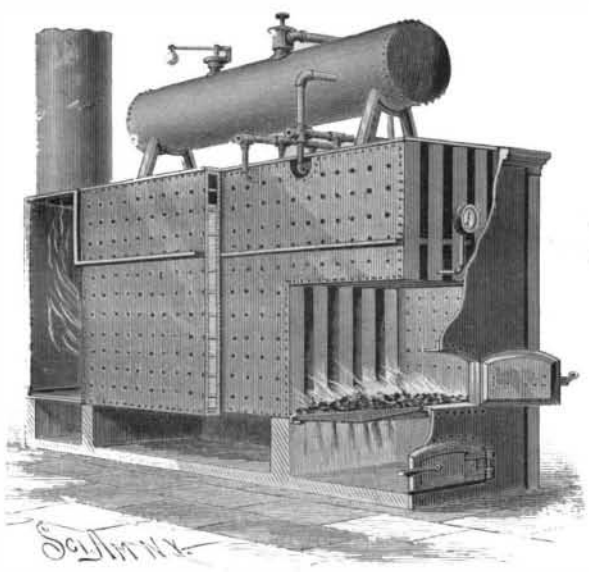
IMPROVED STEAM BOILER.

The boiler shown in the accompanying engraving has an extensive heating surface, and is capable of standing high pressure. The water boxes or sections are formed of sheets of iron or steel, connected by short bolts and retained apart a short distance by strips at the edges, so as to form boxes of flat form, the space between the sides being about an inch. Any suitable number of these boxes are placed side by side with narrow spaces between, and are connected by braces so as



COOPER'S IMPROVED STEAM BOILER.

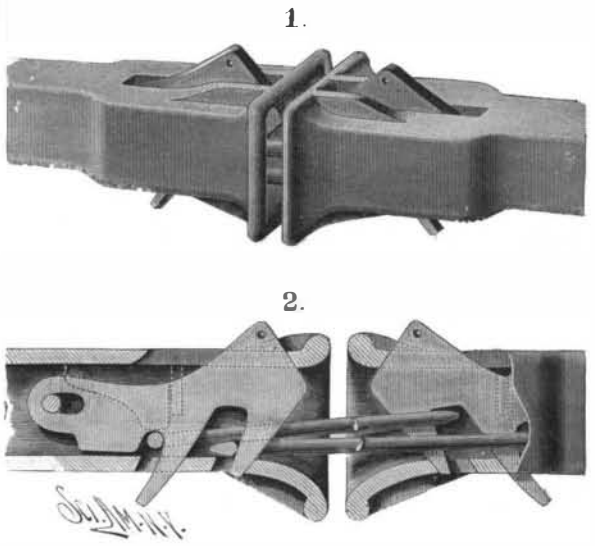
to form flues that terminate in a smokebox at the rear end of the boiler. Between the sections, a short distance below the water line, are placed bars which extend from the front plate to the smokebox, and are bent at the inner ends and extended upward to the top of the sections; these bars prevent the flame from rising too high between the sections. The interior boxes are cut out at the front end to form a firebox, the sides of which are formed by the outside boxes. Pipes connect the boxes with the steam dome; the feed water pipe is connected with the rear lower ends of the boxes. It will be seen that this boiler has extensive heating surface compared with the body of water, and can be made to stand a high pressure.

This invention has been patented by Mr. George H. Cooper, of New Westminster, British Columbia, Canada.

A DOUBLE-LINK, AUTOMATIC CAR COUPLING.

