Readings in Mining English

矿业英语注释读物

矿井固定设备

中国矿业学院外语教研室 编注

煤 炭 工 业 出 版 社

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内 容 提 要

本书内容选自英国出版的书籍，适于有一定英语基础而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固定设备。注释部分举有大量例句，对理解语法很有帮助。参考译文力求准确、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。

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前　言

本书原文主要选自英国Statham编著的Coal Mining Practice一书，目的是帮助读者提高英语水平。对其内容在技术上是否先进和是否符合我国实际情况没有严格要求，请读者阅读时注意。

本书由中国矿业学院外语教研室齐殿林、张式平二同志编注。

Contents

I. THE COAL-WINDING EQUIPMENT

SHAFT EQUIPMENT

The equipment for a shaft will normally comprise the following items, which are subsequently described: [1]

(1) The headframe. (2) The winding rope sheaves. (3) The winding ropes. (4) The detaching hook, safety catches, cage and/or[2] skip suspension. (5) The guides. (6) The kep gear. (7) The cages or skips. (8) The heapstead or pit-bank equipment. (9) The pit-bottom equipment. (10) The winding engine. (11) The signalling equipment. (12) The overwind and speed-control equipment. The arrangement of the heapstead and pit bottom will depend entirely upon the method of transporting the coal in the shaft, i. e., [3] the use of skips or cages. Items (7), (8) and (9) are therefore interdependent.

In addition, [4] arrangements must be made to carry the colliery services through the shaft, by the installation of cables for electric power, signals and telephones, compressed-air mains, rising main for pumps (where necessary), and water pipes for fire-fighting and dust suppression. Care must be exercised [5] to ensure that the equipment in the shaft does not restrict unduly the flow of air.

The Headgear or Headframe. [6] ——The main purpose of the headframe is to provide support for: (a) the sheaves carrying the winding ropes; (b) the cage guides, which are supported by buntons built into the shaft walling; (c) the locating guides, which are used to bring the cage or skip accurately into position [7] at the pit bank; (d) the detaching plate; and safety catches; (e) the kep gear.

The headframe varies [8] considerably in design but usually comprises a four-legged structure erected over the shaft and having a pair of back stays to resist the over-turning moment due to the pull of the winding rope.

The headframe is built in structural steel, using rolled joists, or lattice girders, with riveted or welded joints. The use of standard sections and prefabrication of large parts in the factory make [9] the erection of a steel headgear on site a relatively simple job, and are an advantage if it should be necessary to make subsequent modifications to suit changes in winding conditions. With [10] reasonable attention and regular painting, a steel headgear will last for many years.

Although the lower part is usually surrounded by the buildings forming the pit bank or heapstead, [11] the headgear is an entirely independent structure standing on foundations forming part of the shaft collar, with the back stays often braced against an extension to the winding engine foundations. [12]

An alternative arrangement is to erect a massive brick and/or stone wall at each side of the shaft, forming a combined foundation for the side legs and back stays. Girders carried between the walls may be used to support the various stagings required for the heapstead structure.

The air-lock casing for the upcast shaft may be built inside the legs or alternatively it may enclose the legs. The air-lock is usually built in brickwork or concrete, but steel-plate construction is sometimes used. The size and layout of the air-lock will depend upon the winding duty to be carried out [13] in the upcast shaft.

Position of Winding Engine; The Fleet Angle.——An important factor in deciding the position of the winding engine is the so-called "fleet angle". This is the angle formed between the axis of the winding rope and the plane of the head sheave, acb and edf, Fig. 1. With a drum winder [14] this angle will vary continuously, as [15] the rope is wound between the "outside angling", with all the rope off the drum as at A, and the "inside angling", with all the rope on the drum as at B, Fig. 1.

It [16] is generally considered to be good practice to limit the fleet angle to a maximum of 1°30′, the tangent of which is 0.0262 (usually taken as $^1/_{40}$). [17] A greater value than this at the outside position will cause the rope to pull across the drum at the beginning of the wind instead of coiling evenly. [18] A greater value at the inside position will cause wear to the outer wires of the rope due to excessive side rubbing between adjacent turns.

The fleet angle is determined by the length of rope between the head sheave and the drum, termed the "rope plane" or the "rope lead", and by the spread of the rope on the drum, which is fixed by the drum diameter and shaft depth. For the inside angling, the spread of rope inside the plane of the head sheave is required, i. e., dimension ab, and for the outside angling the distance from the plane of the head sheave to the dead turns, [19] dimension ef. We have, therefore, the two conditions:

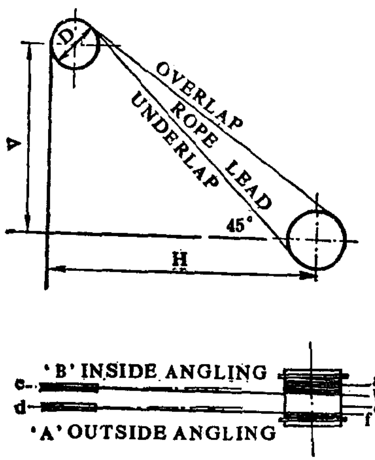

Fig.1 Rope angling.

$$\text{outside angling} = \frac{\text{spread ab}}{\text{rope lead}} \qquad \text{inside angling} = \frac{\text{spread ef}}{\text{rope lead}}$$

The maximum value of each of these ratios is $^1/_{40}$, and therefore the minimum length of a rope lead for given winding conditions can be calculated.

