and the figures on the dial then become obscured.

The flag on the Franco-American taximeter has but two positions, the "vacant" and the "recording." The number of the tariff to be used is operated by a key or lever, as is also the "non-recording" device.

The flag shaft on the Jones instrument makes a revolution for each transaction, passing successively through the positions of "tariff 1," "non-recording," and "tariff 2" to the "vacant." In these two instruments the "non-recording" position is used while the passenger is paying the fare, and also when the car is held up by a traffic block, a mechanical derangement, or other cause for which the passenger should not legitimately be charged.

The unscrupulous chauffeur can profit by the ignorance or inattention of the passenger. One passenger having been discharged, and another immediately hailing the cab, the chauffeur may not throw the flag from the "non-recording" position to the "vacant" and then to the "tariff" position, as he should do, but on some makes of taximeters can move it from "non-recording" backward to "tariff." If the passenger does not notice this, at the end of his trip he will be required to pay the sum shown on the taximeter, which includes the charge of the previous passenger as well as his own. This is particularly likely to be the case where the first passenger had only a short ride, the chauffeur being reasonably certain that the second passenger will not quibble over a matter of 30 to 60 cents. Again, with any make, at the end of the trip the chauffeur may move the flag from the "tariff" position through the "non-recording" to the "vacant" without stopping. The figures will thus disappear from the face of the instrument before the passenger has had time to read them, so he must take the chauffeur's word as to the charge.

If the passenger will assure himself of the correct position of the flag, and will insist on reading the taximeter before making his payment, he will protect himself against an overcharge.

The taximeter is actuated by means of a flexible cable driven by a star wheel that is operated by the rotation of one of the vehicle wheels. The connection between the star wheel and the vehicle wheel may be by spur gears, or by a spiral of 1⅛ turns attached to the spokes of the driving wheel. With taximeters operating by a spiral, it is possible in some cases to bend this in such a manner that it engages two teeth of the star wheel where it should engage but one, the taximeter then registering double.

An accurate operation of the taximeter cannot be secured when it is driven by one of the driving wheels of the car. The driving wheels are controlled by the engine, and if running on a slippery pavement, they may revolve more than once where the front wheels, which are actuated by the forward movement of the car, would make but one revolution. If a chauffeur runs his car with the taximeter-controlling wheel on a slippery portion of the pavement while the other driving wheel has good traction, a far greater mileage will be recorded by the instrument than should justly be the case. It is quite usual to see taxicabs operating on slippery days with a non-skid device on the wheel that is not operating the taximeter. The action of the differential, due to the difference in the traction of the two driving wheels, will then cause the taximeter to register a far greater mileage than is legitimate. The profit due to this comes only in part to the chauffeur, for he usually gets a percentage of the day's takings. It is the company operating the taxicabs that will receive the greatest benefit from an arrangement of this sort. In certain European cities it is against the law to operate taximeters by one of the driving wheels of the vehicle, and this is undoubtedly a great protection to the traveling public.

The taximeter itself is protected by lead seals, which must be broken in order that access may be gained to any part of the mechanism. Because of this, the chauffeur does not attempt to dismount any of the mechanism; and even should he disconnect the star wheel, so that the instrument will not register at all, the discrepancy between the normal mileage of his car and the reduced mileage shown by the instrument as a result of his act, would lead to his prompt detection.

It is possible for the chauffeur to defraud the company by carrying passengers while the taximeter flag is in the "vacant" position, collecting from them what they are willing to pay, and explaining the extra mileage shown by the instrument as having been required in returning from some distant point after the discharge of a passenger. He can also run with the flag in the "non-recording" or "payment" position, when no corresponding charge will appear on the instrument; but as the taximeter clockwork records for the benefit of the company the minutes during which the flag is in this position, an excess would lead to his detection.

In London, all taximeters are under the strict supervision of the police department; and not only must each make be passed upon, but every instrument must be tested and stamped before it can be put into service. In Paris, as well as in London, the police have the authority to stop any taxicab for the purpose of inspecting the instrument and receiving assurance of its correct operation, and can also arrest any chauffeur whose flag is not in the proper position for the number of passengers he is carrying.

