ever constructed. The method of utilizing this force for the destruction of an enemy's ship, by vessels as now built, is to seize the opportunity when the intended victim is aground, at anchor, or in some way not in motion, and then to strike her as nearly at right angles to the exposed side as possible. This, of course, causes the complete stoppage of the attacking vessel, after which the engines are to be reversed, and the ram released. If the blow is given at an acute angle, or the attacked vessel is in rapid motion across the line of attack, the wrenching force produced would be perhaps more dangerous to the giver than to the receiver, owing to the lack of lateral strength in the form of ram as now universally built.

The consequence of this well-known lateral weakness of the regulation ram is, that all naval officers share Admiral Porter's opinion that no ship has yet been constructed that would serve the purpose of a ram; and they recognize the fact that the cases are few and far between in which a commander would be justified in risking his ship and his reputation in what he would himself feel to be a most reckless form of attack.

In view of this well-known idea, it seems strange that the form of ram shown in our illustration has not long ere this forced itself into use, as the thing, when once seen, looks too obvious and simple not to have come forward to fill the acknowledged want.

With a ram formed as this one is, the most advantageous angle of attack is precisely that which would be the most dangerous with the usual pattern, or, say, about twelve degrees. Every sailor knows how handily he can lay his ship alongside of a wharf or another vessel in such a manner as to foul his anchor when it is hanging at the bow, and this is the manœuvre by which he can use this ram with the best effect. The corner of the heavy iron plate will, as it touches the enemy's side, enter it with ease as far as the projection from the side of the bow will allow, and will cut a long furrow, plough-like, under the water-line. This attack does not necessitate any stoppage of the ship which acts on the offensive, as is the case where the blow is given "end on," which is an advantage of great moment in a strong current, a narrow passage, or when crowded by hostile or friendly vessels.

Having delivered her blow in passing, she is at once on her course again, and ready for whatever is required by the exigencies of the engagement.

The ram here illustrated, for use on war-vessels, is the invention of Mr. John F. Ward, M.Am.Soc.C.E., of Jersey City, N.J. Ships' rams, as usually constructed, present a sharp vertical cutting edge with comparatively little horizontal width. Such a ram, by striking squarely the side of an enemy's ship, may doubtless inflict much damage; but there is also great danger of wrenching off the ram of the attacking ship, by reason of a glancing blow or the swinging action of a strong current, or of so straining the frame of the attacking vessel that the ram would be practically valueless for further service.

The present device is intended to overcome the inherent disadvantages of the older form, and it accomplishes this end by a departure from former practice as radical as it is simple. Instead of a vertical plane of attack, we have here a horizontal ram, with projecting ends extending transversely through the bows of the war-ship, and presenting on either side of the stem an attacking angle of strong and heavy iron plate, so located as to strike below the water-line, and to be effective at almost any angle of approach. The most dangerous blow of all to an enemy with this ram would probably be an almost parallel glancing attack, which would tear a long, narrow path through the plating of the enemy's ship, and rupture any frame in the track of the ram. A hole of this nature would be most difficult to stop, and would to a considerable extent cancel the advantages of water-tight compartments in a war-vessel.

The drawings show the ram as arranged in the bow of the ship, though of course this arrangement might be modified at the will of the naval constructor, and in accordance with the type of vessel upon which it is to be used. The plate as shown here is about 6 inches thick, and about 8 feet wide and 16 feet long. Through the forward half of this plate passes a steel shaft about 24 inches in diameter, which is further braced 2 feet and 4 feet above and below the main plate by other stiffening plates, about 1½ inches thick, strongly secured to the sides of the ship by angle-iron; and the main plate is also in like manner connected with the ship's sides. The purpose of this steel shaft and the supplementary plates is to transmit the strains coming upon the angle of attack of the main plate to as great a surface as possible in the bow of the ship. In the plan shown, this surface distribution amounts to about 269 square feet.

The plan or "Section E F" is proposed for the adaptation of this ram to a war-ship already built, in which the difficulty of adjusting a large single plate to the position required for the shaft is overcome by making the plate in pairs. This plan also shows heavy bars or brackets in the rear of the ram-plate, for further connecting it with the ship's side, and transmitting strain from the ram to the ship.

