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Experimental longwall with caving at Monidih Colliery

Introduction

IN order to take advantage of the latest developments in the coal industry of Poland, India entered into collaboration with Poland in respect of design and construction of collieries. Apart from deriving other benefits, this was done to serve the dual purpose of meeting steeply increasing demand for coal and better conservation of the valuable fuel-energy in future. Monidih Project, with a targetted daily production of 7,000 tonnes will be among the biggest Indian coal mines.

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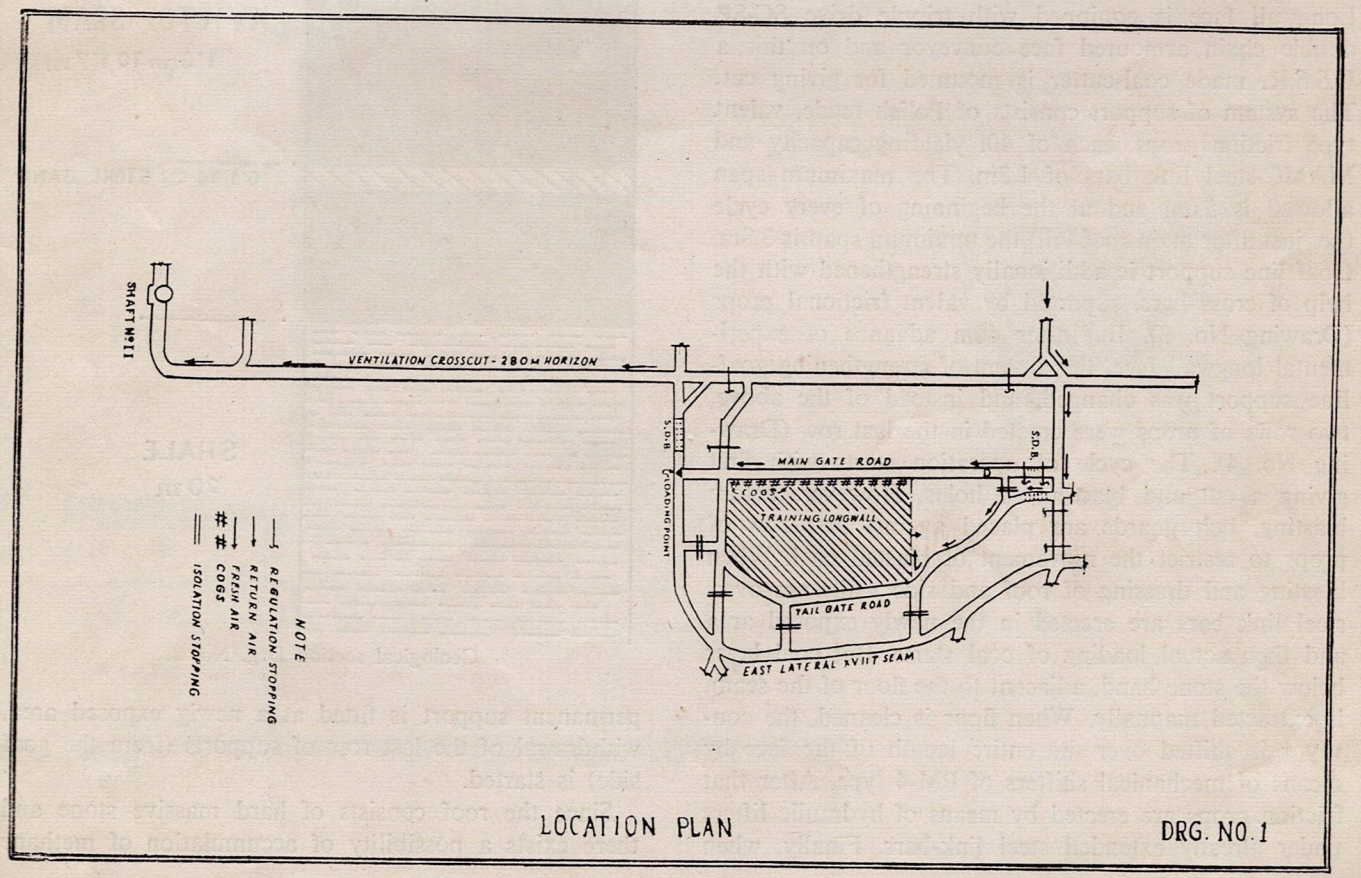
Since underground as well as surface conditions are more or less favourable, exploitation with caving was in general envisaged in designing this project. At present development works are in progress in a 280 metre-horizon for preparing a set of longwall faces for final extraction and in a 400 metre-horizon, preparation of access roads is in progress. Experimental longwall face of 50m length has been started in order to train the crew and supervisory staff properly. Further, as the main roof consists of massive sandstone and thus poses serious roof-breaking problems, it is important to enable the staff and workers gain sufficient experience in this vital aspect of mining before adopting optimal



LOCATION PLAN DRG. NO. 1

length of longwall faces. Thus, on the basis of various experiments carried out at the training longwall face, the aim is to find out particularly the most suitable system of face and gate road supports commensurate with the requirement of proper strata control of the property in and around this project.

