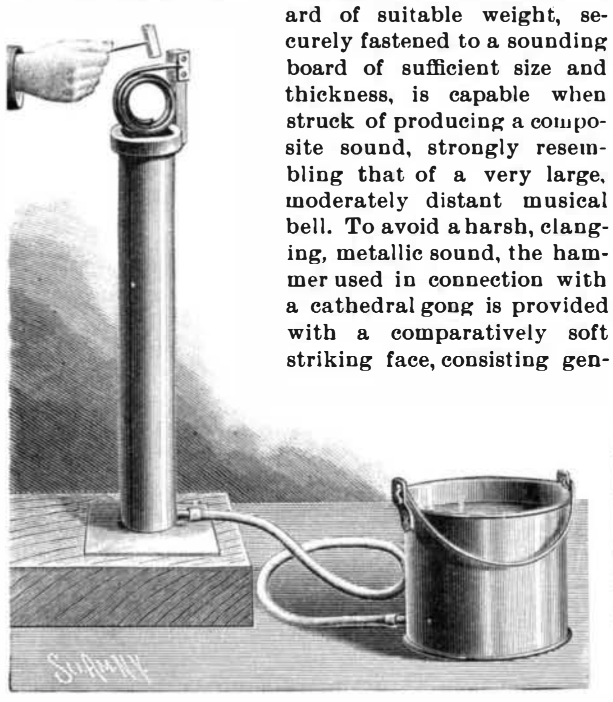
AN EXPERIMENT IN RESONANCE.

BY GEO. M. HOPKINS.

Nearly every one must have heard the cathedral clock gong. Some time since it was applied only to fine French and English clocks, but at present it is largely used in the better class of American clocks. There is, however, a great difference in these gongs and in the way in which they are mounted, and a corresponding difference in the sounds they emit when struck. A gong of uniform temper attached to a standard of suitable weight, securely fastened to a sounding board of sufficient size and thickness, is capable when struck of producing a composite sound, strongly resembling that of a very large, moderately distant musical bell. To avoid a harsh, clanging, metallic sound, the hammer used in connection with a cathedral gong is provided with a comparatively soft striking face, consisting generally of a firm piece of sole leather. If one listens intently to the sound of one of these gongs, he will be able with little difficulty to detect a few of the many tones which form the very complex sound. He can readily distinguish a very grave, subdued note, also a sound of high pitch, and a discord, but no approximation to the number of sounds produced by the gong can be made without a resonator which will select out the different sounds in succession. An instrument of this kind is shown in the annexed engraving. It consists of an upright tube closed at the bottom, open at the top, and furnished with a small lateral tube at the bottom for receiving a flexible tube for conveying water. In the present case the flexible tube is connected with an ordinary tin pail having a lateral tube at the bottom. The upright tube is elevated above the level of the table so that its full length may be utilized as a resonator. The cathedral gong used in this experiment was a small one formed of a rod of steel one-eighth inch wide, one-sixteenth inch thick, and about thirty inches in length, formed in a spiral of about three turns, the outer end being secured to an arm projecting upward from a heavy metal cap resting on the top of the resonator. The hole in the cap is somewhat smaller than the mouth of the resonator.



EXPERIMENT WITH THE CATHEDRAL CLOCK GONG AND RESONATOR.

The gong being struck at a point near its fixed end by a small soft rubber mallet, is set in vibration. As the striking is repeated at frequent intervals, the pail containing the water is raised, causing the water to flow quietly into the resonator, gradually diminishing the length of the column of air contained by the tube. When the length of the air column is such as to respond to any particular note, that note is re-enforced so as to become prominent. In this manner one note after another is brought out until the last and highest is heard.

By lowering the pail and allowing the water to return to it from the resonator, the re-enforced sounds will be heard in reversed order. As many as eight tones will be heard prominently, while with more care still others will be heard, thus showing the complex character of the sound produced by the gong, and showing clearly the reason of the harmonious and pleasing effect which has made them so popular.

By skillfully using the mouth as a resonator, most of the tones may be separated out so as to be readily distinguished by the operator.

Employer's Liability—Safe Machinery.

The measure of an employer's liability in the matter of providing machinery for his employes was defined as follows by the Supreme Court of Pennsylvania in the recent case of the Lehigh & Wilkesbarre Coal Company *vs.* Hayes: "An employer is not bound to furnish for his workmen the safest machinery, nor to provide the best methods for its operation, in order to save himself from responsibility for accidents resulting from its use. If the machinery be of an ordinary character, and such as can with reasonable care be used without danger to the employe, it is all that can be required from the employer; this is the limit of his responsibility and the sum total of his duty."

