PICTET'S SMALL ICE-MACHINE.

The small ice-machine shown in the accompanying cut is designed to produce small quantities of ice at a time. It is capable of operating intermittingly and produce a kilogramme of ice in about fifteen minutes, or continuously and give 4 to 5 kilogrammes per hour, with an expenditure of power always below that of a one-horse power steam engine. It is adapted, then, for use on steamboats, in country seats, in colonial dwellings, in agricultural industries, and in all cases where it is easy to take a horse from his ordinary work, or to use him when idle, long enough to effect the operation; in a word, it is applicable in all cases in which there is a motive power at one's disposal, and in which the only means of obtaining ice economically is to manufacture it one's self.

The apparatus is not very different in principle from Mr. Pictet's large ice-machines which we have already made known. It is merely very much simplified so as to supply the special wants of the new applications for which it is designed.

The apparatus consists essentially of a compressing pump actuated by the motor; of a congealing refrigerator, with a condensing tank that also surrounds the cylinder and pump; and of a congealing refrigerator in which are placed the moulds filled with water to be frozen. All these parts and their accessories—suction valves, frame, driving shaft, gearing, etc.—are skillfully grouped so as to occupy but a very limited space, inasmuch as the bed plate is only 50 centimeters square, and the total height does not exceed 1·3 meters. The operation of the apparatus may be readily understood. At the beginning the sulphurous anhydride is in the congealing refrigerator. The pump sucks it up, and evaporation absorbs a large quantity of heat from a solution of glycerine in the refrigerator, and from the moulds filled with water placed in the glycerine. The anhydride is afterward forced by the pump into the condenser, where it liquefies, and gives up to the water in the condensing tank a certain quantity of heat. The colder this water of condensation is, the less the work demanded by compression. The anhydride, then, constitutes an intermedium, which permits, after a manner, of *drawing heat* from the congealer and *pouring* it into the condenser. When the apparatus is operated continuously, it becomes necessary to keep the condenser at a low temperature, this being easily done with a circulation of 200 liters of water per hour in the condensing tank. When the operation, which requires from twelve to eighteen minutes, is finished, the moulds are removed from the congealer, and a distributing cock is opened so as to allow the liquefied anhydride in the condenser to run into the congealer. In about a quarter of a minute the former communication is again established, and the machine is then ready to begin operations anew.

All that the apparatus demands, then, is motive power, since it is closed up, and the anhydride describes a complete cycle at each operation. The duration of the initial change of sulphurous anhydride is indefinite. In practice it depends only on the degree of tightness of the joint of the piston-rod stuffing box.

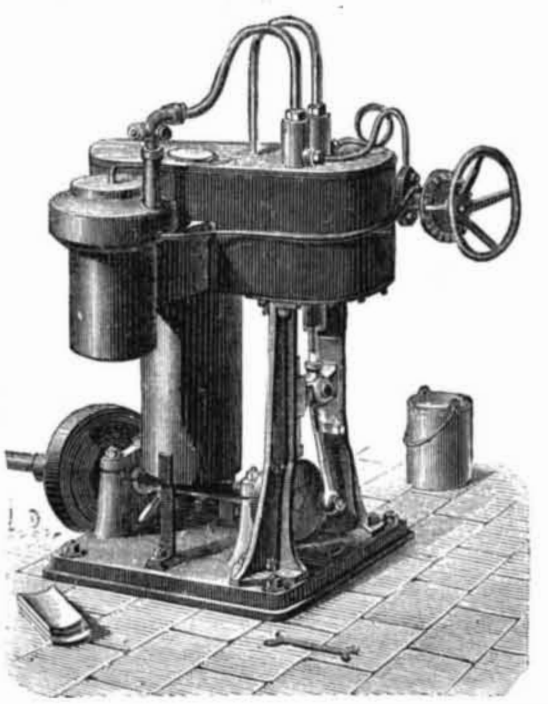
The ice produced in the moulds is in the form of three slightly curved layers, which are afterward superposed so as to make a single compact block, weighing one kilogramme.—*La Nature.*

Incandescent Gas Lights.

