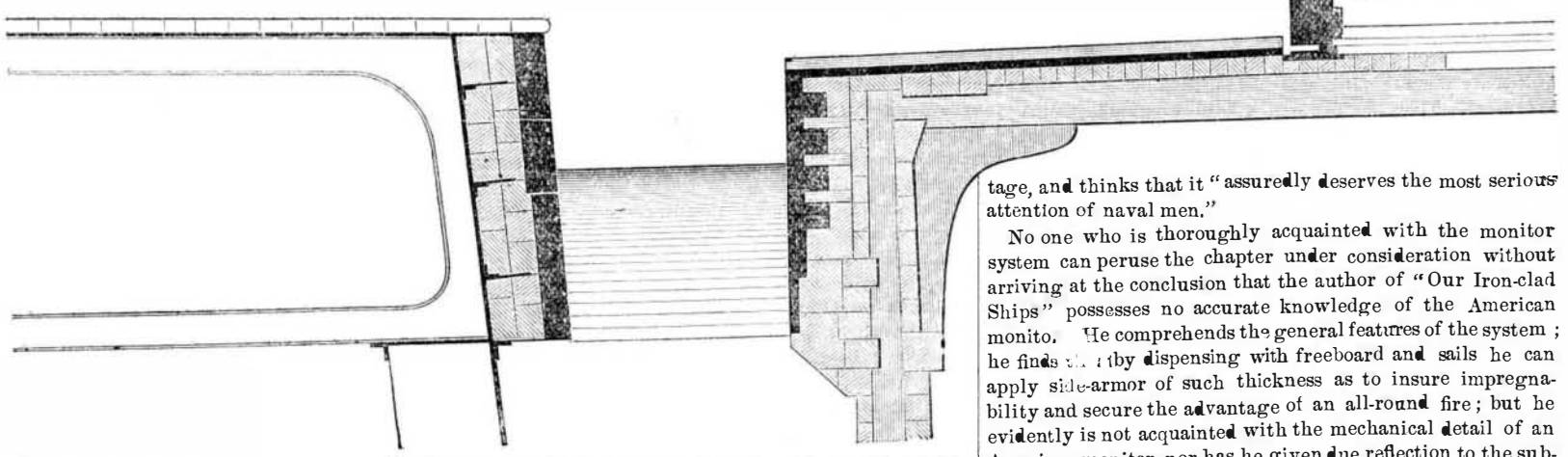
ENGLISH AND AMERICAN IRON-CLADS COMPARED.

[From the Army and Navy Journal.]

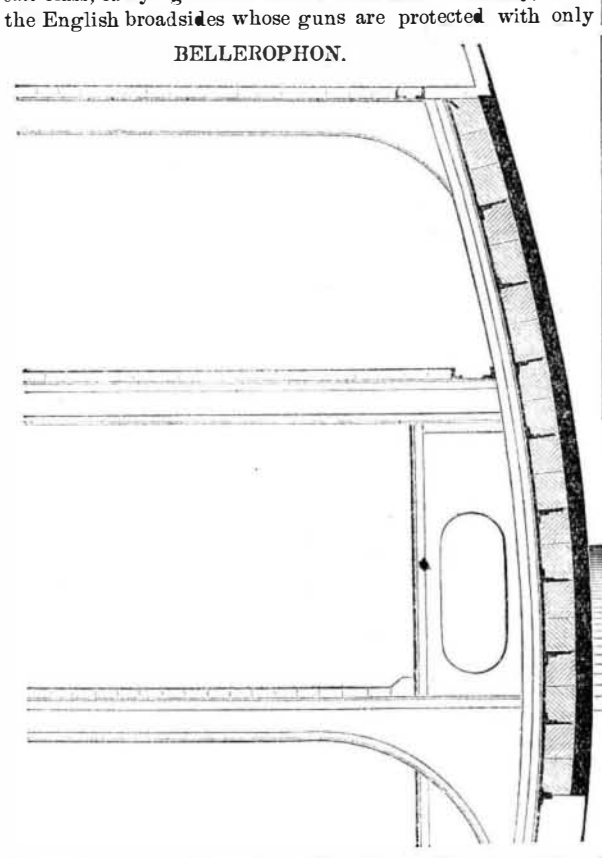
The chapter on turret ships, and the tabular statement of the strength of armor-plating of the English iron-clad fleet, contained in Mr. Reed's recent work, "Our Iron-clad Ships," cannot fail to attract attention on this side of the Atlantic.