A MACHINE TO SET AND FILE SAWS.

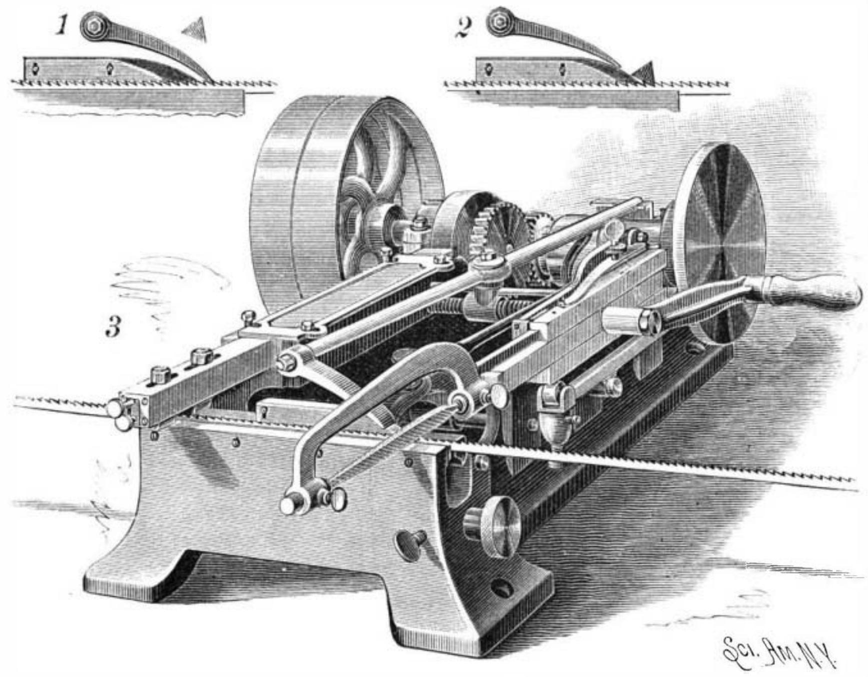
In the machine herewith illustrated the saw is alternately clamped and released, and moved the distance of one tooth during the reciprocation of the file by means of a holder sliding in a guideway, the teeth being at the same time automatically set by an adjustable mechanism, whereby the work is effected with unfailing accuracy, and the teeth appear uniform when filed. It is a patented invention of Mr. W. H. Parry, New York City.

On the power shaft in one end of the frame of the machine is a crank disk which operates a slide moving in a longitudinal guideway, a file holder on the outer end of the slide having adjustable bushings by means of which different sized files may be readily supported therein. The guideway is pivoted at its inner end on the main frame, while its outer end is supported upon a friction roller adjustable upon a lever, there being on the rear end of the lever a friction roller engaging a cam, whereby, when the slide moves outward, the file remains in a horizontal position, but on its return stroke the file is raised from the saw. A spring whose tension can be readily regulated holds the outer end of the guideway in contact with the friction roller.

The saw is held on a transversely extending bar held between the fixed and movable jaws of a clamping device, the transverse bar being connected with vertically arranged racks whereby it may be adjusted according to the width of the saw blade. The fixed jaw of the clamp is formed on the main frame, and the movable jaw is made in the form of a lever fulcrumed on the main frame. The movable jaw has a tail piece carrying a spring whose free end rests on a cam fulcrumed on a pin on the main frame, and the cam has an arm carrying a friction roller engaging a cam on the main driving shaft, whereby a releasing and clamping movement is given to the movable jaw. On the top of this jaw is held a block whose front face is in line with the face of the jaw, and carrying a guide bar adapted to engage the top of the teeth of the blade, holding the latter in place as it is fed along. Over the rounded front edge of this block the feed pawl is adapted to travel in feeding the saw forward to bring new teeth successively in line with the reciprocating file. The feed pawl is pivoted on the outer end of a feed lever whose other end has a pin engaging a cam on the main driving shaft, each revolution thereof moving the pawl backward and forward, while the feeding forward of the blade is regulated by means of a stud on which the pawl lever is mounted. Fig. 1 represents the position of the pawl as the blade is being fed forward, while Fig. 2 shows its position during the forward stroke of the file.

