refractory unroasted ores, poor fuel, and crude fluxes are used. Another drawback is that the narrow exits facilitate unequal sinking of the charge and prevent a quick combustion. Baranzoff, Truran, and more recently Rachette, have widened the top of the stacks so much that the dimensions of the furnace, contrary to the form generally in use, gradually increase from the base upwards; but how this extraordinary construction can be of use is a question which has called forth various views, and which can only finally be settled by practical experience.

For easily fusible charges and the manufacture of a white pig iron, free from silicon, Tunner still considers narrow tops, narrow belly, and a wide hearth, necessary, that the gases may reach the tension and temperature necessary for the reduction of the ores. It is evident that the capacity and daily production of blast furnaces must vary, with their dimensions and forms, from each other. For instance, there are small charcoal furnaces with a daily production of scarcely two and a half tuns of gray pig iron, while the coke furnace of A. Schneider, at Barrow in Furness (Fig. 1.), turns out daily as much as ninety-seven and a half tuns, the maximum thus far obtained.

Boshes deviating at wide angles are to be avoided. Although facilitating the carbonization of the iron by retarding the descent of the intervals towards the hearth, it often occurs that a part of the charge remains on the boshes, unaffected by the heat; but with steep boshes the charges sink more rapidly and uniformly, and smelt sooner, especially if coke and a hot blast are employed.

The construction of the hearth, or that part of the furnace in which the carbonized iron is brought to a liquid, is of essential importance, as on it depends the quantity as well as the quality of the pig iron produced; and it must be adapted to the nature of the materials as well as to the blast, and in proper proportion tothe capacity of the boshes. Narrow and high hearths concentrate the heat more than wide ones, hence they are especially used in smelting gray cast iron and difficultly reducible ores, and with light coal and weak blast; while wide and low hearths are found to be more suitable for white pig, readily fusible and easily reducible ores, dense coal, and strong blast. As the charges fall more rapidly in the latter, they are used wherever a large production is needed, the temperature necessary for the production of gray pig being brought about by a hot and concentrated blast, and by the use of a greater quantity of fuel, in case the ores need the addition. The hearth is generally of a circular, square, or oblong section, and it widens towards the top; and, as already mentioned, it is either free of access or is built solid, in which case only the four arches leading to the tweer and the side where the door is remain open. In the first instance, the hearth is easily accessible in case of repairs, and it can be cooled by the air, which is desirable, for it has, of all the parts of the furnace, to endure the greatest heat, and hence is most subject to destruction. Cooling is sometimes effected by surrounding its sides as well as the boshes with hollow iron water boxes, through which a current of water circulates; sometimes the sides are kept merely moist on the outside by slowly dripping water. However, such a protection requires a larger quantity of coal for maintaining the necessary temperature in the interior of the furnace, and is likely to cause explosion if the water, by accident, penetrate through into the melting mass.

In many furnaces, especially in those for making white pig, a hearth is not used; and other conditions being equal, the temperature in the melting zone is thus decreased; the boshes are here made steeper and the belly higher up the shaft. We find this construction especially in many blast furnaces in Wales and Scotland, using ores found in the coal formation; and sometimes also in the furnaces of Styria, which use readily fusible spathic ores and brown iron ores.

TO TRAIN FUCHSIAS.—When a slip has grown six or eight inches high, nip out the top down to the last set of leaves; it will then throw out branches on each side. Let these grow eight or ten inches; then nip them out as before; the tops of each branch, when grown the same hight as the others, nip out again; then procure a stick the size of your finger, eighteen inches in length; take a hoop skirt wire, twine back and forth alternately, through holes made in the stick equal distances apart; place this firmly in the pot back of the plant, tie the branches to it, and you will have, when in flower, a beautiful and very graceful plant.

AMMONIA FOR VERBENAS.—The sulphate of ammonia is an excellent manurial liquid to apply to verbenas and other flowers, giving to the foliage a dark green, luxuriant and healthy appearance. It is economical, clean and easily applied. Prepare it in the evening before using, by dissolving one ounce of ammonia in two gallons of water. It may be applied with safety about once a week.

