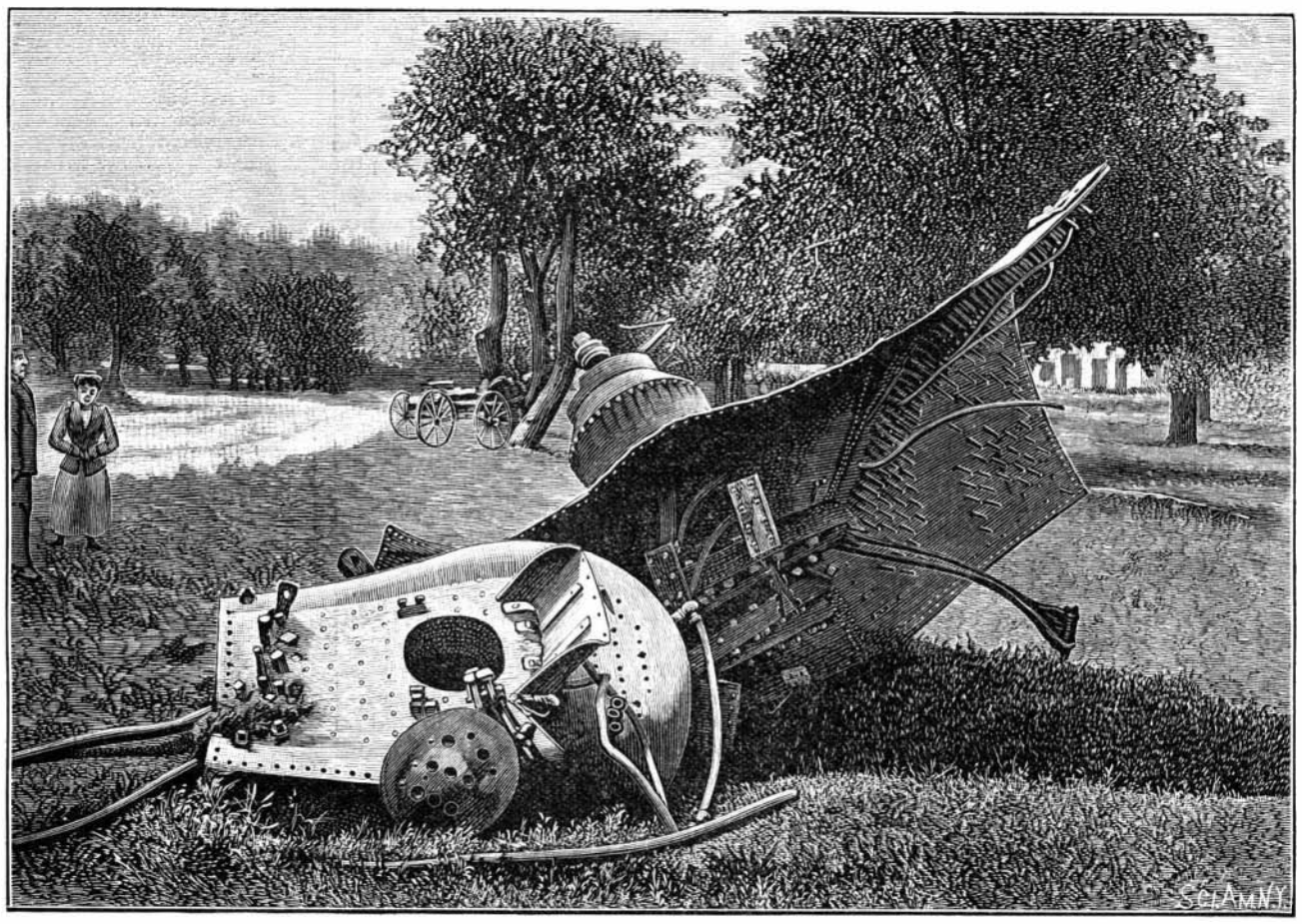
LOCOMOTIVE EXPLOSION.

