Theory and Practice.

At a recent meeting of the California Academy of Sciences, Professor Joseph Le Conte remarked as follows:

There is a common, deeply rooted prejudice in the popular mind—and it seems to be affecting even scientific men, on the one side, as well as practical men on the other—that there is a kind of antagonism between theory and practice.

Now, so far from this being the case, a true theory is indissolubly connected with a true practice. There is an indissoluble marriage bond between them. It is even closer than this: it has the relation of spirit and body. Science is a complex web, woven warp and woof; the warp is scientific theory, the woof is the material derived from nature. It is impossible that one should exist apart from the other. Every intelligent human action, particularly of the complex kind, is necessarily guided by theory. And this is the true difference, in fact, between human activity and ordinary animal action. Human action is the most complex, and it is always guided by theory. The only difference between good practice and bad practice is that one is guided by good theory, and the other is guided by false or bad theory. But all human action which pretends to be intelligent or rational, is guided by some theory, good or bad.

There is, I admit, a kind of theorizing, a spirit of theorizing, and a theoretical habit of mind, which is destructive of good practical work. But it is equally destructive of true science also. I refer to that theorizing upon an unsubstantial basis, that theorizing merely for the sake of theorizing, and merely for the pleasure of the intellectual activity of theorizing—merely for the self-complacent contemplation of the beauty of the theories that we create out of our minds. In this case the whole web, woof and warp, is woven out of the human mind, without the material being furnished to it by nature. It is like castle building in the air, unsubstantial and resting upon a cloud; beautiful it may be to contemplate, but rapidly disappearing before the sun. It is like spiders' webs, woven out of its own bowels, both warp and woof; beautiful and intricate in its structure, and glittering with the dew in the early morning, but quickly brushed away from the path of progress. This kind of theorizing is equally as fatal to true science as it is to practical work.

This kind of theorizing is what we would call speculation. Now speculation bears the same relation to true theorizing in the world of science, which speculation bears to legitimate enterprise in business. As speculation in the field of business is prostrating to true enterprise, and through it prostrating to the true prosperity of the community, even so speculation in the realm of science is destructive to true theorizing, and therefore destructive to real practical work.

But as enterprise is the basis upon which all legitimate industry rests, and must inevitably rest, and the whole prosperity of society must also rest with it, even so it is upon sound, cautious, inductive theorizing that the whole progress of science and also of sound practical work is based. Science is the open foe of speculation in both fields. Science is the fast friend of legitimate enterprise and legitimate industry, also, in both fields.

The Evaporation of Moisture from Leaves.

An exhaustive study on the physical functions of leaves has recently been published by Professor J. Boussingault, of Paris, in which the phenomena connected with the absorption and transpiration of leaves are treated at great length.

