Correspondence.

Irrigation by Wind.

To the Editor of the SCIENTIFIC AMERICAN:

In your issue of May 18 is an alleged discussion of "Irrigation by Wind." The writer takes the bicycle as an illustration, and traces its growth from its crudest forms through forty-six years to its present marvelous perfection—the most perfect, from a mechanical point of view, of any machine now in existence, not even excepting the watch, because the bicycle has more scientifically and perfectly constructed bearings than the watch. The writer then tumbles from this exalted height to the "Jumbo" windmill and lauds it for its "ease of construction, economy of cost, capacity in power," etc., none of which qualities does it possess.

In the first place, the "Jumbo," 21 feet in diameter and 27 feet long, with eight fans alluded to, will require 2,264 feet of lumber for the shield up to its shaft. This makes no mention of the frame on which the lumber is to be nailed and which carries the wheel, and which would doubtless bring it up to 4,000 feet of lumber. As a moment's reflection will show, of the eight fans described, but a quarter of them, or two, will be exposed to the wind at any one time, and of those two you really get no benefit except from one of them, for either one shields the other or else both stand so obliquely to the wind that not more than half efficiency is attained. You are, therefore, reduced to one-eighth of the sail surface. This one-eighth, by reason of the fact that it faces in one of two directions, is reduced to one-half of its efficiency again, leaving the sail surface with an efficiency of only one-sixteenth. Now add to this the further fact that it is not practical to get these wheels up where they get a good wind exposure, and the efficiency is reduced to almost nothing, which is found to be the case in practice.

A wheel needs to be at least 30 or 40 feet above the ground even in a level country to get good results, and in these prairie countries where irrigating is now being done, numerous groves are being planted, and the efficiency of the wheel that must be placed on the ground is very small and very little figuring will show that its cost is very large as compared with the marvelously efficient steel wheels now made. So far from the "Jumbo" being the germ of a new idea, it is a very old form that, together with a similar wheel with a vertical shaft, which is much better, were among the first of wind wheels and the most frequently reinvented and the most easily demonstrated to be utterly worthless.

A modern steel wheel, on a 40 foot steel tower that will pump more water in a year than this "Jumbo" described, can be bought at one-fifth its cost, and the pump for the steel wheel, since it works constantly when the wind blows instead of only a small portion of the time, is proportionately smaller and proportionately less costly. L. W. NOYES.

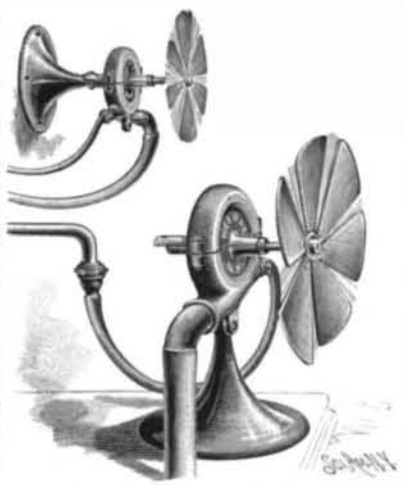
Breaking of the Earth's Crust.

From the point of view of the general geographer, whose scope takes in not only the superficial aspects of a country, but its physical construction as well, perhaps the most interesting contribution to African knowledge that has been made within late years is the demonstration by Dr. J. W. Gregory, of the British Museum, that there exists in Eastern Africa, occupying a very considerable portion of its extent, a narrow, and in places a very deep, trough, in which the great lakes and many of their tributaries are located, and which, with a more or less open and depressed lowland, communicates with the basin of the Red Sea, and yet further with the Dead Sea and to the Valley of the Jordan. To use Dr. Gregory's own words: "From Lebanon, then almost to the Cape, there runs a deep and comparatively narrow valley, margined by almost vertical sides, and occupied either by the sea, by salt steppes and old lake basins, and by a series of over twenty lakes, of which only one has an outlet to the sea. This is a condition of things absolutely unlike anything on the surface of the earth." The presence of such a rift, for rift it appears to be, can only be compared with the long lunar rifts which have so long puzzled astronomers. To Professor Suess, the eminent geologist of Vienna, we owe, indeed, the first demonstration that over large areas of the earth's surface the crust has been steadily breaking through in the direction of the earth's center, and that the crust has been torn and rifted throughout all time by the subsidences of earth blocks; and he truly, many years ago, pointed out the probable existence of this vast Afro-Asiatic trough, the evidence to which has now been supplied by Dr. Gregory.