A FISH, 3½ feet long, with a slender eel-like body and a large head with a mouth like a crocodile's, has been brought to San Francisco, says the *Mining and Scientific Press*. The teeth are sharp and transparent, sloping backwards from the jaws. Immediately back of the head commences a large wing-like fin, about six inches high when erect, which runs the length of the back. The fish was found dead at Humboldt Bay, and is preserved in alcohol.

AN old lady said to her sons: "Boys, don't you ever spekerlate or wait for something to turn up. You might as well go and sit down on a stone in the middle of a medder, with a pail twixt your legs, and wait for a cow to back up to you to be milked."

## Correspondence.

### Working Steam Expansively.

*To the Editor of the Scientific American:*

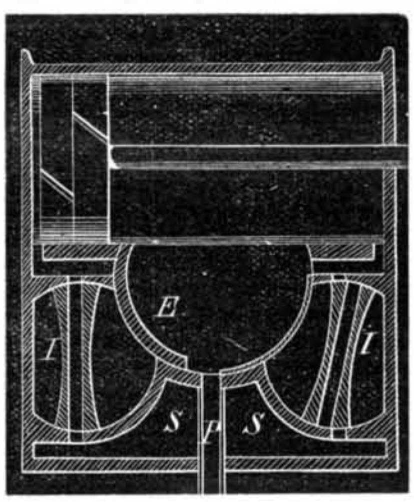
I have a few ideas in regard to steam engine economy which I wish to be made public through the columns of your valuable paper.

There are but few, if any, steam engines in use that utilize the full expansive force of the steam; nearly all use steam expansively to some extent, but in most cases there is but a small percentage of its force utilized. For the purpose of showing the great waste of power in nearly all of our machine shops, manufacturing establishments, saw mills, etc., I submit the following table, showing the comparative power of engines using the same amount of steam, steam pressure at 100 lbs. and an engine cutting off at full stroke being taken as giving a unit of power:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Cutting off | at | full stroke | will | develope | 1 | unit | of force. |
| " | " | 7/8 | " | " | 1·13 | " | " |
| " | " | 3/4 | " | " | 1·28 | " | " |
| " | " | 2/3 | " | " | 1·40 | " | " |
| " | " | 1/2 | " | " | 1·71 | " | " |
| " | " | 1/3 | " | " | 2·23 | " | " |
| " | " | 1/4 | " | " | 2·71 | " | " |
| " | " | 1/6 | " | " | 3·60 | " | " |
| " | " | 1/8 | " | " | 4·48 | " | " |

An engine cutting off at less than one eighth of its stroke will not utilize as much force as an engine cutting off at one eighth of its stroke, as steam at 100 lbs. pressure, expanded into more than eight times its volume, will be at less than atmospheric pressure.

In a common slide valve engine, the pressure on the valve and the imperfection of the exhaust render it impracticable to cut off at less than two thirds or three quarters of the stroke. Now, if we can have the induction and exhaust valves independent of each other, we may change the cut-off without deranging the exhaust. The engraving represents a vertical section of the interior working parts of such an engine. I I represent the induction valves, and E the escape. The valve at the left being open, the steam passes from the steam chest, S S, through the valve to the cylinder, and the escape, being open on the other side, allows the steam to pass from the other end of the cylinder, through the valve, E, and the escape pipe, P. The valves move in orbits, and




hence the motions are rotary. The valves are moved, but the width of the port thus reduces the friction. There is but a portion of the valve (equal to the area of the port) exposed to steam pressure, and this is partially balanced by the pressure on the same amount of surface from the cylinder. Now if by a certain mechanism the induction valves may be made to open and cut off at one eighth, one sixth, one quarter, or one half of the stroke, and the escape remain open during the whole of the stroke, would there not be a great increase of power? I have a mechanism by which these ends may be accomplished. I have written this for the purpose of eliciting the criticism of some one of experience, as my knowledge is wholly theoretical. C. H. C.

