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WHAT IS TO BECOME OF OUR BROWN-STONE FRONTS?

One of the most striking features of modern American building is the great favor with which the material known as brown sand-stone or brown free-stone is regarded. It is a rich colored sand-stone admirably adapted to the production of fine architectural effects; it is cut with great facility and is not too expensive; yet notwithstanding these great advantages it lacks an essential quality of all good building stone—durability.

We have noticed lately several articles upon this subject, which would, independent of our own observation, have convinced us of this; but as long ago as 1854 we asserted that this stone could not endure our climate.

Since that time we have made numerous observations, all which have confirmed the opinion then formed. It is rare that the condition of brown stone exposed fifteen or twenty years to the action of weather cannot be expressed by the word "scaly;" and we were assured once by an extensive builder who has in his life erected a great many brown stone fronts, that in his opinion the life of the fronts would not without repairs, average over thirty years.

We have in mind a large building in which this material was employed and which has stood certainly not more than fifteen years, yet which now exhibits unmistakable signs of incipient decay. Nothing was omitted to make this building permanent but a proper selection of material. Fifteen years more unless the crumbling blocks shall be taken out and replaced by new ones will certainly make sad inroads into this costly and elegant structure.

A writer in *Appleton's Journal* has recently called attention to the condition of Trinity church in this city which he states to be in a state of incipient decay, though confessedly built of the best brown sand-stone this country affords. He also calls attention to the ultimate result of this decay as shown in the tablets and tombstones of old cemeteries, that of Trinity church in particular. Here, he remarks, "rough, unsightly slabs will be found, which once were tablets, recording the virtues of the mortals whose memory they were intended to perpetuate; yet now they stand, and that is all, a collection of scarcely cohering strata, ready to fall in fragments at a touch. The greater exposure of these stones has but accelerated a result which will be the fate of all things in which this material is used."

The writer of the article referred to, concludes as follows: "The present generation will scarcely see the palaces of our millionaires transformed into seamed and broken ruins; but what will be the condition of these buildings a hundred years hence, or even in fifty years?"

To suppose that our architects have been all along ignorant of the defective character of this stone would be scarcely more complimentary than to suppose they had encouraged its use in full knowledge of its deficiencies for the sake of gain. One or the other of these suppositions must, however, hold good. It can hardly be supposed that such material would have been placed in the many costly brown-stone churches to be found in this country in the face of an earnest protest from conscientious architects. Such protests would be likely to be regarded also by private individuals about to erect mansions for their own use, however little they might have availed when made in reference to buildings erected by the general, State, or city governments.

The history of the latter class of buildings has been one of shameful jobbing, in which private interests have nearly always been considered as paramount to the public welfare.

It is time that in American architecture the element of permanency should begin to be considered. Hitherto there has been some excuse for temporizing and there may still be the same excuse in new and rapidly growing cities, in which the changes twenty or thirty years will produce can hardly be predicted, but in older cities like New York or Philadelphia it would seem that no element of uncertainty need remain to interfere with the adoption of a solid and substantial method of building, in which mere outside display should not override every other consideration.

BOILER EXPLOSIONS.

So long as the use of steam continues to extend, and the causes which lead to explosions are permitted to remain, the number and frequency of these disasters must be expected to increase. In reading the reports of boiler explosions which almost daily reach us, we find a very large proportion of them referable to causes in no way connected with the original construction of the boilers, but to causes which have come into existence through carelessness or mismanagement. Here a valve is stuck fast, and there a piece of bungling patchwork has been applied, or a boiler has been altered in form and the stays removed in the alteration have not been replaced, although the change may have made them all the more necessary. In another case the boiler may have been over-heated, and so on through the entire category of causes of danger too well known to be dwelt upon at length. Now either the conditions under which a boiler may be safely worked are too manifold and complex to be complied with, or there is gross culpability connected with nine tenths of the explosions which occur. If, like nitro-glycerin, a boiler were likely to explode under the most ordinary circumstances of treatment, if it were a matter of extreme difficulty to secure proper care in their use, and when every thing had been attempted to secure immunity from explosion, the risk remained that there might still be something left undone, which, if undiscovered, would render the previous caution of no avail, there would be more excuse.

But this is not the case. A well-constructed boiler is not essentially such a terribly destructive agent as to endanger the lives of all who come near it. The conditions of safety are few and easily complied with. The care demanded in its use is not more than can be easily given, and the want of proper attention to the simple requirements of the case can be regarded in no other light than that of criminal neglect.