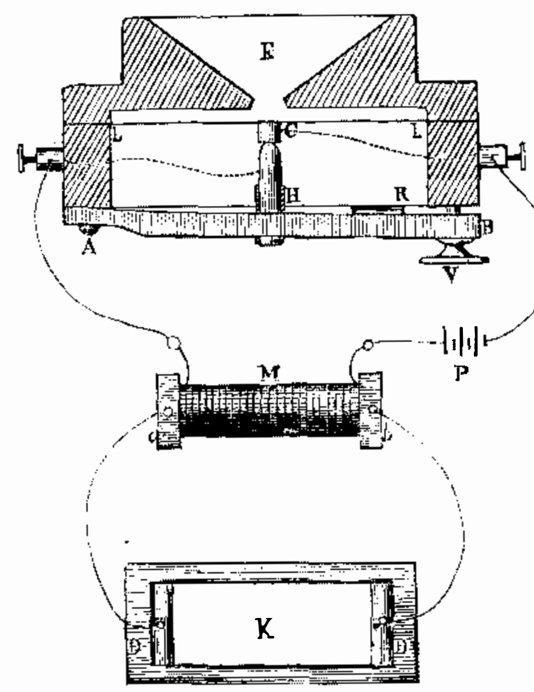
Among others, numerous experiments were made on the difference in evaporation during the day and night. Those carried out with the leaves of the grape vine gave the following hourly averages per square meter of foliage: in sunshine, 35 grammes (560 grains); in shade, 11 grammes (176 grains; during the night, 0·5 gramme (8 grains). The trellis on which the vine was trained was 39 inches high and 125 feet long, and presented a surface of 406 square feet of foliage. In sunny weather this was found to lose by evaporation in the course of 24 hours, 120 lbs. of water, and nearly half of that amount during cloudy weather. To give an idea of the enormous amount of aqueous vapor dissipated by plants in the sunshine, calculation showed that an acre of beets could lose in the course of 24 hours between 20,000 and 23,000 lbs. Another experiment made with a chestnut tree 35 years old showed that it lost over 16 gallons of water in the course of 24 hours. The structure of the leaf, however, containing 70 to 80 per cent of water, and possessing a thickness frequently of not more than four-thousandths of an inch, the question might occur why the evaporation is not much more rapid. The answer to this is found in the peculiar structure of the tissue forming the epidermis, designed especially to moderate the transpiration. In order to observe the remarkable retentive power exercised by this epidermis, one may expose for a few hours to the sun two cactus leaves of the same superficies, one of which has been deprived of its epidermis. In the case of the latter the evaporation will be about fifteen times as rapid as in the other. It is the presence of a similar tissue, forming the skins of fruits, which prevents an evaporation that would be otherwise too rapid. An apple, for instance, deprived of its skin, loses 55 times as much water as a whole specimen in the same time. The physiological energy of leaves is notably lessened by losses resulting from rapid evaporation. Thus an oleander leaf, containing 60 per cent of water, when introduced into an atmosphere containing carbonic acid, decomposed 16 cubic centimeters of this gas; one containing 36 per cent decomposed 11 cubic centimeters, and one containing but 29 per cent was without action.

IMPROVED MUSICAL CONDENSER.

Some time ago Mr. Varley constructed an apparatus, called by him the "musical or singing condenser," and the same is now being exhibited in London and attracting general attention. The apparatus, like so many others of similar character, is too complicated and incomplete for practical purposes. It consists of the receiver, the transmitting apparatus, and the condenser. The latter, K, is composed of a pile of leaves of paper and tinfoil, following alternately; the pairs 2, 4, 6, etc., are united together at one end; the pairs 1, 3, 5, etc., at the opposite end. The whole is inclosed by copper frames, D D', supplied with screws to connect the wires. The sheets may be firmly compressed, the operation not being disturbed thereby in the least.

The receiving and transmitting apparatus consists of a sort of telephone, E. The place of the diaphragm is filled by a sheet of metal foil, L L, in the center of which is fastened a cylindrical piece of carbon, G. Against the latter is placed a second carbon cylinder, H, resting on a wooden crosspiece, A B, fastened at A to one wall of the case, B, by means of a regulating screw, V, to the other wall. A spring, R, extending across the board, A B, imparts to the latter a certain degree of elasticity, which is necessary to insure success.

The metal sheet receiving the sound is connected with one of the poles of a battery, consisting of six Leclanché cells; the lower carbon cylinder is connected with the primary helix of the induction coil, M, which connects on its part with the other pole of the battery. Finally the two poles of the secondary helix of the coil are connected with the ends, D D', of the condenser.



VARLEY'S MUSICAL CONDENSER.

The secondary helix of the coil consists of twenty layers of No. 32 wire, well covered with silk; the primary helix consists of five layers of No. 16 wire. The length of the coil does not exceed 2¾ inches, and the core is ⅜ inch thick.

The receiving and transmitting apparatus must be regulated by experimenting. The two carbon points, when at rest, should not touch each other, but must be brought into contact by the slightest vibration of the metal sheet. The right position may be determined as follows: When the same note is repeatedly sounded into the collector, the carbons may be approached till the sound is distinctly reproduced. When three notes, sounded in succession into the collector, are plainly heard from the condenser, the apparatus may be considered sufficiently well regulated. The melody must be sung into the receiver while the mouth is placed as near as possible to the entrance. Voices resembling the sound of a flute are most easily reproduced.

