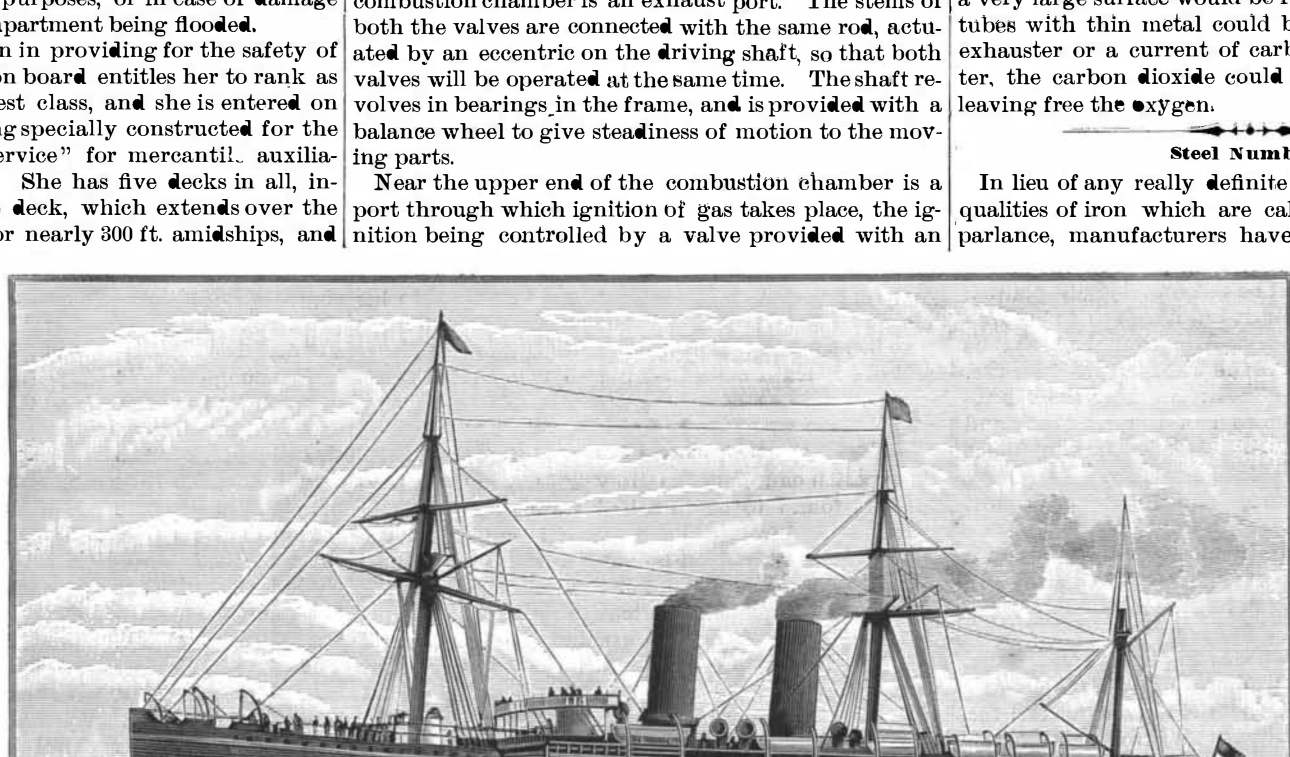
Coignet's Concrete.

M. Coignet has, says Captain Fowke, as the result of a series of experiments, given us the recipes for making two kinds of concrete suitable for house building, which he distinguishes by the epithets of economic concrete and hard and solid concrete. The first is composed of sand, gravel, and pebbles, 7 parts; argillaceous earth, 3 parts; quicklime, 1 part. This concrete, he says, properly beaten up and mixed, has given walls nearly as hard as the common soft rubble masonry used in Paris. In price it competes with ordinary pise work, over which, however, it has the advantage of being able to resist moisture. The hard concrete is composed of sand, gravel, and pebbles, 8 parts; common earth, burnt and powdered, 1 part; cinders, powdered, 1 part; unslaked hydraulic lime, 1½ parts. The materials to be perfectly beaten up together. Their mixture gives a concrete which sets almost immediately, and becomes in a few days extremely hard and solid, which property may be still further increased by the addition of a small quantity, say one part, of cement; and the price, depending principally on that of the time and labor, was in Paris, under favorable circumstances, 3½d. to 4d. per cubic foot; with more favorable conditions, 2d. per cubic foot. A house three stories in height, 65 feet by 45 feet, standing on a terrace, having a perpendicular retaining wall 200 feet in length and 20 feet high, has been actually constructed with every part, including foundations, vaults of cellars, retaining wall, all walls, exterior and interior, without exception, of this hard concrete (Beton dur), as well as the cornice, mouldings, string courses, balustrades, and parapets, and without bond iron, lintels, or wood throughout. The use of plaster in the interior is also avoided, as the concrete takes a surface sufficiently fine for papering.