The vestry of Clerkenwell have decided to give trial to a new system of gas illumination, introduced by Mr. J. Lewis, of 12 Clerkenwell Green. In this system the old gas burner is discarded, and its place is taken by a thimble or basket of platinum wire gauze inverted over the end of the supply pipe. The coal gas is mixed with compressed air by means of an air-pump, and the mingled gases pass to the platinum gauze, and escape through its meshes. They are lit on the outside, and the wire speedily becomes white-hot. The total combustion of the gas is further assisted by the draught up two side pipes branching from the main supply pipe below the burner and curving downward. The appearance of the incandescent thimble is very pleasing, and the light is brighter, softer, and steadier than a gas flame. No flame is seen above the incandescent wire, and there appears to be total combustion of the gas. The lighting power of the system is said to be 5¼ candle power per cubic foot of gas consumed. A similar plan has been brought out in France by M. Clammond. In this a mixture of gas and heated air is employed, and the gas is burned in the meshes of a platinum basket as above. The air slightly condensed arrives at the burner by a separate pipe to that of the gas, as in Mr. Lewis's arrangement, but it is likewise passed through a tube of refractory material heated to 800° C. or 1,000° C. by means of a number of small gas flames round it. After this heating it is allowed to mingle with the coal gas and proceed to the burner. A horse power of work expended in condensing the air is stated to do for an illumination of 200 Carcel lamps, and one Carcel lamp requires from 0·95 to 1·6 cubic feet of gas according to the burner. The latter has to be replaced every forty or fifty hours. A modification of the platinum burner is also provided for replacing the chalk cylinder in the oxyhydrogen light, and adapted for stage and lecture purposes. Dr. Regnard has further adapted the platinum cage to a petroleum lamp. In this case the compressed air is supplied by a hand-bellows or a bag filled with air and loaded with weights. The air passing over the petroleum oil in a reservoir mingles with the vapor, and the mixture passes to the platinum cage, where it is burnt. While upon this subject we may also mention a new arrangement whereby a strip of platinum foil is passed through a gas flame and traversed by the electric current. It is stated that a light equal to thirty candles can be obtained from two cubic feet of gas per hour by help of a very weak current.—*Engineering.*

An Army in Blue Specs.

It is said that Arabi, the general of the Egyptian revolutionary forces, is going to be very circumspect and hold his ground quietly, expecting that the English army will soon be disabled by ophthalmia, without the need of fighting. The

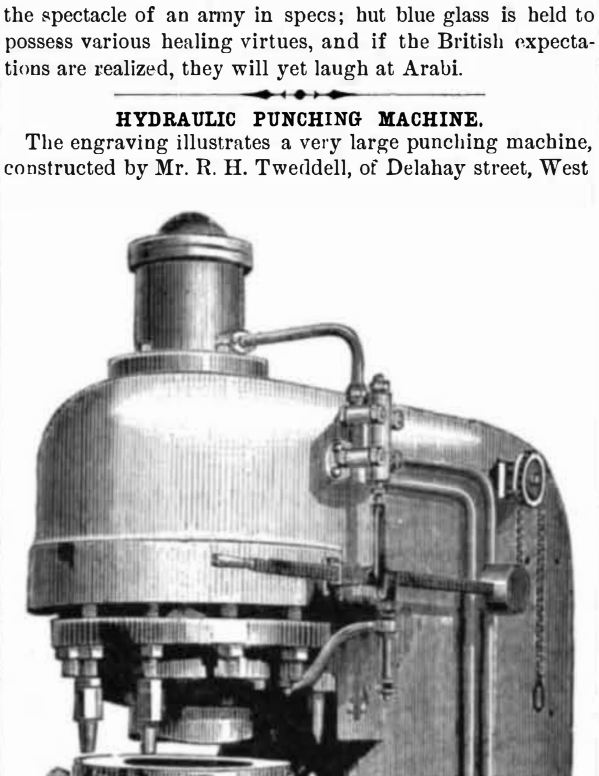


PICTET'S SMALL ICE-MACHINE.

