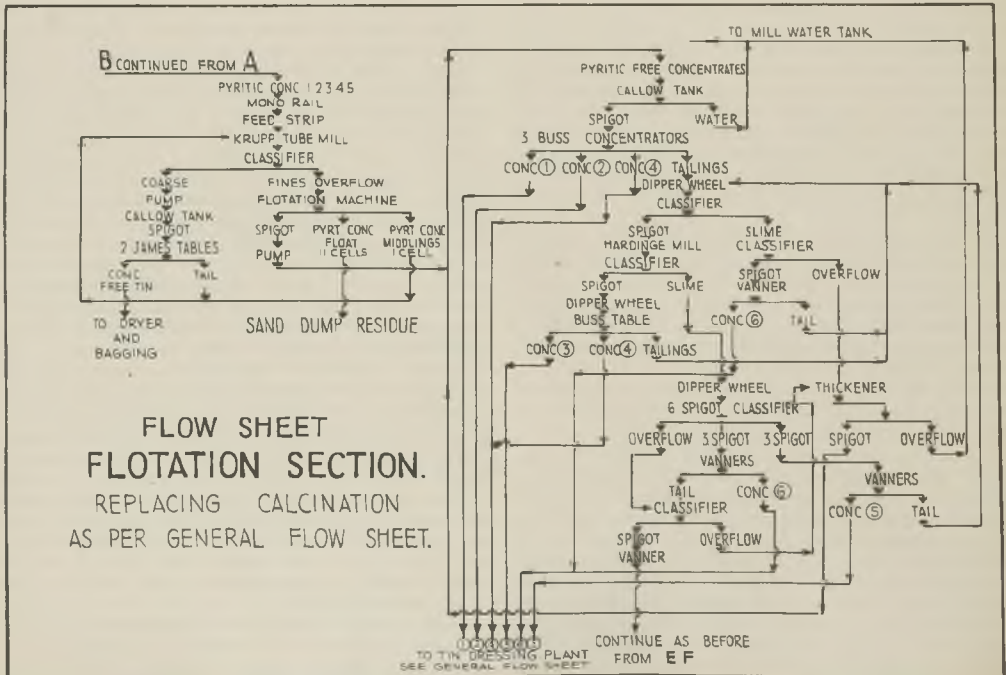
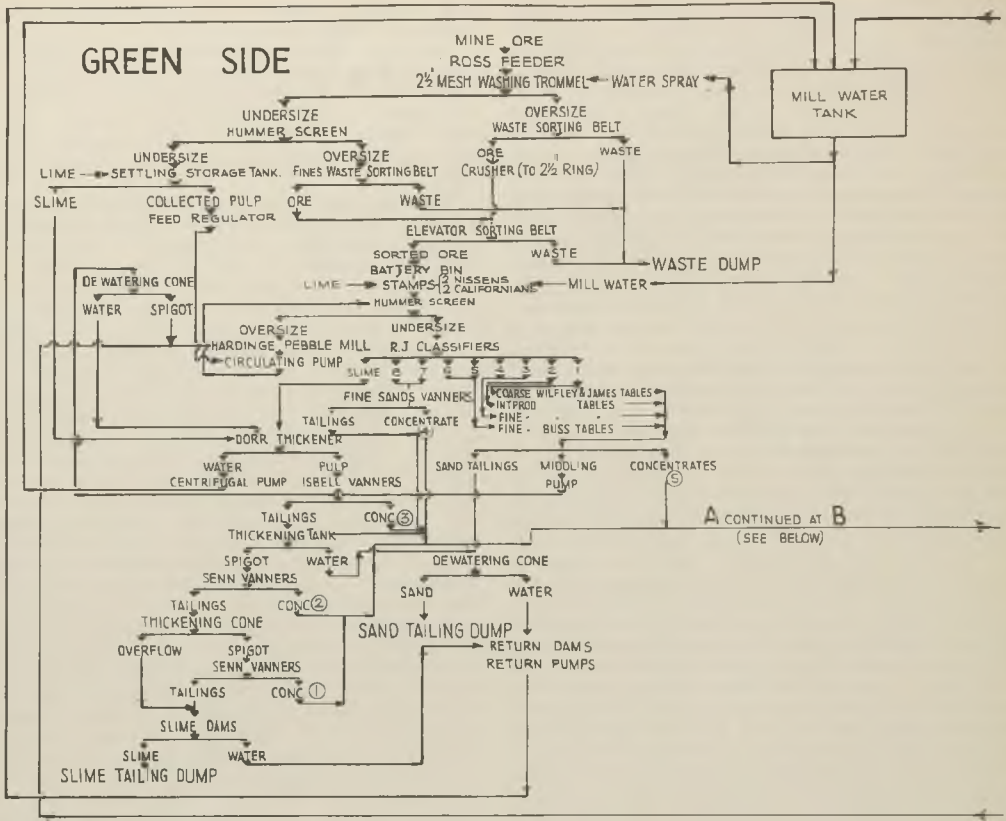
It will be seen that the flow sheet consists of a general flow sheet together with a supplement representing the flotation section. The general flow sheet is divided into two sections: "Green Side" and "Burnt Side." The foregoing description completes the essential work on the "Green Side."

The calciners have now been shut down, and a plant for the flotation of the iron pyrites (and copper pyrites) has taken their place. This plant is described below.

(b) *Burnt Side.*—The plant, Green Side, so far described, produces from 10 to 22 long tons of pyritic concentrates per day. The pyritic concentrates collected from all the concentrate boxes were transported by mono-rail to the drying floor in front of the four feeding chutes to the calciners. When "Burnt" the concentrates were water-cooled, elevated and passed over a combined d.c. and a.c. magnetic separator. This separator, known as the third magnetic separator, gave a double treatment to the "burnt" concentrates. The first d.c. treatment pulled out the iron to the smaller travelling belt, where it received a second treatment using a.c. magnets. The effect of the second treatment is to "shake up" the iron and so liberate the fine cassiterite held mechanically by the magnetized iron particles. The residual tin concentrates remain on the belt and can be collected in boxes, or, in this case, join the iron-free concentrates. Owing to the rather costly maintenance charges in connexion with the cooling arrangements, wet magnetic separation was proposed, but was never actually put in. At this stage it was decided to try a flotation process for the elimination of the iron.

The flow sheet on the "Burnt Side" now that flotation is in practice is largely the same. The chief alteration is that no calcination takes place, and the collected pyritic concentrates are re-ground in the Krupp tube-mill (mentioned later) continuously in closed circuit and reduced to approximately 50%—90, + 200. The discharge from this tube mill is classified; the overflow goes direct to the flotation feed box and the spigot from the classifier is pumped to a Callow tank above the two James tables. These tables make two products, a first concentrate containing only free tin liberated by the tube-mill re-grinding, and the remainder iron pyrites with locked-up cassiterite values. The free tin (or black tin) is collected separately in the boxes and is added to the black tin caught by the slides and collected in the same way from the first floor of Wilfley and Buss tables. The second product is automatically returned to the Krupp tube for further grinding. The further process of re-concentration on the "Burnt" side is obvious from a study of the flow sheet. Attention is drawn to the fact that no tailings or middlings are made here, except those from the four vanners making concentrates from four spigots of the 6-spigot classifier. These tails are run to a single, final, Senn vanner, the tail from which is de-watered in a separate dam and the solids stacked for subsequent re-treatment. This product is known as "stacked" vanner tails; it is highly ferruginous and is in a very fine state of division: its assay value is now approximately 1.1% metallic tin, none of which is free.

The necessary elevation of the concentrates on the "Burnt" side is done by two dipper wheels and one centrifugal slimes pump. A large thickener (size,



**FLOW SHEET
FLOTATION SECTION.**
REPLACING CALCINATION
AS PER GENERAL FLOW SHEET.

24 ft. diam. by 10 ft.) takes the various overflows, separates the clear water and allows a small spigot product to be re-treated again in the circuit.

FLOTATION PLANT.—Briefly, this unit consists of twelve cells in series and the ordinary agitation froth process is adopted. The spindles are cross-belt driven at a speed of 600 r.p.m. with no gears. The total power required is approximately 14 h.p., and is obtained by belt drive from an electric motor. The flotation agents used are sulphuric acid, potassium xanthate and local "tarry water," which is a waste by-product from the gas producer power plant. The consumption is:—

Xanthate, approximately $\frac{1}{2}$ lb. per ton treated.
Sulphuric acid, approximately 9 lb. per ton treated.

The total tonnage of concentrates treated per month is 426.

The average composition of the Krupp mill feed is approximately:—

Pyrites (FeS ₂)	26.2
Silica (SiO ₂)	36.5
Magnetite (Fe ₃ O ₄)	6.5
Hematite (Fe ₂ O ₃)	16.6
Cassiterite (SnO ₂)	12.1
Copper Pyrites (CuFeS ₂)	2.1
	100.0

Typical screen percentage analyses of the products, feed to and discharge from the Krupp tube-mill and the flotation feed are as follows:—

Mesh.	Krupp Tube-Mill. Classifier Overflow		
	Feed.	Discharge.	Flotation Feed.
+ 20	5.0	—	—
+ 40	9.6	0.1	—
+ 60	13.6	1.2	—
+ 90	10.7	4.4	1.9
+ 150	26.0	31.0	25.9
+ 200	17.4	32.0	24.3
— 200	17.7	31.3	47.9
	100.0	100.0	100.0

The success of the process depends on floating the iron pyrites and not the cassiterite; the floated pyritic tail averages about 0.7% tin and 2.0% copper.

CONCENTRATES.—The various grades of concentrates are buddled and kieved in accordance with the plan as set forth at the foot of the flow sheet on the "Burnt" side. The origin of the concentrates is clearly shown above; they are indexed No. 1 to No. 6. The highest grade metallic tin concentrates is sent direct to the dryer. The lowest grades, Nos. 4, 5, and 6, are buddled twice before kieving. The actual practice adopted varies slightly as is customary in the majority of tin dressing plants when this stage of concentration has been reached.

The total average percentage recovery for the year ended 1928 was 62.1 (the concentrate grade being 63.5% metallic tin), making no allowance for the value of 3,975 tons of "stacked" vanner tails of an average value of 1.6% tin accumulated for further treatment. The total recovery becomes 70.2% if full value is allowed for this product. The recovery from this product (vanner tails) by "Chemical Process" is estimated at 80 to 90%. These figures are based on a series of tests carried out over a long period. It will be realized that there is extreme difficulty in recovering the cassiterite values, owing to the very fine dissemination of the black tin, coupled with the presence of large

quantities of iron in the form of pyrites and oxides. There is very little "free" tin, and over 77% of the values of the vanner tails is contained in 63% of the total weight, which is all—200. Even these values (0.9% tin) are not free.

FINAL DRYING, ROASTING OF IRON, AND MAGNETIC SEPARATION OF FINISHED (No. 1) CONCENTRATES.—

(a) *Dryer.*—Various types of dryers have been in use at different times, including an archimedean screw type. The most successful one for our purpose is the rotary dryer in use at present. The fuel (wood) consumption is low, and the rapidity of drying marked. This dryer and the working results have been fully described by Mr. J. A. L. Ortlepp in his recent paper on "A Rotary Tube Dryer Furnace" (*Journal, Chemical and Metallurgical Society of S.A.*, Vol. 28, No. 9, March, 1928) read before the Chemical and Metallurgical Society.

The black (free) tin recovered separately and immediately from the first row of Wilfley and James tables, and also the final concentrates originating from the Buss tables and vanners, still contain a fairly high percentage of iron, both in the form of iron pyrites and oxide. This is due to incomplete flotation, and also as a result of unlocking or freeing of the iron particles as a result of re-grinding subsequent to flotation. In order to produce high grade shipping concentrates, as much as possible of this iron is removed.

(b) *Rotary Roasters.*—A severe lowering of the final grade of finished concentrates makes it imperative to roast a small tonnage daily before magnetic separation is attempted. These roasters consist essentially of two lengths of ordinary 9 in. diameter steam piping, 20 ft. long. They are fired externally by gas from the power gas producer. The concentrates are fed in one end through a regulated (valve) spigot. The slow rotation of the pipes, which are set at a slight slope, carries the concentrates to the discharge end. Only 5 or 6 ft. of the pipe is heated to a red heat; the remainder is cooled by a spray of water. A small centrifugal fan supplies a light current of air from the discharge end, which is totally enclosed, to sweep out the SO₂ gas, etc. A small glass window allows the heating work to be watched from the discharge end. The pipes are set side by side and are chain driven from a worm gear driven by an electric motor. The total h.p. required for the two roasters and the fan is about 1½.

These two roasters are capable of roasting from 3½ to 4 long tons of concentrates per day.

(c) *Magnetic Separators.*—Before roasting, the dried concentrates are put over the belt of No. 1 magnetic separator. This is an ordinary magnetic separator of the Wetherill type. This machine removes the magnetite, iron oxide, etc. The resulting tin concentrates are roasted to convert the iron pyrites to a magnetic oxide. After roasting, the concentrates are put over No. 3 separator, which is a large combined d.c. and a.c. machine. The iron rail from No. 1 separator is re-treated on No. 2 separator (small a.c. machine).

(d) *Smelting.*—At two periods during the existence of the mine, smelting operations have been carried on owing to unusual circumstances. The work was carried out in two reverberatory furnaces, not gas fired, together with a liquating furnace. Owing to the exceptionally high percentage of iron oxide in the concentrates, together with the lack of alluvial or other siliceous concentrates for mixing, Leeuwpoort concentrates *per se* are not a smelting proposition. Given gas firing instead of coal, better temperature

control could be counted on, but even so the temperatures that have to be run are too high. Serious losses, due to volatilization, have to be faced. Contrary to expectations the actual running or working costs were low, and the discarded slags were of low value. Smelting operations, taking the whole output of the country and involving judicious mixing of suitable concentrates at a central point, e.g. Witbank coal district, on a fairly large scale should be economically successful.

(e) *Vanner Tails*.—This product is the final tail made by the single Senn concentrator, this Senn receiving the combined tails of four Isbell vanners on the "Burnt" side.

A typical screen analysis of the product at the present time is as follows:—

Mesh.	By Weight. %	Tin Value,	Tin Contents. %	Tin Contents. %
		Metallic Tin. %		
+ 40	0.2	1.00	.017	1.3
+ 90	1.5			
+ 150	15.0	0.66	.100	8.8
+ 200	20.0	0.70	.140	12.3
— 200	63.3	1.40	.886	77.6
Total	100.0	Av. 1.142	1.143	100.0

The total tonnage of "stacked" tails is 18,800.

Over 63% of the product is — 200, and unfortunately the values are in the fines. Several years ago some thousands of tons of these low grade iron-tin concentrates were separately treated and concentrated by gravitation. The resulting concentrates were smelted and turned into refined tin (99.8%), but the over-all recovery was poor. It was obvious that the only satisfactory solution would be a chemical process. Research work with this end in view has been carried out for some time. The work was started by the point reached by the Tin and Tungsten Research Board workers.¹ It is well known that the basis of the original research work was the treatment of tin ores by the volatilization of tin as chlorides. The company's research chemist has been successful in his endeavours, but it is premature to make any definite statement until, say, a 5-ton unit plant has been actually run for a period, from which practical data can be obtained.

(f) *Power Plant*.—The power supply consists of four 4-cylinder direct coupled suction gas engines with the alternator and fly-wheel in the middle of each engine. Wood fuel is used. The makers' rating is 212 b.h.p. at sea level for each engine. The total units (k.w. hrs.) generated last year was 3,642,615

at a total cost of £11,164 = 0.735 pence per unit. This cost includes all charges, labour, superintendence, maintenance, etc. The actual cost for fuel alone is approximately 0.39 pence per unit.

(g) *Sand Pumps*.—As is well known, these centrifugal pumps have to stand excessive wear due to attrition. The life of the liners and impellers is very limited. Morris sand pumps, rubber lined pumps, and others have been continuously run and trials made for years. Recently a centrifugal pump has been cast and machined in South Africa to special specification, with beneficial results. Compared with an ordinary Morris sand pump dealing with — 10 mesh pulp at 65 ft. static head, the daily costs for renewals plus labour were 5s. 10d. per day and 15s. 10d. per day respectively: i.e. the running cost of the Leeuwpoot tin mine pump was only slightly more than one-third, conditions being identical in each case. On coarser material ($\frac{3}{8}$ in.) and static head 80 ft.:—(1) The L.T.M. pump costs were 12s. 4d. per day: 80 ft. head; (2) the Morris pump costs were 42s. per day: 20 ft. head; (3) rubber lined pump, costing approximately £50: 80 ft. head; the impeller life was 5 days and the casing life was 14 days; (4) the Leeuwpoot pump differs from other pumps of the same size by the elimination of the internal liner, and the utilization of the casing by thickening it at points which gives uniform and better wear; (5) having the impeller of smaller diameter than cover liner greatly obviates cutting action in liner joint; (6) filleting sharp corners in impeller, which causes material to run in centre, prolongs the life; (7) adjusting shaft whilst pump in motion to take up wear between impeller and suction cover liner is an advantage; (8) the pump is more compact and accessible.

