Readings in Mining English

矿业英语注释读物

矿井工作面设备

中国矿业学院外语教研室
淮北煤炭师范学院英语教研室 编注

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内 容 提 要

本书内容选自国外出版的书籍，适合于有一定英语基础而又想尽快掌握阅读专业文献技能的人员阅读。专业内容涉及了主要的矿井工作面设备。注释部分举有大量例句，对理解语法很有帮助。译文力求准确，通顺。词汇表中有大量的专业词汇。

本书可供有关工程技术人员及大专院校师生学习专业英语之用。

责任编辑：殷永龄　顾建中

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前　言

本书引用的原文选自德意志联邦共和国的英文资料和英国国家煤炭局技术培训部1979年编的教材Underground Support Systems等书，目的仅是为了帮助读者提高阅读英语的能力。对于其内容在技术上是否先进和是否符合我国实际情况并没有严格要求，请读者阅读时注意。

本书由中国矿业学院基础部外语教研室齐殿林教授和淮北煤炭师范学院外语系英语教研室张式乎副教授共同编注。

Contents

I. SHEARER LOADERS FOR LONGWALL MINING

In Europe, longwall mining is comprehensively mechanised by[1] the almost exclusive use of shearer loaders and ploughs. In the Federal Republic of Germany ploughing has been applied to a greater extent[2] than in other countries. In spite of this[3], the proportion of coal extracted by shearer loaders is steadily increasing. It accounted for[4] 36 per cent of the total national output in October 1977.

There are a number of convincing reasons why shearer loaders are gaining ground[5]. Their operation is essentiaely more independent of the floor and roof conditions, dirt bands and changing seam conditions than that[6] of ploughs. Optimum adaptation of the cutting height, the fixed cutting depth, and better roof control are further arguments in favour of[7] shearer loaders.

In October 1976 the effective working time on a plough face was in the range of 35 per cent, compared with 48 per cent on a shearer face. The average outputs reflect the above figures (FRG[8] October 1977—1130 t from a plough face, 1678 t from a shearer face). It should be noticed, however, that shearer loaders are generally operating in seams of greater thickness.

Shearer loaders are now available for seams ranging from 0.75 m to 4.50 m in thickness. The various machine versions[9] for the respective operating conditions encountered are assembled from a great number of major components in accordance with the unit principle of construction.

Eickhoff shearer loaders, for instance, can be equipped with longitudinal motors having ratings of 170, 200, and 300 kw, and 450 kw will shortly be available. Transverse motors are 150 kw at present and 230 kw units will be available soon.

The shearers travel on or alongside the conveyor. Ranging arms of different length from 740mm to 2,230mm are available. The shearers can be manufactured to operate on various voltages and frequencies generally used, with various haulage methods and speeds, and different drum speeds and drum design for various machine heights.

Contrary to former years the manufacturers of such machines are therefore no longer in a position to[10] produce identical machines in large series, but are compelled to assemble the mining machines from a large number of existing components according to principles which require continuous revision and improvement, and to integrate them into complete systems together with the face conveyor and roof supports as required by the mining conditions encountered[11].

Although a high degree of development and great operational safety for the severe operating conditions under-

groud have already been reached, efforts have to be made to develop the mining machines further with a view to[12] meet the following future requirements:

(1) — increased outputs(and at the same time a further improvement in operational safety),

(2) — Extension of the working range (e.g. into steeply inclined seams),

(3) — Improvement of the ergonomical conditions (e.g. reduction of dust make and noise).

Increased Outputs

The current trend is for more coal[13] to be extracted from fewer faces.

The output from some faces is already so high that even short stoppages on a face result in[14] an enormous loss of output. The required increase of outputs from shearer loaders is therefore closely connected with the requirement for higher operational safety, a better degree ofutilisation and easier monitoring of all functions of the machine.

The improvement in performance is therefore not limited to the development of more powerful motors, haulgea boxes, gearheads, and ranging arms, but also includes the electrical monitoring of the machines and eventually full automation.

This also applies to the development of cutting tools, as[15] the tool life and the tool costs are decisive for the perfermance of a machine.

Outputs can also be increased by multi-machine operation on a face. The efficiency can be improved by the elimination of stable holes and by avoiding stoppages caused, for instance, by large lumps breaking out of the face and which must be crushed manually.

It is also obvious that the limitation of the operating voltage to 1000 V sets a limit to[16] performance and that the further increase of the nominal motor ratings will require the introduction of higher voltages.

Extension of the Working Range

Comprehensive experience has been gained with shearer loaders in level and slightly inclined seams or in workings to the rise.

