AMERICAN INDUSTRIES.—No. 43.

THE MANUFACTURE OF STOVES, RANGES, AND HEATERS.

Perhaps no one thing has contributed so generally and positively to the increased comfort of American homes as the great improvements which have been effected in the stove manufacture within the lifetime of men who are not yet old. The business does not cover all branches of the house-heating service, but it is the most important one, and one in which the products very largely go to supply the wants of the common and middle classes of people. In fact there are none so poor now, in this country at least, but they have the advantages of stove heating to make their apartments comfortable and for cooking purposes, and our mechanics and laboring men generally are now more comfortably protected against the cold in their living rooms than were the richest and most favored a hundred years ago.

For family and office stoves, and for nearly all kinds of ranges, heaters, and furnaces of the present improved construction, the world is indebted almost exclusively to American inventive genius and mechanical skill. German and Dutch stoves of rude contrivance were first used, and Benjamin Franklin made an improvement on these in what he styled his "Pennsylvania fireplace." One of his arguments for them, as given in his quaint language, was: "If you sit near the fire, you have not that cold draught of uncomfortable air nipping your back and heels, as when before common fires, by which many catch cold, being scorched before, and, as it were, froze behind." But we have made great progress in the stove manufacture since Franklin's time, and probably there is not another firm in the country which has been more conspicuously identified with this advancement than that of Fuller, Warren & Co., whose extensive works, known as the Clinton Stove Works, at Troy, N. Y., are illustrated on the first page of this paper. The business of which they are the direct successors was founded over half a century ago, when cooking stoves were in the first stages of their development, and from that time to this the house has occupied a leading position, not only as regards the improved patterns of stoves they manufacture, but in the care and nicety with which the parts are finished and made to fit and work easily. In the latter particular their stoves have always been conceded by the trade to have especial excellence, whether in the cheaper or the more costly kinds.

In our illustrations, the views in the center and on the right hand side at the top show where the patterns are prepared for the moulders, and the flasks made—the latter being the boxes containing the sand in which the moulds are made. But a small portion of the work in getting out patterns is done at the foundry, a huge amount of outside help being constantly employed in this and in getting up new designs. The pattern is first made in wood, and from this a casting is taken, which, after being filed and fitted up with the greatest nicety, is used as a working pattern. These iron patterns are all "bedded," as it is called, or backed up with wood, which is done in the same department as the flask making. One of the most important points in all stove pattern making is to have the patterns of such form and the weight of metal in the various parts so balanced that there will be the least possible liability of the castings to warp and crack with the extreme and sudden variations of temperature to which all stoves are subjected. To guard against this the pattern maker often has to modify designs or change proportions, though it is generally possible to do this in parts of the work which are not seen.

The moulding and casting, which is shown in the view to the left at the bottom, is carried on in four large shops, the buildings for this portion of the work covering two acres and a half of ground. Three cupolas are used daily, from which forty to forty-five tons of iron are run for an average day's work, though the foundry has a capacity sufficient to run as high as sixty tons a day. The best No. 1 American pig is principally used, and two hundred and forty men are employed in this branch of the business. About forty thousand pieces are taken out of the moulds every day. The sand used in moulding is found in large quantities and of excellent quality in the neighborhood. Adjoining the moulding shops is an interior space of about the size of two full city lots, in which are piles of fire pots and rough heavy pieces for heaters and furnaces, where they are placed when taken out of the sand until the other parts are finished. The casting proper, or pouring the metal, is mostly done by carrying the metal by hand to the moulds, but for the large pieces cranes are used to take the molten metal from the furnaces to where the casting is to be made. The running of the metal always takes place between two and four o'clock in the afternoon, the mornings being occupied in preparing the moulds and taking out the castings from the previous day's work.

All the other work, when taken out of the sand, goes to the cleaning room, which is shown in the view to the right in the middle of the page. Thirty men are employed in this department. All of the small pieces, and some of the larger ones, are here milled in drums about the size of a hogshead, revolving at a slow rate of speed, to rub off all of the sand which may adhere to the castings and smooth the rough edges. A great deal of this work is done by hand, which is necessary on most of the large pieces, the men using stiff steel wire brushes. Many machines have been contrived for taking the place of hand work in this department, but no one of them has thus far met with favor in the trade.

The "polishing" room represents the department where the iron work intended for nickel plating is prepared for that process. All such parts, as also the other portions of a stove which are intended to show bright iron without nickel plating, are first ground on emery wheels, and then the parts which are to be nickeled are polished on leather-covered wooden wheels. About one hundred emery wheels are used daily for the finishing of bright parts.

