The bridge has been designed for live loads on each of the four tracks, consisting of two 190-ton locomotives coupled and followed by a uniform load of 5,000 lbs. per lineal foot.

While the arch may be considered as two-hinged, the abutment bearings will be solid and made without pins. The whole design is such that the movement at the crown is only a few inches, and in a structure of this size it was considered useless to provide for very small movements at the abutments. There are two expansion joints in the floor system of ingenious design. They are so arranged that the opening is never more than ⅛ inch under any conditions. This was done to prevent the whole floor system moving under the action of a train starting or stopping on the bridge.

Beyond the main arch the viaduct is continued over Ward's Island to Little Hell Gate, which is not navigable to deep draught boats, and therefore required only an ordinary deck lattice truss bridge of five spans, varying in length from 105 to 245 feet. Beyond this the viaduct is continued over Randall's Island to the Bronx Kill, where a double lift bridge, having two spans of 160 feet, will be built. The line curves on a 3 degree curve from a point 80 feet north of the Hell Gate arch and then continues on a tangent to the main land at Port Morris, where connection is made with the New Haven. The maximum grade will be 0.72 per cent. compensated.

The method proposed for erecting the main arch is somewhat similar to that employed with the cantilever bridge now building over Blackwell's Island further down the river. The abutments and towers will first be built up to the level of the floor and the skew backs erected on falsework at the base. A temporary steel tower about 175 feet high will be erected on top of each pier and anchored in the rear by eye-bar chain cables with a strength of 1,700 tons. These cables will be carried back to a " dead man " about 425 feet in the rear of the abutments. The main floor girders will be brought to the bridge site and buried in the ground in four rows or columns between the " dead men " and the abutment to take up the horizontal thrust. In the beginning the shore panels will be erected by derricks on the piers, and as soon as these are up the eye-bar anchor chains will be anchored to the structure, being carried up about 90 feet on the temporary tower and then down to the rear. A traveller running on the top chord will be used to erect the arch, hoisting the members from scows moored in the channel below. After the first few panels have been erected the anchor chain will be raised to the top of the tower and the remaining erection completed. Closing of the arch will be done by manipulating sand or hydraulic jacks mounted under the foot of the temporary towers. No additional metal will be required in any of the members in the arch to provide for excessive stresses during erection.

The plans for this gigantic piece of engineering work were prepared by Gustav Lindenthal, consulting engineer, and Messrs. Palmer and Hornbostel, architects. Besides planning a bridge of ample strength, the designers have endeavored to make it as beautiful as possible. Mr. Lindenthal's conception is that of an imposing portal or gateway from the Sound into the East River, just as the Brooklyn Bridge forms a gateway from the harbor.

The steel used in the bridge will weigh in the neighborhood of 80,000 tons, and the whole structure will take about three years to complete.

The return of the British battleship " Dreadnought " after a cruise of 10,000 miles at an average of 17 knots seems to demonstrate the reliability of steam turbines for battleships. The " Dreadnought " is the first battleship provided with steam turbines, and for this reason the trial cruise has been watched with great interest by all concerned in ship building, as well naval as commercial. While there doubtless has been a great deal of information gained during this trial cruise, it is not likely, however, that much information of value will be given to the public, in view of the policy of the British admiralty of keeping such information secret.

MODERN AMATEUR MACHINE SHOPS.

By W. L. McLaren.

With a fore-word by Mark G. McElhinney.

I.

In these days of mental activity, surplus energy often finds vent in the prosecution of hobbies, so that there is being established an increasing number of amateur machine shops.

In the old days the amateur machinist was compelled to be content with a very meagre outfit, most of which was home-made, but to-day, thanks to the extraordinary development of tool-making, he is well looked after.

Many leading tool-makers pay particular attention to the wants of the amateur, and there is now no requirement which cannot be adequately met. In times past small tools were so expensive that only the rich man of leisure could indulge his tastes in this direction, but to-day these requirements are supplied at a price so reasonable that no man of average income, who so desires, need be without a fairly complete amateur outfit.

Another important advance lies in the fact that while the older small tools were very light and inadequate, scarcely more then expensive toys, the modern small lathes, shapers,

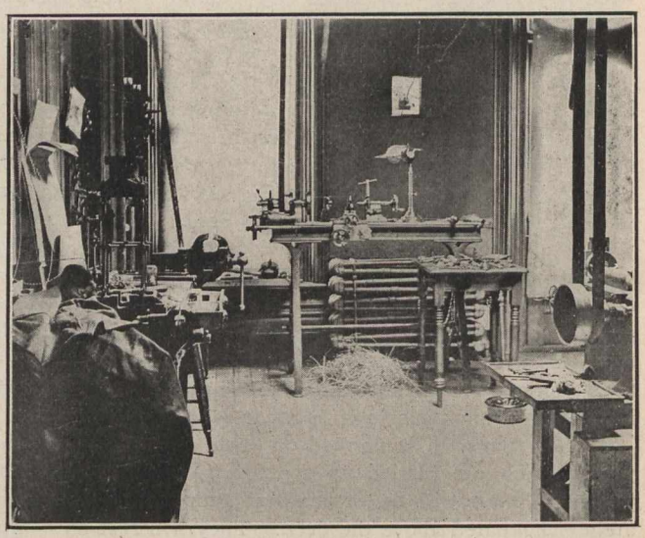

Fig. I.

drills, and other tools are marvels of efficiency and embody all the improvements and devices of their larger counterparts used by industrial concerns.

For a long time in England, France and Germany there were many amateurs amongst the leisure classes, and amateur work reached a high state of excellence, but in later years, since on our own continent there has been felt the results of rapid commercial development and consequent comfort, I think, that I may safely state that to-day in the United States, and in Canada, amateur mechanics has reached a stage never dreamed of in England and on the Continent.

Furthermore, I believe that, after twenty years' experience with small tools, without prejudice to my own nationality as a British Canadian, in the production of practical, efficient and beautifully-made small tools the United States leads the world.

Not only this, but we look to them for the thousand and one requirements in the line of castings, steel and brass goods, which are so necessary and convenient to the amateur worker. The above statement was furnished me by Dr. Mark G. McElhinney, of Ottawa, Ontario, and I include it in this article in order to show the attitude of the amateur machinist toward the subject, and more particularly as an opinion upon the high quality of the tools and materials which are manufactured in the United States.

Dr. McElhinney's shop is located in a brick addition to his residence. It is heated by hot water and lighted by elec-