This investigator was actually able to trace a long parallel-sided and steeply-walled valley, of perhaps twenty to twenty-five miles wide, extending southward from the Great Nyanza to beyond the first parallel of south latitude, or over a linear distance of some 150 miles or more. Over much of this extent the boundary walls are described as being "so precipitous that not even the most expert of cragsmen could scale them;" sheer precipices are indicated with elevations of 800 and 1,000 feet. This remarkable structure of most unique development and extraordinary persistency must be regarded as one of the most interesting features of the earth's surface.—Prof. Angelo Heilprin.

SIMPLE AND EFFICIENT FANS.

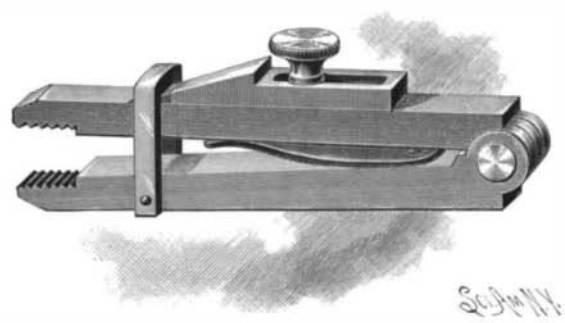
For ventilating or cooling sleeping rooms and other apartments, or for use in any situation where running water, at a pressure of twenty pounds or more, is available, the simple fan and connected motor herewith illustrated is designed to afford most efficient service, at a low first cost, and needing but the slightest possible attention afterward. The standard or base, as shown, may be fixed in a vertical or horizontal position, and the water connections may be satisfactorily made with hose where it is not desired to make permanent lead or iron pipe connections, the work being done by any one without the aid of a mechanic. This improvement has been introduced by Messrs. A. F. Weed & Company, 106 and 108 Liberty Street, New York, who originally designed the motor to operate a line of mechanical models requiring a light power. It has been found to be so well proportioned and so accurately adjusted that it runs at high speed without vibration and almost without wear, requiring no attention beyond an occasional oiling of the bearings, and has been adapted for all kinds of light machinery. Fittings are furnished for ready attachment to any style of basin cock, and, once installed, the device is always ready to operate by simply turning the faucet.



THE WEED WATER FAN MOTOR.

A NOVEL WRENCH.

In the wrench shown in the illustration the pivoted jaw arms are pressed apart by a spring, and one of the arms carries a pivoted holder or bail which extends over the other arm, limiting its outward movement, the jaws of the two arms being held in close gripping engagement with a nut, pipe, or other article by sliding a wedge along one arm and under the bail. The improvement has been patented by Mr. Alexander Delhommer, of Breaux Bridge, La. The wedge has a rearwardly extending shank in which is a longitudinal slot engaged by a screw screwing in the arm, and when this screw is loosened the wedge is free to slide along the arm, but when the jaws are brought into engagement with an article to be gripped, and the wedge is moved forward under the bail, the wedge is fastened in position by means of the screw, locking the gripping jaws upon the article.



DELHOMMER'S WRENCH.

The Clean Streets of Rome.

A correspondent of the New York Sun, in a recent letter from Rome, writes as follows:

I have been a good deal interested in observing the mode of cleaning the streets in Rome. They are kept so clean, even the poorest of them are kept so much cleaner than the best streets in New York, that I have given some time to the study of the system in force here and its expense. I have been kindly furnished by the officials of the city, on a request made through the consul-general, with answers to a series of questions which I framed in order to enable me to obtain accurate knowledge on the subject.

What the stranger sees of the process of street cleaning is that all over the city are men in a cheap uniform, armed with a broom of twigs, a basket, a shovel and a small red painted covered cart, very much as we see used by the men engaged in repairing the pavements with us, only smaller. Each obviously has allotted to him a certain portion of the street, and he is engaged all day in keeping it clean by sweeping up the dirt and putting it into his red cart. When he has no work of this kind to do he sits down on the edge of the sidewalk and proceeds, from a supply of twigs, to mend or make his broom. At stated periods in the day he wheels his cart off to a place of deposit, where its contents are emptied into large carts in waiting, which in turn carry the dirt out to places just outside the city gates.