glare of the sun and the fine sand that floats in the air have been found to play the mischief with foreign soldiers. It is affirmed that during the Egyptian campaign of the great Napoleon two-thirds of his men were at one time distressed with eye diseases. According to the English papers, every precaution is to be taken to save the British troops, now pouring into Egypt, from such maladies; and among other speculations, 25,000 pairs of blue spectacles have been purchased at five cents per pair. Probably Arabi will laugh at the spectacle of an army in specs; but blue glass is held to possess various healing virtues, and if the British expectations are realized, they will yet laugh at Arabi.

HYDRAULIC PUNCHING MACHINE.

The engraving illustrates a very large punching machine, constructed by Mr. R. H. Tweddell, of Delahay street, West



HYDRAULIC PUNCHING MACHINE.

minster, for Messrs. Raylton, Dixon & Co. It is intended for stamping out manholes in marine boiler plates at one operation, and will stamp a hole 18 inches by 14 inches in a ¾ inch plate. It weighs 14½ tons. The machine is so simple, and its construction is so clearly shown in our engraving, that we do not think any special description is necessary.

Modern Improvements in Glass Making.

The following is a record of the principal improvements in glass making during the last fifty years, as given by a prominent manufacturer:

Robert Lucas Chance, of Birmingham, England, successfully introduced the manufacture of Bohemian sheet glass into his district in 1838. James Chance perfected the process of grinding and polishing sheet glass, now known as patent plate.

The substitution, about the year 1830, of carbonate of soda, as the alkaline ingredient in glass in place of kelp, and subsequently, for crown and sheet glass, of sulphate of soda (saltcake) in the place of carbonate.

An increase in the size and improvement in the workmanship of the plates, sheets, and tables produced.

An improvement in the color of the glass by the use of purer materials and modifications in the process of melting.

Numerous improvements in the flattening of sheet glass, resulting in the removal or diminution of many imperfections.

The use of the diamond in the process of splitting cylinders in the place of a red hot iron.

An increase in the size of the melting pots and furnaces, with the view of economizing coal and labor.

The adoption, in the casting of plate glass, of various mechanical contrivances. The origin of some important improvements of this class is due to the manager of the Birmingham Plate Glass Works.

The use of the same pot for the two processes of melting and casting plate, superseding the old method of transferring the contents of the melting pot into the vessel used for casting.

The substitution of small coal, or slack, in the melting processes in the place of the large coal or lumps.

The application of Siemens' regenerative process to the melting of glass, by which the amount of smoke is greatly diminished, the color of the glass is improved, a greater control is obtained over the furnace, and a saving of fuel is effected wherever, by this process, slack can be substituted for large coal or lumps. These advantages are to some extent counterbalanced by the increased cost of the furnace, and its increased liability to get out of order. The process, however, as applied to glass making, is so new that there has been scarcely time as yet to overcome the difficulties that have presented themselves.

The introduction of the Gill furnace, whereby coal is economized to a remarkable extent without sacrificing the effectiveness of the combustion or the evolution of heat.

There have been many improvements, besides, in machinery for pressing and ornamenting glassware, but they are too numerous and intricate to detail here. The most important of these, too, have had their origin in the United States, which have rapidly come to the front with labor-saving devices in glass manufacture as in other industries.—*Pot. and Glass. Reporter.*

Fireproof Cement.