The apparatus may be used in the same way as Edison's telephone. When it is used as a microphonic receiver, the carbon points must be brought into contact.—*L'Électricité.*

Natural History Notes.

An Aquatic Fern.—Professor D. C. Eaton, in a communication to the *Bulletin of the Torrey Botanical Club*, announces four additions to the fern flora of North America. These are all tropical species, and were detected in Florida. One of them, *Ceratopteris thalictroides*, is one of the most peculiar of ferns, and was discovered growing in the waters of Prairie Creek. It is as truly an aquatic plant as pickerel weed (*Pontederia*), or burr reed (*Sparganium*), and has been found in still or slowly moving waters in most tropical and many sub-tropical regions. It occurs in several of the West Indies, in Mexico, New Granada, and Brazil, and in Africa, Madagascar, India, Java, Hong Kong, Australia, etc. The sterile frond varies from a perfectly simple leaf to one which is twice or three times pinnate; the simpler ones are floating, and are produced early in the season, and the more compound fronds come later, and are emergent. The veins are everywhere finely reticulated. The fertile fronds have very numerous linear, or somewhat podlike segments, with the margin reflexed to form a broad and continuous membranaceous involucre. The sporangia are scattered on the backs of the veins, and are nearly globose in form, and are more variable in respect to the ring than in any other fern. This organ is sometimes entirely wanting; at other times it is composed of a few obscure joints; and again it is broad and nearly complete. So variable is this fern that at least four genera and two suborders have been found for its reception; and, though Hooker placed it at the end of the *Pterideæ*, its proper position among ferns is by no means yet settled. Up to the present but two sterile specimens of this curious plant have been found, but it is hoped that ere long the discoverer, Dr. Gurber, may be successful in his search for fruiting fronds.

Embryology of the Gar Pike.—The gar pike (*Lepidosteus*) being one of the few living survivors of those vast extinct orders of geologic ages, it has been considered especially important by naturalists that means should be taken to compare its embryology with that of other modern fishes in order that the structure of past races might be more fully known, and more light thrown on modern questions of evolution. As much as this knowledge has been needed, no one had been successful in raising the young of the gar pike till last summer, when Mr. Alexander Agassiz accomplished it. The results of his observations are recorded in a paper read before the National Academy, in this city, during November. The gar pike ascends the St. Lawrence in May, and about the 20th lays its large viscous eggs, which stick fast in an isolated way to whatever they happen to alight on. The eggs look very much like those of toads, having a large outer membrane and a small yolk. Mr. Agassiz's assistant brought to Cambridge about 500 naturally laid eggs, all but thirty of which were destroyed by mould. The young began to hatch in six days, and Mr. Agassiz began his studies, the misfortune to the eggs preventing any examination previous to the birth of the fish. He found that the little gar pikes were not so different from the young of the bony fishes as he expected. He did not make out the development of the lung; but, judging from external characters, the difference is small. Connection with the sharks was exhibited in the similarity of the branchial arches, and by the presence of the lateral fold in which the pectoral fins are formed. The manner in which the tail is developed was found to be very like what takes place in the bony fishes. Among the ganoids the dorsal cord is at first straight, then it assumes a slight curve upward at the extremity, and finally there appears, underneath, the beginning of a lobe pointing toward the complete heterocercal tail. This is likewise so in the bony fishes; but in the gar pike it is a permanent condition, while in the bony fishes the extremity of the dorsal cord becomes extinct. The mode of development of the pectoral lobe furnishes another point of resemblance. A likeness to the shark is noticeable in the brain and mode of formation of the gills. The young gar pikes are slow in their movements, swimming about but little, and attaching themselves to fixed objects by an extraordinary horseshoe-shaped ring of sucker appendages about the mouth. The summing up of Mr. Agassiz's investigations is, that the young gar pike has many characteristics in common with the sharks and skates, but is not so different from the bony fishes as has hitherto been supposed.

