THE JOURNAL

OF THE

Chemical, Metallurgical & Mining

SOCIETY OF SOUTH AFRICA.

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THE JOURNAL OF
THE CHEMICAL, METALLURGICAL & MINING
Society of South Africa.

BYE - LAWS.

(ADOPTED BY THE COUNCIL, 8th AUGUST, 1903.)

1. Annual General Meetings will be held on the third Saturday of the month of June in each year.
2. Ordinary General Meetings will be held on the third Saturday in each month.
3. All meetings, unless otherwise provided for in the notice convening the same, shall be held in the Council Chamber of the Chamber of Mines, Johannesburg, at 7.45 p.m.
4. Any Member or Associate may introduce a visitor to the Ordinary General Meetings; visitors may, with the consent of the Chairman, take part in any discussion and read papers.
5. Every paper which it is desired to bring before the Society shall be clearly written on one side of the paper only, and shall be lodged with the Secretary at least fourteen days before the date of the meeting at which it is proposed to be read.
6. The Council shall decide what papers shall be read at meetings of the Society.
7. All contributions communicated to the Society, with their illustrative drawings, shall become the property of the Society unless stipulation be made to the contrary; and Authors shall not be at liberty, save by permission of the Council, to publish or cause to have published such contributions until they have either appeared in the Journal of the Society, or a period of three months shall have elapsed since the date of their being handed to the Secretary.
8. All papers brought before the Society shall be read, discussed and replied to within a period of four months, subject to the Council having power, should they deem it desirable, to extend that time.
9. Members and Associates whose subscriptions for the current year remain unpaid after the 1st day of October may be denied the privileges of the Society pending payment of the same; Members and Associates whose subscriptions for the current year remain unpaid after the 15th day of November may be removed from the roll of the Society.
10. At Annual General Meetings the election of officers shall take place in the following order:—1. President; 2. Vice-President; 3. Treasurer; 4. Members of Council.
11. All Deeds, Documents and Writings requiring execution on behalf of the Society shall be signed by the President and Treasurer, or in the absence of either or both, by Members of the Council duly authorised, under authority of a Minute of the Council.
12. The Minutes of all Special General Meetings shall be read and confirmed at the next convenient Council Meeting.

NOTICES.

The next ordinary General Meeting will be held in the Council Chamber of the Chamber of Mines, Market Square, Johannesburg, on January 21, 1905, at 7.45 p.m., preceded by the Monthly Social Dinner, at the Corporation Restaurant, at 6 p.m.

PAPERS AND DISCUSSIONS.—*Country and Foreign Members and Associates unable to be present at the Meetings of the Society are invited to send in Papers to be read and also to contribute, in writing, to the various subjects under discussion. Papers should be clearly written on one side of the paper only, and be sent to the Secretary at least 14 days before the date of meeting.*

Owing to the great expense of reproducing diagrams, authors of papers are requested not to submit for publication in the Journal any other than those absolutely necessary to illustrate the text.

Detailed large scale diagrams or drawings and photographs, samples or models are invited for exhibition at the meetings to illustrate contributions.

All contributions to this Journal should be addressed to the Secretary. Special attention is drawn to Byelaw No. 7.

SUBSCRIPTIONS.—*Members and Associates are reminded that Subscriptions for the year 1904-1905* ARE NOW DUE, *and should be remitted without delay to the Hon. Treasurer, P.O. Box 4375, Johannesburg. Attention is drawn to Bye-law No. 8, above.*

PROPOSAL FORMS.

Forms for proposal of intending Members, and application forms for Associates and Students, may be obtained on application to the Secretary.

PROCEEDINGS AND PERIODICALS.

The following periodicals are received regularly.

w, Weekly; *m*, Monthly; *q*, Quarterly; *a*, Annually.

African Review, The (London), *w*.
Proceedings of the American Inst. Mining Engineers (New York), *a*.
Proceedings of the American Philosophical Society (Philadelphia, Pa.).
Proceedings of the Australasian Inst. Mining Engineers (Melbourne), *a*.
Australian Mining Standard, The (Melbourne), *w*.
British and South African Export Gazette (London), *m*.
Canadian Engineer (Toronto), *m*.
Proceedings of the Canadian Mining Inst.
Canadian Mining Review, The (Ottawa), *m*.
Cassier's Magazine, *m*.
Chemical News, The, *w*.
Proceedings of the Chemical Society (London).
Chemist and Druggist (London), *w*.
Coal and Iron (London), *w*.
Colliery Guardian, The (London), *w*.
Proceedings of the Colorado Scientific Society (Denver, Colo.).
Compressed Air (New York), *m*.
Electrical Engineer, The (London), *w*.
Electro Chemical Industry (New York), *m*.
Electro-Chemist and Metallurgist (London), *m*.
Engineering and Mining Journal, The (New York), *w*.
Engineering Magazine, The (New York and London), *m*.
Engineering Press Monthly Index-Review (Brussels), *m*.
Engineering Review, The (London), *m*.
Engineer, The (Cleveland, Ohio), *bi-m*.
Proceedings of the Federated Inst. of Mining Engineers (Newcastle-on-Tyne).
Indian and Eastern Engineer, The (Calcutta), *m*.
Indian Engineering (Calcutta), *w*.
Proceedings of the Inst. of Mining and Metallurgy (London), *a*.
Iron and Coal Trade's Review (London), *w*.
Journal of the American Chemical Society, *m*.
Journal of the Franklin Inst. (Philadelphia), *m*.
Journal of the Society of Chemical Industry, The (London), *m*.
Proceedings of the Liverpool Engineering Society, *a*.
Mines and Minerals (Scranton, Pa.), *m*.
Mining and Scientific Press (San Francisco), *w*.
Proceedings of Mining Engineers of Peru (Lima).
Mining Journal, The (London), *w*.
Mining Reporter, The (Denver, Colo.), *w*.
New Zealand Mines Record (Wellington, N.Z.), *m*.
New Zealand Mining, Engineering and Building Journal (Dunedin, N. Z.), *w*.
Page's Magazine, *m*.
School of Mines Quarterly (Columbia Univ., New York), *q*.
Science and Art of Mining, The (Wigan), *bi-m*.
Proceedings of the Smithsonian Instn. (Washington).
South Africa (London), *w*.
South African Engineering (London), *m*.
South African Mines, etc., The, *w*.
Proceedings of the State School of Mines (Golden City, Colo.).
Technology Quarterly (Boston, Mass.), *q*.

Associates Admitted December 7, 1904.

WATERS B., B.S.A. Explosives Co., Ltd., Dynamite Factory, Modderfontein.
BELLASIS, JOHN HENRY, Rhodesia, Ltd., P. O. Box 98, Bulawayo. Surveyor and Assayer.
HARRIS, GEORGE J., c/o Messrs. Napier and Rogers, Selukwe, Rhodesia. Amalgamator.
KIENS, CARL, Surprise G. M. Co., Selukwe, Rhodesia. Cyanider.
LINDSAY, ROBERT, P. O. Box 6093, Johannesburg. Analytical Chemist.
SPARKS, HERBERT JOSEPH, Rhodesia, Ltd., P. O. Box 98, Bulawayo, Rhodesia. Mining Engineer.

Members Elected December 17, 1904.

ADAMSON, ROBERT, Guinea Fowl Mine, *via* Gwelo, Rhodesia, Mine Manager.
CORBETT, W. G. P., Crown Deep, Ltd., P. O. Box 1056, Johannesburg. Assistant Assayer.
CROFTS, JAMES MURRAY, M.A., B.Sc., Johannesburg College, Barnato Park, Berea, Johannesburg. Principal.
DAVEY, ERNEST, Butterfly Mine, Hartley, Rhodesia. Mill Manager.
DURRELL, HAROLD WOODMAN, Crown Reef G. M. Co., Ltd., P. O. Box 1081, Johannesburg.
HENLE, HEINRICH, Technical and Commercial Corporation, Ltd., P. O. Box 4158, Johannesburg. Manager.
HOFFMAN, JOHN D., Crown Reef G. M. Co., Ltd., P. O. Box 1081, Johannesburg. Miner.
LANDAU, ABRAHAM LIONEL, F.C.S., East Rand Proprietary Mines, Ltd., East Rand. Cyanider.
POLLITT, R. B., De Beers Explosive Works, Somerset West, C.C. Assistant General Manager.
WILEY, HARRY, May Consolidated G. M. Co., Ltd., P. O. Box 50, Germiston. Shift Boss.

Changes of Address.

Members and Associates are requested to notify the Secretary immediately of any change in address, otherwise it is impossible to guarantee the delivery of Journals or Notices. The Secretary should be at once notified of non-receipt of Journals and Notices.

MEMBERS.

ATKIN, AUSTIN J. R., to Geldenhuis Main Reef G. M. Co., Ltd., P. O. Box 7, Geldenhuis.
BARRON, W. E., *l/o* Germiston ; Nourse Deep, Ltd., P. O. Box 1056, Johannesburg.
CRAUFURD, A. J. F., *l/o* Roodepoort ; Van Ryn G. M. Estates, Ltd., P. O. Box 22, Benoni.
CROSSE, A. F., *l/o* East Rand ; P. O. Box 598, Johannesburg.
ELMORE, F. E., *l/o* Willesden Lane ; 4, Broad Street Place, London, E C.
LEUPOLD, H. L., *l/o* Cleveland ; Simmer and Jack Proprietary Mines, Ltd., P. O. Box 192, Germiston. Assistant Surveyor.
SOLLY, B. C. TRAVERS, Lancaster West G. M. Co., Ltd., P. O. Box 360, Krugersdorp, and not as stated in November *Journal*.
WILLIAMS, G. W , *l/o* East Rand ; South Rose Deep, Ltd., P. O. Box 21, Germiston.

Proceedings AT Ordinary General Meeting, December 17, 1904.

The ordinary general meeting of the members of the Society was held on Saturday evening, December 17, in the Council Room of the Chamber of Mines, Mr. W. A. Caldecott (President) in the chair. There was a total attendance of 82, as follows:—

62 Members: Messrs. W. Cullen, F. F. Alexander, P. Carter, T. Lane Carter, R. E. Hall, A. Heymann, Dr. W. C. C. Pakes, C. B. Saner, M. Torrente, A. Whitby, Prof. J. A. Wilkinson, J. R. Williams, J. Littlejohn, D. J. Arkell, A. J. R. Atkin, R. K. Bath, Dr. B. Bay, E. Brooks, W. B. Brown, P. Browne, D. V. Burnett, G. Carter, R. W. Chew, F. W. Cindel, D. Cobb, F. S. Cochrane, G. S. Cochrane, E. H. Croghan, J. H. Dinwoodie, W. Dowling, P. L. Edwards, K. F. Ferguson, N. M. Galbreath, A. Gillies, A. Goldwater, W. Hamilton, J. Higham, A. M. Hunter, G. Hunter, W. H. Jollyman, Jas. Lea, C. W. Lee, M. P. Lee, H. Leupold, H. L. Leupold, R. A. G. Maurice, H. H. Morrell, P. T. Morrisby, S. Newton, Prof. A. Prister, J. F. Pyles, A. Richardson, Dr. L. Sack, R. Stokes, James Thomas, J. E. Thomas, J. R. Thurlow, J. P. Ward, H. Warren, J. F. Whitton, S. Williams.