A fireproof cement is being introduced made from a material found in the Eifel Mountains. It is alleged by eminent professional men to be the only material known to science which possesses besides its plastic qualities the virtue of being fireproof. Moistened with water, this cement forms an elastic mass, which can be exposed when dry to great heat without shrinking or showing any cracks. Such a cemet should be peculiarly adapted for repairing defective fireplaces, cracks in retorts, etc., as mortar for fireproof buildings, and for the interior plastering of furnaces. The mode of its preparation is as follows:

The cement is to be well mixed in a dry state, a small quantity of water is added and mixed well together. As a mortar it can be used in the ordinary way. In lining furnaces, however, care must be taken to press the cement well into the walls, so as to leave a smooth, even surface, as when dried by the air the cement easily crumbles and will not harden till ignited. Moreover it must not be treated roughly until it has been well burnt. Cracks in furnaces, retorts, etc., should be well cleansed and scraped, and if possible roughed before applying the cement. The parts to be mended should be damped beforehand.

An analysis by Dr. Bischof, of Wiesbaden, gives the following results:

The cement is a pale gray, gritty substance, consisting of a good deal of fine dust, with angular and round particles of quartz. When mixed with water it is very sticky, compact, and easily moulded. In 100 parts of the material dried at 120° C. there were:

Clay earth	10·18
Silica, chemically combined	11·03
Silica, mechanically mixed (sand)	73·58
Iron oxide	0·41
Lime	0·23
Magnesia	0·17
Potassium	0·99
Loss by heat	3·46
	100·05

As will be seen, the quantity of fusible matter such as iron, etc., is very small indeed, if any. Under the fire treatment the cement showed the following results: After being heated to silver smelting heat, or about 1,000° C., the cement turned to a gray color, speckled with a few black spots, the fracture being earthy and porous.

To remove smoke stains from ivory, immerse the pieces in benzine, and go over them with a brush.

The Ammonia in the Atmosphere.

Hitherto the quantity of nitrogen which the soil obtained from the atmosphere was estimated by determining the quantity of ammonia and nitric acid in rain water. A few years ago Schloesing proved, however, that rain water only carries down the nitrate of ammonia, while carbonate of ammonia is only partially precipitated with the rain, another portion always remaining in the atmosphere. Of this latter ammonia a certain quantity is directly absorbed by the soil, and, since it is there oxidized to nitric acid, the soil always remains capable of taking up some more ammonia, and he calculates that 63 kilos of nitrogen are conveyed to the earth annually in this way on each hectare of surface.

We know already from our daily experience that the absorption of this ammonia, so important to the nutrition of plants, is not the same on all soils, for sandy soils require a more frequent application of nitrogenous manures than do the clay and loam soils. It was, therefore, of great practical interest to ascertain just how much ammonia the different soils were able to abstract from the atmosphere in the course of a year. The first experiment in this direction was made by R. Heinrich, who sought to determine the maximum amount of ammonia that any kind of soil could absorb from the atmosphere, and he thought to ascertain this with greatest certainty if he used an aqueous solution of hydrochloric acid to absorb it.

The experiment was continued for two years in the following manner: A 20 per cent solution of hydrochloric acid was exposed to the open air for a month in a glass vessel, 5 centimeters (2 inches) deep, with a surface equal to 78·5 square centimeters (over 12 square inches). When it rained the glass was covered so as to keep out the water, but permit free access of air and wind. The vessel stood on the green sod of a field, over forty yards from any buildings, at the experimental station of Rostock, and two-thirds of a mile from the nearest houses in the city. The shores of the North Sea are about seven miles northward from this station. At the expiration of each month the acid was evaporated and the sal ammoniac weighed.

The results of Heinrich's two years of observation have been tabulated, and all the more important meteorological data added. Toward the end he also determined the quantity of ammoniacal nitrogen contained in the rain and snow water. The numbers in these tables show, first, that the amount of ammonia absorbed by the given surface of acid liquid is very different according to what season of the year it is examined. The mean value of both years showed 24·068 mg. nitrogen absorbed by the soil as ammonia in a year. The amount in winter was 2·912 mg. nitrogen; in spring, 6·712 mg.; in summer, 9·766 mg.; and in autumn, 4·678 mg. From this the relation is seen between the absorption of ammonia and the temperature, and it is seen more distinctly in certain months. If the month shows a steadily rising temperature the absorption is higher relatively than in months that are just as warm, but have the temperature falling.