The Sequoias.—Mr. John Muir has an interesting paper in *Harper's* upon the "New Sequoia Forests of California." He gives therein the details of a discovery by himself of a grand forest of *Sequoias* seventy miles long, lying considerably south of the isolated groups hitherto known, and containing large numbers of saplings, which indicate that the species is still in a vigorous state of existence. It has heretofore been argued that the few groups of these trees known made it probable that the species was dying out from its last strongholds upon the earth, for it has come down to us from pre-glacial times, when it existed in Europe also, as geology testifies. Mr. Muir's researches lead him to believe that the species has never been more extensively distributed on the Sierra in post-glacial times than it is now; and that to-day it is as full of life and vigor as it was 10,000 years ago.

Instinct in a Crab.—Dr. Darwin, in his "Voyage of a Naturalist," thus describes a crab which makes its diet of cocoanuts, and which he found on Kneeling Island, in the South seas:

"It is common on all parts of this dry land, and grows to a monstrous size. It has a front pair of legs, terminated by a strong and heavy pincers, and the last pair by others which are narrow and weak. It would at first be thought quite impossible for a crab to open a strong cocoanut covered with the husk; but Mr. Liesk assures me he has repeatedly seen the operation effected. The crab begins by tearing the husk, fiber by fiber, and always from that end under which the three eyeholes are situated. When this is completed the crab commences hammering with its heavy claws on one of these eyeholes till an opening is made; then turning around its body, by the aid of its narrow pair of pincers it extracts the albuminous substance. I think this is as curious a case of instinct as I ever heard of, and likewise of adaptation in structure between two objects apparently so remote from each other in the scheme of nature as a crab and a cocoanut."

A Viviparous Cockroach.—At a recent meeting of the Entomological Society of London, Mr. Wood-Mason stated that it might interest the members of the Society to hear that in the course of his anatomical work he had discovered a remarkable case of viviparity in the orthoptera, in a large cockroach belonging to the genus *Panesthia*, the species of which inhabit the tropical forests of Southern Asia and of Australia, where they live in the rotten wood of fallen trees The species in question was *Panesthia Javanica*, from the abdominal brood pouch of the female of which he had extracted young white specimens of 6·5 mm. in length; and these, from their being already provided with legs, antennæ, black eyes. and the full number of already hard tipped gnathites, as well as from their size, he judged were just on the point of birth when the mother was thrown into the alcohol. He further suggested that the curious and as yet unexplained habit evinced by several European species of cockroaches (*Blattidæ*) of carrying their egg capsules about with them for a week, or even for so long a period as a fortnight, before depositing them, might possibly be explicable as the retention of a vestige of a lost viviparous character.

Astronomical Notes.

OBSERVATORY OF VASSAR COLLEGE.

The computations in the following notes are by students of Vassar College. Although only approximate, they will enable the ordinary observer to find the planets.

M. M.

Positions of Planets for January, 1879.

Mercury.

On January 1 Mercury rises at 6h. 20m. A.M., and sets at 3h. 47m. P.M. On January 31, Mercury rises at 6h. 16m. A.M., and sets at 3h. 23m. P.M.

Mercury can be seen only in the morning. On the 16th it will be ir its best position, and will rise about 6 A.M. It can probably be seen in the southeast.

Venus.

Venus will not be seen in the early part of the month. On January 1 Venus rises at 8h. 2m. A.M., and sets at 5h. 2m. P.M.

On January 31 Venus rises at 8h. 3m. A.M., and sets at 6h. 16m. P.M. Venus and Jupiter will be nearly in the same position on the evening of the 23d.

Mars.

On January 1 Mars rises at 4h. 52m. A.M., and sets at 2h. 11m. P.M.

On January 31 Mars rises at 4h. 36m. A.M., and sets at 1h. 32m. P.M.

It will be seen that Mars can be visible to the eye in the early morning only; like Mercury, it rises south of east.

Jupiter.

Jupiter sets early all through the month. It rises on January 1 at 9h. 17m. A.M., and sets at 7h. 1m. P.M.