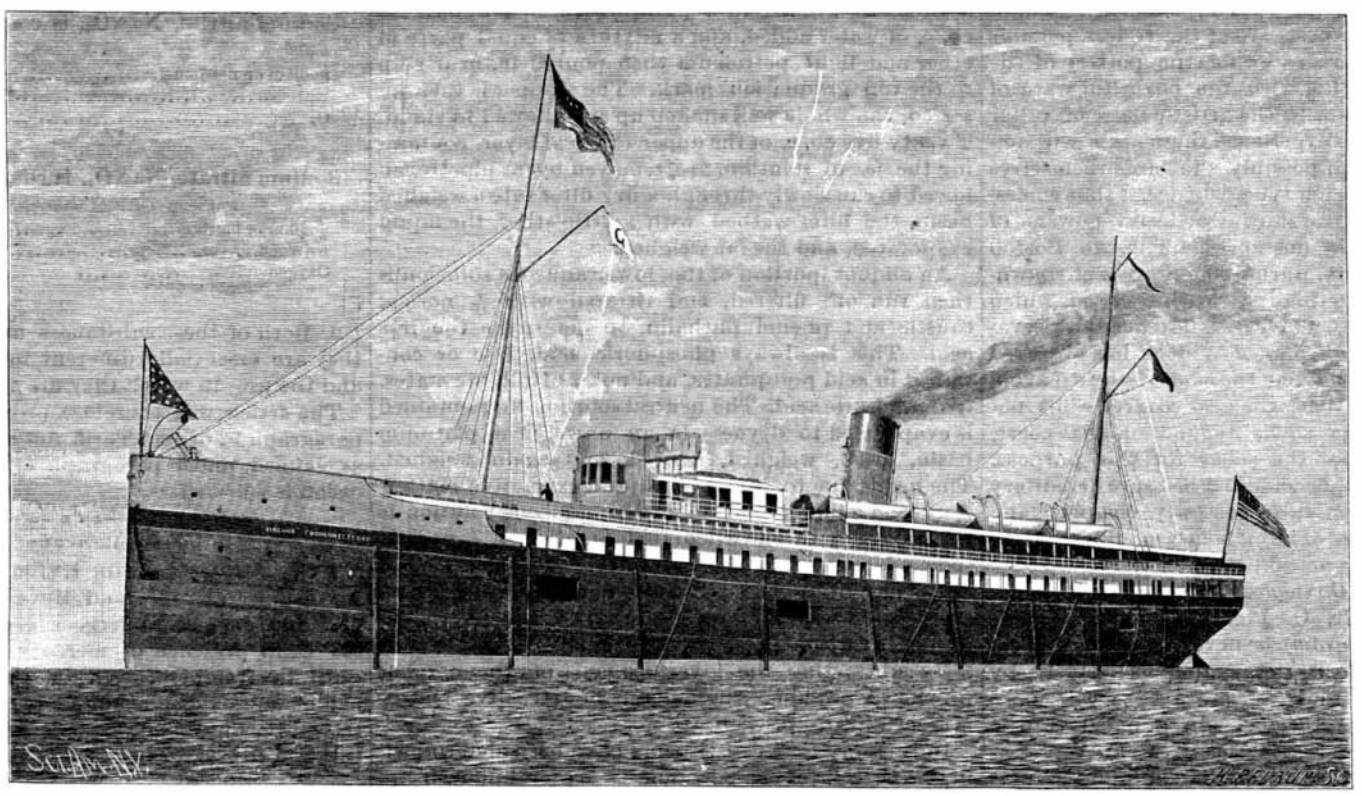
At Oyster Bay, Long Island, on September 9, the boiler of a 46 ton passenger locomotive exploded, killing the engineer and fireman and one brakeman. The body of the engineer was thrown two hundred feet away to the south of the track, while that of the fireman was thrown a hundred and fifty feet to the north, and the body of the brakeman was thrown over and twenty feet to the rear of the train, which consisted of three cars. The brakeman was on the tender, and the engineer and the fireman were in the cab. the train standing at the depot just ready to start when the explosion occurred. The crown sheet of the firebox, with a portion of the cab, shown in our engraving, were thrown about a hundred and fifty feet away, while the frame and remains of the locomotive were left in a nearly vertical position, its front portion being partially forced into the ground. This peculiar position of the locomotive was illustrated in the SCIENTIFIC AMERICAN of Sept. 26. The explosion was evidently in the water chamber over the firebox, but its cause is unexplained, although it is reported that the dead engineer had said the riveting in the crown sheet and some of the outer plates of the firebox was defective. The locomotive was built in 1889 and had been overhauled a few months ago.



LOCOMOTIVE EXPLOSION—APPEARANCE OF CROWN SHEET AND PART OF FIREBOX.

