## TERRA COTTA LUMBER.

One of the most interesting and useful inventions made within the past few years is the process of making terra cotta lumber. The making of fire hardened clay materials, whether brick, tile, or vessels of any kind, carries us back to the dawn of history. While clay beds are to be found in vast quantities in almost all countries, the utilization of the material so lavishly bestowed by nature has been, for the most part, limited to brick and pottery. It is only recently that the idea has been suggested that a material might be produced from clay which would lack the brittleness of the articles so long known, and possess the exceptional and highly valuable quality of admitting of being cut and "dressed" into irregular shapes with edged tools.

Before our time anything constructed of clay had to be given its finished form while soft, and before the material had "set." Now we can make the material in large blocks, and afterward cut and shape it as we can lumber. This peculiarity, which is so valuable, is due to the same character of internal structure which wood possesses—that is, porousness. In proportion as wood is porous, within limits, of course, it is most useful for the vast varieties of building purposes to which it is applied. And so by making terra cotta porous we bring it more within the category of wood substances, and then properly name it "*terra cotta lumber.*"

It has similarities and dissimilarities of the utmost importance in contrast with wood and clay materials, and they seem to supplement each other. In other words, terra cotta lumber occupies an intermediate position between brick-like substances and lumber. It is, for instance, brittle and not fibrous, it lacks strength to resist the transverse strain which is possessed by wood, quantity for quantity; but it presents greater resistance to superimposed weight. It is fireproof, while wood is not, and it can be "dressed" by the plane and saw, which, generally speaking, clayey substances cannot be. In addition, it will receive and retain on its surface plastering or other surfacing without the application of lath. It must be borne in mind that, being at once an earthy substance and of open or porous structure, it possesses all the qualities which appertain to those two characteristics in all substances; and it possesses the advantages not belonging to substances not having these both.

As an article of commerce and use it may be produced easily, the clay being found at hand in almost any part of the country. Hence its cheapness; hence its universal utility. Compared with other commodities it may be called home-made, like those articles of universal use produced in the farm houses everywhere. It may be applied to domestic purposes on a small scale or to the largest public structures. Its uses, indeed, require no enumeration—they suggest themselves readily to the mind. Thus invention in the useful arts is steadily bringing into utility the products of nature, which otherwise would lie like worthless material on the surface of the earth. If clay were valuable only for brick, piping, etc., but a small fraction of the clay would be utilized; but with this process a very large percentage of it becomes immediately useful. In this material, what New Jersey alone produces may be taken as an example.

The belt of country underlaid by these clays extends entirely across the State, and, as described by Prof. Cook, the State Geologist, includes an area of 320 square miles; while the area within which these deposits have been worked up to the present time is only 68 square miles, the actual openings of the clay beds being only a fraction of this last area, so that, notwithstanding the hundreds of thousands of tons that are annually produced, the industry itself may still be regarded as in its infancy. The average depth of these clay deposits is about 400 feet, and their order of superposition is shown in the following table:

| | | Feet. |
|---|---|---|
| 1. | Dark colored clay (with beds and laminæ of lignite) | 50 |
| 2. | Sandy clay, with sand in alternate layers | 40 |
| 3. | Stoneware clay bed | 30 |
| 4. | Sand and sandy clay (with lignite) | 50 |
| 5. | South Amboy fire clay bed | 20 |
| 6. | Sandy clay, generally red or yellow | 3 |
| 7. | Sand and kaolin | 10 |
| 8. | Feldspar bed | 5 |
| 9. | Micaceous sand bed | 20 |
| 10. | Laminated clay and sand | 30 |
| 11. | Pipe clay (top white) | 10 |
| 12. | Sand clay, including leaf bed | 5 |
| 13. | Woodbridge fire clay | 20 |
| 14. | Fire sand bed | 15 |
| 15. | Raritan clay beds: Fire clay | 15 |
| | Sandy clay | 4 |
| | Potter's clay | 20 |

These clays form one of the most important elements of material wealth that the State possesses. Several hundred thousand tons of fire clay are dug annually and sent into market for making fire brick, fine pottery, sewer pipe, terra cotta ware, retorts, and crucibles, facing for wall paper, etc. The average price per ton is about $4, and the aggregate production of fire clay alone in its crude state exceeds $1,000,000. The stoneware clay from Perth Amboy is shipped to all parts of the United States, and supplies the material for most of the stoneware that is used in the country. Fine earthenware was formerly imported almost wholly from Europe, but within the last few years extensive potteries have been established at Trenton, which have been remarkably successful in the qualities of the wares made, and in finding a ready market for them. The Trenton potteries employ several thousand men, women, and boys, and produce several million dollars' worth of ware annually. Although the principal ware made is of the common white earthen and iron stone, the quality of which is fully equal to the best English ware of those grades, these works at Trenton also produce a much higher grade of decorated ware, that bids fair to supersede that which is now imported of this kind. The manufacture of pottery is rapidly increasing in quality and extent. The great abundance of the clay, its superior qualities, and its convenience to market have made it almost essential to the successful prosecution of some of the great industries of the country.