SANITARY CEILINGS AND WALLS.[1]

MUCH has been done by the sanitarians of the country, and especially the Board of Health of this State, to try to enlighten the people sufficiently in regard to the unsanitary nature of the prevailing modes of coating, or recoating and ornamenting, the ceilings and walls of rooms for domestic habitation; yet much remains to be done in this direction. The reason is, no doubt, that those who strongly condemned the prevailing modes offered no relief, gave no way of any kind by which the people could even plainly cover their ceilings and walls. Professor R. C. Kedzie, in his lectures when president of the State Board of Health some years ago, advised his audience to forego the pleasure of decorated walls, or to simply whitewash them with lime, rather than stop what he terms "wall-respiration" by sealing or strangling the pores in the plaster with paste and paper, kalsomine, or paint. He illustrated to his audience, by means of blowpipes filled with dried mortar, and some coated with paper, others with paint and kalsomine, how readily air passes through walls of ordinary mortar and with stucco finish (the so-called hard finish), or when simply whitewashed, and how this "wall-respiration" was prevented by all the other modes; and under the professor's directions the State published a book entitled "Shadows from the Walls of Death," and placed copies of it in all the public libraries, with this Bible inscription on its cover: "And behold if the plague be in the walls of the house with hollow streaks, greenish or reddish, then the priest shall go out of the house to the door of the house, and shut up the house seven days. . . . And he shall cause the house to be scraped within round about, and they shall pour out the dust that they scrape off without the city into an unclean place."

This book contains seventy-five specimens of arsenical wall-papers, all gathered from the paper-stores of Michigan, and gives authenticated cases of poisoning from many of these papers; and on all of them arsenic was found in the colors, not only green, but nearly all colors and tints, and some also in making the finish or lustre. A year or two ago the sanitarians of Massachusetts made quite an effort in this direction, introducing a bill in the Legislature to prohibit the sale of such paper; but the paper-men used their influence against it, sent representatives to the Legislature, who claimed or pretended to prove that there was no foundation to the claims made by the sanitarians, and the bill was defeated.

Now, while there are many cases where the people have suffered from arsenical wall-paper, I am fully satisfied from a thorough study of this subject of wall-coatings constantly for fifteen years, and quite a portion of the time applying the same, removing old papers and kalsomine, and from talking with sanitarians and scientists on the subject, that a greater amount of sickness is caused from other conditions of the walls, and conditions that generally prevail, and in nearly every house, than from the very dangerous arsenical wall-papers; and I believe in many of the cases cited, where it was proven that the patients had suffered in rooms coated with paper which proved on examination to contain arsenic, that other conditions connected with the same paper and walls contributed largely to the troubles.

Before going further, I wish to explain that I will show, before the completion of this paper, how people may decorate their rooms in a way that is approved of by the sanitarians who had before condemned every thing used for the purpose, except lime white-

[1] Abstract of a paper read by M. B. Church of Grand Rapids at a sanitary convention at Hastings, Mich., Dec. 4, 1888.

wash. By the method I shall give, and illustrate with specimens I have with me, I will show that walls can be ornamented with any degree of elaboration desired, or plain, and at much less expense than with any of the old modes. The article has been sold for some years, and I find it in use by most of the sanitarians I talk with on this subject.

We will now consider the prevailing modes a little further. It is well known that most houses are papered, and that care has been taken in most cases to choose dark papers with many figures, for the same reason that a workman prefers a colored shirt; and I think I do not overstate when I say that seven-eighths of the buildings papered are papered more than once, that is, that two or more layers have been pasted on, one upon another, and that a large portion of these, say one-half of them at least, have from six to a dozen layers on. It seems as though people should only need to be reminded of this nasty practice, saying nothing about its effect upon health, to induce them to at least remove the old coats of paper and paste, after they have become filled with filth, before applying new coats. It is not necessary for me to explain, what every person knows, that flour-paste will soon mould; that it is a ready absorbent of moisture and disease germs; also that paper is a very ready absorbent. They may not be aware, however, that the coloring and bronzes, which are pulverized metals, brasses, etc., are only temporarily held upon the face of the paper with animal matter (glue), that soon decays; and glue is the greatest absorbent of moisture, and the natural culture-ground for the germs. If these little pests get sufficient heat while there, they will flourish (and the rooms are sometimes very warm above the lines of the doors and windows, with a moderate fire); and where repeated coats of this paste, paper, and glue are applied, from which outdoor air with its purifying effects is excluded by the respirating pores being sealed or strangled, the danger is much greater. The glue soon rots sufficiently to allow the air or any friction to remove small particles to which these germs have attached themselves to float about the room unseen, until they lodge in the system of some unsuspecting victim, whose physical condition is such that they take effect; then they still have the little particles of fertilizer with them to help give them a start on their deadly mission.