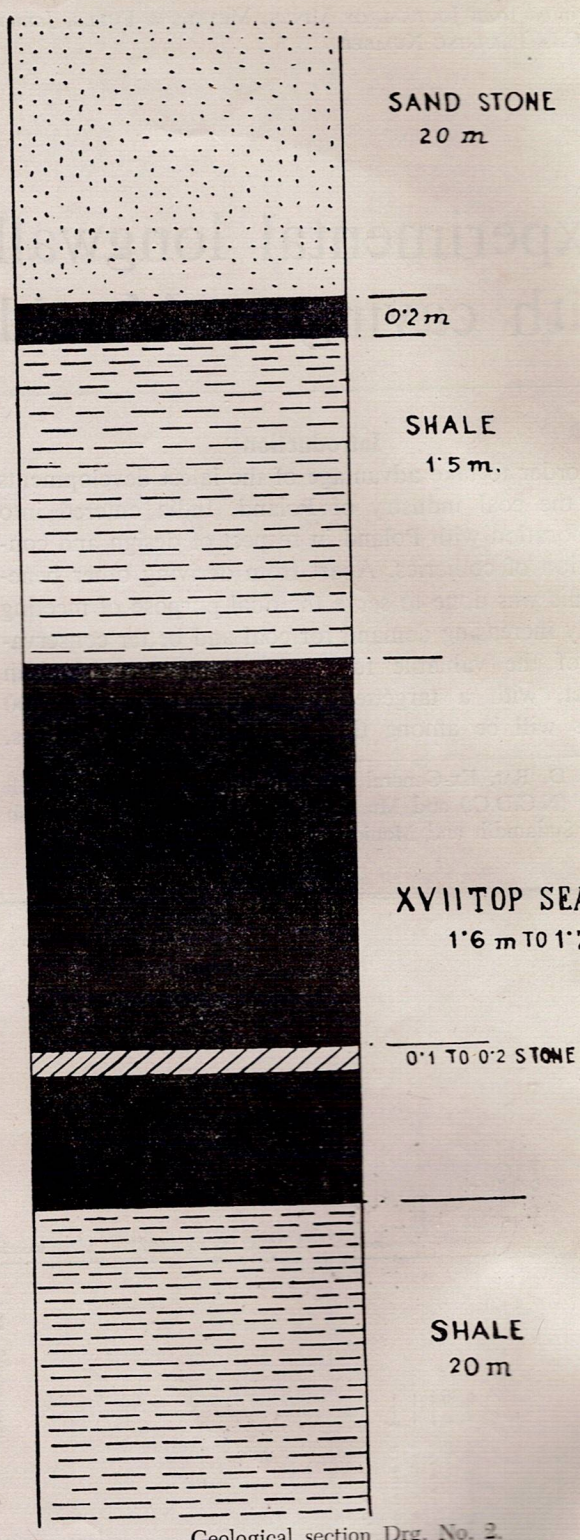
Location and geological conditions

Experimental longwall face, selected for studies, is located in the eastern part of XVII Top seam workings near ventilation shaft. The seam was opened by ventilation cross-cut and east lateral at 280 metre-horizon (drawing No. 1). The rate of gas emission is quite high and the mine falls under degree III. The seam thickness and gradient vary from 1.6m to 1.7m and 5 to 7 degrees respectively. In this part of the area, a stone-band of 10-20 cm thickness occurs at a height of approximately 0.4 metre from the floor of the coal seam. A shale band of 1.5m thickness forms the immediate roof which is followed by layers of massive sandstone. The floor comprises sandy-shales. The section of the seam is depicted in Drawing-2.

Longwall face is laid along strike and as indicated earlier, the system of exploitation is with full caving at a working depth of approximately 280m.