The large transportation companies operating taxicabs in New York city are sincere in their endeavors to protect their patrons from overcharges, and inquire into all complaints. They state that a considerable proportion of the complaints made to them are due to the carelessness of the passenger in not noticing the position of the flag or in neglecting to read the instrument, and in unfamiliarity with its operation. In going to a point exactly one mile distant from the starting point, for example, the direct run would record a charge of 50 cents; but if traffic conditions required the driver to go even slightly out of the way, the instrument would record 60 cents. The taximeter measures the distance in units of one-quarter of a mile, and makes its charge in advance. A recognition of this fact would remove one cause of discussion between passenger and chauffeur.

When a knowledge of the taximeter is instinctive in the traveling public, the chauffeur will not attempt to mislead or to overcharge; but until then it is only to be expected that unscrupulous drivers will endeavor to add to their incomes by imposing on the ignorance or credulity of their passengers.

CLAY PRODUCTS OF THE UNITED STATES.

Bricks have been found as old as 4000 B. C., so that their use is coeval with the birth of history. In the Middle Ages, with the rise of Gothic architecture the use of brick greatly declined. It was not until the reign of Queen Elizabeth that the manufacture again flourished in England, and it was not until 1625 that bricks began to be made of uniform size.

In this country brick were probably first burned in the colony of Virginia as early as 1612, says Charles E. Hall in an interesting Bulletin of the Bureau of the Census. In New England brick and tile making seems to have been followed as an independent calling about the year 1647. Though the product was of good quality the industry did not thrive, as money was scarce and timber plentiful, and it was not until after the revolutionary war that home-made bricks came into general use. With increasing prosperity the desire and necessity for more substantial structures arose. The growth of the industry from year to year naturally provided a stimulus for the invention of machinery that would produce better brick, new shapes, and different sizes; and in turn these new inventions contributed to further the growth of the industry. The earliest record of a patent issued by the United States Patent Office for brickmaking is dated May 15, 1800, and was for a brick and tile machine invented by G. Hadfield, residence not recorded. Other patents issued about that time were one to E. Miller, July 17, 1802, for a brick machine; one to N. and P. W. Miller, January 5, 1804, for a brick and tile machine; one to W. Hodgson, Richmond, Va., May 22, 1805, for an apparatus for making tile, brick, etc.; and one to J. F. Gould, Newburyport, Mass., March 1, 1806, for a brick machine. The first patent granted for a brick-kiln was issued to H. Read, of Kensington, Pa., June 17, 1840; and the first for a brick dryer, to S. M. Parish, of Baldwinsville, N. Y., August 16, 1864.

Although much the same process for making brick and tile has been used for ages, the evolution of the industry through the use of improved methods and machinery has brought about a great change in the character of the product. It is a long stride from the use of hand pick and shovel to steam shovel in uncovering the clay bed; from the old-fashioned ring pit to the machine that grinds, tempers, and molds; from the use of a hand mold to the machine with a capacity of 100,000 bricks per day; from the open air system, or a weather beaten drying shed, to the utilization of artificial heat for drying; from the temporary to the patented continuous kilns; and from the poorly made product of years ago to the firm, straight-edged, and otherwise well finished product of to-day. Of the $119,956,959 capital invested in this industry, the machinery, tools, and implements represent $33,295,324, or 27.8 per cent, an increase in five years of $16,045,486, or 93 per cent.

Common Brick.—Enormous quantities of common brick are manufactured in all sections of the country. Surface clays are generally used, and more attention is given to the volume than to the color and general qualities of the product, as the price is low and the brick used mostly in ordinary wall construction and foundation work.

Sand-lime Brick.—The sand-lime brick industry has passed the experimental stage, and though still in its infancy there is every reason to believe that it will eventually rank among the foremost of the country. The successful manufacture of sand-lime brick in foreign countries appears to antedate that in this country by several years. According to United States Consul-General Mason, at Berlin, the discovery that freshly pressed bricks of sand and lime could be hardened in a few hours by heat and pressure of steam was made in Potsdam, Germany, about 1880. Plants on a large scale were subsequently constructed, and the industry extended throughout Germany and Great Britain. In the United States the industry has grown from one plant, established in Michigan City, Ind., in 1901, to fifty establishments in 1905. In some instances these brick were made in establishments having clay products as their chief output, while in others they were products of plants exclusively confined to the manufacture of sand-lime brick.