11 Associates and Students: Messrs. W. H. Graham, H. F. King, R. W. Leng, W. Patrick, W. Rigg, Hy. Rusden, C. Schertel, C. B. Surmon, E. R. Williams, L. A. Womble, A. L. Wright.

8 Visitors, and Fredk. Rowland, Secretary.

The President: I beg to propose that the proceedings at the last meeting, as published in the *Journal*, be confirmed.

Mr. J. R. Williams: I second the motion.

Mr. S. Williams: Mr. President, I was rather surprised by your announcement at the last meeting that no prizes would be given for papers read during the past year on mining or milling. I should like to know the reason, since we have had some very good papers read upon these subjects. There was one paper read before the Society on mining which, I think, deserves some recognition. I think it was said by Mr. J. R. Williams that the paper in question was too great to be discussed by the Society, and that it was more fit for publishing in book form for reference. There was also a paper read before the Society on milling which received some very eulogistic remarks from the chair, and extracts of which have been published in various technical journals in England and America. Why were these papers not considered worthy of prizes?

The President: Gentlemen, with regard to the remarks you have just heard, I may say that all the papers read before the Society during the course of the year were very carefully considered by the Adjudicating Committees elected by the members at a general meeting Their decisions were submitted to the Council and confirmed. Although not a member of any of the Adjudicating Committees, I am quite in agreement with the Committees' decisions that in the particular branches specified by Mr. Williams no paper was read which could be considered worthy of a prize and gold medal. The decisions were made by the duly elected representatives of the whole body of members in the manner prescribed and according to the regulations of the Prize Scheme.

Mr. C. B. Saner: As one who was greatly concerned in the results of the judging, I think the Prize Committee could not have done better. I was part author of a paper, not knowing at the time that I was entering for a prize, but in looking over our own paper and various others in the mining section, I do not think, as the rule says, they were good enough for a prize. I was very pleased to think that the Adjudicating Committee from the start should have thought fit to raise a high standard, which all of us would like to see maintained.

Mr. J. R. Williams: It so happens that I was appointed as adjudicator on no less than three of the Prize Committees. I think honestly we have done our best and, as the last speaker said, we did not give prizes to please everybody. What we want to do is to raise the standard as high as we possibly can. We are now recognised all over the world as a useful scientific body, and I think we ought to keep that in view.

The President: If no other member has any remarks to make upon this subject, I put it to the meeting that the minutes of the last meeting, as published in the *Journal*, be confirmed.

The minutes were then confirmed.

Messrs. Lees and Gillies were then appointed scrutineers, and after the scrutiny of the ballot papers, the President announced that the ten candidates for membership had been duly elected. He had also further pleasure in announcing that during the past month six more gentlemen had been admitted by the Council as associates of the Society.

General Business.

Mr. W. Cullen: I think the Society is much beholden to Mr. Stark and Mr. Torrente for the very interesting afternoon we enjoyed on the Crown Reef Mine. It was unfortunate that the weather was so unpropitious, but I am sure that all those who visited the Crown Reef and saw the various processes will agree with me that even under those adverse conditions we had a very pleasant day, and I beg to move that a vote of thanks be passed to Mr. Stark and Mr. Torrente for their kindness.

Mr. J. R. Williams seconded the vote of thanks, which was received with applause.

The President: The applause with which you have received Mr. Cullen's proposition is quite sufficient to show our feeling in regard to Mr. Stark and Mr. Torrente's kindness, and the Secretary will be asked to write conveying our thanks to those gentlemen.

In the absence of the author, Mr. Collings, the following paper was then read by Mr. F. F. Alexander:—

THE AUDITING OF ORE RESERVES.

By B. I. Collings (Member).

The gold mines of the Witwatersrand have already won an unique reputation for consistency and permanency, and any means by which their speculative element may be still further eliminated cannot fail to be a matter of very great importance to everyone connected with the industry.

Investments of all kinds are bought to pay dividends, the percentage varying in proportion to the risks incurred—the safer the investment, the lower the rate of interest—while the more speculative the investment, the higher the rate of interest. This is a very obvious truism, but I will discuss its bearing on the mines of the Rand. The Transvaal Government, in estimating the present value of the Witwatersrand mines in order to assess the profits tax, assumes that the investor will receive 7 per cent. simple interest on his money, while his original capital is returned to him by equal annual payments to a sinking fund, which is re-invested at 3 per cent., the low rate of interest of 3 per cent. being taken to ensure its safety. In other words, the risks attached to Rand mining shares are such that the Government considers that a probable rate of interest of 7 per cent. is necessary to induce the public to put money in these ventures.

The shares, however, might be capitalised at a lower rate of interest if the risks could be lessened.

Two ways present themselves of achieving this—

1st. An increase of ore reserves.

2nd. Greater reliability in the estimation of their tonnage and value.

There is probably no goldfield in the world where the proportional tonnage developed is as great as in the mines of the Rand, but it must be remembered that money sunk in development represents capital locked up and producing no interest. A considerable amount of development ahead is advisable in order to maintain an even grade and to demonstrate sufficiently the probable value and amount of the ore in the mine. This should be carried to a point where the loss of interest in capital locked up counter-balances the additional security that such outlay will give. This varies, naturally, in different parts of the Rand, and a mine in the central Rand, with deep levels developed to the south of it, and where all the main dykes and disturbances are well understood, does not require such large developments to give equal security as a mine in a less known part of the fields.

But it is to the second alternative that I wish particularly to refer, and in order to obtain this greater reliability I would suggest a system of auditing ore reserves.

There have been at least two cases since the war where shareholders in prominent mines, which had been considered "gilt-edged" securities, have suddenly been informed that the ore reserves, either in amount or value, had been largely over-estimated. The consulting engineer is now completely in the hands of his samplers, on whom he has to rely for the data which shall determine the nature of his reports. The sampling done on the Rand is invariably honestly conducted, and systematic salting and similar practices are unknown, but the salaries paid to the samplers, considering the importance and also the arduous nature of the work, are not such as to attract a class of men who can be considered always reliable. It was at one time considered that anyone was competent to do sampling work, although that idea is now considerably modified. Granting even that the sampling is all that it might be, there is no doubt that if the work be checked by an independent source, there would be far less danger of such serious discrepancies as have occurred in the past. In auditing ore reserves I do not propose a complete re-sampling of the mine, but that the Reef widths be checked at each place that the mine samples are taken, and that occasional check samples be taken for assay, or, as an alternative, various drives and wings be taken haphazard and sampled over a length of 50 ft. or 100 ft. and compared with the mine results. Note should also be made of any leaders or portions of reefs that may have been left in the hanging or footwalls of the drives or stopes.

The office work, methods of averaging samples, and estimating tonnage should be checked. The percentage of ore to be left for pillars, sills, etc., should be estimated, and any poor patches left in stopes that had originally been calculated as payable throughout should be written off. Experiments should also be made to determine more accurately the number of cubic feet of ore that go to the ton.

The final results should be given in such a manner that the non-technical man can clearly understand the estimated profit in sight in the mine, which is usually what he wants to get at. I would suggest that the results be given in milling tons and extraction values rather than stoping tons, often with no given value at all, the payable and unpayable tonnage being kept separate, as is now usually done. The mine sampling auditors would necessarily have to be experienced men, and in order to give their certificates their full value, should pass a Government examination before being permitted to practice, the mining department also having the power to suspend them if thought fit. The ore reserves should be audited every year and the auditor's certificate appear in the annual reports. I trust that these few remarks will lead to a discussion on a subject which has, perhaps, not received the attention that its importance deserves.

The President: We have all heard with a great deal of interest Mr. Colling's paper on the auditing of ore reserves, which has some bearing upon a paper recently read before the South African Association of Engineers, entitled "The Theory of the Most Profitable Life of a Rand Mine." I trust that this paper will also evoke an interesting and valuable discussion.

SOME FURTHER IMPROVEMENTS IN APPLIANCES FOR THE CYANIDE CLEAN-UP.

By D. V. Burnett (Member).

Members will doubtless remember with gratitude a short paper by Mr. Thomas, of the Simmer and Jack G. M. Co., published in the *Journal* of October, 1903, in which he gives us improvements in the clean-up apparatus. With 200 stamps running and a clean-up conducted by what I may call the ordinary methods, many a cyanide man has groaned in spirit on his way to work at 3 a.m. with little prospect of a finish before nightfall. Any attempts, therefore, to introduce improved methods and shorter hours will be hailed with acclamation by those of us to whom a clean-up is at best a weariness of the flesh.