(h) *Concrete Launderers*.—It has been found economical to make and use reinforced concrete launderers at points in the mill where coarse material is run at comparatively high velocity (cost 7d. per ft.).

(i) *Water Supply*.—The average daily "make up" of water for milling and concentrating is approximately 220,000 gallons. The amount circulating per day is approximately one million gallons. At 216 tons milled per day, the weight ratio of water to solids in treatment is approximately 23:1. About 8,000 to 10,000 gallons per hour is required in the washing trommel alone to wash away the fines and clean the ore for sorting.

(j) *Sale of Concentrates*.—The concentrates when cleaned magnetically, are bagged in triple bags and shipped to Singapore (F.M.S.) in shipment lots of 10 long tons each.

ELECTROLYTIC CADMIUM AT GREAT FALLS

The electrolytic cadmium plant of the Anaconda Mining Company at Great Falls is described by W. E. Mitchell in Technical Publication No. 320 of the American Institute of Mining and Metallurgical Engineers. The writer says that electrolytic production of cadmium at the Great Falls plant started in the first part of the year 1925. Prior to that time, an experimental unit had been in operation for a few months during the year 1922. At present the plant is the largest producer of

cadmium, not only in the United States but in the world.

Electrolytic cadmium is characterized by its very low content of impurities. The main impurities, which are lead, copper, zinc, and iron, do not aggregate more than 0.05%. The consumption of cadmium has increased rapidly since the war, with the growing use in the plating industry. Cadmium plating has come into prominence because of its connexion with the automobile and radio industries. As a protective coating, a deposit of cadmium is superior to zinc. Cadmium is also used extensively in alloys. Important among these is

¹ "Report of the Tin and Tungsten Research Board, 1922," pp. 74-100.

the alloy with copper used in telephone and trolley wire. In proportion of 0.5 to 1.2%, cadmium adds materially to the strength and wearing qualities.

Practically all commercial zinc concentrates contain a small amount of cadmium. In the electrolytic zinc process, the cadmium that is dissolved in the regular leaching operation is removed from solution with metallic zinc, generally added in the form of zinc dust. This precipitate also contains the copper taken into solution, and the excess of zinc dust, which is required in order to insure a complete removal of all impurities. The precipitate is treated by a separate process to recover the copper, cadmium, and excess zinc. In order to make the metals more soluble and to render insoluble such impurities as iron, arsenic, and antimony, the precipitate is roasted. The roasting is carried out in gas-fired McDougall furnaces, with a roasting temperature of about 700° C. The roasted residue is leached with dilute sulphuric acid, spent electrolyte from the zinc electrolyzing, containing 10 to 12% free H_2SO_4 . The leaching is done in cylindrical tanks of 30 tons capacity, agitated mechanically. The leaches are finished neutral and decanted to Dorr thickeners. The thickened residue, still containing a considerable amount of copper, but with low cadmium and zinc content, is filtered and washed

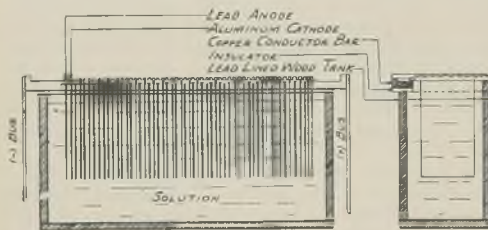


FIG. 1.

in a Moore filter, dewatered in an American filter, dried and shipped to a copper smelter. The overflow from the Dorr thickener contains copper, cadmium, and zinc. Copper is first removed by a careful addition of zinc dust. The precipitation is carried out in tanks of 30 tons capacity, agitated mechanically. A high copper residue is produced, which is separated from the copper-free solution in a Dorr thickener, filtered in an American filter and shipped to a copper smelter.

The solution is treated with zinc dust, which precipitates cadmium in a finely divided state, contaminated by the excess zinc required to insure complete precipitation. The precipitation is carried out in tanks of the same construction and size as those used for copper. The precipitate, generally called cadmium sponge, is separated from the solution by filtration through a filter press. The cadmium sponge dissolves very slowly in dilute sulphuric acid. When oxidized the solubility is greatly increased. The oxidation is carried out by stock piling the sponge for two or three weeks. The wet sponge oxidizes rapidly when piled in deep heaps, where a quick dissemination of the evolved heat from the oxidation cannot take place.

The partly oxidized sponge is leached with spent electrolyte from the electrolytic cadmium cells in tanks of 30 tons capacity, agitated mechanically. The leaches are carried to the neutral point and allowed to settle in the leach tanks. The clear

solution is filtered through a filter press. The filtered solution is pumped to a storage tank, from which it flows by gravity to the electrolytic cells.

The residue is allowed to remain in the leach tank until enough has accumulated to necessitate a clean-up. This residue and the mud from the filter press are returned to the plant treating the regular zinc-dust purification precipitate. The advantage in using partly oxidized sponge is that it contains a sufficient amount of metallic zinc and cadmium to give a good purification. If the sponge is too high in copper, or has become completely oxidized, the solution may run too high in copper. In this case, a small addition of freshly precipitated sponge will be needed to precipitate the dissolved copper.

Electrolytic deposition of cadmium is generally attended with a large production of trees and sprouts. Rotating cathodes are often used to overcome this tendency. The Great Falls plant, however, has always used stationary cathodes, and has succeeded in establishing a condition that gives a satisfactory deposit with such an arrangement. The cells are of the same construction as for the electrolysis of zinc, and the same type of anodes and cathodes are used. Fig. 1 shows the

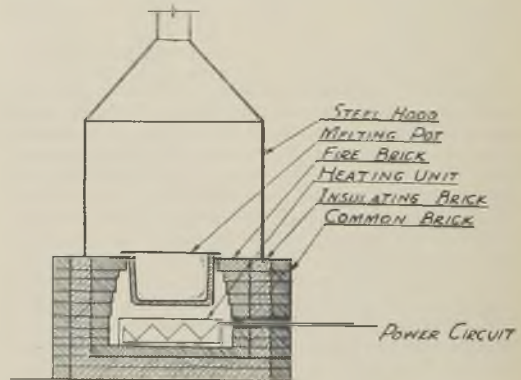


FIG. 2.

sections of a cadmium electrolytic tank cell. Each cell has 27 anodes and 26 cathodes. The spacing is 3.5 in. from centre to centre of cathodes. The cell voltage is approximately 2.6 volts and the current density is 4.25 amp. per sq. ft. Each cell has individual solution feed and the spent electrolyte discharges into a common collecting launder. The feed contains 100 to 200 g. per litre cadmium and 80 g. per litre zinc; the spent electrolyte about 70 to 80 g. per litre H_2SO_4 . Glue is added to the cells to reduce the formation of beads. The amount used averages about 10 lb. per ton cathodes. The tendency to form beads is also counteracted by carrying the cell temperature at about 25° C.

The cathodes are stripped every 24 hr. One plate is lifted out at a time and carried to the stripping rack. The beads are scraped off and treated separately. The sheets are washed with water, rolled into bundles and dried in a steam oven. The ampere efficiency based on the production of good sheets varies between 80 and 90%. The percentage of metal produced as beads is generally about 5%. The beads may be pressed together in a press and charged to the melting furnaces with the cathodes.

The spent electrolyte is returned to the tanks for leaching sponge. In order to keep down the zinc content, it is necessary to replace a certain amount of this electrolyte with fresh acid. Concentrated sulphuric acid may be used if pure contact acid is available; if it is not, spent zinc electrolyte, depleted to a low zinc content, may be used. The cadmium in the acid that is withdrawn may be recovered by precipitation on metallic zinc. On account of the content of free acid, the zinc consumption is high. A better way of disposal is to use the withdrawn acid to leach zinc-dust purification precipitate.

The dry cathodes are melted under a thin layer of caustic soda, to prevent excessive oxidation. The melting is carried out in cast iron pots of about 1,000 lb. capacity, heated electrically to a temperature of 400° to 450° C. The pots are well hooded to prevent oxide fumes from entering the room. Fig. 2 shows a section of the melting pot. The caustic soda becomes thick and viscous from oxidized cadmium and is replaced occasionally. The consumption of caustic soda is about 40 lb. per ton of metal cast.

The caustic slag, containing cadmium oxide and a large amount of metallic beads and shots, is leached with water to dissolve the excess caustic soda. The solution is decanted off and the oxide and beads are treated with warm dilute sulphuric acid. The metal is taken into solution very slowly, because of its high purity. By the addition of manganese dioxide, however, the speed of the reaction may be greatly increased. The leach solution, after filtration, is fed to the electrolytic cells.

The cadmium is tapped from the pots and cast in bars weighing approximately 75 lb. These bars are re-melted and the cadmium cast into marketable shapes. At present it is cast into pencils, slabs, anodes and balls. The pencils are $\frac{1}{2}$ in. dia. by 10 in. long. Slabs are $\frac{3}{8}$ in. thick, 4 in. wide, and 15 $\frac{1}{2}$ in. long. Anodes are $\frac{3}{8}$ in. thick, 2 $\frac{1}{2}$ in. wide, and 17 $\frac{1}{2}$ in. long. The balls are 2 in. dia. These finished products are washed in dilute sulphuric acid, then in water, to remove the oxide film. They are then dried and packed into boxes for shipment.

The Hayden Plant of Nevada Consolidated.—

A paper summarizing concentrator methods and costs of the Hayden Plant of the Nevada Consolidated Copper Company, prepared by W. I. Garms, mill superintendent, has been published by the United States Bureau of Mines, Department of Commerce, as one of a series of papers on milling methods and costs at representative operations in different mining districts. The Hayden concentrator is located at Hayden, Arizona, about 20 miles from the mine at Ray. During the last quarter of 1928 an average of 10,366 tons of ore containing 1.25% copper was treated daily in the plant. The average recovery during this period was 87.84% of the total copper, the concentrate containing 19.88% copper. The present method of concentration is here given.

The concentrator is divided into eight sections, each with a capacity of 1,500 tons per day. The sections are flexible enough to permit the treatment of as much as 2,000 tons each, although with poorer metallurgical recovery due to resulting coarser grinding.

Briefly, the operations at the coarse crushing plant and at the concentrator are as follows:—

(1) Coarse crushing by gyratory breakers and large rolls to 1 in. for shipment to the concentrator.

(2) Fine crushing in a roll circuit from through 1 in. to 10 mesh size.

(3) Fine grinding in a ball mill circuit to 10% on a 100 mesh screen.

(4) Concentration by flotation of fine grinding product, producing finished concentrate and a reject tailing.

(5) Dewatering of flotation concentrate in settling bins and filters.

The paper includes tables of screen analyses of the heads and various products and distribution of the copper; average analyses of flotation heads, concentrates and tailings; distribution of copper by screen sizes in average flotation heads, concentrates and tailings; typical quarterly flotation plant report; metallurgical data; summary of costs per ton of ore treated; distribution of power; consumption of heavy supplies and ore treated per man per shift.

Flotation of Oxidized Silver Ores.—The best process for the treatment of oxidized silver ores is usually some form of cyanidation. In recent practice, flotation has gained some favour when the precious metals are associated with minor amounts of base metal minerals. The Rare and Precious Minerals Experiment Station of the United States Bureau of Mines, Department of Commerce, in co-operation with the University of Nevada, Reno, Nevada, has completed flotation experiments on an oxidized ore in which the original galena had changed to anglesite and minium. The silver and gold are largely associated with the lead. The best concentration, 79% of the silver and 85% of the gold, was obtained by using a mixture of one part of amyl xanthate with 4 parts of 15% aerofloat used as a collector and three to five pounds of sodium sulphide added to the cells as a sulphidizer with not to exceed $\frac{1}{10}$ th pound of pine oil as a frother per ton.

Amyl xanthate is better than ethyl or a mixture of both. The froth is brittle without the aerofloat or coal tar to act as a stabilizer. Sodium sulphide increases the recovery as additions are made of 1 lb., 2 lb., and up to 5 lb. per ton. More is unnecessary or detrimental. The introduction of calcium ions, either as calcium polysulphide or as lime, has resulted in a marked decrease in the silver gold recovery amounting to 5 to 25%.

Treatment of Manganese Ore by Volatilization.—Semi-commercial volatilization tests, having for their object the beneficiation of a manganese ore which could not be used in the iron and steel industry on account of an undesirable zinc and lead content, have recently been conducted at the Intermountain Experiment Station of the United States Bureau of Mines, in co-operation with the University of Utah, Salt Lake City. After ten days of experimental work, during which time the plant was operated continuously, a manganese product was produced which met the requirements of the iron blast furnace operator.

Beneficiation of this ore was brought about by the addition of diluents and by heating to a temperature just below the point of fusion of the mixture. The zinc and lead were driven off as fumes and were collected in bags as the oxides of the respective metals. The lead content of the ore was reduced from 3% to practically zero; the zinc was reduced from 2.7% to 0.2%. In this way the ore, which is refractory to all other metallurgical methods of treatment, can be converted into a useful saleable material and the undesirable constituents, which have been removed, are recovered as by-products.

SHORT NOTICES

Winding at Great Depths.—The practical solution of the winding problem on the Rand is dealt with by W. Elsdon-Dew in a paper read before the Third Empire Mining and Metallurgical Congress.

Mining of Platinum Ores in the Transvaal.—A. A. English and W. E. Turvey describe mining practice as carried out on the oxidized ore of the Waterval (Rustenburg) Platinum Mining Co., in a paper read before the Third Empire Mining and Metallurgical Congress. At the same congress K. Richardson describes the method employed in mining the Zwartfontein central ore-body.

Shovelling, Trimming and Ore Transport.—The use of mechanically operated scrapers in workings of flat dip at the Modderfontein "B" gold mines is described by C. L. Butlin in a paper read before the Third Empire Mining and Metallurgical Congress.

High-Lift Pumps.—At the Third Empire Mining and Metallurgical Congress a paper read by W. G. C. Nixon dealt with the high-lift pumping installations of the Randfontein Estates Gold Mining Co., Witwatersrand.

Rockbursts.—In the *Journal of the Underground Officials' Association of South Africa* for March 10, W. J. Brinton gives some notes on rockbursts and tremors.

Sieving.—E. J. Ivers discusses progress in the technique of sieving in *Metall und Erz*, 2 Aprilheft.

Onverwacht Platinum.—The mining and recovery of platinum at the Onverwacht mine is outlined by J. E. Healey and T. K. Prentice in a paper read before the Third Empire Mining and Metallurgical Congress.

Rand Gold Metallurgy.—A paper read by H. A. White before the Third Empire Mining and Metallurgical Congress records the progress in Rand gold metallurgy since 1924.

Metallurgy of Transvaal Platinum Ores.—A review of the metallurgical position of the Transvaal platinum industry is given by F. Wartenweiler and A. King in a paper read before the Third Empire Mining and Metallurgical Congress.

Metallurgy of Bwana M'Kubwa Ore.—C. S. van der Poel in a paper read before the Third Empire Mining and Metallurgical Congress describes the metallurgical operations at Bwana M'Kubwa.

Aluminium.—Innovations in the metallurgy of aluminium were discussed by R. J. Anderson in a paper read before the World Engineering Congress held in Tokyo in October, 1929.

Natural Potassium Nitrate.—The occurrence of potassium nitrate near Goyder's Pass, McDonnell Ranges, Central Australia, is described by Sir Douglas Mawson in the *Mineralogical Magazine* for March.

Valuation of Ore-bodies.—L. V. Melville in the *Transactions of the Geological Society of South Africa* for 1929 discusses graphic methods of showing variations in values in ore-bodies.

Roan Antelope Mine.—An outline of the geology and development of the Roan Antelope mine is given by D. C. Sharpstone in a paper read before the Third Empire Mining and Metallurgical Congress.

Gowganda Silver Area.—A. D. Campbell deals with the Gowganda Silver area in the *Canadian Mining and Metallurgical Bulletin* for April.

Messina Copper Mining Industry.—In a paper read before the Third Empire Mining and Metallurgical Congress, A. B. Emery describes the operations on this Transvaal Copper field.

Dust in Mine Air.—J. Boyd discusses the estimation of dust in mine air in a paper read at the Third Empire Mining and Metallurgical Congress.

Engineering Laboratories in Witwatersrand University.—The *Journal of the South African Institute of Engineers* for April contains an article by W. J. Walker on the design and equipment of the engineering laboratories in the Witwatersrand University.

Indian Mineral Industry.—G. H. Tipper discusses recent mineral developments in India in a paper appearing in the *Journal of the Royal Society of Arts* for April 18.

RECENT PATENTS PUBLISHED

A copy of the specification of any 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.

32,763 of 1928 (326,223). A. DAVIES, London. An apparatus for the electro-magnetic separation of minerals. A rotatable drum is energized by a lower magnet at such a point that attracted materials are carried out of the energizing region for collection.

35,855 of 1928 (301,832). MINERALS SEPARATION, LTD., London. A froth flotation process characterized by the employment of a reaction product, obtained by condensing a hydrocarbon and sulphur in the presence of a metal and chlorine, as a flotation reagent.