An examination of Mr. Reed's tables shows that the iron-clad fleet of England is by no means so formidable in point of armor as supposed. Not less than twenty-four ships, nearly all first class, are protected by only 4½-inch armor plating; while, according to the dimensions specified in the tables, the *average thickness* of the solid plates of the entire iron-clad navy is somewhat under six inches. In view of this fact, it is to say the least, inconsistent on the part of Mr. Reed to contrast, as he has done, by pictorial representations, the side-armor of the *Dictator* with that of his last and strongest—not yet completed—vessel, the *Thunderer*, which is wholly unlike any other of the English iron-clad ships. The accompanying illustrations, drawn to scale with great exactness, furnish data which place the question of comparative strength in quite a different light from that in which Mr. Reed presents it, and enable us to judge accurately of the power of resistance of the boasted broadside iron-clads as compared with our monitors. We might with perfect propriety have contrasted the strength of our smaller turret vessels of the *Passaic* class, carrying eleven inches thickness of battery, with the English broadsides whose guns are protected with only four and a half inches solid plating, since fully one half of the entire fleet carries that light armor; but in order to present the question in an aspect more favorable to the English, we have selected the *Bellerophon* for comparison, her solid armor-plating representing the average thickness of the whole English armored fleet. We have, however, not followed Mr. Reed's example, of contrasting our thickest side-armor with that of the English average strength. Accordingly, we have placed the section of the *Dictator* against that of the *Bellerophon*, and the section of the *Kalamazoo* against that of the *Thunderer*.

THUNDERER.



BELLEROPHON.



We cannot pass unnoticed Mr. Reed's deceptive method of keeping the strength of the battery out of view in comparing the resisting power of iron-clads. No one understands better than the constructor of the "breastwork monitor" *Thunderer*, the leading feature of the monitor system, the submerging the hull so nearly as to render the *side-armor* of but secondary importance. Besides, the side-armor of a monitor is not intended to protect the guns. We need scarcely urge that, under such circumstances, it is highly improper to exclude the battery from an illustration put forth for the purpose of imparting information as to the relative offensive and defensive power of broadside ships and monitors.

The sections of the *Bellerophon* and the *Dictator*, represented by our engravings, furnish conclusive evidence that the former could not successfully oppose the latter. The 6-inch plating, 10-inch wood backing, and 1½-inch skin of the *Bellerophon*, offer protection so utterly inadequate to contend against turret guns of adequate power, worked behind fifteen inches thickness of iron, that no question can be raised as to the result of a conflict between these vessels, especially at such ranges as would prevail during harbor defense. It should be borne in mind, with reference to the side-armor, that during defensive operations, a monitor can almost invariably point the bow towards the assailant, in which case, apart from the protection which results from deep immersion, the angle of the armor of the bow is so acute that every kind of projectile will be deflected.

Respecting the inferior resisting power of a series of thin plates as compared with an equal thickness of solid armor-plating, we repeat what we have so frequently urged, that the superiority of the monitor over the broadside vessel is not affected by the difference of strength of laminated and solid armor. It is all-sufficient that monitors do carry turrets from eleven inches to fifteen inches in thickness, and that turrets of such enormous thickness are readily handled. The number of plates composing that thickness has obviously nothing to do with the principle. The weight being alike in both cases, all we have to do is to substitute solid for laminated plating.