Dr. Henry B. Baker, secretary of our State Board of Health, has shown us many different kinds of these little bacilli, some of which he had printed cuts of, taken from photographs. He explained how, by the aid of the latest improved microscopical instruments, it was possible to distinguish these pests one from the other, — those causing typhoid-fever from those causing consumption, etc., — and explained how their growth can be watched, where they have been caught on bits of moistened glue; how they must come to a certain state of maturity before they are dangerous; and that they do not then take effect unless the lungs, or other parts of the body they strike, are in such a weakened or inflamed condition that nature cannot expel them.

The fact that these conditions do not always cause serious mischief; that some people do live in rooms the walls of which are in a very unsanitary condition, and probably filled with vermin, contagion, and filth, without apparent or immediate injury to them, — causes many to think that these claims made by the sanitarians are without foundation, or not of vital importance, while they probably suffer from these causes, more or less, which they attribute to having taken cold, or to having committed some impropriety in eating or overwork; and when they become very sick, they flee to another climate, if they are well-to-do, where they often recover, probably by getting in a room not in so bad a condition, and return home to have the old trouble return, and continue to breathe this slow death-dealing matter, to save the expense of removing the filth from the walls, or because they do not believe or have not heard the warning.

Another unsanitary practice is what is known as kalsomining, which is the covering of ceilings and walls with coats of inert powders and colors, temporarily fastened to the wall with the same kind of animal matter used in coating wall-papers. This glue coat also strangles the wall, but is not so bad as wall-paper, seldom contains as much poison, and does not admit of coating so many times without falling off, though there is more glue in it (and it rots sooner) to be set afloat. Another bad practice is the painting of walls with oil-paint, composed of lead, zinc, and colors mixed with oils. This seals the pores of the walls more effectually than does the kalsomine or wall-paper, but remains longer before it decays sufficiently for small particles of the lead to be dislodged, though it always gives off a slight smell of paint, and when the room has been closed it always has a stuffy or stifled smell, something as do also all rooms covered with many layers of wall-paper. The painted walls can be washed; but, even if washed frequently, the fine cracks always found in walls will be washed full of filth and the germs of disease, if any, in the room.

The article or process I have referred to as being adapted to making a clean, cheap, and sanitary coat for walls, is composed mainly of sulphate of lime, known as gypsum or alabaster, which has been calcined by subjecting it to great heat in retorts, or boiled in large kettles until its water of crystallization is driven off, so that, when water is added to it again, it will again take up its original water of crystallization. This process is called "setting," and takes place naturally in about seven or eight minutes, reforming a stone much like the original stone in the quarry, but more porous. This rock in the natural state, as we grind it at Grand Rapids for use on farm-crops, contains from 35 to 40 per cent of sulphuric acid. The better grades of this rock, after calcining, are so manipulated in making this article for walls, which is known as alabastine, that this setting process is retarded for a number of hours, adapting the plastic, or liquid, to being spread upon walls with a brush in a very thin condition; so that fifty coats, as applied to walls from time to time, form a hard, porous shell not thicker than card-paper; and the coat is not of a glue or paste nature, the size and admixtures used to retard the setting having been absorbed by the base in taking up its water in setting. There is only one other article on the market that is claimed to produce the effects produced by alabastine, and that is called "anti-kalsomine and plastico." These articles are made in many shades, ready for the brush, by adding water. Many kalsomines are put up and sold in the same form, but are dependent on glue to hold them to the walls.

The late Richard A. Proctor explained, in one of his last contributions to the *Inter-Ocean*, how much moisture, in tons, would be thrown off by respiration from an audience of a certain size in a given number of hours. That this moisture is condensed mainly on the walls of the room, is easily seen by rubbing the finger on almost any painted wall, where the moisture does not penetrate readily, but is on the surface, as is often seen on windows. This is sometimes seen on paper and kalsomine; but they absorb moisture so quickly that it does not show on the surface, though they attract more than the paint. That this moisture carries contamination with it, is certain; also that it rots such materials. The paint, as explained before, is not quickly rotted, but oxidizes slowly, so that the effect from it is not so bad as from paper or kalsomine. That air passes through walls is proven by the dust-marks seen on plastered walls, or those that have been only whitewashed or alabastined, indicating the spaces between the lathing caused by the dust being filtered from the air more between the laths than on them.