There are two circumstances which render it easier to keep the streets clean at Rome than with us. One is the excellence of the pavement. A little more than one-half of the superficial area of the streets is macadamized, while the other half is chiefly paved with small trap rock blocks, almost identical with those brought from the Palisades and used with us. About one per cent of the superficial area is paved with asphalt, and a very small fraction with wood. But, however paved, the streets are kept smooth, so that there are no inequalities to retain dust.

The other circumstance which facilitates street cleaning here is that nothing is ever thrown into the streets from the houses or stores. No one seems to think of throwing any such matters into the street, for the reason in part that garbage and all the dirt and refuse that accumulate in the houses and stores are taken from them daily by men employed by the city, who ordinarily come into the houses and buildings and remove such refuse and carry it off in carts to places of deposit outside of the city. When the owners do not arrange to have the raccogletoli, as the collectors of garbage are called, come into the houses, they deliver it to them at fixed hours.

You will be astonished at the absurdly small figure which it costs to keep clean and sweet the streets of Rome, a city of 500,000 inhabitants. The following are the official figures, which include not only the expense of sweeping the streets and removing the sweepings to the places of deposit outside the city, but also the like removal of the garbage and house dirt and the watering of the streets. The horses and carts belong to the city, it having been found that the work was done more cheaply and better in that way than by contract, though ordinarily the contract system prevails for similar public work—such for instance as the collection of the octroi—much more generally than with us. A small charge, averaging only six cents a month, is made for the removal of garbage from each house, where the owners elect, as they almost universally do, to have the collectors come into the houses for that purpose. The sweepings are taken away from the several places of deposit outside the city walls by the peasants, who are glad to come and get the stuff.

If we reckon the dollar at five francs, the total expenditure in 1894 for all the service I have specified was $148,461, but from that must be deducted $31,428 received from various sources, including about $29,200 for the removal of garbage from houses, so that the net expense was only $117,033.

With reference to the length of streets swept there are in all about 180 miles, of which all except eighteen are swept daily. Each street is not only swept in the daytime, as I have described, but also specially each night. As to the superficial area there are about 2,956,000 square yards of street and 332,000 of sidewalk, making a total superficial of 3,286,000 square yards for the city.

There are employed in the performance of the work I have specified about 813 persons of all grades. Of these, 453 are the sweepers, 42 the cart drivers who carry away the street sweepings, 58 the cart drivers who carry away the garbage and refuse of houses and stables, and 129 the men who enter the houses and carry out the garbage from them. There is one superintendent, who has twelve clerks and as many assistants. Hostlers, farriers, harness makers, watchmen, etc., make up the balance. The total number of 813 is sometimes increased by men for a special service to 853.

The amount of street surface assigned to each sweeper varies with its width, its locality and importance, and with the mode of pavement. In the streets that are macadamized it is a maximum of about 30,000 square feet, while in those that are paved it is in some cases as low as 12,000 square feet. The average for the city is about 20,000 square feet to the sweeper.

The surprise which the small aggregate expense will excite will be much diminished when we come to know the wages that are paid. The street sweepers get, if we reckon the franc at 20 cents, 36 cents a day, and are entitled to a summer and winter suit of clothes and to two hats and two pair of shoes a year; but the total expense of these for the whole 453 sweepers is only $2,680 a year. The highest salary paid is $850 a year, to the superintendent, and there are only thirteen persons who receive annual salaries, some of them getting only $216 a year. The cartmen get from 45 to 50 cents a day. Those who deal with house garbage get from the city 25 cents a day, but are allowed to have some pickings from the matter removed. The highest wages paid to any employes is to the foremen, $1.25 a day. The mechanics get 50 to 60 cents and harness makers 50 to 80 cents.

Safeguards Against Deterioration of Drug Stock.