It is not our intention to enter upon the much-discussed topic of the ultimate causes of boiler explosions. There are certainly cases wherein all the conditions of safety seem to be fully supplied, and yet explosions occur. In such cases we must look for causes among those which have been treated by various authors and which we believe are mostly faults of construction. No amount of care can obviate dangers from this cause, but we have already said that cases of this kind are comparatively rare.

If, then, want of proper care in the management of boilers be admitted to be criminal, we submit that there should be a severer code adopted to enforce proper care. A proprietor should not be permitted to run a boiler which is in an unsafe condition, and ignorance should not be allowed as a mitigation of neglect.

There ought to be a system of rigid inspection adopted in this country, and it should be enforced by law, the expenses of which might be defrayed by paid licenses from the owners of boilers, who should be prohibited from running a boiler a single day after it is condemned by the proper authorities. Any violation of this law should incur severe penalties.

We have a system of inspection for marine boilers, but there are hundreds of boilers on land to one on water, and many of them are in charge of men who are utterly unfit for the work. Whatever of supervision exists under the present system—and, if we mistake not, there is something of the kind provided for on the statute books of most of the States—it is certainly very inefficient; so much so as almost to amount to nothing. This is not only evident from the number of explosions which occur, but still more evident from the condition of a large proportion of the stationary boilers scattered over the country.

It is time this matter was more vigorously taken in hand, and some efficient efforts made to reduce the number of accidents arising from this source. It would not, it seems to us, be difficult to draft a law providing for systematic inspection and summary action when compliance with its requirements should be refused.

IS THERE SUCH A THING AS SOCIAL SCIENCE?

There is a great deal said, now-a-days, under the captivating title of "Social Science;" but much of what is said and written warrants a doubt of even the existence of such a science. Still more does it warrant the doubt that those who attempt the discussion of social topics, have, even admitting the existence of such a science, ever mastered the first rudiments of it.

The wordy and weak discussions which have filled up the time of the so-called "Social Science Conventions," have not availed to fix public attention upon social evils more strongly than before they were uttered. The few suggestions made for reform, and the correction of acknowledged existing evils, have been of the most impracticable kind, and showed most glaringly superficiality of thought in those who offered them. If there be not now, it is high time there ought to be such a thing as social science.

It is painfully evident that society is, in some respects, going from bad to worse. We will not say that, on the whole, it is deteriorating; but granted even that it is growing in virtue and increasing in knowledge, that its sanitary condition is improving and its moral health better than in the dark ages—all this is not enough.

It is sad to reflect that whatever progress has been made, or is now making, is the result of bitter experience to those who have gone before us, and whose blood and tears have stained the pages of history for ages.

Is there no way to adjust society on immutable principles? Must all progress be in the future as in the past secured by experiment? And must what we call social science be forever a mass of ill-assorted facts culled from history? Surely there is some more solid basis than this for social organization.

Did we want proof that nothing like social science exists among us, it is found in all that surrounds us. Very little that passes current in society will stand the test of reason. Our eating, our working, our dress, and even our sleeping, are alike performed with a general disregard to physical law. Pauperism has become a profession. Disease though on the average, perhaps, not so deadly as it was a century ago, is, if not more general, still not less diffused. Perfectly healthy people are the exceptions, not the rule. The professions of law and medicine still find enough in the misery and crime of humanity to amply sustain them. The administration of justice is too often a mockery, and legislation has become a matter of barter and sale. The drones of society are on the increase, and honest hard-working producers are compelled to contribute to their support.

Could these things be if social organization had been reduced to a science? Blackstone, in his "Commentaries," has laid down some general principles upon which all society must be based, and any departure from which is a step toward anarchy; but these principles underlie the civil rights of people united in a national compact. They leave untouched great and fundamental physiological and biological laws, the disregard of which has burdened society with the greatest evils under which it now groans.

Until some prophet arises capable of grappling with this subject from a physical and biological, as well as a political and legal point of view, and beginning down upon hardpan, shows how society may be constructed in harmony with all the conditions of pure living, regardless of creeds, conventionalities, or traditions, let us not flatter ourselves that such a thing as social science exists. A heterogeneous mass of facts does not constitute a science, any more than a rude heap of stones and sand and lime may be called a temple.