The mining of thin seams is affected[17] by inherent limitations set by the height of the conveyor, the necessary clearance underneath the machine, and the height of the machine itself. Thin seams can therefore only be extracted by shearer loaders if the machine travels alongside the conveyor. This results in guiding problems which cannot be solved by the use of a guiding arrangement provided in the travelling track only. A solution eventually found was to trap the machine against the conveyor. This opened possibilities for[18] the shearer loader in a seam thickness which so far[19] was reserved for the plough. A great number of EDW-170-LN shearers are now operating, particularly in Great Britain where they extract thin seams

of high-grade coking coal.

In steeply inclined seams the use of shearer loaders has been limited due to haulage difficulties, and finding adequate safety devices to retain the shearer on the gradient. New developments which dispense with[20] additional safety devices outside of the machine and which provide for the necessary haulage arrangements have extended the working range of shearer loaders into steeply inclined seams.

The cost of roadway drivage and maintenance increase considerably with the depth of the workings. The development of advanced headings has so far impeded face advance. The chainless haulage system for shearer loaders now allows for multimachine operation. Within such a system face end machines can be used which are designed for the purpose and which thus not only eliminate stable holes, but also cut the roadway section, so that high outputs are achieved with the resulting increased productivity[21].

Improvement of Ergonomical Conditions Underground

Compared with other industrial activities, working underground is particularly laborious and dangerous. Efforts are therefore being made[22] to ease the tasks and to increase the safety of the workings underground not only because of the existing stringent regulations, but also because of the necessity to obtain people who are willing to operate the equipment. This also urges the need for further development.

For many years the problem of dust suppression on shearer loader faces has been a concern, and much[23] remains to be done in this field. In this connection, reference is lately often made to[24] the hydraulic extraction of coal by water jets or to the use of water jets for assisting conventional mining machines.

Underground operations are continuously jeopardised by the ocurrence of fire damp. To eliminate such hazards hollow shaft ventilation is frequently used in the U.K.[25] for feeding water and air into the depth of cut by means of Venturi spray jets.

The operation of shearer loaders is also improved by the provision of controls at each end of the machine by radio control, and by automatic control enabling independent operation of the shearer on the face.

COMPONENTS OF SHEARER LOADERS

The targets of development outlined in the foregoing call for[26] continuous improvement and further development of all machine components.

Motors:

High outputs require high motor ratings. An optimum machine adaptation must be employed for each particular type of coal to keep the specific energy(kWh/cu. m) at a minimum.

The accommodation of high ratings within the limited

space necessitates the use of water-cooled motors. Whilst[27] cooling the stators of motors is now an accepted standard and end-shield cooling is applied for the latest motor designs, trials are now also being made to increase the motor rating further within a given space by cooling the shafts.

The motors used so far for longwall power loading machinery are three-phase induction motors which due to their design are sufficiently[28] robust to meet the operating conditions underground. In an effort to[29] reduce the specific energy (kWh/m) to a minimum it is necessary to coordinate the drum speed with the travelling speed of the power loader, and this[30] could be achieved by a machine equipped with d.c. motors for powering the drums which is said to have been developed[31] in the USSR[32], although there is no information of the operating results.

The motors of conventional shearer loaders are positioned in the longitudinal axis of the machine and require a shaft at either side for power transmission to the gearheads. Such machines therefore require a complex gearing system which, however, offers the advantage that the motor power can be divided among[33] the two drums and the haulage box as required.

New machines such as, for instance, the EDW-150-2L are equipped with transverse motors fitted direct[34] to the ranging arm. This advantage, however, is achieved at the expense of[35] the power distribution between the two

drums which is no longer possible, and the drum which is subjected to[36] the higher load determines the travelling speed of the shearer by making full use of[37] its motor power.

Haulage Units

Hydraulic haulage units for power loaders have been used for nearly 30 years now. In the course of the decades they have been improved to a high degree of perfection and now allow for controlling the travelling speed of the shearer as a function of the lood on the motor and the haulage box (Eicomatik). They prevent overloads and operate safely using flame-resistant fluids.

However, the development of the semi-conductor technique has progressed to a stage during the last decade that[38] it is now possible to design electrical haulage units powered by d.c. motors the speed of which is controlled by thyristors. Compared with hydraulic haulage units electric haulages are simpler and more robust; the electricals[39] are easily inspected and maintained via[40] the use of plug-in control units. In addition, their various functions are monitored and they respond more rapidly to speed alterations than hydraulic haulage units. Amongst[41] the first power loaders equipped with such electric haulage units are the Eickhoff double-ended ranging drum shearers' EDW-150-2L, and the electric haulages have fully met the expectations from the very[42] first installation.

Chainless Haulage Systems

After the use of haulage ropes and chains, chainless haulage systems are now gaining ground. They offer[43] the advantages of greater safety, of a steadier machine operation, and of multi-machine operation on a face.