The top of the drawhead of the coupling herewith shown has a slot of sufficient size to allow the coupling hook to be readily inserted and removed through it, the hook having a short slot in its rear to receive a pin, by which it is secured in place, the pin being kept in position by a key or other suitable means, and so arranged as to allow the coupling hook the necessary play. Fig. 1 is a perspective and Fig. 2 a sectional view of the couplings linked together. The coupler has two hooks upon its lower side, for which there are corresponding slots in the lower side of the drawhead, the rear hook being made so long that it will never be raised out of its slot when the coupler is in use. The forward side of the forward hook is inclined or rounded so that it will be raised by the contact of the coupling link of the opposite car when the cars are run together, to allow the link to pass this forward hook, which then drops back into place and the cars are coupled. The coupling hook has three bearing points besides the pin on which it works—an inclined seat at the forward end of the slot in the top of the drawhead and two inclined seats at the forward end of the two slots in the bottom of the drawhead. With this construction, each drawhead is permanently provided with a coupling link, the inner end of which is held by the rear hook; and when two cars are run together, the draught strain will be sustained by two independent links, either of which is intended to be sufficiently strong for use should the other be broken, while, should both be broken, the cars can be coupled by an ordinary coupling link, and the coupling still be automatic.

This invention has been patented by Messrs. William H. Adams, James D. Felthousen, and Albert Lawtenslager, of Albany, N. Y., and is an improvement on a former patented invention of the same inventors. For further particulars in reference thereto address Mr. Albert Lawtenslager, 71 North Pearl Street, Albany, N. Y.



AN IMPROVED CAR COUPLING.

CONSTRUCTION OF TORPEDO BOATS.

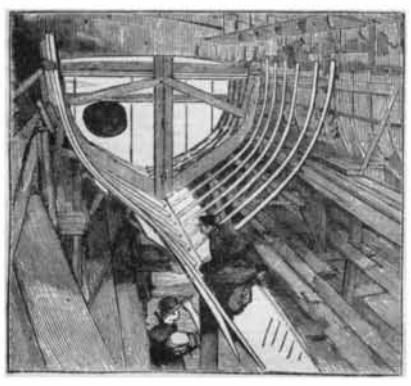
The construction of torpedo boats is an industry of very recent growth. It is one, however, which has of late attracted much attention, in consequence of the rapid increase in the number of such vessels in foreign navies, and the very few in our own. We are glad this deficiency is being fast put an end to; the British Government having in the course of construction at the present time no less than fifty thoroughly serviceable first-class, sea-going torpedo boats, all of which will be completed in the course of this year.

Among the most celebrated constructors are Messrs. Yarrow & Co., who, during the last few years, have supplied nearly every country in the world with boats of this type; and the British Government at the time of the Russian scare last spring contracted with them for the supply of twenty-four, which are now fast approaching completion. In addition to these, Messrs. Yarrow & Co. are building similar vessels for the Spanish, Austrian, Dutch, Italian, Japanese, Portuguese, and Chilian Governments; and at the present moment their works represent a scene of the greatest possible activity —a very pleasant contrast with the general depression of trade in other parts of the country.

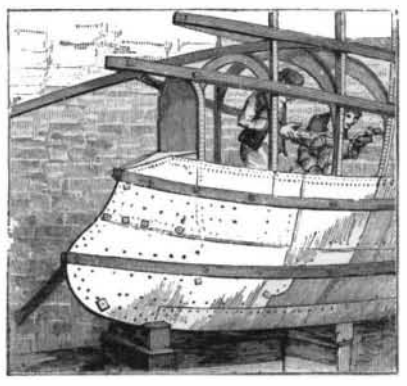
In these works, not only are the vessels themselves constructed from the very commencement, but also the machinery for propelling them, giving employment to over 1,200 men.

To give some idea of the amount of material which enters into the construction of a torpedo boat, it may be mentioned that the bars forming the skeleton work of the hull, if laid out in a continuous line, would extend for a length of over two miles, all of which has to be bent into shape, punched, and fitted up in its place, to which framework the outside skin plating of the hull is attached.

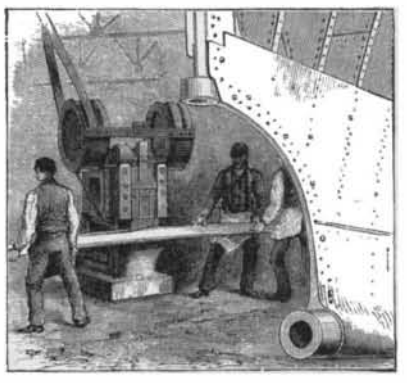
The longitudinal section represents probably the most interesting torpedo boat ever constructed, and shows very clearly what the internal arrangements of such a



TRAINING THE HULL.