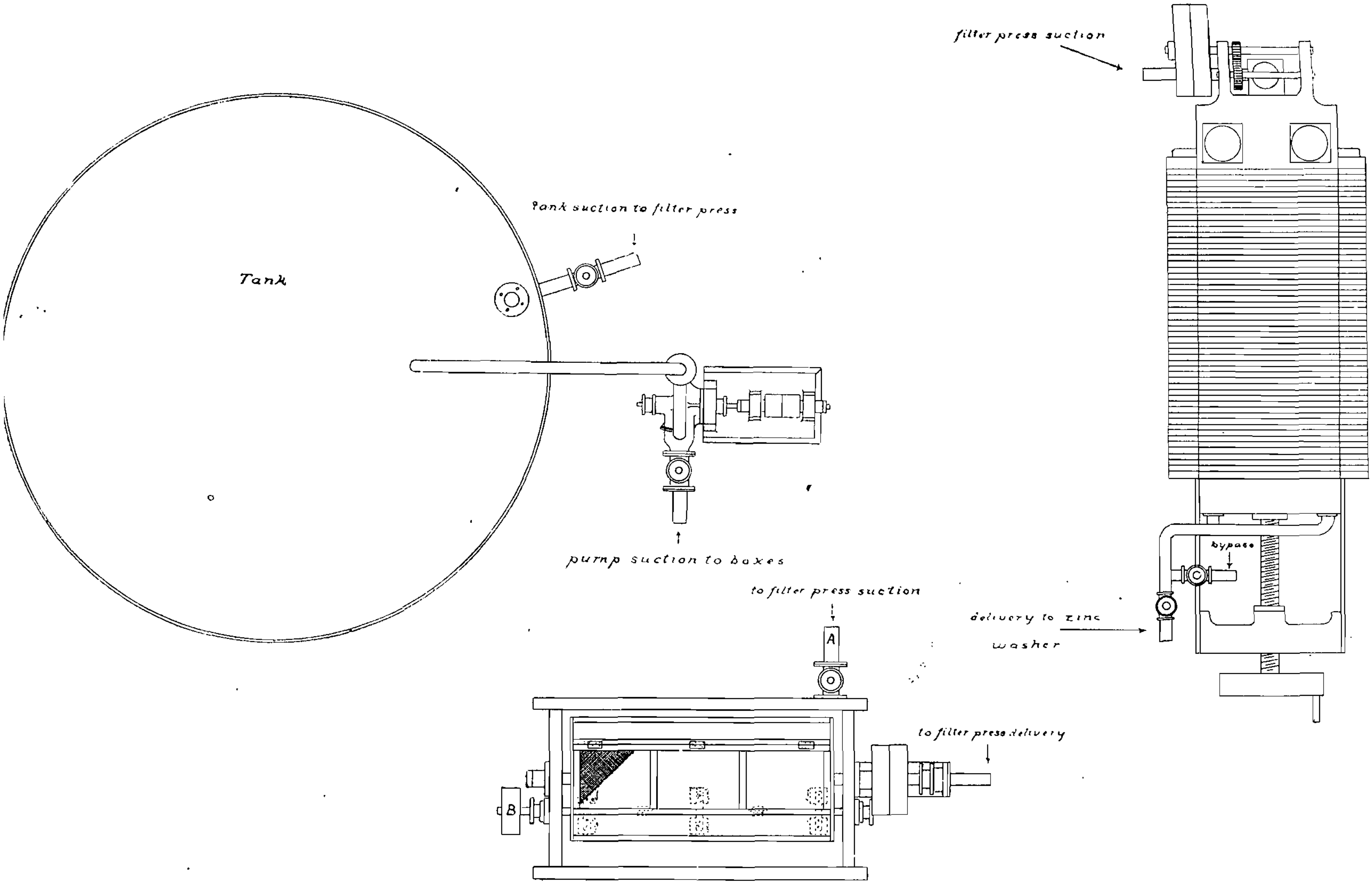
In this hope I will describe the process as adopted at the present time on the Crown Deep, Ltd. At first sight it might appear that our methods and those of Mr. Thomas are so similar that a further description is unnecessary. We use, as he does, a 2-in. centrifugal pump and a zinc washer, but there, so different are the details, the resemblance ends. With a 2-in. centrifugal pump, driven at 1,600 r.p.m, we pump out the solution from our boxes, from which the coarse zinc above the tray has already been removed, the box being then cleaned out by hand. The solution is thrown by the pump into a tank of a capacity sufficient to contain the solution from at least half the total number of boxes. As this pump can empty one box 20 ft. by 5 ft. by 2 ft. completely in eight minutes, the men at work are never kept waiting for a box to clean up. When we remember the long waits caused by the slowness of the filter press pump, this is a real subject for congratulation. Even a stoppage of the main power, if the pump has been at work for some time, will now hardly cause a check in our operations. Mr. Thomas, you will remember, pumps with a 2-in. pump into his filter press, and at 25 lbs. pressure he switches off on to the plunger pump, which means slow work when the press is nearly full and at high pressure. The fine zinc and gold slimes at the bottom of the boxes are conveyed to the zinc washer by hand. In our machine this has a cylindrical trommel of circular plates connected by narrow steel plates, between which the fine mesh screening forming the sides of the cylinder is attached with a hinged door, through which the material to be washed is introduced.

It is to the details which follow that I wish to draw your attention. The trommel is wholly contained in a wooden vat, in which it revolves on a spindle, which rests on bearings outside the vat. Dimensions are, of course, a matter of local convenience; my trommel is 3 ft. 9 in. in length, with a diameter of 20 in., to suit a wooden vat which was once used for hand washing. This I find at each filling washes conveniently eight buckets of precipitate. The trommel is rotated by a small belt to the spindle. This spindle, which runs the whole length of the box, is perforated to allow solution to play upon the contents of the trommel, and to the end of this perforated pipe a hose from the delivery end of the filter press is fastened; a gland and bearing allows of a water-tight connection between the fixed pipe, which takes the hose and the revolving spindle. To the lower part of the box, at a point marked A in the drawing, the suction hose of the press is attached. Now, if a small amount of acid solution be run into the box and the pump of the press started, all liquid in the box will be pumped out, filtered, and returned to the box. If the trommel is at the same time rotated, the gold slimes from the inside are washed into the filter press and the acid solution returned quite clean to begin the circuit again. In order to insure that all the gold slimes are taken into the suction of the press, an agitator is fixed inside the box under the trommel (marked "B" in drawing), which is also rotated by a small belt from the counter shaft, and which by the revolution of its paddles keeps the gold slimes in suspension.

It must be clearly understand that these two appliances, the tank and the washer are worked in conjunction with one another. The washer cleans the zinc faster than the precipitate can be removed from the boxes. By a simple attachment of valves the filter press is then switched on to the tank again, this in its turn making room for further work by the 2-in. pump. I find that by keeping the solution in the washer slightly acid, the zinc washed in the trommel and left on the screening is very thoroughly cleaned. This washed zinc can either be replaced in the zinc boxes, or, where acid is used, conveyed to the dissolving tubs. In the former case I find that, being cleaned, the zinc precipitates gold well, while with acid treatment the reduction in bulk by the removal of the slimes spells a considerable economy in the amount of acid required. As against hand washing, this system gives me several advantages. It saves both time and labour, to say nothing of sore fingers; it prevents the pulverisation of the zinc by scrubbing, and especially as the washing is done in acid solution which is always clean it gives me a much more complete separation of zinc and slimes than if, as heretofore, it were washed in slimy solution.

I need hardly say that in taking Mr. Thomas' paper as my text, I do so in no spirit of criticism, only I claim that for the common benefit I may point out the improved points of the appliance at which we have arrived on the Crown Deep. Our 2-in. pump works continuously, our zinc washer is not turned by hand—though, in the case of a breakdown, this could easily be done—the zinc is washed cleaner, and the slimes are removed as they fall.

In conclusion—and in proof of the pudding, let me point to the eating—on the Crown Deep at one time we used to start work at 3 a.m. (in itself no pleasure) on a winter morning, and finish often in the "wee sma' oors." Now, with



Illustrating "Some Further Improvements in Appliances for the Cyanide Clean-Up," by D. V. Burnett (Member).
All Connections made by Hose.

two white men and four or five coolies, I clean up some twelve extractor boxes 20 ft. by 5 ft. by 2 ft., and clean them thoroughly, too, in about six hours, having all slime ready for drying.

My thanks are due to Mr. F. S. Cochrane, a member of this Society, for the practical working out of these details and also for making the drawings which illustrate this paper; and also to Mr. W. T. Hallimond, Manager of the Crown Deep, Ltd., for allowing the publication of these figures.

The President: You will all remember the appreciation with which Mr. J. E. Thomas' paper was received, and you may also remember the prediction at that time that the bringing before the Society of the useful devices instituted by Mr. Thomas might lead to further developments and improvements. We have heard with pleasure this evening of the developments described in Mr. Burnett's paper, and I trust that at some future meeting still further improvements will be announced.

Mr. Maurice: With regard to Mr. Burnett's paper, I should like to say that we have at the Crown Deep, at present under the same extractor house roof, two separate precipitation plants. On the Crown Deep side there are twelve extractor boxes, but on the Robinson Central Deep we only use four extractor boxes of the same average size. When we clean up, we find that we can in a twelve hours' shift just manage to clean up the four boxes with a filter press pump, whereas all the Crown Deep boxes are cleaned up in considerably less time through Mr. Burnett's ingenuity.

THE FORMATION OF "THE WHITE PRECIPITATE" IN THE PRECIPITATION BOXES OF CYANIDE WORKS.

By Dr. B. Bay (Member).

As zinc cyanide ($ZnCy_2$) plays an important *rôle* in the zinc boxes, I thought it advisable to prepare this compound and to study the action of zinc shavings on it. Zinc cyanide was prepared by allowing hydrocyanic acid to pass into a solution of zinc acetate, and the precipitate so obtained was washed and dried.

In the first experiment 0·3615 gm. of zinc cyanide was dissolved in 300 c.c. of 0·41 per cent. KCy solution; 100 c.c. of this solution was allowed to stand for 48 hours with several grammes of fresh zinc shavings. During this time a white granular, partially flocculent, precipitate was formed. This precipitate was filtered, washed, dissolved in hydrochloric acid, and the zinc determined gravimetrically as zinc oxide.

Zinc cyanide used = 0·1205 gm.
,, oxide found = 0·0608 ,,
= 0·0485 ,, of metallic zinc.

Hence 72·49 per cent. of the zinc existing in the $ZnCy_2$ was precipitated.

The filtrate from the precipitate was diluted to 500 c.c.; in one portion the KCy was determined and found to be 0·156 gm.; in another portion the zinc was determined and found to be 0·365 gm. Therefore, the filtrate contained 7·7 times more zinc than the precipitate. The zinc in the filtrate may exist partly as $Zn(OK)_2$ and partly as K_2ZnCy_4, which remain unprecipitated.

The zincate may be formed according to the following equation:—

$$K_2ZnCy_4 + Zn_2 + 2H_2O = 2ZnCy_2 + Zn(OK)_2 + 2H_2.$$

The figures above mentioned show—

1. The large quantity of zinc that is dissolved by a strong cyanide solution (0·41 per cent. KCy).
2. That such a strong cyanide solution under certain conditions is unable to prevent the precipitation of the zinc cyanide existing in the solution.

The amount of cyanide in the precipitate obtained by this experiment was not determined quantitatively, but an estimation was made in the case of one of the tests described later.

The question now arises as to the causes that lead to the precipitation of the $ZnCy_2$. Does the solution become weaker in free KCy or is more zinc cyanide formed than can be kept in solution?

A fresh solution of zinc cyanide in KCy was prepared containing 0·0625 gm. of zinc cyanide in each cubic centimetre. A portion of this solution was placed in a flask with shavings, so as not to completely cover them. In another flask zinc shavings were also placed and completely covered with another portion of the same solution. In the flask where the shavings were completely covered with solution, no precipitate was formed, while, on the contrary, in the other flask where the shavings remained exposed to the air, a thick white precipitate was thrown down. It is evident, from this simple experiment, that the exposed surface of the shavings undergoes oxidation. Further, that capillary attraction causes the cyanide solution to remove the zinc oxide, thus consuming most of the KCy and precipitating zinc cyanide, whereas with the immersed shavings this reaction is retarded, as no air comes in contact with them. Wet zinc shavings exposed to the air must form either a basic carbonate or oxide of zinc, which is much more soluble than metallic zinc and which takes up a part of the KCy in the solution, so that zinc cyanide is precipitated. This experiment confirms good cyaniding practice of avoiding the exposure of wet shavings to the air for long. Otherwise, not only is zinc lost by oxidation, but the danger of precipitating more zinc cyanide in the boxes is increased.