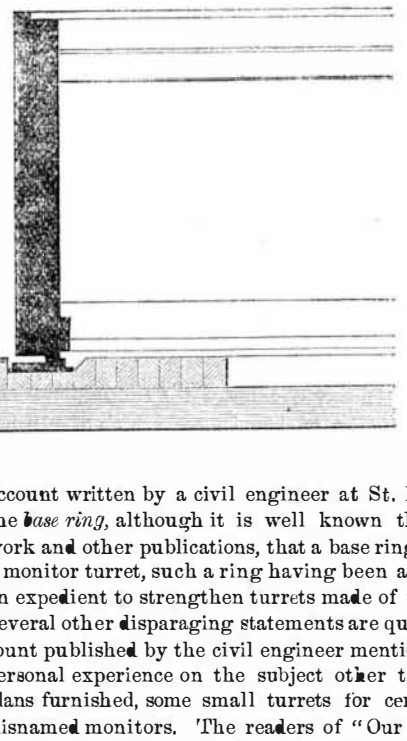
Much has been said by English writers about the weakness of the wrought-iron armor-stringers placed behind the plates for the protection of the upper part of the submerged hulls of monitors. We readily admit that broad, solid plates are better; but our iron works during the war could only supply the stringers and the thin plates. It should be observed, however, that they fully answered the purpose, not a single life being lost within a monitor hull or turret during the protracted contest with fixed forts, notwithstanding that our adversaries had the advantage of steady aim and an accurate knowledge of ranges. The armor of the hull of the *Kalamazoo* consists, as shown by the engraving, of four wrought stringers of eight inches square, together with two plates, each three inches thick. The aggregate weight of these stringers and plates being the same as a solid plate ten inches thick, we have only to substitute such a plate to render the vessel's hull practically impregnable.

As our engraving furnishes precise data for comparing the armor of English and American iron-clads, and also points out very clearly the unsatisfactory character of the pictorial representations in Mr. Reed's work, we dismiss the subject of armor-plating and pass on to the chapter headed "Turret ships." We do not propose to criticise Mr. Reed's views with reference to the turrets applied to full-rigged ships, or his disparaging comparisons between Cole's turret ship the *Captain*, and the broadside ship *Hercules*; but we cannot refrain from observing that while his demonstration about the importance of an all-round fire is unanswerable and fatal to Cole's ship, he over-estimates the advantage of the "simultaneous fire of the *Hercules* in six separate directions," and commits a serious mistake in assuming that four guns in two turrets can only fire in *two* directions. If loading, aiming, and firing could all be effected in an instant, the argument would no doubt be sound; but such not being the case, the firing may alternate, viz., one gun may fire while the other is being loaded. By this method objects separated thirty degrees may be kept under fire as effectually as if two guns in broadside were applied. Evidently, the turret may be as well moved from a given position and returned to it, during loading, as to remain stationary. Indeed, reasons are not wanting why it is better to keep moving than remaining still. We have alluded to this subject to correct the general impression that both guns in a monitor turret must necessarily fire in the same direction. Mr. Reed deems the assumed necessity of firing both guns in the same direction to be a great disadvantage, and thinks that it "assuredly deserves the most serious attention of naval men."

KALAMAZOO.

No one who is thoroughly acquainted with the monitor system can peruse the chapter under consideration without arriving at the conclusion that the author of "Our Iron-clad Ships" possesses no accurate knowledge of the American monito. He comprehends the general features of the system; he finds that by dispensing with freeboard and sails he can apply side-armor of such thickness as to insure impregnability and secure the advantage of an all-round fire; but he evidently is not acquainted with the mechanical detail of an American monitor, nor has he given due reflection to the subject, as will be seen from the following brief examination of his views and quotations. The chief constructor of the English navy thinks that our turrets "are especially liable to be driven out of their proper position by the spindle becoming bent when struck by heavy shot." The proposition that a weight of 200 tuns, kept in place by a vertical wrought-iron shaft of twelve inches diameter, should be driven out of position by a shot, is too absurd to demand refutation. In disparagement of the monitor turret, he quotes an erroneous account written by a civil engineer at St. Louis concerning the *base ring*, although it is well known through Bourne's work and other publications, that a base ring forms no part of a monitor turret, such a ring having been applied simply as an expedient to strengthen turrets made of very thin plates. Several other disparaging statements are quoted from the account published by the civil engineer mentioned, who has no personal experience on the subject other than building, to plans furnished, some small turrets for certain river boats, misnamed monitors. The readers of "Our Iron-clad Ships" also learn from the same source that the rotation of the turret is liable to be stopped "by the downward swelling caused by the impact of heavy shot." We have pointed out on former occasions, that this assumption is a gross mistake; that stoppage from such a cause is impossible, since the outer plating—comprising more than three-quarters of the entire thickness—does not reach the deck.

DICTATOR.