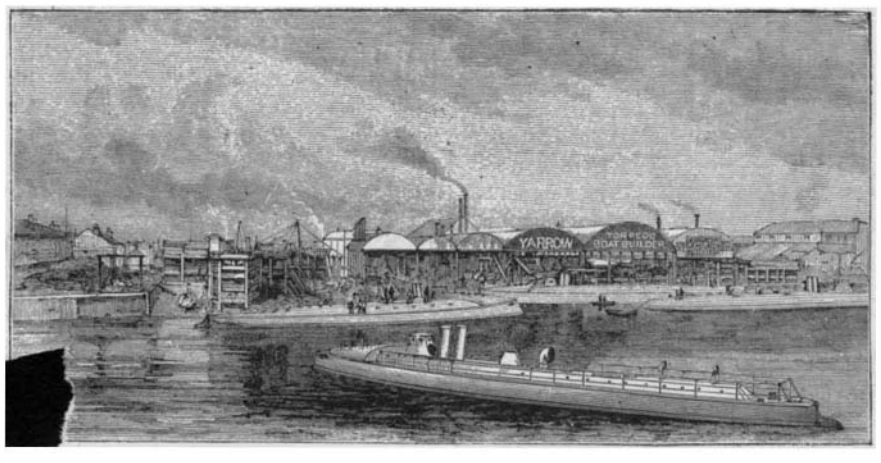
PUTTING A SKIN PLATING AT THE BOW.



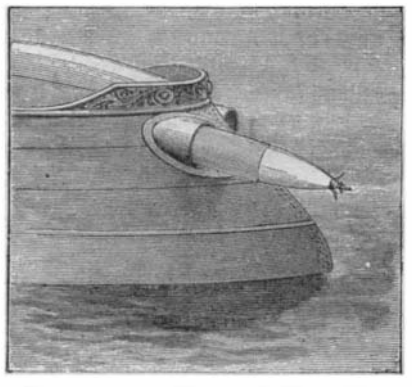
SHEARING A SKIN PLATING.

FORGING STEEL SCREW PROPELLER.

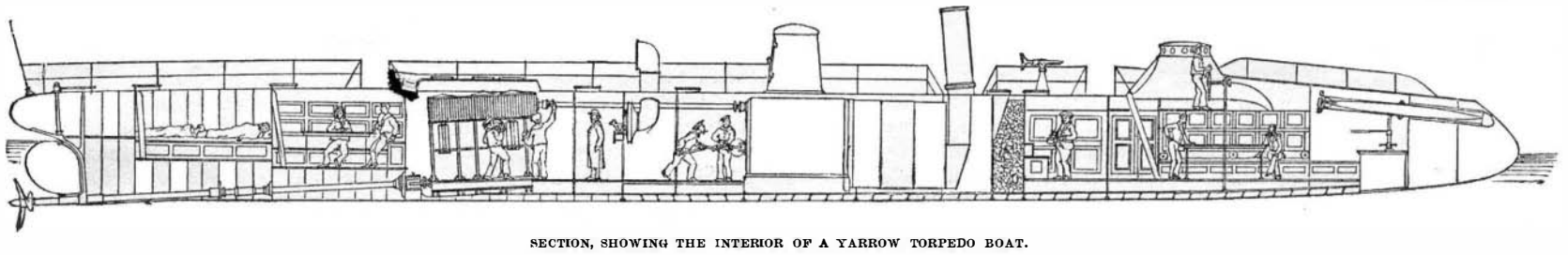
BORING OUT SCREW PROPELLER.



VIEW OF MESSRS. YARROW & CO.'S WORKS FROM THE RIVER THAMES.



VIEW OF BOW, SHOWING WHITEHEAD TORPEDO BEING DISCHARGED.



SECTION, SHOWING THE INTERIOR OF A YARROW TORPEDO BOAT.