Another very weak solution of potassium zinc cyanide was prepared by dissolving 0·8637 gm. of zinc cyanide in 900 c.c. of 0·091 per cent. KCy solution. Used zinc shavings, after very careful washing, were placed in 400 c.c. of this solution. The moment these shavings were introduced into the solution, a white, granular precipitate was formed. After they had remained in the solution for about ten minutes, the precipitate was filtered, washed, and distilled with sulphuric acid. The prussic acid so set free was collected by $AgNO_3$, as described in a recent paper by Prof Prister and myself. After igniting the silver cyanide, 0·094 gm. of silver was obtained, corresponding to 0·025 gm. of cyanogen.

Cyanogen in the original 400 c.c. = 0·160 gm.
,, found in the precipitate = 0·025 ,,
,, ,, ,, = 14·66% of original amount.

The zinc was determined in the dissolved precipitate volumetrically with ferrocyanide, using uranium acetate as indicator, and it was found to amount to 0·0473 gm. of metallic zinc. Hence only half of the precipitate consisted of zinc cyanide, as the cyanide found corresponds only to 0·027 gm. of zinc; the other half of the zinc in the precipitate may occur as hydroxide, and I hope to elucidate this point soon. The zinc in the filtrate, on the other hand, was found to amount to 0·0594 gm. Therefore, in this experiment also, the amount of zinc in the filtrate was larger than in the precipitate, but not so large as in the first experiment, as the shavings had not been so long in the solution and the solution was much stronger in KCy.

With the last-mentioned weak solution other experiments were also made to determine how much zinc cyanide would be precipitated by used zinc shavings. In the first case, 100 c.c. of the potassium zinc solution was allowed to stand overnight with shavings; the amount of

Cyanogen obtained by distillation was found to equal 0·0244 gm.,
Cyanogen in the original solution = 0·04 gm.,
,, found in the precipitate = 0·024 ,,
,, ,, ,, = 60·8 % of original amount.

In a second case 100 c.c. of the potassium zinc cyanide solution was in contact with shavings for about an hour, and the amount of

Cyanogen obtained was 0·0135 gm.
,, in the original solution = 0·04 gm.
,, ,, precipitate ... = 0·0135 gm.

Hence 35 per cent. of the zinc cyanide present in the solution was precipitated in an hour.

The free potassium cyanide in the solution before immersing the shavings was found to be 0·065 gm. by the silver nitrate test, but after standing for an hour in contact with the shavings and filtering off from the precipitate, the amount of KCy was found to be only 0·3455 gm., or 70 per cent. of the original amount present. The amount of KCy consumed by standing in contact with shavings was again determined by allowing 90·2 c.c. of the above weak solution of zinc cyanide to remain overnight in contact with used shavings.

Before immersing the shavings in the solution, the KCy was determined by titrating with silver nitrate solution and found to be 0·0585 gm.; after bringing in contact with shavings and allowing it to stand overnight, the filtrate contained 0·028 gm. of free KCy.

The above-mentioned estimations of cyanogen, zinc, and potassium cyanide were not all carried out in each experiment for lack of time.

I have observed a similar reaction in a working solution obtained from the top of a "medium" box without contact with shavings.

The solution was quite clear after standing several days corked, but when allowed to stand open, a fine white precipitate formed. This precipitate was filtered, washed, and was found to contain zinc, calcium, iron and cyanogen. This is evidently due to the same reaction as when shavings are present, since the KCy which keeps the zinc salts in solution is decomposed by absorbing CO_2, and the zinc is precipitated.

The President: The thanks of the Society are due to Dr. Bay for the paper he has just read, which has evidently involved a great deal of labour. There are, unfortunately, very few of us who have the leisure or opportunity to investigate the matter of white precipitate and other chemical reactions occurring in the cyanide process from a purely chemical standpoint, but as it is from the precipitation boxes of the cyanide works that the dividends of most of our mining companies are derived, it seems to me that those of our members who have the opportunity are doing most important work. These researches, undertaken from a purely scientific point of view, may in the future be of a very great practical value.

THE ASSAY WEIGHT AND ITS RELATION TO THE BALANCE OF PRECISION.

By A. Whitby (Member).

REPLY TO DISCUSSION.

Mr. A. Whitby: I do not purpose to take up much time in replying to the discussion on my paper; my critics have treated me so generously that there is little left to say. The little point raised by Mr. McA. Johnston as to the electrical characteristics of the rider when excited by rubbing the glass plate of the balance I have since observed, but I must leave this for the consideration of others more deeply versed in these phenomena.

Mr. Gardiner accuses me of being hard on the assayer, but on what grounds I fail to see. The temptation to employ the same metal forceps, which are commonly used for removing the prill from the cupel to the pan of the balance, in the duty of lifting the weights is ever present to the assayer. An examination of the weights more generally used in assaying will show scratching in very many instances.

Prof. Wilkinson assails me with looseness in the use of terms. The word "sensibility," in connection with balances is, I believe, the correct term, but, as a matter of fact, I really found myself rather tired of repeating this word, and employed the services of another having the same meaning, with at least the authority of two technical writers to support me.

With regard to the rather lengthy discussion on the influence of altitude and mass *versus* weight, I consider this only of academic interest, and not affecting the main issue. This, the only serious discussion on my paper, is of great scientific interest, but I hold that, since the weights are platinum and the material to be weighed is gold, and the specific gravities of both approximating, it should be possible for an assayer in, say, London to get the same result as one in Johannesburg, since what affects the one metal nearly equally affects the other. In cases where the specific gravity of the metal weighed is greatly divergent from that of the weights, I can conceive it possible for Mr. Laschinger's deductions to have some value, but as things stand, we are weighing two metals of closely approximating specific gravity against each other, and the questions of mass, gravity, vacuo, etc, hardly affect the question. In conclusion, I wish to thank Messrs. J. R. Williams, Heymann, Gillies and others for corroborating data in support of my contention that assay weights are not what they should be.

The President: As you are aware, Mr. Whitby's valuable paper has called forth a sub-committee of the Society to try and obtain what we all desire—accurate weights. This is a somewhat lengthy business, but the sub-committee are doing all in their power to expedite the matter.

IMPROVEMENTS IN SLIMES TREATMENT.

By M. Torrente (Member).

REPLY TO DISCUSSION.

Mr. M. Torrente: The difficulties which have been found in criticising my paper by some of the gentlemen who have taken part in the discussion must have been very great, considering that all they had to criticise was the results obtained by the experiments, and that in some cases they had not even seen the process at work on the large scale, since adopted, nor were they aware of the results presented below. Since the publication of my paper, a great amount of work has been done which gives more accurate knowledge of the process and makes the answering of many of the points raised in the discussion a comparatively easy task.

With regard to some of the questions suggested in connection with the shape and position of the inclined plane and partition, it may be said that it will be in many cases a matter of choice as to the form or shape these will take in a tank. A circular shape may, under some circumstances, be advisable or convenient. Since the paper was read to you, two tanks have been put in operation at the Crown Reef accumulated slimes plant. The first was built exactly as indicated in the paper, and did good work. It was nevertheless found that the slimes had a tendency to settle unevenly in the tank, and it is here that the non-stability of slimes pulp was very much in evidence. To remedy this drawback a second tank was provided with two partitions dividing the tank into three parts, leaving the centre division for the rising column of clear solution. This was found to be a great improvement, and the settlement of the slimes has since been observed to take place very evenly over a level surface. The two columns of pulp of the same gravity compensate each other inside the tank, and the slimes outlet being in the centre, the discharge carries the pulp away just at the very spot where the tendency would be for it to rise.

The same results ought to be obtained with a circular plane and partition, but this in every day work would be found more difficult, especially in tanks of large diameter; and further, their construction would be more expensive.

The remarks as to the values of solutions hardly apply to experiments which were made under known conditions. The reference to the work done in the first experiment is most satisfactory and has given a correct explanation, that whereas in most cases there is an inclination when working out experiments to avail one's self of the most favourable conditions, the contrary method was tried here, and the utmost has been done to get as near as possible to working, or even adverse, conditions. The results showed that in the industrial working of this method it is possible to obtain excellent results.

Some criticisms do not give much chance for reply, *e.g.*, the sublevel delivery. What has a violent sublevel delivery to do with a steady delivery right on the top of the mass? Anybody who has worked a sublevel delivery will vouch for the fact that the disadvantages are far beyond any advantages it may possess. Indeed, in all the plants formerly belonging to the Rand Central Ore Reduction Company the latter were discarded and replaced by a floating platform where the splash from the launders was arrested, and the results obtained were far superior to those when the sublevel delivery was used.

The same applies to some remarks about dilution. If, for the sake of argument, say, 100 tons of slimes carrying 200 tons of solution are settled in the new way, in a tank which happens to be full of solution (say 500 tons) the dilution may be considered to be practically 100 tons of slimes in 700 tons of solution, which is almost impracticable in any other way at present in use. If these slimes are discharged with 50 per cent. moisture, we see that 100 tons of slimes carry 100 tons of solution along with them to the residue dam, and hence the amount of solution displaced out of the tank would be of 100 tons and not a drop more, *i.e.*, not more than at present experienced in actual practice.

There is not, in this case, any advantage in delivering the pulp in the centre of the vat. The further it is delivered from the point where it will be discharged the better results will be obtained, and the reasons are obvious to anybody well acquainted with slimes treatment. Whether anything with a conical bottom is a spitzkasten, or *vice versa*, is a matter hardly worth arguing here. There is no fear that mud rushes will choke pipes, as these are absent in this plant, and in a well constructed tank for the purpose of this slimes settlement the more the mud rushes towards the centre of the cone and chokes there, the better it will work. Thick slimes are just what we require, and the harder they rush and choke, the better. Imagine how nice it would be, if we could get from the bottom of a tank such a product, as let us hope we will see yet, that could be discharged at once on to a belt and carried away.

This process of slimes settlement cannot be compared with the work done in any of the modern plants by the use of tangential delivery of pulp for the purpose of agitating and treating the mass. The fact that this tangential delivery is introduced all round in new plants, is not a matter of choice. It replaces the now obsolete stirring gear, which it surpasses by far in the treatment of current slimes. But once the gold is dissolved, that is to say the slimes are treated, it could very well be dispensed with, as no further advantage can be derived from it. There is nothing to be gained by having a charge, three or four hours after it has been transferred, still revolving in the tank, instead of being allowed to settle. This is one of the drawbacks of tangential delivery. It is so much time lost and this can only be compensated by greater plant capacity.