The central shaft of the monitor is also criticised, and Cole's plan of revolving the turret recommended. The chief constructor apparently does not comprehend that the settling of the deck does not affect a turret which, like a mill-stone on its spindle, is supported on a central shaft; while on Cole's plan such settling causes the rollers to recede from the base which they are intended to support. The views expressed relative to turning the ports away during conflict ignore the fact that the American monitors are provided with massive port-stoppers, which are always shut except at the moment of firing. The important circumstance is also wholly overlooked that the turret, during an engagement with a single opponent, is always kept in position by the officer in charge, the gunner having in fact nothing to do with lateral aim; he fires whenever the roll or elevation suits. Again, a *single*-turreted monitor, in nearly all cases, fires over the bow, obviously uninfluenced by the rolling, and but little affected by the state of the weather, as it happens but seldom that the ports are flooded when pointed towards the bow

The assumed "bending" of the turret shaft is purely imaginary, as the following explanation will show The deck ring which supports the base of the turret rests upon four bulkheads, all as deep as the vessel, two being placed transversely and two longitudinally. The tops of these bulkheads cannot be, and never have been, out of a true plane in our monitors with iron hulls. *Wooden* monitors, be it observed, are makeshifts, incompatible with the turret system.

As no constructor understands this better than Mr. Reed, why does he put before his readers, as a serious objection against the monitor turret, the statement of an inexperienced civil engineer concerning the settling of the deck of the wooden turret vessel *Miantonomoh?* And why does he advance as a point against the *system* the fact that the base of our wooden vessels had "coats round the turrets to keep them water-tight" while crossing the ocean? He knows that the turrets of the monitor fleet, exposed to the waves of the Atlantic during the war, were at all times ready for action. Those who saw the monitors during the gale off Fort Fisher, with their turrets half submerged, can estimate exactly the strength of the objection urged. In fine, the assumption that the joint between the base of the turret and the deck is liable to leak so as to endanger the safety of the vessel, is mere conjecture based on inferences drawn by those who are not correctly informed of the true cause of the foundering of the original *Monitor*—an accident wholly unconnected with any defects of construction.

Referring to the "breastwork monitors" *Thunderer* and *Devastation*, without masts and sails, we are of opinion that they will prove the most powerful ships in existence; but they are costly, first class iron ships, protected with solid armor, such as only England can produce at the present time, and they draw twenty-five feet of water. Our experienced naval officers well know that such vessels are not calculated for the defense of the several harbors, dock-yards, and maritime cities of this country; they know that the points to be defended are too numerous to admit of our employing such costly structures as the *Thunderer* and *Devastation;* and that the American monitor, with its impregnable turret, submerged hull, and light draft of water, is better adapted for our shallow waters.

The writer of the chapter on turret ships, apart from his erroneous views of the American monitor, appears to have forgotton what took place subsequently to Admiral Du Pont being relieved from his command at Charleston. The report of Du Pont that the monitors "are totally unfit for blockading duties" being quoted, it will be asked, why is the report of his successor, Admiral Dahlgren, omitted? The former was detached before he had time to become at all acquainted with the new system; while the latter, during two years, blockaded Charleston with the monitors so effectually that the Confederate stronghold was completely sealed. The report of the several commanders of the monitors during the first demonstration against Charleston, under Du Pont's command, is quoted as decisive against the monitor turret; but no reference whatever is made to the important fact that these officers were wholly inexperienced with them, and that the vessels were brought directly from the engine establishments to the enemy's batteries. Had the fleet not been brought into action again, the reference to the reports from the commanders during this their first essay would have been unavoidable; but what are the facts? Admiral Dahlgren afterward engaged the Confederate batteries, with these same monitors, nineteen times between July 18th and September 8th. The report of this experienced commander and accomplished naval artillerist concludes thus: "The battering received was without precedent. The *Montauk* had been struck two hundred and fourteen times, the *Weehawken* one hundred and eighty-seven times, and almost entirely with 10-in. shot."

New Railway Bridge.

The piers for the new railway bridge over the Connecticut river, at Saybrook, Conn., on the Shoreline railway, are now nearly completed. They are made in a rather novel manner, with a view to prevent damage to the wooden piles from insects.

A cluster of nine or twelve pilesare driven as near together as possible, and around this cluster are placed sections of cast iron cylinders of the required diameter, until they reach from the hard bottom of the river to ten feet above high water. After these are in position, the intervening space between the piles and the inside of the cylinders is filled with a concrete of water cement and sand, so that, when finished, the structure is made as solid as one can well imagine.