A recent number of the Bulletin of Pharmacy contains an interesting article on this subject by Leon C. Fink, from which we abstract the following:

A large proportion of the materials which constitute the stock of an average drug store are particularly prone to deterioration, and painstaking pharmacists are required to exercise more than ordinary circumspection to prevent exposure of sensitive pharmaceuticals to pernicious influences. In fact, the art of affording such protection is quite as important as the ability to select drugs and prepare medicines properly.

A complete tabulation of all the chemical and physical changes which can modify and injure pharmaceutical preparations is not within the scope of this article, but it is deemed apposite to mention a few exemplary forms of deterioration which will serve to suggest to the minds of intelligent pharmacists others which can occur from similar causes.

The importance of maintaining a uniform temperature through day and night, in a pharmacy, is apt to be overlooked. Remember that your stock is largely made up of fluid preparations holding chemical substances in solution. These are reasonably permanent at a normal temperature, but, as the temperature lowers, the solvent power of the menstruum is reduced and precipitation of the less soluble ingredients occurs. Results grow gradually worse as the temperature goes down, until disaster comes in the freezing of aqueous solutions and consequent bursting of bottles.

Change of temperature may also cause loss and annoyance from breakage of demijohns through expansion or contraction of liquid contents. If a demijohn is filled with cold liquid, tightly corked, and subsequently transferred to a warm room or climate, the liquid will expand with rise of temperature and blow out the cork or burst the vessel. Tightly corked demijohns filled with hot liquids frequently collapse under atmospheric pressure as the contents cool and contract. It is therefore a safe rule never to fill such large glass containers completely, but rather leave an ample cushion of air to allow for expansion and contraction.

Sunlight can do incalculable damage to chemicals, pharmaceuticals, plush goods, and toilet articles in general, unless special precautions are taken to prevent its injurious action. Calomel is not altered by the atmosphere if kept in the dark, but when exposed to sunlight it gradually turns gray or black, indicating decomposition. Santonin acquires a yellow color by exposure to sunlight. Silver nitrate becomes gray or black on exposure to sunlight in the presence of organic matter. Sunlight darkens yellow mercurous iodide and yellow mercuric oxide in consequence of their partial reduction. Bright green scales of soluble ferric phosphate and soluble ferric pyrophosphate turn dark on exposure to sunlight. Red mercuric iodide is permanent in the air if kept in the dark, but acquires a brownish tint by exposure to sunlight. Quinine bisulphate readily acquires a deep brown-red color on exposure to direct rays of sunlight. Quinine sulphate and quinine hydrochlorate are gradually colored yellow by similar exposure. Ferric salts in solution with sugar are reduced to ferrous salts by action of sunlight. Many volatile oils are injured by prolonged exposure to atmospheric oxygen and sunlight, while some are eventually rendered worthless and entirely unfit for use. Perfumes exposed to direct rays of sunlight rapidly degenerate and soon acquire a rank odor. It is apparent, therefore, that they should not be habitually presented in show windows.

Drugs and chemicals are frequently injured by absorbing moisture or carbonic acid, or both, from the atmosphere. Solids that absorb moisture from the air are called hygroscopic. Solids which absorb moisture from the air and become liquid, or dissolve therein, are called deliquescent. Crystalline substances which part with their water of crystallization on exposure to air, thereby losing their crystalline form, are called efflorescent.

On exposure to atmosphere, caustic soda absorbs water and is liquefied, subsequently solidifying and becoming efflorescent. This change is caused by the absorption of carbonic acid and the crystallization and efflorescence of the sodium carbonate thus formed. Potassa also deliquesces and absorbs carbonic acid under similar exposure. Chlorinated lime absorbs moisture and carbonic acid from damp atmosphere, with loss of valued properties and formation of a plastic mass; it should, therefore, be kept in a closely covered jar and stored in a cool, dry place.

Lime becomes "air slaked" by exposure to ordinary atmosphere, absorbing water and carbonic acid, and being converted into hydrate and carbonate of calcium. Carbonate of potassium is extremely deliquescent in humid air, forming a colorless or yellowish alkaline liquid of an oily appearance. Chloride of zinc, acetate of potassium, and chloride of calcium are also very deliquescent salts which require special protection.