CONSTRUCTION OF TORPEDO BOATS AT YARROW & CO.'S WORKS LONDON.

craft are like. In the bow are two tubes, into which, it will be seen, the Whitehead torpedoes are placed. They are ejected from these tubes at the required moment by the officer in charge, which is done by means of either compressed air or gunpowder. Aft of the torpedo compartment are the commander's and officers' cabins, next to which come the boiler and engines. We may here remark that the stokehole is sealed down air tight, no ingress or egress being permitted, and air is pumped into it by means of a steam ventilator, so that the men who are firing the boiler are actually at work under a pressure of air. Aft of the machinery compartment there is the crew space and petty officers' cabin. On deck will be seen two conning towers—one forward of the funnels, which is for use in time of war; the other, on deck amidships, being in a more suitable position for navigating when cruising about. The special interest that attaches itself to the torpedo boat represented by the sectional view is due to its unprecedented speed, which, on recent trials, was shown to be 27½ miles an hour. It may here be mentioned that when going full speed the boiler consumes no less than 1½ tons of coal per hour, evaporating water at the rate of one ton every four to five minutes, the engines developing over 1,200 horse power. —*Illustrated London News.*

Concrete as a Fireproof Material.

The engine works of the Barrow Shipbuilding Company, only lately restarted, are largely constructed of stone, and except in connection with the roof, pattern makers' floor, brass finishers' department, stores, and the gates, there is little or no wood, and yet stone it appears is not a good fire-resisting material and the best of it cracks, while iron exposed to a fierce flame buckles and twists and is soon practically destroyed. Properly made concrete, however, successfully resists fire, and when iron beams or joists are embedded in it, they are well protected. It is now possible to construct large buildings entirely of concrete, although for roofing it is not perhaps always successful; but for walls and floors it is eminently suitable, while its use for foundations is widely known—for this latter purpose six parts of ballast, one of sand, and one of Portland cement makes a concrete good enough for any kind of foundation. When great care is taken in making concrete for walls, these can be one-fifth less in thickness than brickwork. For flooring, concrete has successfully stood the test, especially in the North of England, and there is a large warehouse in Sunderland which has no less than 1,800 tons of cement concrete in its floors. These were made of slabs, some being as large as 21 ft. by 12 ft. 6 in. and 13 in. thick—four parts of hard broken brick to one of Portland cement being used; and the iron girders were thoroughly embedded on all sides, except under the bottom flange. After six years these floors stand quite unshaken, and although there have been two or three serious fires, no damage has yet been done to the building itself. Care was taken to see that the cement used was not below 700 lb. tensile strength per square inch.

A Cheap Camera.

A good substitute for a more expensive camera lucida for the microscope can be made as follows: Cut a piece of thin metal, brass or copper (or even tin will do), into the form of a letter L. After smoothing the edges, bend one limb into an inclosed band, to clasp the end of the eyepiece after the cap is removed. Clasp the other limb, near its **juncture with** the ring, **with a pair of pliers, and twist** it on its **own axis through an angle of 90°.** On the **outer end bend a cockeye to hold** a piece **of wood, in the end** of which make a slight split and insert the edge of a cover glass to serve as a mirror. Of course, both the image and the pencil point are seen by looking through the glass—the former by reflected, and the latter by transmitted light. The light reflected is sufficient to give good definition when ordinary powers are used. In this way, each member of a class can easily make a camera for himself.—*Botanical Gazette.*

Venice.

