



Fig. 6—Output of underground Bantu employees—Mine No. 3

ripe for a final breakaway from these traditional practices.

As an example of the great potential of job combination in stoping, a recent feasibility study in the Klerksdorp area concerned the allocation of a short stope panel, with its own drilling and cleaning facilities, to each group of five Bantu workers. The group, working on delay-free routines, could readily drill, clean, support, and sweep the panel daily, giving an output of 25 tons per shift, a performance greatly superior to current stoping results.

This type of technical advance calls both for more extensive training and for considerably increased earnings, not neglecting the very important incentive part of the pay packet.

### CONCLUSION

The present productivity campaign in the mining industry, on which all the mining groups are engaged, comes at a time when Bantu earnings are increasing at an unprecedented rate and overall pro-

ductivity in gold mining is decreasing.

There are encouraging signs, however, that every avenue for advance is being vigorously explored. It is the purpose of this paper to suggest that not the least fruitful of these will be the improvement in the quality, the amount, and the extent of incentive payments to Bantu miners.

### REFERENCES

1. BLACK, R. A. L. A review of progress in mechanisation in the mining industry of Southern Africa during the last decade. *J. S. Afr. Inst. Min. Metall.*, vol. 58, Mar. 1958, pp. 345-361.
2. MCGREGOR, H. H. Manpower utilisation in South Africa with special reference to the mining industry. *Ibid.*, vol. 70, Jun. 1970, pp. 347-356.

### Contribution to above paper by A. A. Hazell\*

It is particularly relevant at the present time to present a paper on the value of incentive payments. There is little doubt that we are in

\* Consulting Engineer, Johannesburg Consolidated Investment Co. Ltd.

an era of rapidly escalating wages, and is therefore important that management should strive to attain increasing productivity. The author advances many arguments to show that incentive payments can result in greater productivity. Furthermore, of course, they provide a protection to management in so far as payment is made only if productivity is improved, and the scheme can be designed to ensure that management gets its share of the improvement.

Bonus and incentive schemes are effective only within the framework of good management, and the important requirements are the following:

- (a) well-trained personnel,
- (b) correct production planning,
- (c) correctly set complements,
- (d) unassailable performance measurements,
- (e) unassailable performance standards,
- (f) a simple relationship between production and reward so that a good estimate of reward can be made by the worker even on a daily basis,
- (g) a management team committed to improving productivity,
- (h) a substantial reward directly proportional to production, and
- (i) the possibility of personal promotion.

Whether individual or team incentives are used depends on the organization. If the individual can get results that depend primarily on his own contribution, (e.g., a stopper, developer, or gang leader, who must co-ordinate, organize, and direct the efforts of his gang), then the payment should be to the individual and the scheme should be designed as such. However, as far as the stope or development Bantu gang is concerned, a team bonus is desirable since the results obtained are entirely dependent on the completion of work by other gang members. If the gang is to optimize output, it must look to the plan designed by the miner and shift boss. The optimum can be obtained only by working to a plan, and the individual must pitch his output to achieve the plan, i.e., average or standard performances are required, not outstanding performances. From this it

tractor's job and can be used to determine the target for any work situation. As such, it can be used to determine the contract.

The use of incentive schemes within a strong management organization can result in large increases in productivity, and the results

achieved can be used as a basis to determine the point at which different methods or further mechanization should be introduced.

can be concluded that individual bonus is undesirable in such a situation.

The use of work study to define

the required work performance is the basis of a good bonus scheme. Furthermore, it is the basis of sound training and ensures that a trained Bantu gang member can effectively contribute and earn reward from his first day in the gang. Work study equally well applies to the con-

## **SOUTH AFRICAN NATIONAL COMMITTEE ON TUNNELLING**

In 1970, the South African Institution of Civil Engineers, the South African Institute of Mining and Metallurgy, the South African Institute of Mechanical Engineers, and the Geological Society of South Africa held an international conference on tunnelling, known as Tuncon 1970.

Shortly before this, the Organisation for Economic Co-operation and Development (O.E.C.D.) had held an Advisory Conference on Tunnelling in Washington. Arising out of the O.E.C.D. conference, a decision was taken by twenty participating countries that each member country should establish a focal agency at the national level with the objectives of co-ordinating and assessing tunnelling activity, stimulating improvements in tunnelling technology, and participating in the activities of a proposed international tunnelling association.

Leading figures in the O.E.C.D. conference played an active part in Tuncon 70 and have continued to

keep the Republic of South Africa, although not a member country, informed of progress towards establishing such focal agencies.

In October 1971, South Africa was represented at a meeting held in London to discuss this progress and to consider forming an international association. It became clear that there was both the need and the opportunity for a similar focal agency to be set up in the Republic of South Africa with representation from the public and private sectors. The South African National Committee on Tunnelling (SANCOT) was accordingly established at the end of 1973 with the following membership:

S.A. Institution of Civil Engineers  
S.A. Institute of Mining and Metallurgy  
S.A. Institution of Mechanical Engineers  
Geological Society of S.A.  
S.A. National Group of I.S.R.M.  
S.A. Association of Consulting Engineers  
S.A. Federation of Civil Engineering Contractors  
CSIR  
Chamber of Mines of South Africa

Department of Water Affairs  
Department of Mines  
National Transport Commission  
S.A. Railways  
City Council of Johannesburg.

SANCOT has now embarked on the following activities.

- (i) The collection of demand data regarding the amount of tunnel construction planned for the future for both mining and civil-engineering uses, and the preparation of statistical demand forecasts.
- (ii) A review of existing legal requirements in tunnelling.
- (iii) A study of contracting practices.
- (iv) The identification of technical needs that might be met through research and development.

It is intended that the results of these studies will be disseminated through a series of publications.

SANCOT intends to ensure South Africa's participation in international tunnelling activities and will be represented by its chairman at the inaugural meeting of the proposed International Tunnelling Association in Oslo at the end of March 1974.

## **SUID-AFRIKAANSE NATIONALE TONNELBOUKOMITEE**

In 1970 het die Suid-Afrikaanse Instituut van Siviele Ingenieurs, die Suid-Afrikaanse Instituut vir Mynbou en Metallurgie, die Suid-Afrikaanse Instituut van Meganiese Ingenieurs en Die Geologiese Vereniging van Suid-Afrika 'n internasionale konferensie in verband met tunnelbou gehou, wat bekend

gestaan het as Tonkon 1970.

Kort tevore het die 'Organisation for Economic Co-operation and Development' (O.E.C.D.) 'n Adviserende Konferensie in verband met Tunnelbou in Washington gehou. Voortspruitend uit die konferensie van die O.E.C.D. is 'n besluit deur 20 deelnemende lande geneem dat elke lid-land 'n sentrale liggaam op nasionale vlak sal stig met die doelstellings om tunnelbou-aktiwi-

teite te ko-ordineer en 'n waarde-bepaling te doen, om verbeterings in die tunnelbou-tegnologie te stimuleer en deel te neem aan die aktiwiteite van 'n voorgestelde internasionale tunnelbouvereniging.

Leidende persoonlikhede by die O.E.C.D. konferensie het 'n aktiewe rol in Tonkon 70 gespeel en het steeds die Republiek van Suid-Afrika, hoewel nie 'n lid-land nie, op hoogte gehou in verband met