In order to equalise the bending of the underlap rope as it passes over the head sheave and on to [20] the drum, the rope plane should make an angle of about 45° with the horizontal.

The length of the rope plane should not, however, be increased excessively beyond that [21] required to give satisfactory angling. The rope in the lead, i. e. ,between the drum and the sheave, has a tendency to "whip", [22] and this tendency is increased in a long lead due partly to the natural elasticity of the rope and also to the sag which develops in the rope when the cage at bank is lowered back on to the keps.

Winding Ropes.——The most important attribute for a winding rope is the ability to withstand, without permanent deformation, repeated bending under stress such as [23] occurs when the rope is wound over the head sheave or on to the drum. This requires a construction which is flexible, but in which the constituent members are restrained in their relative positions. A construction using wires laid evenly in a helix about a central core has these properties and is able to yield under stress, returning [24] to its original form when the load is removed.

The basis of all wire-rope construction is, therefore, the simple strand which normally consists of six wires laid round a central core which may be of wire or hard fibre. The outer wires are twisted uniformly about the core to form a continuous helix throughout the length of the strand. Additional wires may be added to form larger strands, which are then "laid up" [25] to form a rope, with the strands twisted in a helix about a central core.

Rope Lay.——Early wire ropes were laid up with the wires forming the strands twisted in the opposite direction to the strands forming the rope [26]. This construction, called ordinary lay, is not satisfactory for winding (or haulage) because there is uneven wear on the wires. Due to the relatively short length of wire exposed on the crown of the strand in each lay, the wear due to pressure between the rope and the head sheave or the drum is concentrated on the crowns of the outer wires which are thereby reduced in section before other parts of the rope are affected. In addition, owing to the wires in adjacent strands crossing at an angle, cross-cutting between wires occurs inside the rope. This leads to premature breakage of individual wires which unravel from their position in the strands, thus causing [27] the rope section to lose formation and increase the rate of wear as well as [28] reducing the factor of safety. Furthermore, there are practical objections to using a rope with loose and broken wires.

In Lang's lay construction, introduced in 1879, the wires forming the strands and the strands forming the rope are both twisted in the same direction. With this construction, the wires in adjacent strands lie more evenly together, so reducing internal wear, while (29) on the outside of the rope a longer length of wire is exposed at the crown of each wire, giving greater resistance to external wear.

For this reason a rope of Lang's lay construction gives a longer life than a rope of ordinary lay of the same size and working under the same conditions. A disadvantage of Lang's lay, however, is a tendency to untwist, so that the ends must be retained in the same relative position in which the rope was manufactured, which makes the rope somewhat more difficult to handle and install than an ordinary lay rope.

Attempts to overcome troubles due to untwisting and at the same time to give better wearing qualities to the rope led to the introduction of the locked-coil rope in 1884, and to the flattened-strand rope in 1894. These types of construction form the basis of winding-rope practice at the present time.

In addition to being practically non-spinning, these ropes have a compact construction with a uniform external surface which, (30) by distributing the pressure and friction load on drum or head sheave over a number of wires, offer a greater resistance to wear.

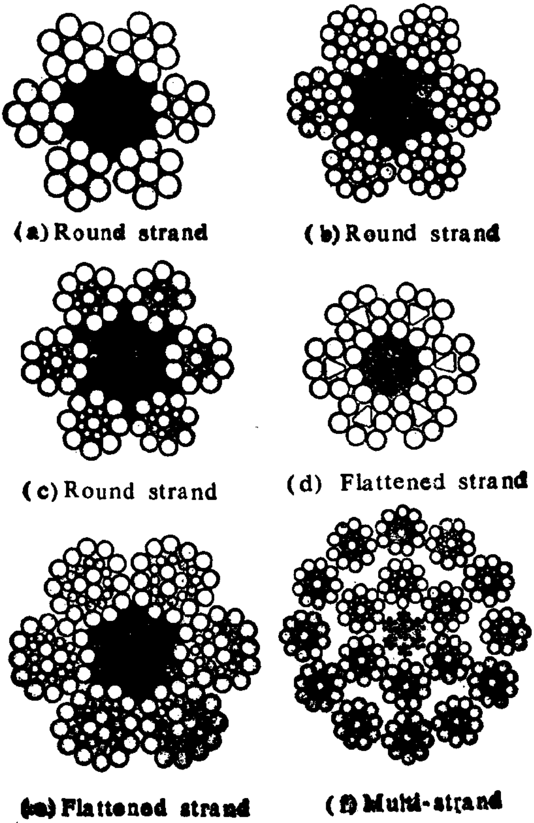

Fig.2 Stranded ropes. Typical sections.