A. S. VON ROCHAN.

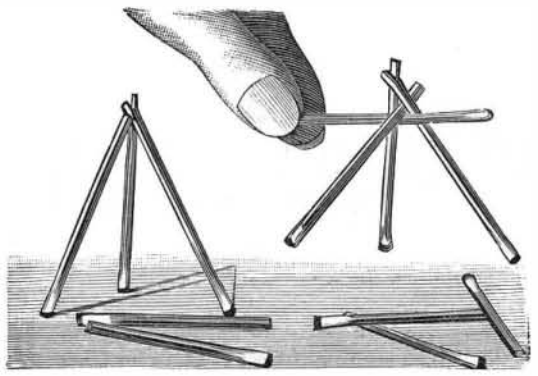
There are two things in Venice that I have never been able to make out: How do they build a house, and how do they put out a fire? Building materials, of course, can be procured, and there is certainly no want of water. But where is the ground on which firemen or builders can take their stand? Even for the commonest repairs of houses three or four stories high, in streets only five or six feet wide, some plan must be adopted of which I have no conception. Two or three beams, half a hundred building stones, and a hod of mortar would block up the street, and interrupt the traffic of a whole quarter.—*Architect.*

SIMPLE MATCH TRICK.

To lift three matches by means of one, it is necessary to make an incision in the end of a match and insert the pointed end of a second match into this incision. Place them on the table with a third match resting against them for a support, as shown at the left of the figure. Then present a match to any one who may be looking on, and ask them to raise the three together by means of the match in the hand.

The solution is given at the right of the figure. Bear lightly against the two matches that are joined until the third falls against the one held in the hand. Then raise it, and all three will be lifted together.

Although this trick, which we find described in a



A SIMPLE MATCH TRICK.

French paper, *Le Chercheur*, is probably as ancient as the art of making matches, our juvenile readers may find it of interest, and possibly it may afford them a half hour's amusement at recess time.

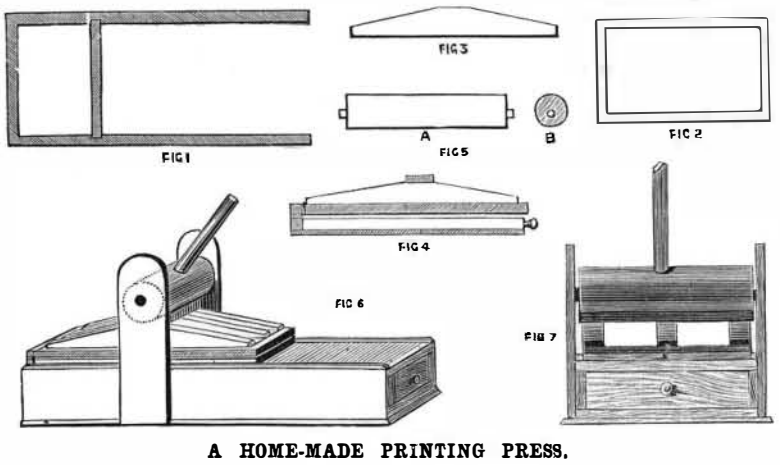
Heat Developed by Various Systems of Lighting.

In the *Zeitschrift fur Elektrotechnik*, Mr. Wilhelm Penkert gives the following as the results of his experiments on the amount of heat emitted by various kinds of lights during one hour:

INCANDESCENT LAMPS.	
Siemens & Halske	427 units.
Edison	355 "
Swan	430 "
GAS BURNERS.	
Siemens recuperator	1,500 units.
Argand burner	4,860 "
Two-light burner	12,150 "
KEROSENE.	
Round wick	3,360 units.
Flat wick	7,200 "
MISCELLANEOUS.	
Carcel lamp	4,200 units.
Paraffine candle	9,200 "
Spermaceti candle	7,960 "
Wax candle	7,960 "
Stearine candle	8,940 "
Tallow candle	9,700 "

A HOME-MADE PRINTING PRESS.

"Faust," in the *Amateur*, of London, gives the drawings and details for building a press capable of printing a sheet 8 x 10 in., and which is of a strength and solidity sufficient to give a good impression. Figs. 1 and 2 show sections of frame; Fig. 3, pieces for giving strength to top of platen; Fig. 4, carriage with its hinging; Fig. 5, front and end elevation (A and B) of impression roller, so made as to form with its handle an eccentric lever; Figs. 6 and 7, perspective and end views of press. The pieces for frame, drawer, guides, etc., are of clean yellow deal, well seasoned and free from knots, while the platen, bed, and sides and ends of carriage are made of mahogany. The manner of making a platen here shown insures its being almost as rigid as if it were made of cast iron. The turning of the impression roller must be looked after with care, to be sure that the two pins just off the center at the ends, on which the roller turns, are absolutely in line with each other. The press will be greatly improved in appearance and its durability will be increased by a thorough coating with a spirit varnish. It is estimated that the cost of the materials for such a press will not exceed from $2.50 to $3.