Red Front Brick.—In the production of red front brick great care is exercised in the selection of raw materials and in the process of manufacture. The clay must be well tempered; the brick molded free from flaws or sand cracks; the method of drying be more complete than for common brick; and the repressing and subsequent drying, setting in kiln, and burning, skillfully and systematically managed. This additional attention necessarily increases the cost of production. Every State reported the manufacture of red front brick except Florida, Nevada, South Dakota, Vermont, Wyoming, and the Territory of Arizona. The State of Pennsylvania ranks first in value of product, New Jersey second.

Fancy and Ornamental Brick.—Fancy colored and ornamental brick are primarily pressed brick. The different shades of color in the former are produced by the addition of artificial materials or by the manipulation of the kiln fires, while the distinguishing feature of ornamental bricks are the designs in relief or in intaglio upon the surface to be exposed.

Fire Brick.—As the name implies, fire brick are used where intense heat must be withstood, as in cupolas, blast and glass furnaces, coke ovens, locomotive fire boxes, etc. The utility of the appliances just mentioned depends largely, it not altogether, on construction out of materials which will stand intense heat without fusing, cracking, or yielding in any way.

A new fire brick made from ashes has been produced by a Michigan firm. The ashes are united by a powerful binder, molded, and the product conveyed straight to the drying room. It is claimed that the brick are ready for laying five days after manufacture; that they have been tested in fire and water with satisfactory results; and, further, that the product is two-fifths lighter than terra cotta, and yet stands considerable crushing force.

Enameled Brick.—These bricks are ornamental, and in addition to being used for external decoration in the construction of buildings, are extensively used for sanitary purposes, their glazed and vitreous surfaces rendering them waterproof and easy to clean. As the surface of the brick to be enameled must be smooth and free from sand, pressed and fire brick are most often used.

Hollow Building Tile and Blocks, and Fireproof Brick.—On December 9, 1856, a patent was issued to M. and J. H. Buck and F. A. Cushman, of Lebanon, N. H., for a machine for pressing hollow building brick or building tile. This industry, though yet in its infancy, is rapidly growing in importance, as the product is essential to the construction of modern fireproof buildings.

Possibly nothing has contributed more to the demand for burnt clay products, and brought more clearly to the attention of the public their value as a fire retardant, than the recent great fires in Baltimore, Rochester, and San Francisco. Without considering, however, these occasional catastrophes, it is estimated that the United States yearly sustains a fire loss of $250,000,000, a sum almost double the combined value of all clay products manufactured in this country during the same time and nearly three times the total value of all the brick, fireproofing, terra cotta, lumber, hollow building blocks or tile, and roofing, floor, and encaustic tile. With such an enormous annual property loss, and with the thinning out of the forests of the country, it is reasonable to believe that a change in building methods is imminent, and that the new era of construction will be of immeasurable benefit to those engaged in the manufacture of burnt clay building materials.

It is claimed that the annual fire loss in this country during the past five years amounted to about $2.50 per capita, as against only 33 cents per capita in the larger European countries. This unsatisfactory showing for the United States has resulted in a growing demand for a fireproof brick that can be used in the construction of moderate-priced dwellings, and several large plants are now making a specialty of such an article.

Drain Tile.—The manufacture of drain tile also dates back to early ages, and many instances of its general use by the ancients have been found. That it was used, probably in a crude form, by the early settlers of this country can not be doubted, as patents were issued for its improved manufacture in the year 1800.