REMARKS BY THE EDITOR:—Our correspondent has fallen into an error, which has already led to the fruitless expenditure of vast amounts of time, thought, and money. Although his statement of the relative powers developed by steam of the different degrees of expansion noted is, in the abstract, correct, he would find (were he to test the matter experimentally, as has already been done by others) that in practice the anticipated economy never follows the use of highly expanded steam. Losses by radiation of heat, by leakage, and above all by internal condensation, become far greater in proportion to the quantity of steam used, where great expansion occurs, than with steam "following" further, and these losses do not enter into his account. They are so great, finally, that there is soon reached a limit, in ordinary engines, beyond which no gain results from further expansion. Chief Engineer Isherwood, of the U. S. Navy, in whose ability and accuracy as an experimenter we have the greatest confidence, although differing widely with him in our deductions from his recorded results, found that the maximum economy, in the ordinary marine engine, occurred with the cut-off at about four tenths the length of stroke, and this conclusion was confirmed by later experiment. With jacketed cylinders, higher piston speed, and higher steam pressure, a shorter cut-off is allowable, and great economy is realized, as is seen in the "compound" or "double cylinder" engines now so rapidly coming into use.

Our correspondent, were he to build his engine, would therefore be likely to find himself sadly disappointed in the result expected from a short cut-off. Again, the best engines in the market, if of sufficiently large size to justify the expense of such valve gear, are now invariably provided with independent steam and exhaust valves, and are capable of expanding to any desired extent. In first class engines, the point of cut-off is adjusted by the governor, a requisite which has escaped the attention of our correspondent.

The most intelligent, practical, and best educated engineers in the country have been studying the use of steam for many years, and are now far ahead of our correspondent in both theory and practice. They understand the requisites of economy and the methods of securing it, and, as a consequence, the American stationary engine leads the world, and is copied by all the most enterprising builders of Great Britain and the continent of Europe.

### A Pennsylvania Gas Well.

*To the Editor of the Scientific American:*

I wish to give you some description of a gas well here in the Butler county oil fields. It is situated about two miles from the village of Fairview, and was drilled last June in search of oil. It was put to the depth of 1,200 feet and was abandoned on account of a strong flow of salt water and gas; so much came out that the boiler that made the steam had to be moved to a distance of 25 rods. After the well had been abandoned about two months, the pressure of gas became so strong that it forced the water entirely out of the hole, and last fall a company was formed here to utilize the gas, which was done by bringing it through 3½ inch pipe here to Fairview and thence to Petrolia, three miles from Fairview. The gas will be used to light and warm both places. I visited the well in company with two other gentlemen; the gas is taken out of the well through 3 inch pipes into an old fashioned two flued steam boiler; upon the boiler is placed a steam gage which indicates a steady pressure of 80 lbs. The boiler has also upon it two safety valves steadily blowing off, also a cock in the boiler of one inch in diameter open all the time. This well has also an escape through a 6 inch pipe, the noise of the escaping through which can be heard readily for a distance of two miles. I was told by a gentleman here that the main discharge was closed for a second of time, when the indicator on the steam gage instantly flew around to its utmost capacity, which is 250 pounds. This well is a great curiosity to the neighborhood. W. E. P.

### Lens Fires.

*To the Editor of the Scientific American:*

On page 193 of the current volume of the SCIENTIFIC AMERICAN, appears an article on lens fires, which reminds me of an affair that was reported in the daily papers eighteen or twenty years ago; and believing the subject is entitled to more consideration than most people imagine, I send you the substance of the event alluded to.