Powdered extracts should be carefully protected from exposure to moist air, in small bottles with mouths wide enough to admit the blade of a spatula. Selected corks should be used, and the bottles should be kept in a cool place—never in a current of hot air from a stove or furnace.

It is particularly essential that granular effervescent salts be kept in securely corked bottles, for if access of air be permitted, sufficient moisture will soon be absorbed to cause the acid to act upon the carbonated base and gradually liberate carbonic acid. The valued effervescent properties of the preparations will thus be irretrievably lost.

If clear lime water be exposed to the influence of air, a pellicle of calcium carbonate is formed upon the surface; this film sinks to make room for another, until finally nearly all the lime is rendered insoluble and the supernatant liquid is comparatively valueless. It is essential, therefore, that a goodly excess of lime be kept in the bottom of the lime water bottle to maintain the strength of the solution. The container should be kept in a cool place, as cold water dissolves more lime than hot water.

Solution of lead subacetate is decomposed on exposure to air or on being mixed with water containing air in solution, white precipitate of insoluble carbonate of lead being formed. When freshly made, it should be divided into two or four ounce bottles, kept full and tightly sealed until required for use. Liquor potassa and liquor soda also possess marked affinity for carbonic acid, and should be preserved in securely stoppered bottles.

Quinine sulphate, like some other alkaloidal salts, does not "lose strength" by exposure to ordinary dry atmosphere, but rather loses water of crystallization by evaporation and becomes correspondingly richer in quinine. It should be borne in mind also that effloresced carbonate of sodium is stronger than the normal crystallized salt in proportion to the amount of water it has lost. Sulphate of soda, commonly called Glauber salt, contains more than half its weight of water of crystallization, nearly all of which is dissipated on exposure to dry atmosphere, leaving a dry, white powder which is a correspondingly richer salt. Sulphate of zinc also effloresces slowly in dry air.

Atmospheric oxygen causes many undesirable changes in chemicals and pharmaceuticals. On exposure to air the color of sirup iodide of iron slowly changes to yellow and subsequently to brown, the change of color proceeding from the exposed surface downward. This color can sometimes be bleached and the sirup restored to its original appearance, but here is a case where an ounce of prevention is worth a pound of cure—keep the sirup in small bottles, full and well corked. Sirup bromide of iron is of course similarly affected.

Certain fixed oils will remain unchanged for a great length of time in air-tight vessels, but when exposed to the atmosphere they attract oxygen and ultimately become concrete. The tendency of linseed oil to dry or harden on exposure to air is typical in the extreme. Exposed to the air, lard absorbs oxygen and becomes rancid; it should, therefore, be kept in well closed vessels, or procured fresh when required for use. In the rancid state it irritates the skin, and sometimes exercises an injurious reaction upon substances mixed with it.

Phosphorus absorbs oxygen from the atmosphere with sufficient avidity to cause rapid combustion and necessitate its preservation under water. Prolonged exposure to air gradually transforms light green ferrous carbonate into the familiar red-brown "subcarbonate of iron," which is ultimately little more than ferric oxide and can undergo no further change from similar influences.

Not content with ravaging the pharmacist's stock, this belligerent element exhibits a remarkable propensity, in the presence of moisture, for rusting his spatulas and other metallic utensils.

Serious pecuniary loss by evaporation of volatile solids like camphor results from exposure of these substances in ordinary open wooden drawers. Menthol is extremely volatile, and should therefore be kept in securely corked bottles to prevent loss. Exposed to the air, carbonate of ammonium partially volatilizes, becomes opaque, and crumbles into a white powder. Iodine is most advantageously kept in securely closed glass receptacles—most ordinary wares are liable to be attacked or permeated by it. Chloral evaporates slowly when exposed to dry atmosphere. Powdered drugs which depend upon volatile constituents for medicinal virtue, like cinnamon, cloves, orris root, and valerian, should, so far as practicable, be kept in bottles or some other comparatively air-tight container.

Stronger water of ammonia should be kept in strong, glass-stoppered bottles, which should be stored in a cool place and opened with extreme care. When warm, the liberated gas frequently forces the stopper out with considerable violence, and many accidents resulting in injury to the sight of operators are on record.

Pressed roots and herbs are more convenient to handle, occupy less space, and are better preserved than crude drugs in bulk form. Furthermore, the danger of error is materially reduced by handling neatly pressed, wrapped, and labeled packages.

