Steamers to Run Fifty Miles an Hour.

At a recent meeting in London of the Society of Junior Engineers, Westminster, a paper was read by Mr. C. Hurst, explanatory, among other things, of the power necessary to obtain a speed of 40 knots in steam vessels. Mr. Hurst explained that the power necessary to be introduced into steamers of light construction in order to obtain any required speed could not be determined by the old method of reckoning the resistance as proportionate to the midship section, but was to be ascertained by Reech's law, taking the actual speed and proportions of a first-class torpedo boat as the basis of comparison.

According to Reech's law, the speed attained by a model with any given power will illustrate the speed attainable in a large vessel having the same proportion of power, the speed of the large vessel being in all cases greater than that of the small in the proportion of the square root of the increased dimensions. Thus, if we take a first-class torpedo boat for our model, 110 feet long, 12 feet broad, and 6 feet 3 inches draught of water, and 52½ tons displacement, the speed, with 470 horse power, will be 21¾ knots, and these elements will enable us to determine what the speed of a vessel would be of the same form and of the same proportionate power, but three times larger every way. Such a vessel will be 330 feet long, 36 feet broad, and 18 feet 9 inches draught of water; her displacement will be 3^3 or 27 times greater, or it will be 52½ × 27 = 1,417½ tons. As each 52½ tons displacement must have 470 horse power, the total power will be 470 × 27 = 12,690 horse power. We shall then have two vessels in all respects identical, except that one is constructed on three times the scale of the other.

Although, however, the power is strictly proportionate in the two cases, the speed will not be the same, but by Reech's law the larger vessel will be the faster in the proportion of the square root of 1 to the square root of 3, or 1·732 times. If, then, the speed of the smaller vessel be 21¾ knots. that of the larger will be 21¾ × 1·732, or 37·6 knots per hour. If we take the larger vessel as four times the size of the smaller, the speed, with the same proportionate power, will be twice greater, or it will be 21¾ × 2 = 43½ knots per hour. The power necessary to attain this high speed will be 4^3 or 64 times 470 = 30,080 horse power. The displacement of the larger vessel will be 4^3 × 52½ = 3,360 tons, and the displacement due to the machinery will be 805·71 tons, taking the weight at 60 pounds per horse power, as in Thorneycroft's engines. The total number of horse-power required will be 470 × 4^3 = 30,080 horse power. The displacement will be 134·4 tons per 1 foot of draught. The weight of the machinery will therefore increase the immersion by 5·9 feet; and if we take the weight of the hull as equal to the weight of the machinery, the draught of water with water in the boilers and the vessel ready for sea, except coal and stores, will be 11·8 feet, leaving a balance of 13·2 feet for coal and stores. If we take the consumption of fuel at 2 pounds per horse power per hour, the consumption of coal will be 26·8 tons per hour for 30,080 horse power; and if we take the speed of the vessel at 43½ knots per hour, equal to 49·4 statute miles, the time required for a voyage of 3,000 statute miles in length will be 3,000 ÷ 49·4 = 60·8 hours. Consumption of coal to be provided for will be 26·8 × 60·8 = 1,629·44 tons as total consumption for the voyage.

This weight of coal will depress the vessel 12·12 feet, which brings up the draught to 23·92 feet, leaving a margin of about 150 tons for extra fuel and for stores. The result of the whole calculation is to show that a speed of 40 knots, or thereby, is attainable on an Atlantic voyage with a vessel of moderate size and light construction and without any inordinate consumption of fuel; and it rests, says Mr. James C. Paulson, in the *Engineer*, with those who challenge the accuracy of this computation to show wherein it is erroneous, if they can. In merchant vessels advantage has not hitherto been taken of the quality of lightness for the attainment of high speed, and it is important that this essential condition should now be taken into account.