The center pier of thirteen cylinders—five, eight in diameter, and eight, five feet in diameter—is the one on which will revolve the balance draw, with two openings for the passage of vessels on either side. The draws will be 120 feet in the clear, affording ample room for any vessel that will ever pass up the river to go through the draw. The draw-bridge proper will be of iron, 288 feet in length, and will revolve on a pivot in the center of the large pier, and will be supported by a circular track railway, and so geared that it can be opened or closed by one man.

Another Card from an Advertiser.

The Lamb Knitting Machine Company, Chicopee Falls, Mass., in sending a new advertisement, state as follows: "Please insert this advertisement on last page of your paper for three months. We are happy to assure you that in all of our extensive advertising, no other paper brings so many applications for further knowledge of our machine as the SCIENTIFIC AMERICAN; and one good thing is, it does not cease with the issue of the paper, for we now often get our notice cut out and sent us which was inserted over a year ago."

THE EAGLE CARPET STRETCHER.

Our engraving represents a new carpet stretcher, which, we think, will commend itself to every intelligent upholsterer. It gives a powerful leverage, at the same time being simple in construction, quickly and easily applied, compact, and portable. It does not injure the face of the carpet in putting it down.

It is only a trifle larger than the tack hammer; but a carpet can be stretched better and more strongly by it than anything of the kind we have yet seen. The detail in the margin of the engraving gives a good idea of the construction of the implement. Thejaws, A, have goosenecks, pivoted at B. The points, C, engage with the floor when the implement is in use, and the power is applied at the handle, D.

The larger engraving shows the method of applying the tool. With ordinary stretchers the operator can only stretch the portion of the carpet between the point where he stands and the base boards. With this he may draw himself, furniture, or what not, along with it, as he has a good fulcrum on the floor, by the engagement of the points therewith.

In use the carpet is doubled back, as shown in the engraving. The jaws which are self-clutching, hold tighter and tighter as more power is applied to the lever or handle, D. The carpet being stretched is tacked temporarily back from the base board, and the edge being then released is turned down and permanently tacked to the floor. The temporary tacks are then withdrawn. The jaws thus come in contact only with the back of the carpet, and the face is not marred and torn as by the use of the old style of carpet stretcher.

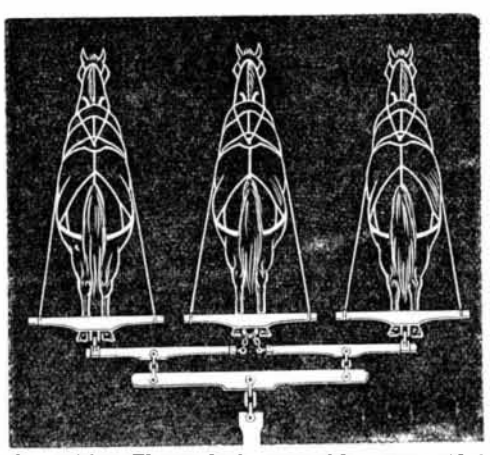
The instrument is excellently adapted for stretching canvas on the deck's of steamboats for painting, and for stretching webs on sofas.

The instrument has been in practical use about one year, and has, we are informed, given the most perfect satisfaction. The inventor, a practical upholsterer, states that those who use this tool, and thus become practically acquainted with its merits, will never exchange it for any carpet stretcher yet introduced to the public.

Patented, through the Scientific American Patent Agency, Feb. 8, 1869, by William Brown, New York city. Address for State or manufacturing rights The Whitlock Exposition Co., Nos. 35 and 37 Park Place, near Church street, New York.

HOW TO HITCH THREE HORSES TO ONE PLOW.

The diagram published in No. 2, current volume, showing how to hitch three horses to one plow, has received some severe criticism, which it doubtless deserves. It is stated that no equalized draft can be obtained by it, unless the horses draw equally, naturally. Nothing about the device compels



them to draw alike. The method proposed has, it is said, been tried in many portions of the country, and found of no value.

We have received several diagrams illustrative of ways in which draft may be equalized, one of which, as being the most practical, we give herewith. This will close the subject as we can give space to no more communications upon it.

The diagram explains itself sufficiently without description.

M. BOILLOT states that he filled jars with hydrogen and placed some sulphur in the same, and, having passed an electric spark through the latter, igniting and volatilizing it, that a perceptible quantity of sulphureted hydrogen was produced.