Equipment and systems of extraction

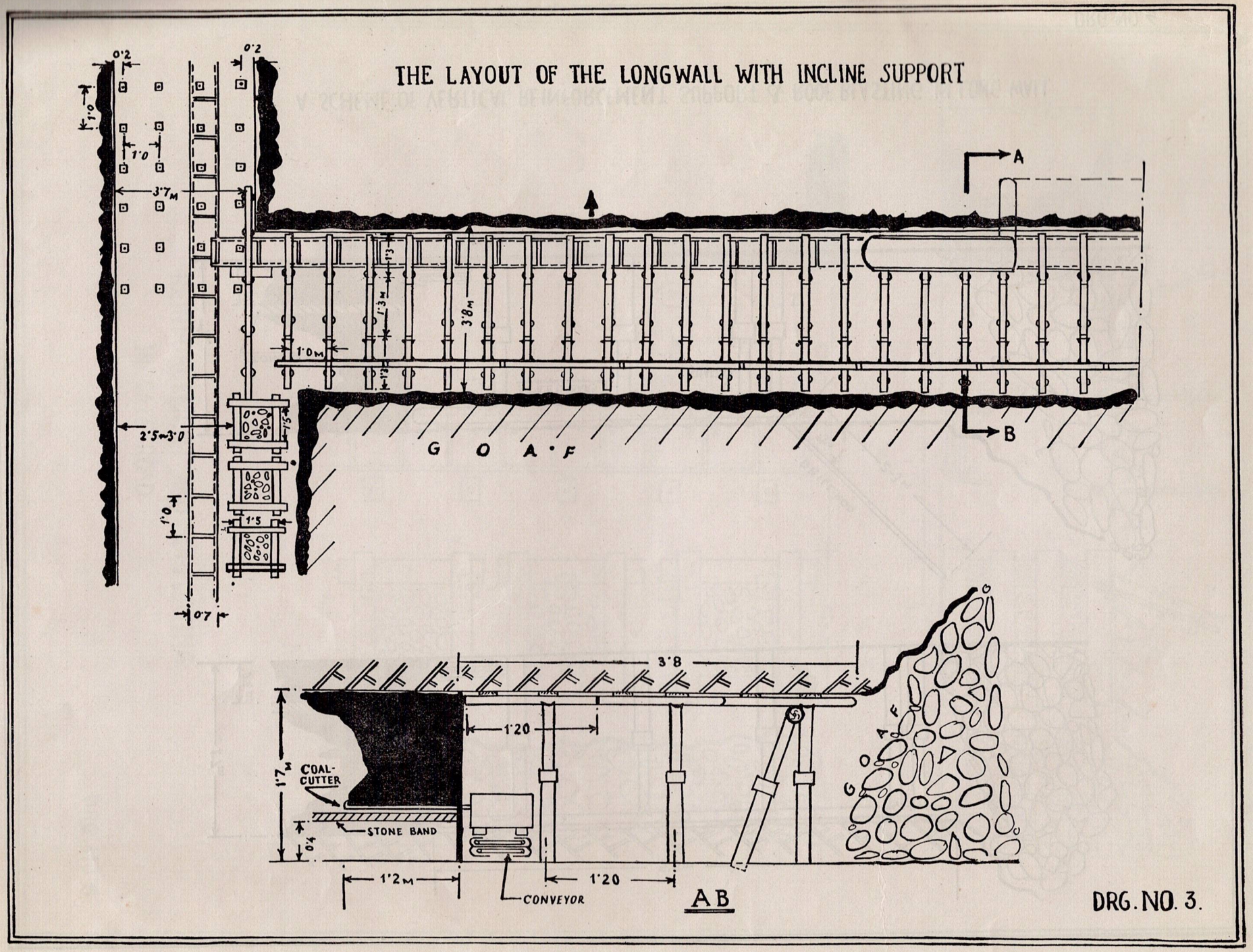
Longwall face is equipped with tripple drive SC-SP double chain armoured face conveyor and on this a U.S.S.R. made coal-cutter is mounted for giving cut. The system of support consists of Polish made, valent type friction props, each of 40t yielding capacity and MAMC-steel link bars of 1.2m. The maximum span allowed is 5.0m and at the beginning of every cycle (i.e. just after main roof fall) the minimum span is 3.8m. Goaf line support is additionally strengthened with the help of cross bars, suported by valent frictional props (Drawing No. 3). But after 60m advance of experimental longwall face, the system of strengthening goaf-line support was changed, and instead of the above, two rows of props were erected in the last row (Drawing No. 4). The cycle of operation starts with first giving a cut and blasting of holes. However, before blasting, belt guards are placed against first row of props to restrict the movement of blasted coal. When blasting and dressing of roof and side walls are over, steel link bars are erected in the newly exposed area and then actual loading of coal starts. But coal layer below the stone band, adjacent to the floor of the seam, is extracted manually. When floor is cleaned, the conveyor is shifted over the entire length of the face by means of mechanical shifters of PM-4 type. After that friction props are erected by means of hydraulic lifters under already extended steel link-bars. Finally, when

