

missing it on their return, attempt to rise to the surface unaided, and are drowned. At other times the diver will be wounded by jagged rocks, or his rope will become entangled, exposing him to great risks where the depth is great.

Though varying much in quality and size, the sponges are roughly divided into three classes: (1) The fine white bell-shaped sponge, known as toilet sponge; (2) the large reddish variety called bath sponge; (3) the coarse red sponge used for household purposes, carriage cleaning, etc. Two thirds of the produce of the Syrian coast are purchased by native merchants for exportation, while the remaining third is purchased on the spot by French agents. France takes the bulk of the finest qualities. One tenth the price received by the finders goes to the government for revenue.

It is possible that this high-priced and durable variety of sponge might be cultivated in our southern waters, as a substitute for the beautiful but tender sponge they now yield. The experiment would be worth trying.

#### INSPECTION OF BOILERS.

We have recently received the report of the Hartford Steam Boiler Inspection and Insurance Company for 1874. These annual reports always contain a great deal of information valuable to steam users, and we give a summary of the present one.

The company report the total number of boiler explosions of which they have knowledge, occurring during the year in the United States and Canada, to be 105, killing 183 persons and injuring 199. They were only able to ascertain the causes of a few of these explosions, but venture the opinion that they might have been prevented in great part by a system of careful inspection. As we have already explained to our readers, the ground in England is so well occupied by boiler insurance companies that the cause of every explosion is carefully investigated; and the results of these investigations confirm the opinion of the Hartford company, that boiler explosions can be prevented.

During the year, the company inspected 29,200 boilers. Of this number, 9,451 inspections were internal and complete, and the hydraulic test was applied to 2,078 boilers. The number of defects discovered by these inspections was 14,256, of which 3,486 were regarded as dangerous, or, in other words, the company declined to take any risks until the defects were remedied. The report is mainly taken up with explanations of the nature of these defects and the proper remedies. It is not uncommon to find a furnace out of shape, or with a fractured sheet, as the result of overheating and sudden cooling. Blisters in plates are caused by imperfections in the iron. They should be trimmed off and a patch applied, if the thickness of the sheet is much reduced. External corrosion is caused by exposure to the weather, leaky fittings, and the like. Boilers should be set so that they can readily be examined externally. Internal corrosion is ordinarily caused by acids in the feed water, and the remedy is, of course, to purify or change the feed. In cases of internal corrosion, some plates of a boiler will be clean and bright, while others are corroded and pitted. This seems to be due to differences in the iron composing the sheets. Internal grooving is caused by change of shape, due to varying temperature and the action of acids in the feed water.

One of the most common difficulties is caused by the deposit of scale in boilers. The principal impurities in water are lime, sodium, and magnesia, with salts of iron and organic matter. The carbonate of lime is deposited in the form of a soft slush; but combined with other impurities, it forms a hard scale. If a boiler is blown out while the water is hot, this slush remains, and is baked into a hard mass; but by allowing the water to cool, and then letting it run out, the slush can readily be removed by a stream of water from a hose. The sulphate of lime, unlike the carbonate, forms a hard scale at once, and is, therefore, much more troublesome than the carbonate. It becomes necessary in such a case to use some kind of scale preventive. The company hesitate to recommend any of the patent compounds in the market, since it is impossible to say that a preparation which is good for one boiler will be good for all. Frequent blowing will be found very beneficial, lowering the water level two or three inches at a time. Potatoes act mechanically, enveloping the deposits and preventing their adherence to the boiler. Petroleum has been found useful in some cases, but its general application is not recommended. Astringents, containing tannic acid, decompose the carbonates, forming insoluble tannates; but the tannic acid in some cases attacks the iron of the boiler. Common soda appears to be one of the best solvents, being introduced with the feed, in ordinary cases in quantities of from 1 to 2 pounds a day. Whenever solvents of any kind are used, the boiler should be cleaned frequently. The use of feed water heaters, to collect the impurities, has been recommended in former reports. These views are entitled to great respect, from the extensive experience of the company with deposits in boilers and the means of preventing and removing them. We can fully endorse the recommendations given above.

While we have necessarily been brief in our review of this admirable report, we have endeavored to notice all the most important points.

#### MICHIGAN'S SALT INTERESTS.

The first establishment for the production of salt in Michigan went into operation in the spring of 1860. Four thousand barrels were made the first year. In 1864, the yield was upwards of half a million barrels. The next five years showed little progress; since then the gain has been steady until 1874, when the total product was 1,026,979 barrels. Thus in fifteen years the Saginaw Salt Springs have become

as productive as the Kanawha (Va.) Springs, where the manufacture of salt has been carried on since 1804; and two thirds as productive as our New York springs, where the manufacture was begun as early as 1797. The manufacturing capacity of the salt works of Michigan is now about 1,800,000 barrels a year: the total product since 1860 being nearly eight million barrels. Owing to the constant efforts of the State Inspector, and the intelligent care of the manufacturers, during the past two or three years the quality of the salt produced in Michigan has been much improved, so that it begins to compare favorably in the markets with the products of Onondaga.