Pottery.—It is recorded that a white ware was produced at a pottery erected in Burlington, N. J., in 1685 by the American agents of Dr. Daniel Coxe, of

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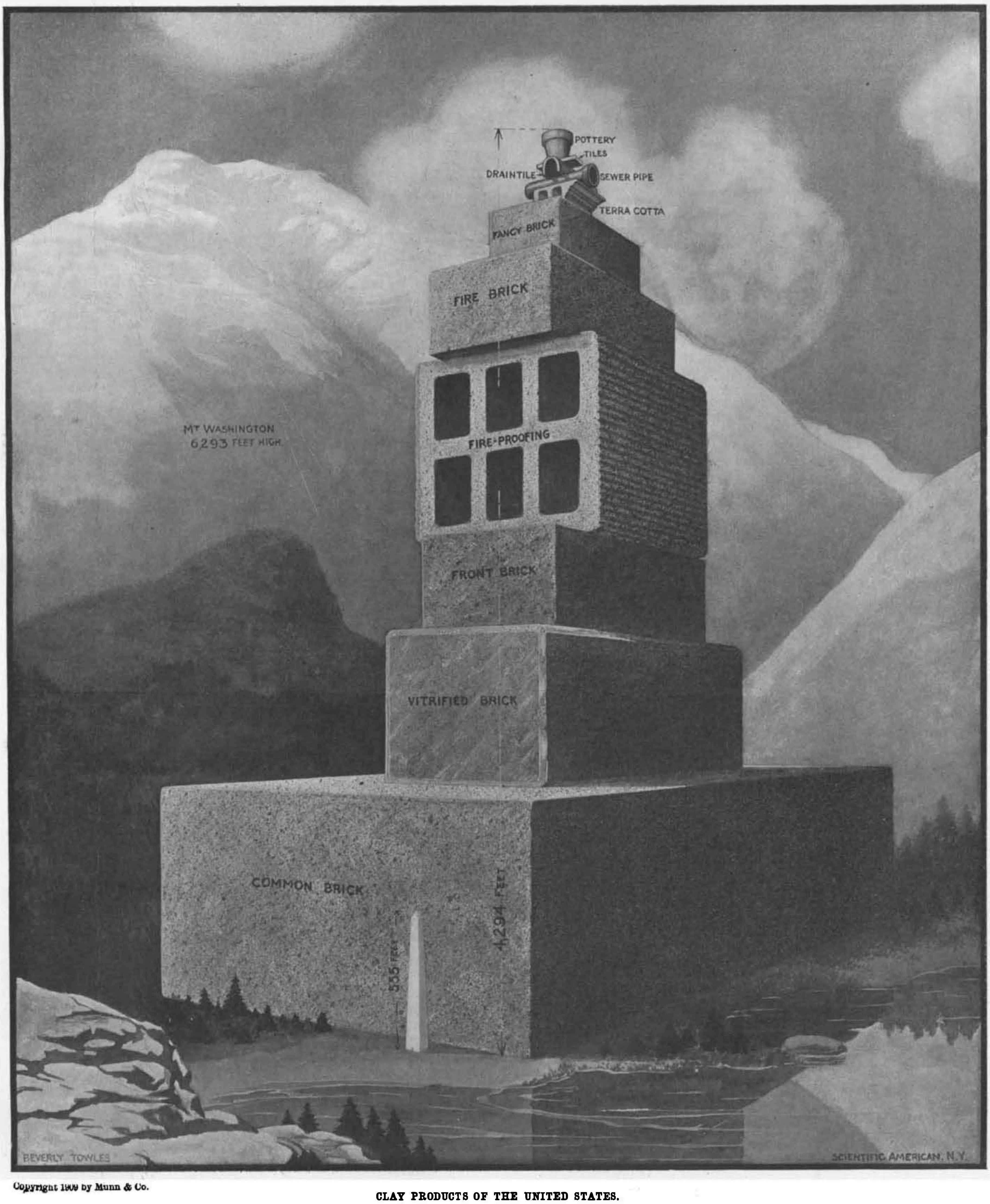

CLAY PRODUCTS OF THE UNITED STATES.

The pyramid of burned clay would be 4,294 feet high and represents a value of $158,942,369.—[See page 93.]

London. However, it is not likely that the ware made at this pottery was white, general opinion being that it was yellow and cream colored, as at that time no other ware was known except the porcelain which came from China, and was known as "China ware." Ordinary household pottery and ornamental vases for flowers were made in West Whiteland, Chester County, Pa., as early as 1753; a pottery and glass works was in operation in Germantown, New Quincy, Mass., in 1760; and a pottery in South Carolina in 1765. Cream colored ware, both plain and decorated in blue, was made in Philadelphia in 1770.

