moved along the bore of the log so as to thoroughly dry the latter in every part without charring, the heat being intensified by a draft of air passing through the cylinder longitudinally. In Fig. 2 is shown a double fire box, D D, with an internal trough, C, by which the outside of the pump log can be dried in a similar manner. In Fig. 3 is shown a manner of applying the invention to roofs of buildings, decks and sides of ships, etc., the firebox, F, being placed in a case mounted on wheels, f f, to be drawn from place to place. Figs. 4 and 5 show the trough, F, made of boiler iron, to contain the saturating substance, a fire being built under the trough to keep the substance liquid.

Patented August 1, 1865, reissued August 20, 1872, to George Palmer, of Littlestown, Pa.

Correspondence.

The Years of the Several Planets.

To the Editor of the Scientific American:

It is the rule, among astronomers and authors on astronomy, to call the sidereal revolution of any planet (the earth excepted) its year, and, so far as practical and instrumental astronomy is concerned, the name will pass; but where truth and proper understanding of the fact is required, it will not do. The reason is obvious. It is not true that the sidereal revolution of any planet in the solar system is the exact year of that planet, whichever one it may be. The sidereal revolution of any and of every planet is more than its year, and that inversely as the number of their respective revolutions round the sun. Thus, Mercury revolves round the sun 107,-080 times during the period of precession (25,800 years), and by virtue of the gyration of his poles (which, I claim, is in the same direction as is the gyration of the earth's poles, and that the motion of the one keeps exact pace, so to speak, with the other), he finishes his year at a point, in his orbit or in the heavens, twelve seconds and one tenth of a second (12·1″) short of the point at which he finished his previous year. Venus makes 41,876 revolutions round the sun in the same space of time, and hence, by virtue of the like gyratory revolution (for planets all gyrate in the same direction, that is, retrogressively and in the same space of time), she completes her year at a point in the heavens thirty seconds and three fourths of a second (30 75″) short of the point where she finished her previous year. The earth revolves round the sun, during the same period, 25,800 times; hence she completes her year at a point 50 25″ from her sidereal place, or from the point where she completed her previous year. Mars makes 13,731 revolutions; and hence completes his year at a point 1·34″ short of where he completed his previous year. Jupiter makes 2,175 revolutions; and he of course finishes his year at a point 9′ 55 5″ short of where he completed his previous year. Saturn revolves round the sun 876 times in 25,800 years; and of course he completes his year at a point in the heavens 24′ 39″ short of the point at which he closed his previous year. Uranus moves round the sun 307 times in the above period; hence he completes his year at a point distant 1° 1′ 21·5″ from the point where he finished his previous year. And Neptune revolves round the sun about 156 times; hence he completes his year at a point 2° 18′ 28″ distant from the point in the heavens where he closed his previous year.

Claiming that, by virtue of solar retrogressive motion, the poles of every planet gyrate as do those of the earth, and that the planets complete their respective revolutions in the same time. I maintain that the year of each planet, as given above, is approximately correct.

I therefore call upon astronomers, especially those having the use of powerful telescopes, to note these facts, and watch the polar movements of the several planets. If the several planets do not gyrate as I say, and if their several poles do not complete revolutions in the time I say (25,800 years about), then my theory of solar retrogressive motion is untrue. But if they do, and I risk my honor on the assertion, then my theory is true, and the sun moves in the plane proper of the ecliptic.

Gloucester, N. J.   JOHN HEPBURN.

[For the Scientific American.]
ESTIMATING THE VALUE OF BONE BLACK.
BY F. L. BARTLETT, STATE ASSAYER, PORTLAND, ME.

The direct value of bone black for refining purposes consists in the capacity of the black for absorbing lime and removing the coloring matter common to raw sugar. The value can hardly be estimated by chemical analysis, which also has the disadvantage of requiring considerable time and no little expense. My method of determining the value of bone black, although not wholly new, has the advantages of quickness and accuracy.