The first satisfactory evidence of saline waters in the State, of a strength to make the manufacture of salt profitable, was published by the State Geologist, Dr. Houghton, in 1840. The untimely death of that gentleman deprived the State of its main reliance for giving intelligent direction to the development of the industry which promised so much advantage, and the interest languished for twenty years. Since 1860, as we have already seen, the correctness of Dr. Houghton's opinions have been amply demonstrated.

The primary source of the brines of Michigan is not yet fully determined, though indications point strongly to a deposit of rock salt underlying a large portion of the northern part of the Lower Peninsula. No borings have yet demonstrated this theory; still such would seem to be the most probable source of the present supply of brine. The immediate sources of the saline waters appear to be areas of depression in the strata known as the Michigan salt group and the contiguous sandstones above and below. Along the Saginaw Valley, the depression seems to be greatest, and here the brines have the highest specific gravity. The rocks which furnish the brine lie a thousand feet or so below the level of the lakes, and all wells carried to a sufficient depth in this region are sure to yield rich and productive brines. The quantity of brine seems to be unlimited. The strength of the brine increases with the depth; in the first well sunk it marked 1 degree at the depth of 90 feet; 4° at 516 feet; 60° at 559 feet, and 90° at 636 feet.

Borings have also been made in the Michigan representatives of the Onondaga salt group, which furnish the brines of New York, but thus far they have failed to afford more than a reasonable hope that these rocks may yield brines sufficiently strong to be worked with profit.

The salt-producing territory of the State is divided into twelve inspection districts, comprising sixty-eight salt companies, working forty kettle blocks, as many steam blocks, twenty-two pan blocks, and forty-four hundred solar salt covers.

The first variety of salt block consists of fifty or sixty kettles and the stone or brickwork in which they are set, a protecting building from 75 to 100 feet long and about 20 feet high in the center, and sheds on each side containing drainage bins. The brine is pumped to vats, near each block, whence it is carried in pump logs along the brickwork between the double rows of kettles, with a spout for each kettle.

The process of manufacture is very simple. The kettles are filled with brine and heated, and the scum which rises is skimmed off. Then the brine is boiled, whereupon crystals of salt form on the top and fall to the bottom. When the brine is about half evaporated, the salt is dipped out and thrown into baskets to allow the mother liquor to drain away.

In the steam process, the brine, after settling in vats as in the kettle process, is drawn into the steam settlers, strong wooden cisterns, from 100 to 120 feet long, 8 feet wide, and 6 feet high. Here the brine is heated by steam pipes until brought to complete saturation; then after standing a while to settle, the clear brine passes to the grainers, which are wooden vats differing from the settlers only in being shallow, and heated in the same way. The saturated brine begins to deposit salt at once, and in the course of twenty-four hours is exhausted. During this time the hot brine is constantly stirred, making the crystals fine. The salt is then thrown out upon draining boards; thence it is taken to the packing house, where it remains a fortnight for complete drainage, before it is packed in barrels.

A pan block is a building large enough to cover the settler, the pans, and the packing room. From the settlers the saturated brine is drawn to the pans, set in flues so that the heat is applied at bottom. In this process—which is considered most economical—the evaporation is very rapid, and the salt makes continually, with great economy of heat.

The solar process is the simplest of all, the evaporation being effected by sun heat alone. Shallow wooden vats, 18 feet square, are employed, each provided with a movable roof or cover, so as to protect or expose the brine as the weather may require. The evaporation begins in April, or as early as the weather becomes sunny, and continues until November. The first crop of salt is gathered about the middle of July, the second in September, and a third in October. The middle crop is the most valuable, owing to its greater coarseness. About a tenth of a crop is gathered in November, which ends the season. The annual product of a "cover" is about fifty bushels.

Four grades of salt are recognized by the State Inspector, to whose annual report, for 1874, we are indebted for the foregoing information:

Fine salt: Suitable for general use for family purposes. Made with artificial heat; of this grade the yield last year was 960,757 barrels.

Packers' salt: Suitable for packing and bulking meat and fish. Yield, 20,090 barrels.

Solar salt: Coarse and fine. Claimed to be equal to the best Onondaga solar. Yield, 29,391 barrels.

Second quality salt: Includes all salt intended for No. 1 of the foregoing grades, but not up to the standard. Good for salting stock, hay, hides, etc. Yield, 16,741 barrels.