The nickel plating department, as shown in the view on the right at the bottom of the page, represents a portion of the stove making business which was unknown until within the past five years, but during this period the popularity of this style of stove ornamentation has become so pronounced that it is now seen on all classes of work. A large sized Weston electric machine is employed here, and 8,000 to 10,000 pieces are plated per day, requiring the services of fifty men. After nickel plating the pieces are burnished on wheels made of felt and of muslin; the latter consist of enough thicknesses to make the width of the face of the wheel, and the edges of the muslin, when the wheel is revolved at a very high rate of speed, form an efficient burnisher. On some of the stoves now made there are as many as seventy nickel plated pieces.

In the "mounting" room, illustrated in one of the views, the stoves are all put together, the parts being made to fit nicely and work evenly. In the thoroughness with which this final testing of all the preceding operations is done the firm have long had a high reputation. For many years, in their early history, they were the makers of a line of stoves which became celebrated throughout the country, though they have since been to a large extent superseded by more modern patterns.

The designer and patentee of these goods, Mr. P. P. Stewart, gave his entire personal attention to the manufacture, and especially to the mounting, looking over the work in this department every day. It is one of the traditions of the foundry that if he could insert the edge of a piece of paper between an oven door and its frame, the door had to be rehung. The easy working as well as the perfect fit of all dampers and doors and movable pieces of all kinds, is carefully looked after in this department, and when it is remembered that in some of their first-class goods as high as 150 pieces are required in one stove, it will be seen that this is one of the most important divisions of the business. The stoves are all put together before being sent out, except that, in an order for export, it is sometimes, though not often, desired that the parts be packed separately to save freight. In such cases, however, the stoves are all put together at the works, as if for the local trade, and afterward taken apart to box for shipment.

It would require a good deal of space to make even a bare enumeration of all the goods produced by this establishment. They have a wide variety of patterns in some of the best styles ever introduced of stoves, ranges, and heaters, and make, besides, all the tin and copper work required on their premises. What is known as the anti-clinker grate, in stoves for parlor and office use, has met with a good deal of favor during the few years it has been in use. This grate, as is generally known, allows for a space between the upright parts of the fire pot and the grate, in which a poker can be used to remove any clinker that has lodged there. Some of their stoves are made for wood and soft coal, and some for hard coal, while others are calculated for use with either. A large tin shop, not shown in our illustrations, gives employment to fifteen hands; 500 boxes of tin are used here in a year for making stove fittings, with stamping machinery, etc., and for lining reservoirs, oven doors, warming closets, etc. Asbestos and fireproof paint are also used in the linings of oven doors to help retain the heat. Fifty tons of sheet iron are consumed yearly, with a good many tons of sheet copper, used principally for reservoirs. Another considerable department is that in which the japanning is done, in an oven 8 by 14 feet. All the fine pieces go into the oven twice, being carefully coated with a fine brush for the finishing operation. The oven is generally heated to only about 350°, though it is sometimes as high as 500°. All of the bolts and rods used, from five inches up to seven feet long, are made on the premises, but those smaller than this are purchased, although all the door pins used are made in the shop. There is a large storeroom, in which a great stock of stove manufacturers' hardware and supplies is carried, such as bolts, rivets, nuts, oils, paints, varnish, etc., which are issued on requisitions of the different foremen and charged up to the various departments, and the works, which is in what is locally known as South Troy, is connected by telephone with the main office, in the center of the city, from which all its operations are constantly directed.

The general view of the works, in the middle of the page, gives a good idea of their size and capacity. Over 600 men are constantly employed here, besides a large number of outside workmen. A pair of 300 horse power engines, built by William Coutie & Son, of Troy, furnish the power. The premises cover six acres of ground, all of the buildings but the moulding shops being five stories high, and the whole of this space is in constant use for the handling of the immense amount of work all the while going through the establishment. Tracks from the Hudson River, New York Central, Troy and Boston, and Vermont and Canada railroads, run on one side of the foundry, and on the other is the firm's dock on the Hudson river, just opposite the United States Arsenal at West Troy, which may be seen in miniature in the picture. There could not be a more convenient location for obtaining supplies of coal and iron, or for shipping goods, and the iron business has been for so many years a leading feature in that section that almost the whole of the male population have been brought up to and worked all their lives in some one or other specialty of this trade. The stoves made here, besides selling in every part of this country, are exported to almost every quarter of the globe. There is a good demand for them in England, and in Germany, Russia, and Scandinavia; several shipments have been made to Constantinople and other ports on the Mediterranean; some sales have been made in Japan and on the east coast of Asia; a few days ago an order was filled for Australia; and from both the east and west coast of South America considerable trade in this line is now coming here.