It appears, however, that the potteries established before the revolutionary war did not meet with marked success, and that this industry, like the manufacture of brick, did not assume commercial importance until after that war, when a period of new economic and industrial life began. About this time many enterprises were launched, including a number of potteries.

Our first page engraving shows a graphical comparison of the magnitude of clay products for one year. The pyramid would be 4,294 feet high and looms well up toward the summit of Mount Washington.

The total value of the products of clay in the United States in 1907 was $158,942,369. It was divided up as follows:

	Quantity.	Value.
Common brick	9,795,698,000	$58,785,461
Vitrified paving brick	876,245,000	9,654,282
Front brick	585,943,000	7,329,360
Ornamental brick	....	361,243
Enameled brick	....	918,173
Fire brick	....	14,946,045
Stove lining	....	627,647
Drain tile	....	6,864,162
Sewer pipe	....	11,482,845
Architectural terra cotta	....	6,026,977
Fireproofing	....	3,162,453
Hollow building tile or blocks	....	1,088,165
Tile, not drain	....	4,551,881
Miscellaneous	....	3,000,201
Pottery	....	30,143,474

Correspondence.

POE AS A SCIENTIFIC WRITER.

To the Editor of the SCIENTIFIC AMERICAN:

At this writing the University of Virginia is celebrating the one-hundredth anniversary of the birth of America's great poet and author, Edgar Allan Poe. It may not be generally known to those interested in scientific subjects, aviation, etc., that the immortal composer of the "Raven," originator of the short story, and the first great exponent of the science of deduction and unraveler of intricate ciphers and cryptograms, cherished an ambition, according to his biographer, to shine as a scientific writer. Among his miscellaneous writings there is a descriptive article on the flying machines of Henson and Stringfellow, the originators of the single and superposed fixed surfaces, or aeroplane, as it is known, and whose labors at that time (1845) were the sensation of Europe. Henson and Stringfellow constructed and tested a number of model aeroplanes of various shapes and designs; what they conceived to be the best one was fitted with the marvelously light steam engine constructed by Stringfellow (now at the Smithsonian Institution, Washington) and forms the subject of Poe's article, written in the flawless style peculiar to him, employing terms in the description of the model that are new, and doubtless were the invention of his own fertile brain. J. C. PRESS.

South Norwalk, Conn., January 20, 1909.

AUTOMATIC BLOCK SIGNALS.

To the Editor of the SCIENTIFIC AMERICAN:

I do not agree with Mr. Fagan, who says automatic signals are in any way responsible for railroad accidents. The Boston Elevated Railroad is thoroughly equipped with an automatic block system, installed in such a manner that an accident from a rear-end collision is impossible. A train disregarding one of these signals, at danger, is brought to an immediate stop by an air tripping device. This is much better than any system of rigid discipline of employees. A signal system has come under my notice, which will eventually, I believe, be universally used on all railroads in the United States. It is a system of electric semaphores, centrally controlled, and by pressing a button from the central office, it will set the signal at danger at any desired point on the road. This signal, equipped with a telephone in a box, is located at the base of the pole. As each conductor carries a receiver in his pocket, the train crew is in a position to communicate with the central, or dispatcher's office, and find out why any particular signal was at danger. These signals would be so arranged (as all automatic signals are at the present time) as to show danger in case the signal was out of order; and the train crew would communicate with the dispatcher before proceeding. With this system a dispatcher could *block* trains for a whole division. Of course, he would have to receive prompt "O. S." from stations along the line. The advantages of this system would be a saving in interlocking apparatus and the doing away with a great many block towers (but not switch towers). It is also superior to the automatic block system, in my opinion, for this reason: That trains are under central control, and in case of a train disregarding a signal, an indicator located in the dispatcher's office would show what signal had been disregarded. This is the case in the Boston Elevated Railway's dispatcher's office. F. H. SIDNEY.