36,441 of 1928 (302,178). I. G. FARBEN-INDUSTRIE A.-G., Frankfurt-on-Main. Preparation of pure chromium oxide by the reaction of an alkali metal chromate or dichromate with red phosphorus.

5,121 of 1929 (306,949). TRENT PROCESS CORPORATION, New York. Metallic oxides are mixed with coal, indirectly heated in such a manner as to reduce the oxides and volatilize the coal, and subsequently subjected to a hot air blast which completes the volatilization of the coal and converts the reduced metal to the fluid state.

13,780 of 1929 (326,085). S. WRIGHT, Altrincham. For the purpose of treating finely divided material by a gas, the material is allowed to fall in a chamber from one to another of a series of rotating retarders which are moving in opposite directions.

16,005 of 1929 (325,762). SIEMENS AND HALSKE A.-G., Berlin-Siemensstadt, Germany. Beryllium alloys are prepared by fused electrolysis, the metal to be alloyed with beryllium being introduced to the molten mass by anodic solution.

16,376 of 1929 (312,657). A. FOLLIET, Paris. Oxidized ores of poor quality are mixed with coal and an alkali chloride, and treated by a blast of air, at a temperature between 650° and 800° C., whereby the metallic elements are volatilized and subsequently condensed, but the scorification of the residue is avoided.

20,422 of 1929 (326,116). T. M. CRAMER, Los Angeles. Borax is separated from ores containing crude sodium borate by heating the ore to above 212 F. under pressure, whereby the borax dissolves in its own water of crystallization and may be removed from the ore without the formation of mud and slime.

NEW BOOKS, PAMPHLETS, Etc.

☛ Copies of the books, etc., mentioned below can be obtained through the Technical Bookshop of *The Mining Magazine*, 724, Salisbury House, London, E.C.2.

Petrographic Methods and Calculations. By Dr. ARTHUR HOLMES. 2nd impression. Cloth, octavo, xviii + 515 pages, illustrated. Price 15s. London: Thomas Murby and Co.

The Microscopical Examination of Coal. By C. A. SEYLER. Physical and Chemical Survey of the National Coal Resources, No. 16. Paper covers, vi + 64 pages, illustrated. Price 2s. 6d. London: H.M. Stationery Office.

Steel Pit Props. By T. ASHLEY, S. M. DIXON, and M. A. HOGAN. Safety in Mines Research Board Paper No. 58. Paper covers, 67 pages, illustrated. Price 1s. London: H.M. Stationery Office.

Mica.—By H. S. SPENCE. Paper covers, 142 pages, illustrated, with map. Price 30 cents. Publication No. 701, Ottawa; Department of Mines.

Horton-Windsor District, Nova Scotia. By W. A. BELL. Paper covers, 268 pages, illustrated. Price 50 cents. Memoir 155 of the Geological Survey, Canada.

Mineral Deposits of the Union of South Africa. Edited by Dr. LEOPOLD REINECKE and the late Dr. P. A. WAGNER. Paper boards, 310 pages, illustrated, with maps. Handbook for the Third (Triennial) Empire Mining and Metallurgical Congress, 1930.

Southern Rhodesia. Report of the Director, Geological Survey, for the year 1929. Paper folio, 10 pages. Salisbury.

The Yerranderie Silver Field. By L. F. HARPER. Paper covers, 63 pages, illustrated. Mineral Resources of New South Wales, Paper No. 35. Sydney: Department of Mines.

The Mineral Resources of Palestine and Transjordan. By G. S. BLAKE. Paper folio, 41 pages. Price 100 mils. Jerusalem: Public Works Department.

"New Standard" Code.—Compiled by H. G. TELLING, F.C.S., F.I.P.I. Cloth, 693 pages. Office edition, £5 5s.; pocket edition, £4 4s.; mining supplement, £2 2s. Special attention is given to mining, and the Supplement dealing with that subject, used in conjunction with the general code, ensures economy, and at the same time secures facility of expression. London: Amalgamated Code Compilers, Ltd.

COMPANY REPORTS

City Deep.—This company belongs to the Central Mining-Rand Mines group and works a deep level property in the central Rand. The report for the year 1929 shows that 1,232,802 tons of ore was mined and after sorting out 12.1% of waste, 1,083,900 tons averaging 5.707 dwt. was sent to the mill. Gold recovered totalled 295,615 oz. worth £1,254,120 and silver and osmiridium brought the revenue up to £1,258,143, or 23s. 3d. per ton. Working costs amounted to £1,397,378, or 25s. 10d. per ton. The resulting working loss was £139,234, or 2s. 7d. per ton. The loss is mainly due to shortage of payable stope faces. The average results of development have varied little during the past four years and the available ore reserves at the end of the year were estimated at 1,323,400 tons averaging 6.2 dwt. as compared with 1,445,100 tons averaging 6.1 dwt. a year ago.

Rezende Mines.—This company, formed in 1908, operates a gold mine in Southern Rhodesia. The report for the year 1929 shows that 91,610 tons of ore was mined, and, after sorting 16.6% waste, 76,400 tons of ore was milled, yielding 28,093 oz. gold, equal to 40s. 3d. per ton. Working costs per ton amounted to 23s. 9d., and the working profit was £63,080, or 16s. 6d. per ton milled, as compared with £63,523 and 16s. 8d. in 1928. The ore reserves at the end of the year were estimated to be 184,000 tons averaging 8.8 dwt. as compared with 165,000 tons averaging 9.6 dwt. in 1928. Work on the Reliance mine, held under option, was confined to shaft sinking, and the shaft had, at the end of the year, reached a depth of 140 ft. It is intended to sink to 210 ft. and cross-cut to the reef in the sulphide zone. On the Monarch claims work to the end of the year has shown the reef to be 18 ft. wide, assaying 7.8 dwt. on the east side and 6.4 dwt. on the west side. Two dividends absorbing £37,500, equal to 25%, were declared during the year.

Kagera (Uganda) Tinfields.—This company was formed in 1926 to work alluvial tin deposits in Uganda. The report for 1929 shows that 312 tons of tin concentrates was produced as compared with 266.2 tons in 1928. Of the year's output, 260 tons was sold, realizing £34,645, an average price of £133 5s. per ton, or approximately £28 per ton less than in the previous year. The profit for the year's working was £7,622, as compared with £23,198 the year before, and £7,500 was distributed as dividends, equal to 7½%. No true estimate can be given as to ore reserves in the mine, but 300 tons are probable. This, together with 1,615 tons of proved detrital ore, gives a figure of 1,915 tons as ore reserves. The company still holds its 10% interest in the country being prospected by the Billiton Company in East Africa.

Champion Reef Gold Mines of India.—This company was formed in 1889 to work a gold mine in the Kolar district of Mysore, India. It is managed by Messrs. John Taylor and Sons. The report for the year 1929 shows that 53,695 oz. of gold was produced from 101,280 tons of ore, 12,459 oz. recovered from 265,684 tons of tailings retreated, and 408 oz. obtained from old copper plates, making the total return of 66,562 oz. gold as compared with 63,337 oz. in 1928. Total income for the year was £273,814, and working costs amounted to £221,444, the profit for the year being £52,370, an increase of £13,249 over that of the previous year. Dividends absorbed £33,150, equal to 12½%. Ore reserves at the end of the year were estimated to be 278,086 tons, as compared with 269,356 tons a year ago. Development has revealed good ore in the central shoot down to present bottom level and in Glen section good ore has opened up for a length of 622 ft. in the deepest level.

Mysore Gold Mining.—This company, formed in 1880, also belongs to the group of gold mines in the Kolar goldfield managed by Messrs. John Taylor and Sons. The report for the year 1929 shows that 99,692 oz. of gold was produced from 213,043 tons of ore milled, and, in addition, 2,536 oz. was obtained from sundry sources. The total revenue for the year was £418,135, and expenditure totalled £287,424, leaving a profit of £130,710, or £47,184 less than in 1928. 1s. 9d. per share was distributed as dividends, absorbing £106,750. Ore reserves at the end of the year were estimated to be 517,024 tons, or 52,593 tons less than the year before. A well-mineralized lode has been discovered

in the southern section of the property, and the pilot shaft is being deepened to continue the development of this lode.

Malaya Consolidated Tin Dredging.—This company was formed in 1926 to work alluvial tin property in the State of Perak, F.M.S. The report for the year ended September 30 last shows that 3,926,990 cu. yd. of ground was excavated, and 767 tons of tin concentrates recovered, equal to 0.327 katty per cu. yd. The product realized \$875,760 and the net profit for the year was \$19,372, which was carried forward.

Sungei Kinta Tin Dredging.—This company, formed in 1925, operates alluvial tin property in the State of Perak, F.M.S. The report for the year ended December 31 last shows that 1,398,100 cu. yd. of ground was treated, yielding 477 tons of tin concentrates, equal to 0.764 lb. per cu. yd. The area worked out amounted to 24.83 acres. The net profit for the year was £25,026 and £20,000 was distributed as dividends.

St. John del Rey.—This company has worked the Morro Velho gold mine in Minas Geraes, Brazil, since 1830. The report for the year 1929 shows that 164,800 tons of ore was crushed, yielding 108,879 oz. gold, worth £459,265. In addition, bullion value £13,206 was taken from old workings and explorations, and silver to the value of £2,576 was recovered. The tonnage crushed shows an increase of 11,700 tons, and a yield of 1s. 11d. per ton more than in the previous year. Working costs in Brazil were £310,618, development absorbed £29,544, and London expenses were £10,864, leaving a profit of £103,774. Dividends absorbed £71,701 and £30,000 was transferred to capital works account. The new ore-body opened up at Horizon "25" has been developed to a length of 1,000 ft., though the western limit has not yet been reached, and the grade of ore is consistently good. On Horizon "26" this new north-west lode appears to be of low grade, but explorations are proceeding. When development on this horizon has proceeded sufficiently, plans for working the mine at greater depth will be considered. The reserves of ore are estimated at 1,455,100 tons, the highest recorded, mainly due to the additional tonnage developed on the north-west lode and to the body discovered south-east of Horizon "22".

South Crofty.—This company was formed in 1906 and works a tin mine between Camborne and Redruth. The report for the year 1929 shows that 75,668 tons of ore was crushed, yielding 795 tons of black tin and 259 tons of arsenic, as compared with 74,039 tons of ore, 795 tons of black tin, and 279 tons of arsenic in the previous year. The value of the black tin recovered was £101,389, and of the arsenic £4,864, and the profit for the year was £7,838. After writing off £5,148 for depreciation, the balance was carried forward. The profits for the year were small owing to the low price of black tin, the average price being £128 17s. 10d. per ton, as against £141 15s. 5d. in the previous year. A contract has been entered into for the sale of 200 tons of wolfram from the company's Castle-an-Dinas property.

DIVIDENDS DECLARED

Anglo-Oriental Mining.—Pref. 10d., Ord. 3d., less tax, payable May 26.

Broken Hill South.—1s. 6d., less tax, payable May 23.

Changkat Tin Dredging.—1s., less tax, payable April 30.

Gold Fields Rhodesian Development.—6d., less tax, payable May 29.

Mount Lyell.—1s., less tax, payable June 23.

Oriental Consolidated.—50 cents, payable May 16.

Oroville Dredging.—1s. 6d., less tax, payable May 16.

Pahang Consolidated.—Ord., 3d., less tax; Pref., 3½%, less tax, payable May 31.

Petaling Tin.—10%, payable April 26.

Premier (Transvaal) Diamond.—Pref. 6s. 3d., less tax, payable April 24.

Sinai Mining.—Ord. and Pref., 1s. 9d. less tax, payable May 8.

Sungei Way Dredging.—5%, payable April 28.

Transvaal Gold Mining Estates.—6d., payable May 5.

Vereeniging Estates.—1s. 6d., less tax, payable July 25.

Waihi Gold.—1s., free of tax, payable May 9.

Weardale Lead.—6d., less tax, payable April 17.

Zinc Corporation.—Pref., 4s.; Ord., 2s., less tax, payable June 16.

NEW COMPANIES REGISTERED

Briseis Tin and General Mining (1930).—Registered April 28. Nominal Capital: £100 in £1 shares. Objects: To adopt an agreement with the Briseis Tin and General Mining Company and to carry on all kinds of mining and exploration business. Office: 704-705, Salisbury House, London Wall, E.C. 2.

Complex Research (Argentine).—Registered as a private company on April 12. Nominal Capital: £100 in £1 shares. Objects: To acquire the exclusive right to use in Argentine a secret process for the manufacture of gold from chemical and other compounds or matter; and to carry on the business of goldsmiths, etc.

Complex Research (Roumania).—Registered as a private company on April 12. Nominal Capital: £100 in £1 shares. Other particulars are similar to those of the Complex Research Company (Argentine).

New Nigel Asbestos.—Registered April 28. Nominal Capital: £125,000 in 2s. shares. Objects: To acquire the assets of Nigel (Transvaal) Gold-fields and to carry on the business of miners, workers and winners of asbestos, metals, minerals and precious stones of all kinds, etc. Office: 65, Bishopsgate, E.C. 2.

Puket Tin Dredging.—Registered: April 8. Nominal Capital: £300,000 in 5s. shares. Objects: To adopt an agreement with the Waihi Gold Mining Company and Tronoh Mines, to acquire mines and other rights in Siam, the Federated Malay States, the Straits Settlements, or elsewhere. Directors: W. P. Gauvain, A. M. Mitchison, C. V. Stephens, and C. V. Thomas. Office: Portland House, 73 Basinghall Street, E.C. 2.

Yugo-Slavian Concessions.—Registered as a private company on April 10. Nominal Capital: £5,000 in 2,900 Ordinary shares of £1 each and 42,000 Deferred shares of 1s. each. Objects: To adopt an agreement with Michael Vinogradoff to acquire any petroleum, asphalt, naphthaline, or oil-bearing lands; to sink wells; to sell petroleum and other mineral oils; to produce, generate and distribute electrical energy or power; to carry on the business of a light and power company, etc. Office: Imperial House, 80 Regent Street, W. 1.

BRITISH COLUMBIA

DEPARTMENT OF MINES

British Columbia, the Mineral Province of Canada, has produced approximately **\$1,184,200,000** worth of mineral products.

Mineral production year 1928 - \$65,372,583

Estimated production year 1929 - 70,030,976

SPECIAL REPORT ON PLACER MINING IN BRITISH COLUMBIA is now available, and may be obtained, together with copies of the Annual Reports, Bulletins, etc., upon application to—

THE HON. THE MINISTER OF MINES,
Victoria, B.C.,
or
BRITISH COLUMBIA HOUSE,
REGENT STREET, LONDON, S.W. 1.

COMPANY MEETINGS AND REPORTS SECTION

CONSOLIDATED MINES SELECTION CO., LTD.

Directors : Walter McDermott (*Chairman*), R. J. Frecheville, F. W. Green, Alfred Hicks, Sir Ernest Oppenheimer, Louis Oppenheimer, J. S. Wetzlar. *Secretary* : H. S. Johnson-Hall. *Office* : London Wall Buildings, Finsbury Circus, London, E.C. 2. *Formed* 1897. *Capital* : £600,000 in 10s. shares.

Business : Finance of and investment in mining ventures in various parts of the world.

The thirty-fourth ordinary general meeting of shareholders of Consolidated Mines Selection Company, Ltd., was held on April 15, 1930, at River Plate House, Finsbury Circus, E.C., Mr. Walter McDermott (Chairman of the company) presiding.

The Chairman, in moving the adoption of the report and accounts for the year ended December 31 last, said: Ladies and gentlemen, a copy of the report of the Directors, including a statement of accounts for the year ending December 31, 1929, was sent to all Shareholders with the notice calling this meeting, and I presume you will allow me to take it as read; in which case I shall be able to put forward the following resolution: "That the Directors' report, balance sheet, and profit and loss account, as presented, be and they are hereby approved and adopted." Before putting that resolution to the meeting, I will lay before you certain explanations of the figures in the accounts, and some description of the details of the past year's work and of the business which is likely to affect the Company's position during 1930. No change has been made in the capital of the Company, which stands at £600,000 in 1,200,000 shares of 10s. each, all issued and fully paid. There are no debentures or other preference charges against the capital account. In quoting you figures from the accounts I will not give the shillings and pence. The general financial position at the end of 1929 can be summed up by stating that cash, cash assets, and sundry debtors and debtor balances amounted in the aggregate to £255,924, against which there stood creditors, credit balances and contingent liabilities amounting to £30,723. From these figures it will be seen that cash and cash assets exceeded all liabilities by the sum of £225,201. The other assets of the company are represented by investments in shares and other securities, valued in the balance-sheet at £622,856; and this sum added to the cash and cash assets makes up an excess of assets over liabilities of £848,057. But this amount is an underestimate of the actual standing of the company, because the item of £622,856, for investments, is a valuation of securities based on their actual original cost, or on their market quotation at the end of December, whichever was the lower figure on that date. If the list of securities had been calculated throughout on their market prices of the day, a very considerable increase of the total valuation could have been shown. But this would not have been a proper method of book-keeping when dealing with investments of the fluctuating character of those in which the Company deals. The balance sheet will show you that the company has a reserve of £120,000 put aside from profits earned in past years, but not distributed in dividends. Your directors will try to keep this reserve untouched as a margin of safety in future business.

