

## A comparison between hydraulic and pneumatic rockdrills

by D. CLEMENT

The regulation of compressed-air reticulation systems is very poor compared with that of electrical systems; this means that electro-hydraulic rockdrill systems offer greater flexibility, additional power being readily available at the working face. At present, with pneumatic rockdrills, the production in gold mines cannot be increased without large-scale capital expenditure on compressors and reticulation systems. However, with an electro-hydraulic system, additional rockdrills could be installed in stopes as required by merely plugging in extra hydraulic rockdrills and power packs to the electrical supply.

During 1975, face conveyors will become available for use in gold mines. With machines of this type it will be possible for face cleaning after a blast to be done in well under an hour. If the drilling time is improved, a daily face advance would be obtained. Drilling times can be improved by the use of hydraulic rockdrills with higher penetration rates, or the number of rockdrills used on a face can be increased.

Hydraulic rockdrills can be made more compact than pneumatic machines of equivalent power, thus affording considerable advantage in the operation of rig-mounted rockdrills where higher-powered machines can be used. However, there are some twenty-thousand

hand-held rockdrills in use in the gold mines. Significant savings in face drilling times with hand-held rockdrills can be made by increasing the penetration rates of hydraulic rockdrills (this is limited by the power that an operator can control), by increasing the mobility of the operator with light-weight hydraulic machines, or by increasing the number of machines. Drilling in crushed rock, pneumatic rockdrills invariably stall owing to a lack of torque. Hydraulic rockdrills, however, can have positive rotation, and the torque will be limited only by the capability of the operator.

The overall energy efficiency of the compressed air used in gold mines is about 5 per cent. Air compressors use about 200 million kWh a month, and account for nearly half the cost of electric power, or some R24 million a year. If the overall efficiency of an electro-hydraulic rockdrill system was 30 per cent, the same energy used by rockdrills in stopes would cost only R4 million.

Leakage in compressed-air systems results only in a power loss, whereas loss of fluid in conventional high-pressure hydraulic systems entails also a direct financial loss due to the cost of the fluid. However, the use of low-cost hydraulic fluids such as emulsions of 5 per cent oil and 95 per cent water removes this disadvantage. Manufacturers of hydraulic rockdrills should give this aspect attention at the early development stage.

If the pneumatic rockdrills in a stope were replaced by comparable hydraulic rockdrills, an additional heat load of up to 10 kW would be present in the stope. The cooling effect of the pneumatic machine, which at best is 5 kW, would also be lost, and consequently the hydraulic rockdrill system would require an additional 15 kW of cooling per rockdrill. However, the heat pickup from the face is some 1.5 kW per metre of face. For a 40 m face using three rockdrills, this gives a heat pickup of 1440 kWh per 24-hour day, while the rockdrills would only be operating for, say, 4 hours per day, giving an additional heat load of 180 kWh per 24-hour day. This means that stope cooling would have to be increased only by 12.5 per cent.

Certainly, the maintenance of hydraulic rockdrills is more complex than that of pneumatic machines, and repairs to hydraulic equipment should not be done underground. But, for any mechanized mining machinery, this problem can be overcome by the design of a machine as a number of plug-in type modules. Then, repairs can be done by unskilled machine operators, who can remove defective parts and plug in factory-reconditioned units, with very little machine downtime. This system is already operating in rock-cutting machines, where at present 90 per cent of the underground maintenance and repair work is being done by unskilled Blacks.

## Hydrometallurgy

A new journal devoted to all aspects of the aqueous processing of metals is scheduled to appear this year. Entitled *Hydrometallurgy*, the journal will be published in quarterly issues, one volume per year.

*Hydrometallurgy* aims to bring together studies on novel processes, process design, process chemistry and mineralogy, equipment design, modelling, control economics, and

interfaces between unit operations, and to provide a forum for discussions on case histories and operational difficulties. It is hoped that it will also facilitate rapid publication of results between major international gatherings and provide a medium for the publication of interdisciplinary papers on hydrometallurgy or papers not suitable for the chemical literature.

The editors are Dr N. M. Rice, Department of Mining and Mineral Sciences, The University of Leeds, Leeds LS2 9JT, England, and Mr G. M. Ritcey, Extraction Metallurgy Division, the Mines Branch, Department of Energy, Mines and Resources, 300 Le Breton Street, Ottawa K1A 0G1, Canada.