On January 31 Jupiter rises at 7h. 39m. A.M., and sets at 5h. 39m. P.M. Jupiter and Venus have nearly the same position on January 23.

Saturn.

Our distance from Saturn is increasing, and the planet is less conspicuous, but is readily found as soon as the daylight is out. It passes the meridian on January 1 a few minutes after 5 P.M., and on the 31st at 19m. after 3 P.M., at an altitude of 45° to 46°. Saturn sets on the 1st at 10h. 57m. P.M., and on the 31st at 11m. after 9 P.M.

The satellite Titan can be seen with a small glass. On December 14 this satellite was seen far on the left of the planet (with an inverting telescope), and as it repeats its journey in sixteen days, it will be found in that position again on the 30th, and again on January 15.

The smaller satellites of Saturn can be seen only by the aid of large telescopes. At times six of the moons are seen surrounding the planet, sometimes lying along its path and sometimes grouped together around the tips of its ring.

Uranus.

The distant planet Uranus rises on January 1 at 8h. 59m. P.M., and sets at 10h. 17m. of the next morning. On January 31 Uranus rises at 6h. 56m. P.M., and sets at 8h. 17m. A.M. of the next day. This planet, which was at one time near Regulus, is now near the star Rho Leonis.

Neptune.

On January 1 Neptune rises at 52m. after noon, comes to meridian at 7h. 40m., and sets at 2h. 20m. the next morning. With small telescopes it can be seen as a star. As it comes to the meridian about 4m. earlier every evening, it is not likely to be seen even as a star after the middle of the month.

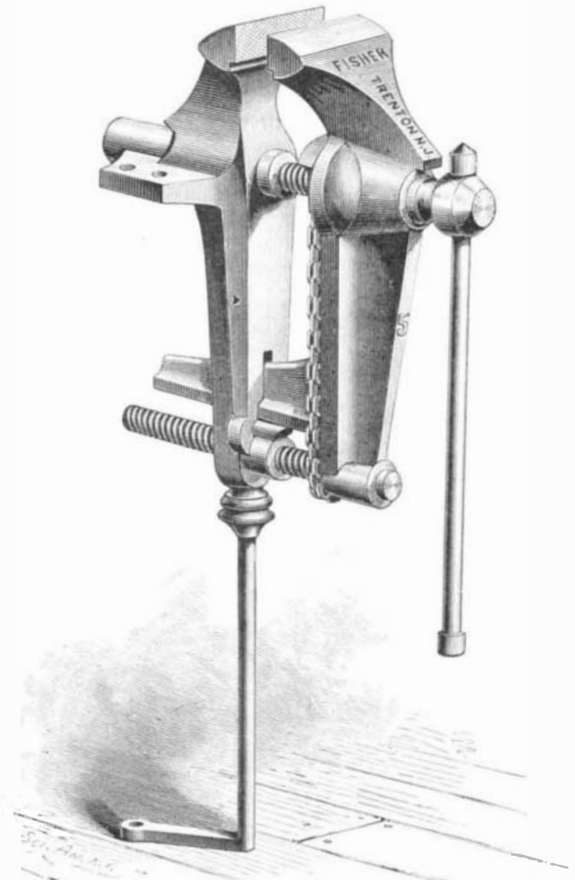
Proportions of Hulls, Engines, and Boilers of Yachts.

The following table, giving dimensions of hull and machinery as proportioned by a well known builder of steam yachts, contains particulars which will be of interest to many of our readers:

HULL.						ENGINE.					BOILER.		
Length over all.	Beam.		Draught.		Tonnage, carpenter's measurement.	Nominal horse power.	Diameter of cylinder.	Stroke.	Diameter of propeller.	Pitch.	Diameter of shell.	Height of shell.	Heating surface.
ft.	ft.	in.	ft.	in.	tons.		in.	in.	in.	ft.	in.	in.	sq. ft.
25	5	8	2	3	4	2	3	5	26	3	28	45	75
28	5	10	2	4	5	3	3½	5	28	3	30	46	90
32	6	4	2	6	6	4	4	6	30	3½	33	48	115
38	7	6	3	2	10	6	5½	7	36	4	36	56	170
50	9		3	6	16	10	7	9	42	5	46	76	246
60	10		4	2	26·5	15	9	12	48	5	50	82	332
68	11		4	8	37·5	20	10	12	54	6	54	86	402
75	12		4	10	43	30	12	12	56	7	60	90	504

DOUBLE SCREW PARALLEL VISE.