THE TWIN SCREW STEAMER VIRGINIA.

This is the name of a new and beautiful steamship lately built by the Globe Iron Works Co., Cleveland, Ohio, for the Goodrich Transportation Co. The *Marine Review* says she is the trimmest, neatest, handsomest and most elegantly appointed passenger steamship built on any inland water, and the finest ship that flies the American flag. The extravagant expressions about her yacht-like lines and her sylph-like mould are all contained in the fact that her per cent of fullness or coefficient is 0·61 full, 0·15 less than any large steamer on the lakes, and equal to the finest-lined ocean steamship. The dimensions of the hull are 278 feet over all, 260 feet keel, 38 feet beam and 25 feet deep. Built of high test steel; the stanchions are drop-forged steel. The water bottom is divided into six sections, three on each side, and contains a tank that will hold 4,500 gallons of fresh water. The hull is divided into six watertight bulkheads, in addition to the collision and stuffing box bulkheads. If by any possible force the boat could be cut squarely in two, both ends would float.



THE NEW LAKE STEAMER VIRGINIA—TWIN SCREWS.

The Virginia's twin screws will be turned by two sets of inverted triple expansion engines, each with cylinders 20, 32, and 52 inches by 36 inches stroke. Steam will be furnished these engines by two double-ended boilers, 13 feet in diameter by 21 feet 2 inches long, having 12 furnaces and being equal to four 13-foot boilers. Steam fans can be used to produce an induced rather than forced draft, the same fans running regularly for the purpose of ventilating the fire hold. The engines make 130 revolutions while driving the boat 18 miles an hour, the starboard wheel being turned to the right and the port wheel to the left, in opposite directions. Each stateroom has four berths, two of which can be pulled out into the cabin. The latter are hung with curtains; 400 incandescent lights shining from every nook of the cabin will illuminate the same. The vibration experienced on most steamers will be eliminated by transverse frames of the bulkheads, which will give the main deck a high degree of stiffness.

The Virginia will leave Chicago at 9 o'clock each morning and, including the stop at Racine, will make the run to Milwaukee in five hours. Each of the Virginia's auxiliary engines will be fitted with a reducing valve, instead of having, as most steamers have, only one reducing valve for all auxiliary engines.

Coating Metals with Lead.

To coat sheet iron with lead (Horgan's process) it is freed from scale by means of hot dilute sulphuric acid, washed with water, and transferred to a vat containing a solution of lime or other alkaline compound, which serves to prevent oxidation and acts as a flux. The sheet iron is then placed in a dilute solution of zinc chloride containing on the average 20 pounds of oxalic acid and 10 pounds of sodium sulphite per ton of iron treated. These quantities depend, however, upon the quality of the metal. After this immersion the sheets are passed through melted lead and allowed to drain. A very closely adherent coating is obtained by this process.

Terrestrial Magnetism and Radiant Sunlight.

Prof. Frank H. Bigelow contributes a note to the *American Journal of Science* for September, on the cause of the variations of the magnetic needle. He finds, from a discussion of magnetic observations made at thirteen stations during the month of June, 1883, that "the permanent magnetic condition of the earth may be principally due to the orbital motion of the earth through the radiant field of sunlight. The rotation of the earth on its axis causes a modification of the direction of the axis of polarization, by diminishing the angle between the two axes, and as the result of the annual motion may cause it to rotate in a secular period about the axis of figure, or if the magnetization has already become set in the body of the earth, may cause a succession of secular waves to sweep over it from east to west, as is shown to be the case in the history of the isogonic lines and the long-period deflections of the needle." This interesting identification of the magnetic and light action of solar radiants is in harmony with the results of the investigations of Maxwell and Hertz. And Prof. Bigelow believes that, by the application of similar considerations to Mercury, we will be able to satisfactorily account for the outstanding motion of this planet's perihelion.

Pictures in Sulphur.

In demonstrating that sulphur melted at about 115 degrees can be cooled in paper, the author happened to use a lithographed card, of which the edges were turned up. Upon taking away the card he discovered that the lithographed characters were clearly and distinctly impressed upon the cooled surface of the sulphur, and remained after hard friction and washing. By repeated experiments he has been able to get very fine results, removing the paper each time by a mere washing and rubbing process. He finds that sulphur will receive impressions from and reproduce faithfully characters or designs in ordinary graphite crayon, colored crayons, writing ink, typographical inks, china ink, lithographic inks—colored or uncolored—and others. He remarks, too, that it will reproduce with remarkable exactitude geographical maps.—*Charles Lepierre, Bull. Soc. Chim.*

Spouting Wells in Washington.