As regards the results of operations for 1929,

the profit and loss account, including the credit balance of £7,757 carried over from 1928, shows a profit of £120,057. The directors recommend increasing this unappropriated profit to a total amount of £128,057 by a transfer to the profit and loss account of £8,000 from the dividend equalization account, reducing this latter from £18,000, now on the books, to £10,000, which will be continued as a reserve for any future needs. The directors recommend that a dividend be declared of 2s. per share, less income-tax, making 20% for the past year, absorbing £120,000 and leaving a sum of approximately £8,000 to be carried forward into the accounts for 1930, subject to the amount of the additional remuneration due to the directors when the dividend is paid. I shall put a resolution before the meeting to carry out the recommendation of a dividend, and, if you pass that resolution, the dividend will be paid to all Shareholders registered in the books of the Company on March 8, 1930. I do not think that the items making up the balance sheet require any further detailed explanation, and we are pleased to mention that the New Company Act does not introduce any new requirements for our old-established methods of keeping our books and presenting their contents to the Shareholders. As you now know the general results of last year's operations, you will, I think, be chiefly interested to hear what is the position of the Company to-day as regards the interests held and what prospects they offer of profits for the current year. The interests I can describe to you; but their prospects, over a given period, must be touched on with discretion to avoid the danger of prophecy in a business which admits only a very limited certitude.

The very large interest we hold in the new Ordinary 10s. shares of the Anglo American Corporation of South Africa makes this concern a most important item in our list of holdings, and the corporation's yearly operations and future permanent returns of profits depend on very large interests it has in gold, diamond, and copper investments. Its gold-mining investments are confined to the wonderfully regular producers of the Rand, and are for the most part in Brakpan, Springs, West Springs, and Daggafontein mines, in the development of which the Consolidated Mines Selection Company took so prominent a part for many years. Year by year the Anglo American Corporation has increased its investments and influence in the diamond mining and marketing industry, until it now occupies a leading position in its relations with all the great producing mines. At our meetings for several years past I have made prominent mention of the fact that our yearly business and future prospects were closely connected with diamonds, through our holding in the Anglo American Corporation, but I will postpone anything to be said on the peculiarities of the industry until I come to the

subject of our future prospects. In estimating the value of our holding in Anglo American Corporation, it is necessary to remember that it has a very large reserve account and a large appreciation at present market quotations over the book value of its investments taken in its balance sheet.

At our last year's meeting I described the marvellous developments which had already been accomplished in the Northern Rhodesia copper deposits, and I mentioned the amalgamation that had been effected of interests held by a number of mining groups, which resulted in the formation and capitalization of a great holding company, known as the Rhodesian Anglo American, Ltd., in which the Anglo American Corporation was very largely interested. When this merger of interests took place, the shares which we then held in some copper companies were included, so that to-day our company is not only interested directly in the Rhodesian Anglo American, Ltd., shares, but it has indirectly a large stake in the enterprise through the Anglo American Corporation. During the twelve months, since our last meeting, the prospecting of great areas by diamond drilling has been continuous; and with such remarkable success in proving extension of the copper deposits in length and depth and such great uniformity of occurrence of a profitable grade of ore that the market value of shares in the different companies rose steadily month by month. A number of experienced mining engineers were sent to Northern Rhodesia by capitalists in the United States, with the result of large purchases of shares. The American financial crisis of last year resulted in heavy selling here, with a consequential drop in prices; a drop still evident to-day. Last year I ventured to prophesy that, before the productive stage was reached in any of the mines, there would be plenty of fluctuations in share prices.

The Daggafontein Mines, Ltd., in which we are interested, both directly and indirectly, is being developed at a more rapid rate than in the past, because it has more working faces now available; but it depends for its present means of development on facilities afforded from the workings of its mining neighbour, the Springs Mines, Ltd., while its own main vertical shaft is being sunk. Some of the latest assays have been very satisfactory, and the engineers consider there is a good prospect of opening a paying property, the chances for which are the more favourable from the fact that the terms of lease with the Government are less onerous than those of other areas in the Eastern Rand.

Our venture in the Botanamo mine of Venezuela is continuing to make profits, and from them to repay gradually the money which was originally advanced for equipment and development; but there has been no important extension of the rich ore shoot proved, either in depth or in length. It was originally hoped that some of the gold-bearing veins on which the investment was based might prove to be of value; but the prospecting work done on them has so far proved disappointing, as regards the chances of a continuation in depth of the rich ore below the present 400 feet level and of a recurrence of local enrichments in length. I consider, personally, that we need not give up hope that there is more to be discovered in a deposit of its character and under similar geological conditions to those which carried the extremely

rich ore shoot of the El Callao mine of Venezuela to a depth of 1,100 feet.

The Mawchi tin and wolfram mines have been continuously and actively developed since the date of our last meeting, at which I placed before you a description of this property and details of the conditions under which our company became interested. I am pleased to be able to say, to-day, that the mine developments effected in the past twelve months have come up to our expectations, by adding largely to the reserves of ore and by establishing the grade of the whole quantity yet in sight to be fully as good as the average estimated at the time of investing in the property. For the month of March, 3,420 tons of ore were crushed and yielded 155½ tons of concentrates of 64·6% combined tin and wolfram. According to the Manager's report on the first month's milling, the actual return of concentrates affords evidence that the regularly reported assay results of mining progress can be relied on as giving correct values of the ore being developed. The mill is an old one and, although put into order and improved in details, it still requires certain slimes treatment and other equipment, the machinery for which is now on the way to the mine. When these improvements are installed, an increased recovery is to be expected on the ore as crushed. During March, 20 tons of concentrates, containing 64·5% mixed metals, were purchased from tributors and will yield a profit when marketed. You are aware of the fact that one of the uncertainties in continuous working is the matter of transport over long distances in a very mountainous country with great rainfall causing injury to roads occasionally. The roads have been kept so far in such repair that no very serious interruption has taken place in the communication between seaport and mine, and concentrates purchased from native workers have been shipped with a resulting profit for the company. The price of tin has fallen since we became interested in Mawchi; but, as we know from the last few years' experience, investors in all base-metal mining operations must be prepared to face fluctuations in market prices of the products. From the best information we can secure, there seems to be little risk of such further fall in tin and wolfram as would materially reflect on our prospects of working Mawchi at a good profit; and we have two strings to our bow in the production of two metals, not necessarily influenced by the same market conditions. In the mining chances, there is a favourable element in the number of distinct veins producing profitable ore, so that the risk of occasional local impoverishment is spread over a number of separate ore occurrences. In January the Commissioner of the Federated Shan States visited the mine and expressed to the Manager his congratulations to the Company on the progress of development of operations and the work accomplished in building up the camp to a degree he had not expected to see. When the difficulties of working at Mawchi are taken into consideration, it is evident that much credit is due to the Manager, Mr. Jobling, and his staff, for bringing the property into its present promising condition, recognized at once by the Commissioner.

In considering the outlook over the current year it is desirable to bear in mind certain broad facts affecting the diamond and copper interests. The future of the diamond industry is a matter of the highest importance to our company in any attempt to describe our future prospects; but its

singular character and peculiar conditions of existence make prophecy difficult and undesirable. The demand for diamonds is world-wide, although it is in great part a luxury trade that supports it. The raw material, the rough stones, are only saleable to those who control the highly skilled craft of cutting and setting. To purchase the product of the mines, to hold large stocks through times of depression, and to reach the buyers for the trade, has required a separate organization with large capital, and this is known as the Diamond Syndicate. That Syndicate has, in effect, stabilized the industry for about 38 years, and neither the successful mining, nor the vast machinery for preparing and retailing the output would have been possible without the Syndicate.

As regards the ultimate buyers of the finished cut stones, there are, of course, variations in the demand from different countries due to local conditions and to alternations of periods of prosperity and depression; but over the whole world and long periods of time, a remarkable stability has been established. For example, America is a large consumer, and in times like the recent financial crises a marked falling off is evident in the demand. It may, however, be mentioned here that there has never been an actual stoppage of purchases from across the Atlantic, although just now there is a very great uncertainty introduced by speculation about the expected new tariff which is being discussed. A very important element in the whole industry is the financial interest of the South African Government in the results of mining and in the success of marketing the stones, and I am able to say that relations of producers, buyers, and the Government are of the most friendly nature. The rumours that a recent conference between the parties had failed to agree were never justified by the facts.

In mining of every description, except for gold, chances must be taken of market fluctuations in products, and we have seen, for example, in silver, zinc, tin, lead, coal, and phosphates as great changes of basic conditions as have occurred in diamonds. Your directors are quite satisfied to await the course of events in 1930 without uneasiness as to future justification of investments in this section of our business.

There is an absolute agreement of opinion among British and American mining engineers as to the vast extent of the copper deposits existing in Northern Rhodesia and occurring in the form of remarkably regular beds of ore, of an average grade that will pay good profits—even with copper at a lower price than it is to-day—after the mines are equipped for working on the large scale to which investors are accustomed in the industry. The only doubts expressed by critics as to the extent of future profits are based on possible difficulties in the supply of native labour and in the absence of certainty about the future price of copper. The long experience in South Africa of the chief engineers who are directing operations has been applied to a very thorough examination of the data which will determine the numbers and sources of the future labour supply, on a yearly ascending scale; and the conclusions reached have quite satisfied the large capitalists who will be finding the capital to get the industry to the producing stage.

On the question of future demand for, and consequent price of copper, the world statistics afford the strongest argument for the belief that a steady rise in total yearly metal consumption can be depended on; and, as affecting calculations on both demand and price, it is well-known that the enormous copper deposits of very low grade ore now being worked in the United States have their established limitation in quantity of ore and in price of copper at which profitable working will be possible in future. It must, of course, be borne in mind that the great properties in which we are interested will require a long time to reach the dividend-paying stage. But market valuations of to-day will not prevail when the time for returns arrives. In other words, the prices at which our investments were made took into account the deferred period for any possible return of interest. This position of lock-up of capital has a material bearing on the subject of the earnings of the company in the immediate future, so far as a part of our capital is concerned. It is felt to be a very satisfactory element in the development of this great new copper field that the industry will be in British territory and under British control; and I say this in spite of a full knowledge that, for these days, an appeal to patriotism seems to be of less popular force than it has been for preceding generations.

In concluding the subject of our prospects for the current year, I will say that your directors are satisfied with the general investment position, without daring to venture on making any guesses as to profits by the end of 1930. The Company has lived through many fluctuations, and these are natural to our business; no one will venture to say that this year of grace is a safe time in which to prophesy on industrial or political affairs quite capable of affecting mining results. The cash position, after payment of the proposed dividend, is sufficiently strong to enable your Directors to take advantage of any promising new business offering. I trust that what I have said will give you the chief points you desire on the Company's position; but, before putting to you the resolution you have heard, approving and adopting the Directors' report and accounts, I will give those present the opportunity of asking any questions. I will ask Mr. Green to second the resolution.

Mr. F. W. Green: I beg to second the resolution.

The Chairman: Before putting that to the meeting, gentlemen, I am prepared to answer, if I can, any questions that may be asked by those present.

After replying to various questions, the Chairman put the resolution to the meeting and declared it carried unanimously.

The Chairman: I have now to propose: "(a) That the sum of £8,000 be transferred from dividend equalization account to profit and loss account. (b) That a dividend of 20% (2s. per share), less income tax at the rate of 3s. 3d. in the £, be and the same is hereby declared payable this day to shareholders registered on March 8, 1930. (c) That the balance of £8,057 13s. 7d. be carried forward to next account, subject to further remuneration due to the Directors."

Mr. A. Hicks: I beg to second the resolution.

The resolution was put to the meeting by the Chairman and carried unanimously.

After the election of directors, and of officers of the company for the current year, the proceedings terminated.

ANGLO-AMERICAN CORPORATION OF SOUTH AFRICA, LTD.

Directors: Sir Ernest Oppenheimer (*Chairman*), L. A. Pollak (*Deputy Chairman*), Sir F. D. P. Chaplin, Sir E. Davis, W. Dunkels, F. W. Green, W. L. Honnold, W. E. Hudson, W. McDermott, V. Munroe, W. J. O'Brien, L. Oppenheimer, J. S. Wetzlar, G. H. Whigham. *Technical Director:* Carl R. Davis. *Head Office:* Johannesburg. *Secretary:* J. Boyd. *London Office:* 4, London Wall Buildings, E.C.2. *London Manager and Secretary:* H. S. Johnson-Hall. *Formed* 1917. *Capital issued:* £4,000,000.

Business: Finance of and investment in mining operations in Southern and Central Africa.

EXTRACTS FROM THE REPORT OF THE DIRECTORS FOR THE YEAR ENDED DECEMBER 31, 1929.

To be submitted at the Thirteenth Annual General Meeting to be held in Johannesburg on Saturday, May 17, 1930.

The companies in which the Corporation is principally interested are the following:—Rand Selection Corporation, Ltd.; New Era Consolidated, Ltd.; Cape Coast Exploration, Ltd.; Companhia de Diamantes de Angola; Consolidated African Selection Trust, Ltd.; Consolidated Diamond Mines of South-West Africa, Ltd.; De Beers Consolidated Mines, Ltd.; Brakpan Mines, Ltd.; Daggafontein Mines, Ltd.; Springs Mines, Ltd.; West Springs, Ltd.; Rhodesian Anglo American, Ltd.; Transvaal Coal Corporation, Ltd.; Ammercosa Land and Estates, Ltd.; Rhodesian Land, Cattle, and Ranching Corporation, Ltd.

Diamond Interests.—The Syndicate's sales of rough diamonds were satisfactory up to October, 1929. The financial crisis in Wall Street, which occurred towards the end of that month, brought with it—as was only to be expected—a cessation in demand. The stoppage of sales was not accompanied by any panic, the Trade knowing that the big Producers, both within and outside the Union, work in complete harmony and subscribe to the principles of limitation of output and sales through one channel. The co-operation between our Government and the big Producers is best demonstrated by the successful issue of the Conference recently called by the Union Government to deal with the various problems confronting the Diamond Trade.

Cape Coast Exploration, Ltd.—Operations during the year were continued on the farm "Kleinzee," and a modern plant for the treatment of the diamond deposits is in course of erection. The proved diamond content of the farm "Kleinzee" exceeds 400,000 carats, and the title under which the farm is held reserves the sole mineral rights to the Company.

Companhia de Diamantes de Angola.—The production of diamonds for 1929 amounted to 312,000 carats as against 237,000 carats for 1928, an increase of 75,000 carats. A dividend of 5% was paid during the year out of the profits earned during 1928. A similar dividend of 5% was declared in January, 1930, from the profits earned in 1929, and it is anticipated that a further dividend for 1929 will be distributed after the final accounts for the year are completed. Owing to the satisfactory position of the reserves, development work is being conducted on a reduced scale. Production for the current year promises to be on a scale equal to that of 1929.

Consolidated Diamond Mines of South-West Africa, Ltd.—During the year the division of the original £1 shares into one 10s. 7½% Cumulative Preference Share and one 10s. Ordinary Share was carried into effect. The right given to holders of Option Certificates to take up shares at par expired on October 1, 1929, when all but a very small number of the options were exercised.

Rhodesian Anglo American, Ltd.—The formation of this Company was reported in the last Annual

Report. In October, 1929, the Capital of the Company was increased from £2,500,000 to £3,500,000 in shares of 10s. each. Of the 2,000,000 new shares thus created, £1,500,000 were offered to shareholders at a premium of 30s. per share. The Corporation underwrote the issue for a commission of 2½%. The reason for the increase in Capital was that the Directors of the Company believed that the continued expansion of the Northern Rhodesian Copper Mining Industry and the growth of the various enterprises in which the Company is interested offered remunerative opportunities for the investment of the additional funds. Since October, a further 281,625 shares have been issued at 40s. per share for the purpose of increasing the Company's shareholding in the more promising copper mining properties in Northern Rhodesia. Through the holding in Rhodesian Anglo American, Ltd., the Corporation is interested in the following Companies:—Bwana M'Kubwa Copper Mining Company, Ltd., which produced 6,672 tons of best selected copper during the year, an increase of over 800 tons on the output for 1928; the Rhodesian Congo Border Concession, Ltd., on whose concession as a result of the work carried out in the ground adjoining the N'Changa property an ore body of great width carrying high copper values has been disclosed, and a very large tonnage of high grade ore is already definitely indicated, whilst important extensions can be fairly assumed. Plans for the development of this ore body have been agreed and the work is well in hand. At many points outside the N'Changa district discoveries warranting further investigation have been made. For this purpose and to enable prospecting operations to be carried on vigorously the existing staff is being substantially augmented; the N'Changa Copper Mines, Ltd.; Loangwa Concessions (Northern Rhodesia), Ltd.; Rhodesia Minerals Concession, Ltd., and the Rhodesia Broken Hill Development Company, Ltd., which during the year produced 12,121 tons of zinc and 1,635 tons of lead. Additional acid plant was erected and put into commission during the year. Diamond drilling has established the extension of the 5 and 6 Kopje ore body to a depth of 800 ft.