Our illustrations explain themselves, and require but a word of description. The terra cotta lumber is rendered porous by the simple though ingenious device of mixing in resinous saw dust with the wet clay, and when the clay has dried burning out the saw dust, thus leaving interstices in the brick like material. The fine clay, free from vitreous ingredients, is taken from the bed thoroughly mixed by means of small quantities of water with any desirable quantity of resinous saw dust, increased in proportion as it is desirable to make the product more porous. At Perth Amboy, where the works of the New York Terra Cotta Lumber Company are located, there are eight of these mixing mills in use, run by steam.

After a thorough mixing has been accomplished, the workmen shovel the mixture out of the mills and into a traveling trough, constructed of a wide leather belt and side walls, to the belt elevator, by means of which it is carried to the third floor. Here it is shoveled into a compressor, also worked by steam, through which it passes to the floor below, and is forced through a die into any requisite shape. Here, usually in the shape of large slabs, it is left to air dry. After partially drying here, it is carried to the first floor, and then dried on a brick flooring heated by flues running underneath it from grates, as shown in our illustration on first page. Here in a short period it is thoroughly dried and hardened.

It now goes, in the form of slabs, to the ovens, six in number, where it is piled up in layers, and, after all openings are closed, brought to an intense heat and all the saw dust burned out. This occupies forty-eight hours, and produces in that time about 180 tons of completed fireproof lumber.

It is now planed, tongued, grooved, sawed, etc., into any desirable shape, and this floor almost resembles a saw mill or carpenter's shop. The dust of the sawing is carried off by means of a steam blower.

In conclusion, we may enumerate some uses to which it may be applied. It is light, bulk for bulk, and may be united like joiner work or nailed into place like so much wood. In the waterworks of the Holly system it has been used and pronounced admirable for filters. Saturated with petroleum, it becomes a valuable fire lighter or kindling wood which may be used indefinitely. When immersed in boiling asphalt for a few moments, sufficient bituminous matter is absorbed to resist the action of water, for the asphalt becomes part and parcel of the material itself, and does not flake off when exposed to cold or dampness, as with common brick, solid terra cotta, or iron.

This fact and the splendid insulating qualities both of the material and the asphalt are now attracting the attention of electricians, and give reasonable hope that one of the problems of underground telegraphy has at last been solved.

The many future uses to which it may be put can be conjectured from the number of applications for patents being now made by Mr. Gilman, the inventor, for special purposes, to wit: Filters, underground electrical insulation, steam boiler and pipe sheathing, fire lighters, imperishable ground sills, waterproof brick, grain and elevator bins, refrigerators, safe and vault linings, fireproof jackets for iron columns, furnace linings, safety warehouses, etc.

Not the least noteworthy characteristic of this material is the fact that there is no waste in its manufacture, for the reason that all the remnants and edgings made by sawing, etc., find a market.

Up to this time, the factory of the company, located near Perth Amboy, N. J., has been engaged chiefly on architectural work for Columbia College, the H. H. Cook mansion, and other modern fireproof structures.

Samples of this fireproofing exhibited at the American Institute in this city received the medal of superiority, with a diploma. A new mill, the largest plant of the kind in the world, will be erected the coming season.

Patents have been granted by England, Canada, and Continental governments of Europe, as well as by the United States. The New York offices of the company are at 71 Broadway.

## The Dust in the Atmosphere.

BY DR. ASSMANN, OF MAGDEBURG.

Every one has noticed that when a ray of sunlight streams through a dark room, the air that otherwise seemed pure is seen to be inhabited by millions of very small particles. These little bodies are all embraced under the general name of "atmospheric dust."

There is a considerable difference in the general properties of this dust both in size and shape, as well as in weight. In size the particles of dust vary from several millimeters in the large flakes of soot from our factories, or the pieces of carbonized vegetable particles that are carried aloft in burning over swamps, down to the almost immeasurable particles that are designated by the term "cosmic dust," and probably result from the combustion of meteorites. They do not exceed in extent the ten-thousandth part of a small snow crystal.

