find their way into vinegar made from fruit juices. Vinegar which contains them must contain also as impurity some mucilaginous or albuminous matter, or the eels would have no food and could not exist. They need air also, and they have been observed engaged in a curious struggle with the mycoderm on the surface. The plant tends to prevent their obtaining the requisite supply of air, and the eels were seen combining their efforts to submerge it. They may be killed by heating the vinegar to 128° F., or by adding boracic acid. Vinegar when long kept, especially if exposed to the air, putrefies and becomes ropy, losing its acidity, and acquiring an unpleasant smell; the presence of the vinegar plant, vinegar eels, or other foreign substances is liable to induce putrefaction, especially if the vinegar is weak.—*Popular Science Monthly*.

THE SULPHUR INDUSTRY OF THE UNITED STATES.

By HARRY C. MYERS.

THE mineral deposits of the great West have for many years attracted a great deal of attention, both in the United States and abroad. Besides the common minerals and compounds that chemists acknowledge as existing, there are beds of pure white kaolin, mineral wax or ozokerite, borax, petroleum, bituminous coal veins forty feet thick, rich sulphur deposits, etc. Sulphur, I believe, is not recognized by text-books as existing to any extent in the United States, and yet, in the Territory of Utah, there is beyond doubt the richest and largest known sulphur deposit in the world.

It would seem by the extent and purity of this deposit, however, that at some remote period the sulphur must have poured out in a molten mass and flowed like lava into the valley beneath. This enormous deposit was located in about 1870 by the government surveyor, and is situated two hundred miles south of Salt Lake City, between the counties of Millard and Beaver, on Cove Creek.

The deposit is about two thousand feet square, and shafts have been sunk in different places from thirty to sixty feet deep without reaching the bottom of the deposit. The depth is as yet unknown. It is easy to see by using these figures and multiplying by the weight of a cubic foot of sulphur, which is over a hundred pounds, that this deposit contains easily ten million tons of sulphur.

The poorest ore yet found in this locality contains 40 per cent. sulphur, and is almost black in color; but as the 90 per cent. ore is inexhaustible, the poorer ores are disregarded. These ores were analyzed at Case School of Applied Science by a familiar process, and found to be absolutely free from arsenic and antimony, which cannot be said of the imported Sicily sulphur.

The sulphur in this deposit is in strata, measuring from eleven to twenty-two inches in thickness, and as it is a surface deposit, it is worked much like the quarrying of stone. It is then refined by a new process, which consists of melting the sulphur, forcing and straining it through a cylinder by the heat and pressure of steam, and as the ore is only contaminated with lava sand, it is very easily separated.

In many parts of this deposit the vapors are still rising and the deposition is continuous. In sinking shafts the vapors are so intense that several workmen are required, for one man is soon overcome and another one must take his place; and often birds and small animals enter the sulphur pits for shelter and are soon overcome and suffocated.

In 1872, a party of business men endeavored to find the extent of this deposit. On camping out the first night, their tents were filled with vapors and they were nearly suffocated. Next day they started to sink a shaft. Again the vapors drove them away, and they had nothing to show for their trouble except a pair of sore eyes apiece. On their return they reported the discovery of the infernal regions in active operation.

The way in which this deposit was discovered is a rather peculiar one. It was noticed at a certain time in the year, when the foliage of the trees was just beginning to appear, that wherever a tree was growing near a sulphur deposit it was greener and more advanced than the trees about it. Knowing this fact, a single person was enabled to discover and locate fourteen deposits. This advanced growth was probably due to the warmth of the rising vapors. Soon after the discovery of these beds, some English capitalists sent over experienced men at a great expense, who, being ignorant of this fact, failed to make a single location.

A few years ago sulphur was discovered in Mount Humboldt, Nevada, which was 98 per cent. pure, but it proved to be only a "pocket," and was soon exhausted. Rich deposits were also discovered in New Mexico, as well as in California and Colorado. In fact, at the exposition at New Orleans, nearly all the Western States reported sulphur deposits and exhibited specimens of the ore, but owing to lack of railroad facility or extent of the ore these deposits have not been operated to any degree.

The high rates of freight in the West have been a great drawback to the mining industries, and have compelled us to borrow of our neighbors when we have abundance at home. This is the case with our sulphur industries.

We now import nine-tenths of our sulphur from Sicily. The ore there is taken from the bed of an extinct crater, several hundred feet below the surface, and is carried to the surface upon the backs of children. The ore does not average above 20 per cent. It is then partially refined and shipped to us as "crude sulphur." This is done to avoid the duty on the refined article, and as it is shipped free as ballast, it makes a cheap article with which American high priced labor and freights will hardly allow of competition.

The great demand for sulphur is, of course, for the manufacture of sulphuric acid, and it would seem at first sight that it would be necessary to ship the Western sulphur to the East and supply this demand, in order to make the enterprise a profitable one. This, plainly enough, would eat up the profits. But such is not the case; the demand for sulphur in the West is enormous, and is steadily increasing, and will continue to increase as long as the population increases and new industries are started in operation.

Sulphur is used largely in the West, especially in Colorado, New Mexico, and Texas, as a "sheep dip." This "dip" is composed of sulphur and an alkali, and

is used for cleansing the sheep and destroying a kind of itch that is common in that locality. The carrying out of this cleansing is compelled by law. Little towns in the West, that are hardly noticeable on the maps and are almost unheard of, purchase annually from five to ten car loads of sulphur.