Near North Yaquina, Wash., a company recently secured a large body of arid land on Moxee, and immediately began the work of boring. August 15, flowing water was struck at 400 feet, which has increased in flow from the rate of 80,000 gallons to 250,000 gallons per diem, and is increasing. As the work went on, water was sent through an 8 inch pipe 33 feet in the air. Those interested in the scheme claim that hundreds of thousands of acres of arid lands will be reclaimed in central Washington, through a system of artesian wells, which would otherwise be without value except for cattle range.

Natural History Notes.

Coloration of the Flat Fishes.—Whoever has seen flat fishes alive, or even dead, but not divested of their skin, must have remarked the notable difference existing between the color of the dorsal surface, exposed to the water, and the ventral surface, which in the living animal faces the bottom. While the dorsal surface is more or less colored, the ventral surface remains white. What is the meaning of this? The Weismann school, rather more Darwinian than Darwin himself, insists upon attributing the fact to natural selection. And this school, according to which the environment acts upon the living being, ascribes it to a physical influence--to the fact that the ventral surface naturally receives much less light than the dorsal. In truth, one can scarcely see what natural selection has had to do with it. From the standpoint of the latter the coloration of the ventral surface seems indifferent, and, if it is not, it is permissible to think that it would be more advantageous to the fish to have this surface gray, like the dorsal, than white, that is to say, conspicuous.

Mr. Cunningham, of the Maritime Biological Association, of Plymouth, has recently studied the phenomenon, and does not conceal his sympathy for the theory of the action of the environment. He experimented with young flounders (*Pleuronectus flexus*), whose eye had not left the ventral surface. The pigment of the latter had already disappeared in great part. The animal was already lying on this side, and, on the dorsal, the pigmentation was pronounced. Mr. Cunningham made the following experiment.

Darkening the cover and sides of a glass vessel, he placed the latter, containing some young flounders, upon a support, and beneath it arranged a mirror that reflected solar light upon the bottom, so that the dorsal surface was exposed to darkness and the ventral to light: he reversed the normal conditions. The water was copiously renewed, and the fish had all the food that they needed. Other fishes were placed in a smaller vessel which was normally lighted. The results were as follows: Out of the thirteen fishes that received light from beneath, only three remained like the ones that received light normally. The others exhibited a varying quantity of pigmentary cells and chromatophores. Under these conditions, it really seems as if the absence of pigment in the animals in normal conditions is due to the difference of circumstances, and that light is the agent that determines the development of the pigmentary cells. It cannot be the only one, however, for pigments exist in many animals dwelling in the darkness of great depths.

Change of Habits in Animals.—It has been suggested in some scientific quarters that the necessities of various creatures to employ different means to exercise their functions may have an important influence eventually in modifying the structure of the creature itself, and thus induce variation leading to new species in time. In the Old World the English sparrow builds in holes in old ruins, in wheat or hay stacks, or anywhere but in trees. When introduced to America, where no such opportunites are afforded, it makes its nests in trees. Not having been accustomed to building in such places, the nests are of the rudest possible character, and compare as would the pottery of the ancient American Indian with the beautiful ware of our Trenton potteries with the artistic nests of other birds. No doubt with experience these nests will improve in character, and possibly the birds themselves will vary from the foreign type, when that time comes. A number of creatures show wonderful powers of adaptation to suit circumstances. Thus in Boston Harbor, the sea urchin, during the process of spawning, has a habit of covering itself with seaweed, which is packed down tightly above it as if to avoid observation. In Tampa Bay, Professor Willcox has observed that the sea urchins, having the same desire to avoid observation at that time, are also covered—but not with seaweed. Empty shells abound on that coast, and this creature uses the shells for this purpose. Habits, once acquired, become in a measure hereditary—changing only when dire necessity compels; and with the forced change of habit some modification of structural character is not impossible.

Multiplication of Ophioglossum.—It results from the observation of Mr. G. Poirault that the adder's tongue fern (*Ophioglossum*) is never reproduced from its spores, but that it is propagated exclusively by buds that form on its roots.