MICA BROCADES--A NEW PRODUCT OF ART.

No doubt all of our readers are acquainted with the mica which is so extensively used in doors of stoves. But it may be stated that under this term a whole group of minerals is comprised, either occurring massive or disseminated in rocks. They have all a more or less foliated structure and pearly luster. They are elastic, transparent, or translucent, and have a specific weight of 2·7. In Germany mica has recently found application for the production of bronze-like colors which bear the names "brocades," "crystal colors," and "mica bronzes." The mineral is to this end well crushed, boiled in hydrochloric acid, then washed with water, and assorted according to the size of the laminæ. Mica scales thus obtained exhibit a glass-like luster combined with a silver-white appearance. The advantages of these brocades (which by the way may be colored) over the ordinary metallic brocades, are stated to be the following: 1. They do not contain any ingredient injurious to health. 2. They possess metallic luster like the ordinary brocades, and some surpass them even in liveliness of color. 3. Brown, black, blue, green, and rose are obtained in remarkable beauty, which is not the case with the metal bronzes. 4. They comport themselves with perfect neutrality toward sulphurous exhalations. 5. Their specific weight being very slight, their yield is consequently correspondingly great. In their application they may be fixed upon all kinds of articles of metal, wood, glass, plaster-of-Paris, and paper board. They are consequently well adapted to the preparation of artificial flowers, fancy papers, sealing-wax, in tapestry, furniture-making, and painting. Theaters may employ them for imitating gold-rain and snow, for which purpose they recommend themselves on account of their lightness and cheap price. In short, they may be used for almost all the purposes to which the ordinary bronze powders have been applied. In fixing these brocades upon articles of any kind it is advisable to paint them first with a color similar to that of the bronze; for silver, a ground of white lead is suitable; for blue, one of ultramarine, etc. They are equally suitable for oil and glue colors, which latter are fixed with a mixture of four parts of glue and one of glycerin. Upon this coat, when hard, the binding material for the brocade is spread, and after one quarter of an hour this latter is sifted over. As binding material a paste, consisting of four parts of boiled starch and one of glycerin, is recommended. If desirable, the powder may be finally pressed down with a roller. If the ground is formed by an oil paint, the binding material for the brocade should be constituted of a dammar, or pale copal varnish, upon which, when only pitchy, the powder is sifted over. When finally coated with a suitable spirit, dammar, or copal varnish, the so-prepared articles assume a luster which, in beauty and durability, far surpasses any heretofore obtained with the common bronzes. When small particles of mica-silver are spread over articles coated with asphalt varnish, the result is a good imitation of granite. The crystal colors are also suitable for calico printing, and fabrics upon which they are applied, surpass in brilliancy the heavy bronze and glass-dust fancy fabrics from Lyons. Employed between or on colored gelatin plates, they give rise to superb crystallizations, which are used as inlayings for buttons and various other articles. They may be spread over finished porcelain and glassware, if these are heated again to the fusing point of their glazing.

According to Dr. C. Cech and L. Schneider, in Prague, these brocades may be colored with the following dye stuffs: Rose, with a decoction of cochineal; carmoisin, with the bluish magenta red; bright red, with fuchsine and Havana brown; violet, with Hofman's violet. A solution of Prussian blue in oxalic acid, serves for producing a bright blue, and Girard's violet for deep blue; light and dark green are imparted by aniline green and curcuma; gold with curcuma, dark brown with a proper bark extract, and black with litmus and haematoxylin or logwood extract. Silver needs no color. According to Dr. L. Feutchwanger's (*vide* his popular "Treatise on Gems"), mica is found in this country at Williamsburg, Mass., Hartford, Conn., and many other places. The green mica, which is of a beautiful grass-green color, is found in Brunswick, Me. The rose-red mica, which is also a very beautiful mineral, is principally found at Goshen, Chesterfield, Mass., Acworth, N. H., Bellows' Falls, Vt., etc. Mica, according to the above named mineralogist, when of good colors, may be used for jewelry and other ornaments.

POLAR EXPEDITIONS.

A difficult problem has a charm, by very virtue of its difficulty, which will attract and fix the attention of a certain class of mind. It is, moreover, a class of mind the world could ill dispense with, and which has conferred innumerable benefits upon mankind. It is mind which grapples with all questions, without regard to practical applications, is content to seek knowledge solely for the sake of knowing, leaving the useful applications of its investigations to another class of mind altogether. It is not inventive, but curious. It is sufficient that a thing is obscure, to secure at once the most ardent effort at solution from men of this class of mind.