This sulphur is then sold to the various ranches in the vicinity and used as described. Sulphur, again, is largely used in restoring old vineyards, especially in California and that vicinity. It is also used in a variety of smaller ways that are well known in the East.

The imports of this article in 1878 were 48,102 tons, and in 1886 were 117,538 tons, showing an increase of over sixty-nine thousand tons in the importation in eight years, and in the next eight years the increase of course will be much greater unless we bring our Western sulphur into the market. And it will be brought into the market and will compete with the Sicily trade, just as sure as American energy and enterprise continues to be what it has been in the past.—*Amer. Jour. Pharmacy*.

IMPROVED WARPING MACHINE.

Mr. ROBERT HALL, Bury.

THE manufacture of small wares is a branch of the textile industries of no great dimensions, and it is probable that it is owing to this fact that it has to a certain extent escaped the hands of mechanical inventors and improvers. We believe that small ware looms have not been changed to any important extent for many years, though we know of one improvement, which we hope shortly to notice, that must be regarded as a considerable one. In the preparatory stages of winding and warping, matters are in a very primitive state, the latter process being still generally performed by hand. Improvements are, however, on the alert, and we have made a note of the fact, and the following description may perhaps be regarded as that of one of the first results.

This is an ingenious adaptation of the ordinary stop motion warping machine to the wants of the small-ware trade. As will be seen from our illustration (Fig.

FIG. 1.—HALL'S WARPING MACHINE—SIDE VIEW.

FIG. 2.—HALL'S WARPING MACHINE—FRONT VIEW.

1) of the side view, it differs little in appearance from the machine just mentioned, the reel frame and stop motion being the same. The front view (Fig. 2), however, shows the nature of the changes that have been introduced. The cylinder has been elevated from its former position and divided into sections. Upon these are mounted the small warp rollers, with their ends played in slide standards. The contents of the reel being divided according to requirement, are attached to the rollers, and the machine being started, the warping proceeds, the warp being rapidly traversed in a lateral direction to the extent of the width of the bobbin, so as to fill it uniformly, and by crossing prevent any falling down of the sides, there being no flanges to sustain these. By means of the foot lever, any particular bobbin can be raised out of action and stopped for any requirement or for doffing, without interfering with the remainder. When the bobbin is filled, it falls into the grooved tops of the standards prepared to receive it, and is doffed. The section cylinder shaft is friction driven.

As a smallware warp may contain any number of threads, from those required to form a narrow tape or fillet to the considerably greater number entering into such fabrics as ribbons, bands, belts, braces, girths, webs, etc., it will be obvious that this improvement will find a fairly wide field of usefulness, as it can be made of any dimensions in its details, according to requirement. It lends itself with facility to various purposes; as, for instance, each section may be of different counts or colors of yarns, while patterned warps of any sort and any length may easily be made.—*Textile Manufacturer*.

MANUFACTURE OF OIL OF SASSAFRAS.

By THOMAS C. HARRIS.

IN some of the interior counties of North Carolina may be seen in operation many primitive establishments for the manufacture of the oil of sassafras and oil of pennyroyal. The apparatus used in this work is so exceedingly rude and primitive as to appear ridiculous to most observers; but the product is of good quality, and constitutes a profitable industry. For these oils the usual style of "still" may be briefly described as a short trench in the ground, ending in a low flue or chimney. Over this trench is placed a closed wooden box, having a sheet-iron bottom, and an auger hole on top, through which water is poured. An ordinary barrel stands endwise on top of the steam box, and has several holes bored through its bottom, and also through the top of the steam box, allowing steam to pass freely up through the barrel. A lute of clay is used to close the joint between the lower end of the barrel and the steam box, as well as the cover of the barrel. Instead of a "worn," a tin pipe immersed in a trough of cold water is used; and a steam connection with the barrel is generally made by an elbow branch of wood, bored out with an auger. The sassafras tree (*Sassafras officinale*) grows abundantly in this section (Raleigh, N.C.), especially on worn-out lands, where it is usually found in dense thickets of small shrubs. The root is dug and washed free of dirt, and, after

being chopped short and bruised with a hachet, is ready for the "still."

When the barrel is filled with the roots, and the cover made tight with clay, the process of distillation goes on rapidly. The steam passes through the mass of bruised roots, and is condensed by the tin tube into a mixture of distilled water and oil, and runs into a glass vessel set to receive it. Being of different densities, the oil and water rapidly settle into two strata, and one can be decanted from the other. It is said that the operator of such a "still" can pay all running expenses and make a clear profit of three dollars per day.

The same outfit is used in the production of the oil of pennyroyal (*Hedeoma pulegioides*), which grows abundantly in the woods in many counties.—*Pop. Sci. News*.

QUICK SETTING CEMENT.

ACCORDING to the *Journal du Ceramiste et du Chau-fournier*, the maritime authorities at Boulogne have been using, since August, 1885, a quick setting Portland cement, made by the French Cement Company, of Boulogne-sur-Mer. It has the appearance of Portland cement, and is made under similar conditions, and differs entirely from the Boulogne Roman cement formerly made. Laboratory experiments have shown that this cement, mixed with sea water at 63° F., sets in about ten or twenty minutes. When used with gravel in the proportions of 1 to 1, or 1 to 2 of gravel, it sets in thirty and ninety minutes respectively. It is necessary to mix a small quantity at a time, and to