an average, for the year 1882, of 113,500,000. The slip of valves is reduced to one-half of one per cent.

ECONOMY OF STEAM-BOILERS.—William Kent reports, to the American society of mechanical engineers, the results of a series of tests of fuels in various ways, and under various forms of boilers. He gives the following as relative values of fuels determined by burning under the Babcock & Wilcox boilers:—

Welsh bitum	109.6.
Scotch bitum	109 5.
Cambria, Penn., semi-bitum	91.2.
Pittsburgh, Penn., bitum	99.5.
Ohio bitum	84.9.
Vancouver's Island	85.7.

PREVENTING THE FREEZING OF WATER IN WATER CLOSETS.—According to this invention, the inventor, Mr. J. W. Blakey, applies a receptacle or box at any suitable or convenient position between the water main and the point where such water is discharged, and fills the receptacle or box with rock or other salt. The water pipe is coupled or attached to each end of this receptacle or box, so that any water that comes from the main to the discharging point has to pass through the box. The pipe connections are moreover so arranged that a portion only of the salt is exposed to the rush of the water, and so that only a suitable portion of the salt is taken up each time. The water passing through the box takes up the required quantity of salt which has the effect of preventing it freezing. A salt-supply receptacle is arranged in connection with the box and a valve for recharging the latter therefrom as required.

HARDENING SOFT LIMESTONES WITH FLUOSILICATES.—The application of alkaline silicates to the exterior of buildings, in order to prevent the deterioration of the stone, has not been attended with satisfactory results. H. L. Kessler proposes to use a solution of fluosilicates of bases whose oxides and carbonates are insoluble in a free state. When soft limestone is saturated with a concentrated solution of a fluosilicate of magnesium, aluminum, zinc, or lead, a very considerable degree of induration is soon reached, and the resulting products, except the liberated carbonic anhydride, are less soluble than the stone itself. No varnish is formed, and therefore no danger arises from expansion of frost beneath it. The process has resisted the severe tests of winter. Colors may be introduced satisfactorily.

SIMPLE AND COMPOUND ENGINES ON SHORT ROUTES.—Mr. Boulvin has determined a series of formulas expressing the relations between size of vessel, weights carried, and distances traversed, and the weights of the simple and the compound engine, and finds, that, for short routes, the best form of engine is the single cylinder rather than the compound. He finds that for lines from twenty to sixty miles in length, as those from Dover to Calais and from Ostend to Dover, a gain of a knot an hour may be obtained by the use of the simple engine instead of the compound, in consequence of the saving in weight of machinery. On long routes the economy is on the side of the compound engine, in consequence of the saving in weight of fuel. The later practice of English constructors has been in accordance with this result, and with the principles involved in the work of Mr. Boulvin. He constructs curves showing the equations graphically, and illustrates their use by examples.

HEAVY ENGINES AND AMERICAN RAILROAD-TRACKS.—Mr. O. Chanute states that heavy "consolidation" engines do not injure the track more than the lighter engines formerly did. Trains have been lengthened from 22 cars in 1874 to 38 in 1883; and the weights hauled, from 106 to 223 tons. By strengthening draw-heads, links, and pins, accidents from breaking apart of trains have been diminished, and the cost of haulage has been reduced from one cent to a half-cent per ton per mile.

M. P. TIHON has lately shown at the Industrial Science Society of Lyons a new semi-incandescent lamp, giving the brilliancy of an arc light. This is attained by having two carbon rods, slightly inclined to one another, brought down on to a small prism of chalk, and separated from one another by a small rod of the same material. The current passes through the chalk rod making it incandescent. By this means the light is rendered steadier than an arc light, and it is said to have the same brilliancy.

MAHOGANY STAIN.—A very good and cheap method of preparing mahogany stain is to boil one pound of logwood in four quarts of water, and add a double handful of walnut peelings. Boil again, take out the chips, and add one pint of vinegar. This does best for beech wood. Another method is to grind burnt sienna in ale or vinegar, make it thin, spread on with a brush, and, while wet, it may be grained and shaded with the same, using burnt umber. For black walnut use the same, using burnt umber. For yellow stain, grind and mix with ale or vinegar, aloes or gamboge; or, make a stain by boiling curcuma in water.

NATURE-PRINTING.—A novel style of printing from natural objects has just been perfected by Mr. Thos Stonywood. In this process the impressions are taken directly from the objects themselves, thereby possessing a vigour and a freshness, to which mere copying, however artistically done, could never attain. Articles as diverse as a spider's web and a mutton chop are reproduced with almost photographic exactitude, round objects and flat being copied with equal facility. Thus leaves are copied with exquisite effects. As impressions of both large and small specimens can be transferred and on any substance, many channels are opened for the employment of this ingenious method of printing.

CREDIT TO AN AMERICAN NATURALIST.—In an official report by M. Bouchen-Brandely, secretary of the college of France, the author states that he has learned by two years of study that the sexes of the Portuguese oyster are confined to separate individuals; that after this discovery he conceived that it might be possible to artificially fertilize the eggs of this mollusk; and that, after two years more of experimenting, this attempt has been successful. Americans will be interested to learn that in 1879 an American naval officer, Lieut. Francis Winslow, who was stationed at Gibraltar for a few weeks, determined the unisexuality of the Portuguese oyster, and reared it from artificially fertilized eggs. His results were printed in the *American naturalist* in 1879 or 1880; but, as I have no opportunity for reference at present, I cannot give the exact date.

COCOA AND CHOCOLATE.—Many drinkers of these pleasant beverages are unaware as to the method by which the cocoa seeds are obtained. Cocoa, or cacao, is extracted from the seed of small trees of the genus theodrama, which, when cultivated, grows from 12 ft. to 18 ft. high, but to a higher elevation in their wild state. The flowers are small, and cluster on the branches and trunks, the matured fruit appearing as though artificially attached. Out of each cluster only one pod is allowed to mature, and this when full grown is from 7 in. to 10 in. long by 3 in. to 4½ in. wide. The five cells contain each a row of from five to ten seeds embedded in a pink, acid pulp, the cocoa bean. The tree is indigenous to Mexico, but it can be cultivated within the 25th parallels of latitude, and thrives at any elevation under 2,000 ft., but it requires a rich soil, a warm humid atmosphere, and protection from cold winds. The trees are propagated from seeds in a nursery until they attain a height of from 14 in. to 18 in., when they are transplanted and carefully sheltered by planting other trees about them. They commence to bear about the fifth year, but do not attain maturity until the eighth, and continue yielding fruit for nearly half a century. There is no special time for harvesting the crop, as the trees continue bearing all the time, flowers and fruit in all stages being curiously borne on the same tree. But in Venezuela the principal gatherings are in June and December. Chocolate is generally made from the finer varieties of cocoa seeds, and was a favourite beverage in Central America long before Columbus discovered the New World. As at present prepared, chocolate is made in cakes, while cocoa is usually sold in powder, flakes, or nibs. The constituents of the average cocoa seed are as follows: — Fat, cocoa butter, 32; nitrogenous compound, 20; starch, 20; cellulose, 2; theobromine, 2; saline substances, 4; water, 10; cocoa red, essential oil, 10.

THE following is an illustration of what private enterprise may effect for the benefit of science. When the Swedish ship *Monark* was leaving Sweden last year for Australia the second officer on board applied to the Zoological Museum at Upsala for the loan of a trawl and some vessels for preserving natural history objects. The results have been the collection of some 120 species of fish, 50 of insects, some birds, and about 100 varieties of the lower sea fauna of the Pacific, which have now arrived at Upsala.