All raw sugars contain more or less lime and coloring matter, which must be removed by the bone black. Following out this idea, I prepare my solutions as follows: No. 1. Take best granulated sugar 195 grains; molasses (45 per cent) 3·5 cubic inches; lime 772 grains; boil all together in 1¾ pints water for about 30 minutes, filter, and add sufficient water to make 2⅜ pints. This will be a solution of saccharate of lime containing the coloring matter from the molasses. Solution No. 2 is made by adding 0·915 cubic inch sulphuric acid to 1⅞ pints of water. This will be found to very nearly neutralize the lime solution, bulk for bulk; if it does not, water or acid must be added to No. 2 until 3·05 cubic inches of it will just neutralize 3·05 cubic inches No. 1. To use these solutions, 154 grains of the bone black to be tested is weighed out, and powdered fine enough to pass through a 60 sieve; 1·52 cubic inches of solution No. 1 is poured into an evaporating dish and the black added, well stirred, and thrown on to a filter, and washed with water to make 3·05 cubic inches of the filtrate. This is then slightly colored with a solution of litmus, and enough of the acid solution No. 1 is poured in from a burette to neutralize the lime remaining in the filtrate. The amount of the acid solution required will indicate at once what the value of the given sample is, compared with pure bone black.

I find that pure bone black treated in this way will require about 0·305 cubic inch of the acid solution to neutralize the remaining lime; while an old valueless black requires about 0·6 or 0·7 cubic inch, a fair commercial article will require from 0·4 to 0·5 cubic inch, of the acid solution. Of course the acid only indicates the declining power of the black; the color of the filtrate from the treated black will show its power for decolorizing. Good black will make a very nearly colorless filtrate when treated as above. By comparison one may soon learn to select from any number of samples the one best calculated for refining purposes. It is perhaps necessary to state that the black should always be dried before operating with this test. I usually dry at 300° Fah. My results, so far, with this process have been extremely satisfactory.

The Potassa Industry.

Not more than twenty years ago all the potassa in commerce was made from the ashes of trees and plants which contain potassium. The steppes of Casan, Bukowina, the Moravian forests, and the primeval forests of Canada were the chief sources of this compound, so indispensable in many of the arts. The costliness of the raw material, the extermination of the forests drawn upon for its production, and the remoteness of the places of production combined to make potassa an expensive article, an article which in the course of time it became necessary to be sparing of, and to avoid using as far as possible.

The time when even hard soda soap was made with potassa, and the potassa soap then decomposed with common salt, salted out, has long since passed away. In the manufacture of hard soap, the potassa was long since replaced by soda, which, since the introduction of the Leblanc process, has been getting cheaper year by year. Soda has been introduced into the glass manufacture, and is even used for washing by the housewife.

There are a few industries in which potassa, or carbonate of potassium, cannot be dispensed with. This is the case in the manufacture of lubricating soap, of prussiate of potassa, and of crystal glass. The more the forests were thinned out, the more necessary it became to seek for other sources of production; and hence in the last twenty years various new manufactories have been started, which may be classed under three heads, and, strangely enough, belong to the three different kingdoms—animal, vegetable, and mineral. The three chief sources were: 1. Beet root molasses. 2. Suint of wool. 3. Sulphate of potassium, or, in general, from the potassic *abraum* salts of the Stassfurt mines.

The manufacture of potassa from charred beet root molasses, called in Europe savin or *Schlempekohle*, is the oldest of these three. It had its origin in the north of France, in districts where the cultivation of the beet and the manufacture of beet sugar are extraordinary developed. Robert de Massy, of Rocourt, was the first who took up this branch of industry. The method of manufacture has gradually attained great perfection, and is described in full by F. Kuhlmann in the report on the chemical portion of the London Exposition of 1862.[*]

Potassa from beet molasses is made, as stated, in Northern France, also in Belgium, Moravia, and the provinces of Hanover, Saxony, Pomerania, Brandenburg, and on the Rhine. The total production at present in all these countries is about 12,000 tuns of potassa of 80 to 84 per cent. It is almost exactly proportional to the development of the beet sugar industry in the separate States, and is divided about as follows: 64 per cent in Northern France, 24 per cent in Germany, 4 per cent in Belgium, and 8 per cent in Austria.