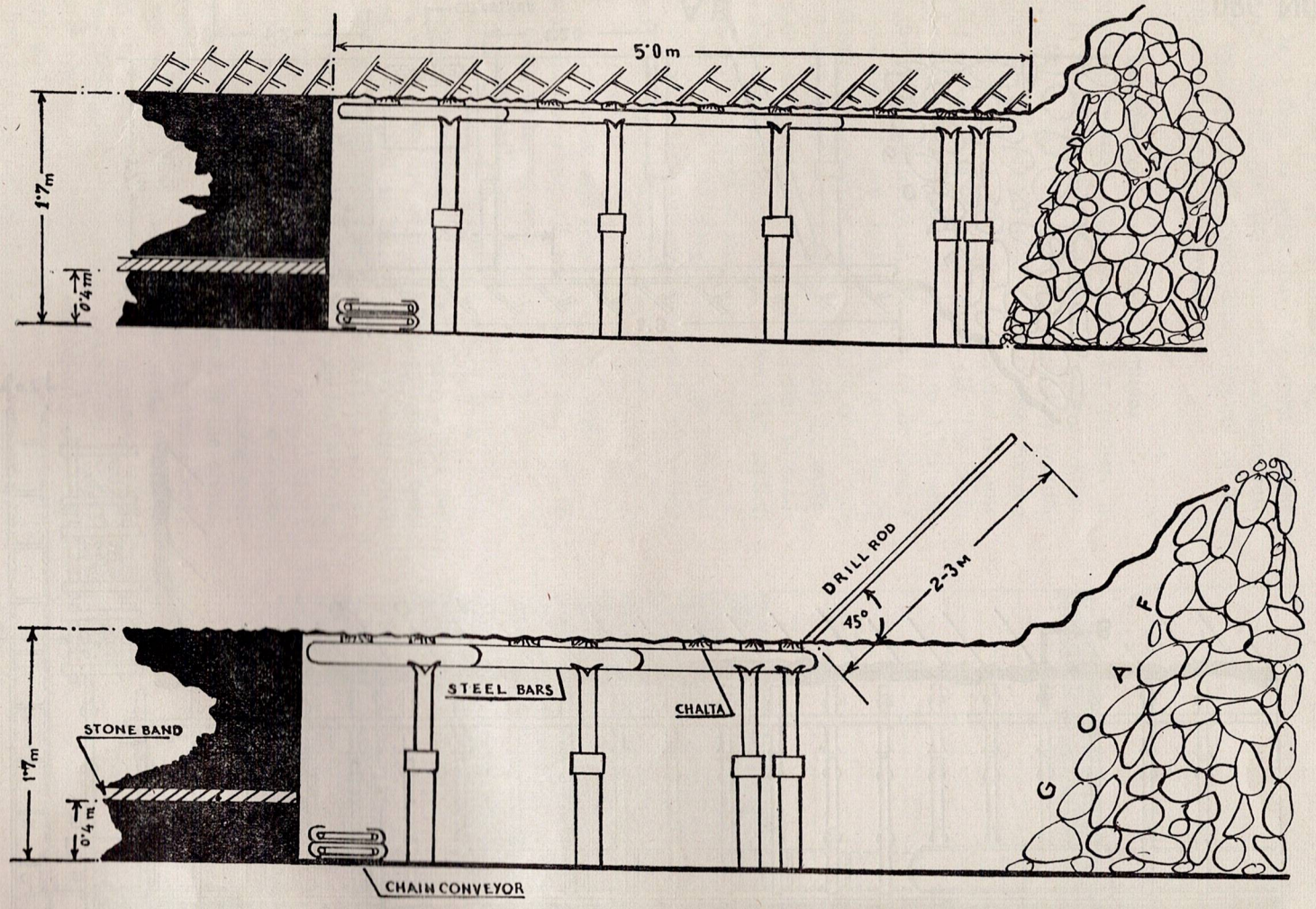


Geological section Drg. No. 2.

permanent support is fitted at a newly expose withdrawal of the last row of supports (from t side) is started.