Signal Dept., B. & M. Railroad Terminal Division, Wakefield, Mass., January 12, 1909.

THE MEAT INDUSTRY OF AMERICA.—II.

The reader of this article will be surprised to learn that from fifty-six to fifty-eight per cent only of the animal, as purchased on the hoof, is available for the table. In the early days of the meat industry, the other forty-two to forty-four per cent was regarded as useless and allowed to go to waste. To-day, however, there is practically no part of the animal that is not turned to some useful account. It is claimed, indeed, that the profit of the packing houses is now almost exclusively made out of the by-products.

The hides are carefully stripped by a workman, especially trained to the task, who is careful not to spoil the hide by the slightest slip of his knife. After they have been inspected, they are graded, according to their quality, salted, and stored, and finally sold to the tanneries. The various fats from the animals are worked up into tallow, and the finer qualities, known as butter fats, are used in the manufacture of oleomargarine or butterine, for which by-product Swift & Co.'s plant has a capacity of fifteen tons a day. From the beef suet is made the by-product known as stearine, which is used in large quantities by the tanners and the candle manufacturers. From the seven thousand skins of the sheep, which are killed in this establishment every day, there is gathered daily about ten tons of wool. The lean meat trimmings are passed through a process of preparation, from which they emerge as a good quality of sausages. Horns and hoofs, which at one time were thrown away, now find a ready market. Packing-house refuse is used extensively, also, in the great fertilizer industry. The viscera, immediately upon their separation, are passed down a chute into a lower room, where, after going through certain processes of cleansing and chemical treatment, they are made to render their tribute of useful product, the fibrous matter being dried and ground up for fertilizing material. The bones are worked up into glue and phosphate, the latter being ultimately made into fertilizing material by mixing it with the nitrogenous matter of the fibrous residue, above mentioned, and of the blood.

A most important part of the work of the government inspector consists in looking after the sanitary conditions of the various floors or rooms throughout the building, and the personal cleanliness of the large army of employees. The workmen are required to keep their working clothes clean, or as clean as the conditions of work of this character will admit. Those that handle the meat must wash their hands at stated intervals, lavatories with running water and the necessary appliances being provided for this purpose. If an inspector sees a workman with clothing that is unnecessarily soiled, he orders him to at once change to another suit. For the disinfection and cleansing of the cleavers, scrapers, knives, saws, and other tools, vats of boiling water are provided in close contiguity to the rail and the working benches; and, in cases where defective animals have been detected, the inspector orders the butchers, before they proceed to another department, to at once cleanse their hands in a disinfectant solution of bichloride of mercury; he sees, also, that all tools and implements are similarly cleansed and disinfected. Sheet-iron clothes lockers are provided for the clothes of the workmen, with sheet-iron partitions between the compartments, and perforated sheet-iron doors in front to insure a free circulation of air.

Having now described in detail the various processes in the preparation of refrigerated meat for the market, we will proceed to describe the other great system of meat preservation known as curing, as carried out in the cutting up, pickling, salting, and smoking of ham and bacon. The hogs are driven from the stockyard pens, where they have already undergone a government inspection, to the dressing floor, which has a capacity of 1,000 hogs an hour, or 10,000 per day. They are driven, a few at a time, into a pen, on one side of which revolves a large hoisting wheel with short lengths of chain attached by means of hooks to its outer rim. In the pen are two boys, who quickly loop the chain around the hind legs of the hog. As the wheel revolves, it lifts the animals, one by one, to the top of the wheel, at which point the chains are automatically transferred to an inclined rail. Here the porker passes an operator, who swiftly dispatches it with a deft knife thrust; and after a short interval it is automatically released into a huge vat of scalding water of a temperature of 150 deg. F., where it remains for five minutes. The effect of the hot water is to loosen the hair and scurf and clean the hide. It is then taken from the tank and drawn up through a vertical cylindrical scraping machine, which is full of downwardly-projecting steel scrapers, which are pressed by springs against the body of the animal as it passes through, and take off in a few seconds time nearly all of the hair. It then passes to the scraping bench, where such portions of the hair as have not been removed by the machine are taken off by hand. The bench is arranged as a traveling table, and the hogs, laid across it side by side, travel slowly past the line of operators. When the animal reaches the end of the bench, the operation of dressing is begun. Here the first government inspector examines the glands of the throat, feeling some and cutting into others in order to be sure that the animals are perfectly healthy. The animal is then held in front of what is known as the polishing machine, which consists of a rotating shaft provided with a number of flexible arms made of heavy belt leather, each arm being shod at its end with a steel strap. As the shaft revolves, the animal is pressed against the rotating arm and is strongly beaten and scraped. It is then subjected to a steam jet blast, after which it is hung on the shaving rail, where the last of the hair is removed by hand. This finishes the cleaning; and at this point government inspector No. 2 looks for and identifies the pass mark of inspector No. 1, and places a tag upon the animal.