The manufacture of potassa from the suint of wool is of more recent date. Maumené and Rogelet, of Rheims, exhibited the first sample of this interesting product at the world's fair in London, 1862. Its manufacture was described by A. W. Hofmann in the reports by juries.

The manufacture of potassa from sulphate of potassium, by Leblanc's process, could attain greater development, because it was not limited for crude material. This industry is also of recent date. Kuhlmann, in his report on the London Exposition of 1862, stated that the sulphate of potassium, obtained as a by-product in refining that made from beet molasses, was partially worked over into potassa. In Germany, this branch of manufacture was introduced on a large scale, in 1861, by Vorster and Grüneberg, at Kalk, near Cologne. Here, too, it was instigated by the sulphate of potassium, obtained from beet molasses, and which contained so much of cyanogen compounds that it was scarcely saleable in market.

The discovery of the Stassfurt salt mines, of course, turned attention in that direction. The methods employed for treating Stassfurt brines have recently been given in our columns, so that we here give but a brief outline of the process employed by this firm:

1. A double sulphate of potassium and magnesium is obtained by the action of a hot solution of sulphate of magnesium, kieserite, on the chloride of potassium: $3K\ Cl + 2Mg\ SO_4 = Mg\ SO_4, K_2\ SO_4 + K\ Cl, Mg\ Cl_2$.

2. Decomposition of the first double salt by allowing its hot solution to act upon chloride of potassium, or by macer-

* A. W. Hofmann: Report by Juries, 1862, p. 55; Wagner's *Jahresberichte*, 1863, p. 276.

ating the undissolved double salt in a cold solution of chloride of potassium: $K_2\ SO_4, Mg\ SO_4 + 3K\ Cl = 2K_2\ SO_4 + K\ Cl, Mg\ Cl_2$.

3. Decomposition of the artificial carnallite ($K\ Cl, Mg\ Cl_2$) by refining, or by maceration with cold water.

Starting with three molecules of chloride of potassium and one molecule of sulphate of magnesium, they obtain as end product one molecule sulphate of potassium, one molecule chloride of magnesium, and one molecule chloride of potassium.

The sulphate of potassium obtained in this way was very pure, and, when put through the Leblanc process, yielded a pure potassa, free from soda. In places where sulphuric acid is cheap, and there is a market for hydrochloric acid at a fair price, it is preferable to convert the chloride of potassium directly into sulphate by the use of sulphuric acid. For this latter process, the chloride of potassium from the refinery of the savin of beet molasses, containing 10 to 12 per cent of sulphate, is well adapted. The sulphate of potassium obtained from kelp in the manufacture of iodine should be mentioned among the sources of crude material for making potassa.

In converting sulphate of potassium into carbonate, the same precautions must be taken as in the manufacture of soda ash. If the charcoal used in the reduction contains much nitrogen, like the English Sunderland coal, prussiate of potassa is formed in such quantities during the fusion that, in the latter case, its manufacture pays.

On evaporating the carbonized lyes to 50° Baumé, the ferrocyanide crystallizes out along with the undecomposed sulphate, and can be separated from the latter by extracting with hot water. A second recrystallization produces a beautiful commercial product, which contains about one per cent of the potassa made. Andrae and Grüneberg, and the chemical manufactory of Pommerensdorf, make prussiate of potassa in this way as a by-product.