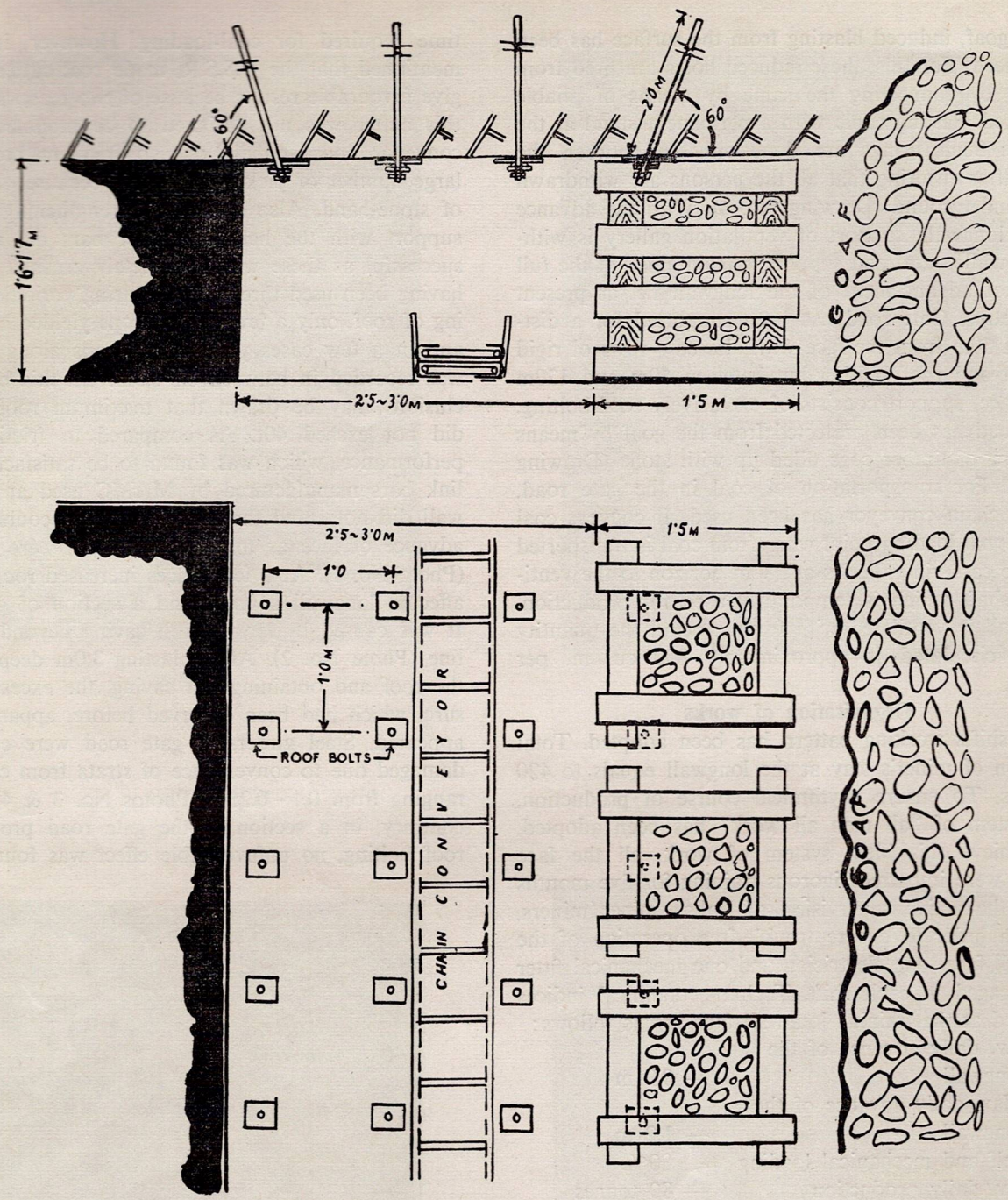
Since the roof consists of hard massive sto there exists a possibility of accumulation of


THE LAYOUT OF THE LONGWALL WITH INCLINE SUPPORT
0·2
1·0
1·0
3·7M
2·5-3·0
1·0
0·7
1·5
1·3M
1·3M
3·8M
1·0M
A
B
G O A F
3·8
1·20
1·7M
COAL-CUTTER
STONE BAND
0·4
1·2M
1·20
CONVEYOR
AB
DRG. NO. 3.



A SCHEME OF VERTICAL REINFORCEMENT SUPPORT & ROOF BLASTING IN LONG WALL

DRG. NO. 4.