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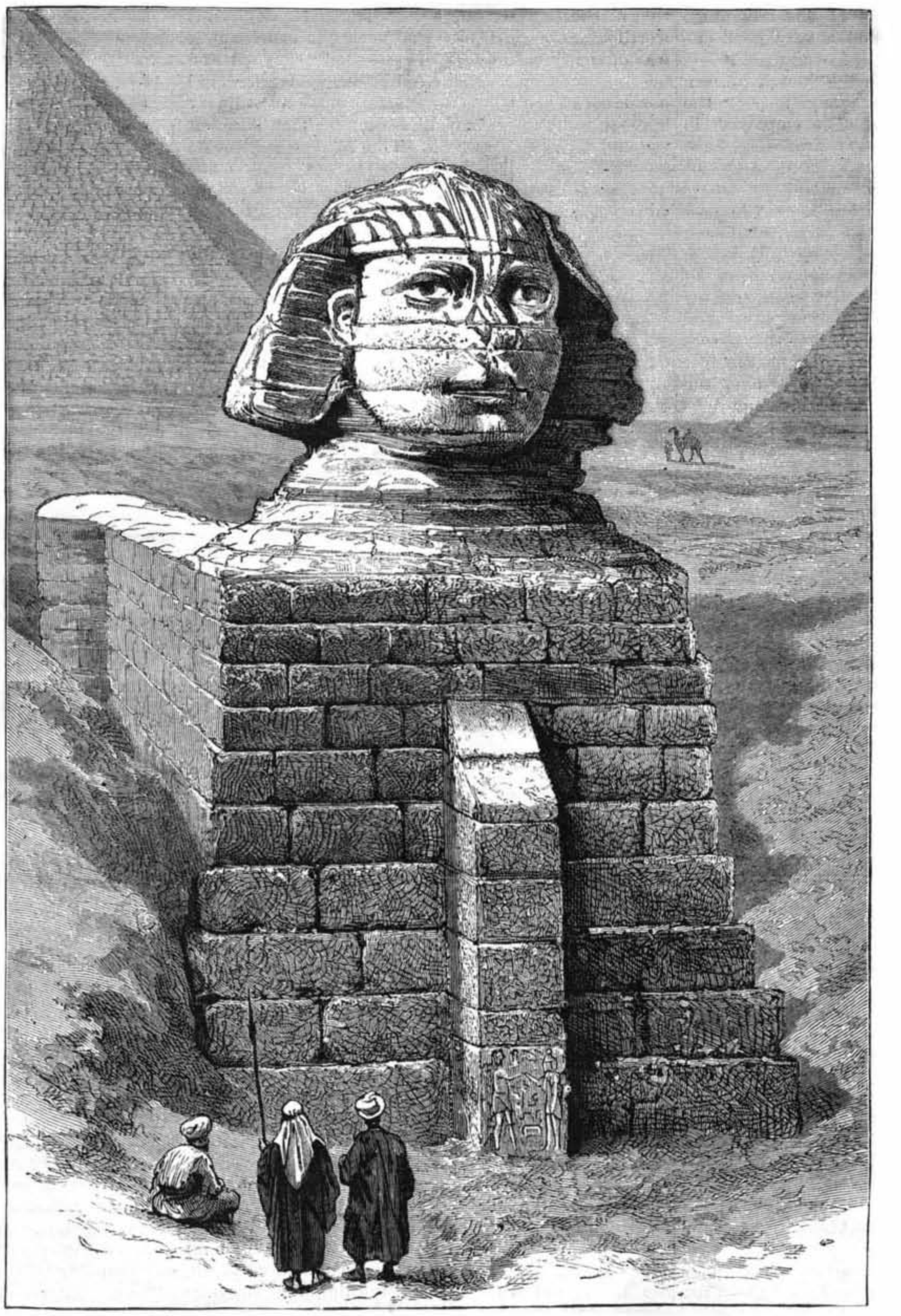
Calorific Power of Coal Gas.