Examine your stock of dandelion and rhubarb roots occasionally to be sure that purchasers do not find worms in them and form unfavorable impressions of you and your business methods.

Cantharides should be thoroughly dried and kept in securely closed containers. The vapor of chloroform quickly kills insects which infest cantharides, and their destruction can be accomplished by placing a small quantity of chloroform in a wide mouth bottle or other open vessel upon the surface of the infested drug and securely closing the container. The heavy chloroform vapor will then gradually sink through the drug and destroy the insects.

The modern method of marketing chlorinated lime in hermetically sealed parcels is not only a source of convenience, but affords protection which serves to prevent loss of the loosely combined chlorine, upon which the value of the preparation as a disinfectant is almost entirely dependent. The disagreeable odor of chlorine which clings to the hands of the operator is also avoided.

Charcoal is used in medicine chiefly for its absorbent and disinfectant properties. Owing to its absorbent powers, it should not be unnecessarily exposed to the atmosphere of a laboratory or pharmacy, lest it be thus rendered unfit for medicinal purposes.

Fine sponges should be kept in a closed showcase or drawer. Carriage and slate sponges, which are frequently allowed to become soiled and lend an untidy appearance to the store by rolling about in a window or on the floor, can be conveniently kept assorted and conspicuously displayed in the wire basket with separate compartments for different sizes.

Oxalic acid should not be kept in paper parcels, since it soon renders the paper fragile, and in being thus scattered about may, by admixture with other drugs, cause loss of life. Owing to its external resemblance to Epsom salt, and its very poisonous nature, the substances should not be kept in similar drawers. The practice of keeping them in containers of different style and safely remote from each other is less likely to lead to accidental confusion.

Remember that heated atmosphere usually accumulates near the ceiling, and preparations subject to injury by exposure to elevated temperature should not be kept on upper shelves. Several cases are on record wherein chlorinated lime, which is known to greedily absorb water and carbonic acid from a humid atmosphere, was put up in securely corked and sealed bottles, which were then placed upon an upper shelf until the heat of summer, or a very warm apartment, had liberated sufficient gas to cause a startling explosion, sometimes followed rapidly by a succession of similar ones and a cloud of dust.

Lard, ointments, cerates, and, in fact, nearly all animal fats, are liable to grow rancid by prolonged exposure to air, this change in many cases being accelerated by heat and light. Every precaution should, of course, be taken to avoid such decomposition; but when rancidity is apparent, preparations should never be dispensed, for, instead of having the mild demulcent properties which constitute their chief value, they become irritant and entirely unfit to serve as vehicles for medicinal substances to be applied to the skin. Ointment jars should invariably be thoroughly cleaned and freed from rancidity before refilling with fresh stock.

With ordinary drug store arrangement it is scarcely practicable to entirely protect tinctures and fluid extracts from injurious effects of air, light, and changes of temperature, but any provision which tends to prevent precipitation from these causes is commendable. The stock of tinctures should be placed in charge of one capable employe, who should be held responsible for its condition. Haste is apt to make serious inroads upon accuracy in preparing pharmaceuticals.

The danger from leaving bottles insecurely corked is apparent when we consider that if a fluid extract prepared from a menstruum composed of diluted alcohol be exposed to the air in an open vessel, the alcohol will evaporate much more rapidly than the water. By this change of character in the menstruum certain resinous constituents of the drug frequently become insoluble and are deposited, rendering the fluid more or less turbid, and materially lessening its medicinal value. Collodion loses ether by evaporation, and becomes comparatively worthless.

The deterioration which can occur in a single drug store from causes indicated here commands the constant attention of the manager, and much greater is the problem which confronts the wholesale manufacturer, who must prepare a great variety of products in large quantities to be distributed in the market in all directions, where they are expected to remain unchanged through the extreme variations in temperature which characterize the severe winters in the north and the torrid summers in the south; and no less injurious is the improper exposure to which pharmaceuticals are frequently subjected in temperate climates.

IT is stated that Dr. Bertillon has discovered a new method for identifying handwriting by enlarging the letters by photography and measuring the alterations due to beating of the pulse.