Potassa made from sulphate of potassium is very pure; it contains, as an average, 92 to 93 per cent of carbonate of potassium, and, as impurities, 2 to 3 per cent soda, 2 per cent chloride of potassium, and 1 to 2 per cent sulphate. It is highly prized on account of its purity, as compared with Russian potassa, which only contains 68 to 70 per cent potassa. The following table shows the analysis of the best kinds of potassa in market:

SOURCE OF THE POTASSA.	Quality.	Carbonate potassium and potassium and potash calculated as carbonate.	Carbonate Sodium.	Sulphate potassium.	Chloride potassium.	ANALYST.
American potassa	1	104·4	1·4	4·0	2·0	F. Mayer.
" "	2	71·2	8·2	16·1	3·6	"
" pearlash	..	71·3	3·3	14·3	3·6	Payen.
Tuscany potassa	..	74·1	3·0	13·4	0·9	"
Ilyrian	..	89·3	0·0	1·2	9·5	H. Gruneberg.
Russian	..	69·6	3·0	14·1	2·0	Payen.
Siebenburger potassa	..	81·2	6·8	6·4	0·6	H. Gruneberg.
Hungarian house ash	..	44·6	18·1	30·0	7·3	"
Gallician potassa	..	46·9	3·6	29·9	11·1	"
Refined suint ash	..	72·5	4·1	5·9	6·3	"
French beet ash	1	90·3	2·5	2·8	3·4	"
" "	2	80·1	12·6	2·5	3·4	Denimal.
German potassa	1	92·2	2·4	1·4	2·9	{ H. Gruneberg.
" "	2	84·9	8·2	2·8	3·5	

The small quantity of phosphate of potassium in beet root potassa is included in the carbonate.

According to tolerably reliable data, there are at present 7,250,000 kilogrammes (over 7,000 tuns) potassa of high grade manufactured in Germany by the Leblanc process. There is no doubt that this potassa, together with that made from the beet, will gradually supplant the Russian potassa. In Russia, the cost of production is increasing from year to year since the emancipation of the serfs, and the production has proportionately decreased. The quantity exported in the last 10 years was 5,171,758 pouds, or 84,-717,315 kilogrammes (about 84,000 tuns), decreasing from 11,010,910 kilogrammes in 1864 to 5,540,035 kilogrammes in 1873, or nearly one half.

A still greater falling off is noticed in American ash. The quantity exported from New York in 10 years was 10,981,-400 kilogrammes; that of 1865 was 2,610,725 kilogrammes, against 388,050 kilogrammes in 1873. These fallings off must be met, and this is doubtless done by the manufacture of artificial potassa in Germany, France, and England.

The present state of the potassa industry is given in the following table:

	Tuns
1. Wood ashes: Russia, Canada, United States, Hungary, Gallicia	24,000
2. Beet ashes: France, Belgium. Germany, Austria	12,000
3. Potassa from sulphate: Germany, France, England	15,000
4. Potassa from suint: France, Belgium, Germany, Austria	1,000
Total	48,000

The relation of these figures, compared with those of twenty years ago, at which time wood ashes were exclusively employed, and Russian potassa ruled the market, show that the potassa industry is at present in the midst of a complete revolution. The quantity of potassa made from wood ashes forms scarcely half of the total production; it decreases from year to year, and the time is not distant when wood ashes will have entirely disappeared from the market. The latter is first displaced by the beet root potassa, which is a constant by-product in the beet sugar manufacture, and can be put into market at a very low price, and is produced in the refining of other valuable by-products, such as chloride of potassium, carbonate of soda, etc., which fully cover the cost of manufacture. The manufacture of potassa from the sulphate has now attained a still greater importance, as the Stassfurt salt deposits promise an inexhaustible supply of potassium compounds. The center of gravity for beet root potassa lies in Northern France; that for artificial potassa from sulphate of potassium naturally lies in Germany, which has every prospect of being the chief source of chloride of potassium and the chief country in the production of potassa.

—*Dr. H. Grüneberg.*