Of such sort is the intellect now grappling with what may be called, when its difficulty alone is considered, the great geographical problem of the age.

It is hard for men of practical and inventive minds to see what earthly benefit can ever arise from these explorations, yet it would not be prudent to assert that no benefit could ever accrue, and many of the most proud mechanical, engineering, and chemical achievements of modern times have had for their germ, investigations seemingly as hopeless and impracticable as this.

Scarcely any scientific or literary periodical falls under our notice that does not bestow more or less of its space upon the subject of polar exploration.

Putnam's Monthly, for November, contains a long and interesting article on the "Gateways to the Pole," which maintains that the only true solution of the problem is that of Capt. Silas Bent, of "Japan Expedition fame," as put forth in an address, delivered by that navigator, before the St. Louis Historical Society. The date of Captain Bent's address is not given.

The author conceives "the true Arctic problem to be, not whether there is a passage to the pole." but "*Is there a permanent and navigable way to the pole?* This question is answered in the affirmative by Captain Bent, who, in the absence of direct confirmatory experience, undertakes to prove, that, from the very nature of things, such a passage must exist.

While we grant that the vast amount of heat, which passes into the sea at the equatorial regions, and passes to the north in the waters of the Gulf Stream, in the Atlantic, and the Kuro-Siwo, in the Pacific, would favor belief in the existence of open passages through which these waters find their way to the Polar Basin; yet to argue, that because a thing is probable, it is real, seems more speculative than sound. The scientific world will be slow to accept the two "gateways" of Captain Bent till somebody finds them unlocked. This aspirant for Polar Honors not only believes that these avenues actually exist, but, to use his own language, "the only practicable avenues by which ships can reach that open sea, and thence to the Pole, is by following the warm waters of these streams into that sea; and that to find and follow these streams, the water thermometer is the only guide, and that, for this reason, they may be justly termed 'the thermometric gateways to the Pole'."

One would suppose, that if open and navigable passages really exist, they might be seen as well as determined by the thermometer. This latter, it strikes us, is what might be called feeling our way to the pole.

We regard continuance upon the surface of the great streams alluded to, as entirely an unsettled question. The natural effect of heat upon the specific gravity of water would, if not counteracted by other influences, certainly keep these currents at the top; but who shall say, in the present state of our knowledge, that such influences do not exist.

Com. Rodgers made extensive deep-sea soundings in the Arctic Ocean, in 1856. He uniformly found warm and light water at the top, cold and heavy water at the bottom, and warm and light water again beneath the cold middle stratum. An important fact was also discovered in these soundings, namely, that the outflowing surface currents were salter than the middle stratum. It is inferred from this fact, that the water in these surface currents flows into the Polar Basin in under currents, from regions where much evaporation is going on, and where, consequently, a greater proportion of salt exists in the water than in other parts of the ocean.

The subject of an open Polar Sea is discussed in Maury's "Physical Geography of the Sea," Chapter VII. It is there stated, that an under current setting into the Polar Basin exists in Davis Strait, with a corresponding surface current flowing out. It is also a common thing for Arctic navigators to throw out an anchor upon icebergs floating north, impelled by these under currents, and thus get their vessels towed north gratis by these ice tugs. Dr. Kane, in his narrative, gives a most graphic description of an adventure of this kind, whereby he secured considerable progress in spite of a head wind and strong opposing surface current.

These facts show that Captain Bent's opinions are no less speculative than those of others who have preceded him. No amount of reasoning will convince thinking people upon this subject, no matter how plausible it may seem at first sight. Of all problems, the solution of which must depend upon actual experiment, this one, obscured as it is by a multitude of unknown conditions, must be regarded as the chief.

THE CARE OF HOUSE-PLANTS.

The recent frosts have admonished all amateur and professional horticulturists to remove all plants intended to be cultivated in the green-house or conservatory during the winter, from their beds to pots. We find in *Tilton's Journal of Horticulture*, a very seasonable article, from the pen of Wm. F. Channing, M. D., on the care of "house-plants," which will be of great service to those who have neither green-house nor conservatory, and who, notwithstanding, desire to preserve and enjoy the companionship of their summer favorites.