Dividends.—Dividend No. 10 of 12½% equal to 2s. 6d. per share, was declared on February 19, 1929. Payment of the dividend absorbed £464,806 12s. 6d. In addition, Dividend No. 1 on the Cumulative Preferred Stock of 3% for the six months ended December 31, 1929, was declared in December, 1929, and payment of this dividend absorbed an amount of £60,000. Since the close of the year Dividend No. 11 on the Ordinary Shares of 22½% or 2s. 3d. per share, was declared on February 19, 1930.

Copies of the Full Report and Accounts may be obtained at the London Office: 4, London Wall Buildings, E.C.2.

BRAKPAN MINES, LTD.

Directors : L. A. Pollak (Chairman), J. Boyd, W. J. O'Brien, R. B. Hagart, W. E. Hudson, J. L. Jourdan, F. A. Unger. Secretaries and Consulting Engineers : Anglo American Corporation of South Africa, Ltd. Head Office : Johannesburg. London Office : 5, London Wall Buildings, E.C. 2. Formed 1903. Capital : £1,020,000.

Business : Operates a gold mine in the Far East Rand.

REPORT OF THE DIRECTORS FOR THE YEAR ENDED DECEMBER 31, 1929.

To be submitted at the Twenty-seventh Ordinary General Meeting, to be held in Johannesburg on May 16, 1930.

The capital of the Company is unchanged at £1,020,000 in 1,020,000 shares of £1 each, fully paid and issued. No alterations have taken place during the year in the Company's claim holdings.

From the Working Expenditure and Revenue Account it will be seen that :—

The profit amounted to	£660,530	5	9
Deduct—Donations	3,295	4	0
Add—Dividends on Shareholdings £970 15 10	£657,235	1	9
Interest, Commission, Exchange, etc. 12,545 10 10		13,516	6 8
Leaving a Net Balance of Revenue over Expenditure for the year of	£670,751	8	5
Add—Balance to Credit of Appropriation Account at December 31, 1928	59,536	12	3
Making a total available Credit of	£780,288	0	8
Against which the following amounts have been appropriated :—			
Government Taxes	£67,025	3	9
Government Participation in Profits	90,368	6	7
Reserve for Liability Under Miners' Phthisis Acts	17,355	11	0
Dividend No. 34	242,250	0	0
Dividend No. 35	255,000	0	0
		671,999	1 4
Leaving a Balance unappropriated at December 31, 1929, of	£58,288	19	4
The Capital Fund shows a credit for the year of £1,964 13s. 10d., which is mainly attributable to the refund by West Springs, Ltd., of their proportion of the cost of the Joint Ventilation Fan, previously charged out to Capital Account. The net credit is made up as follows :—			
Shaft Sinking and Equipment, as per Schedule attached to Balance Sheet—Credit	£2,204	13	4
Less—Expenditure on Shares and Interests in Other Concerns	239	19	6
Net Credit	£1,964	13	10

The unexpended balance of Capital Funds has been increased accordingly.

The amount payable to the Government for the year under the terms of the Mineral Lease Agreement is estimated at £90,368 6s. 7d. This figure represents 13.473% of the profits for the year as compared with 9.423% for 1928. This increase is due to a smaller allowance for amortization being authorized than that for last year. The amount charged to working costs for development was £99,405 5s. 10d. In connexion with the annual reserve in respect of the Company's liability under the Miners' Phthisis Act, the amount set aside for 1929 is £17,355 11s. This, with the previous figure of £25,960 13s. 6d. and interest accrued, gives a total reserve of £44,484 9s. 1d. The Company's ultimate assessment is estimated at £199,714.

Two dividends were declared during the year, as follows :—

	%	Rate per Share.	Total Amount
Dividend No. 34	23½	4s. 9d.	£242,250 0 0
Dividend No. 35	25	5s. 0d.	255,000 0 0
	48½	9s. 9d.	£497,250 0 0

EXTRACTS FROM THE CONSULTING ENGINEERS' REPORT.

The results of operations for 1929 provide a number of features calling for comment. The tonnage milled was a record, and this also applies to the number of ounces of gold produced, fathoms broken and footage developed. Whilst the yield and profit were better than those for the previous year, working costs were higher, owing to the larger fathomsage stoped, the increased development footage, and the greater expenditure in the Reduction Department accounted for by heavier maintenance and reconditioning work.

The following is a comparison of results for the year under discussion with those for 1928 :—

	1928.	1929.
Tons milled	1,016,500	1,028,300
Revenue per ton milled	32/4.5	32/11.8
Working costs per ton milled	19/9.4	20/ 1.6
Working profit per ton milled	12/7.1	12/10.2
Total working profit	£639,755	£660,530

The supply of native labour was sufficient from February until the middle of the year. From then onwards the position grew worse, till in December it became acute. Due to the fluctuation in the native labour complement, the tonnage milled during the first half of the year was practically 4,000 tons per month greater than that for the latter portion of the year, in spite of the smaller number of working days. The fathomsage broken was increased to 79,380 fathoms, while the measured stoping width showed a further decrease of 2.02 inches. The value of the ore mined from the Payable Reserve during the year was 0.38 dwt. above the average of the Reserve as at the beginning of the year. This was due to the fact that during the period when native labour was abundant, the number of available stope faces did not permit sufficient control over the grade being exercised. By the end of the year ore of average grade was being mined.

A total of 31,978 feet of development was accomplished during the year, an increase of 4,000 feet over the 1928 footage. The following is a comparison of results of the last two years :—

	1928.	1929.
Payable footage sampled	10,430	9,805
Percentage payable	47.7	40.7
Average reef width, inches	43.37	39.55
Average assay value, dwt.	13.63	11.92
Inch-dwts.	591	471

The recalculation of the Ore Reserve as at December 31, 1929, shows a reduction in tonnage, while the stoping width and value have also decreased. Details are given below :—

	Tons.	Stope Width. in.	Stope Value. dwt.	Inch-dwt.
As at December 31, 1928 ..	2,938,050	57.61	8.21	473
As at December 31, 1929 ..	2,531,440	54.08	7.89	427
Decrease	406,610	3.53	0.32	46

SPRINGS MINES, LTD.

Directors : L. A. Pollak (Chairman), J. Boyd, W. J. O'Brien, R. B. Hagart, W. E. Hudson, F. A. Unger, J. S. Wetzlar. Secretaries and Consulting Engineers : Anglo American Corporation of South Africa, Ltd. Head Office : Johannesburg. London Office : 5, London Wall Buildings, E.C. 2. Formed 1909. Capital : £1,500,000.

Business : Works a gold mine in the Far East Rand.

REPORT OF THE DIRECTORS FOR THE YEAR ENDED DECEMBER 31, 1929,

To be submitted at the Twenty-first Ordinary General Meeting to be held in Johannesburg on May 16, 1930.

The capital of the Company remains unchanged at £1,500,000 in shares of £1 each, all fully paid and issued.

From the Working Expenditure and Revenue Accounts it will be seen that :

The profit from operations for the year amounted to	£785,455	12	4
Deduct—Donations	3,236	0	4
	782,219	12	0
Add—Dividends on Shareholdings, Interest, Commission and Exchange, and Sundry Revenue	15,693	10	11
Leaving a net balance of Revenue over Expenditure for the year	797,913	2	11
Add—Balance to credit of Appropriation Account at December, 1928	49,220	6	1
Making a total available credit of	847,133	9	0
Against which the following amounts have been appropriated :—			
Government Taxes	£73,750	7	4
Government Participation in Profits	151,727	16	7
Capital Funds	23,240	8	3
Reserve for Liability under Miners' Phthisis Acts	7,646	14	4
Dividend No. 20	262,500	0	0
Dividend No. 21	281,250	0	0
	800,124	6	6

Leaving a balance unappropriated at December 31, 1929, of

The Capital Expenditure for the year amounted to £42,663 1s. 4d., made up as follows :—

Shaft Sinking and Equipment, as per Schedule attached to Balance Sheet	£42,867	8	4
Less Credits—Shares and Interests in other concerns	£61	17	0
Property Account	142	10	0
	204	7	0
	£42,663	1	4

The Union Government's participation in the profits of the Company in terms of the Mineral Lease, is estimated at £151,727 16s. 7d. This sum is equivalent to 19·016% of the total profits of the Company for the year. Expenditure on development for the year amounted to £116,008 17s. 1d., which has been charged to Working Expenditure and Revenue Account. In connexion with the annual reserve in respect of the Company's liability under the Miners' Phthisis Act, the amount set aside for 1929 is £7,646 14s. 4d. This, with the previous figure of £15,116 5s. and interest accrued, gives a total reserve of £23,443 3s. 11d. The Company's ultimate assessment is estimated at £130,371.

Two dividends were declared during the year, as follows :—

	%	Rate per Share.	Total Amount.
Dividend No. 20	17½	3s. 6d.	£262,500 0 0
Dividend No. 21	18½	3s. 9d.	281,250 0 0
	36½	7s. 3d.	£543,750 0 0

EXTRACTS FROM THE CONSULTING ENGINEERS' REPORT.

The following tabulation gives comparisons of the results obtained during the last two years :—

	1928.	1929.
Tons milled	830,600	825,600
Revenue per ton milled	41/4·4	41/1·5
Working cost per ton milled	20/9·7	22/1·2
Working profit per ton milled	20/6·7	19/0·3
Total Working Profit	£853,852	£785,456

Tonnage and yield show only small variations, but working costs increased by 1s. 3·5d. per ton milled. The total increase in working expenditure is about £48,000, which is mainly accounted for by additional charges to development, winding, pumping, and reduction costs.

Although the sinking of No. 4 Shaft was completed in 1928, the cost of operating this shaft did not become a direct charge against the account "Winding" until 1930. During the year under review, therefore, part of the expenditure was debited to Development, and this, combined with the increased footage done, explains the additional cost of development. Towards the middle of the year, permission to use a portion of the Boiler Plant at No. 2 Shaft was withdrawn by the Government Inspector of Machinery. These boilers were shut down and had to be replaced. The cost of the various replacements was borne by Working Expenditure, and during the latter part of the year some £26,000 was thus charged out against the cost of winding. With regard to pumping, the additional water encountered in the north-eastern portion of the mine was responsible for the heavier charges to this account. The fathomage stoped was increased, but the total costs were lower. The stoping width was reduced by one inch.

The development footage accomplished in 1929 was 31,870 feet as against 28,986 feet for the previous year. At a number of points, ore of high grade was disclosed. Amongst the more important headings may be mentioned the A-4 Haulage, the subsidiary work between B-5 and F-4 Haulages, and the district in the vicinity of the Daggafontein Mines boundary from 6-G-5 Level downwards. A satisfactory feature was that both M-6 and 6-M Haulages disclosed payable ore. The payable ore developed during the year amounted to 1,114,929 tons, while the cost of development work was £116,009, or 2s. 1d. per ton of ore developed.

The Ore Reserve at the end of 1929 was estimated at 3,250,000 tons. Details as well as a comparison with the previous figures are given below :—

	Tons.	Stope Width. in.	Stope Value. dwt.	Inch-dwt.
As at December 31, 1929	3,250,238	50·49	9·30	470
As at December 31, 1928	3,008,641	52·50	9·10	478
Increase	241,597		0·20	
Decrease		2·01		8

The value of the ore mined from the Reserve during the year was just below the average value of the Ore Reserve.

WEST SPRINGS, LTD.

Directors : L. A. Pollak (Chairman), J. Boyd, R. B. Hagart, L. Oppenheimer, F. A. Unger. Secretaries and Consulting Engineers : Anglo American Corporation of South Africa, Ltd. Head Office : Johannesburg. London Office : 5, London Wall Buildings, E.C. 2. Formed 1918. Capital : £1,793,000.

Business : Works a gold mine in the Far East Rand.

REPORT OF THE DIRECTORS FOR THE YEAR ENDED DECEMBER 31, 1929.

To be submitted at the Thirteenth Ordinary General Meeting to be held in Johannesburg on May 16, 1930.

The capital of the Company remains unaltered at £1,793,000 in 1,793,000 shares of £1 each. The area leased by the Company from the Government of the Union of South Africa is 3,286.4 acres on Farm Rietfontein No. 8 = 2,235.65 claims.

From the Working Expenditure and Revenue Account it will be seen that :

The profit from operations for the year ended December 31, 1929, amounted to	£248,482 12 8
Deduct—Donations	1,666 1 8
	246,816 11 0

Add—Dividends on Shareholdings	£186 2 0
Interest, Commission and Exchange	3,556 8 9
	3,742 10 9

Leaving a Net Balance of Revenue over Expenditure for the Year of	250,559 1 9
Add—Balance to Credit of Appropriation Account at December 31, 1928	67,191 7 9
	317,750 9 6

Making a Total Available Credit of	317,750 9 6
Against which the following amounts have been appropriated :—	
Government Taxes	£12,908 13 6
Government Participation in Profits	11,984 5 8
Capital Funds	9,722 6 7
Reserve for Liability under Miners' Phthisis Acts	2,733 10 4
Dividend No. 8	89,650 0 0
Dividend No. 9	89,650 0 0
Directors' Special Remuneration ..	8,564 0 0
	225,212 16 1

Leaving a Balance unappropriated at December 31, 1929, of	£92,537 13 5
The capital expenditure for the year amounted to £10,722 6s. 7d., made up as follows :—	
Shaft Sinking and Equipment, as per Schedule attached to Balance Sheet	10,248 9 7
Shares and Interests in Other Concerns	473 17 0
	£10,722 6 7

The Union Government's participation in the profits of the Company, in terms of the Mineral Lease, is estimated at £15,951 9s. 5d. This sum is equivalent to 6.366% of the profits of the Company for the year. Owing to certain debits to Capital Account in 1928 being subsequently allowed by the Government as a charge against Working Costs, there was a refund of £3,967 3s. 9d. in respect of Union Government Participation for that year. This is shown in the Appropriation Account, together with resultant alterations in Normal Tax and Directors' Remuneration. Expenditure on development for the year amounted to £109,784 13s. 8d., which has been charged to Working Expenditure and Revenue Account. In connexion with the annual reserve in respect of the Company's liability under the Miners' Phthisis Act, the amount set aside for 1929 is £2,733 10s. 4d. This, with the previous figure of £3,170 17s. 7d. and interest accrued, gives a total reserve of £6,047 1s. 8d. The Company's ultimate assessment is estimated at £34,240.

Two dividends were declared during the year, as follows :—

	%	Rate per Share.	Total Amount.
Dividend No. 8	5	1s. 0d.	£89,650 0 0
Dividend No. 9	5	1s. 0d.	89,650 0 0
	10	2s. 0d.	£179,300 0 0

EXTRACTS FROM THE CONSULTING ENGINEERS' REPORT.

Additions to the reduction plant enabled a substantially larger tonnage to be crushed, with a beneficial effect on Working Costs amounting to 1s. 6d. per ton milled. At the same time it must be remembered that this benefit was not fully available until the middle of the year, so that the effect during the current year should be even more marked. While the yield per ton was considerably lower, the total profit was but little affected, thus demonstrating the advantages of the increased milling capacity. The following tabulation is given in support of the above :—

	1928.	1929.
Tons milled	647,300	763,500
Revenue per ton milled	27/8-55	24/8-00
Working cost per ton milled	19/7-94	18/1-89
Working profit per ton milled	8/0-61	6/6-11
Working profit	£260,565	£243,483

The tonnage of ore developed during the year, including that indicated by the advance of stope faces, was 922,700 tons, which makes the cost per ton of ore developed 2s. 5d. The development results call for no special comment except for the fact that the value of the new ore developed during the year was 5.4 dwt. A comparison of the ore reserve with the position a year ago is given herewith, and it is particularly gratifying that there is an increase of 57,000 tons despite the fact that the estimated stoping width has been decreased by nearly 4 inches :—

	Tons.	Stope Width. in.	Stope Value. dwt.	Inch. dwt.
As at December 31, 1929	2,752,680	57-26	6-34	363
As at December 31, 1928	2,695,520	61-16	6-80	416
Increase	57,160			
Decrease		3-90	0-46	53

The value of the ore mined from Payable Reserve during 1929 very closely approached the average of the Reserve at the beginning of the year, being only 0.07 dwt. above the latter figure.

The rearrangement of the flow-sheet of the reduction plant, whereby part of the Tube Milling plant is put on secondary grinding has not only proved very successful from the point of view of tonnage, but also with regard to operating expenses and extraction; costs being reduced from 3s. 3d. to 2s. 10d., and the residue value being lowered from 0.453 dwt. to 0.355 dwt.

DAGGAFONTEIN MINES, LTD.

Directors : L. A. Pollak (Chairman), Sir A. Bailey, J. Davidson, R. B. Hagart, H. G. Latilla, A. F. Mullins, C. L. Read. *Secretaries and Consulting Engineers* : Anglo-American Corporation of South Africa, Ltd. *Head Office* : Johannesburg. *London Office* : 5, London Wall Buildings, E.C. 2. *Formed* 1916. *Capital issued* : £827,945.