Effect of Cold upon Animals.—In a paper read to the French Academy of Sciences, M. Colin discusses the action of cold on animals. The rabbit endures considerable cold. Adults have lived in ordinary hutches suspended from the branch of a tree or standing on a heap of snow, and their temperature has only been lowered about one degree in five or six days, when the outside temperature varied from 19 deg. to 15 deg. C. Other individuals have lived in perfect health for two months in cubical hutches, completely open on one side, when the temperature ranged from 10 deg. to 25 deg. Sheep and pigs are also able to live through severe weather, but the dog and horse are killed by it.

Pliny and the Ants of North America.—In Pliny we find the following passage in regard to a certain species of ant: "Among the northern Indians called Dowdes, there are certain ants that *extract gold from the mines*. . . . This metal, which they extract in winter, the Indians rob them of in summer, while the ants are hidden in their tunnels because of the heat."

This passage having struck us by its clearness, says Mr. Vercoutre (in *Revue Scientifique*), we have been led to ascertain whether the assertions of Pliny are accurate, and, if so, what were the ants that he had heard spoken of. Now, we have found that there exists a particular species of ant that engages in this sort of mining, and that it is the *Pogonomyrmex occidentalis*, studied by Rev. Mr. McCook.

These ants, in fact, after they have finished the hillock that serves as a dome to their galleries, cover the whole with a sort of mosaic work formed of fragments of rock, fossils, ores, etc., which they obtain through a regular mining operation at a considerable distance beneath the surface of the earth. As in the country where these ants are met with it happens that the subsoil is often an auriferous deposit, it will be conceived that the roofing of the ant hills is frequently composed of spangles of gold, which, washed by the rains of winter, are in the fine season easily recognized and collected by the aborigines, who thus evidently profit by the labors of the ants.

The fact mentioned by Pliny is therefore absolutely exact; but, what is very curious is that but a single species of ant (the one mentioned above) engages in this peculiar labor and that this ant is *found only in North America* (Colorado, New Mexico, etc.) Hence the dilemma: Either *Pogonomyrmex occidentalis*, in the time of Pliny, inhabited the Indies properly so called (Hindostan), from whence it has entirely disappeared since that epoch, since it is very certain that it is not found there at present; or else it always inhabited North America solely, and then Pliny's narrative, too precise to have been manufactured out of whole cloth, would necessarily have been derived from travelers that had already visited America at that remote epoch.

The first hypothesis seems to us inacceptable, for, although it is true that certain species of ants (such as *Atta septentrionalis*) seem to be on the road to degeneracy, it can be asserted that ants are in nowise creatures whose species can *totally* disappear from a continent in a few centuries; and if, consequently, we must admit the second hypothesis (which would make the "northern Indians" vaguely mentioned by Pliny to be "North Americans"), we must see therein a very unexpected argument, which we offer in support of the opinion that the ancients were acquainted with certain parts of America.

The Analysis of Shoe Blacking.

BY DR J. PINETTE.

Victor Holbling was the first to publish a detailed method for the analysis of shoe blacking. In the following a simpler method is described.

About 5 grms. of the blacking are weighed out into a 200 cb. c. graduated separating funnel, about 100 cb. c. of water added, and a mixture of equal parts of ether and light petroleum then poured in, nearly up to the top graduation mark. The stopper is then inserted, the whole well shaken up and allowed to stand. Twenty-five cb. c. of the upper ethereal layer, containing the fat in solution, are removed by a pipette, allowed to run slowly through a dry filter into a weighed basin, the filter washed with a little ether, the liquid evaporated, and the fat weighed.

An aliquot portion of the lower aqueous solution is then run off, filtered, and titrated with $\frac{1}{10}$ normal caustic and phenol phthalin, to determine the free acid. This is always phosphoric acid, free or contained in acid phosphates, and not, as Holbling states, free sulphuric acid. The neutral solution thus obtained is evaporated to dryness in an unweighed platinum basin, dried, weighed, ignited, and again weighed. The loss is due to invert sugar and extractive matter. A second aliquot portion of the aqueous solution is neutralized with the calculated amount of $\frac{1}{10}$ normal soda, evaporated in the water bath until the smell of ether has disappeared, filtered, made up to 25 cb. c., and treated with Fehling's solution for the determination of invert sugar.

By subtracting the invert sugar from the number previously obtained, the amount of extractive matter is ascertained.