If water from freshly fallen snow be evaporated under the microscope, we discover in it particles that derive their origin from all three of the natural kingdoms, animal, vegetable, and mineral.

Floegel, for example, found, in such cases, living infusoria and algæ, bacilli and micrococci, mites, diatoms, spores of fungi in immense numbers; also fibers of wool, mouse hairs, pieces of butterfly wings, skins of the larvæ of insects, cotton fibers, pieces of grass seed, bits of grass, epidermis, pollen grains, rye and potato flour, grains of quartz, minute pieces of roofing tiles, with bits of iron and coal.

The weight of the particles is limited by the possibility of their being sustained and floated on the currents of air. The larger their surface and the less the weight, the longer they will continue to float in the atmosphere.

Dust can be raised only by mechanical force, and this force is the moving air. If the motion of the air is horizontal, the quantity of dust lifted from the ground is comparatively small, particularly if the inclination of the surface varies but little from the horizontal. If the horizontal motion of the air is changed by a vortex or whirlwind into an ascending one, it raises a much greater quantity of dust. Those regions that have few or no plants in them are specially favorable to formation of ascending currents of air, in consequence of their being strongly heated by the sun's rays. But these very regions are most frequently covered with a fine grained, light soil that is easily carried off by the wind, so that we may consider our deserts as the chief source of the atmospheric dust.

It has long been known to seamen who sail in that portion of the world, that off the west coast of tropical Africa the atmosphere is often filled with a thick cinnamon colored dust, so that the coast is scarcely visible at a distance of five (English) miles. This dust consists chiefly of fine quartz sand, and of still finer yellowish detritus, mixed with very numerous organic forms. Hellmann has proved that the furnace which makes this "trade dust" is western Africa. The rain of dust thus formed often lasts ten days, and extends several miles from the spot where it originated.

In many cases masses of dust are precipitated from the atmosphere in form of rain, snow, or hail; hence snow and rain water not infrequently have a yellowish red color.

The phenomenon known as "rain of sulphur" depends upon an admixture of pollen with the rain.

Volcanoes furnish a second source of atmospheric dust. During the eruptions huge volumes of ashes and fragments of rocks are carried up into the air and borne to a great distance. The swamp burning common in northwestern Germany (and the forest fires in America) cause the formation of large quantities of dust

Fires for domestic and manufacturing purposes contribute a large percentage to the atmospheric dust. If we consider that in London over seven million tons of coal are consumed annually, and in the whole of England fifty million tons, and that the products and residues of this combustion are for the greater part carried into the air, it will be possible to form some conception of the quantity of dust derived from this source.

Finally we have to mention cosmic dust, which is referable to meteorites.

Concerning the actual quantity of dust floating in the air, Tissandier found in the air of Paris, after a week of dry weather, that there were 23 milligrammes in a cubic liter (or about 1 grain to 100 cubic feet). After a heavy rain there was about one-fourth as much (6 milligrammes to 1 liter).

The effect of the atmospheric dust is to diminish the amount of light and heat received from the sun, in the first place, and in the second to condense the aqueous vapors. An English investigator maintains that without dust no clouds could exist, no rain be formed; that dust is the nucleus on which vapors are condensed. Whether he is correct, farther research must decide.

The effect of atmospheric dust is of a manifold nature. Many plants owe their fertilization to the winds which carry the fructifying grains of pollen. But the moving air also bears along with it a number of germs that cause plant diseases, such as rust, mildew, and blight. Animal bodies suffer in two ways from dust, either by the mechanical irritation of delicate organs, or by infection. In the latter respect the recent investigations of Pasteur, Naegeli, Kock, etc., render it exceedingly probable that all infectious diseases are due to the introduction into the system of a specific living germ of disease.

Hence the dust of the atmosphere is a factor which, in a meteorological and morphological, as well as phainological and hygienic aspect, exerts an important influence on our ball of earth and its inhabitants. Its investigation and study is still in its infancy and will certainly bring to light many other very important results.—*Chemiker Zeitung.*