"How to make plants grow in the house is a much more important question than how to make them grow in the green-house. Few persons have conservatories. Almost every person has a window at which the spring and summer of plant-life may be fostered and maintained during the long winter months.

"Formerly almost every house had its plants. The children and the flowers were the chief ornaments of the old homestead. During the last generation, or since the introduction of furnaces and gas, the cultivation of plants in our houses has steadily declined. I propose now to show that this great deprivation and loss to our modern houses is unnecessary, and that plants may flourish as well under the dispensation of gas and the furnace as in the days of the old wood-fire and mold-candles.

"It may be true that plants will not grow in an artificially desiccated air. The skin and the delicate membranes of the throat and lungs parch in the dry furnace heat just like the leaves of the plants. The freshest complexion becomes wizened by a winter of this sirocco. What then shall be done in our furnace-heated houses? Simply introduce evaporators, which shall furnish to the air at least one-half as much moisture as the air naturally contains at the same temperature in spring or summer. The shrinking of the woodwork of the houses, or warping of furniture, are indications of an unnaturally dry heat, which is fatal to plant, and injurious to animal life.

"It is true also, that plants will not thrive in close rooms, charged with the sulphurous acid escaping from the combustion of anthracite or a product of combustion of impure illuminating gas; and in the same atmosphere the throat and lungs of human beings will suffer more or less severely. What is the remedy? Open a ventilator into the chimney, near the top of every room, if you can do no better, and keep it open, at least during the evening, while the gas is burning.

"I am prepared to say that furnace-heat and gas-light are no obstacles to the cultivation of plants, observing only the precautions which are equally essential to human health. I think the rule should be broadly stated, that any room in which plants refuse to grow is unfit for human life.

"In this connection, it is proper to enter a protest against the barbarous habit of excluding the sunshine from inhabited rooms, especially in winter. Its effect is almost as depressing on children and delicately organized women as upon plants.

"There is one other obstacle to the growth of plants in the modern house; which is the plague of insects. Some varieties, especially the microscopic red spider, are uncontrollable in a dry atmosphere, but retire at once before proper evaporation. For the rest improved resources of which I may speak at another time, make it toterably easy now to keep house-plants free from parasites.

"To illustrate theory by fact: I heat a moderate sized house, containing about twenty thousand cubic feet, with a furnace. I find it necessary to expose seven square feet of evaporating surface in the air chamber of the furnace to produce a proper degree of atmospheric moisture. Half this surface would answer with better exposure. About a pint of water is evaporated in twenty-four hours for each seven thousand cubit feet in the house, in raising the temperature from 40° to 70°, two pints in raising it from 30° to 70°, three pints in raising it from 20° to 70°, and four pints in raising it from 10° to 70°, and about five pints in raising it from zero to 70°. Thus, in the extremest of cold weather, it requires nearly six pails of water in twenty-four hours to keep the atmosphere of the house soft and agreeable though not appreciably moist; that is, not nearly as moist as the ordinary summer air at 70°.

"At twelve windows north, east, south, and west of the house thus heated, I have about seventy plants, mostly of the common kinds in very fine condition. During several years I have never known them to be injured by the furnace-heat and never by the gas, freely consumed, except in a single instance of an ivy growing near the ceiling of the room during an accidental leaking of gas.

"I find that ivies thrive peculiarly under the conditions described, growing well in positions furthest from the light; as, for instance, on the hearth, forming a magnificent fireboard. Six or eight varieties of variegated leaved ivy thrive well with the common. I find that roses which have blossomed during the summer in the ground, being potted after hard frost, stripped ruthlessly of every leaf, and trimmed in almost to bare poles are covered with buds within a month at my window, and blossom all winter, great authorities to the contrary notwithstanding. This winter a Madame Bosanquet has left all the rest, showing buds in three weeks, closely followed, however, by the Agrippina Souvenir de Desire, Sarfano, Hermosa, and Sanguinea.

"The Chinese-primrose, and coral-drop begonia are never out of blossom with me in the winter. A heliotrope, occupying a whole window, gives hundreds of its clusters, beginning in December. The orange, lemon, myrtle, and diosma grow with the greatest ease; and the Daphne odora and laurustinus blossom in their season. Among other plants which I find it good to have in the house, I will mention the varieties of winter and spring blooming cactus, geranium, oleander, abutilon, calla, Tradescantia zebrina (large and small leaved), hoya, maurandia, tropæolum, saxifrage, Coliseum vine, Maderia vine, and the usual bulbs."

