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TORPEDO LAUNCH WARFARE.

In a recent issue, we gave a description, with illustrations, of Admiral Porter's torpedo boat, the Alarm, a vessel designed for offensive operations wholly, and intended as a type to be copied in equipping a fleet of similar craft. The Alarm is therefore a very excellent representative of our American style of torpedo warfare. There is, however, another class of vessels adaptable to the same service, namely, the swift steam launch, which bears about the same relation to the larger craft as a light flying battery might to an assemblage of heavier though more effective field guns. In the United States service, the launch is of secondary importance beside the large light draft torpedo boat; but in France, if we may judge from the very extended experiments recently made at Cherbourg, the launch is given the first place. The launch accomplishes her object—namely, the explosion of a single torpedo, as near to the enemy's side or bottom as is possible—by sheer audacity, aided by opportune circumstances of weather. It would of course be a useless risk to attempt to run alongside a large vessel in broad daylight or under bright moonlight, for discovery would be certain sufficiently soon to enable a well directed shot to sink the small craft. Her work is to be done in weather when the fog lies low on the water, as it often does during cold days when the sea is warmer than the air, or during driving storms of snow or sleet, when vision a hundred feet from the ship is impossible. Then the launch, with her exhaust carefully muffled, creeps cautiously up to her victim, and with a bold dash gets within point blank of the guns before her presence can be known. It is exceedingly difficult to use depressed guns with any accuracy at a stationary object, much less at one moving at eighteen knots per hour; and in any event, before a shot can be fired the launch will have reached the spar torpedo guards or nettings, if any are out. She then relies on her speed to slide her up on the spars, or to carry her through the netting sufficiently to enable her to push her long torpedo boom up against or very near to the ship. If the launch survives the effects of her own explosion, she endeavors to back off; if she fails, her crew pay for their temerity with their lives. The last is fortune of war, and not to be considered in view of the results.

In Fig. 1 is represented the ironclad vessel to be attacked, which is supposed to have discovered the approaching launch, and flashes the electric light upon her. All movements of the little vessel are now perfectly apparent, and the puff of smoke from the ironclad's side indicates that she has already opened fire. The helmsman on the launch has

[*Continued on page 246.*]