Before answering any further criticisms, allow me to quote from Mr. Parsons' Presidential address to the Engineering Section of the British Association. He says: "Generally, what is usually called an invention is the work of many individuals, each one adding something to the work of his predecessors, each one suggesting something to overcome some difficulty, trying many things, testing them when possible, rejecting the failures, retaining the best, and by a process of gradual selection arriving at the most perfect method of accomplishing the end in view."

Nothing could be better described. On reflection, the immense amount of work done in connection with slimes in the last few years will be evident. This work has cost very big sums, and has given to the mechanical engineer every possible opportunity to use his ingenuity in its development. The treatment of the slimes themselves has indeed changed very little since the day when a piece of cyanide was dropped into a bucket full of slimes pulp. Very often you will hear when speaking of some of the most successful plants in these fields that "So and So built that plant," and the name of some leading mechanical engineer is mentioned. But how about the failures? Has anybody ever heard any of the very great failures we have had, being attributed to the mechanical engineer? No. The metallurgist has had to suffer, and there is no case known where he has ever tried to saddle any of the blame on his brother the mechanic, who after all had only given practical shape to the ideas of others.

It is an accepted fact that the ideal slimes plant must be a continuous one, and there must be a way to reach and maintain that fixed condition which at present gives so much trouble to reach, and which varies so considerably according to locality, methods of working, etc. There is no doubt that the metallurgist, with the able help of the mechanical engineer, has a much better chance to succeed in his endeavours than he will if left to work his own salvation as best he can.

An answer was given here at the last meeting to some remark concerning the results obtained at the Crown Reef accumulated slimes plant, as compared with those obtained in other more modern plants working on current slimes. It is a difficult comparison to make as regards costs and results. The suggestion as to the advisability of introducing two settlements of 30 hours with a ratio of solution to slimes of four to one is very good indeed, but what is to be done when after 60 hours settlement with a ratio of dilution of 5 or 6 : 1, no decent settlement can be obtained, and the charge has to be got rid of to make room in the plant for the next?

I venture to bring to your notice some of the results obtained since the experiments were made. Before writing their criticisms a couple of gentlemen took the trouble of visiting the plant, and it is very flattering, considering how little they saw, that they should have given such an amount of thought and time to pass their opinions thereon. Even now there is nothing much to see; just enough to show that there is something in this new departure. Nevertheless when men find anything worth at least some reflection, the chances of future success and improvement are very great. The work so far done at the Crown Reef is of the crudest kind. In the first instance the cones have not the necessary taper to rush the slimes towards the centre. One tank is working with one partition and doing well. The next tank has got two partitions and is doing better. The third tank will be taken very soon in hand and it is contemplated, as soon as finances allow, to put in a cone which will comply with the required conditions. Under present adverse conditions it is to be wondered that any results are possible, but so far everything looks very promising. So as not to detain you much longer, any lengthy statistics will be excluded from this paper. The following very short figures relating only to tonnages and profits may be sufficient food for reflection as to work which may be done on these lines.

The average amount of slimes treated for the period of 8 months, January to August, inclusive, was 2,986·75 tons per month. This is as much as could possibly be settled so as to obtain a fair value from the slimes.

In September and October, with one tank provided with the inclined plane and partition, this average was raised to 3,233·50 tons per month.

In November with two tanks, one with one inclined plane and partition and the other with two, we treated comfortably 4,103 tons.

This month everything seems to indicate that we shall treat 4,500 tons.

The monthly profits average as follows :—

	Value of the slimes. dwt. per ton.	Profit per oz. fine gold. Shillings.
January to May (inclusive)	5·395	36·4
June to August ...	4·411	40·6
September to October ...	4·00	34·1
November	4·31	40·2

Considering the odds against which the work has been carried out, these results are very encouraging and in a better adapted plant ought to be greatly improved. The experience gained is also very valuable. For one thing it proves that the most difficult slimes on the Rand can be settled in 12 hours better than they can in the time now taken, which varies from 30 to 60 hours. Further, it seems to indicate that the time is not far off when the problem of continuous slimes treatment will be an accomplished fact.

The President : Mr. Cullen has already very ably expressed the thanks of us all to Mr. Torrente for his valuable and interesting paper, and also for his kindness in showing our members the plant in operation. I can only re-echo his words. It seems to me Mr. Torrente has given us a very good illustration of the simile I ventured to use a few months ago in reference to combining theory and practice.

In announcing the discussion of the papers mentioned on the agenda as now open, I should like to mention that we have received a contribution to the discussion of the paper read by Mr. Andreoli from our old friend, Dr. Loevy, one of our past presidents, and one to whom the Society owes a very great deal.

NOTES ON THE GOLD OF THE ROODEPOORT DISTRICT.

By Gabriel Andreoli (Member).

DISCUSSION.

Dr J. Loevy, Berlin (contributed): With reference to the paper read on the above subject by Mr. G. Andreoli, I think the following data will be of general interest.

In 1897 or 1898 the late Mr. A. Goerz drew attention to the remarkable fact that the gold recovered from the mines of certain portions of the West Rand was much purer than that produced on other parts of the Rand. In July and August, 1899, I conducted, at the instance of Mr. Goerz, a series of analyses of mill gold from mines both on the Western and the Eastern parts of the Rand. I had intended reading a paper on this subject before the Society, but was prevented from doing so by the outbreak of the war and the consequent stoppage of the Society's work. The analyses, together with some explanatory remarks, have therefore been published in the *Suedafrikanische Wochenschrift*, Berlin, 1899, No. 371. As this matter has now been brought forward again, it affords me much pleasure in communicating the analyses referred to above, which show the correctness of the statements made five or six years ago by Mr. A. Goerz and confirmed in Mr. Andreoli's paper.

Analyses of Mill Bullion.

I.—East Rand Mines.

	Geldenhuis Estate. %	May Consolidated. %	New Goch. %
Au ...	86·58	88·40	87·06
Ag ...	12·54	11·34	10·43
Cu ...	0·86	0·21	2·35
Fe (+loss)	0·02	0·05	0·16
Co ...	Nil	Nil	Trace
Ni ...	Nil	Nil	Trace

II.—West Rand Mines.

	York %	Lancaster Gold Botha Reef %	Lancaster Gold Battery Reef. %	Princess. %	Roodepoort United Main Reef. %
Au ...	92·60	91·20	91·00	92·40	97·00
Ag ...	6·74	8·18	8·57	7·29	2·98
Cu ...	0·63	0·52	0·35	0·23	Nil
Fe (+loss)	0·03	0·10	0·08	0·08	0·02
Co ...	Trace	Trace	Nil	Trace	Nil
Ni ...	Nil	Trace	Nil	Trace	Nil

NOTES ON SAFETY FUSE:

Its Manufacture, Testing and Use

By James Thomas (Member).

DISCUSSION.

Mr. W. Cullen: Various gentlemen who have read papers before this Society, including myself, have referred to fuses incidentally, but I think, all the same, the subject is one that was quite fitted to have a paper devoted to itself, and when I have said that I really do not think I have anything more to say, except, perhaps, from a manufacturer's point of view I have not been connected with the manufacture of fuse but I know manufacturers at home in Germany, Belgium and England, who kick to a great extent against the tests brought out by the Mines Department here to control the quality of the fuse entering this country. These tests have justified themselves, and if any one cared to examine the statistics of the mines department regularly, statistics of accidents connected with the use of explosives, they will find a gradual but perceptible diminution in the number. That I put down to the better quality of fuse which we now have in the Transvaal. We know of a great many bad qualities of fuse which come into this country and do excellent work. I know several qualities of fuse which, in spite of the Mines Department tests, are quite bad and, still I know it is used year in and year out by certain mines without causing any accident. For dry workings you can get a cheap quality of fuse and do good work in open workings without any great danger attached, but the Department has very wisely assumed that a fuse may sometimes be treated well and sometimes badly and may be put not only in dry holes but in wet holes, and they have based their test on the assumption that the fuse may at some time or other come in contact with water. I need not point out to you the very serious thing it is to a mine if the fuse stops burning. It is responsible for more accidents on these fields than any other thing. Mr. Thomas said he had not come across a case of short circuit. If he refers to comparativly recent times that is quite correct, but before these tests were brought out several cases came under my own personal observation. I think, if those tests have made Mr. Thomas come to this conclusion, it is an admirable thing. There is another matter—the rate of burning. It is difficult indeed for the manufacturers at home to appreciate that for six or seven months in the year we have absolutely dry weather and as Mr. Thomas pointed out in his paper, and they have sometimes to make their fuse from powder under very dry conditions at home. Black powder is going somewhat out of fashion, and to get the quality of black powder which is required to be satisfactory, as far as the rate of burning is concerned, is not always easy. It is an extremely difficult thing for manufacturers to gauge the conditions we have as far as the humidity of the atmosphere out here is concerned. Another thing is that a fuse may arrive in this country perfectly satisfactory, but after being stored under a corrugated iron roof for some time if it were tested again and submitted to the same conditions, as far as time or the rate of burning goes it would be rejected. That also is a very important matter. In the case of shaft sinking a man has to fire as many as 24 shots with varying lengths of fuse and it is a serious thing if there is a difference between the time of say 100 secs. and 80 secs. These are things which nothing will obviate except sensible storage. I merely indicate this as I think the merchants in Johannesburg are not quite cognisant on the point. A fuse to give satisfactory results should really be stored in a common sense manner. I hope what I am saying now will have Mr. Thomas' support, for I am sure it is an important matter. I think Mr. Thomas has earned the gratitude of this Society, particularly of those members of the Society who are connected with the practical part of mining, for bringing forward this very interesting paper. Before the close I will make one remark which applies to many other things besides fuses, namely, that there is no possible series of tests, no matter how strict, will ensure safety unless the fuse itself is treated properly underground. I noticed when reading through Mr. Thomas' paper that he has seen men tie up their tools with fuses before going below; that is not an uncommon practice, and, although we have but little trouble with detonators, it very often happens that although they are perfectly good above ground if they are stored in a damp corner of the mine they are absolutely no use and may lead to a very bad accident.

The President: Mr. Cullen has declared that he has no particular knowledge of the manufacture of the fuse, but I think that his subsequent remarks show that his knowledge is greater than he claims it to be. At any rate, we very much appreciate the valuable information Mr. Cullen has given us.

Mr. H. Leupold: I may state I hope to carry out some experiments with different kinds of fuses which have been submitted to me, and I shall be pleased at another time to submit the results to the Society.