THE NEW CUNARD STEAMSHIP ETRURIA.

In September, 1884, Messrs. John Elder & Co. launched from their yard at Govan the Etruria, a large steel screw steamer for the Cunard Company, to supplement their service of express steamers between Liverpool and New York. The dimensions of the vessel are: Length over all, 520 ft.; breadth, extreme, 57 ft. 3 in.; depth to upper deck, 41 ft., and to promenade deck, 49 ft.; with a gross tonnage of about 8,000 tons. She is entirely built of steel throughout, and is divided into 10 water tight compartments, most of the bulkheads being carried up to the upper deck, and fitted with waterproof and fireproof doors, giving access from one part of the ship to the other. By this arrangement the danger of fire spreading, should it break out in any division of the ship, is removed as far as possible, and greater safety is obtained by being able to isolate any apartment for sanitary purposes, or in case of damage to the hull and the compartment being flooded.

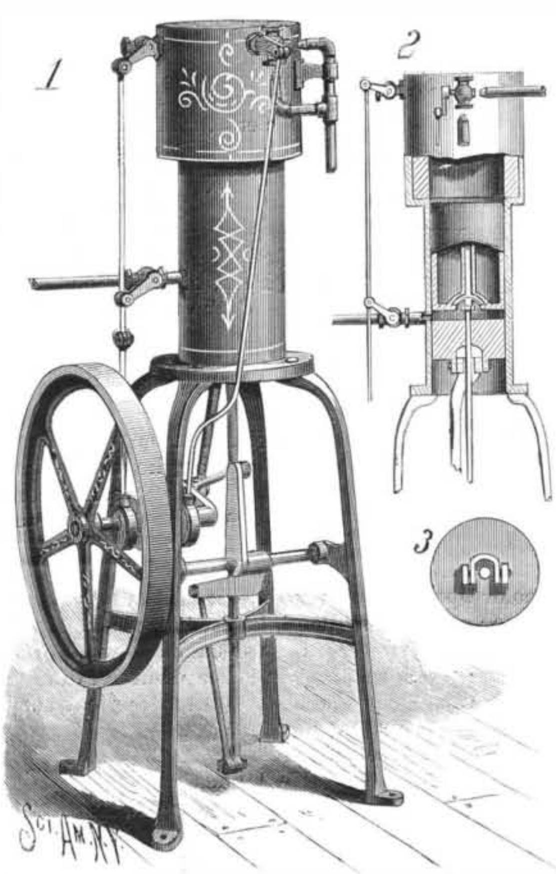
The special care taken in providing for the safety of the ship and the lives on board entitles her to rank as a transport of the highest class, and she is entered on the Admiralty list, being specially constructed for the requirements of the "service" for mercantile auxiliaries in the time of war. She has five decks in all, including the promenade deck, which extends over the breadth of the vessel for nearly 300 ft. amidships, and would be reserved for the use of first-class passengers. The first-class accommodation forms a special feature, and occupies the whole of the main and lower decks, with the exception of the portion set apart for the use of the crew. Altogether, accommodation can be provided for 720 first-class passengers, the largest part of which is arranged for two-berth staterooms only, which are replete with all fittings usual in the highest class of passenger steamers—a number of the rooms being fitted *en suite* for family use. The engines are made to indicate upward of 14,000 horse power. They are compound, having three inverted cylinders—one high pressure 71 in. in diameter, and two low pressure each 105 in. in diameter. The high pressure cylinder is placed between the two low pressure cylinders, and all are adapted to a stroke of 6 ft. The Etruria reached New York from Liverpool, on her first voyage, on May 4, 1885; on one day during the trip she ran 449 miles. On her trial trip she made 24 miles an hour. Our engraving is from the *Illustrated London News.*



THE NEW CUNARD STEAMER ETRURIA.

AN IMPROVED GAS ENGINE.