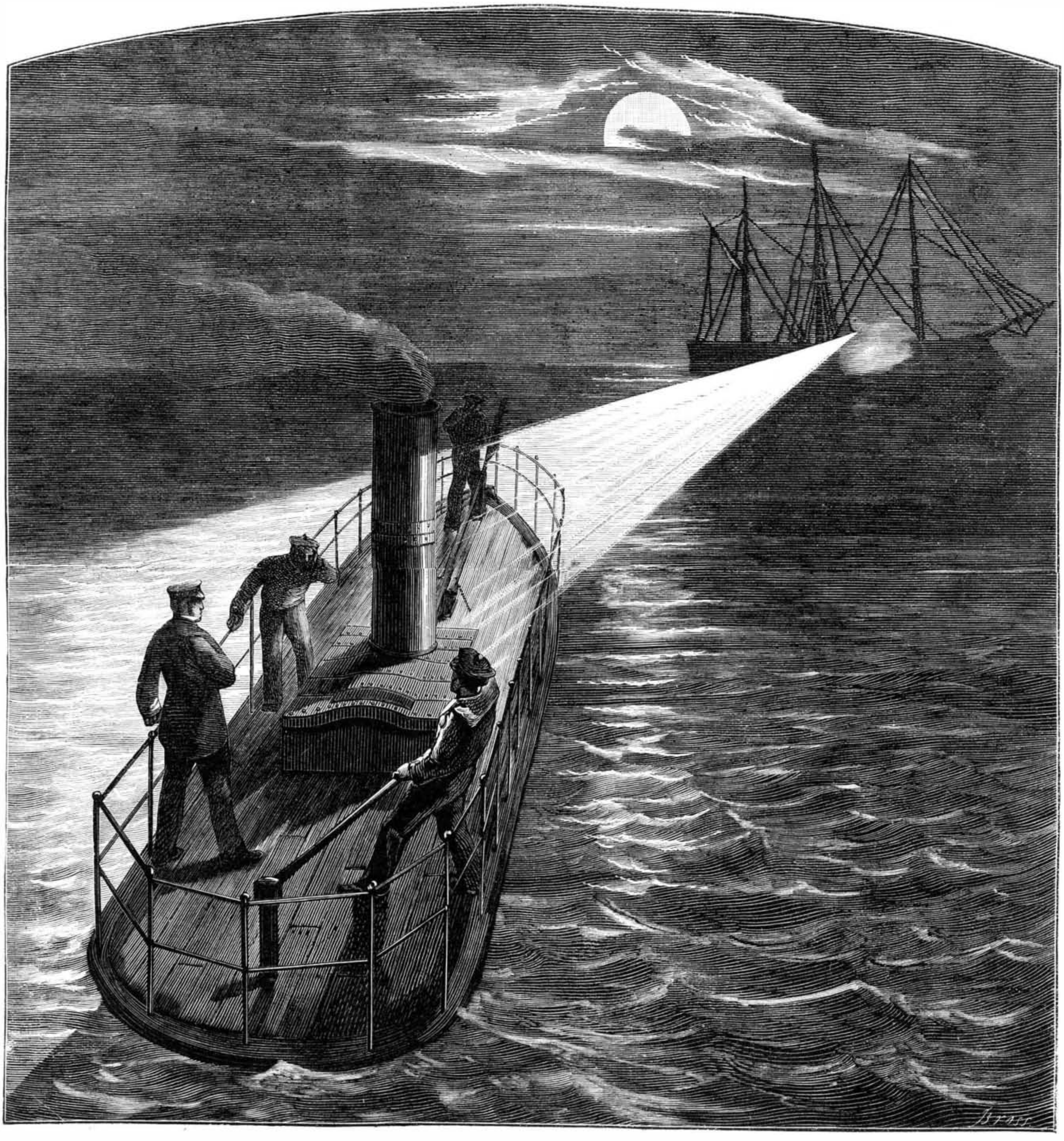

Fig. 1.—TORPEDO EXPERIMENTS AT CHERBOURG, FRANCE.

[*Continued from first page.*]

jammed his helm hard a-starboard, showing that the boat is going about, and thus abandoning the attack until some time when her huge antagonist shall be less wide-awake.

Fig. 2 shows one of the new French torpedo launches, recently built by Thorneycroft in England. She is of steel; and although only 64 feet in length, has attained a speed of 18·85 knots per hour. Her engine is capable of developing 200 horse power. The torpedo employed is charged with 66 lbs. of gun cotton, and its effects are shown in Fig. 3, which represents the stern of an old frigate used in Cherbourg for the experiments. The Paris correspondent of the London *Times* writes concerning these experiments as follows: "This was the first occasion of testing in French waters whether a torpedo could be launched against a ship in full sail. Accordingly Admiral Jaurez, who commands the squadron, ordered a disabled ship, the Bayonnaise, during a rather rough sea, to be towed out by a steamer belonging to the navy. A second lieutenant, M. Lemoinne, was sent for, and informed that he had been selected to make the experiment of launching the Thorneycroft against the Bayonnaise while both were in full sail. He accepted the mission without hesitation, picked out two enginemen and a pilot, and went down with them into the interior of the Thorneycroft, of which only a small part was above water, this visible portion being painted of a grayish color, so as to be easily confused with the sea. The torpedo was placed so as to project from the bow of the vessel, at the extremity of which were two lateen sailyards about 10 feet in length. The towing steamer then took up its position in front of the squadron, and the Thorneycroft also assumed the position assigned for it, an interval of three or four marine miles separating the torpedo and the Bayonnaise.

"On a signal being given, both were set in motion, the steamer advancing in a straight line, and the Thorneycroft obliquely, so as to take the Bayonnaise in flank. The steam tug went at fourteen knots an hour, going at full speed in order to escape the Thorneycroft. The latter went at nineteen knots an hour, a rate not attained by any vessel in the squadron. The chase lasted about an hour, the squadron keeping in the rear so as to witness the operations. At the end of that time the distance between the Thorneycroft and the Bayonnaise had sensibly diminished, and at a given moment the former, in order to come up with the latter at the requisite distance, had to slacken speed to eight knots an hour. The whole squadron watched this last phase of the struggle with breathless interest, and people asked themselves whether the shock of the torpedo would not infallibly destroy the little vessel that bore it. It was feared that the lives of the second lieutenant, Lemoinne, and his three companions were absolutely sacrificed. However, the two vessels got visibly nearer.

"All at once the Thorneycroft put on a last spurt, and struck the Bayonnaise with its whole force on the starboard bow. The sea was terribly agitated, a deafening report was heard, and the Bayonnaise, with a rent as big as a house, sank with wonderful rapidity. As for the Thorneycroft, rebounding by the shock about 50 feet, even before the explosion occurred, it went round and round for a few moments, and then quietly resumed the direction of the squadron. No trace remained of the Bayonnaise; it was literally swallowed up by the sea."

The best mode of defence against torpedo launches lies in the electric light, which renders them visible when approaching at night, even at quite a long distance away. Our engravings are selected from the pages of *L'Illustration*.