The *Annales de Chimie et de Physique* recently contained a description, by M. Witz, of his experiments for determining the calorific power of coal gas. The method pursued was that of Berthelot, and consisted in the instantaneous combustion of an explosive mixture in a shell plunged in the water of a calorimeter, the elevation of the temperature of which could be exactly measured. A number of trials led to the determination, for a well-purified gas, of a calorific power of 5,200 calories per cubic meter of gas at 0° temperature and 760 millimeters pressure, saturated with aqueous vapor. This result was obtained from a gas mixed with six times its volume of air. Before passing through the scrubber and purifier, the same gas had a calorific value of 5,600 calories; so that it lost something by purifying. If the heat developed by the explosive mixture of one volume of gas and six volumes of air is taken as the standard for comparison, it is found that the same gas gives 5 per cent more heat when fired with 1·25 volumes of oxygen. With 11 volumes of oxygen, on the contrary, the calorific power is less by 4·6 per cent. It, therefore, decreases with dilution in oxygen. It is not so when gas is mixed with air. When diluted with 11 volumes of air, the calorific value is greater by 2·5 per cent. than when the gas is mixed with only 6 volumes of air. Thus the effect of the extra dilution is inversely to what might have been expected upon general principles.



THE GREAT SPHINX AS NOW CLEARED FROM THE ENCUMBERING SAND.

THE EGYPTIAN SPHINX.

For some months past, excavations have been carried on at Ghizeh, near Cairo, with the view of freeing the famous Egyptian Sphinx from the masses of sand which have gradually buried the monument. M. Maspero, the Director of the Boulak Museum, has superintended the operations, which have proved remarkably successful, and in a recent letter he states: "The result is beyond all my hopes. The face, raised fifteen meters above the surface, is becoming expressive, in spite of the loss of the nose. The expression is serene and calm. The breast has been a good deal injured, but the paws are almost intact. We have nearly reached the limits of the diggings of Mariette and Caviglia. The work now going on is in beds of sand, which have not been disturbed since the first centuries of our era." Later he writes: "The stones of the right paw are covered with Greek votive inscriptions, while the left have none—an indication that the piety of the faithful was called into play more on the south side."

Accordingly, M. Maspero thinks that there might have been direct communication between the Sphinx and the granite temple to the south, and that in the intervening space either an unknown chapel may be concealed or some group of statues, such as Mariette discovered at the Serapeum. Another important question to be solved by excavation is whether the Sphinx rests on a bed of rock or on a specially hewn out pedestal. Egyptian sculptors represent the Sphinx on a pedestal ornamented with designs similar to those on early sarcophagi; and if their representation prove true, there is a prospect, according to M. Maspero, of finding the door of a temple or a tomb on the eastern side.

In this case the pedestal may have been buried by the time of the Roman occupation, and the Ptolemies may have erected their monumental stair over the sand which covers it. This question will be decided when M. Maspero unearths the first steps. Our illustration is from a sketch by Mr. Charles Royle, Alexandria.—*The Graphic.*

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The Mercurial Preventive of Phylloxera.

Prof. E. W. Hilgard, of Berkeley, Cal., in a note to *Science*, says: It appears perfectly practicable to protect vines planted in uninfested ground from attack coming from without, by surrounding the stocks with a sufficiently thick (eight to ten inch) layer of mercurialized soil, which, without obstructing or repelling the entering insects, will insure their being fatally poisoned before they can pass through it. This would leave the choice between grafting on resistant stocks on the one hand and the mercurial protection on the other, in the planting of new vineyards, the cost being (in California) about the same in either case; it would also serve for protection against threatened invasion, in the case of vineyards already planted, since, apart from the case of open soil cracks giving access to the vine roots, the stocks are the only known route by which the phylloxera reaches the root. Such are the presumptions created by our small scale experiments; how far the process will prove available in large scale practice remains to be determined by experience.

As regards, however, the treatment of ground and vines already infested, our experiments tend to show that the diffusion of the mercurial vapor is too slow, at the ordinary soil temperatures, to promise success; especially in the case of clay soils, which absorb and render inert a large amount of mercurial vapor before an effective excess can be obtained. It has been abundantly shown that the mercurialized soil exerts no unfavorable action upon the growth of the vine; and there is every reason to expect that an application once made will remain effective during the life of the vine.

Steam Lifeboats.—An Opportunity for Inventors.