Mr. Hunter: I would like to draw Mr. Thomas' attention to the fact that all the English fuses deteriorate within two to four weeks after the case is opened. That has been the experience on our property. I think all other storekeepers on mines will agree that no German fuse of the class we have used, and which is sold roughly, at about 4d. per coil, suffers from this defect.

Mr. W. Cullen: In justice to the English manufacturers, I do not think, so far as my information goes, that the English manufacturers seriously catered for this field before the war. I do not think they have quite realised the different conditions obtaining here to those at home. We have here two very great changes in the seasons, a very wet period and a very dry period. I think there is a great deal of truth in what Mr. Hunter says. The market before the war was almost entirely in the hands of Continental manufacturers. Whilst regretting this fact, I am pleased to say that English manufacturers are beginning to realise its importance. I have had occasion myself to point out the difficulties to which Mr. Hunter has drawn attention, and I am sure our home manufacturers will have their due share in the business sooner or later.

The President: We have several mine managers with us to-night, and I trust they will give us the benefit of their experience on this matter.

Mr. C. B. Saner: In sinking a deep level shaft we have from 32 to 38 holes to fire, and we find it pays to fire the whole lot practically at the same time. Although Mr. Thomas has said it seems ridiculous to use two coils of fuse and two detonators in each hole, we find it is better to do so, because if only one hole misfires, it greatly delays matters, as it takes a considerable time to get down after blasting, so that it is better to ensure, as far as possible, that practically every shot should take effect rather than the waste of 4d. per hole. Mr. Cullen was speaking of 16 to 20 holes. Our average last month came to 34 holes per round. We have been drilling about 32 holes about 8 to 10 ft. deep, and one or two pop holes just to square the shaft, and we find it is much better to blast the whole lot. We have used a fairly expensive fuse rather than a cheap one, so that we were practically certain they would go off. Concerning British manufacturers, three years ago I was in England and mentioned the matter to one or two of those firms I visited. I wanted the Britisher to realise that South Africa was not a dumping ground for their waste. They said they were looking into the question, and were sending over representatives to the States to find out what was a good thing. I ventured to tell them they were too late.

Mr. P. Carter: During the last two years I think we have used nearly all the principal fuses sent out to this country. We occasionally get a bad case, but in such an event the agent very kindly takes it back and gives us a good one. I may add that those I have found to be the worst occasionally have not been of British manufacture.

Mr. T. Lane Carter: There is one little matter which might be mentioned, namely, that if you are ever in doubt about a fuse it is best to destroy it and not try to use it in the mine at all. On a certain mine there was a supply of fuse before the war. It was kept for two years and eight months and after the war this same fuse was tried in the mine. The fuse would not ignite the detonator. That was an example of the penny wise and pound foolish policy. Another point might be mentioned, namely, the question of instantaneous fuse. There is such a fuse and in some cases it is a useful thing to have. A number of holes fired together would serve the purpose better than if the holes went off consecutively.

Mr. Ward: I think Mr. Thomas is rather hard on the miner in saying that he is not treating the manufacturer of fuse fairly. I have never known a miner use the fuse which he has used previously to tie up his tools with. Very frequently missfires occur through dampness. I have also noticed that detonators do not go off. Perhaps the sawdust in the detonator itself is damp and the fuse does not get a fair chance.

Mr. Hunter: I hope Mr. Thomas does not refer to any mine in this country. I do not think anyone of us ever saw the boy who drills the hole tying up his drills with fuse.

The President: I may mention that Mr. Cullen has promised us at an early date a paper on "Electrical Firing" which I am sure we shall all appreciate.

SAND LIME BRICKS.

By H. Gerlings (Member).

DISCUSSION.

Mr. Cobb: My object in coming here this evening is to learn more about sand lime bricks. I have had an opportunity of testing them in various ways. It has been said that these bricks have proved satisfactory for building purposes for seven to ten years' Some little time ago I had two sand lime bricks sent to me to test. They were placed along with clay bricks in a kiln that was fired at 2,000° F. in a place from which they could be easily removed. The bricks, when at a full red heat, were taken out and plunged immediately into a bucket of water. The clay brick showed little or no sign of damage by this test, but the sand lime brick I could scarcely find, and the thought struck me that something like that would happen if a building built with these bricks caught fire.

General.

The President: I am pleased to announce that the Castle Brewery Management have been good enough to invite the members of the Society to visit their factory at an early date in the new year.

After reciprocal interchange of seasonable good wishes for the coming year, the meeting then closed.

Visit to the Crown Reef G. M. Co., Ltd.

In response to a courteous invitation from Mr. H. S. Stark, General Manager of the Company some 75 members of the Society visited the surface works of the Crown Reef G. M. Co., Ltd., on Wednesday afternoon, December 14, 1904.

Mr. Stark, assisted by Mr. R. C. Atkinson, the Resident Engineer, personally conducted the party around the property, visiting the workshops where the students of the Transvaal Technical Institute were busily engaged in the practical portion of their annual examination, after which the experimental gas producer plant was inspected. Mr. Atkinson lucidly explained the plant as follows :—

Gas Engine.

The gas engine is of the Otto type, and is manufactured by the Gas Motoren Fabrik, Deutz, Germany. The plant consists of—

1st. The producer,
2nd. The scrubbers,
3rd. The engine.

The Producer—Consists of a cast iron cylinder 7 ft. high over all by 2 ft. 3 in. diameter, brick lined with fireproof bricks. At the base is a fireplace, and underneath a small well filled with water, into which the ashes fall (helping to produce vapour). At the extreme top is a large two-way cock, where the coal is fed in; beneath this the casing is surrounded by a water jacket 6 in. or 8 in. deep, and this water becoming heated, vapour is given off, which is led by means of a pipe to the under side of the grate and combines with the fumes given off by the coal to form producer gas.

The Scrubbers—Of which there are two, consist of a wrought iron shell 8 ft. 3 in. high by 2 ft. 1½ in. diameter. At the base a well to receive the gas, at the top end an inlet for water and a spray to spread the water over the whole area. The entire chamber, with exception of gas well, is filled with coke, through which the gas percolates in the opposite direction to the water which falls down. The gas in its course through the scrubbers to the engine being in this manner cleansed, cooled and filtered of all by-products of the coal.

Between the scrubber and the engine and as near to engine as possible a small receiver is placed—thus to have a volume of gas ready as the suction produced by the engine demands it.

The Engine—Is a single cylinder gas engine of the Otto type, as stated above, of simple design and strong construction and requires little attention in working. In general appearance it resembles a horizontal steam engine, but here the resemblance ceases. The connecting rod is coupled direct to the piston which is of the hollow trunk pattern to permit this—a heavy fly wheel as is usual and necessary to complete the main moving parts. The valves for gas inlet and air are operated by means of gearing from the crank shaft, the motion being transmitted by means of a shaft and cams to the valves.

Previous to passing the gas inlet valves the gas passes through a small separator or filter, which consists of a cast iron box with a number of circular discs placed a few inches apart, having holes in them smaller than the supply pipe, and thus the speed of the gas is accelerated and dashes against the surface of the discs, leaving any tar or other residues on their surface. The engine is known as a four-cycle engine, that is to say, one explosion takes place every two revolutions of the fly wheel, the operation being of the following sequence during four consecutive strokes: The first out-stroke draws in the compound charge of gas and air—compression takes place on the return stroke and it is then or just over the centre that ignition and explosion takes place—expansion now takes place the third stroke, and on the next return stroke the gases are expelled or exhausted. One of the most interesting features of this engine is its sparking arrangement, which consists of a coil of wire moving radially between the poles of a powerful steel magnet, the current set up being intensified in its passage through the coil and to the explosion chamber. It strikes one as being ingenious and withal simple, while its regularity and efficiency is undoubted. The cylinder is, of course, water jacketed, to take away some of the heat generated by the explosion, and both on the air intake and exhaust side silencers are fitted.

This engine was put down at the Crown Reef entirely with a view to making tests with the various South African coals and to see how near we could approach the very excellent and economical results attained by the gas producer plants installed in the United Kingdom, in America and on the Continent. The consumption there with best Welsh coal being as low as ·82 lb. per i.h.p. per hour for an 80 h.p. plant, it goes without question that it merits the attention of engineers on the Rand, who are indebted to Mr. Stark for his enterprise in giving them this practical object lesson on these fields.

The engine has been at work for one month, during which time careful, exhaustive and accurate tests have been made with various coals, both Natal and Transvaal, the engine being loaded by means of the ordinary Prony brake, the coal being carefully weighed, gas measured, indicator diagrams being taken every ten minutes and temperatures at regular intervals. These tests have come out beyond all expectations, and though we have not yet the tabulated data of tests available, we can say with certainty that the best test, *i.e.*, with Dundee coal (a semi anthracite) the consumption works out at the rate of ·926 lb of coal per i.h.p. per hour and 1·283 lb. per b.h.p. The b.h.p. averaged 25, the the i.h.p. 30, giving $\frac{\text{b.h.p.}}{\text{i.h.p.}} = \cdot 83 =$ mechanical efficiency. Using best English anthracite coal, the tests on these engines go to show that the consumption is greater for a small plant than a larger. For anthracite coal of different calorific values the rule is that the consumption is inversely proportional to the calorific value of the coal. The producers are made of such a size that you can run without charging for four or five hours, but this is not to be recommended, a better plan being to keep the producer practically full, which can be done by putting in a small charge every hour.

It is a well-known fact that anthracite coals are the best for gas engines, since the tar and other by-products contained by bituminous coal is, in the absence of efficient filters, likely to clog the valves and pistons of the engine, necessitating stoppages to clean them. This has, I believe, in a great measure already been overcome by the makers of this engine, who have quite recently patented a filtering device, which meets this drawback and is expected to be on the market shortly. For running a plant on the Rand without stoppages it would be wise to have two producers, so that one could be cleaned while the other is in work. The scrubber too might be increased in area with great advantage, and, last but not least, to make doubly sure of no stoppages when tar separator or filter requires cleansing, a duplicate set of pipes to the engine would overcome this difficulty.

The members then journeyed by tram to the mill and cyanide works, where the improvements in slimes treatment were exhibited and described by Mr. Torrente.*

The residue dump treatment plant was the next object of interest, the party being shown the various stages of treatment from the dump to the extractor house, where Mr. Stark explained the methods adopted, as follows :—

The top of the dump is crossed by deep ditches about 20 ft. apart for the reception of the liquor.

* *Vide* paper by Mr. Torrente in the *Journal* for August, 1904, pp. 46-49.

When the top ditch is filled the solution runs through an overflow launder to the one lower and so on to the lowest part of the dump.