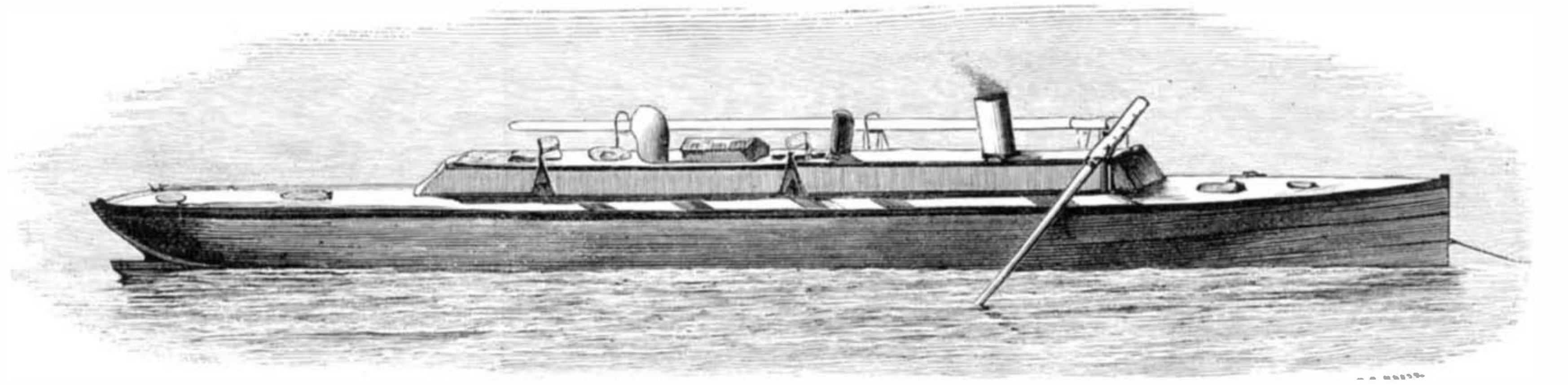

Fig. 2.—THE THORNEYCROFT TORPEDO LAUNCH.

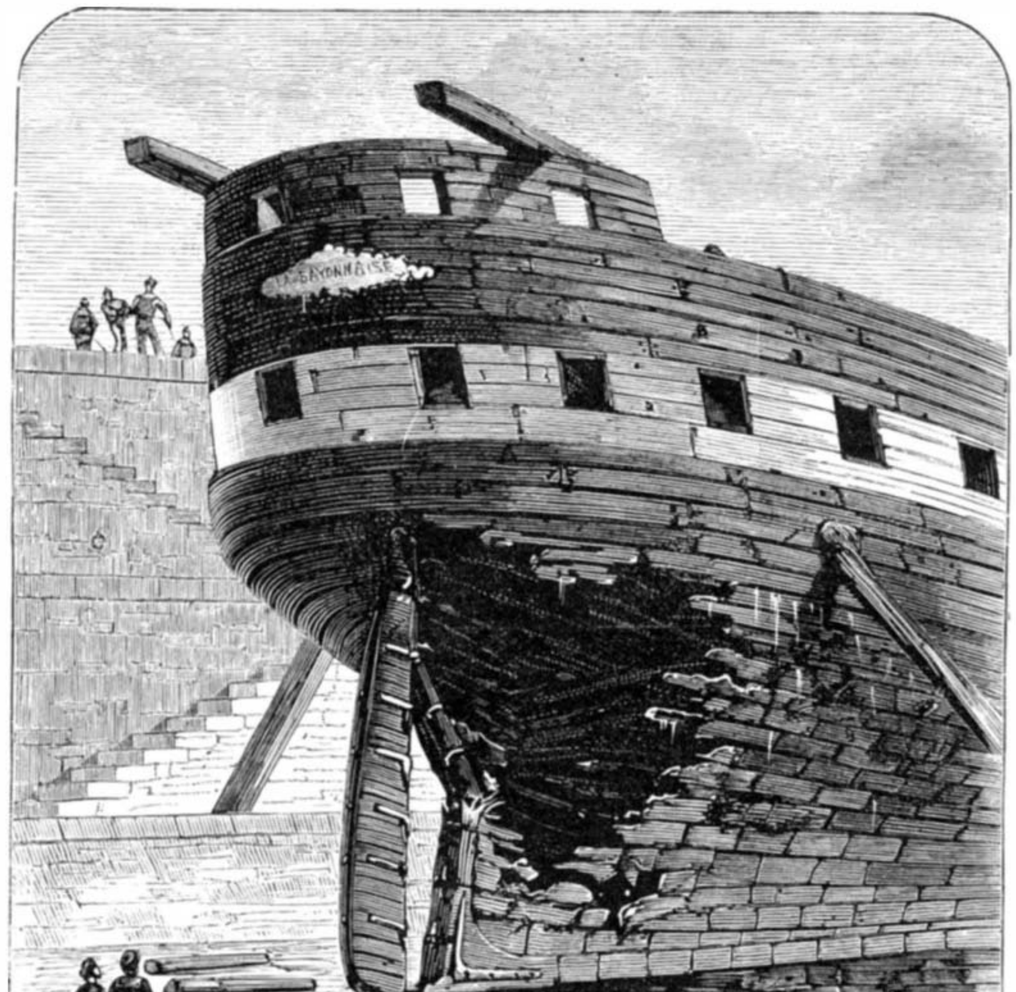

Fig. 3.—EFFECT PRODUCED BY A TORPEDO.

