

the steel than in the iron boiler. The former evaporated 11.66 cubic feet of water per hour; the iron boiler 9.37 cubic feet. The quantity of coal consumed was on an average 2,706 pounds for the steel one in twelve hours, and 2,972 pounds for the iron boiler. The plates of the steel boiler over the fire were found to be uninjured, while those of the iron one were about worn out. In Prussia several worn out plates of iron boilers have lately been replaced with steel, which, it is stated, lasts four times as long. As steel is twice as strong as iron, thinner plates of the former may be employed for boilers, and more perfect riveting can be secured. A greater quantity of steam can also be generated in the steel boiler on account of its thin plates, and thus much fuel may be economized.

Steel Ships.

On Wednesday forenoon two large vessels built of steel were launched from the building-yard of Messrs. Jones, Queegan & Co., at Liverpool. One was a sailing-ship named the *Formby*, of 1,271 tons tonnage, built for the East India trade; the other a paddle-wheel steamer named the *Hope*, of 1,492 tons. At a *dejeuner* which took place after the launch, Mr. Jones made some remarks on these vessels. He said that steel is much stronger than iron, weight for weight, and, consequently in shipbuilding, that equal strength can be given with less weight of steel than of iron. The strain resisted by iron-built ships had been found to be from 19 tons to 20 tons per square inch, while the resistance of steel is found to range from 42 tons to 48 tons, giving a mean of 45 tons for steel, or considerably more than double that of iron. Keeping these results in view, the *Formby*, a vessel built of steel, required 500 tons of material in her hull, while a similar ship made of iron would have required 800 tons. The difference in weight of hull would cause a difference of nearly 2 ft. in displacement in favour of the steel vessel, requiring also less propelling power. In the case of steamers, the advantages were still more obviously in favour of steel. If the *Persia*, a steamer of 3,600 tons and 900-horse power, had been built of steel instead of iron, her displacement would have been diminished about one-sixth, and she would have been enabled to carry double her present cargo. Mr. J. Reed, the Chief Constructor in the Royal Navy, who was present, said he should watch with great interest the career of the two ships which had just been launched. He remarked that merchant ships can be built to test a principle when war-ships cannot, as the former can be examined and repaired annually, while the latter are sent abroad for periods of three or four years. He perfectly agreed with what had been said of the importance of steel for the construction of small ships, and stated that the Government took great interest in the question of employing steel as a material for shipbuilding.

Case-hardening Iron.

A new method of case-hardening iron has been patented in Germany by M. Martignoni. The process consists in rubbing the surface of the iron, while at a red heat, with the following composition:—5 parts of cow-hoof, reduced to fine shavings;

5 parts of quinquina; 2.5 parts of common sea-salt; 1.5 parts of saltpetre; and 10 parts of coarse black soap. This mixture is formed into a paste, and applied by a roller, on which it is smeared. The iron is subsequently tempered in cold water.

Substitute for Paint over Plaster.

A Frenchman has discovered a substitute for paint over plaster. A coat of oxide of zinc, mixed with size, and made up like a wash, is first laid on the wall, ceiling, or wainscot, and over that a coating of zinc, prepared in the same way as the first wash is applied. The oxide and chloride immediately effect a sort of combination, forming a cement, smooth and polished as glass, and possessing the advantage of oil paint without its disagreeable odour.

New Gas Material.

At a stated meeting of the Franklin Institute, held in Philadelphia, November 19th, Professor Fleury exhibited samples of a new artificial fuel and gas material, the invention of Mr. William Gerhardt. This invention consists in preparing porous bricks, balls, or otherwise shaped fireproof material, which are fully saturated with gas-tar, coal-oil, or any other hydrocarbon of a similar nature. These bricks are afterwards dried, and used for the purpose of producing illuminating gas or fuel. The oil having burnt out, the material is used over again; it leaves no ashes, and preserves its porosity. The use of fuel that is free from sulphur is of the highest importance in the manufacture of steel, iron, glass, &c., and it is claimed that this artificial fuel is well adapted for these purposes, as well as for other uses, because the price of manufacture is not so high as the present price of coal.

How Change of Sex is Accomplished in a Beehive.

Carpenter informs us that in every hive of bees the majority of individuals are neuters, which have the organs of the female sex undeveloped, and are incapable of reproduction, that function being restricted to the queen, who is the only perfect female in the community. If by any accident the queen is destroyed, or if she be purposely removed for the sake of experiment, the bees choose two or three from among the neuter eggs that have been deposited in their appropriate cells, which they have the power of converting into queens. The first operation is to change the cells in which they lie into royal cells; which differ from the others in form, and are of much larger dimensions; and when the eggs are hatched, the maggot is supplied with food of a very different nature from the farina or bee-bread which has been stored up for the nourishment of the workers, being of a jelly-like-consistence and pungent stimulating character. After the usual transformation, the grub becomes a perfect queen, differing from the neuter bee, into which it would otherwise have changed, not only in the development of the reproductive system, but in the general form of the body, the proportionate length of wings, the shape of the tongue, jaw and sting, the absence of the hollow in the thighs where pollen is carried, and the loss of power of secreting wax.