A legal gentleman, in one of our large eastern cities, upon entering his office one summer morning, found the loose papers on his table just starting into a light flame, which surprised him greatly, as there was no fire in the room at that time, neither was it apparent how they could have ignited from any external cause, the windows being closed. This happened several mornings in succession, but one day he arrived at his office earlier than usual and succeeded in detecting the origin of the fire. Sitting at his table, he felt a burning sensation upon one of his hands, which gradually increased until it became insupportable; and on looking at the window through which the sun was shining, he noticed that one of the panes of glass had a bubble or flaw in it which served to concentrate the rays of light in the same manner as a burning glass, and with sufficient power to ignite paper in a few minutes. The dangerous pane was at once removed, and with it the cause of a "mysterious conflagration."

J. H. L.

### Sugar Manufacture in the Sandwich Islands.

*To the Editor of the Scientific American:*

The sugar planters of the Sandwich islands have had, and many of them are now having, a hard struggle for life. Many of us had had no experience in the sugar business when we commenced our plantations; and what little knowledge we have now has been attained only at great expense and loss of time and material. I have received many valuable hints from your paper, and would like to see more upon the subject of plantation sugar making. My plant consists of 500 gallon clarifiers, precipitators, an open train, a steam leach and a vacuum pan. I want to know how best to apply sulphurous acid gas to the cane juice in order to check fermentation and bleach the sugar. Also, whether sulphate of baryta is used for precipitating the dirt in the cane juice? If so, how should it be applied, and in what quantity?

S. L. AUSTIN.

Onomea Plantation, District of Hilo, Hawaii, Sandwich Islands.

### Low Water in Steam Boilers.

*To the Editor of the Scientific American:*

Reading the many articles in your paper on boiler explosions, and especially on the low water question, I venture to give my views and experience which, perhaps, may benefit some of your readers. I once attempted to raise steam and pump up a two flue 40 inch boiler with water only just up to bottom of the flues; but before I got 15 lbs. steam, I heard a report like a pistol shot; and on looking under the boiler, I saw the third sheet cracked from about two inches below the water, running up about a foot, and the water squirting out like a saw blade. The sheets were not overheated, for I had fired very slowly and carefully. I claim that it was caused by the expansion of the flues. I think that a boiler, with water enough in it to protect any considerable part of it and yet let the flues become hot, must be subjected to a strain sufficient to open any weak places in it without the aid of internal pressure.

I am now running a boiler, similar to the one above re ferred to. The feed water enters through an ordinary stand pipe, near the back end. The engineer let the water get low and then crowded on the pump. The result was that one of the flues cracked for about 4 inches across its bottom just where the feed water strikes it. A boiler maker repaired it by putting on a soft patch, that is, a plate screwed on with red lead under it and it does very well. But on one occasion since, the water was low again, and it leaked as at first, but the pump was kept going, and when the flues were covered it stopped. These cases, and others of the same nature which I have known to occur, lead me to believe that a large per cent of explosions are due to expansion.

East Pascaquola, Miss. P. Berger.

### Discriminating Flax and Cotton Fibers.

*To the Editor of the Scientific American:*

On page 194 of your current volume, Mr. C. R. Stodder says: "No chemical tests are known to distinguish flax from cotton fiber." Allow me to refer Mr. Stodder to the Scientific American, Vol. XIII, No. 3. "These two fibers are distinguished by rosanilin, or fuchsin. Loosen one end of a piece of linen so as to separate the woof and warp, and dip it into an alcoholic solution of fuchsin; wash in water as long as it colors the water, and then put it in weak ammonia. The ammonia will discharge the fuchsin from the cotton fiber but not from the flax, so that the cotton thread will become nearly white, while the flax retains its red color." This is Böttger's test. H. M. Wilder.

Philadelphia, Pa.

## AMERICAN LOCOMOTIVES.---THE BALDWIN WORKS.

Let a man stand beside a railway when an express train thunders past at forty miles an hour, with its ten or twelve heavy coaches and sleeping cars; and, if he does not feel mingled sentiments of awe and admiration, he must be very unimpressible. Grade or level, straight line or curve, all are alike; it whirls over one and round the other, never ceasing in its energy for a moment.