A HOME-MADE PRINTING PRESS.

Council of Engineering Societies on National Public Works.

The organization now includes twenty-one engineering societies, representing a total membership of about 2,600. It was resolved at the last meeting that the organization should be called the Council of Engineering Societies on National Public Works, and that its object should be to promote an improved system of national public works. In making the Council permanent, a president, vice-president, and executive board of seven members were chosen, and it was decided that its membership should consist of the committees on public work of the various engineering societies throughout the United States, and as associates, with all the privileges except that of voting, any engineers interested in the development of a national policy. The organization has already enlisted the interest of many of the most prominent American engineers, and promises to make itself felt in influencing the future engineering work of the Government. Sub-committees of one member were appointed to gather information in regard to the organization and conduct of the public works of the United States, France, Italy, Austria, Great Britain, and Canada. These results will be published from time to time, and a strong effort made to secure public co-operation. A committee was also appointed upon legislative information. It is believed that the best informed members of Congress appreciate the fact that the time has come for a radical change in the administration of the internal improvements made by the Government, and that instead of the highly diversified schemes now brought before Congress and the River and Harbor Committee of the House, through influences eminently local, there should be a board of public works, under, probably, the Treasury Department, which should discuss and thoroughly digest all these proposed plans before they are submitted to Congress. Such a board would operate in very much the same manner as the present Lighthouse Board, whose suggestions are always received with respect and are usually carried out. Some of the members of the Council do not feel that the time has quite come when it would be advisable to approach the members of Congress with such a proposition, but they all agree that the necessary information should be collected with as little delay as possible, and that the proper time for presenting the results of this investigation in a bill before Congress cannot be far distant. There is at present a manifest disposition on the part of the people to enlarge the functions of Government, and to give it the power to do for the nation many things which were formerly left to individual enterprise. So long as the conduct of public affairs can be kept in the hands of honest and disinterested representatives of the best element of the people, this tendency is to be warmly encouraged. If the Council of Engineers succeed in framing a wiser policy for the national works, we shall hope that these same advisers will be tempted to improve, through legislative enactment, the administration of some of those larger enterprises, such as transportation and communication, upon which the interests of the people are so greatly dependent.

Tonnage of the Tehuantepec Ship Railway.

The wise man who is about to build, first sits down and counts the cost, and, if he is an engineer, he adds to this calculation what the returns of the investment will probably be, that is, what there is to justify the cost. In the transisthmian ship railway, the cost has been very carefully estimated, and the **other side of the equation,** the returns, has **received not less thoughtful** consideration. **During the year 1879,** the total tonnage **of the vessels which were** entered and cleared from the Isthmus of Panama, and from such Atlantic and Pacific ports as indicated the doubling of Cape Horn, amounted to 2,938,386 tons. In 1885, this had increased to 4,518,934 tons, a gain of 54 per cent. At the same rate of increase, the tonnage for 1890, the date of the completion of the ship [illegible]ilway, would be about [illegible] is calculated that the [illegible] tonnage which would be [illegible]g the two oceans by a [illegible]ne [illegible]uld at least amount to [illegible]000 tons. This would give a total tonnage for the first year of the railway of over 7,000,000 tons, provided that the vessels engaged in this trade chose a short land carriage in preference to the entire or partial circumnavigation of a continent or to the reshipment of their cargoes at the Isthmus, which is not an unnatural supposition. It is difficult to estimate the increased growth of commerce which would result from such stimulus. The tonnage on the Suez Canal increased nearly 400 per cent from 1872 to 1883, and at Tehuantepec the increase would be scarcely less, as the indications all point to a marked development of the commerce of the tributary countries.