We give herewith an engraving of a new parallel "leg" vise, manufactured by Messrs. Fisher & Norris, of Trenton, N. J. The movable jaw of this vise is supported by an arm that passes through a mortise in the stationary one, and it is operated by two screws which are connected by an endless chain, each screw being provided with a chain wheel, so that when the upper screw is moved by the handle the lower



FISHER & NORRIS' PARALLEL VISE.

screw moves simultaneously with it, thereby insuring the parallelism of the jaws.

We are informed that the jaws are of the best tool steel welded on and properly cut and hardened, and that the screws and thread boxes are of the best refined iron, the latter being "solid cut." These vises are either with or without a swivel attachment.

NEW SAMPLE PACKAGE FOR THE MAILS.—A mail package, composed of tin, has been approved by the Postmaster General, for the transportation of samples of flour, bran, sugar, needles, nails, etc. The package has a clasp; there is no danger of its self opening in the bags, while the contents can be readily inspected.

Correspondence.

The Supposed Volcano in the Moon.

To the Editor of the Scientific American :

The account, in your issue dated the 21st inst., of the supposed volcano in the moon, seen by Mr. John Hammes, calls to mind a theory I had some years ago, namely: meteors fall, of course, upon the moon as well as upon the earth, but the moon having no atmosphere, they reach its surface with their full cosmical velocity. If a meteor as large as some that have reached the earth should strike the moon the heat developed would turn the meteor to vapor, and an astronomer on the earth that chanced to have his telescope pointed that way would observe phenomena similar to those seen by Mr. Hammes. SAMUEL P. GARY.

Oshkosh, Wis., December 14, 1878.

A Fast Little Side-Wheeler.

To the Editor of the Scientific American :

In your issue of November 23, I was interested in the statement made by S. Firth, of Auckland, N. Z., in relation to his steam launch, and as my experience has been the opposite to his, in relation to vertical boilers, I thought it might be of interest to some of your readers.

I built a small side-wheel boat, 26 feet long and 5 feet 8 inches beam, flat bottom, with fine lines fore and aft, and depth of hull 2 feet. The paddle wheels are 4 feet 8 inches in diameter and 24 inches wide, being connected to engine by gearing—proportion, 5 to 1. The engine is horizontal, 4 inch bore and 6 inch stroke, cutting off at ¾ stroke. The average number of revolutions of engine is 300, with 100 lbs. of steam. The boiler is 36 inches high and 22 inches diameter, containing 91 flues 24 inches long by 1 inch diameter, and a fire box 18 inches diameter by 12 inches high.

I have raised 5 lbs. of steam in 20 minutes from cold water, and with anthracite coal, nut size. This boiler furnishes ample steam, with exhaust draught. The boiler never foamed any, excepting once or twice when first used, which was caused by oil being used in drilling holes for rivets, and considerable remaining inside.

This boiler performed so well that many have remarked its good qualities. Last winter the boat was lengthened 10 feet, and the wheels enlarged to 5 feet 8 inches diameter and 28 inches wide each. The boat draws 7 inches, and will carry 20 persons, drawing about 12 inches. She easily makes a mile in 8 minutes, and I think that compares well with many steam launches using the same power. Our river is shallow, which prevents our using a screw. Sometimes we can get only 14 inches of water in many places. In going through rapids we have used steam as high as 110 and 120 lbs., but never has the boiler failed in any particular.