The modern locomotive is truly the most wonderful of all man's inventions; and though many may gainsay this, and point to another triumph of ingenuity as its peer, we think, when all its complex parts and the functions they are called on to discharge under trying circumstances are considered, the locomotive engine will stand out as one of the greatest of man's works. It is not alone required that it shall be powerful and capable of drawing great loads, but it must be enduring; it must adapt itself to the work required of it; it must be rigid and yet capable of a certain flexibility in its parts. It must ride on its springs and yet hold firmly on the track; its driving machinery must be permanently attached to its boiler and yet in a certain sense entirely independent of it; and the whole of the vast machine, although exercising the most varied and opposite powers, must be so designed as to work harmoniously together. One end of it—the furnace—generates the most intense heat while the other end is comparatively cool. One half, so to speak, the boiler, is undergoing tremendous internal and external pressure from the force of expansion and the steam within it, while the other portions have no strain whatever, except when in actual operation. When it is in operation, suddenly the driving machinery is called upon to not only carry and withstand the burthen of the boiler and its duties, but to transmit force in an entirely different direction; to do it economically and constantly, in all temperatures and all atmospheric changes; through dust and drought, and at a velocity of twenty or forty miles an hour as the case may be. It has not only to withstand its own internal forces, which tend to derange it, but also encounter others which it would seem impossible to provide against. Think of a mass of intricate machinery, thirty tuns in weight, in motion all over, hurled at the rate of forty miles an hour over the face of the country, and then consider whether our claim is extravagant.

If such a specification as the foregoing were handed to an inventor at the present day, and he were requested to provide a machine to comply with the conditions, he might be pardoned for some incredulity as to the sanity of the man who drew it. It is a thing of slow growth, the modern locomotive.

From the rude germ of the first high pressure boiler and engine mounted on wheels has sprung, piece by piece and detail by detail, the present magnificent and wonderful machine, a piece of mechanism, capable of drawing—in the case of the heaviest machines fifty tun engines—forty times its own weight. Without apostrophizing the locomotive further, let us look into a modern locomotive shop—the largest of its kind in the country—and see what is being done there, and follow hastily the details necessary to produce such machines.

The Baldwin Locomotive Works of Philadelphia has a world-wide reputation for its engines; and, being recently in that city, we were accorded permission to visit them. The concern has been in existence nearly forty years, and in that time has built engines for nearly all quarters of the civilized globe. At the present time the average rate of production is nine complete engines per week. Of these, some are for home use and some for foreign countries, but the essential character of them remains the same. All are built according to well known plans and specifications, such as have been proven and found reliable. Respecting those for foreign countries, the works are now just finishing a number for Russia, which are of the usual American type of wood burning engines. Some months ago the company sent a number of engines to Russia to show engineers in that country how to use their anthracite coal, of which large veins exist in the southern part. Until the advent of these machines, the Russian capitalists had become quite skeptical as to the possibility of utilizing the coal, for their own mechanics had essayed the solution of the problem in every conceivable type of boiler and grate, only to abandon them all. The intense heat generated burned out all their appliances, and it remained for American engineers to put the American locomotive in successful operation. The result is that large orders may be in time expected from the country, and it is to be hoped that the Baldwin Works, who, if we are not in error, were the pioneers in this enterprise, will reap some profit, the first venture being quite unprofitable. The Russian mechanics were so dilatory and slow to comprehend that a force had to be sent out from the Baldwin Works to erect the machines and put them in operation.

Of course, in making such a number of engines as these works turn out—over 450 annually—the greatest exactness and rigid attention to system must be observed, else all would be confusion. Therefore, as the first step toward getting machines under way, systems of "cards" or specifications are provided for the guidance of the foremen in charge of the several departments. For example, the superintendents, or parties immediately in charge, decide that engines of such a type must be ready on the 20th day of May. Immediately upon this decision, the schedule for so many crossheads, so many feed pumps, so many guide bars, rocker arms, links and reverse levers is made out and handed to the foremen in charge of the shops where these parts are made, and the date is mentioned when they are to be delivered to the company—say for April 5th. The same plan is observed with all the other details, parts, and appurtenances; and it is found to work harmoniously and satisfactory. It has the great merit of reducing every foreman to his own place, or, more properly, of confining his attention to his own affairs. It will readily be seen that the foreman knows nothing as to whether the parts he makes are needed now or next year, but that all he has to do is to make them out of the material furnished. He cannot say, as some might: "Why, they don't want these now; the boiler ain't made yet," and then give his attention to what he thought most satisfactory; but he does the work he came to do, and leaves the direction of it to the persons who undertook that department. This is really the secret, if it is a secret, of the possibility of making nine or more engines per week. Without it the other vast capabilities of the works would go for nothing.