During the last meeting of the Institute of Naval Architects, the question of using steam lifeboats was made the subject of a very interesting and useful discussion. Messrs. Benjamin and Taylor have designed a very ingenious steam lifeboat, and they read a paper describing it, and exhibited a model. The boat in question is, of course, intended to be unsinkable, and, as we understand the description, she is also to be uncapsizable. A shallow hull has a rounded structure built up on top of it, within which the rescued crew of a ship are to find shelter, safety, and even a warm bath. Propulsion is effected by screws under the bottom of the boat, and partly incased in semicircular tunnels, excavated, so to speak, in the floor of the hull. So far as can be seen, the craft does not possess any of the characteristics that a lifeboat, as the term is now understood, has. But, whatever the defects of the scheme, it possessed the advantage that, as we have said, it elicited a very good discussion.

It can hardly have failed to strike thoughtful people that oars and men are in many respects the worst propelling agents that could be employed in working a lifeboat; and numerous proposals have been made for using steam instead. It is of the utmost importance that a lifeboat should get alongside a wreck as soon as possible; but hours are now spent in pulling from the shore to a wreck, when each minute may mean a life lost. Indeed, so fully is the inadequacy of manual power recognized, that at all large and important lifeboat stations, such, for example, as Ramsgate, the lifeboat is invariably taken out by a tug steamer to windward of the wreck, down to which the lifeboat then drops. When a rescue has been effected, her sails are hoisted and she runs for a port. But there are dozens of lifeboat stations where no tug is available; and in not a few cases the lifeboat has been unable to do any good, simply because she could not be rowed or sailed to the wreck. It is not too much to say that if lifeboats could be provided with steam power, a very large number of lives now lost each year would be saved. There is consequently the greatest possible stimulus to invention, and nothing, we believe, but the utter hopelessness of the task has prevented inventors from solving the problem set before them. No doubt the magnitude and exceeding difficulty of the problem are not fully realized. Captain Chetwynd, of the National Lifeboat Institution, a man of over thirty years' special experience, set these difficulties very clearly before the Institute of Naval Architects, and when he sat down his hearers must have felt certain that whatever power may yet be used for the intended purpose, steam cannot be employed. Captain Chetwynd explained that none but those who have, like himself, been personally engaged in lifeboat work can form any adequate conception of the force and fury of the waves on, for example, the Goodwin Sands. It is easy to talk about metacenters, and centers of gravity, and buoyancy; but in a heavy confused sea the laws of stability seem to be in abeyance. Over and over again, a 30 foot lifeboat stands literally on end against a sea. On two occasions, lifeboats have been turned clean over endwise. To say that they roll their gunwales under is nothing. The motion in them is simply inexpressibly violent, and apparently taking place in every direction at once. Apart from this, the seas continually break into them with tremendous violence. "When," said Captain Chetwynd, "I have often urged a boat's crew to go off in a heavy gale, they have met my expostulations with the argument, 'Our backs would be broken by the seas falling into the boat.'" He had experience of cases in which a breaker has tumbled over the bows of a boat, without the slightest injury to men forward of midships, while the men in the stern were maimed or disabled by the smash of tons of water into her stern; those forward being saved by the sea leaping clean over their heads. In addition to this, the boat must not draw 3 feet, or she cannot get through the shallow water of breakers to go alongside a wreck. On the Goodwin Sands, the lifeboats on a draught of but 3 feet are constantly thumped down on the bottom when they get in the trough between two waves. The graphic picture drawn by Captain Chetwynd places the indomitable courage and hardiness of our lifeboat crews in a stronger light than ever. Most of his hearers for the first time in their lives realized the character of the work done night after night on our coasts, and the wonderful qualities of the boats themselves. The National Lifeboat Institution possesses 270 self-righting boats. These latter craft have gone out 4,700 times and saved 12,000 lives, and in only thirty-nine instances have they been capsized, while in only 21 were lives lost. Of large boats the Institution possesses 22. These have been out 653 times and saved 1,668 lives, without once being turned over. The possibility of using steam has been anxiously considered by the Lifeboat Institution. They experimented as far as was possible for two years in this direction, and a special committee was formed at Liverpool to consider the subject. They came reluctantly to the conclusion that steam could not be used for the purpose.