Besides their main offices and salesrooms in Troy, occupying three large buildings on River street, they have in New York city, at No. 236 Water street, salesrooms and a large stock of goods always on hand. In Chicago they have an immense warehouse located on the North Pier, and connected by telephone with their offices and salesrooms at No. 56 Lake street. In Cleveland, Ohio, their warehouse and salesrooms are located in the three commodious buildings known as Nos. 76, 78, and 80 River street. And a large stock of their wares is kept at Omaha, Neb., for rapid distribution, by Milton Rogers & Son; and from these central points they are enabled to make distribution of goods with great promptness and dispatch.

Photographic Novelties.

PHOTOGRAPHY APPLIED TO THE BIOSCOPE.

The London *Photographic News* reports the following most recent novelties in photographic discovery. M. Eugène Simmonar has invented a kind of bioscope, in which a portrait is shown with the eyes sometimes open, sometimes shut. The illusion of the same person alternately awake and asleep is very perfect. To obtain this effect, the inventor takes a double photograph of a sitter in exactly the same position, only in the first the eyes are open, in the second closed. From these two negatives prints are taken, one on the right side, the other on the reversed side of the same sheet of paper, in such a way that the two images, when viewed by transmitted light, accurately coincide; this can easily be done by the carbon process. By means of a small instrument arranged for the purpose, the light and reversed sides of the paper are alternately illuminated, and the face is seen with the eyes successively open and shut. Thus the illusion of a person rapidly winking can be perfectly produced.

PHOTOGRAPHIC TOY.

M. Lipman has applied an analogous principle to the production of trinkets, in which are set two photographic miniatures, something similar to those which M. Dagron used to make many years ago. For example, one of the miniatures represents a lady holding her opera glass to her eyes, the other a portrait of the same lady without the glass. By means of a small button acting on a reciprocating motion, one image may be rapidly substituted for the other, and a very good illusion is obtained of the figure raising and lowering the opera glass. Effects of this kind are susceptible of any amount of variation. A large number of highly interesting applications of a similar description would appear to be open to gelatino-bromide plates, especially as their superior over wet collodion plates, as regards sensitiveness, increases enormously the facility for obtaining the desired result.

Steam on the Upper Delaware.

The steamboat Kittatinny, the first that ever reached Port Jervis, N. Y., returned to Delaware Water Gap April 28, without accident, having run the 50 miles in less than five hours. The Kittatinny is 60 feet long, 14 wide, and can carry 70 passengers. The Port Jervis *Union* does not think that the attemp to navigate the Delaware to that point will be permanently successful. It says: The opening the Delaware to steam navigation would uncover one of the most delightful regions in this country. The scenery along the river is grand and picturesque in the extreme. Every mile presents some new and wonderful panorama, and thousands of those who go to the Catskills and Adirondacks for wild landscapes would spend their seasons in this valley if once its beauties were made accessible. The Lehigh and Eastern Railroad will do something toward increasing the travel in this valley, but nothing will ever quite equal the advantages that would be offered by a line of steamers plying between Trenton and Port Jervis. We would like to see all the difficulties removed, and the daily arrival and departure of steamboats to and from Port Jervis; but we know that so long as the Delaware remains a mere big mountain torrent, with treacherous rocks and foaming shoals, the thing cannot be accomplished.

Fall of Meteoric Dust.

Professor Silvestria, of the Catania Observatory, reports the fall, on the night of the 29th of March, of a shower of meteoric dust, mingled with rain. Besides the usual characteristics of color, chemical composition, and the mixture of mineral and organic particles and minute infusoria, there was a considerable proportion of iron, either in a purely metallic state or in metallic particles, coated with oxide. The size varied from a tenth to a hundredth part of a millimeter, and the form was either irregular or spherical, as if it had undergone fusion. This phenomenon was first observed in the Indian Ocean, south of Java, in 1859, and has been corroborated by Professor Nordenskjöld's Arctic observations.

The Self-leveling Ship's Berth.