REINFORCEMENT AND SUPPORTING IN GATE ROAD

DRG. NO. 5

in the goaf, induced blasting from the surface has been introduced. For this, these induced holes are fired from surface by connecting the same by means of pliable armoured blasting cable with a permanent stand at the surface. Such firings are done only in between the shifts after ensuring that all the persons are withdrawn from underground (Drawing No. 4). With the advance of the longwall, support of ventilation gallery is withdrawn while gate road support is maintained at the full length of advancement of the longwall i.e. at present 120 metres. Gate road has been supported for a distance of 50m from the face with alternate rows of rigid support and roof bolting but between 50m and 120m from face, support consists of exclusively roof bolting. Gate road has been protected from the goaf by means of a row of timber cogs filled up with stone (Drawing No. 5). For transportation of coal in the gate road, double chain conveyor has been used. It conveys coal to sectional loading point wherefrom coal is transported in mine cars via galleries at 280m horizon to the ventilation shaft which is temporarily used for production. Longwall is ventilated with fresh air and the quantity of air circulated is approximately 800 cu. m. per minute.

Organisation of works

Three shifts working pattern has been adopted. Total duration of miner's stay at the longwall equals to 420 minutes. To ensure rhythmical course of production, the system of "all men all work" has been adopted. To achieve this ideal system of work, all the face miners were impatred rigorous training for five months under the active supervision of Polish miner/miners, Also in order to ensure trouble-free operation of the longwall face, one electrician and one mechanical fitter are engaged in each shift. Techno-economical indices achieved at the training longwall face are as follows:

1. Av. daily advance of the longwall	— 0.9 m
2. Max. daily advance of the longwall	— 1.2 m
3. Self and mechanical loading	— 80%
4. Av. daily production	— 80 tonnes
5. Max. daily production	—120 tonnes
6. Av. O.M.S.	—2.8 t/manshift
7. Av. consumption of explosives	—300 gms/tonne
8. Av. consumption of electrical detonators	— 2 pcs/kg of explosive consumed

Observations made during different operations of the experimental longwall face

Introduction of coal cutting machine helped in reducing the number of blasting holes and shortening the time required for coal-loading. Howev mentioned that the U.S.S.R. made coal give favourable results because of two re this cutter was not designed to be mo conveyor and secondly due to frequen large number of picks presumably becau of stone-band. Also system of strengthe support with the help of timber bars successful as these were completely crus having been used three times. During pe ing of roof, only a few valent props yield and in a few cases yielding of props a was recorded in between 0.2-0.3m. On t clusions may be drawn that maximum did not exceed 40t. As compared to performance, which was found to be sat link bars manufactured by MAMC used wall did not stand the tests because in advance of face as many as 100 bars (Photo No. 1). At a few places increased affected longwall support and a section It was caused by lack of full caving be line (Phote No. 2). After blasting 3.0m the roof and obtaining full caving, the sure, which had been observed before, a appeared. Steel girders at gate road we damaged due to convergence of strata fr ranging from 0.1 – 0.25m (Photos No. 3 contrary, in a section of the gate road roof bolting, no unfavourable effect was