If, however, the warmer months are those which show the highest absorption of ammonia from the atmosphere, then it would not do to draw conclusions for the whole year from observations made during a few weeks in summer, as Schloesing has done.

What was most striking about the numbers in the table was the small amount of absorption during August, 1881, in which time the weather was unusually calm, and there were no south or southwest winds.

From the quantity of ammonia absorbed with different directions of the wind it can be seen (as might be anticipated) that the ammonia in the air does not come from sea, but rather from the air passing over the solid land.

It would not be reasonable to draw any conclusions as to the total quantity of ammonia that the soil gets from the air, based upon the quantity absorbed by such a small surface of hydrochloric acid. Nevertheless it is interesting to compare these numbers with those found by Schloesing. This small surface of 78·5 square cm. absorbed 26 mg. of ammonia per year, hence a hectare of surface would absorb 30·6 kilos per year of nitrogen. Schloesing concluded from his experiments that it would be 63 kilos. If we took the June average for the whole year we should get 48·732 mg. for our small surface, equivalent to 62·1 kilos per hectare, which is nearly the same as given by Schloesing. On the other hand, taking the February average, it would make only 15·1 kilos a year. These numbers prove that any determination of the absorptive power of soils for ammonia in the atmosphere must be continued throughout the whole year to get at the true absorption.—*Forschungen auf dem Gebiete der Agriculturphysik.*

Ancient English Oaks.

Among the ancient oaks of England few are more interesting than the gigantic ruin now standing in an arable field on the banks of the Severn, near Shrewsbury. It is the sole remaining tree of those vast forests which gave Shrewsbury its Saxon name of Schobbesburgh. The Saxons seized this part of the country A.D. 577, when they burnt the Roman city of Uriconium, where Wroxeter now stands, four miles from the village of Cressage; and underneath this now decrepit dotard it is said that the earliest Christian missionaries of those times—and possibly St. Chad himself—preached to the heathen before churches had been built. The Cressage Oak—called by the Saxons Criste-ache (Christ's Oak)—is probably not less than fourteen centuries old. The circumference of the trunk was about 30 feet, measured fairly at a height of 5 feet from the ground; but only about one-half of the shell of the hollow trunk now remains. It still bears fifteen living branches, each 15 feet or 16 feet in length. A young oak grows from the center of the hollow.

The noted oaks of England, thanks to those who have preserved them, thanks to the universal veneration for timber, and to a stirring and lengthened history, are innumerable. Windsor Forest is particularly rich in historic oaks, and Sherwood Forest, though disafforested, still contains some memorial timber, like Needwood, once a crown forest, now a fine estate of well-farmed land. Dryden's

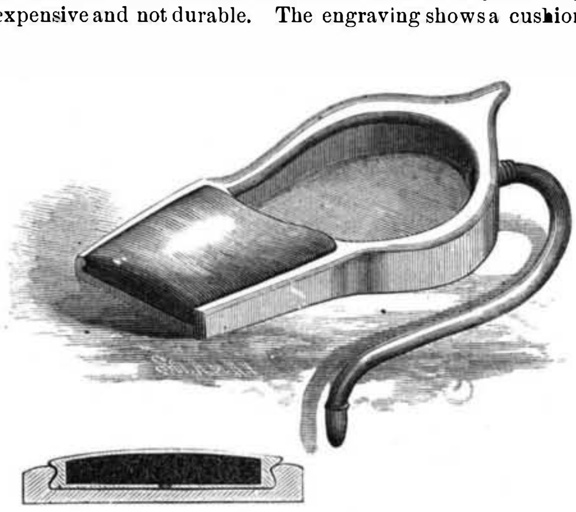
"Three centuries he grows and three he stays,
Supreme in state, and in three more decays."