## Mineral dressing

Contributions are invited for the Symposium on Recent Progress in Mineral Dressing in South Africa, which is to be arranged jointly by the South African Institute of Mining and Metallurgy and the National Institute for Metallurgy. The Symposium will be held in Kelvin House, Johannesburg, on 17th and 18th September, 1975.

There will be no formal papers, and the Symposium will consist of short contributions (approximately 10 minutes each) on five general topics. These contributions should be about recent advances that are considered worth reporting but on which there is not sufficient information to warrant the presentation of formal papers. They can be informal and will serve the purpose of bringing the audience up to date on the state of the art.

A number of contributions have been specially commissioned, but the organisers are hoping to receive 10 or 12 contributions for each topic. The main topics of the symposium will be

- Sorting
- Comminution and classification
- Concentration
- Flotation
- Automation and Modelling.

People wishing to make contributions are asked to submit titles and short descriptions of the subject matter before the end of March, 1975. As the organizers wish to distribute preprints before the symposium, contributors should submit their written contributions (approximately 1200 to 1500 words) by the 1st of August, 1975, at the latest.

All titles, descriptions, and contributions, in either English or Afrikaans, should be sent to Mr L. F. Haughton, National Institute for Metallurgy, Private Bag 7, Auckland Park 2006.

## Mineraalbereiding

Bydraes word verlang tot die Simposium oor Onlangse Vordering met Mineraalbereiding in Suid-Afrika wat gesamentlik deur die Suid-Afrikaanse Instituut vir Mynbou en Metallurgie en die Nasionale Instituut vir Metallurgie gereël gaan word. Die simposium sal op 17 en 18 September 1975 in Kelvingebou, Johannesburg, gehou word.

Daar sal geen formele verhandelings wees nie en die simposium sal uit kort bydraes (ongeveer 10 minute elk) oor vyf algemene onderwerpe bestaan. Hierdie bydraes moet handel oor die jongste ontwikkelings wat as noemenswaardig beskou word, maar waaroor daar nog nie voldoende inligting beskikbaar is om die aanbieding van formele verhandelings te regverdig nie. Hulle kan informeel wees en sal dien om die gehoor op die hoogte te stel van die stand van die kuns van mineraalbereiding.

Daar is reeds spesiaal opdrag gegee vir 'n aantal bydraes, maar die organiseerders hoop om 10 of 12 bydraes oor elke onderwerp te kry. Die hoofonderwerpe van die simposium sal wees

- Sortering
- Verpoeiëring en klassifikasie
- Konsentrasie
- Flottasie
- Automatisering en modellering.

Sal diegene wat bydraes wil lewer, asseblief die titels en kort beskrywings van die onderwerp voor die einde van Maart 1975 indien. Aangesien die organiseerders gedrukte eksemplare voor die simposium wil versprei, moet persone hul geskrewe bydraes (ongeveer 1200 tot 1500 woorde) nie later nie as 1 Augustus 1975 instuur.

Alle titels, beskrywings en bydraes, in Engels of Afrikaans, moet gerig word aan Mnr. L. F. Haughton, Nasionale Instituut vir Metallurgie, Privaatsak 7, Auckland Park 2006.

## Rock mechanics

The Sixteenth Symposium on Rock Mechanics is to be held at the University of Minnesota from 22nd to 24th September, 1975. The Symposium is the official Symposium for 1975 of the International Society for Rock Mechanics (I.S.R.M.), and the Council for I.S.R.M., consisting of members from 25 countries, will meet during the Symposium.

The theme of the meeting is Design Methods in Rock Mechanics, and it is intended to review current design methods and approaches to rock engineering in problems such as rock foundations, rock slopes, mine layouts, ground movement and subsidence, support of tunnels and large excavations, and blasting rounds — surface and underground. The Symposium will be preceded by two workshops: one on design methods in rock mechanics, and the other on practical aspects of ground strengthening.

Further details are obtainable from Professor C. Fairhurst, 16th Symposium on Rock Mechanics, Dept of Civil and Mineral Engineering, University of Minnesota, Minneapolis Minn. 55455, U.S.A.

## Powder metallurgy

The annual meeting on powder metallurgy organized by The Metals Society is this year to be held at the Stratford Hilton Hotel, Stratford-upon-Avon (the notification did not include the date of the meeting). The meeting is to have two distinctly separate themes:

- Examination and testing of raw materials and products

- Handling of metal powders.