In Great Britain, a number of various designs are used. A problem connected with some chainless haulage systems is the fact that [44] they impede the flexibility of the face conveyor and can cause operational restrictions.

The Eicotrack system (fig. 1) of Gebr. Eickhoff has overcome this problem, because contrary to other systems the rack sections have half[45] the pan length, so that displacements and deflections between the line pans have only half the effect between the rack sections. This unique advantage naturally entails higher costs.

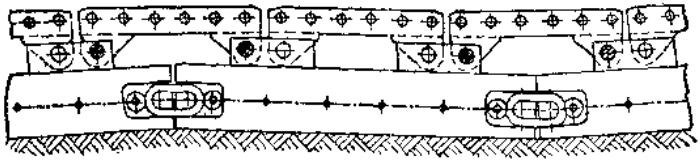

Fig. 1 Eicotrack rack sections.

In special cases, however, the flexibility of the face conveyor is still not considered sufficient. In such cases, the rack sections are not fixed to the face accessories, but are slidingly arranged in a channel or at the trapping

tube. This[46] fully eliminates any effect on the flexibility of the conveyor. Depending on the conditions, the line of rack sections is fixed at one or several points along the face.

Existing haulage units can be converted for operation via Eicotrack. Haulage forces of up to 300 kN[47] are currently used for present-day power loaders. But even these forces are sometimes insufficient for heavy machines in steeply inclined seams. Higher haulage forces are obtained if booster haulage units (fig. 2) are installed in addition to an existing haulage unit to house an additional hydraulic motor and with the followup train of gear wheels. The oil flow from the pump in the main haulage

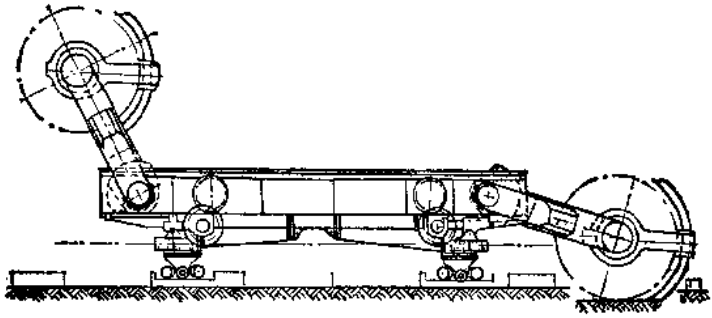

Fig. 2 EDW-300-LH with booster haulage box.

unit is then distributed to the two hydraulic motors which transmit the power to the two rack wheels. This hydraulic arrangement ensures that both rack wheels exert the same force on to the rack. Higher haulage forces are therefore

reached at the expenses of correspondingly reduced travelling speed.

Gear Boxes

Shearers powered by longitudinal motors need gearboxes to which the ranging arms with the planetary gearings can be mounted. The gearheads are built in different sizes in accordance with[48] the existing motors and house the bevel wheels, lubrication pumps and hydraulic pumps. Oil cooling is required for high ratings. Intermediate, two-speed gearboxes are available when a lower drum speed is reguired.

It is unavoidable, however, that low drum speeds result in a higher torque load on the gearings at a given rating. All two-speed gearboxes known so far[49] can therefore not operate at full load and should therefore be protected against overloads. However, the trend for low drum speeds is quite obvious, and new developments must be planned from the beginning to transmit the full motor power at low speeds.

Ranging Arms

Ranging Arms in[50] many different lengths are available for shearer loaders. For face end machines, for instance, extra long ranging arms, sometimes obtained by bolting two together, can be installed. Here again[51], oil circulation and oil cooling are required for the transmission of high powers. The low drum speed is now finally rea-

ched at the end of the ranging arm in the planetary gearing. If the requirement for low drum speeds continues in the future, even higher reduction ratios and loads must be coped with[52] by the planetary gearing. If, in addition[53], the use of hollow shafts increases with dimensions for a sufficient air flow to ensure adequate ventilation, the only practical solution seem to be double planetary gearings. Meeting such requirements[54] will lead to[55] very complex and expensive designs.

Drums

As the use of shearer loaders increases[56], the drums have also required extensive development, and this has led to a type now generally used, i.e. the screw drum which meets two requirements:

A—Positioning of an efficient pick lacing for high cutting performances and, B—Creation of a satisfactory loading and conveying effect of the drums.

Different conceptions of the drums also involves[57] different wet cutting arrangements as the necessity to fit the drums for wet cutting is now commonly accepted.

However, whether some few large jets or a spray jet for each pick are required, whether these spray jets should be positioned in front of or behind the pick, what optimum water quantities should be used and at what pressure, and how their operational safety and ready use can be ensured, are still matters of debate[58].