A special exhibition of the Huston self-leveling berth was given on board the Havana steamer City of Alexandria, April 28. This berth is so hung and balanced as to maintain a level surface whatever may be the rolling or pitching of the vessel. By this means two sources of discomfort during sea-voyages are materially overcome. The new berths are placed like ordinary berths, and take up but little more room; and while they must necessarily partake of the larger motions of the ship they are quite free from sudden pitching and rolling. Many who have used them at sea testify to a complete exemption from sea-sickness while occupying them. And to those who do not suffer from this distressing malady their advantages would seem to be scarcely less marked. They are so well balanced, and keep their level so surely, that their occupants can lie at ease, with no risk of being thrown out by a sudden lurch of the ship. Any one who has been tossed about in an ordinary berth will appreciate the luxury of a level and steady sleeping place during rough weather.

Was it Wind or Lightning?

A suit has been brought in the Circuit Court at Madison, Wisconsin, to collect from an insurance company for damages done by the great storm of 1878. The property was insured against lightning, and the company resist payment on the ground that it was destroyed by wind. The plaintiff hopes to prove by the evidence of members of the Signal Corps that the whirlwind which destroyed his house was of electrical origin. A vast amount of insurance is likely to be affected by the decision of this case, owing to the heavy losses of property during the recent whirlwinds.

River Scenery of Alaska.

Alaska is covered with a network of deep, cool, perennial streams, that flow on, ever fresh and sweet, through grassy plains and mossy bogs and rock bound glacial cañons, telling everywhere, all the way down to the sea, how bountiful are the clouds that fill their ample fountains. Some thirty or forty rivers have been discovered in the Territory, the number varying, as the smaller ones have been called rivers, or creeks, by the mapmakers. But not one of them all, from the mighty Yukon, 2,000 miles long, to the shortest of the mountain torrents falling white from the glaciers, has thus far been explored. Dall, Kennicott, and others have done good work on the Yukon, and miners, trappers, and traders have been over most of the region in a rambling way, and each have brought in detached bits of river knowledge, which, though too often misty and uncertain, have been put together in maps that are better than nothing.

The coast line in particular, with the mouths and lower reaches of the rivers, has been fairly drawn, but their upper courses are in a great part invisible, like mountains with their heads in a cloud. Perhaps about twenty of the Alaska rivers are a hundred miles or more in length. The Stickine is, perhaps, better known than any other river in Alaska, because of its being the way back to the Cassiar gold mines. It is about 350 or 400 miles long, and navigable for small steamers to Glenora, 150 miles, flowing first in a general westerly direction through grassy undulating plains, darkened here and there with patches of evergreens, then curving southward, and receiving numerous tributaries from the north, it enters the coast range and sweeps across it to the sea through a Yosemite valley more than a hundred miles long, and one to three miles wide at the bottom, and from five thousand to eight thousand feet deep, marvelously beautiful and inspiring from end to end. To the appreciative tourist sailing up the river through the midst of it all, the cañon for a distance of about one hundred and ten miles is a gallery of sublime pictures, an unbroken series of majestic mountains, glaciers, falls, cascades, forests, groves, flowery garden spots, grassy meadows in endless variety of form and composition—furniture enough for a dozen Yosemites—while back of the walls, and thousands of feet above them, innumerable peaks and spires, and domes of ice and snow tower grandly into the sky. Sailing along the river the views change with magical rapidity. Wondrous, too, are the changes dependent on the weather. Avalanches from the heights, booming and resounding from side to side; storm winds from the Arctic highlands, sweeping the cañon like a flood and filling the air with ice dust; rocks, glaciers, and forests in spotless white.

In spring the chanting of cascades, the gentle breathing of warm winds, the opening of leaves and flowers, birds building their nests, hundred acre fields of wild roses coming into bloom, and tangles of bramble and huckleberry, swaths of birch and willow creeping up the lower slopes of the walls after the melting snow, massive cumuli piled about the highest peaks, gray rain clouds wreathing the outstanding bows and battlements of the walls. Then the breaking forth of the sun on it all; the shining of the wet leaves, and the river, and the crystal spires of the glaciers; the looming of the white domes in the azure, the serene color grandeur morning and evening, changing in glorious harmony through all the seasons and years.—*San Francisco Bulletin.*

APPARATUS FOR REGISTERING SOLAR RADIATION.