Enquiries should be directed to the Meetings Manager, The Metals Society, 1 Carlton House Terrace, London SW1Y 5DB.

# Vacation School

The South African Institute of Mining and Metallurgy has great pleasure in announcing its intention of holding a vacation school on the topic of electric-furnace melting. This Vacation School is intended to be of interest to metallurgical engineers, electrical engineers, and control engineers employed in industry, and in research and development organizations. It is the intention to conduct this Vacation School on a high technical level, and to supply notes on each of the topics covered by the programme, with references to the relevant technical literature, to encourage an enhanced understanding of the topic.

The programme will cover four days at the University of the Witwatersrand, and will include a visit to the Vanderbijlpark Works of Iscor to see the 150-tonne electric-arc furnace coupled with vacuum degassing, and to Dunswart Iron and Steel Works to see the sponge-iron plant and the melting of sponge iron in electric-arc furnaces.

The Institute has been particularly fortunate in obtaining the services

of the following two main speakers: Mr R. Langman, Electricity Council Research Centre, U.K., and Mr R. Reddy, Union Carbide Corporation, U.S.A. In addition, lectures will be presented by the following: Brodfuhrer, Mr A., Elektrode Maatskappy van Suid-Afrika, Electrode manufacture and application; De Waal, Mr F., South African Iron and Steel Industrial Corporation Limited, Electric arc furnaces coupled with vacuum degassing; Enslin, Professor N., Department of Electrical Engineering, University of Cape Town, Fundamental electrical aspects of electric-furnace melting; Hayhurst, Dr A., Vereeniging Refractories Ltd, Electric arc-furnace refractories; Howat, Professor D., Department of Metallurgy, University of the Witwatersrand, Fundamental metallurgical aspects of electric-furnace melting; Lay, Mr M. J., Electricity Supply Commission, Effect of electric melting furnaces in power-distribution systems with particular reference to Escom.

The intention of these Vacation Schools is to give engineers in industry and research and develop-

ment the opportunity of participating in short, intensive technical programmes, to encourage technical interaction between engineers engaged in similar spheres, to supply a refresher course with particular emphasis on trends and new developments, and to encourage continued familiarity with the relevant current technical literature.

The registration fee for attendance at this Vacation School will be R200 per person, which covers all costs including lunches, visits to plants, and social activities. The Men's Halls of Residence at the University of the Witwatersrand have kindly agreed to provide accommodation at R6 for dinner, bed, and breakfast for participants who require lodgings.

The Institute should be informed as soon as possible, but not later than 30th April, of the names of people who would like to attend this Vacation School. Not only will this facilitate arrangements but, as will be appreciated, the numbers have to be restricted so that those who attend can obtain the maximum benefit.

## NIM reports

The following reports are available free of charge from the National Institute for Metallurgy, Private Bag 7, Auckland Park 2006.

### Report no. 1681

*The determination of sulphur and phosphorus in chromite.*

The procedure for the determination of phosphorus is based on the British Standards Institution (B.S.I.) method for phosphorus in ferrochromium, with modifications, based on the work of Elwell and Wilson, to deal with the chromium occluded in the hydroxide ( $R_2O_3$ ) separation.

Several procedures are examined for the determination of sulphur. The procedure finally adopted in-

volves leaching of the fused sample, reduction of the sulphate with a mixture of hydriodic and hypophosphorous acids, and collection of the hydrogen sulphide in a zinc acetate solution. After addition of p-phenylenediamine, the sulphide is determined spectrophotometrically.

### Report no. 1687

*The viscosities and electrical conductivities of slags associated with the production of high-carbon ferromanganese alloys.*

Viscosities and electrical conductivities in the five-component system  $SiO_2 - Al_2O_3 - CaO - MgO - MnO$  were measured at an  $Al_2O_3$  content of 10 mole per cent for

compositions similar to those of slags associated with the production of high-carbon ferromanganese alloys.

The  $SiO_2$  content has a major effect on the magnitude of viscosity and electrical conductivity.  $MnO$  has the greatest effect of the basic oxides involved in the decrease of viscosity and the increase of electrical conductivity.  $MgO$  exerts a variable but less significant influence on both these properties.

The results are presented as pseudo-ternary sections at  $1500^\circ C$  and permit prediction of the effect of changes in composition on the viscosities and electrical conductivities of the slags.