It should be borne in mind that it is not claimed that the amount of air that will pass through walls the pores of which have not been strangled, cuts any considerable figure in furnishing air to the inmates of the room, but that this purifying of the ceilings and walls takes place by the constant passing of pure air through and through them, oxidizing, or practically burning, these little germs, as it is well known pure air will do. In one of Professor Kedzie's lectures, he cites experiments made by Professors Marker and Shultz, in which they prove that a difference of 20 degrees in temperature on either side of a wall of brick and mortar would cause 8 cubic feet of air to pass through each yard of such wall every hour.

I have some samples here of the sanitary coating I have referred to, applied on panels, showing sections of quite elaborate designs, as well as plain work. I will explain them. This panel I now show you is finished mainly in what is called relief-work. This corrugated work on the lower portion is done by applying the alabastine thick; then a coarse graining-comb was drawn through it in various shapes, before it set. The colors having been ground in and chemically united, it forms a solid tint all the way through the mass; so that slight abrasions, like cutting it off with a knife, still show the same color. Half of this combing has been varnished, which you see produces a somewhat darker and a satin or leather like effect. This varnished work is washable, and is as easily cleaned as any varnish. The centre is simply bronze in the varnish. The upper portion, or decorated frieze, has less body on, and was made by dipping each corner of a wide brush in the two different tints, which easily produced the blended or soft shaded effect. The ribbon was put on with a thin coat of the material through a paper stencil, and the vine in the same way. The flowers were put on with oil-color. The other side has at the bottom what is called heavy stippling, and a slight representation of bas-relief, that is sunk below the surface. The frieze above is ornamented in what is called flat relief, to imitate solid or high relief. The blended grounds of the frieze have been stippled; that is, pounced with the ends of a brush or with a covered block, to give it a slightly roughened effect. These effects are admitted, even by paper-dealers, to be finer than it is possible to produce with the finest papers, and will make a blended tint or whitened wall, on which borders, leaves, etc., can be applied with stencils, and keep within bounds of the expense of papering.

Here we have a plain tinting on large sheets of paper with what is called a combination stencil border. The background of the border was put on with one paper stencil, and the other or main stencil was used over it. This plain tint has the same stencil border on with one tint, which can be done as easily and as cheaply as the cheapest wall-papering. Here we represent a wall blended from top to bottom in two shades. The manufacturers will show any painter so that he can do this blending easily, and usually with one coat. This and the relief-work is done with a late make of this material, made for this kind of work. When it is necessary to renew alabastine, you have no old paper or kalsomine to take off, but simply to repeat the process. I should add, it will be seen, as this forms a stone cement that hardens with age, it precludes any possibility of the colors being liberated to float around the room, as they do from paper and kalsomine, even if they were poisonous. Some claim that a wall should be impervious instead of porous. This might do very well with perfect ventilation, if it were possible to have such a wall; but one partially so is only strangled, and gives a better chance for matter behind to ferment and the germs to propagate. Now, we show here sections of this work varnished, which is nearer impervious than any wall I have ever seen, as the varnish combines with the outer part of the porous stone surface by penetrating into it; also there is nothing behind but the pure stone cement of a cold nature, the air has access to the back of the varnish, and there is absolutely no chance behind for fermentation or decay. However, for plain work, it is as well, and as cheap in the end, without varnish (as it will stand some cleaning, with care, to remove spots); and the surface can be recoated almost as cheaply as the wall can be washed. Then you have a choice of new tints; and any broken places in the plaster, which always occur, are filled and cemented by brushing on this cement again with a brush.

NOTES AND NEWS.

THE senior class this year at Harvard numbers 210, and is the smallest class in the university.