Solar radiation is an element which undoubtedly plays considerable of a *rôle* in meteorological phenomena, and several methods have been employed to automatically register the period during which the sun is shining, the interruptions to radiation caused by clouds, etc. The Meteorological

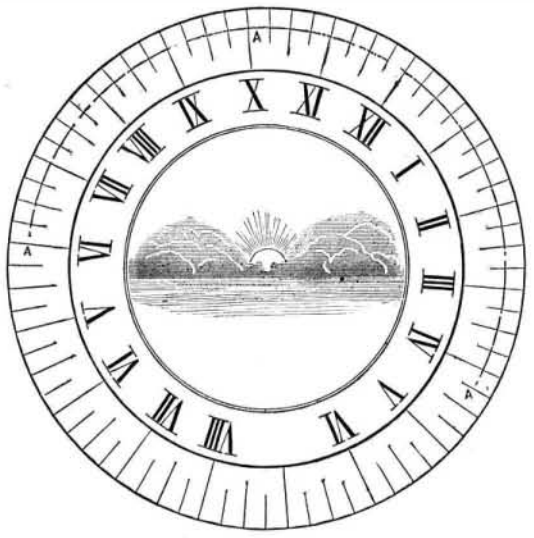


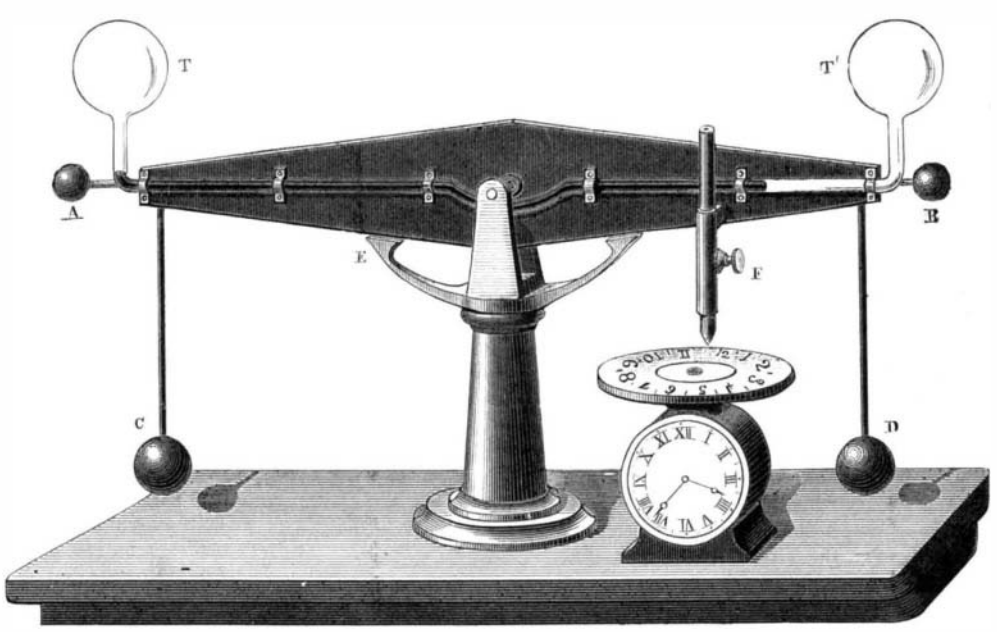
Fig. 2.—TRACING MADE BY APPARATUS FOR REGISTERING SOLAR RADIATION.

Observatory at Kew has in operation an apparatus designed for such a purpose by Campbell. It consists of a glass globe filled with water, forming a lens, and so arranged as to carbonize a strip of paper by concentrating the sun's rays when they traverse the atmosphere. An English physicist, Mr. David Winstanley, has remarkably improved on this system. His apparatus consists of a differential thermometer, T T' (Fig. 1), mounted on the beam of a balance, as shown in the accompanying engraving.

The two bulbs of the thermometer, T T', are covered with lampblack. The bulb, T, to the left is alone exposed to the open air, all the rest being inclosed in a box. When the sun shines the air contained in the bulb, T, dilates, and the mercury in the differential thermometer is driven into the tube, thus destroying the equilibrium of the balance. The beam then inclines, and the point of the pencil, which is fixed to the support, F, rests on a paper circle fastened to a copper disk. This disk keeps constantly revolving on its axis, carrying with it a paper dial like that represented in Fig. 2. When the sun is no longer shining the balance resumes its equilibrium, the pencil ceases to touch the paper, and the tracings made by it are thus broken.