The saw-setting mechanism has a longitudinally extending bar operated from the main shaft to make a forward and backward stroke to two full strokes of the file. In the front of the bar is a vertical slot in which slide dies for setting alternate teeth to the right and left on the saw blade, the dies being adjustably held by set screws, and readily movable to the position necessary to set the teeth of the saw blade more or less to the right and left. The handle seen at one side will be used, ordinarily, only during the adjustment of the saw in the machine for the starting of the work.

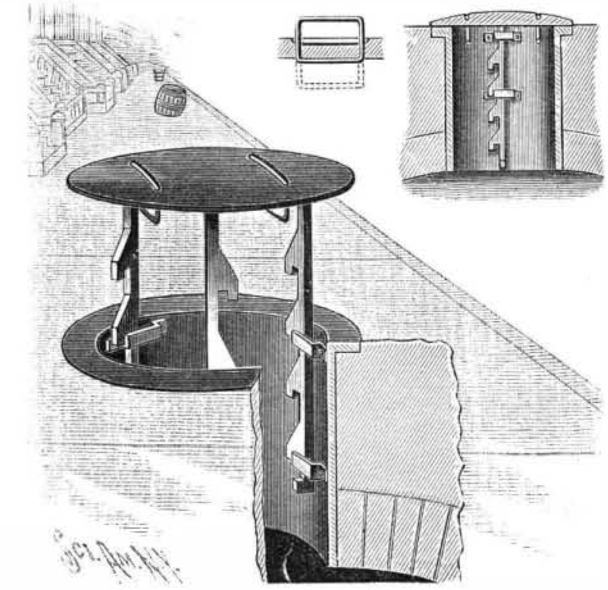
For further information relative to this machine, address Mr. G. H. Havens, Fifty-sixth Street and Eleventh Avenue, New York City.



PARRY'S SAW FILING AND SETTING MACHINE.

A VAULT COVER FOR SIDEWALK OPENINGS.

The illustration represents a device designed to afford for vault openings a cover which may be conveniently lifted and held in elevated position, for purposes of ventilation and the introduction of coal or other material into the vault below, without entirely removing the cover from the opening it is designed to close. It has been patented by Mr. Henry W. Sauer, of No. 207 Tenth Avenue, New York City. The lining thimble or shell inserted in the vault hole, and permanently fixed in its arched roof, has secured in its sides vertically arranged keepers or rectangular loops, adapted to engage toes integral with downwardly projecting limbs on the under side of the cover. The handles are made of rectangular links, loosely secured to slide in perforations in the cover, which, in use, may be raised to the height desired and then held in such position by a slight lateral turn, whereby the toes on the limbs may be placed in engagement with the keepers. A reverse movement of the cover will permit it to be lowered upon its seat in the top of the vault opening.



SAUER'S VAULT COVER.

Horned Dinosaurs.

At the late meeting of the British Association, in the Geological Section, Prof. Marsh gave an interesting account of his discoveries with regard to the gigantic Ceratopsidæ, or horned Dinosaurs. During the last two years Prof. Marsh has been working in the far West of America, near the Rocky Mountains, at certain beds called Laramie. It was formerly doubted as to whether these beds were tertiary or cretaceous, and it has now been found, by examination of the flora, that the lower part is true cretaceous and that the upper part is tertiary. In the true cretaceous these saurian remains have been discovered. They are of great size, and the blocks in which they are embedded sometimes weigh as much as two tons. Securing them has been a work of great difficulty, and has called for the exercise of much engineering skill. The remains, of which the professor exhibited diagrams, particularly of the skull, differ from those most familiar to European workers. The skull is of great size, and is characterized by two large horn cores near the eyes, and by one smaller horn core on the nose, like the rhinoceros, the latter extending a considerable way backward, where it appears to be armed by rudimentary cores. The teeth also are peculiar in having two fangs implanted crosswise. In the adult, the length of the skull is quite eight feet. The brain is relatively very small. To bear this enormous weight there are peculiar modifications of the neck vertebræ and of the four limbs. Prof. Marsh is disposed to refer this Ceratopsida to a distinct order of the Dinosaurs.

A Paste which will Stick Anything.

A paste which will stick anything is said by Professor Winchell to be made as follows: Take two ounces of clear gum arabic, one and a half ounces of fine starch, and half an ounce of white sugar. Dissolve the gum arabic in as much water as the laundress would use for the quantity of starch indicated. Mix the starch and sugar with the mucilage. Then cook the mixture in a vessel suspended in boiling water until the starch becomes clear. The cement should be as thick as tar, and kept so. It can be kept from spoiling by the addition of camphor or a little oil of cloves.