The ditches which catch the solution after it has percolated through the dump are from 6 to 10 ft. deep and are in solid rock; the greater part of the solution comes off on the surface but a not inconsiderable portion filters through the soil and reaches the ditches through cracks in the rock. On the east side where the slimes dams prevent surface ditches, a tunnel is being driven to catch the solution. The ditches lead to settling sumps, where the sand and slime in suspension are removed. From these sumps the solution is run through precipitating boxes filled with iron wire. The wire is obtained from old hauling-rope cut in 18 in. lengths and untwisted. From the back sump the liquors are again raised to the top of the dump through wooden pipes by a high-lift centrifugal pump.

The clean-up is made in steel-lined revolving barrels which have hollow axles to admit the wash waters. When the iron is cleansed the fine precipitate is pumped to a filter press.

The working of an ingenious water meter invented by Mr. Yabsley and Mr. Atkinson was then described by the latter, as under :—

Water Meter.

At the dumps plant a novel and ingenious water measuring apparatus was seen in operation; this was, the engineer tells us, the outcome of a suggestion by Mr. Yabsley, one of the engineering staff, and has since been perfected and provisionally protected in the names of Yabsley and Atkinson. It consists of a wooden box 50 in. by 30 in. by 23 in. deep. At the end where the water flows in from the launder are two breakwaters, so as to ensure an undisturbed head of water in the remaining part of the box. At the other end of the box is a thin metal or glass aperture, so designed as to cause the head of water in the box to vary exactly in the same proportion as the quantity of water flowing through the aperture.

A glass float is so arranged as to float on the surface of the water and work a pen or pencil, which, moving in suitable guides, records on a sheet of paper, which is mounted on a revolving cylinder worked by clockwork, the varying height of the water, and thus the varying flow. The paper is graduated in inches vertically and for hours lengthwise, 24 hours being one revolution. The height of paper equals $6\frac{3}{4}$ in., each inch registered being equal to ten tons per hour, which equals $10 \times 24 = 240$ tons per day per inch. The capacity of meter, therefore, is equal to $6\frac{3}{4} \times 240 = 1{,}620$ tons per day.

At any period of the day it is possible to tell the quantity of water passing at that time by noting the height of pencil on the chart and by taking the average height of the diagram with a planimeter and multiplying by the tons per inch the quantity of water that has gone through in the 24 hours is at once ascertained. The diagram perforce shows any stoppages and duration of same, the meter is also used for measuring the air pump delivery water, *i.e.*, condensed steam, thus showing the steam consumption of the engine. In the case of a hauling engine showing a proportional height of line to the depth hauled. We are given to understand that it is giving every satisfaction, and that the error is practically nil.

After visiting the boiler house, the party returned and were entertained at the General Manager's house to tea and other light refreshments by Mr. Stark.

Mr. W. Cullen (Vice-President) thanked Mr. Stark and his staff on behalf of the Society for their kindly reception of the members and their courtesy in showing them over the property and describing and explaining the methods adopted in the various departments of the works. Mr. Stark, having briefly acknowledged the thanks, the party left for town, after spending, despite the continuous rain, a most profitable and enjoyable afternoon.

Queries and Replies.

Queries and replies thereto on any point in connection with Chemistry, Metallurgy and Mining are invited from Members and Associates for publication under this heading in the Journal, subject to the sanction of the Editorial Committee.

They may be submitted unsigned, providing that the Secretary guarantees that the contributor is a Member or Associate.

A. No. 22.—The only method of definitely determining the composition of the "scum" in the zinc boxes referred to in this query would be by analysis. Occasionally zinc shavings, contaminated with lubricants during turning, allow the latter to float on the surface of the solution in the compartments. When material containing much floured mercury or amalgam is cyanided, there may be observed small irregular spongy black masses, floating upon the solution in which the zinc shavings are immersed. This material appears to be a zinc-gold-amalgam buoyed up by included hydrogen. On rolling into pellets and heating the colour of metallic gold is seen, and globules of metallic mercury appear also. In general, the composition of the zinc box precipitate is complex and variable under different conditions, containing not only all the concentrated undissolved impurities present in commercial zinc, but also metals in the working solutions precipitated by zinc, suspended matter filtered out of any turbid solutions entering the boxes, and also products of interaction between the zinc, water, and substances dissolved in working solutions. (W. A. C.)

Notices and Abstracts of Articles and Papers.

CHEMISTRY.

Analysis of Margules' Platinic Sulphate.—"Margules, by the action of alternating currents, dissolved platinum in strong sulphuric acid, and has since succeeded in crystallising the substance formed, which he assumed to be platinic sulphate. The author has analysed Margules' recrystallised substance, reducing the platinum by passing hydrogen through the solution, filtering, and determining the sulphuric acid in the filtrate. The results showed a considerable excess of sulphuric acid; but by two or three recrystallisations crystals were obtained agreeing closely in composition with the formula $Pt(SO_4)_2.4H_2O$. These Orange-yellow crystals readily lose water at the ordinary temperature *in vacuo* over sulphuric acid, darkening in colour, whilst the salt with excess of sulphuric acid loses but little even at 100° C. Both the hydrated and the anhydrous salts are very soluble in water; from the dark-coloured solution of the anhydrous salt sulphuric acid precipitates yellow crystals, probably of the hydrated salt."—L. Stuchlik. Ber., 1904, 37, 2914—2915.—*Journal of the Society of Chemical Industry*, Oct. 31, 1904. (J. A. W.)

Commercial Wet Lead Assay.—"The following methods are convenient for all lead determinations, but especially suitable for the assay of poor ores containing about 0·5 per cent. I. The ore is dissolved in nitric acid and evaporated with sulphuric acid, water added, the whole heated to dissolve soluble sulphates, the solution filtered, and the residue well washed. Filter and residue are now returned to the original flask, and digested with slightly acid ammonium acetate solution till all lead sulphate is dissolved. The liquid is diluted with water, and potassium chromate solution (9·396 gms. per litre) added in known quantity and slight excess. The solution is filtered and the residue washed free from chromate; the filtrate is acidified with 25 c.c. of hydrochloric acid (sp. gr. 1·1), a crystal of potassium iodide added, and the liberated iodine determined by titration with sodium thiosulphate solution (36 gms. of the pure crystallised salt to the litre, half strength, however, usually preferred) and starch. The liberated iodine affords a measure of the unused chromate, and hence of that used in precipitating the lead. The chromate solution and the stronger thiosulphate solution are equivalent per c.c. to 0·01 gm. of lead. The only substance which interferes with this process is antimony, which tends to prevent solution of the lead sulphate. If antimony be present, a slightly ammoniacal ammonium acetate solution is used for the digestion, and is acidified after solution is complete, before diluting and precipitating with chromate. With much lead the quantities of ammonium acetate solution and of water are not of moment, but with 1 per cent. or less the strong ammonium acetate solution should not exceed 10 c.c., nor should the bulk after dilution exceed 50 c.c. A large excess of chromate hastens the completion of precipitation of these small quantities, but makes the subsequent washing tedious and gives an objectionably large amount of chromate to titrate. Unless antimony be present, instead of back titration, hot dilute hydrochloric acid may be poured, first into the precipitation flask to dissolve any lead chromate contained in it, then through the filter (the funnel being placed in the neck of a clean flask) till all the lead chromate is dissolved; flask and filter are well washed with warm water, and the solution of lead chromate is titrated with iodide and thiosulphate. II. This method is especially adapted for heavy lime-ores, in the case of which the previous method would be found tedious, on account of the large bulks of calcium sulphate to be washed: To 1—5 gms. (according to richness) of the ore, in a 250 c.c. flask, add 3—5 c.c. of strong nitric acid and 15 c.c. of strong hydrochloric acid: heat till all is dissolved and the excess of acid has been reduced to about 8 c.c. Then add dilute ammonia till in slight excess, and afterwards excess of 80 per cent. acetic acid slowly, with vigorous shaking, and finally 5 c.c. of strong ammonium acetate solution. If antimony and gelatinous silica be absent, and the undissolved siliceous residue be slight, add excess of 10 per cent. potassium chromate solution to the hot undiluted liquid, shake, allow to settle for five minutes, filter, and wash free from soluble chromates. Place funnel in neck of original flask, dissolve lead chromate with hot hydrochloric acid, wash with water containing 0·5 per cent. of acetic acid and titrate the solution with iodide and thiosulphate solution, as before. By using not too much iodide (0·5—2·0 gms.), and having, say, 50 c.c. of 1·1 hydrochloric acid in 200 c.c. of warm liquid, there is hardly any tendency for lead iodide to separate and obscure the reaction. This "short-cut" method gives good results in presence of most other metals, but interference may be caused by barium, if present as carbonate, for barium chromate is insoluble; the addition of 1—2 c.c. of 10 per cent. ammonium sulphate remedies this. Interference also occurs with bismuth, antimony, and silver, and then the first method should be used. Either of these methods is much to be preferred, in the case of poor ores, to the molybdate method (this *Journal*, 1893, 376), which is so generally used, for the end reaction in the molybdate method is not sharp and may involve an error of 0·3—0·5 c.c. (=3—5 mgms. of lead), which, though permissible in a rich ore, may be as much as the total quantity of lead in a poor ore."—H. A. Guess, "Trans. Amer. Inst. Min. Eng., 1904.—*Journal of the Society of Chemical Industry*, Aug. 31, 1904. (A. W.)

Crucible Charge for Determination of Gold and Silver in Zinc Ores.—"As the result of a large number of experiments, the authors conclude that, in the determination of gold and silver in zinc ores by the crucible method, the amount of litharge used should be just sufficient to give a lead button large enough to collect the gold and silver, since lead oxide in the slag seems to interfere with the complete decomposition of the ore and prevents the formation of a slag which is free from lumps and which can be readily poured. The amount of sodium carbonate should be from four to five times that of the ore. Borax glass should be added in amount sufficient to prevent the charge from being entirely basic and to assist in fluxing the gangue minerals not acted on by sodium carbonate alone. If necessary, an amount of argol sufficient to reduce the whole of the litharge should be added, whilst if the ore contain more than

15 per cent. of pyrites the addition of a couple of [iron] nails will prevent the formation of a brittle button. The following charge was found to be the most suitable one for a 20 gm. crucible, the quantities being given in A.T. (assay tons): Ore, $\frac{1}{3}$; sodium carbonate, $1\frac{1}{3}$; borax glass, $\frac{1}{2}$; litharge, $\frac{4}{5}$. The most suitable temperature is 750°—775° C., and the time required for the fusion is 30—35 minutes. The method gives good results with ores containing up to 7·5 per cent. of copper."—E. J. HALL and E. POPPER, *School of Mines Quarterly*, 1904, 25, 355—358.—*Journal of the Society of Chemical Industry*, Oct. 15, 1904. (J. A. W.)

METALLURGY.