In Fig. 2 the line, A A A, represents what was inscribed by the registering pencil on the 1st of September, 1879. It will be seen that the sun shone from 6 to 7:30 o'clock in the morning; and that from 7:30 to 8 o'clock clouds intervened several times, since the line is broken. In a like manner may be seen the duration and interruptions of radiation up to 4:15, when it was definitely arrested for that day. To complete the description of this ingenious apparatus we will add that the metallic balls, A B, are provided with screws, and serve to place the beam in equilibrium. The rods, C D, are made of metal, and are designed to prevent oscillation.

The tracing, which is reproduced reduced one-half, is a specimen of such as the inventor obtains at his Douglas Observatory in the Isle of Man.



APPARATUS FOR REGISTERING SOLAR RADIATION.

The New Oil Pipe Line.

Describing the oil pipe line now being pushed toward the seaboard, the Hornellsville *Times* says: Its beginning is near Bradford. It pursues a straight line to the east that, if continued, will bring it out near Catskill on the Hudson River. It may bend to the southeast to strike water at New York. It is generally considered that this line is intended to convey oil to the seaboard or some river convenient thereto. By whom it is being pushed through is a puzzle. Report says the project is advanced by the Union Tank Line Company This is undoubtedly a branch or only another name for the Standard Oil Company.

The cost of the undertaking cannot be estimated, but that it is a gigantic enterprise and will cost a vast sum may easily be shown. The tanks at Cameron Mills will cost nearly $10,000. Each of the pumps will weigh sixty-five tons, and will cost $16,000 or more. The engines will consume five to ten tons of coal per day. The pipe is wrought iron and costs $1.20 a foot. Add the cost of surveying, clearing away, laying the pipe, burying it, engine buildings, and a score of other things, and the expenditure, were it known, would seem fabulous.

A new telegraph wire has been put up along the railroad, and a report of progress at various points is daily wired to headquarters. When the line is in operation a full report of the business at each station will daily be telegraphed to the proper officials. Every length of pipe is numbered, and is checked off when put on and taken off of the cars. It is receipted for by the teamster and again by the men who lay it. Every detail in this great scheme is watched and properly recorded and reported.

Chinese Sheet Lead Factories.

The manufacture of sheet lead for the lining of tea chests is an important industry at Hong Kong. The melted lead is pressed into sheets by hand between pairs of large paving tiles smoothly covered with several layers of unsized paper. As he drops the melted lead on one tile the workman quickly presses it into a sheet with the other. The paper being a bad conductor of heat, the lead does not solidify immediately it leaves the ladle; and as by long practice the workman always ladles out exactly the same quantity of lead, the sheets vary but little either in size or thickness. The sheets are afterwards trimmed by hand with large shears.

A New Process for the Treatment of Sulphureted Ores.

A new method of treating gold-bearing sulphurets, by which such ores can be reduced, it is said, at a cost not exceeding $4 a ton, has lately been developed and tested in Philadelphia. The *Record* describes the process as follows: The ore is first passed through a powerful rock-breaker, in which it is broken into small pieces. From here it goes into a pulverizing machine, where it is reduced to grains so fine that they will pass through a sieve running 3,600 holes to the square inch. Thence it is put into the ore roaster. This is the chief feature of the process. It is composed of fire-clay retorts of cylindrical shape, built one above the other in four tiers, the entire structure being fifteen feet high, eight wide, and twelve deep. The heat in the retorts varies, the lower one being the warmest and the upper the coolest. The powdered ore is passed into the rear of the top retort, and is moved slowly along by means of a comb worked by machinery until the front is reached; thence it falls into the retort below, then moves back, and the operation is repeated until the last and bottom retort is reached, when it passes out, the whole operation consuming about four hours. By this process the sulphur is burnt out of the ores, the base metals are oxidized, and the gold is left in a free metallic state.

After this the ore, having been cooled, goes into an automatic amalgamator. Here it is treated with hot fumes of mercury, which instantly attach themselves to the precious metals and amalgamate every particle of the free gold in the ore. By the other processes numberless small pieces of gold, which have not gravity enough to attach to the plates, float away and are lost. With the use of hot mercury, however, these small particles are rolled into globules and are consequently saved. Again, when ordinarily treated, small portions of gold become coated with copper and iron, and are thus lost. In this process, however, such a coating is stripped off by the action of the hot mercury, a condition of amalgamation which is never accomplished when cold mercury is employed.

After passing from the amalgamator the ore is thoroughly cooled and then thrown into settling pans filled with water, which are kept agitated for the purpose of settling the quicksilver containing the gold. This is next placed in a retort, where the mercury is separated from the precious metals.