To cure a felon, says a correspondent, mix equal parts of strong ammonia and water, and hold your finger in it for fifteen minutes. After that withdraw it and tie a piece of cloth completely saturated with the mixture around the felon and keep it there till dry.

Cements of Rubber and Gutta Percha.*

The number of rubber cements in use all over the world is something remarkable. Almost all of them have as the base either gutta percha or India rubber, and some cheap solvent. Gutta percha tissue, to be sure, is used as a cement without the addition of any solvent, its sticking properties being brought out by the application of heat. This may be noticed in the application of the bindings that goaround the bottoms of trousers and the stamp marks in hats, and other work of a similar nature. In making a cement, one should know pretty thoroughly what is to be expected of it before they could advise upon it. For instance, an ordinary rubber cement will hold on a host of different surfaces and with the best of success, except where there is continued dampness. For holding to damp walls, or surfaces where there is a constant presence of moisture, there is nothing equal to Jeffry's marine glue, the formula for which has been published and republished all over the world. It consists of; India rubber, 1 part; asphaltum, 2 parts; coal tar, 12 parts.

The rubber, after having been massed, is dissolved in the undistilled coal tar, and the asphaltum is then added. This glue, as its name indicates, is oftentimes used for mending articles at sea, or patches, for instance, that are to be laid on surfaces that are to be under water, and it has been found to be a most excellent thing. Of glass cements there are a great many, the rubber as a rule being dissolved in some very volatile solvent and some hard drying gum is added. . . .

A gutta percha cement for leather is obtained by mixing the following. It is used hot; gutta percha, 100 parts; black pitch or asphaltum, 100 parts; oil of turpentine, 15 parts. An elastic gutta percha cement, especially useful for attaching the soles of boots and shoes, as on account of its great elasticity it is not liable to break or crack when bent. To make it adhere tightly the surface of the leather is slightly roughened. It is prepared as follows: by dissolving 10 parts of gutta percha in 100 parts of benzin. The clear solution from this is then poured into another bottle containing 100 parts of linseed oil varnish, and well shaken together.

Davy's universal cement is made by melting 4 parts of common pitch with 4 parts of gutta percha in an iron vessel, and mixing well. It must be kept fluid, under water, or in a dry, hard state.

A very adhesive cement, especially adapted for leather driving belts, is made by taking bisulphide of carbon, 10 parts, oil of turpentine, 1 part, and dissolvin this sufficient gutta percha to form a paste. The manner of using this cement is to remove any grease that may be present in the leather by placing on the leather a piece of rag and then rubbing it over with a hot iron. The rag thus absorbs the grease, and the two pieces are then roughened and the cement lightly spread on. The two pieces are then joined, and subjected till dry to a slight pressure.

A solution of gutta percha for shoemakers is made by taking pieces of waste gutta percha, first prepared by soaking in boiling water till soft. It is then cut into small pieces and placed in a vessel and covered with coal tar oil. It is then tightly corked to prevent evaporation, and allowed to stand for twenty-four hours. It is then melted by standing in hot water till perfectly fluid, and well stirred. Before using it must be warmed as before by standing in hot water.

A cement for uniting India rubber is composed as follows: 100 parts of finely chopped rubber, 15 parts of resin, 10 parts of shellac; these are dissolved in bisulphide of carbon.

Another India rubber cement is made of: 15 grains of India rubber, 2 ounces of chloroform, 4 drachms of mastic; first mix the India rubber and chloroform together, and when dissolved the mastic is added in powder; it is then allowed to stand by for a week or two before using.

Cement for sticking on leather patches and for attaching rubber soles to boots and shoes is prepared from virgin or native India rubber, by cutting it into small pieces or else shredding it up; a bottle is filled with this to about one-tenth of its capacity, benzin is then poured on till about three parts full, but be certain that the benzin is free from oil; it is then kept till thoroughly dissolved and of a thick consistency; if it turns out too thick or thin, suitable quantities must be added of either material to make as required.

An elastic cement is made by mixing together, and allowing to dissolve, the following: 4 ounces of bisulphide of carbon, 1 ounce of fine India rubber, 2 drachms of isinglass, ½ ounce of gutta percha; this cement is used for cementing leather and rubber, and when to be used, the leather is roughened and a thin coat of the cement is applied. It is allowed to completely dry, then the two surfaces to be joined are warmed and then placed together and allowed to dry.

