

sometimes made, even with the best of men, and the winding engineman is as careful and painstaking as his brother of the railway engine.

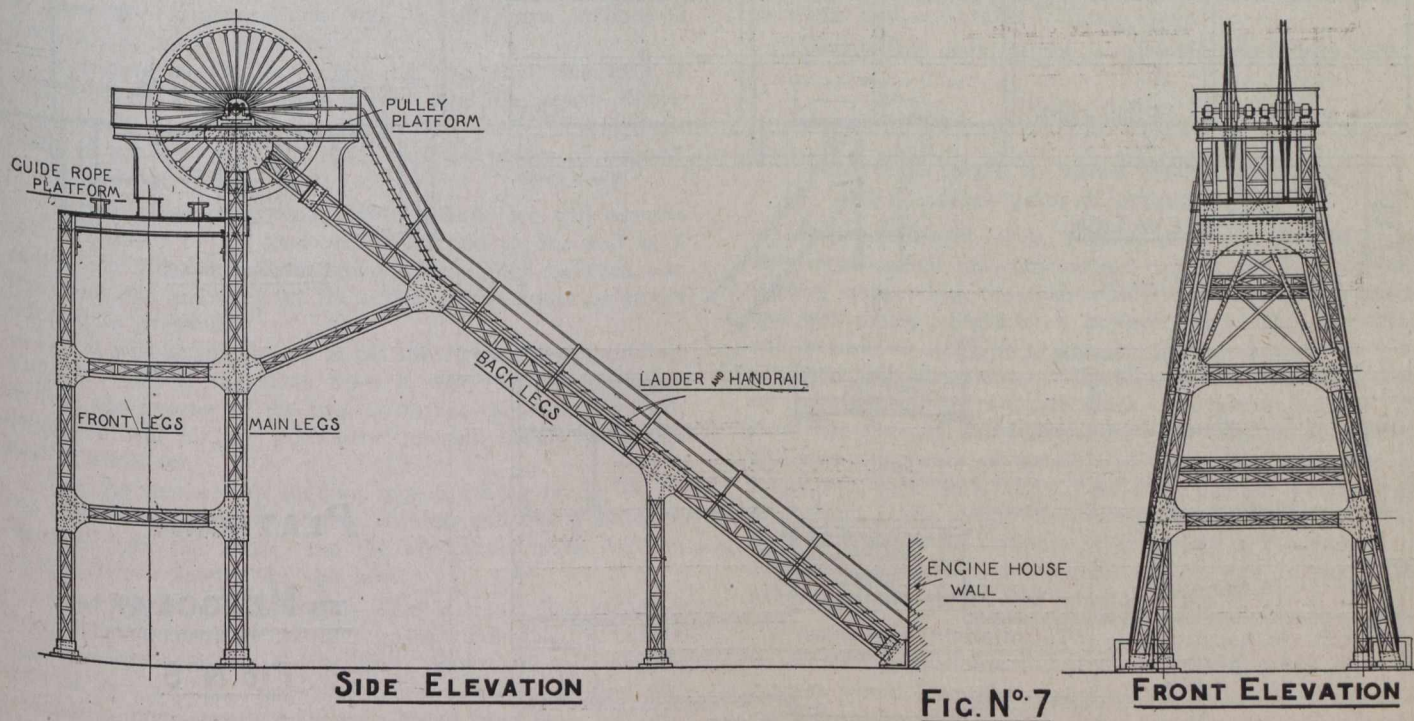
In the early days it occasionally happened that the engineman forgot to shut off his steam soon enough or omitted to apply his brakes in time, and, instead of landing his load either of men or material at the appointed place, brought the cage right over the pulley, or, failing that, broke the rope at the top of the headgear and dropped the cage to the bottom. In order to prevent this the King's safety hook was designed. This is operated by means of a heavy plate having a circular hole cut in same through which the rope passes normally, and is usually placed on the guide-rope platform. In case of an over-wind the catch, or safety hook, passes through the plate until the sides come into contact with same. This causes the rope to be released at the top, and also spreads out the part of the hook above the plate, at the same time providing a lug or catch on the safety hook which matches with the plate, and so prevents the cage from falling down the shaft again. This operation causes quite a severe shock to the headgear, as the cage and its contents would actually drop a few

(1) The rolled steel headgear made with I-beams, channels, etc., and braced with angles and tie-rods; and

(2) The lattice headgear, in which practically the whole of the members are composed of four angles, placed to make a box section, and laced together on all four sides with small flats.

Each type possesses particular advantages. That made from rolled I-beams, etc., is easier and cheaper to produce, although the dead weight to handle will generally be greater. The facility with which the connections can be made and the use of standard details to a large extent make it rather desirable from a shop and erecting point of view, but it has one great disadvantage, and that is the lack of stiffness without the insertion of a large excess of weight, which would put it right out of the running. With the advent of the broad flange beams, however, during the last few years this has been improved to quite a large extent.

The greatest detriment to the lattice headgear is the high cost per ton produced, which, however, is offset to a large extent by the decrease in weight necessary to carry a given load, as the disposition of the material more nearly



### LATTICE TYPE HEADGEAR

inches, and, therefore, it is necessary in cases where this gear is adopted to allow for this extra load.

The other device, used in cases where the winding rope breaks, produces a stress on the guides, as generally it is of the slipper type, actuated by a spring, and only comes into operation by the rope parting.

The stress in this case also is liable to be very severe, as the rope may break at the maximum speed, and a small fraction of time must elapse before the various parts fulfil their duty, and during that time the cage is increasing its velocity. The action is purely of the character of a brake, and it would be fairly good practice to allow about twice the dead load of the falling cage, chains, rope and load for both cases, and also use a low unit stress on the parts affected.

In addition to the special loads described, the structure will have to be designed to carry its own dead weight, wind and snow loads. The two latter loads, however, are not of a very serious nature as compared with the live loads.

There are two types of steel headgear in general use:—

approaches the ideal form for struts and columns. Other features which prohibit its adoption in many cases are:—

(1) The increased area of metal exposed to the action of the weather, and consequently greater danger of oxidation of the structure.

(2) Painting is also more costly, not only on account of the greater area to cover, but also for the comparative inaccessibility of the various parts.

For a given amount of material there is no doubt but that the lattice structure provides a high degree of stability and freedom from vibration. Taking it all round, there appears to be very little ultimate difference in the two methods, and generally the type is chosen according to the fancy of the purchaser, or settled by the manufacturer to suit his outfit and stock material.

Figs. 4, 5 and 6 show the general outline of a rolled beam headgear, and Fig. 7 is a type drawing of a lattice structure, and from these figures a good idea may be obtained of the usual disposition of the material.