Business : Is developing a gold mine in the Far East Rand.

REPORT OF THE DIRECTORS FOR THE YEAR ENDED DECEMBER 31, 1929.

To be submitted at the Fifteenth Ordinary General Meeting of Shareholders, to be held in Johannesburg on May 16, 1930.

During the year 69 of the options issued to shareholders were exercised.

Under date March 4, 1929, a circular was issued to shareholders informing them of the decision of the Directors to proceed at once with the sinking of No. 3 Shaft on the Company's property. In order to procure funds to carry out the extended programme of operations, shares in the capital of the Company were offered at 22s. 6d. each to shareholders registered on the March 15, 1929, in the proportion of one new share for each two shares held. The Anglo-American Corporation of South Africa, Limited, underwrote the whole of the new issue for a commission of 2½%, and in addition subscribed for a further 49,552 shares at 22s. 6d. The response of shareholders to this offer was very satisfactory. In terms of the offer, 308,993 shares were issued at 22s. 6d. per share, and the issued capital of the Company at December 31, 1929, was therefore £827,945.

In addition, the following options at par to November 24, 1930, are outstanding:—

(1) On shares issued in satisfaction of loans and interest	171,882
(2) On working capital shares	204,998
(3) To underwriters of working capital shares	205,185
(4) To Cassel Clydesdale (Springs) Gold Mines, Limited	40,000
	622,065

The cash receipts and expenditure from the inception of the Company to December 31, 1929, after making allowance for sales effected, were as follows:—

RECEIPTS.

	£	s.	d.
Working Capital—505,185 Shares at 20s. each ..	505,185	0	0
308,993 Shares at 22s. 6d. each ..	347,617	2	6
Shares Issued against Options exercised at 20s. ..	250,187	0	0
Cash and Cash Assets taken over from Vendors ..	2,437	15	4
Sundry Revenue received to date	42,736	2	11
Sales of Surplus Water	8,253	17	0
Owners' Share of Licences	12,756	8	1
Loans	450,000	0	0
	£1,819,173	4	10

EXPENDITURE.

	£	s.	d.
Transfer Duty, etc.	11,879	9	8
Shaft Sinking, Permanent Haulage Ways and Equipment	939,069	3	0
Estate Buildings and Improvements	668	8	11
Development	166,444	2	11
General Expenses	135,317	15	4
Guarantors' Commission—Loans	25,000	0	0
Interest on Loans paid and accrued	251,684	3	1
Cash and Cash Assets, less Creditors	326,596	16	2
	1,856,660	0	1
Less—Guarantors' Commission and Interest, settled by Shares issued	237,486	15	3
	£1,619,173	4	10

In 1925 the Company paid the whole of its liability to the Miners' Phthisis Fund up to the date of closing down in August, 1921. With the resumption

of operations the mine was again scheduled, and a reserve of £392 shown in the balance sheet for Liability under the Miners' Phthisis Act represents the new total estimated liability of the Company to the Compensation Fund.

EXTRACTS FROM THE CONSULTING ENGINEERS' REPORT.

The results obtained from development work during the year were as follows:—

Working Place.	Footage Driven.	Average Width. Inches.	Average Value. Dwts.
Collecting Haulage No. 1	951	20·1	14·2
Collecting Haulage No. 1 N.F. ..	210	—	—
Collecting Haulage No. 2 S.F. ..	111	—	—
S.M.2 Haulage	393	30·7	15·9
S.M.3 Haulage	991	29·5	7·1
S.M.4 Haulage	1,015	—	—
S.M.5 Haulage	1,104	9·1	22·1
Total for the Year 1929	4,775	18·52	14·20
Previously reported	2,634	21·11	10·56
Total to date	7,409	19·67	12·46

The whole of the footage accomplished consisted of haulageways. Whenever these haulages encounter faults which have shifted the position of the reef, the haulage is necessarily in country rock for some distance, even if the throw is comparatively small. This is due to the fact that steep grades have to be avoided, as the haulages later on will be used for the transportation of ore. This explains to a great extent why a considerable portion of the footage accomplished during the year was off reef; but, in addition, the total distance driven in S.M.4 Haulage was in dyke. This again was unavoidable, as the direction of the haulage from a certain point onwards was determined by the proposed lay-out of the No. 3 Shaft Main Station.

The value of the payable exposures during the year has been encouraging, and compares very well with the results for the year 1928, as is shown in the following comparison:—

	1928.	1929.
Payable footage	545	830
Percentage payable	40·1	37·6
Width in inches	30·34	23·19
Value in dwts.	14·44	22·69
Inch dwts.	438	526

Excellent progress was made with the installation of the surface equipment at No. 3 Shaft. Preliminary sinking was commenced during the erection period, but the progress made was necessarily limited to the capacity of the temporary equipment available. As the main items of the plant were gradually brought into commission, sinking proceeded at a better rate, with the result that at the end of the year the shaft had reached a depth of 286 feet.

UNION CORPORATION, LTD.

Directors : Sir Henry Strakosch (*Chairman and Managing Director*), Joseph Kitchin (*Assistant Managing Director*), P. M. Anderson, Earl Buxton, Sir Robert S. Horne, J. Temperley. *Head Office* : Johannesburg. *London Office* : Princes House, 95, Gresham Street, E.C. 2. *London Secretary* : Henry Clark. *Formed* 1897. *Capital issued* : £875,000 in 12s. 6d. shares.

Business : Finance of and investment in mining and other ventures in South Africa and elsewhere.

ABRIDGED REPORT FOR THE YEAR ENDED DECEMBER 31, 1929.

The realized net profit for the year, after deducting all outgoings, including commissions and bonuses paid to the management and staff, is £418,033 19s. 2d., to which £116,595 8s. 9d. brought forward from 1928 has to be added, making a total of £534,629 7s. 11d. An interim dividend of two shillings per share was paid on November 21 last. The Directors have decided to add £30,000 to the Reserve Account, raising it to £660,569 14s. 7d., and have declared a final dividend of three shillings and sixpence per share, making a total distribution of five shillings and sixpence per share, or 385,000 for the year. The balance of £119,629 7s. 11d. is carried forward to new account.

There is very little change in the results shown by the Modderfontein Deep Levels as compared with the previous four years. The tonnage milled during the year was 531,500, the gold output £1,194,605, and the working profit £777,402. The working costs at 15s. 8d. per ton remain low. The mine has been virtually fully developed as regards its Main Reef area. The ore reserves at December 31 amounted to 2,550,000 tons, assaying 8.8 dwt. per ton over a stoping width of 79 inches, comparing with 3,000,000 tons assaying 9.0 dwt. over 79 inches at the end of 1928; and, in addition, there are 110,000 tons in hanging wall leader blocks valued at 4.7 dwt. per ton over an estimated stoping width of 60 inches.

While the profit of the Geduld Proprietary Mines shows an increase, the dividend was reduced by 6d. as a consequence of the higher issued capital. The year's results are better than they appear from the total, as each quarter showed an advance, the annual rate of working profit being £506,816 for the first quarter and £541,548 for the last quarter. During the year 1,008,100 tons was milled, the gold output being £1,353,822, and the working profit £522,188. The working costs amounted to 16s. 6d. per ton. The ore reserves at December 31 amounted to 5,900,000 tons assaying 6.7 dwt. per ton over a stoping width of 58 inches, which compares with 6,100,000 tons assaying 6.5 dwt. over 60 inches at the end of 1928.

The work done in opening up the East Geduld Mines has shown a continuance of satisfactory results. The indicated ore reserves, which amounted to 1,900,000 tons of a value of 6.6 dwt. per ton over an assumed stoping width of 56½ inches at March 31, 1929, were increased by the end of the year to 2,400,000 tons of a value of 6.75 dwt. over 57 inches. The average value of the payable ore disclosed during the first quarter of 1930 is the highest of any quarter to date, and as a result the indicated ore reserves would show an improvement in both tonnage and value.

The continuance of favourable development work has resulted in the decision to instal a reduction plant having a capacity of about 60,000 tons per month, the completion of which will synchronize with the completion of the sinking of the vertical shaft in about sixteen months' time, when milling operations should commence. Accordingly the capital has been further increased to £1,500,000 by the subscription of 500,000 additional shares at par less 5% commission, and, as in the case of the previous issue, the Geduld Proprietary Company and the Corporation have agreed to an offer to the other shareholders in the East Geduld Company of a parcel of the new shares at the price of 32s. 6d. per share in the proportion of two shares for every five shares held.

During the year the development of the Northern Rhodesian copper fields by drillholes and underground work was actively continued by the companies concerned, whose published figures for indicated ore reserves on the various properties increased from 92,000,000 tons of ore of an average grade of 3.83% copper at the end of 1928 to 235,000,000 tons of an average grade of 3.90% at the end of 1929. In anticipation of the important future which should lie ahead of this new copper field, the Corporation during the year added considerably to its interests in the district.

Owing principally to better terms secured for the disposal of lead concentrates, an improved recovery from the ore, and a rather higher average of prices for metals, there was an improvement of about 13% in the profits of the San Francisco Mines of Mexico, but in view of the considerable amount of capital expenditure in prospect the dividend was maintained at 3s. 9d. per share. The results for last year show that 307,450 tons of ore was milled, the revenue being £709,198 and the working profit £415,267. The working costs were 27s. per ton. The ore reserves position is good, showing 1,458,900 tons fully blocked and 435,600 tons partly blocked. Preparations to increase the capacity of the mill in two stages from 300,000 tons to 500,000 tons per annum are under way.

There was a satisfactory expansion of turnover and profit by the Polyphonwerke A G. in the past year in spite of the difficult situation prevailing in the latter part of the year. The foreign trade of the Company, in particular, showed healthy development, and for the purpose of co-ordinating its interests abroad the Company has formed a Swiss holding company under the name of Polyphon Holding Aktiengesellschaft.

The accounts of the British Enka Artificial Silk Co. show a loss of £157,276 for 1929, of which £69,656 represents operating loss and the balance charges for depreciation, debenture interest, etc.

Holders of Share Warrants to Bearer can obtain copies of the full Report and Accounts on application at the London Office, Princes House, 95, Gresham Street, E.C. 2.

OOREGUM GOLD MINING COMPANY OF INDIA, LTD.

Directors : Hon. Lionel Holland (*Chairman*), R. H. P. Bullen, Hon. A. T. J. Fraser, Lieut.-Col. Sir Donald Robertson, Edgar Taylor, Henry C. Taylor. *Managers* : Messrs. John Taylor and Sons. *Secretary* : F. H. Williams. *Office* : 5 and 6, Queen Street Place, London, E.C. 4. *Formed* 1880. *Capital issued* : £303,344 2s. 6d.

Business : Operates a gold mine in the Kolar gold-field, India, and has investments in other properties.

The ordinary general meeting of the Ooregum Gold Mining Company of India, Ltd., was held on April 16, 1930, at the Cannon Street Hotel, E.C., the Hon. Lionel Holland (Chairman of the Company) presiding.

The Chairman, in moving the adoption of the report and accounts for the year ended December 31 last, said : Gentlemen, this year, 1930, marks the 50th anniversary of the career of the Ooregum Company as a company registered and managed in England. The first crushing in 1880 was followed five years later by its first dividend. The record of the mine in succeeding years shows that the 40 tons of ore crushed in 1880 have expanded to nearly 4,900,000 tons, the 42 oz. of fine gold to over 3,080,000 oz. The first dividend of some £24,000, paid in 1890, has been followed by distributions amounting to more than £3,750,000.

The profit on the year's working at £76,555 shows a reduction of over £23,000 as compared with 1928. We have had to face a contraction in the length of the ore shoots in the deeper levels that were being driven, a decline in the grade of ore stoped, and concurrently a call for increased development footage in order to avoid a rapid depletion of the reserves pending further discoveries. It is satisfactory that the decline in the grade of the ore stoped for milling seems recently to have been arrested. There is as yet no justification for increasing the monthly tonnage milled and the gold returns, unless and until the developments that are proceeding with all possible speed at depth mark a recovery in the grade and width of ore, and in the length of the payable shoots.

The mill handled 165,445 tons of ore last year, and over 220,000 tons of the old tailings dump were retreated, but the return of fine gold from all sources at 82,483 oz. showed a falling off of over 8,000 oz. The sales of gold, after deducting royalty charges, produced in revenue £331,426, brought up to £340,053 by other items. This compares with some £374,000 for the year 1928. It represents a fall in revenue of £34,000. On the other side of the account working costs were reduced by over £10,000.

We are left then with a balance of revenue over expenditure of £76,555 to carry to the profit and loss account as the trading profit for the twelve months, increased to £88,156 by the balance of the carry forward from the preceding year, and dividends from the Kolar Mines Power and Brick-making Companies. The interim dividend paid in October absorbed over £30,000, income-tax account £9,600 odd, and we are allocating £12,000 to the depreciation of buildings, machinery and plant, £1,000 to writing down the value of our holding in an Indian mining exploration syndicate, and are transferring £3,000 to the insurance and contingency fund. This leaves us with a disposable balance of £32,155. I shall submit to you later a resolution to pay a final dividend of 6d. per share on both the Preference and Ordinary shares, bringing the total dividend for the year up to 2s. per share on the

Preference and 1s. on the Ordinary shares. This will represent dividends at the rate of 20% on the Preference and 10% on the Ordinary shares—a decrease of 7½% on the 1928 rate—and will leave us with a carry-forward of some £13,000.

The Canadian mining interest has been written down substantially in our present balance-sheet ; otherwise the company's assets remain practically at the same figures as last year. Our investments in Government securities—War Stock, Treasury Bonds and Consolidated Stock—are unchanged, and the company's surplus of liquid assets over current liabilities at something over £123,000 is only some £3,000 below the surplus shown in the balance-sheet of 1928.

To pass now from the accounts to the mining operations of the past year. It is strong testimony to the skill and energy of our superintendent, Mr. Crowle, and his colleagues that the heavy and difficult programme of work planned for last year was carried through. The same policy of pushing on rapidly at depth is being pursued this year, and is aimed at discovering new developments at depth rather than exhausting the possibilities of each successive level. It is satisfactory, therefore, that our reserves of payable ore, estimated at the close of the year at over 270,700 tons—apart from our large tonnage of dumped tailings for retreatment—were reduced by no more than some 24,000 tons last year, although we had mined over 160,000 tons during the year, but we must anticipate a larger diminution of the ore reserves during the current 12 months.

Mr. Kenneth B. Taylor said : Before beginning my remarks on last year's work, I will refer to the strike which has broken out and is affecting all the mines of the Kolar goldfield. There has been no damage done, and we trust that negotiations will lead to an early resumption of work.

Mr. Taylor then dealt in detail with the most important developments in the mine during the year, and, summarizing the results, said : In the 70th level the total length of payable ore was 1,736 ft., averaging 1 ft. 8 in. in width and 22.5 dwt. in value. In the 71st level the length was 1,352 ft., the width 1 ft. 7 in. and the value 17 dwt., while in the 72nd level for 1,131 ft. the value remained the same at 17 dwt. over a width just under 2 ft.

Continuing, he said : As regards the outlook this year, we look forward to a continuance of the improvement in the ore shoot which is being developed in the centre of the property and in Bullen's section it is not unlikely that the shoot will lengthen again once we get below the pegmatite zone which has intruded into the lode channel upon the last three levels on the northern fringe of it. The driving of the 73rd level will also be watched with particular interest, as it will test some areas, which have not been explored, for 300 ft. in depth, and in which it is hoped new ore shoots may be found to replace those which have become unproductive.

The report and accounts were unanimously adopted.

MYSORE GOLD MINING CO., LTD.

Directors: Hon. Lionel Holland (*Chairman*), Sir George S. Barnes, W. F. Garland, Edgar Taylor, H. C. Taylor, Mrs. H. J. Tennant. *Managers:* John Taylor and Sons. *Secretary:* F. H. Williams. *Office:* 5 and 6, Queen Street Place, London, E.C. 4. *Formed* 1880. *Capital:* £610,000 in 10s. shares.

Business: Operates a gold mine in the Kolar District of Mysore, India.

The fiftieth ordinary general meeting of the Mysore Gold Mining Company, Ltd., was held on April 29, 1930, at Cannon Street Hotel, E.C., the Hon. Lionel Holland (Chairman of the company) presiding.

The Chairman, in moving the adoption of the report and accounts for the year ended December 31 last, said:—Although not without features that are distinctly encouraging, I fear that the results of the year's working, as summarized in the report of the directors and as shown in the balance-sheet and accounts before you, must have been a disappointment to the majority of shareholders. Probably to the majority of shareholders—although a reduction in revenue and profit was foreshadowed in my remarks when we met here last April—the drop in the annual dividend from a dividend of 22½% to one of 17½% will have come as an unwelcome consequence, a drop more sudden than they anticipated, or, indeed, than I thought probable when we met twelve months ago.