Furthermore, a uniform external surface on the rope will reduce wear and "plucking" of the wires due to side rubbing as the rope coils on or leaves the drum. Even with ideal angling conditions i. e. 1 in 40, the ropes will meet the drum at an angle greater than the natural angle of the rope on the drum. Consequently rubbing occurs between the moving rope and the next coil, both when winding on and winding off the drum, [31] unless grooving is provided on the drum barrel to locate the rope.

The more compact construction also gives these ropes a greater strength for given overall diameter. This has two advantages, first that [32] the drum and head sheave diameters required for a specific load (and rope) are somewhat reduced and, second, the spread of the rope on the drum is less, thus improving the angling and reducing the overall width of the drum. The effect is therefore to reduce the weight and thus the moment of inertia of the drum and head sheaves, with a consequent saving in power.

Stranded-rope Sections.——Typical sections of stranded ropes are illustrated in Fig. 2 a to f. The first three, a, b and c, show the round-strand construction, of which a is the simple form and b and c involve more complicated core construction. Two examples of flattened-strand construction are illustrated by Fig. 2d and e. This type has largely superseded the round-strand construction, for reasons already mentioned. The fundamental difference between the two constructions is that, [33] instead of a circular strand core, a triangular core is used to give the characteristic shape and flattened surface to the rope. This core may be of solid drawn wire of triangular section, Fig. 2d, which should, however, be of softer material than the strand wires to avoid damage to the wires as they are laid around the triangular core in the form of a helix. A better arrangement is to use a core made of three round wires laid together in the form of a triangle, Fig. 2e, which gives greater flexibility than a solid core. Flattened-strand ropes are made up in Lang's lay.

Multi-strand ropes, Fig. 2f, are fabricated (34) with two or more layers of round strands laid in opposite directions, and as a result these ropes are said to be non-rotating. The size of the individual wire used is small compared with that of other types of stranded ropes, which (35) makes the rope very flexible, but the effective resistance to abrasive wear is lower. In addition, the laying of the strands forming each layer in opposite directions is liable to result in cross-cutting of the wires under radial pressure.

It is customary to build up a stranded rope with a fibre core as shown in Fig. 2a to e. This serves two functions, firstly to prevent internal friction and wear between the wires of adjacent strands and secondly, the core provides for internal lubrication of the wires. For this purpose the fibre is treated with oil or grease during manufacture, usually by vacuum impregnation to exclude water.

THE WINDING OF COAL

Two methods are used for transporting coal through mine shafts: by cages, carrying the coal in tubs; and by skips, into which the coal is loaded direct. [36]

Cage Winding with Tubs——Cage winding, with the coal loaded into pit tubs, has been the standard practice in British mines for many years. In the early days, when coal was worked entirely by hand, the pit tubs were taken to the face to be filled [37] direct. Consequently, pit tubs were small, holding only 4 to 6 cwt., or even less. The development of longwall working, the introduction of coal-cutting machines and, later, the extended use of face and gate conveyors led to an increase in the size of tubs, which were loaded in the gate road or main road and hauled outbye to the pit bottom. Modern pit tubs, constructed in fabricated steel, have capacities up to[38] 35 cwt. and their introduction was an important factor in the development of winding technique.

A typical double-deck cage has a simple design, comprising a main frame of steel supporting the decks as required. The sides and top are enclosed with steel mesh, or with steel sheet, perforated to keep down the weight; the floor for each deck may be solid, or of steel strips or bars, to reduce obstruction to the ventilation. Sliding cage gates are provided to close the ends of the cage when men are riding. The suspension gear is attached to extensions at the top of the main frame.

The weight of a cage and suspension gear is usually approximately equal to the combined weight of the tubs and the coal load. To reduce the dead weight of cages, use is sometimes made of light alloy sheets for the side plates, (39) with steel for the main frame only.

Any reduction in the dead load will bring as advantages, (40) either: (a) A smaller size of winding rope for a specific pay load and factor of safety and therefore a smaller drum diameter. There will thus be a small saving in power consumption, but with cages in balance and the same pay load, this will not be appreciable. Or (b) a greater pay load may be carried with a given rope and drum diameter for the same factor of safety; this however means a corresponding increase in power consumption due to the greater unbalanced load.

Rails at the colliery gauge are fitted on each deck of the cage. Catches are provided at each end of the decks to retain the tubs in the cage when winding. The release mechanism can be arranged to work automatically as the cage lands at the bank or pit bottom. For this purpose a power-operated piston and cylinder may be employed which (41) engages with a tub controller mounted on the