and the most economical means employed; and by their use the strength of the upper chords is also brought into more useful play. The upper chords have no other office to perform, except to maintain the stiffness and integrity of the trusses. The lower chords, on the other hand, are needed to resist the thrust of the arches, when overbalanced by heavy transverse weights. For this reason, the spans not extended to the lower chord, so that their full strength may be reserved for maintaining the equilibriums of the arches.

The maximum weight of 570 ft. is 3,700 T.
Deduct supporting power of stays 500 T.

Leaves for arches and cables to support 2,800 T.

The length of span from center to center is 1,346 ft.
Deflection of cables 60 ft.
Ratio of deflection to span 0.01.
Coefficient of tension 2.56
Span of central rib of arch 1,346 ft.
Deflection of same 43.5 ft.
Ratio of deflection 0.03.
Coefficient of pressure 1.50

Let the weight to be borne by the cables be \(x\), and the compression of the arches 1,346 ft.

Then the tension of the cables will be \(1,346 \times x\), and the compression of the arches 1.75 ft.

The aggregate weight to be supported by the cables and arches is 1,346 tons; therefore \(x + y = 1,346\), or \(y = 1,346 - x\).

And as the thrust of the arches is to be balanced by the tension of the cables, we also have

\[
1.346 \times x = 1.75 \times y
\]

Substituting \(y = 1,346 - x\)

\[
1.346 \times x = 1.75 (1,346 - x)
\]

\[
1.346 \times x = 4,918 - 1.75 x
\]

\[
3.098 \times x = 4,918
\]

\[
x = \frac{4,918}{3.098}
\]

\[
y = 1,346 - \frac{4,918}{3.098}
\]

\[
y = 1,986,600 - 1,346,400
\]

There are 4 cables of equal size and strength.

Each cable therefore has to support 1,346 T.

Each large cable being composed of 43 small cables, each of these has to support 30.873 T.

Tension resulting, 10.873 \(\times\) 43,346 = 457,475 T.

Allowing 5 times the strength, we have the ultimate strength of small cables 28,092 T.

Allowing 4 times, we get 168,570 T.

If the wire-ropes are made of the best quality of cast-steel, they will measure about 2.5 inches in diameter, and will weigh 10 lbs. per foot linear.

Each cable must be balanced by its respective arch.

Each arch has to support 1,346 T.

Compression resulting in 1,346 \(\times\) 1.75 = 2,314.5 T.

Each of the outside arches is composed of 1,346 channel-bars of 12 in. width, and the maximum compression of each bar therefore is 144 T.

Assuming 4 tons maximum compression per 1 cu. in., we have the section of each bar

\[
44,491 \times 4 = 111,125 \text{ cu. in.}
\]

Each of the two middle arches is composed of only 6 channel-bars in place of 12, therefore if of iron, their section would have to be 22 in. square.

This would make them too heavy, and would be bad economy. It will be therefore advisable to get them rolled of soft Bessemer steel, or of a good quality of puddled steel, which will be safe under a pressure of 6.0 to 7 tons.

Assuming 6.0 tons maximum pressure, each of the channels for the middle arches will require a section of

\[
44,491 \times 6.0 = 267,346 \text{ sq. in.}
\]

It is proposed to fill the channel-bars which compose the arches in lengths of 30 ft., by 11 inches wide. The trans-ports being spaced 15 ft. apart from centre to centre, the joints may be broken and spliced on the posts. To facilitate construction, the arches may be treated as polygons of a circle, and each bar will then have to be bent slightly in the centre, to a pattern, so as to fit at any place. The details of the arches and other parts are made plain by Figs. 1 and 2. Figs. 3 and 4, show the manner in which the panel-boards are secured to the posts. The construction of the trans-ports on the upper floor is also exhibited in detail in Fig. 7.

Fig. 1. Pl. 9, is an elevation of a tower on one of the middle piles. Figs. 7 and 8 are sections of the middle stack. Figs. 4, 5, and 6 are plan and section of the central anchor-plate, in which the two central cables are anchored. Fig. 9 is a part of a section of the common roadway on the upper floor. Fig. 1 shows plan and elevation of an ice-breaker.

Iron structures must be well protected against oxidation by coats of durable paint, laid on every 5, or at most, every 3 years. It is better to repeat this process every 2 years, with a single coat only, than to wait 5 or 6 years, and then lay on 2 or 3 successive coats. Heavy successive coats are more apt to peel off than single coats, well applied. Yearly examinations, with repainting here and there, where needed, is the true policy, and the most economical in the end. The inside of the slabs of the towers will be inaccessible to the painter. It will therefore be advisable to fill them with concrete or brickwork, well painted with cement. The grout will most efficiently preserve the inner surface from oxidation.