Starting from the centre of the pulley shaft (which is always made the intersection point of the main and back legs) marked "o," measure along the line "o d" produced the length "o f," which represents by any suitable scale the magnitude of the resultant, viz., 39,500 pounds, and then from the point "f" draw parallel lines with the main and back legs, and the intersection of these lines with the centre lines of the two legs will complete the parallelogram "o g f h," and by the same scale with which the resultant was plotted down the magnitude of the stresses on the two legs are found to be 14,000 pounds for the main and 28,000 pounds for the back legs.

For the descending load the small diagram (Fig. 6a) gives the corresponding figures, and, referring to Figs. 5 and 6, the distribution of these stresses on the two main and two back legs will be seen, and are self-explanatory.

Guide Ropes and Weights.—There are eight of these, four to each cage, and each will weigh twelve tons, complete. Each of the main and front legs will support one-fourth of the total load, viz., 24 tons.

Stress Due to Overwind.—The maximum will be equal to the weight of the cage, tubs and coal, multiplied by two to allow for impact, which will in this case amount to $8,000 \times 2 = 16,000$ pounds.

Referring to Fig. 4, it will be seen that this load is supported by a heavy cross girder, and the exact distribution will depend on the relative distances between the point of application of the force and the points of support at each end of the girder.

Without having anything more definite we will assume that two-thirds of the load will be carried to one end as a maximum, and this will be equally distributed between one front and one main leg by the action of the spurs or struts referred to previously.

As it will be impossible to get the stress due to winding and over-wind at the same time, it will only be necessary to take the greater of the two, so far as the main legs are concerned, but for the front legs this will be an additional load to allow for.

For the case of the winding rope breaking in the shaft, the distribution of the stresses caused will be practically identical with the above, and the allowance made for the over-wind will answer for this also.

Dead Load of Structure.—This is generally assumed from data obtained in previous cases. For this particular case it may be taken at fifty tons. Approximately twelve tons of this will be carried by the two back legs and the remainder about equally on the main and front legs, namely, nine and a half tons each.

Wind Load.—A maximum of about 30 pounds per square foot of actual area of frame exposed will be quite good practice. As, however, it is rather difficult to obtain this information until the calculations are completed, an assumption may be made that the area exposed equals about one-fifth the total area enclosed by the outside lines of the frame.

By adopting this latter course we find the total area is about 2,800 sup. feet, giving a total wind load of 16,800 pounds.

The centre of gravity of this force will be about halfway between the ground level and centre of pulley shaft, and, therefore, the moment will be

$$16,800 \times 30 = 504,000 \text{ foot pounds.}$$

This will be divided about equally between the three pairs of back, main and front legs, and, therefore, the maximum stress on any leg will be equal to:—

$$\frac{504,000}{3 \times 18} = \pm 9,333 \text{ pounds, according to the direction of the wind.}$$

Where 18 feet = the centre of the legs at the base in feet.

Neglecting snow load, which will be comparatively small for a structure of this class, and tabulating the figures found, we have the following:—

Table of Stresses on Front, Main and Back Legs of Headgear.

Nature of stress.	Front legs.	Main legs.	Back legs.
Dead loads—			
Guide-ropes and weights..	48,000	48,000	....
Weight of structure	19,000	19,000	12,000
Total dead load	67,000	67,000	12,000
Live loads—			
Winding stress	....	14,000	28,000
Over-wind stress	2,700	2,700	....
Wind load	9,500	9,500	9,500
Maximum live load	12,200	26,200	37,500
Add 100 per cent. to live..	12,200	26,200	37,500
Grand total	91,400	119,400	87,000

The ordinary methods are now adopted for finding the sections, and a suitable formula would be:—

$$\text{Permissible safe stress in pounds per square inch} = 18,000 - 70\frac{L}{r}.$$

Where L = length in inches between supports,
and r = least radius of gyration of section.

Pulley Platform.—Fig. 8 shows a general plan of a platform from which the construction can be clearly seen. The girders supporting the floor plates are made from angles and web plates. Sometimes, however, and where the details will permit of same, it is cheaper to use channels in place of these built-up girders. Usually, heavy steel plates, half to three-quarters of an inch thick, are laid under the cast-iron sole-plate of the pedestal with the idea of distributing the load as evenly as possible over the intersection of the main and back legs. The floor-plate should preferably be of chequer plate, and if these are judiciously arranged, quite a large amount of stiffness is imparted to the top of the structure to resist the torsional strains due to the unbalanced stresses on the two winding ropes.

Guide-rope Platform.—The construction of this would be similar to the above, and the conductor and over-wind girders would form the supports for the platform.

Practically speaking, neither platform has to support any vertical load other than that of a man walking around or any loads due to repair work going on, and the latter is not likely to be very excessive.

The design of these platforms is largely one of practical experience, and perhaps their most important function is that of a diaphragm, as suggested previously.

The pulley platform may be supported either as shown in Fig. 4 on all six legs, or as indicated in Fig. 7 on the main and back legs only, with the small angle struts inserted as steadiers.

The girders for the guide-ropes and over-wind gear are calculated for in the usual way, the only point to watch being an adequate allowance for the sudden dropping of the cage and its contents on same.

Bracings, Struts and Diagonals.—The whole of these members are put in solely for the purpose of stiffening the structure and reducing the unsupported lengths of the legs.

Generally, the working out of the details will determine to a large extent the best sections to use, and this feature, combined with the general principles of symmetry and proportion and usual practice, will bring about a result which is at once reliable and pleasing to the eye.