It is not quite impossible that a suitable engine and propeller could be employed. The difficulty lies in the boiler. It is very difficult to see how a boiler could be fired at all; but even if it could, it is clear that the water and steam would be continually changing places. What, for example, would occur when a boat stood up on end? And without going so far as this, it is plain that no gauge yet made could give the smallest trustworthy evidence as to what was the level of the water in the boiler. The only attempt that could be made at using a boiler would be to hang it in gimbals. Again, the propeller must be at times working in air, then deeply submerged. If placed anywhere outside the hull, it would probably be torn off. If put under her, it must in the nature of things be very inefficient. It is worth notice that neither Mr. Benjamin nor Mr. Taylor thought it worth while to deal with the boiler problem as if it was of any importance. Indeed, their proposed lifeboat, being comparatively a big, heavy craft, would not labor under the same difficulties as an ordinary lifeboat would. The weight of such a boat is about two and a half to three tons. That of four large boats possessed by the Institution is ten tons each. The lifeboat of Messrs. Benjamin and Taylor weighs twenty-seven tons empty. But, as Captain Chetwynd showed, such a large craft would be useless in breakers. The modern lifeboat is a remarkable example of the skillful adaptation of means to an end, and to depart from its type in any way is, to say the least, an extremely doubtful experiment.

There is another difficulty in the way of the adoption of steam at sea which we have not yet considered. It is the grave objection which lies in the way of experimenting with an invention of this kind. Let us suppose that in a heavy gale a steam lifeboat put to sea with a dozen men on board. If the machinery broke down or became inoperative—let us say from excessive priming due to the rapidly changing position of the boiler—the lives of all on board would be lost. No one in authority would take the responsibility of trying so perilous an experiment. It is obvious, however, that before steam lifeboats can be pronounced satisfactory, such an experiment must be made, not once nor twice, but many times. Among inventors, none has had any experience of lifeboat work. It is said that one enthusiastic individual, who believed that he had solved the problem, went out one night with a lifeboat crew to gather experience. Some hours subsequently he found himself on shore, half dead with cold and misery; sorely beaten and bruised and shaken; almost drowned and wholly miserable; when he had recovered, one of his first acts was to tear up his drawings and burn his models. Even with such an experience before them, there are no doubt men who will still invent in this direction, and to such we would tender a word of advice. From any steam engine or other motor dependent on fire, nothing is to be hoped. If it were possible to put a motor on board which would not depend on such aid, it would, no doubt, prove very useful. It is a *sine qua non* that the motor must be of such a kind that it will leave the men as free as they are now to use their oars or sails, so that, should the motor fail, the crew would run no additional risk because of its presence. There is but one scheme which holds out even a faint chance of being practicable, and that is the use of electricity. It would be possible to put storage batteries into a lifeboat, and to so secure them that they would continue to work under any conditions short of turning the boat upside down. The electrical launch shows that such a mode of propulsion is, under certain conditions, possible, and the experiment of using electricity might be tried without much risk of life. But when we have said so much, we are bound to add that nothing has yet been done in electrical marine propulsion which leads us to believe that it can be applied with success to lifeboats. It may be that a steam engine may yet be devised on, say, the Lamm hot water system, which would render the use of a fire in the boat unnecessary; but of this we see, we confess, no hope. However, no one can place a limit to the power of engineers. We have set the broad facts of a most interesting problem before our readers; possibly, they may find its solution.—*The Engineer.*

The Poisonous Scorpion of Mexico.

At a recent meeting of the Academy of Natural Sciences, Philadelphia, Dr. Leidy read a communication from Dr. V. Gonzalez, giving an account of the scorpions of Durango, Mexico, and the deadly effects of their sting. They are found everywhere in the city, and every effort has been made to exterminate them, but without effect. A reward of a cent and a half for males, and double that amount for females, is paid by the authorities, and the records indicate that some years over one hundred thousand are captured and destroyed. The sting, especially in the case of children, is invariably fatal; the victim, if under two or three years of age, dying in a few hours, and sometimes in a few minutes, in strong general convulsions. No antidote for the poison has as yet been discovered, and the assistance of Dr. Leidy is asked by the writer in his endeavor to determine some successful mode of treatment. It was suggested by Messrs. Horn, Heilprin, and Leidy that the Mexican scorpion must differ from the species found in Florida and California, as the sting of the latter is not usually graver than that of a wasp.