The usual routine of machine work is so well known and familiar that we shall not attempt to describe any "ponderous shears that bite cold iron as a cat does cheese." These and kindred machines have no especial novelty in them, but there are some points about the system employed in duplicating work which are worthy of attention. A routine similar to that observed in the manufacture of sewing machines and pistols is practiced wherever possible. For example: All engines of a certain type have their details exactly alike. For such machines a system of "jigs," or cast iron frames, are provided, which have holes in them wherever the part under execution at the time should have them. These jigs are, therefore, merely bolted on to the rough casting—the crosshead for example—and the drill operated through the hole in the jig. There is no marking off or "laying out," and no possibility of making any mistakes. Similarly in regard to the jaws of the crosshead. A gage or templet is put over the end, clamped in its place, the whole put into the planer together, and the surfaces reduced until the tool comes down to the gage. In this way, or by this plan, the matter of executing each piece exactly alike is reduced to a certainty. Every bolt, taper or straight, has its gage, merely a hole drilled in a block of cast iron, the exact length of the part the bolt goes into. Men don't run up and down stairs in the Baldwin Locomotive Works, trying bolts in holes in the frames, so anxious to make a good fit of them that they fail after all; but they save their own shoe leather and the company's time, and fit the bolts to the gages on their lathes; if they are right by them, they fit the holes the rimmers make.

"So all things work together for good." All things that possibly can be, are tested before they leave the works. The pumps, on which so much depends and which have so much to perform, are all tried before they are attached to see if their joints are perfect. Nothing is left to chance. Everything is looked after and seen to, and nothing is left to supposition. As our informant, Dr. Williams, remarked: "We can't run on reputation one day; we try every day to do better work than the day before." And he is right. A locomotive is a machine which will not build itself or run itself, but if not carefully made will soon show it in all its parts.

We specially noticed the boilers in these works, and can testify to their excellent and thorough construction. Every one is caulked inside as well as out, and we noticed, as we passed through the works, one man caulking the rivet heads in the bottom of the firebox frame. The engines made by this company are all "outside connected," that is to say, the cylinders are outside of the frames. This practice is exclusively American in its universal application for all kinds of traffic, and seems well adapted to our wants. It is safe to say there are no inside connected engines built in the country today.

Also it is interesting to note how opinions vary with experience gained. In 1838 a locomotive with cylinders 12½ × 16, weighing, loaded, 26,000 lbs., was believed to be as heavy as would be needed! It causes a tendency to smile now, in the mind of a railway man, to note this and the weights of even switching engines. The heaviest engines the Baldwin Locomotive Works build are sent to South America, or, rather, the railways of that country demand the heaviest, which have cylinders 20 inches diameter and 24 inches stroke. They have four pairs of drivers of 48 inches diameter, and a total wheel base of 21 feet 10 inches. The weight on drivers is 87,000 lbs. and about 9,000 lbs. on the pony truck, the total weight being 96,000 lbs. An engine of this class will draw 2,000 tuns, gross, on a level, beside itself and tender, and they have in actual use taken 150 gross tuns of cars and load up a grade of 145 feet to the mile, with sharp curves, at a speed of ten miles an hour and with a steam pressure of 110 lbs.; also 268 gross tuns and load up a grade of 116 feet to the mile with 120 lbs. steam and at a speed of one mile in 7½ minutes. Engines of this class can run around curves of 400 feet radius, and even less.