[We would add to the valuable suggestions of Dr. Channing that a most excellent plan recommended by an accomplished florist, and used by us with great success, is to saturate sponges with water and place them upon plates around and among the plants and underneath the stand. A liberal use of these greatly assists in neutralizing the effects of dry heat.—EDS.

The New Thames Tunnel--How the Work is Carried On.

The new Thames Tunnel has progressed so fast since our last notice, that it may now be said to be virtually complete, and will, it is expected, be in a fit state for opening for public traffic about the middle or the end of next month. The whole length, from what may be called the summit of Tower Hill to the end of Vine st., in Tooley st, on the south side of the river, is just 1,320 feet, and of this distance more than 1,280 feet has already been accomplished and completed. Only about forty feet remain to make the junction with the Tooley st. shaft. This short distance, at the rate at which the tunnel has advanced, could be accomplished in about four or four and a half days, but the shaft itself cannot be ready within that time, nor, indeed, is it likely to be ready within the next fortnight. The shaft in Tooley st. is not so deep as that at Tower Hill by two ft. The former is to be fifty-eight ft., whereas the latter is sixty ft. Yet the Tower Hill shaft was sunk quickly and without the smallest difficulty, for, after passing through about twenty ft. of made earth, the clay was reached, a little below, and not a sign of water was detected. What we may call the Tooley st. shaft is a little over ten ft. diameter, and has been sunk to a depth of about twenty ft., where it has come upon a bed of gravel, in which the water is more abundant than could be wished. It is not, however, in sufficient quantity to prevent the shaft being very easily kept dry by means of pumping, but pumping is by no means wished in this case, for the shaft is near some very large buildings, and to pump out much water from beneath them would have the effect of causing their foundations to sink rapidly as the gravel beneath them was diminished in bulk as the water was drawn off. The Tooley st. shaft, therefore, is being sunk by means of a peculiar screw, which is called a "miser," an instrument used in works of this nature, and which brings up the maximum of gravel with the minimum of water. In this way the works are progressing steadily. As far as this shaft has yet gone, it is double lined with iron casing, the inner rim of iron keeping out the leakage which may find its way through the joints of the outer. These iron rings of the shaft are four ft. deep each, and they are forced, by weights, down into the soil before much dredging out within their circumference is attempted. The double iron lining to this shaft will not, it is expected, be continued to a much greater depth than it is at present. There is every sign that the water-bearing stratum has been nearly passed, and that the clay will soon be reached. When this is attained, only one lining of iron rings to the shaft will be used to within a few ft. of the bottom, where bricks, faced with glazed tiles, to reflect the light, will be employed, as in the shaft on Tower Hill. Night and day, every four hours, the shield driving the tunnel, moves forward eighteen inches, so that there is an advance of nine ft. every twenty-four hours.

The manner in which this rapid advance is accomplished is as simple and ingenious as it is safe and quick in its mode of operation. The shield is a disk of mixed wrought and cast iron, weighing about two and a half tuns. In the front next to the clay, it is concave; in the rear, where the men work, it looks like a gigantic cart wheel, having six spokes and an enormous open hollow felly in the center. To this shield, and extending backward over the men at work, is a powerful iron rim, just like the cap to the end of a telescope. Thus, the miners who work it excavate enough clay through the center opening to enable one man to pass in beyond the face of the shield, and he soon cuts away clay enough to find room for two, and when a comrade joins him, there is soon room made enough for three workers, but seldom for more. The clay is of the kind well known as the stiff London clay, of a blackish green color, just moist enough to give it a thorough tenacity, but without any water. When about two feet have been excavated all round in front of the shield, the miners return back through the central hole, and, with ordinary hand-screws, they force the shield on to the length of the distance they have excavated, its long rim still keeping them under shelter as it is advanced. Within this rim a segment of the iron tunnel is at once built in three segments, eighteen inches long, and so on, the process is repeated over and over again. The inner face of the shield is so constructed as to receive the pressure of six screw-jacks—one in each of the six spokes we have spoken of. By these means a pressure of sixty tuns could be brought to bear on the whole shield. As a rule, however, one screw-jack and one man is sufficient to move it forward, and this with ease. In case of any water