is a poetical statement, and some of the dates on trees cut down in Sherwood Forest, and marked 600 years before, in the time of King John, prove that it is an under-estimate. The great Winfarthing Oak, in Norfolk, was called the "Old Oak" in the time of the Conqueror, and has been supposed to have attained the age of 1,500 years. The King Oak in Windsor Forest is upward of 1,000 years old.—*The Gardeners' Chronicle.*

IMPROVEMENT IN BED-PANS.

The engraving shows in perspective and in transverse section an improved bed-pan recently patented by Mr. Walter F. Morgan, of Leavenworth, Kan.

The earthenware pan in common use is found to produce an uncomfortable and painful pressure upon the sacral region, which is more especially complained of by chronic invalids and irritable, sensitive patients. In using the hard bed-pan it has been found impracticable to supply a temporary cushion without decided inconvenience, and the soft pans do not seem to meet the popular demand because they are very expensive and not durable. The engraving shows a cushion



IMPROVED BED-PAN

permanently attached to a grooved socket in the thin end of the pan. This cushion is made of soft rubber stuffed with curled hair, and is of such form as to protect the sacrum from uncomfortable pressure.

Rubber has been selected for the cushions because of its softness, durability, and cleanliness, and because it is impervious.

The pan is provided with a stoppered flexible tube, through which water may be removed from the pan when large quantities of it are used for injections or other purposes. This improvement permits of using the pan continuously for such purposes without removing it.

The Bombardment of Alexandria.

We had eight armor-clads engaged—the Inflexible, Alexandra, Sultan, Superb, Téméraire, Invincible, Monarch, and Penelope. These ships mounted four 81-ton guns, fourteen 25-ton, thirty 18 ton, and twenty-four 12-ton guns, besides smaller pieces, and Gatling and Nordenfelt machine guns. They were protected by armor-plating which varied in thickness from 24 in. to 6 in. The forts they attacked have been recently strengthened and made as powerful as they now are; but little is known of the character of their armaments. They are supposed to contain seven or eight 18-ton guns and numerous lighter pieces, but they are mainly armed with smooth bores, throwing solid spherical shot. These could do little damage to the armor of our ships, and, as a matter of fact, it is reported—although the present reports are very imperfect and vague—that they proved almost harmless.

The sum total of the injuries to our fleet, and the number of killed and wounded, are of the most trifling character considering the nature of the operation, and the fire they had to stand. The armor-plating of the ships - even the thinnest—was evidently of great value, and saved many lives and much injury to the machinery and fighting appliances. Our fire could not be affected by the shots which struck, and there was not the slightest danger of one of our ships being silenced by the enemy. On the other hand, the heavy projectiles hurled by our fleet at the forts—those of the Inflexible weighing 1,700 lb. each—speedily pulverized them, and put their guns *hors de combat.* Our fleet consists of ships, or fighting machines, the chief of which cost over three-quarters of a million sterling, and the greater part of ten years each to complete. They represent the very utmost which all the wealth, mechanical skill, and invention, and the enterprise of this country can produce for the purpose of guarding its interests at sea. It is not very wonderful that the result of so vast an expenditure of money and time as these ships cost should be the speedy destruction of forts hastily completed and imperfectly armed such as those of Alexandria. If a comparison were made of the exact relative strengths of the two opposing forces, and the time, labor, and cost involved in their production, it would be seen how absurdly unequal the contest was.