The animal is now ready for cutting up, and this work is done by an army of skilled workers, each one of whom, as the animals, traveling at the rate of about thirty feet a minute in a continual procession, pass before him down the overhead rail, performs his particular part of the operation with really marvelous speed and dexterity. The viscera are placed in a trough, whence, after they have been carefully examined by a government inspector, they pass to a room where they are separated and sorted, and subsequently manufactured into various by-products. The stomach, after the grease has been extracted, is made into fertilizers; the liver and heart are sold as food products, and the intestines are cleaned and made into sausage casings. The leaf lard (the fat which grows on the inside of the body) is taken out, and subsequently worked into kettle-rendered lard or neutral lard, the kettle-rendered lard being the ordinary lard of household use, and neutral lard being used in the manufacture of butterine. The animal, after being split in two along the vertebræ, finally reaches the end of the rail, where it passes before the fourth government inspector, who examines the inside of the pleural region as a final assurance of perfect health, and also examines the glands near the base of the backbone. The next journey is to the hanging floor, where the sides are sorted according to weight and quality, and are partially cooled by being allowed to hang in a draft of air for a period of a few hours. From the hanging floor the sides are carried into the chill room, a huge refrigerator capable of accommodating many thousand sides. Here they are kept for forty-eight hours at a temperature of 32 deg.

From the chill room the sides are taken to the cutting room, where the shoulders are chopped off, the hams removed, and the feet are cut from the hams by band saws. The bacon pieces are put through rolls to flatten them out into a suitable shape for salting and packing. All the portions of the meat, as thus cut up, are carefully trimmed, and the trimmings are sent down a chute to a room below, where they are retrimmed, the lean portions being subsequently made up into sausage meat, and the fat portions into lard. In the cutting room the "fresh-meat portions" are wrapped in paraffine paper, and packed in boxes and barrels for immediate shipment to the retail butchers. After the meat has been trimmed and cut up, it is sent down a chute into the grading room, where each ham, shoulder, or side is weighed and sorted according to its weight and quality.

It is probable that there is no feature of the meat industry, at least as carried on under modern conditions in the largest establishments, regarding which there has been more popular misconception than that of the curing of meat. While it is undoubtedly a fact that some meat, prepared by obscure and small dealers, occasionally may be subjected to treatment that renders it undesirable, we believe that the system of curing, as carried out by the large establishments under the regulation of federal laws, is perfectly wholesome, and absolutely insures the use of only such ingredients as are healthful.

As a matter of fact, the constituents of the solution or pickle used in curing meat, viz., salt, saltpeter, and sugar, are the same that have been used by the farmer, the butcher, and the housewife from time immemorial; and it is certainly remarkable that, in spite of the fact that the problem of meat preservation has been made the subject of thorough laboratory investigation for a long period of years, the chemists have been able to find nothing which gives more satisfactory results than the time-honored preservatives of our forefathers.

The supervision of the federal government of the curing of meats is carried on with the same thoroughness to which we have drawn attention in our description of the preservation of meats by the method of refrigeration. Salt, saltpeter, sugar, vinegar, and wood smoke are specified by law as the only preservatives that may be used. Borax, of which so much has been heard lately, is expressly prohibited except in the case of meats put up for export in accordance with the directions of a foreign purchaser. In this case borax may be used, provided it is not prohibited by the country to which the meat is to be sent. England