Preservation of Milk.

If milk is kept in ice water at 33·8° to 35·6° Fah., it will continue sweet and unaltered, M. Soxhlet states, 14 days. In one experiment it began, after 17 days, to taste a little rancid; this taste increased till, after 28 days, the milk became coagulable with boiling, and even coagulated in ice water.

Considerable quantities of volatile fatty acids were formed through oxidation of milk fat in the air. This acid formation is completely different from the lactic acid formation which occurs through decomposition of the milk sugar by an organized ferment at high temperature, but is prevented by the low temperature of the Schwartz process, while the oxidation through cold is not hindered, but takes place, though slowly.

Air Suspended in Water.

Some curious experiments with regard to the suspension of water in air have been brought before the French Academy by M. de Romilly. For example, take a bell jar and cover the mouth with net. Place the mouth horizontally in water, and suck up some water into the jar by means of a tube inserted in the upper part, and furnished with a stopcock. If you now close the stopcock and raise the jar, the water will remain in the latter, a meniscus being formed at each mesh of the net, along with a large general meniscus. In a similar arrangement, M. de Romilly succeeds in even boiling this suspended water, by placing a flame under the net (which in this case is metallic). The jar is here made to communicate with another jar placed in a vessel, the suction tube acting through this second jar.

Improved Method of Laying Concrete under Water.

BY JOHN C. GOODRIDGE, JR., OF NEW YORK CITY.

In the ordinary method employed in laying concrete under water it has been considered necessary to use broken stone and coarse gravel with cement. This material thus mixed has been thrown directly on the water, which was inclosed to prevent washing away the cement, or has been dumped from boxes prepared for the purpose.

I have found, by repeated experiment, that it is impossible to obtain a good result from such a mixture. The varying velocity with which bodies fall through water is owing to their different specific gravities. If stone of a specific gravity of 2·5 is used with a cement of 1·4, the stone is in its descent washed entirely free from the cement, and is deposited on the bottom, while the cement, held in partial suspension, and moved by every new addition of the mixture, is finally deposited above the stone and gravel, after being rendered inert by the washing of the water.

My improvement consists, first, in rendering the water (which is inclosed in water-tight compartments or coffer dams, to prevent any motion or current that may allow the escape of the concrete) strongly alkaline by the addition of a sufficient quantity of air-slaked lime. This renders the water less apt to hold the cement in suspension, and causes a more immediate precipitation of the cement. It also causes the concrete to attach itself the more firmly to adjoining masonry; second, sand, clean, sharp, and of fine grain, is selected, and as near as possible of the same specific gravity as the cement, which is about 1·4, and weighing about 88 lbs. to the cubic foot, and carefully mixed with cement.

A good proportion for general use is three parts of sand to one of cement. The proportion may be varied, depending on the strength required of the concrete. In this proportion it requires 4·25 cubic feet of dry cement and 12·75 cubic feet of dry sand to make 10 cubic feet of concrete, measured after being laid in place. The sand and cement are then mixed with water. Sufficient is added to make it thinner than is used in the plastic bétons, yet not watery or thin enough to run, as used in ordinary concrete. A quantity of this mixture should then be placed on an incline, where it should be allowed to lie for a short time until the cement has formed a slight bond with the sand —five or ten minutes—varying with the quickness of the setting of the cement, and then the whole mass should be allowed to slide slowly down the incline or inclines, the bottom of which should be placed in the water, and the concrete evenly distributed by any suitable means.

A large mass should be collected before depositing, in which case the greater portion of the concrete does not come in contact with the water. Succeeding batches are prepared and deposited in the same way, and the process is continued until the space to be occupied by concrete is entirely filled.

Béton so deposited under water needs no ramming. The grains of sand close together with their irregular interstitial spaces filled with concrete. We have then a homogeneous compact mass, weighing about 144 lbs. to the cubic foot, and a specific gravity of about 2·3, and capable of having a crushing strain of over 6,000 lbs. per square inch, and a tensile strength of over 300 lbs. per square inch.

AN iron wash for woodwork can be made by taking fine iron filings 1 part, brickdust 1 part, and ashes 1 part. Put them in glue water, warm, and stir well together. Use two coats.