Three points have come out strongly in this bombardment which have an important bearing upon naval warfare. These are the great protective value of armor-plating to life, and to the machinery and fighting power of a ship; the necessity of making the heaviest guns the primary offensive weapons; and the difficulty of fighting with precision, and maintaining a watchful defense against small craft, through the smoke of an action. We have formerly pointed out that the thinnest armored ships are of great value, notwithstanding the fact that they may occasionally meet with guns which would render their armor useless. This plating is still able to resist the fire of the great majority of guns that can be brought to bear upon it; and it can deflect and keep out the projectiles of light guns which might be brought against it in great numbers. The thin armor of the Penelope and Invincible seems to have been able to protect those ships quite as effectively as the Inflexible's did her. Had they been unarmored, or "freely penetrable" ships, as Sir W. Armstrong advocated in his presidential address before the Institution of Civil Engineers, there would probably have been a great loss of life, considering the fire these ships were under, and a disablement of some or all of the guns. The Invincible, which cost a quarter of a million, has been practically of as great defensive value in this action as the Inflexible, which cost over three-quarters. This does not prove that she is as good a ship for all purposes, but it shows that for many operations, including the present, this thinly armored ship is as useful as any other, and is very much superior to an unarmored vessel. Till the heaviest guns, such as would render this armor valueless at long ranges, have been obtained by foreign powers in such numbers as to make them the common weapons of war, it is premature to call vessels with 8 in. and 6 in. of armor obsolete.

With regard to the position of guns in the class of offensive weapons it is clear that they must continue to hold the highest place. The ram and torpedoes, which are rightly advocated very strongly, are often of great value; but they are of no use in actions of this kind. It would be a mistake to build many ships in which guns are done away with, or reduced in power, in order to develop more completely the full efficiency of the ram and torpedo.

The difficulty of fighting the guns with precision, and of defending a ship against torpedoes and torpedo boats, will be very great after an action has once commenced, by reason of the accumulation of smoke and the time it takes to clear away. As soon as the ships began firing at Alexandria a bank of smoke is stated by the correspondents on board to have risen like a wall, and prevented the results of the fire from being watched. From the very commencement it was so dense that nothing could be seen of what the enemy were doing, and it was only the sharp scream of projectiles overhead, and the upleaping of columns of spray as the shot struck the water that made it clear the fire was being returned. Order had to be given to cease firing until the smoke cleared away. The wind and sun were both in the enemy's favor, and it was some time before the veil of smoke lifted sufficiently for even a glimpse of the shore to be obtained. This glimpse was lost the instant the guns again opened fire, and before it was possible to see where the shots struck. The only way to get a chance of seeing what was being done was by look-outs in the tops, but these are very frail refuges in a general action, and may easily be destroyed, and the look-out limited to the deck.

This smoke difficulty will give the opportunity for torpedoes, torpedo-boats, and any fast auxiliaries, in a general action. When the smoke has once accumulated these craft will run in and endeavor to close with the large ships before they can be seen. Under some circumstances, if a favorable state of the wind is taken advantage of by a torpedo boat a vessel may have no chance of protecting herself. For this purpose vessels are required larger than our present torpedo-boats, which could support themselves at sea for a time, and would be able to accompany a fleet and act as auxiliaries.—*Engineering.*

Carbolic Acid in Blood Poisoning.

The French surgeon, Declat, has recently been making some noise about his discovery of the value of hypodermic injections of carbolic acid in blood poisoning. He extends its value to scarlet fever, smallpox, typhoid fever, etc., and declares that the potent little syringe enables him to "laugh at" these diseases. This is the extravagance of enthusiasm. There is some value in the method, but a limited one. Nor was Declat its originator. Four years ago Dr. N. B. Kennedy, of Texas, used and wrote upon the advantages of these injections, and in April, 1881, he read a paper before the Texas Medical Association, in which he claimed priority of all others in its employment.—*Med. and Surg. Reporter.*

A TWO-MILE BRIDGE.—An addition has been made to the list of long bridges in the bridge of the Pensacola and Atlantic Railroad across Escambia Bay, Florida. It is five miles and a quarter long, and was opened for use August 15.