Cement used for repairing holes in rubber boots and shoes is made of the following solution: *a*. Caoutchouc 10 parts, chloroform 280 parts; this is simply prepared by allowing the caoutchouc to dissolve in the chloroform. *b*. Caoutchouc 10 parts, resin 4 parts, gum turpentine 40 parts; for this solution the caoutchouc is shaved into small pieces and melted up with the resin, the turpentine is then added and all is then dissolved in the oil of turpentine; the two solutions are then mixed together to repair the shoe with this cement. First wash the hole over with it; then a piece of linen dipped in it is placed over it; as soon as the linen adheres to the sole, the cement is then applied as thickly as required.

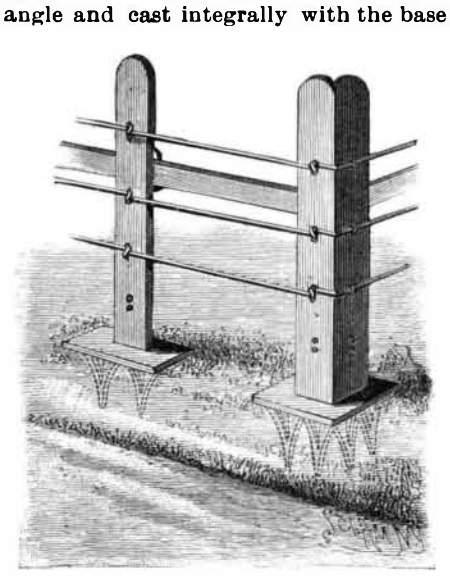
* *The India Rubber World.*

POST FOR WIRE FENCES.

The engraving shows an improved fence post recently patented by Mr. Henry Adams Peabody, of Santa Ana, California.

Two forms of this post are made, one for the division of the panels in a straight fence, and the other for turning angles. The single post consists of a bar of iron cast integrally with the base piece, and perforated with a series of pairs of holes, each pair of holes being designed for receiving the tie wire which binds the fence wire to the post, the wire being passed through the post in the form of a staple, and twisted or bent to retain it in the post. The base piece is provided with triangular projections which extend downward into the earth and form efficient anchors for holding the post in an upright position. The back of the post is furnished with an angled arm for receiving a wooden rail whenever it is desired to use a rail in connection with the wire in the construction of the fence.

The corner post is formed practically of two posts similar to that already described, arranged at the required angle and cast integrally with the base piece.



PEABODY'S FENCE POST.

In this case the base plate is furnished with a greater number of anchoring points for insertion in the ground. A fence constructed according to this improvement may be used anywhere, but it is especially designed for use upon farms, ranches, etc.

"Experimental Science"—What is Thought of It.

The *American Engineer*, referring to Hopkins' "Experimental Science" in flattering terms, and naming the subjects treated under the twenty-three chapters which the work contains, concludes by saying: "Each of these chapters contains beautiful engravings of devices and apparatus, methods and means, that illustrate the instructions. Like the celebrated Faraday, the instruction is conveyed and the experiments described without recourse to mathematics. The majority of students have little taste for the intricacies of numbers and the higher formulæ of mathematics. Most of the apparatus illustrated and described can be constructed and used by any one having ordinary mechanical skill. The work bears the stamp of a thorough scientist, a writer who writes nothing but with certainty of action and result, and of a teacher who imparts scientific information in an attractive and fascinating manner. Like all productions from the publishers of the SCIENTIFIC AMERICAN, this admirable work contains engravings and typography of the highest order. It should find a place in every technical institute and in every engineer's library."

The Consumption of Salt.

According to some statistics recently published in France, the annual consumption of salt per head in England exceeds that of any other country in Europe. For while in France the amount is estimated at about 30 pounds, Italy 20, Russia 18, Austria 16, Prussia 14, Spain 12, Switzerland 8, the Englishman requires no less than 40 pounds. The *Hospital Gazette* thinks that perhaps this is the secret of British thirst. If so, it offers an easy solution to the drink question, which the temperance party should not be slow in adopting.—*N. Y. Med. Rec.*

[The large consumption of salt in England is due to the extensive manufacture of soda, bleaching powders, etc., which are made from salt.—ED. S. A.]

Loss in Keeping Manure.

In order to make some observations bearing directly on the changes which take place in the amount of fertilizing elements between fresh manure and well rotted old manure, this trial was made.