I think the trouble with Mr. Firth's boiler was that it was too small for his engine. My experience inclines me toward the vertical boiler for this kind of purpose. I hope my experience may benefit others who can use only side-wheel boats. C. A. THOMPSON.

Owego, N. Y., Nov. 27, 1878.

Curiosities of Botany.

To the Editor of the Scientific American :

In the article on the "Proceedings of the Torrey Botanical Club," published in your issue of December 7, mention is made of a "full blown rose" from the center of which another perfect flower was growing. I wish to state that two roses were found last summer growing on the same bush, one having a cluster of five perfect buds raised on a stem from its center, and the other three.

A species of Allium was found in which the stamen, in a flower otherwise normal, was replaced by a bulblet; also in another flower one of the stamens was replaced by a perfect flower.

An ear of corn, which has grown wrong side out, is in my possession. The ear has the form of an inverted truncated cone, bearing the kernels on the walls of the hollow. The cob has a smooth exposed surface, and a texture somewhat more compact than the cob of normal ears.

Arkansas Industrial University, Fayetteville, Ark.

F. LEROY HARVEY, Prof. of Botany.

Pure and Unadulterated Baking Powders.

Believing that inestimable good will result to the public from the questions lately raised in the columns of your paper in regard to the healthfulness of certain articles used in the preparation of food, we think you will not hesitate to crown your efforts by pointing to goods of marked purity and reliability.

Cleveland's Superior Baking Powder, manufactured at Albany, N. Y., has, during the past nine years, gained a widespread popularity, and very many of your countless readers will be glad to know that it is approved and recommended for purity and healthfulness by such eminent chemists as the following:

NEW HAVEN, CONN., December 7, 1878.

Messrs. Cleveland Brothers,

911 and 913 Broadway, Albany, N. Y.:

This certifies that I have recently purchased of several grocers in this city packages of your "Superior Baking Powder," have submitted their contents to chemical analysis, and have found them to consist only of very pure and entirely wholesome materials, very suitably combined for this purpose. They contain no other acid than that of the purest grape cream of tartar, and are completely free from alum or any other deleterious or doubtful substance. They are, as to their composition, in all respects what you claim.

S. W. JOHNSON, Ph.D.,

Professor of Chemistry in the Sheffield Scientific School of Yale College; Director of the Connecticut Agricultural Experiment Station.

HOBOKEN, N. J., December 11, 1878.

Messrs. Cleveland Brothers, Albany, N. Y.:

I purchased a package of Cleveland's Superior Baking Powder of Messrs. Park & Tilford, in New York, and have made a careful analysis of the same. I find it to consist of pure cream of tartar, mingled with such other ingredients as render it an effective and desirable baking powder; and that it does not contain any alum, terra alba, or any adulteration whatever. It is, in my estimation, among the most wholesome compositions for a baking powder of which I have any knowledge. HENRY MORTON, Ph.D.,

President of the Stevens Institute of Technology.

NEW YORK CITY, December 12, 1878.

Messrs. Cleveland Brothers, Albany, N. Y.:

The results of a complete analysis on several packages of your Superior Baking Powder, purchased by myself of grocers in this city, confirm the fact that it is made of pure and healthful materials, well manufactured, and it is in every particular reliable and most wholesome. Having had the examination of the materials used in manufacturing your powder for many years, it affords me pleasure to recommend it without reserve. WM. M. HABIRSHAW, F.C.S.,

Analyst for the Chemical Trade of New York; Chemist of the New York State Agricultural Society; Analytical Chemist to the New York Produce Exchange.

WEST PHILADELPHIA, PA., December 7, 1878.

I have made a very careful analysis of "Cleveland's Superior Baking Powder," bought from grocers in this city, and have found it to be perfectly pure, and manufactured from the best quality of cream of tartar and other materials. It is entirely free from alum, acid phosphates, terra alba, and other substances which are frequently used for the manufacture and adulteration of baking powders; and on account of its purity and healthful constituents, deserves to be highly recommended. F. A. GENTH, Ph.D.,

Professor of Chemistry and Mineralogy in the University of Pennsylvania, Philadelphia, Pa.