In this way four constituents have been determined in one portion of the substance. Water and ash are then determined in separate portions, and the difference between substances found, and 100 taken as carbon. The detailed analysis of the ash is conducted in the same manner as a phosphate analysis; Glaser's method as modified by Jones may be advantageously used for determining the lime.

Recently, blackings free from acid have been put upon the market, in which, instead of bone black, a carbonaceous shale is employed. Osnabruck shale contains 21 52 per cent of bituminous matter chemically combined with water. The carbonizing of the molasses is then omitted. The crude materials of acid for blacking are, therefore, fat, molasses, and black shale. Whether cane sugar or potato sugar molasses has been employed, can be told by means of the polarimeter. The cane sugar can either be directly determined by this instrument or by gravimetric analysis after inversion. In many cases a preservative is added to this acid-free blacking, especially if it show any tendency to become mouldy.

Below are analyses of specimens of both classes:

	Acid.	Acid-free.
Water	23·84	13·28
Fat	5·53	3·48
Free acid	1·66	—
Invert sugar	20·14	—
Cane sugar	—	23 35
Extract	3·40	10 81
Carbon	7·86	9·49
Chemically combined water	—	
P_2O_5	10·24	—
SO_3	8·76	—
CaO	12·96	—
Na_2O	5·61	—
Ignited ash of shale	—	39·59
	100·00	100·00

From this the amounts of crude materials may be calculated in round numbers as:

Bone black	13·0	—
Molasses	68·0	63·5
Sulphuric acid	12·0	—
Soda (calc.)	4·5	—
Fat	2·5	2·5
Black shale (20 per cent loss on ignition)	—	34·0
	100·0	100·0

—Chem. Zeit., Chem. Trade Journal.

Nitrate or Nitrite of Soda.

In the matter of the protest of the Merchants' Despatch Transportation Company against the decision of the collector of customs at New York as to the rate and amount of duties chargeable on certain nitrate of soda, imported per Obdam, August 1st, 1890, the following is the opinion by General Appraiser Somerville:

The local appraiser returns the merchandise as nitrite of soda. It was invoiced under this name, and was imported August 1, 1890.

It was classified by the collector as a "chemical salt," and assessed at 25 per cent *ad valorem*, under paragraph 92 of the Tariff Act of March, 1883, which levies this rate of duty on "all chemical compounds and salts, by whatever name known, not specially enumerated or provided for in this act."

The protestants claim that it is exempt from duty, under paragraph 630, which puts on the free list "nitrate of soda, or cubic nitrate."

A sample of the merchandise has been subjected, by direction of the board, to a chemical analysis by Dr. Baker, a competent government chemist, and we make the following finding of facts as to the nature of the article, based upon this analysis and on the papers in the cause:

1. We find the merchandise to be nitrite of soda, and not nitrate of soda, alike by chemical analysis and both popular and commercial designation.

Sodium nitrite, $NaNO_2$, is composed as follows:

	Per cent.
Sodium or natrium	33·34
Nitrogen	20·29
Oxygen	46·37
	100·00

Sodium nitrate, $NaNO_3$, is composed of:

	Per cent.
Sodium or natrium	27·07
Nitrogen	16·47
Oxygen	56·46
	100·00

2. Both of these substances are chemical salts, but they are essentially different in chemical composition and the uses to which they are adapted.

The article was therefore properly classified under paragraph 92 of said Tariff Act of 1883, and is not free, as claimed, under paragraph 630. The collector's decision is affirmed.

Miscellaneous Notes.

THE COMBINATION OF HYDROGEN AND OXYGEN.—According to Krause and Meyer, a mixture of hydrogen and oxygen undergoes gradual combination at 305° C. in presence of mercury, but not in its absence until the temperature rises above 448° C. Carbonic oxide and oxygen combine readily on simple heating to 448° C., but do not explode unless the temperature is raised to 578°, or between that and 606°.

PAPER FROM CORN HUSKS.—Corn husks boiled in caustic soda are being utilized for the manufacture of paper. The cooking process results in the formation of a spongy, glutinous paste, which is subjected to heavy pressure so as to eliminate the gluten, the fiber remaining being made into paper in the ordinary way.

PENNYROYAL OIL.—The principal constituent of pennyroyal oil, according to Pleissner (Annalen), is pulegone, a ketone, isomeric with camphor ($C_{10}H_{16}O$). In ethereal solution it is converted by sodium into menthol.