Photo 1

Mr VARMA u Prof

Photo 2

Photo 4

Photo 3

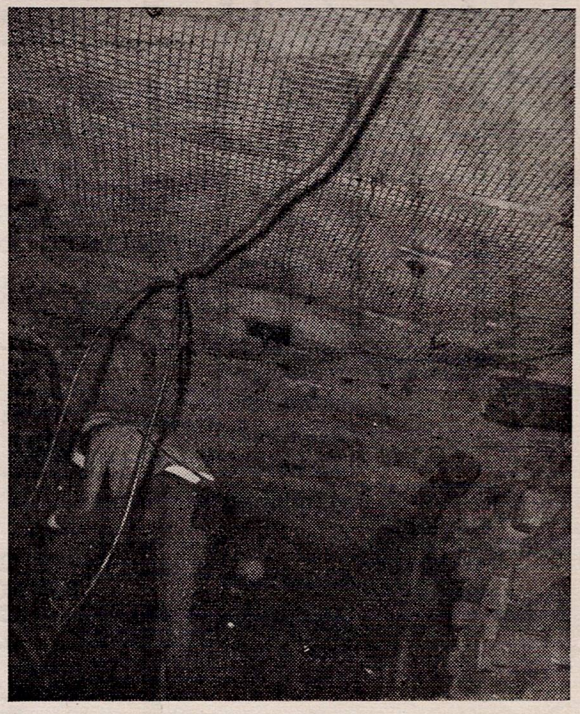
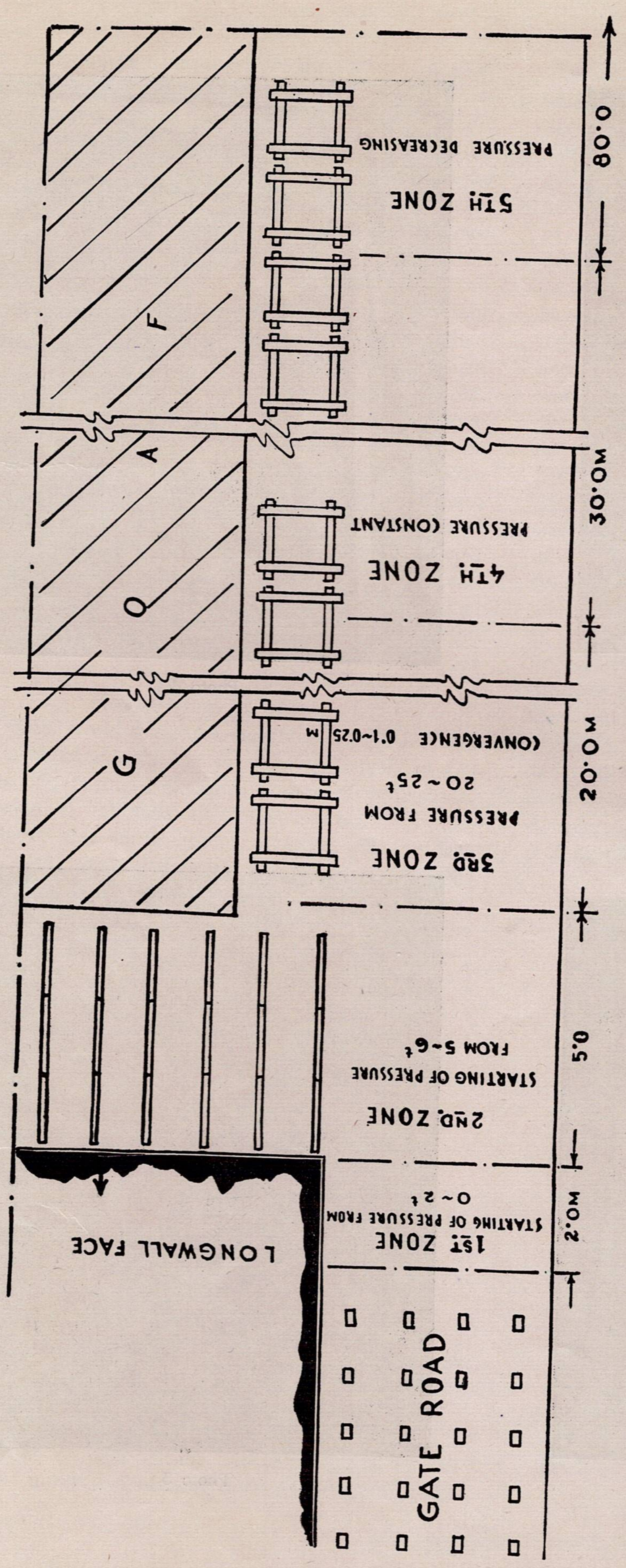
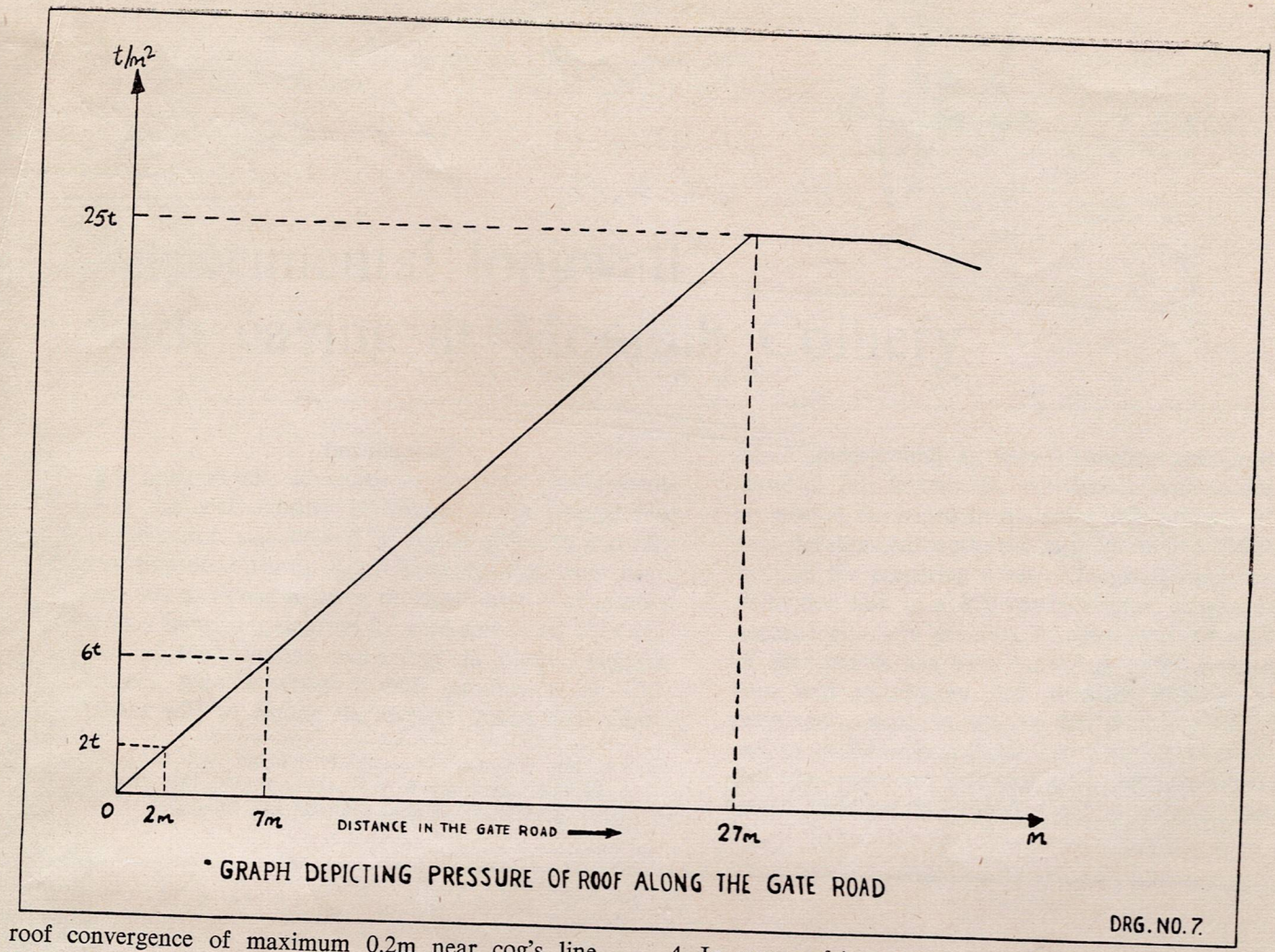