The cause that occasioned this curtailment of dividend is, of course, evident enough. We produced and sold last year over 14,200 oz. of fine gold less than in the preceding year. The lower gold returns were due to the exhaustion of the dumps of old tailings that used to supplement our returns from current ore by some 1,100 oz. of gold a month, but became finally exhausted in November, 1928. From the retreatment of these dumps over 12,000 oz. of gold had been derived during the year 1928. Mr. Henry Taylor, in seconding the main resolution at our meeting last year, emphasized this point, to which I had already referred. It was expected that against the loss of revenue from the dumps we should have been able to set a more substantial saving in working expenditure than has as yet materialized, following upon the reorganization of the reduction plant now that the retreatment of the dumped sands has ended. There has been a saving of nearly £14,000 in revenue expenditure as compared with the preceding twelve months. But there were factors last year that militated against reduced costs. The rate of remuneration for underground labour has increased, and the severe rockburst that occurred in February of last year called for considerable outlay to repair the resulting damage to the levels affected in the Ribblesdale section of the mine, and interrupted for a time the facilities for economical haulage and work in that area.

Our receipts derived from sales of gold, after payment of the royalty charge, are less by over £58,000 than for 1928. Our revenue expenditure is less by just upon £14,500. The profit carried from the revenue to the profit and loss account is thus reduced, as compared with the year 1928, by something over £47,000.

Your directors have deemed it advisable to write down very substantially the value attached to the shareholdings of this company in the Central Manitoba Mines, Ltd., and in the exploration company which has as its main asset an interest in

those mines. The annual general meeting of the Central Manitoba Mines was held in Winnipeg last November. The speech of the Chairman made it clear that in most respects there had been no reason to be dissatisfied with the year's work on the property. The total ore milled during the twelve months amounted to over 52,600 tons, averaging something over 10 dwt. a ton. The gross recovery came to something under \$510,000, and the extraction recovery steadily improved until it has ranged from 95 to 97½%. As I pointed out last year, until developments disclosed reserves sufficient to justify enlarging the mill to handle an increased tonnage, the mine could not become a paying proposition.

It is the view of the engineers that development at greater depth will prove a recurrence of shoots similar in size and value to those exposed in the higher horizons, and the Board of the Company have recently formulated their decision to concentrate upon testing the Kitchener section by further diamond drill bore-holes.

This writing down of the Mysore Company's mining interests in Canada has lowered the figure of our general reserve fund from £175,000 to £120,000; while our holding of Government securities has been reduced to provide further capital for plant and development at depth. Otherwise there is little variation in the balance-sheet figures from those of the 1928 balance-sheet, and the financial position remains a strong one; the fluid assets of the company—cash and Government securities and sundry debtors—exceed its liabilities by nearly £280,000.

It is when we turn to the revenue and profit and loss accounts that we find, in comparison with the previous year's accounts—when a revenue was derived from over 12,000 oz. of gold extracted from the dumped material since exhausted—a severe depreciation both in revenue and profit. From the sales of gold, after deducting the royalty payable to the Mysore Government, the company realized £409,679, which compares with £468,201 in 1928. With other receipts, the income revenue is brought up to £418,134. After deducting the revenue expenditure at £287,424—about £14,000 less than the preceding year—and taking credit for the carry-forward from the previous year, we are left with a final profit for the year of £152,830, which is less by £48,000 than the profit for 1928. The interim dividend paid last October took over £45,000 of this profit. We have again allowed £20,000 for depreciation of buildings and plant, and have strengthened the insurance and contingency fund with an allocation of £4,000, and are left with a disposable profit of £70,890. Of this amount the final dividend that has been declared will absorb over £62,000.

For 43 years the Mysore Mining Company has not failed to pay an annual dividend. Its first dividend was distributed in 1887, and, with the dividend payment made this month, it has since distributed close upon 10½ million pounds among its shareholders in cash dividends.

The occasion of our meeting to-day is a notable event in the history of the company as its fiftieth anniversary. The company in 1880 took over a concession that had been granted to an old Irish soldier, Lavelle by name, who had started in 1871 to prospect the ancient workings on the Kolar field. If the extensive nature of these old workings encouraged exploration, they also proved the cause of loss and disappointment. The miners of ancient times had done their work thoroughly and exhausted the ground to a depth of 230 ft. or more. Three years and more intervened after the company started work in 1880 before any discovery was made. Mr. John Taylor, supported by the chairman, Sir Charles Tennant, urged the policy of further expenditure being applied to sinking a shaft to test the property at depth below the level of the old workings. His advocacy prevailed.

The company had taken over, in 1880, a thirty-years' mining lease from the Government of Mysore, and another factor that has stood the company in good stead has been the stable and judicious Administration of the State of Mysore.

The two most important single events of the subsequent history of the mine, apart from the steady advance in efficiency and economy of mining methods, I should judge to be the completion in 1901 of the great scheme to convey electric power from the Cauvery Falls over a distance of 93 miles to the mining field; and in 1920 the decision of the shareholders to increase the capital of the company in order to provide the funds, which are still being employed, to test the deeper levels of the Mysore mine—to such depths as are being successfully exploited on the Champion Reef and Ooregum properties.

There are few mines that can boast a history so successful, so long and eventful, and yet be able to claim that their resources are far from being exhausted. The reserves of payable ore, which were increased during the preceding year, this past year have been reduced by more than 50,000 tons. They stand at something over 517,000 tons. Improved and more economical methods have enabled ore of lower grade than used to be held payable to be mined at a profit.

Then there is the novel and interesting discovery, to which a brief reference was made in the directors' report for 1928, first indicated by the diamond drill in the southern end of the property, where two boreholes, sunk 320 ft. apart, intersected a lode, hitherto unknown, of narrow width but high value. Last year's report informed the shareholders that a pilot shaft was being sunk to enable the development of this discovery to be undertaken. In November last came the news that this shaft had encountered a reef at a depth of 280 ft. assaying 2 oz. 8 dwt. a ton over a width of 21 in. At a level of 284ft. the lode has been driven on north and south, exposing 181 ft. of payable ore, with an average assay of 1 oz. 11 dwt. over a width of 1 ft. 6 in. The development work is proceeding.

The profitable future of this old mine must be sought in the chances and probabilities of a renewal of payable ore bodies at depth; and we must remember that, while the deepest development point of the Mysore mine is some 6,180 ft. vertical, the neighbouring Champion Reef mine is finding rich ore at more than 600 ft. greater depth. While the year's work at the Mysore mine disclosed at the lower development points no appreciable

improvement, it was marked by several encouraging features. In the north section, north of Edgar's auxiliary shaft, over 58 ft. were driven on quartz over 1 ft. in width and nearly 2 oz. in value, while in the south section of the mine quartz of narrow width but high values was encountered at the greatest depth reached there. These signs of recovery encourage us to push on with development work at depth with good hope that it will meet—as on the Champion Reef mine—with its reward, and that to the fifty years of splendid achievement already recorded many more years of profitable vigour may be added.

Mrs. H. J. Tennant seconded the resolution.

Mr. Kenneth Taylor:—Before beginning my remarks on last year's work, I will refer to the strike which has taken place on the Kolar Gold Field, and about which notices have appeared in the Press. You will be glad to know, if you have not already seen it in this morning's papers, that the strike was ended yesterday, and that work has been resumed.

For some years now the development programme in the mine has aimed at reaching the 76th level as quickly as possible in all sections, and I am glad to be able to tell you that this has been achieved during the year now under review, with the sinking of air shaft and Edgar's Auxiliary to some 50 ft. below this horizon. The object of this rapid advance has been to discover in depth ore bodies of substantial importance. This level is also going to be a main haulage way, which will play an important part in the ventilation of the mine in future years in conjunction with Edgar's subvertical shaft.

The development footage during last year amounted to 11,970 ft., which was 3,687 ft. less than in the year before.

Coming now to the operations on surface, the reorganization of the milling and treatment plant, of which we spoke last year, was continued and practically completed, and so also was the dismantling and cleaning up of the old No. 1 mill. It is satisfactory that during this period of reorganization no interruption took place in the continuous operation of the process.

The process now is to handle a one-product pulp only. Blanket strakes have replaced entirely amalgamating plates, and with finer grinding in the tube-mills, the proportion of the product which formerly had to be dealt with as sands no longer exists. The whole product is ground to a pulp which is being successfully treated in the slime plant, and the sand plant is no longer in use. Although the tonnage crushed last year was only some 4,000 less than in the year before, the gold recovered from all sources was less by 14,228 oz, with a total recovery of 102,207 oz. The average assay value of the ore milled was only 3.33 grains lower, but last year there were no longer any old tailings to contribute their quota, and this alone accounts for 12,060 oz. of the reduction. With regard to costs of working, there was a not entirely unexpected rise of nearly 2s. 5d. per ton. The proportion of the overhead charges borne in previous years by the tonnage of old tailings now has to be charged to the ore from the mine, and, in addition, there was a rise in the mining costs, due to slightly higher costs of stoping and repair work necessitated by rockbursts.

The resolution was adopted unanimously.

CHAMPION REEF GOLD MINES OF INDIA, LTD.

Directors: Hon. A. T. J. Fraser (*Chairman*), Sir George S. Barnes, Mrs. H. J. Tennant, Edgar Taylor. *Managers:* John Taylor and Sons. *Secretary:* F. H. Williams. *Office:* 5 and 6, Queen Street Place, London, E.C. 4. *Formed* 1921. *Capital:* £260,000 in 10s. shares.

Business: Operates a gold mine in the Kolar district of Mysore, India.

The ordinary general meeting of the Champion Reef Gold Mines of India, Ltd., was held on April 30, 1929, at Cannon Street Hotel, E.C., the Hon. A. T. J. Fraser (*Chairman* of the company) presiding.

The *Chairman*, in moving the adoption of the report and accounts for the year ended December 31 last, said: During the year the mill treated 101,280 tons of ore for a production of 53,695 oz. of fine gold. There were also treated 265,684 tons of old tailings from which were recovered 12,459 oz. The total, with the inclusion of some 400 odd ounces from old copper plates, amounted to 66,562 oz. After deducting royalty and refining charges, the sales of gold produced £268,272. Interest and other items bring the total receipts up to £273,813, and the balance over expenditure amounts to £52,370, an increase of £13,250 over the previous year. The average grade of current ore treated was just under 11 dwt. and the recovery shows the very satisfactory figure of 97½%. The balance from last year, together with some £800 from dividends, gives a total disposable of £57,900.

Your directors have decided to write off a total of £20,500—namely, £10,000 against Heathcote's shaft, £7,500 depreciation on machinery and plant, and £3,000 to insurance and contingencies. A dividend of 1s. 3d. a share, taking £33,150, has been declared and paid, thus leaving £4,252 to be carried forward. The capital expenditure for the year amounts to just under £20,000—almost equally divided between sinking Heathcote's shaft and the cost of an electric winder at Tennant's shaft and other plant. The total working cost is just £1,000 less than last year.

The estimates of ore reserves at the end of the year amounted to 278,086 tons, an increase of 8,730 tons over the previous year.

During the period under review, general progress and results may, I think, be described as decidedly encouraging. Development results underground were most satisfactory. In the central ore shoot in the neighbourhood of Carmichael's shaft, the 72nd level, opened up during the year, has proved of about the same value as in the two levels above. Further south, in the neighbourhood of Glen's shaft, there has been a notable improvement. I was able last year to inform you that a comparatively small block of medium grade ore had been developed between the 69th and the 70th levels at this point, and that the latter level showed much promise. At the end of 1929 this ore shoot had been opened up for its whole length at the 71st level, and shows a marked improvement in length and gold contents over the 69th, the figures for the 71st level being as follows: For a total length of 622 ft. an average value of 1 oz. 6 dwt. over 40 in. At December 31 two winzes were half-way down to the 72nd level, and two others had just been started. At the date of our latest news, the two former were down to the horizon of the 72nd level, and some 25 ft. or so had been driven either way from both points. The results of the 100 ft. or so driven—which I must point out are

in the heart of the richest section of the ore shoot—are most encouraging, the average being rather over 2 oz. per ton over a width of 4½ ft.

Judging from the history of the Kolar fields as a whole, such a shoot is more likely than not to continue for several levels below the 72nd. At any rate, it can be said that there are no known faults, dykes or pegmatite bodies that have shown up in higher levels on this mine, or on Mysore, that are likely to cut into it. It will be most heartening to shareholders that new ore shoots of such value can make their appearance at so great a depth.

I regret that two unfortunate events have occurred. In February there was a bad rockburst at the south end of the mine, and Garland's secondary shaft was badly shaken and partly blocked. It seems probable that a considerable expense will be involved in remedying affairs at this point. The other event I have referred to is the unfortunate strike which started on the mine some three weeks ago, and which I will ask Mr. Arthur Taylor to refer to more fully.

Mrs. H. J. Tennant seconded the resolution.

Mr. Arthur E. Taylor referred to the strike on Kolar Goldfield which had since been settled. Turning to the year's progress he said: The outstanding feature of the year's work was the development of a substantial body of high-grade ore in the southern part of the property, and the ore won from this development work had a beneficial effect upon the returns during the closing months of the year. The total footage of development work in the mine amounted to 6,224 ft., an increase of 1,387 ft. over the preceding year. The central ore-shoot was opened up to the 72nd level, and both the width and value of the quartz continue to be good.

Turning now to Glen's section to the south, the year's work in this part of the mine has been most gratifying, for not only have our anticipations of a remake been fulfilled, but the size and value of the ore-body which is being disclosed almost exceed our expectations. You will recollect that last year I drew attention to the great width of the lode at the 70th level, and that the economic value of the ore-body depended on whether the gold became more concentrated in depth.

Heathcote's shaft was sunk a further 185 ft., and at the 70th level a footwall drive or main haulage way from the north and south sections has been driven to connect with the shaft. While development has been principally directed towards opening up ground in depth, those of the shallower levels of the mine, which offer prospects for exposing further ore of value, have again received attention. Working costs, as compared with the previous year, show a considerable decrease in total, but owing to the lesser tonnage treated the cost per ton is somewhat higher. During the past year the steam winding engine at Tennant's shaft has been replaced by a new engine driven electrically.

The report and accounts were unanimously adopted.

ST. JOHN DEL REY MINING COMPANY, LTD.

Directors: Sir Henry P. Harris (Chairman), Lord Lewis, C. F. W. Kup (Managing), L. E. Langley. *Office:* Finsbury House, London, E.C. 2. *Formed* 1830. *Capital issued:* £646,265.

Business: Operates the Morro Velho gold mine, Minas Geraes, Brazil.

The ordinary general meeting of the St. John del Rey Mining Company was held at Winchester House, Old Broad Street, London, on May 1, Sir Henry P. Harris (Chairman of the company) presiding.

The Chairman, in moving the adoption of the report and accounts for the year 1929, said:—Gentlemen, the output of the year is the highest recorded since 1919–20, and would have been higher but for the large proportion of the available labour force which was devoted to development work in the mine. The average monthly crushing was 13,366 tons, which may be compared with the average of 15,092 tons for the 10 years from 1910 to 1920. There is still, therefore, room for improvement in tonnage, and a good prospect of obtaining it during the current year. The yield of the mineral was 56s. 0½d. per ton, which is the highest obtained for several years, and may be compared with the average yield of 53s. 11½d. for the preceding five years. The actual cost of working the mine was less by 10d. a ton than in 1928, but developments in the mine, which are charged to working account, cost 1s. 4½d. a ton more, an increase which was justified by results. The profit amounts to £103,774, to which must be added the balance of £41,293 brought forward, making together £145,067. Of that amount £71,701 will be absorbed by the 10% dividends on the preference and ordinary shares and the balance of income tax, whilst £73,366 will be retained. £30,000 going to capital works account and £43,366 being carried forward. Our policy as regards dividends remains, as you will see, a cautious one, but it is a policy which has served the Company well in the past and placed it in its present strong financial position.

I may mention that I visited Morro Velho last year with Mr. Kup and propose to-day to devote most of my speech to making clear, as far as I can, the present situation at the mine. First let me refer to the question of labour. As you know, the great difficulty with which the Company had to contend for many years was that of labour. The Company therefore has been lucky in being able during the last three years to obtain an average mine force of 911 men per day. These were not sufficient to produce the full tonnage of which the mine is capable, but they have enabled the Company to return to its regular 10% dividend and at the same time to carry out a vigorous and successful development of the mine, and now the tide of labour appears to have turned definitely in our favour. We are informed that owing to the depression in the coffee industry the prospects of our obtaining an adequate mine force are described as better than they have been for years.

