basin were owned by an individual, he would compel the power plants to locate a few miles distant on some tributary of the stream where the water could be used for irrigation after passing through the power wheels, although such construction would be perhaps a little more expensive. He would also compel the railroads to locate their lines around and above feasible power and reservoir sites, in order that the large projects which must eventually be built will not be unnecessarily encumbered, and their construction correspondingly delayed.

The state is endeavoring to look somewhat to the future in these matters as indicated by the above authority granted to its administrative officers for the protection of the public interest.

**Public Investigations.**—Recently a further step in this direction was taken by our legislature. The sum of $50,000 was appropriated for the making of detailed plans and estimates of cost of a number of these projects, and authorizes co-operation with the United States. The government has allotted an equal amount from the reclamation fund and the investigations are now being carried on jointly. The necessary land and water rights are withdrawn so as to prevent further complications, and it is the intent to assign such plans, and rights to the people forming themselves as a district for the construction of the project, or to private capital, who will undertake to carry out the public plans on terms satisfactory to the people. Failing in this, the legislature has submitted a constitutional amendment for vote of the people in 1914 authorizing the issuance of bonds equal to two per cent. of the assessed valuation of the state for the construction of irrigation and power projects, and for developing the cut over timber and other lands of the state.

In other words, the state is now authorized to make water filings, and to gather all necessary information relative to these large irrigation and power projects, which may be necessary in promoting their construction by either private or public funds. It has also taken the first step looking towards construction with public funds if such action is found necessary.

Speaking for the West generally, water is of more value than land. It is highly important that the people be aroused to the value of public water surveys, and the necessity of securing more complete information as to the duty of water.

## NEW SLIDING CAISSON FOR H.M. DOCKYARD, PORTSMOUTH.

Last month Messrs. Swan, Hunter & Wigham Richardson, Limited, launched from their new shipyard at Southwick-on-Wear a large sliding gate or caisson for one of the Admiralty new graving docks at Portsmouth. The caisson was launched on its side owing to the great draft of water required when in an upright position. It was then towed to the shipyard, where it was set upright by adding ballast, and then made ready for the voyage to Portsmouth. The caisson is an interesting steel structure about one hundred feet wide at the top and about fifty feet deep. At the side of the entrance to the graving dock a chamber is built of masonry, and into this the caisson is hauled, when the entrance to the graving dock is to be opened. This chamber is covered by a moveable camber deck fitted with apparatus for lifting or lowering it. The camber deck was shipped in pieces to Portsmouth, and where it will be erected and placed in position.

## ECONOMICS OF CENTRAL STATION HEATING.*

**By Byron T. Gifford.**

THERE are three important branches of central station heating: (*a*)the production of heat units; (*b*) the distribution of this product; and (*c*) making the service attractive to the consumer.

The first of these, the generation of heat, may be handled by three distinct methods: by direct firing, or "straight fuel burning" plants; by an electric generating plant with heating as a by-product; and by a combination of a by-product plant and a heating plant.

Owing to many causes the heating plants of the future will be of the last type. In an arrangement of this kind, electricity, for instance, can be produced much more cheaply than is possible in the most economical electric plant, and there are a number of ways of disposing of this by-product: It may be sold to an existing electric plant at a wholesale rate; a market may be made for it by creating industries requiring a fairly large amount of electricity at a comparatively low price. The author has in mind the case of an industry which has supplied to it 400 kw.-hr. of electricity 20 hours per day, 365 days per year, at less than 1 cent per kw.-hr. The net income to the heating company from this by-product is more than sufficient to meet the payments of the bond interest, taxes and insurance of the entire property. This additional income, amounting approximately to $11,000, is being handled with an increased operating cost of $2,200, as compared with the operation of the plant the year previous when no electric current was generated. With a simple or a twin Corliss engine a kilowatt of electricity can be generated under conditions which exist in the average central heating plant with 45 lb. of steam. Assume, for example, a heating plant serving 200,000 sq. ft. of steam radiation. This load gives an average demand on the boilers of about 40,000 lb. per hour, which, if sent through a simple or twin Corliss engine, will develop 880 kw.-hr. of electricity. Assume that this electricity is sold to some consumer for 1 cent per kw.; at this price 1 cent would be realized for every 45 lb., or 22 cents for every 1,000 lb. of steam delivered to the heating mains before it had left the station. The history of central station heating has proved that a rate averaging 60 cents per 1,000 lb. for steam is reasonable and can be procured from any heating consumer. This would mean 82 cents per 1,000 lb. for the steam generated, which is a good return on the investment.

Heating plants in America at present vary in size from a connected load of 10,000 sq. ft. of radiation to a connected load of 1,750,000 sq. ft. of radiation. These plants are built in towns of upward of 1,000 people.

There are few electric generating plants that can put a kilowatt-hour of electricity on their switchboard below a cost of ½ cent per kw.-hr., and there are also few electric plants that can generate and distribute to the primary side of their transformers for a cost of 1 cent per kw.-hr., especially when the overhead and fixed charges are considered. Heating plants, with electricity as a by-product can do this, and this fact alone will make a place for central heating plants. Some of the larger operating

* Abstract of paper read before the Chicago Section of the American Society of Mechanical Engineers, April 9, 1913.