Making Enameled Brick.

The obvious suitableness of enameled brick for use in many places exposed to moisture, or where contaminating vapors might be present in the air, has doubtless suggested itself frequently to those who have noticed its growing introduction within a very few years past; the great superiority of such bricks to painted brickwork in kitchens, laundries, courts, and cellar areaways does not admit of question, while they may also be used to advantage in many places for wainscoting in halls, as well as for ornamental fronts and trimmings.

Such brick must not, however, be confounded with a cheap glazed one, which has been sometimes used, only to open up like a chestnut burr after the first winter's frost. This description is, of course, cheaper than a good enameled brick, but the materials and workmanship that are necessary to make the latter are absolute requisites if one is looking for lasting qualities. But on account of the high cost, and the difficulty of making a good quality of enameled brick, enough of these inferior glazed ones have been used to impede the more rapid introduction of the best quality, and there are now but three or four establishments in the country which make them.

It was not until after many unsuccessful experiments that good enameled brick were produced in this country, the recipes of English and German enamelers not working well with our clays; and it is always to be borne in mind that the various proportions of the different ingredients have to be slightly changed according to the amount of oxide of iron, lime, etc., that the clay may have. In one of the enameling compounds used for a building brick, the following proportions are used: Fluor spar, 150 parts; Paris white, 60 parts; lime, 50 parts; oxide of tin, 50 parts; kaolin, 50 parts. These ingredients are pulverized and triturated to an impalpable powder, reducing the whole to a homogeneous mass, which is calcined in a crucible. After cooling, it is again reduced to a powder, water added, and the whole triturated to form an enameling compound of about the consistency of cream, in which is to be dipped that portion of the brick to be enameled, the latter to be then subjected to a sufficient temperature to fuse the enamel on the surface, this being done in seggars, or fireclay cases, holding four or five bricks each. The enamel is usually applied only to the one face or head which will be exposed after laying in the wall, except with those intended to be used for corners and reveals or window and door jambs, which have one face and head treated, and are termed "rights" and "lefts" when so moulded that they cannot be used for any corner. A black surface is made by adding to the above ingredients black oxide of cobalt, black oxide of manganese, and umber, previous to pulverizing and calcining; blue, by adding *black* oxide of cobalt; green, by adding suboxide of copper; red, by adding suboxide of copper and red oxide of iron; and almost any desired shade or tint may be given by the use of varying proportions of different ingredients.

These enameling compounds may be used on the surface of ordinary red front brick, but pressed brick are better, that the surface may be as smooth as possible, while they should be free from sand, or the enamel will not adhere. The amount of capital and the plant necessary to engage in a moderate way in the business of enameling brick, as given by a contributor to the *Clay Worker* recently, is as follows:

"In the first place, it is necessary to have a kiln adapted to this work. It is better to have a muffle kiln; but in the absence of this, a kiln can be erected with a capacity of from 6,000 to 10,000 brick for about $600 to $800. Then comes next in order the seggars; these are made to hold five brick each. They are made of fireclay, uniform in size, and burned hard, costing at the factory sixteen cents each. Next, we have the mill or pulverizer to grind the enamels in. This will not exceed twenty dollars. Indeed, any one can make a first-class one that will not exceed half that amount, and be equally as good. Next in order we have the tubs, buckets, and cups. These will cost for an establishment of this capacity about fifty dollars. Here we have an establishment all complete, except the building and enameler to do the work, for less than $2,500. With a kiln of this capacity and the assistance of a man who understands burning, an enameler and two boys can produce on an average 40,000 enameled brick per month."

The cost of enameling, as figured by this writer, is as low as $12 to $15 per 1,000, which certainly leaves a large margin for profit, at to-day's prices, but this is counting on the work being that of a good enameler, and such men are said to be very scarce.