My next subject for consideration is the mine itself. I may perhaps sum up the position by saying that in one direction the mine gives considerable cause for satisfaction, while in another direction it has caused, and is causing, perplexity. I will explain the perplexity first. It is due to

the falling off in value, locally at any rate, of the main lode at horizon "25", and the discovery that the values at that horizon exist in an ore body well to the west and slightly to the north of the main lode. This N.W. body, though not yet fully developed at horizon "25", has been laid open to a stoping length of 1,000 ft., and the results obtained are described by the Superintendent as satisfactory from every point of view. A lode which the Superintendent describes as "in all probability the N.W. ore body" has been laid open for 1,250 ft. at horizon "26" and found to be of unpayable value but for 220 ft. The main lode is now the object of the explorations. If we had to look only to the main lode for reserves the total number of tons would be 955,000, which is under the million tons which it has always been our object to maintain. But the discovery of the high value of the N.W. lode at horizon "25" has led to the exploration of that lode at three higher levels, with the result that the Superintendent now estimates that 400,000 tons have already been laid open between horizons "21" and "25". In addition, there is another recently discovered body of ore, namely, the S.E. mineral found at horizon "22". That is described as a fine body of high-grade mineral providing nearly 300 ft. of stoping length. This has now been developed at three separate levels in 200 vertical feet, and will probably yield at least 100,000 tons. There is also a large body of mineral east of the "20" horizon permanent level, which is an addition to the reserves, though Mr. Chalmers has not yet included it in his estimate of the total ore reserves, which he places at 1,455,172 tons. This is the highest estimate it has ever been possible to make in the history of the mine.

I must now refer to the report which has been presented by Professor Gratton and Mr. Guy Borge on the geology of the mine. Their conclusions are favourable to the working of the mine at greater depth, but we have always to remember, as indeed they point out in their report, that they are dealing with matters necessarily of a very speculative and uncertain character, and that the mine will have the last word.

As announced in the report, Mr. Chalmers will retire from the management at the termination of his present engagement next June. Mr. Chalmers will be succeeded as Manager and Superintendent by Mr. A. H. Millett, in whose business capacity, energy, and good judgment the Board have full confidence. Mr. Eric Davies, now Assistant Superintendent, will become Chief Engineer and Assistant Superintendent.

In conclusion, it may be interesting to mention that the Company has become a centenarian, having been formed on April 5, 1830. The Morro Velho mine was purchased in 1834, and though there must be a limit to the life of the deep mine, there are other possibilities for the future.

The Rt. Hon. Lord Remnant seconded the motion, which was carried unanimously.

EAST POOL AND AGAR, LTD.

Directors : Sir H. Montagu Rogers (*Chairman*), J. C. Gardner, J. L. Holman, E. A. Loring, A. H. Moreing.
General Managers : Bewick, Moreing and Co. *Secretary* : R. J. Thomas. *Office* : East Pool Mine, Carn
 Brea, Cornwall. *Formed* 1913. *Capital* : £250,000 in 5s. shares.

Business : Operates a tin-wolfram-arsenic mine between Camborne and Redruth.

The seventeenth ordinary general meeting of East Pool and Agar, Ltd., was held at 20, Copthall Avenue, London, E.C. 2, on April 15, 1930. Sir H. Montagu Rogers (Chairman of the company) presided.

The Chairman, in moving the adoption of the report and accounts for the year ended December 31 last, said: The quantity of tin concentrates produced amounted to 1,029 tons at an average produce of 25.48 lb. per ton of ore treated, and sold at an average price of £122 2s. 6d. per ton, which totalled £125,677 3s. 6d., compared with 939 tons at an average produce of 23.84 lb. per ton of ore treated, which fetched an average price of £126 4s. 10d. and realized a total of £118,644 11s. 4d. for 1928, a difference and increase of £7,032 12s. 2d. The arsenic sold and in stock amounted to £2,064 3s. 4d. less than 1928. The items credited for rents, probate, and transfer fees show a slight increase, and dividends and interest on investments an increase of £75 18s. 7d. The total receipts amounted to £130,116 4s. 6d., compared with £125,096 11s. for 1928, an increase of £5,019 13s. 6d. The total expenditure for 1929 amounted to £122,711 8s. 4d., and less by £6,770 5s. 11d. for 1928. Analysed, the quantity produced was greater, the produce a higher grade, but the price received was less; still, the total was more. The profit for 1929 was £7,404 16s. 2d., to which must be added £257 14s. 4d., the small balance brought forward from the year 1928, making a total of £7,662 10s. 6d., less £2,000 written off development (suspense) account and £5,000 transferred to reserve account, leaving a credit balance of £662 10s. 6d. to be carried forward to the balance sheet.

As regards the balance sheet, the property account stands at £628 15s. 4d. less by sales than for 1928. Machinery and plant account has been increased by £5,755 9s. 4d., but £2,000 has been written off development (suspense) account, reducing same to £2,000. Stocks of products and stores have been considerably decreased. Sundry debtors and debit balances have increased by £1,121 13s. 11d. The investments at net cost remain the same, but the cash at the bank shows an increase of £9,354 1s. 3d. Liquid assets amount to £26,366 11s. 9d., exclusive of investments. On the debtor side of the balance sheet the amount of issued capital remains the same. Sundry creditors and credit balances show a decrease of £3,306 8s. 6d. £5,000 has been added to the reserve account, which now stands at £15,000. There is a contingent liability of £10,214 18s. notified in the balance sheet in respect of the shares held in Tolgus Mines (1927), Ltd., but inasmuch as that company and its assets have during the current year been acquired by this Company, that liability has ceased, and as the result of such acquisition, the balance sheet for the

current year will necessarily have to be remodelled, not only as regards the amount of issued capital, etc., on the one side, but also its property account and investments on the other side.

My analysis of the accounts strongly emphasizes how absolutely dependent deep lode mining is on the price of minerals, and particularly tin, our main product. At the beginning of 1929 we hoped the price had then reached its lowest, but it went from bad to worse, until it reached £157 10s. per ton for metal, the lowest figure since the year 1922, when £140 was touched. Needless to say, no mine in Cornwall can make any profits or even pay its way at such a price. I would remind you that we only receive about 60% of the price of the metal for the tin concentrates or black tin which we sell. I should like to pay an appreciative tribute to the Tin Producers' Association for the good work they have done in the short period of their incorporation and are continuing to do in their Tin Restriction Scheme. However, we must not forget that any lessened production by a Cornish mine, with its exceedingly heavy pumping charges, means a far greater sacrifice than applies to any company with only alluvial deposits.

The work during the year under review was somewhat limited to ordinary routine work and extension of levels. At the 1,600 ft. level driving west an average of 36 lb. per ton has been disclosed for a distance of 350 ft. lately driven, and we have still 1,000 ft. more to drive to reach the boundary of the sett. Further, as good values have been proved in the old 240 fm. level, the face of which is 600 ft. in advance of the 1,600 ft. level, there is every reason to assume that these good values will be continued for the remaining 1,000 ft. to the boundary. In the old East Pool mine lodes payable values were mined to a depth of 2,000 ft. Driving on the Moreing lode east on the 1,600 ft. level has been continued for a distance of 492 ft., but, as stated in last year's report, the values still remain low. The values are patchy, and as they would not pay to mine at the present low price of tin, large blocks will be left which will be available for stoping when the price increases. As the ore reserves available for milling are still well ahead of the mill and good values have been maintained, we feel justified in looking forward cheerfully to the future. During 1929 the milling plant underwent considerable alterations and remodelling, which resulted in a record crushing of over 90,000 tons of ore. Usually when the tonnage is increased, the extraction is lowered, but in this instance the extraction was increased, averaging 74.4% as compared with 72.9% in 1928. Thus demonstrating the good work accomplished. Before I sit down I take this opportunity of thanking the General Managers, the Superintendent—Mr. Taylor—and his staff for the excellent work they have done and the energy displayed by all.

The resolution was carried unanimously.

SOUTH CROFTY, LTD.

Directors : Francis Allen (*Chairman*), Henry Lovegrove, Frank W. Franks, Josiah Paull. *Secretary* : T. Wallace Evans. *Office* : 6, Broad Street Place, London, E.C. 2. *Formed* 1906. *Capital issued* : £130,000 in 5s. shares.

Business : Operates tin and wolfram properties in Cornwall.

The twenty-fourth ordinary general meeting of South Crofty, Ltd., was held on May 8, at Winchester House, Old Broad Street, London, E.C., Mr. Francis Allen (Chairman of the company) presiding.

The Chairman, in moving the adoption of the report and accounts for the year 1929, said: In dealing with the position to-day one cannot but be dominated by the one outstanding fact, which is the prevailing price of tin. Except for the question of the price of tin, the situation of the mine is good in every direction. Our cash resources are ample, as you will see, and the development, as Mr. Clarence Paull will tell you, continues thoroughly good underground. The De-rating Act has actually resulted in giving us relief in rates to the extent of £1,500 a year. That is a material relief. Wolfram has also become a saleable article once more, and we shall be obtaining and selling a considerable amount from our Castle-an-Dinas property, which will bring in some thousands of pounds. All these features are thoroughly satisfactory, and I am sure it is equally satisfactory to the shareholders, as it is to the Board, that Mr. Josiah Paull, desiring to retire from general managership, has accepted a seat on the Board.

As regards the question of tin prices, nobody here can forecast anything. This Company in the course of its career—and I have been associated with it for twenty-five years—has passed through periodical depressions in the price of base metal. Tin is one of the base metals. We have experienced those periods, and have gone through them before, and what in fact happened was that tin reached such a low price that a large percentage of the companies were unable to continue producing, and for that reason there was a natural falling off in production. That position will be repeated if tin goes another £20 lower. There has been put into force a new arrangement of the Tin Producers' Association. The endeavour of that Association was to see if it could regulate the output of the world's tin so as to prevent the over-production which has been taking place for some two or three years. The fact is that production exceeded consumption and there have been steadily accumulating stocks which have been always hanging over the markets. Until those stocks begin to be absorbed, there can be no material move up in the price of tin. The returns of the visible supplies of tin for the last two months show an increase when many people expected to see a decrease. It is this increase which has brought about a heavy fall in the price of tin within the last fortnight. As soon as you begin to see a decrease in the visible supplies, you will see a rise in the price of tin. When that position will come about, I am not able to prophesy at all. Whereas last year the average price that we received for tin concentrates was £128 17s. 10d., so far this year the average has been £107 10s., or a falling off of over £20 a ton.

I hope, so far as the Shareholders of this Company are concerned, they will not let it be a matter of permanent anxiety to them, because we have always kept a very strong financial position, and whatever troubles are ahead I can assure the shareholders that our financial resources are so ample that if the standard price of tin even goes to £130 we are quite able to carry on and to continue until the turn of the price of tin comes, and that is inevitable.

We have great pleasure in having Mr. Clarence Paull here to-day. He has succeeded his father as Manager, much to the pleasure of all of us. He carries out his duties ably and well, and he is taking his father's place here to-day, Mr. Josiah Paull being in South Africa attending a meeting in connexion with mining and metallurgy. Mr. Paull has prepared a little memorandum as to the underground position which he would like to read to you. Before I move the adoption of the report and accounts, I will ask him to read his memorandum.

Mr. Clarence V. Paull said: It is most disappointing to all of us connected with South Crofty that, having had a successful year's working, we have been unable to pay you dividends owing to the low prices ruling for tin. Our tin output has been up to the standard of recent years. The arsenic sales have fallen somewhat because most of our ore is now being extracted from the lower levels and contains little or no arsenical pyrites. Our development was 6,770 ft., which is 458 ft. more than in any previous year. To have met these additional charges and still reduce our costs by 1s. 6d. a ton is proof that economy has been carefully studied on the mine. You will have observed from the detailed development report that we were successful in finding quite good values over an appreciable footage, especially on the two lodes in the northern area and on the south underlying lode just north of No. 2. Since that report was written we have holed the 290-310 lift on No. 4 lode and payable values were encountered throughout over a width of 5 ft. 6 in. Our 260 cross-cut north of Robinson's is being extended and at 135 ft. north of No. 2 lode a lode about 3 ft. wide was intersected; the tin values contained were such that we have since driven 50 ft. on the strike. Although this lode is rather small it has yielded excellent values over a drive width of 5½ ft. On the Cook's Kitchen Section we have successfully holed the 245-290 lift on No. 1 lode. From the 245-260 level the lode was uniform and payable, but below this it is split into several branches which were difficult to follow in rising and winzing. At Castle-an-Dinas we are now in good running order after experiencing several minor delays, owing to the plant having been idle for ten years. Our first parcel of 10 tons is ready for dispatch and we should be able to show a fair profit on this year's working. The success of the present year depends on the price of tin; the mine itself is in very satisfactory working order.

The Chairman having replied to various questions, the report and accounts were adopted.

SUNGEI KINTA TIN DREDGING, LTD.

Directors: R. Pawle (*Chairman*), R. Sancroft Baker, E. T. McCarthy, L. G. Attenborough.
Secretary: J. Barnes. *Office:* 4, London Wall Buildings, London, E.C.2. *Formed* 1925. *Capital:* £200,000 in £1 shares.

Business: Works alluvial tin property in the State of Perak, F.M.S.

The fourth ordinary general meeting of the shareholders of Sungei Kinta Tin Dredging, Ltd., was held on April 15, 1930, at Winchester House, Old Broad Street, E.C., Mr. R. Pawle (*Chairman* of the company) presiding.

The *Chairman* in moving the adoption of the report and accounts for the year ended December 31 last, said: You will note that, after writing off a sum of nearly £9,000 for depreciation and from sundry preliminary expenses and development, we are left with a net profit of £25,025 15s. 5d. for the year. Out of this we have already paid you an interim dividend of 5%, and we now propose to pay you a final dividend of 7½%, while we carry forward £5,400 4s. 4d., against £3,474 8s. 11d. brought in. A question has arisen on the increase in the income-tax in accordance with the new Budget, and after consultation with the auditors we have decided that if the extra 6d. is claimed by Somerset House it will be borne by the company, as the warrants for the dividend have already been prepared with the income-tax at 4s.

Now, with regard to our dredging operations, the yardage dredged, amounting to nearly 1,400,000, shows a considerable increase compared with the previous year, and is practically equal to the designed capacity of the dredge—namely, 120,000 cubic yards a month. The yield of concentrate per yard has increased from 0.56 to 0.76 lb., while the costs have decreased from 40.7d. to 3.98d., and, having regard to the difficult nature of the limestone bottom and to patches of sunken timber which have been encountered from time to time, we may regard this figure as satisfactory. To show the difficult nature of the limestone bottom, a model has been prepared. This has been constructed from data gathered by taking numerous soundings over a considerable period. In spite of the fact that the net price realized for our concentrates was some £12 a ton less than in the previous year, the gross profits have been more than doubled, the mine costs per ton of concentrates having been reduced from £77 10s. 4d. to £48 12s. 5d., but if we add all overhead expenses in London and the East, including depreciation of dredge, plant, machinery, etc., the total cost to the company of a ton of concentrates is approximately £60. I might mention that at the moment, after paying Government royalty and returning charges, a ton of our concentrate is worth about £100.

Another point which I referred to in my speech last year was the movement on foot to rationalize or stabilize the price of tin. Since that time, as you know, the Tin Producers' Association has come into being, of which this and its associated companies are members. It is quite true that up to date there has been no actual rise in the price of tin, but, on the other hand, it is almost certain that had there been no move towards reduction of output and had the market understood that all

mining companies were continuing carrying out a cut-throat policy of survival of the fittest, surely the price of tin would have been much lower than it is to-day. It is obvious also that when the market takes a turn the revival of price will be far quicker than it would have been had the market not known that the tin-producing fraternity were united. So far curtailment of production has been brought about in the F.M.S. by the closing down of the dredges each week from Saturday night until Monday morning, and also for other agreed periods, but this method of regulation by time factor has proved not to be entirely satisfactory. The matter has been very carefully considered by the Tin Producers' Association, and the council now recommends that all producers shall agree to limit their output of concentrate to 80 per cent. of the 1929 production. A meeting of the members of the association has been called for to-morrow, when this proposal will be fully discussed. It may, perhaps, mean a sacrifice of profits for the time being, but, eventually, I am convinced that it will be of very great ultimate advantage, not only to this company, but to the industry in general.

You will note that we have co-opted our late general manager, Mr. L. G. Attenborough, as a director of this company, and later on I shall have to ask you to confirm his appointment. *That you will do so I feel sure, as Mr. Attenborough and I have been associated together for more years than either of us care to remember, and his 30 years' experience of mining in the East and his particular knowledge of our affairs in the F.M.S. obviously qualify him as a most helpful member of your Board. Finally, I would like to express the appreciation which we and, I am sure all of you, must feel for the excellent services which have been rendered by our manager, Mr. Templeton, and his staff, both European and native, in the East. With regard to the native staff, especially, the curtailment of production has meant a certain amount of hardship, as it has called for reduced hours of working, which means reduced pay. It would obviously be unfair that they alone should shoulder this burden. They have met us half way—they could hardly do more—and for this spirit of loyalty and co-operation we must indeed owe them our thanks.

I now beg to propose: "That the directors' report and balance-sheet for the year ended December 31, 1929, be and the same is hereby approved and adopted, and in accordance with the directors' recommendation a dividend of 1s. 6d. per share, less income-tax, be paid on April 17 to those shareholders on the register on April 1." I will ask Mr. McCarthy to second that.

Mr. E. T. McCarthy seconded the resolution, and it was carried unanimously.

The election of Mr. L. G. Attenborough to a seat on the Board was confirmed, and the retiring director, Mr. E. T. McCarthy, was re-elected.