#### THE MISSION OF THE FLY.

The generally received opinion about flies is that, despite limitless ingenuity expended on patent traps and poisoned paper, they form one of those ills of life which, it not being possible entirely to cure, must perforce be endured with as good a grace as may be. Consequently when they ruin our picture frames and ceilings, insinuate themselves into our milk and molasses pitchers, or lull us to sleep with their drowsy buzzing, only to bite us during our slumbers and render the same uneasy, we thank fate that the cold weather will rid us of the pest. To be sure they are scavengers in their way; but after we have spent several minutes in picking a score or more out of the butter dish, we arrive at the conclusion that it is an open question whether they do not spoil more good material than they carry off bad.

*Festina lente*, good reader, hasten slowly and do not anchor faith to such opinions until you are certain that the above sum up all of the fly's mission in this world. *Musca domestica* (Science uses six syllables in Latin to express that which good round Saxon epitomizes in two) is a maligned insect. He fulfils a purpose of sufficient moment to cause you to bear his inroads into your morning nap with equanimity, or even complacently to view him congregated by the score within your hidden sweets.

Did you ever watch a fly who has just alighted after soaring about the room for some little time? He goes through a series of operations which remind you of a cat licking herself after a meal, or of a bird pluming its feathers. First, the hind feet are rubbed together, then each hind leg is passed over a wing, then the fore legs undergo a like treatment; and lastly, if you look sharp, you will see the insect carry his proboscis over his legs and about his body as far as he can reach. The minute trunk is perfectly retractile, and it terminates in two large lobes, which you can see spread out when the insect begins a meal on a lump of sugar. Now the rubbing together of legs and wings may be a smoothing operation; but for what purpose is this carefully going over the body with the trunk, especially when that organ is not fitted for licking, but simply for grasping and sucking up food.

This query, which perhaps may have suggested itself to thousands, has recently for the first time been answered by a Mr. Emerson, an English chemist; and certainly in the light of the revelations of that gentleman's investigations, the fly assumes the position of an important friend instead of a pest to mankind. Mr. Emerson states that he began his self-appointed task of finding out whether the house fly really serves any appreciable purpose in the scheme of creation, excepting as an indifferent scavenger, by capturing a fine specimen and gluing his wings down to a microscope slide. On placing the slide under the instrument, to the investigator's disgust the fly appeared covered with lice, causing the offending insect to be promptly released and another substituted in his place. Fly No. 2 was no better off than fly No. 1, and as the same might be predicated of flies 3, 4, 5 (or of  $n$  flies, as the algebras have it), Mr. Emerson concluded that here was something which at once required looking into. Why were the flies lousy? Meanwhile fly No. 2, on the slide, seemed to take his position very coolly, and, extending his proboscis, began to sweep it over his body as if he had just alighted. A glance through the microscope, however, showed that the operation was not one of self-beautification; for wherever the lice were, there the trunk went. The lice were disappearing into the trunk; the fly was eating them. Up to this time, the investigator had treated his specimen as of the masculine gender; but now he changes his mind and concludes it to be a female, busily devouring not lice but her own progeny. The flies then carry their young about them; and when the family get too numerous or the mother too hungry, the offspring are eaten.

A while reasoning thus, Mr. Emerson picked up a scrap of white writing paper, from which two flies appeared to be busily eating something, and put it under the instrument. There were the progeny again on the paper, and easily rubbed off with a cloth. "This," he says, "set me thinking. I took the paper into the kitchen again and waved it around, taking care that no flies touched it, went back to the microscope and there found animalcules, the same as on flies. I had now arrived at something definite; they were not the progeny of the fly, but animalcules floating in the air; and the quick motions of the flies gathered them on their bodies, and the flies then went into some quiet corner to have their dainty meal."

The investigator goes on to describe how he continued the experiment in a variety of localities, and how, in dirty and bad smelling quarters, he found the myriads of flies which existed there literally covered with animalcules, while other flies, captured in best rooms or well ventilated, clean apartments, were miserably lean and entirely free from their prey. Wherever filth existed, evolving germs which might generate disease, there were the flies, covering themselves with the minute organisms and greedily devouring the same.

Mr. Emerson, while thus proving the utility of the fly, has added another and lower link to that curious and necessary chain of destruction which exists in animated nature. These infinitesimal animalcules form food for the flies, the flies for the spiders, the spiders for the birds, the birds for the quadrupeds, and so on up to the last of the series, serving the same purpose to man. He certainly deserves credit for an interesting and novel investigation, and for an intelligent discernment which might even attack the more difficult task of teaching us the uses—for Nature makes nothing without some beneficial end—of the animalcules themselves.