From the top of a pile of fresh manure from the cow stable one-half cord was taken, weighed, sampled for analysis, and piled into a close conical heap January 4, 1889. This was the mixed excrement from cows as thrown out of the stable twice daily, and cut corn stover which was being fed freely and the waste used for bedding and to absorb the urine.

At the same time a half cord of an old compost, of which muck was the leading ingredient, was treated in the same way, *i. e.*, was weighed, sampled, and piled in the same manner close by the pile from the stable.

Both piles were reweighed April 13, and returned to the same places, and as carefully piled as before. This was equal to a complete forking over, the piles having been handled twice with a fork in the operation.

On January 21, 1890, both piles were weighed, measured, and again sampled for analysis. The results were:

	Manure. Lb.	Compost. Lb.
January 4, 1889	3,298	2,376
April 13, 1889	2,276	2,130
January 21, 1890	1,148	1,810
Per cent of lost weight in one year	65·19	29·61
Per cent of lost bulk in one year	50·00	28·6

The weights, when drawn out January 4, were for half cord fresh manure, 3,298 pounds; and for one-half cord compost, 2,376 pounds. By April 13 these piles had decreased in weight to 2,376 pounds and 2,130 pounds respectively.

On January 21, 1890, the manure had shrunk from one-half to one-fourth cord, and weighed only 1,148 pounds; the compost had diminished two-sevenths of its bulk to five-fourteenths of a cord, and weighed 1,810 pounds. To compare these losses of weight and bulk in one year:

	Manure. Per ct.	Compost. Per ct.
Loss of weight in one year	65·19	29·61
Loss of bulk in one year	50·00	28·6

Below is given the composition as found on analysis of the above named samples, the first analyses being by Mr. Ladd and the later ones by Mr. Whalen:

	Manure		Compost	
	Fresh. Jan. 4, 1889.	One Year Old. Jan. 21, 1890.	Jan. 4, 1889.	Jan. 21, 1890.
Per cent of water	84·42	75·118	68·195	61·12
Analysis of the dry matter of each sample.				
Total dry matter	513·17	285·65	755·69	698·3
Nitrogen, per cent	1·96	2·06	2·13	1·81
Potash (K_2O)	4·08	2·88	....	trace
Phosphoric acid (P_2O_5)	0·13	0·28	....	0·30

Calculating the total amounts of these fertilizing elements in the manure and compost at the times noted above gives the following:

	Lb.	Lb.	Lb.	Lb.
Nitrogen	10·06	5·884	16·096	12·64
Potash	20·94	8·227	.....	trace
Phosphoric acid	0·67	0·80	.....	2·095

These figures show a loss from the weathering in every particular, except the phosphoric acid, of which a somewhat larger amount was obtained from the later analysis, but the apparent gain is so small that it could easily have occurred within duplicate determinations on so small an amount.

In calculating the actual money loss, Prof. Roberts' estimate on the value of the fertilizing elements has been adopted.*

FRESH STABLE MANURE.

Nitrogen	10·06 lb. at	$0.17,	$1.71
Potash	20·94 lb. at	4,	.838
Phosphoric acid	0·67 lb. at	7,	.047
Value of one-half cord			$2595

SAME AFTER WEATHERING ONE YEAR AND 17 DAYS.

Nitrogen	5·884 lb. at	$0.17,	$1.00
Potash	8·227 lb. at	4,	.329
Phosphoric acid	0·80 lb. at	7,	.056
Value of above reduced by weathering to one-fourth cord			$1.385

Lost on one-half cord, $1.21, or per ton, $0.734.
Per cent of loss, 46·6.

This lost portion was, of course, the easiest soluble, and hence most available and valuable part of the manure.

As no ash determinations were made on the compost at the first analysis, the full value cannot be calculated.

Nitrogen in compost	16·096 at	$0.17,	$2.736
Nitrogen in compost after weathering one year	12·64 at	17,	2.149
Lost from close pile by one year and 17 days' weathering			$0·587

Per cent. of loss from a rather stable fertilizer, 21.45.

It will be remembered that the season of 1889 in this locality was exceptionally cloudy and wet.† Great losses of nitrogen from manures are generally associated with drying and burning out. Hence we must consider these results to be under, rather than over, what may be expected in average years. Hence this condition helps this experiment to show more plainly that stable manure should not be piled up uncared for for any length of time.—*Bulletin N. Y. Ag. Station, Geneva.*

* Cornell University Agricultural Experiment Station, xlii., Art. i.

† Eighth Annual Report, N. Y. State Agricultural Experiment Station, article "Meteorology for 1889."