Photo 5

DRG. NO. 6

ZONES OF ROOF PRESSURE IN THE GATE ROAD





GRAPH DEPICTING PRESSURE OF ROOF ALONG THE GATE ROAD

DRG. NO. 7.

roof convergence of maximum 0.2m near cog's line (Photo No. 5). Front pressure was observed to be active in gate road at a distance of about 30m beyond the longwall face and was advancing simultaneously with the advance of longwall. Compressibility of timber cogs filled with stone erected on the rise-side of the gate road (along goaf) has been observed to be 15.0% (Drawings No. 6 & 7).

Conclusions

On the basis of six months experience gained at the experimental longwall face, the following conclusions may be drawn:

1. In XVIIT seam where stone-band is occurring, introduction of shearer loader is not possible.

2. In case, the performance of MAMC-link bars could be improved, then it will not be necessary to strengthen the goaf line support with the help of additional row of props because Polish made valent type friction props in conjunction with improved link bars will offer as high a load capacity as 40 t.

3. Apart from improving the resistance of link bars manufactured by MAMC against compressibility and twisting, their height should also be reduced to 110mm.

4. In case roof is not caving regularly and properly, induced blasting should be applied and for this a set of 2.0-3.0m long holes should be blasted from surface. This also avoids periodical accumulation of excessive pressure within the working-zone. In addition to the recommendations made above, periodical induced blasting by firing long holes of 6-10m from the gate road should also be done.

5. For supporting gate road maintained along the goaf, yielding support should be used because rigid support is totally deformed at a pressure as low as about 25 t.

In case yielding support is not availing, it is preferable to use roof bolting wherever possible.

6. Timber cogs filled with stone can be used as a protection of gate road from the goaf side. Still better results can be achieved by using concrete cheese—weights piled up in a form of columns along the goaf as their support capacity is higher.

7. The composite team (all men all work type) should be given atleast six month's rigorous training in the various aspects of longwall with caving so that the team is fully conversant with the technology of this type of production system.

1.5 str. 1. Roboty przygotowawcze

1.1 Ot. wyrob. poziome

1.2 Ot. wyrob. pochyłe

1.3 Wyrobiska o odstawie

a. ob. technol. obło, pot.

b. przygotow.

p VIII A 100 m / month.