concrete used, and with these assumed weights he determines approximately the position of the centre of gravity, both vertically and horizontally, of the moving leaf, and then proceeds to determine the position of the centre of gravity of the counterweight, together with its general outline and volume.

Precautions were taken to avoid trouble in securing a balance by keeping the counterweight on the light side, because it is easy to add weight and exceedingly difficult to remove concrete once it is placed. To this end, pockets were left in the concrete counterweight in such size as not to interfere with its strength and in such positions as not to interfere with the position of its centre of gravity when more concrete was added.

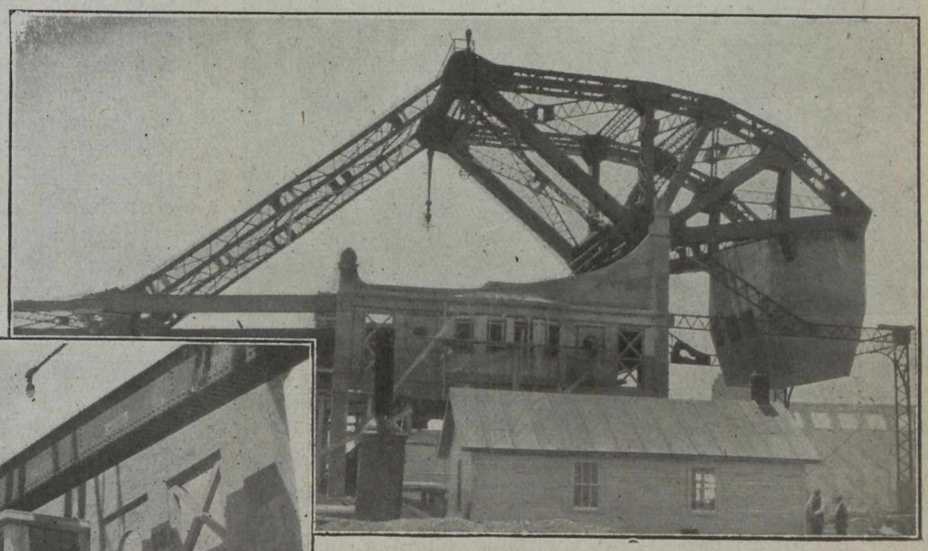
Blocks of concrete were made as early as possible of the local materials to be used for the counterweight in order to determine the unit weight of this material, and some of the timber was also weighed as soon as it arrived. This data was used in completing the design of the counterweight, but before the counterweight was built the entire wood deck had been completed and all the timber weighed. This final weight was used to check the calculations, with the result that only a few yards of concrete had to be added to the counterweight to finally make a balance. The weight adjustment was made by adding concrete until the motors required the same amount of current in operating the bridge either up or down.

Showing Machinery House and Operating Cabin from Bridge. Note Rack on Underside of Operating Strut.

The bridge is lifted by means of two operating struts, which are pin-connected to the moving leaf at the hips, and which are actuated by two heavy pinions which engage steel racks bolted to the under side of the operating struts. The operating struts pass through roller cages or guides, which are pivoted to the shafts carrying the operating pinions. These cages hold the operating struts in contact with the pinions so that the racks and pinions can by no chance get out of mesh.

The machinery house encloses the emergency foot-brake drum, the gasoline engine, the hand-operating mechanism, the electric motors, and the train of heavy gears which carry the power from the motors to the operating pinions. A large compensating gear is provided between the two operating pinions, and is placed on the shaft carrying the second reduction. This gear is similar to an automobile axle gear, and compensates for any variation existing between the rack-teeth on the two operating struts, and thus avoids indeterminate strains in the mechanism. All the machinery is of cast-steel and all large bearings have special bronze bushings, while certain of the smaller bearings are lined with babbit.

The main trunnions are 12½ in. diameter and 1 ft. 5 in. long on the bearing surface, and the counterweight trunnions are 21 in. diameter and 2 ft. 6 in. long on the bearing surface. These are forged steel pins working in phosphor bronze bushings, and a special effort has been made to provide reliable lubrication and numerous grease-cups and greaseways were provided for forcing grease into all such bearings.



View Taken June 14th, 1917.

The bridge is opened and closed by means of two a.c. three-phase, 60-cycle, 550-volt motors running at 560 r.p.m., with a normal running torque of 480 lbs. and maximum starting torque of 1,150 lbs. Each of these motors is provided with a solenoid brake. In addition to the solenoid brakes, there is an emergency foot-brake for use when there is no current. To prevent accidents automatic cut-offs are provided for these motors when the bridge is nearing either the open or the closed position. These cut off the current from the motors and set the solenoid brakes after the operator has been warned by electric light indicators. The operator usually stands by and prevents the current being cut off in this manner, thus completely closing or opening the bridge without interruption.

In order to make doubly sure of never blocking the channel through failure of the electric power, a 6 h.p. hopper-cooled gasoline engine, with a speed of 320 r.p.m., is provided in addition to ordinary hand operation by means of an endless chain from the bridge deck.

An air buffer is located at the outer end of the moving leaf for the purpose of relieving the bridge from jar when coming to rest, and the bridge is locked in the down position by means of a bolt under each truss. These bolts are operated by means of a 5 h.p. a.c. motor, 550 volts, three-phase, running at 750 r.p.m., and furnished with