THEORETICAL EXTRACTIONS AND ACTUAL RECOVERIES.—"As regards occasional saving of more than the assay values, it is no new thing for more gold to be recovered in smelting than was assigned to the ore in the laboratory. It has been attributed to three causes: (1) To the fact that minute proportions of gold are described in the assay as "traces," while in the smelting furnace, when treating large quantities, they accumulate to an appreciable extent; (2) to minute losses of gold in the assay process being proportionately greater than the loss in smelting; (3) to infinitesimal quantities of gold introduced with the fluxes. The American-Mexican Mining and Development Co., Chicago, with mines also in Durango, is also a customer of the Furnace Co., but has not started work yet with these furnaces. It would appear as if the sale of the furnaces is in non-metallurgical hands. Where the ore is fitted for them, they may possibly give satisfaction. The success of the Lustre Co. is evidently due to the suitability of its ores to the pyritic process generally, and similar ores in Tasmania could also be treated successfully without resorting to the particular furnace in question."—Extract from *The Australian Mining Standard*, Oct. 6, 1904, p. 507. (W. A. C.).

MISCELLANEOUS.

STANDARDISATION OF METHODS FOR THE BACTERIOSCOPIC EXAMINATION OF WATER.—The committee recommend that there should be undertaken in all cases:—*(a)* Enumeration of the bacteria present on a medium incubated at room temperature (18°—22° C.). *(b)* Search for *B. coli* and identification and enumeration of this organism if present. The majority of the committee recommend in addition:—*(c)* Enumeration of the bacteria present on a medium incubated at blood heat (36°—38° C.). *(d)* Search for and enumeration of streptococci. In special cases it may also be advisable to search for *B enteritidis sporogenes*. *Collection of the Sample.*—The sample should be collected in the usual manner in sterile stoppered bottles having a minimal capacity of 66 c.c. If not examined within three hours of the time of collection, the bottles must be packed in ice.

Media to be Employed for Enumeration.—For enumeration at room temperature, distilled water gelatin, nutrient gelatin, distilled water agar, gelatin agar, or nutrient agar may be employed, but for enumeration at blood-heat an agar or gelatin agar must be used. When gelatin only is employed, this should be nutrient gelatin, but the use of distilled water gelatin also is to be preferred.

Preparation and Reaction of Media for Enumeration.—*(a) Distilled Water Gelatin.*—A 10 per cent. solution of gelatin in distilled water, brought to a reaction of + 10 (Eyre's scale). *(b) Nutrient Gelatin.*—A 10 per cent. solution of gelatin, containing meat (beef) infusion and Witte's peptone and brought to a reaction of + 10. *(c)* For enumeration at blood heat, the use of nutrient agar is recommended; it is prepared in the same manner as nutrient gelatin, except that 1·5 per cent. of powdered agar is substituted for the gelatin. *(d) Distilled Water Agar.*—A 1·5 per cent. solution of agar in distilled water, brought to a reaction of + 10.

Amounts to be Plated, Size of Dishes, &c., Gelatin.—For an ordinary water, amounts of 0·2, 0·3, and 0·5 c.c. may be "plated" in Petri dishes of not less than 10 cm. diameter. It is recommended to make duplicates in all cases. *Agar.*—Two plates may be made with 0·1 and 1·0 c.c. of the water respectively. The amount of the medium in a plate should be 10 c.c.

Counting.—Counting should be done with the naked eye, preferably in daylight, any doubtful colony being determined with the aid of a lens or low-power objective. Gelatin cultures should be counted at the end of 72 hours, or earlier if necessary on account of liquefaction; agar cultures incubated at blood-heat should be counted after 40—48 hours.

Search for Bacillus Coli.—Either the Glucose formate broth method of Pakes or the bile salt broth method of McConkey is recommended, with anaerobic incubation at 42° C. Fifty c.c. should be the minimal quantity of water examined for the presence of *B. coli*, separate quantities from a minimum of 0·1 c.c. to a maximum of 25 c.c. being added directly to the tubes of culture media, without previous filtration through a porcelain filter. If indications of the presence of *B. coli* be obtained, the organism must be isolated by making surface cultures on litmus lactose agar of reaction + 10, bile salt agar, nutrient gelatin, or Conradi and Drigalski's nutrose agar, preferably the last-named; and then identified by making sub-cultures on surface agar at 37° C., in gelatin (stab and surface cultures), in litmus milk incubated at 37° C., in glucose litmus medium, in lactose litmus medium, and in peptone water (for indole reaction). The typical *B. Colis* must conform to the following description and tests. It is a small, motile, non-sporing bacillus, growing at 37° C. as well as at room temperature. The motility is well observed in a young culture in a fluid glucose medium. It is decolorised by Gram's method of staining. It never liquefies gelatin; the gelatin cultures should be kept for at least 10 days in order to exclude liquefying bacilli. It forms smooth, thin surface growth and colonies on gelatin, not corrugated, and growing well to the bottom of the stab (facultative anaerobe). It produces permanent acidity in milk, which latter is curdled within seven days at 37° C. It ferments glucose and lactose, with the production both of acid and gas.

Streptococci.—It is advantageous to search for streptococci by making hanging-drop preparations of the fluid media employed for the preliminary cultivation of *B. coli*. Any streptococci detected should be isolated on nutrose agar plates and their characters determined."—Report of the Committee appointed at the Congress of the Royal Inst. of Public Health, July, 1903. J. of State Medicine, Aug., 1904. Chem. News, 1904, 90, 177—179.—*Journal of the Society of Chemical Industry*, Oct. 31, 1904. (J. A. W.)

New Books.

AUSTRALIAN MINING AND METALLURGY. By DONALD CLARK. (Melbourne, Sydney and Perth, Australia: Critchley Parker.) Pp. 534; illustrated. Price 21s.

"This volume is a reprint of a number of technical articles contributed by Mr. Donald Clark to the leading mining paper of Australia. Mr. Clark is principal of the School of Mines at Bairnsdale, Victoria, and is known in this country through his contributions to *The Engineering and Mining Journal*. This volume of his writings will be appreciated by those who are interested in Antipodean methods, especially the metallurgical, in which a large number of interesting modifications are to be noted. Broken Hill has been the fruitful source of many efforts to treat complex zinc-lead ores, Kalgoorlie has been a pioneer in milling refractory gold ore by cyanidation with particular regard to re-grinding, Mt. Morgan has had a practice of its own, Mt. Lyell has developed pyrite smelting, and other well-known Australian mining centres have contributed their share to the solution of the problems which face professional men on both sides of the equator.

Apart from a description and elucidation of these metallurgical departures, Mr. Clark gives data covering various systems of mining statistics, historic notes and a large measure of information, much of which will be found valuable by any man who wants to know what the other half of the world is doing. From Mr. Clark's contributions to our own pages, we know that he is careful in his statement of facts and trustworthy in the inferences from them; his writing is easy to follow, without pretence, but clear. We congratulate our contemporary, *The Australian Mining Standard*, on the publication of a volume of such general usefulness."—*Engineering and Mining Journal*, Nov. 10, 1904, p. 756. (W. A. C.)

THE CHEMISTRY OF CYANIDE SOLUTIONS RESULTING FROM THE TREATMENT OF ORES. By J. E. CLENNELL, B.Sc. (Lond.). (Published by *The Engineering and Mining Journal*, New York and London, 1904.) Pp. iv. and 164. 10s. 6d.

The purpose of this book is to present to those directly interested a complete review of the methods in use, as far as possible, for the determination of those substances present in working cyanide solutions under various conditions. The author enumerates in the introduction the following, which he places in numbered classes: (1) Active cyanogen compounds, (2) alkaline constituents, (3) reducing agents, (4) auxiliary agents, (5) inactive bodies, (6) noble metals (7) base metals, (8) suspended matter. Under these headings analytical methods are then considered in detail, and in many cases the actual figures with a critical discussion of a method are given, showing the limits of error. From even a casual survey of its pages, the reader will soon observe that this *Journal* has been, amongst many others, drawn upon. Many of the methods given are those which have from time to time appeared in the pages of our *Journal*, and which are here collated and placed in order in their respective classes. To the chemist engaged in cyanide practice this book ought to prove invaluable, and many a worker will doubtless owe Mr. Clennell a debt of gratitude for his labours in producing such a handy compilation, and none the less because of the author's own share in perfecting and originating many of the methods described. The fact that the author is not unknown to the Rand, having worked here for several years and also originated some methods of analysis still in use on our mines, ought to make its welcome even more assured to those at present engaged on our own cyanide plants. (J. A. W.)

Selected Transvaal Patent Applications.

RELATING TO CHEMISTRY, METALLURGY AND MINING.

Compiled by C. H. M. KISCH, F.M.Chart.Inst.P.A. (London), Johannesburg (Member).

(N.B.—In this list (P) *means provisional specification, and* (C) *complete specification. The number given is that of the specification, the name that of the applicant, and the date that of filing.)*

(P.) 481/04. Frederick Wilhelm Dupre. An improved process for dissolving gold. 2.12.04.

(C.) 482/04. Gilbert John Glossop (1), James Wing (2). Improvements in apparatus for making, mending and sharpening rock-drills. 2.12.04.

(P.) 483/04. Edwin George Weldon. Improvements relating to winding or hauling apparatus for mines and the like. 3.12.04.

(P.) 484/04. John Sumner. Improvements in means for distributing liquid sewage upon filter beds and for analogous purposes. 3.12.04.

(P.) 487/04. William Herbert Loman. Improvements in apparatus for the separation of liquids from solids, more especially intended for use in the treatment of metalliferous ores. 6.12.04.

(P.) 488/04. Thomas Jeaster Morgan. A rotary sampler. 7.12.04.

(P.) 489/04. Frederic Anderson. Improvements in means for fixing tappets to stamp-stems, applicable also to analogous purposes. 7.12.04.

(C.) 490/04. William Maple Bradshaw. Improvements in bearings for shafts. 9.12.04.

(C.) 491/04. Frank Conrad (1), William Maple Bradshaw (2). Improvements in alternate current wattmeters. 9.12.04.

(C.) 492/04. David Mills. Improvements in air pumps. 9.12.04.

(P.) 493/04. Walter Edward Kimber. Improvements in cutters or cutting devices for use in the sharpening of rock-drill bits. 10.12.04.

(C.) 495/04. Hans Ritter von Dalmen. A new or improved process for the manufacture of explosives of the nitrate of ammonia group. 10.12.04.

(P.) 496/04. Raoul Pierre Pictet. Improvements in an apparatus for the separation of nitrogen and oxygen from atmospheric air. 10.12.04.

(P.) 500/04. George Lester Whitcombe. Improved apparatus for separating substances of different specific gravity held in suspension by a liquid particularly designed for concentrating auriferous alluvial matter. 15.12.04.