The force employed in these works now amounts to 2,800 men of all trades. The pay roll will average $14 per head.

It is also interesting to note that, where American engines are brought in competition with foreign ones, they are at once able to prove their superiority, not only in point of workmanship, but in design and practical working. Many instances might be cited of the truth of this assertion, but we content ourselves with only one, the Dom Pedro Railway of South America, where both English and American machines were employed, but the latter proved so superior that none others have been bought since 1863.

The thinker may well ask: "What becomes of all the locomotives?" There is one factory in Philadelphia which makes 450 annually. There are three more factories in Paterson, N. J., which do not turn out less than 500 more. At Taunton, Mass., there are two which may make 200 more. One in Boston produces, or could produce, 200 more, and one in Manchester, N. H., 200 more; in Providence, R. I., 200 more; in Schenectady, N. Y., 200 more: to say nothing of smaller concerns scattered all over the country, and the repairshops of the railways, which also make no small proportion of their own work—an average of at least 1,500 locomotives turned out yearly from the shops alone.

### Preparation of Sewage and Stable Refuse.

Millions of dollars worth of valuable material yearly finds its way, from the sewers of our great cities, into the sea, serving no purpose except to contaminate adjacent waters, while sums, equally large, are expended by agriculturists for the regeneration of worn out soil by artificial fertilization. The collection of sewage presents no special points of difficulty, but its transportation to desired points is by no means readily accomplished. For this purpose an effective plan is greatly needed. One system, which we believe has recently been made the subject of a patent, consists in compressing the manure into cakes with dry peat, and covering the mass with soft clay or equivalent substance to prevent fermentation and evaporation. The idea seems to be a feasible one, though we have no record of its being successfully put in practice.

Other patents have been granted for the preparing and baling of stable manure. This substance, in order to prevent its otherwise too large accumulation, it is necessary to remove from city stables before the straw contained in it is in a sufficiently decayed state for fertilizing purposes. Consequently, the straw must be got rid of, and as it can be utilized for bedding for horses, or for the manufacture of coarse varieties of paper, it is suggested to winnow it out of the mass by means of a suitable machine. Then the residuum is compressed so as to exclude the air, to which the heat and steam of manure is due; and finally the whole is covered with a coating of clay, plaster, or cement. Handles of wisps of straw for convenience in carrying and packing may be compressed with and so attached to the bale. The cakes can thus be readily stored in vessels with sufficient air space between them to obviate all danger of heating, while the use of forks and shovels is necessarily avoided.

### Edible Earths.

Dr. C. Schmidt has made analyses of the comestible earths of Lapland and Persia. One hundred parts of the substance obtained on the coasts of the White Sea have been found to contain

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|---|---|
| Water, left at 100° | 0·269 |
| Water, left at red heat | 0·835 |
| Aluminum | 40·797 |
| Oxide of iron | 0·310 |
| Magnesium | 0·618 |
| Lime | traces. |
| Soda | 1·829 |
| Potassium | 9·845 |
| Silicic acid, traces of fluorine, loss, etc. | 45·506 |

The inhabitants of the country mix this earth with the flour from which they make their bread.

The edible earth found in Persia, and termed Gheli-Giveh, contains

| | |
|---|---|
| Carbonate of magnesium | 66·963 |
| Carbonate of lime | 23·634 |
| Chloride of sodium | 3·542 |
| Sulphate of soda | 0·298 |
| Carbonate of soda | 0·598 |
| Hydrated magnesia | 1·311 |
| Oxide of iron | 0·092 |
| Aluminum | 0·227 |
| Silicic acid | 0·765 |
| Water combined at 120° | 1·153 |
| Water | 1·422 |

Anthracemine.—This new base is one of the products of the action of nitric acid on anthracene. It appears as a very pale yellow pulverulent body, forming soluble and crystallizable salts with hydrochloric and sulphuric acids. Its composition is $C_{28} H_{11} N$.