It is claimed that the gas engine herewith shown saves a great part of the heat which, in the engine of ordinary construction, is taken up by the water in the jacket. It gives power at every stroke, and is thus more efficient than those giving power only at alternate strokes. The engine cylinder is made with an



McDONOUGH'S IMPROVED GAS ENGINE.

open lower end attached to a supporting frame, and is prolonged upward for a distance equal to about two diameters. The upper part is made larger than the lower, so as to form a space for a fire brick lining, shown in the sectional view, Fig. 2. The upper part constitutes the combustion chamber, and by this construction the engine is less expensive to manufacture than if the parts were made separately and bolted together. In the lower part of the main cylinder is an inlet port to admit gas, and in the upper part of the combustion chamber is an exhaust port. The stems of both the valves are connected with the same rod, actuated by an eccentric on the driving shaft, so that both valves will be operated at the same time. The shaft revolves in bearings in the frame, and is provided with a balance wheel to give steadiness of motion to the moving parts.

Near the upper end of the combustion chamber is a port through which ignition of gas takes place, the ignition being controlled by a valve provided with an ignition gas jet and a relighting jet. This valve is operated by an eccentric on the driving shaft, so that it will be opened and closed at each revolution. In the cylinders are two pistons, the upper one being made long, and formed with a central longitudinal perforation, in the lower end of which is a valve opening upward to allow the gas to pass freely upward and prevent its return. The lower end of the piston rod of the long piston is connected with the long arm of an elbow lever operated through a rod connecting its other arm with the crank of the driving shaft. To the shaft is also pivoted the piston rod of the lower piston.

The operation of the engine may be easily understood: When the long piston begins to move away from the other, the gas enters the space between them, and at the same time the spent gas from the previous ignition is driven out through the exhaust port. Then the pistons move toward each other, when the gas, being compressed, opens the valve and passes through the perforation in the long cylinder into the combustion chamber. When the short piston is at the end of its inward stroke, and the long piston is nearly in contact with it, the gas is ignited, and expands, forcing the pistons outward and completing the cycle of movements. By this arrangement the gas is introduced into a cold cylinder, compressed, and then transferred to a hot chamber, where it is fired, expanded, and exhausted at each revolution of the shaft.

This invention has been patented by Mr. Thomas McDonough, of Montclair, N. J.

Separation of Oxygen by Means of Silver.

Troost has recently demonstrated that metallic silver allows oxygen gas to pass through it at a red heat, in a manner similar to the passage of hydrogen through red hot platinum or iron, which was proved some years ago by Deville and Troost. For the experiments a tube of silver was used with a diameter of 1 cm., the thickness of the metal being 1 mm. This was inclosed in a rather larger tube of platinum. When the tubes were heated, and oxygen gas was drawn through the space between the tubes, it was found to pass into the silver tube. The amount passed corresponded to 1·7 liters per hour for every square meter of silver surface. If air were passed between the tubes instead of oxygen, then it was found that practically only oxygen found its way through into the silver tube, as only traces of nitrogen accompanied it. The rate of passage was, however, very much diminished. These experiments were carried on by exhausting the silver tube by means of a Sprengel pump, but it was also found that it was not necessary to thus exhaust, as the simple passage of some other gas through the tube, such as carbon dioxide, was sufficient to cause the transfusion to take place, though at a considerably less rate than exhausting. When a silver tube of less thickness than 1 mm. was used, the rate of transfusion was increased. Various other gases were passed between the tubes, but they only passed through the silver at a very slow rate. It is suggested that this quality of silver, of allowing oxygen to pass with comparative ease, may be some day made use of for isolating the oxygen of the atmosphere, for which purpose a very large surface would be required. Large coils of tubes with thin metal could be used, with either an exhauster or a current of carbon dioxide. If the latter, the carbon dioxide could be absorbed in alkali, leaving free the oxygen.

Steel Numbers.

In lieu of any really definite name for the different qualities of iron which are called "steel" in popular parlance, manufacturers have adopted a system of numbering that gives some notion of the condition of the product by designating the relative amount of carbon that the converted iron has received. It would be better if they would have suggested, also, other materials than carbon; for the best of steel is not only iron with a high and certain amount of carbon, but all steels must contain something besides iron and carbon to be workable and useful.

Soft and low steels are known from 0·10 to 0·76 of carbon; the lower grades are merely purified irons, with none of the qualities of crucible steel; they weld without flux, work soft at high heats, are not burned when approaching the welding heat, and are affected by sudden chilling in a cold bath only as iron would be. As the numbers approach a full per cent of carbon, the steel begins to act like crucible steel; requires a flux for weld, chills and hardens in water, and is capable of being tempered and of receiving a cutting edge. This method of designation is much better than the loose naming of the differing grades "iron" and "steel."