Correspondence.

The Editors are not responsible for the Opinions expressed by their Correspondents.

Steam Engines at the American Institute.

MESSRS. EDITORS:—The steam engine trials at the late Fair of the American Institute, has resulted in an unfortunate controversy between the competitors, and, as it at present stands, between one of the competitors and the judges.

We propose not to continue the controversy in which we have no interest, and in which we think the public has none, but to look at and discuss the causes of dissatisfaction, that we may, in case another similar contest takes place, avoid all questions that have arisen in the trial alluded to.

The rules published for regulating the trial were for the scientific engineer satisfactory, inasmuch as he knows that the measure of the steam in the cylinder is the measure of the power exerted by the engine. He also knows the quantity of water due to the steam, from which he calculates the cost of the power.

The engineer also knows that the water pumped into the boiler is unreliable, either as a measure of steam at the end of the stroke or power evolved; inasmuch as more or less water goes over to the cylinder in suspension with the steam, which is not power to propel the piston, but, on the contrary, tends to obstruct it. This was fully illustrated during the trial when the steam was notably wet, with the exception of some six hours during the second day.

To the public—to users of steam engines, who are accustomed to rate the cost of their power from the coal consumed, the steam test is neither understood nor satisfactory. Hence, the fuel consumed should have been accurately weighed and reported, and such deductions made as the actual steam indicated. This would have satisfied both scientific and purely practical men.

From the acknowledged ability and experience of the superintendent, an able and impartial report was expected by the exhibitors and others interested. While we fully accord to him impartiality, we cannot but regret that the circumstances which surrounded him rendered it utterly impossible to do himself or the subject justice.

His duties as the general superintendent of the whole exhibition, precluded the possibility of giving the special subject of the trial of the engines that undivided attention which its importance imperiously demanded; and it surprises us that the report has attained the high grade of respectability it possesses, considering also that he was almost entirely unaided by the judges.

The non-attendance of the judges is to be severely reprehended. By accepting the office they accepted the duties thereof, and could no more do it by proxy than could the judges of a court in a capital trial. It is true that men's lives were not at stake; but there was what men often value next to it—mechanical and professional reputation.

We have nothing further to say of the judges, but would suggest to the Board of Managers with all due deference, if future trials should be had, to make it a condition that the judges shall be present and assist, that the number shall be not less than five, and that at least three of them be practical men in the business, and the balance scientific men whose attainments, through study and observation, have fitted them for the office; men of these attainments, we are happy to know, are members of the American Institute.

Another point of great importance remains to be mentioned. It is the short time that was allotted to the trial. Being the last week of the fair, there was not time, nor half time to give the superintendent, even if he had nothing else to do and had been properly aided by the judges, an opportunity to do justice to such an important trial. The exhibitors had not time, if any occult or accidental defect should manifest itself, to correct or repair it. The public, too, has a right to complain of being deprived of the instruction in the use of steam and the steam engine, which an extended and properly conducted set of experiments would have afforded.

The character and reputation of the Institute suffers by these half-way experimental trials.

While we would not make these expositions for the money they would put in our treasury, *per se*, yet we would make all the money we could to expend in diffusing knowledge and stimulating improvements; and if we may judge by the crowds collected in the machinery department during the late short trial, we may safely say it was the most attractive and paying part of the exposition. And, had the experiments been continued for four weeks, it would have shown well on the credit side of the ledger, and given better satisfaction to all concerned.

A MEMBER OF THE AMERICAN INSTITUTE.

Burning Bituminous Coal.

MESSRS. EDITORS:—In Illinois the consumption of bituminous coal (or as it is better known, Illinois soft coal) is immense, and anything calculated to do away with some of its inconveniences will be of benefit to hundreds of thousands.

This coal is found in abundance in nearly every section of the State and is a most economical and convenient fuel, but it has its "drawbacks." With a poor draft considerable smoke escapes when the fire is being replenished, and its action upon various substances seems to be not that of pure carbon. I have never analyzed it, which perhaps I should do before addressing you upon the subject.

This nuisance *inside* our dwellings is entirely abated by having a strong draft which will carry up and discharge from the top of the chimney the unconsumed flaky lampblack. But where is it to be deposited? On our roofs, of course, and here lies our great trouble—our somber hued "skeleton." Once settled upon the roof, its apparent destination is the cistern.