— It looks as though California would have the largest crop of grapes in the history of the State. Manager Clarence Wetmore of the Viticultural Commission says, "There are some localities where, from present appearances, the Zinfandel will not yield as heavy as last year. White grapes in most localities are settling for a full crop, and, if nothing unfavorable happens from now till vintage time, we ought to produce from 20,000,000 to 35,000,000 gallons of wine. The raisin-crop will be a heavy one, even with the loss of several thousand acres of vines in Los Angeles County by disease. The State will probably produce 1,000,000 boxes. The outlook for the wine-market is not very good. At least half of the 1888 vintage is in the hands of producers, who will not sell at the ruling low prices. On this account there will not be sufficient cooperage to handle all the wine grapes that will be thrown on the market. As a consequence, most varieties of wine grapes will bring low figures. There is great need of distilleries in this State to convert low-priced grapes into brandy, for which there is a steady demand."

— Below is the speech in which Professor Taylor of the University of Edinburgh proposed the name of Professor Whitney of Yale for the honorary degree of LL.D., which was conferred: "I have now to ask your lordship to confer the degree in absence on William Dwight Whitney, professor of Sanscrit and comparative philology in Yale College. After studying Sanscrit at Berlin and Tübingen for three years, Professor Whitney was appointed to the chair of Sanscrit and comparative philology in Yale College in 1854. In 1856, in conjunction with Professor Von Roth, he edited the Sanscrit text of the Atharva-Veda. During the last thirty years he has been one of the master spirits of the American Oriental Society, having been for several years its corresponding secretary, and latterly its president; and in the journal of that society he has published a translation of an astronomical work termed the "Surya Siddharta," the text and a translation of two Vedic grammatical works, an Index Verborum to the Atharva-Veda, and other important works. He is also the author of an excellent Sanscrit grammar, treating of the language in its historical development, and supplemented by an important catalogue of all genuine Sanscrit roots. Among his other works must be mentioned the "Language and the Study of Languages," the "Life and Growth of Language," the "Essentials of English Grammar," and his collected "Oriental and Linguistic Studies." Nor has he disdained less recondite subjects; for he has also published a German grammar and German reader, two admirable works of their kind. It is mainly to Professor Whitney's unwearying labors as a teacher and an author that America is indebted for the flourishing school of Oriental philology, in which he is *facile princeps*, and on those grounds he was invited to become one of our tercentenary honorary graduates. I have now the honor of requesting that the degree be conferred upon him in absence."

— At the Eiffel Tower, on May 29, Thomas E. Brown, jun., the engineer of Otis Brothers & Co., subjected the Otis lift to a final test before handing it over for public use. The lift, the car of which consists of two compartments, one above the other, weighs 11,000 kilos (24,000 pounds), and, loaded with 3,000 kilos (7,000 pounds) of lead, — that is to say, weighing 14,000 kilos (31,000 pounds), — was raised to a considerable height. There, according to *The Engineer*, it was fastened with ordinary ropes, and, this done, it was detached from the cables of steel wire with which it is worked. What was to be done was to cut the ropes, and allow the lift to fall, so as to ascertain whether, if the steel cables were to give way, the brakes would work properly and support the lift. Two carpenters, armed with great hatchets, had ascended to the lift, and were ready to cut the cables. At a given signal a blow cut the rope. The enormous machine began to fall. Every one was startled; but in its downward course the lift began to move more slowly, it swayed for a moment from left to right, stuck on the brake, and stopped. There was a general cheering. Not a pane of glass in the lift had been broken or cracked, and the car stopped without shock at a height of ten metres (33 feet) above the ground.

— In the Pearson process of manufacturing aluminium, as stated in the *Journal of the Society of Chemical Industry*, one hundred parts by weight of cryolite are mixed with fifty parts of bauxite, kaolin, or aluminium hydrate, fifty parts of calcium chloride, oxide, or carbonate, and fifty parts of coke or anthracite, all being in powder. The resulting mass is heated to incipient fusion in a furnace or in a crucible made of, containing, or lined with, carbon, in which case, the carbon may be omitted from the mixture. The heating is continued for two hours, at the end of which time it is alleged that the aluminium is reduced, and exists disseminated in minute globules throughout the mass. A mixture of twenty-five parts each of potassium and sodium chlorides is then added, and the temperature raised to bright redness: the aluminium collects at the bottom of the crucible. A better separation is, however, effected by powdering, washing, and drying the melt, and adding it to fused zinc, which alloys with the aluminium, and can afterwards