## City Telegraph Wires Underground.

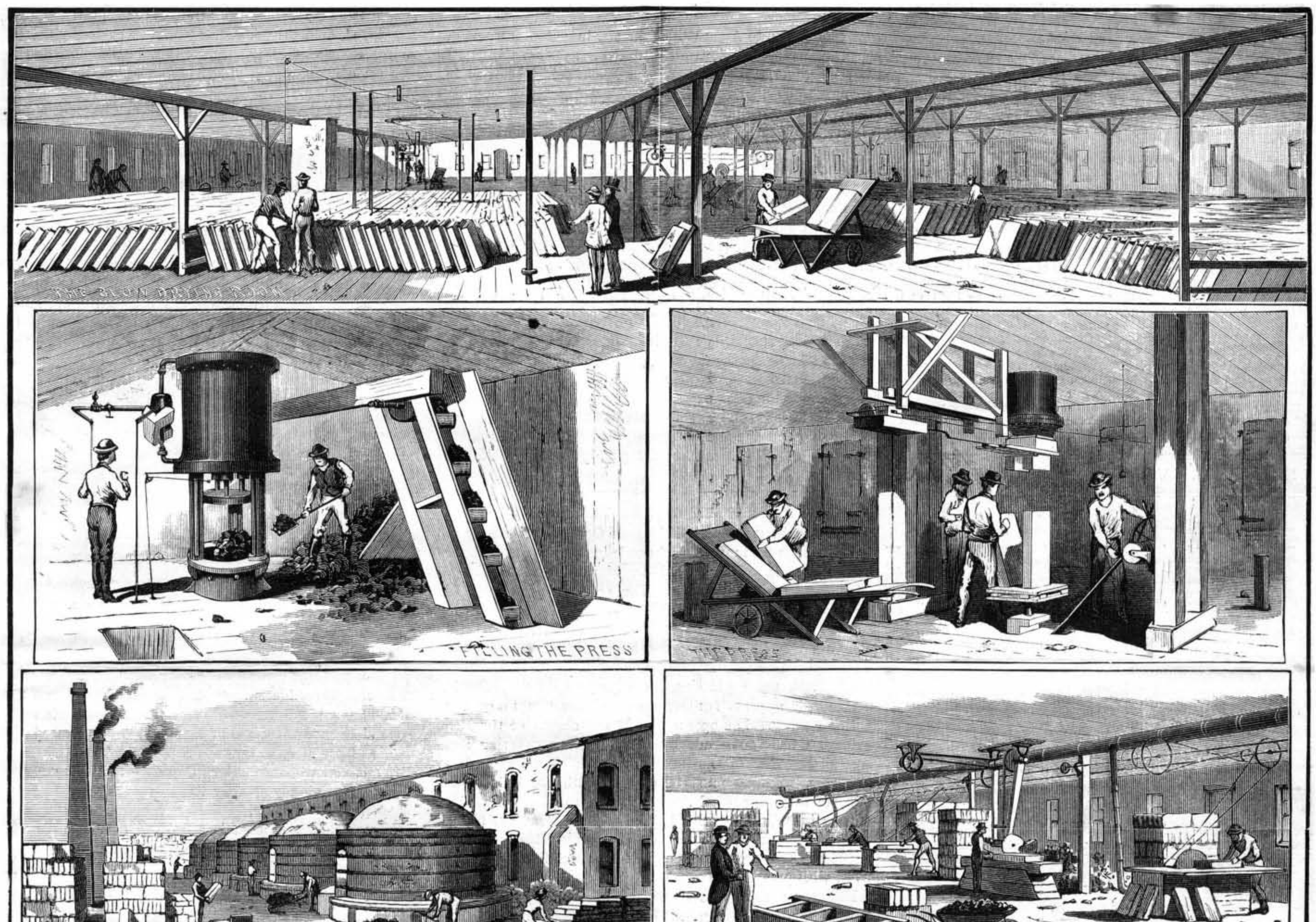
It is gratifying to know that the Western Union Telegraph Company have decided to begin in earnest the work of putting all the wires of the company in this city underground. The first underground main will extend from the company's building at Broadway and Dey Street, up Broadway to 23d Street. The wires, it is said, will be laid in a tube large enough to contain 200 wires. The contract for this primary line has been given out, and work upon it will begin, it is promised, as soon as the weather will permit. The right to use the streets for this purpose was secured a few years ago. The promise is that, if the underground system adopted works well, it will be extended to all parts of the city.

# SCIENTIFIC AMERICAN

[Entered at the Post Office of New York, N. Y., as Second Class Matter.]

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY AND MANUFACTURES.

Vol. XLVIII.—No. 7. [NEW SERIES.] NEW YORK, FEBRUARY 17, 1883. [$3.20 per Annum. [POSTAGE PREPAID.]


**WORKS OF THE NEW YORK TERRA COTTA LUMBER CO.**—[See page 100.]