less domain to connect the MIND of Nature with the phenomena of matter, which has hitherto engrossed its entire attention, though it must be daily marching toward such a consummation. Not that men of science, as individuals, understand or reverence the Mind of God less than those who are not devoted to science, but merely that the connection between Matter and Mind in Nature has not yet become a scientific fact. The science of physiology necessarily takes cognizance of the intimate relations of Mind and Matter in connection with animal existences; but it has not yet assumed to regard as possible MIND (above referred to) pervading all Nature. Grant that it is but a hypothesis that Mind pervades Nature and controls Matter; when, if ever, reason shall prove it to be a fact the hypothesis will disappear like starlight before the rising sun; but the fact will remain.

Instead of the conclusion that "we can know only the finite which comes within reach of our sensual perception," may we not believe that we will know much more (without limit) which may come to us through our reason?—R.

ADULTERATION OF GROUND MADDER, AND OF ITS PREPARATIONS.

By M. C. BENNER.

THE ordinary method of sophisticating madder is to substitute for part of the active coloring matter an inert powder, with which either the extract of a dye-wood or a powerful astringent has been incorporated. The spent bark from the tanneries, dried and powdered, and mixed as may be requisite with extract of chestnut, dry extract of pine bark, Lima-wood or logwood, or sometimes with various proportions of all these extracts, is the adulterant generally selected. The reagents for detecting this fraud consist of slips of white bibulous paper steeped in a solution of stannic chloride at 2° B., allowed to drain, and laid upon a plate of glass. Another reagent consists of the same kind of paper steeped in solution of copperas at the same strength, drained, and laid upon the glass by the side of the tin-paper. A portion of these papers is dusted over, while still moist, with the powder under examination. Upon a second portion of the papers is sprinkled a perfectly genuine sample, and upon a third portion a mixture which the operator has made up with the different extracts in known proportions. After the lapse of fifteen to twenty minutes the under side of the glass is exposed to a gentle heat till the paper is very dry; the adherent powder is then shaken off, and then we examine the spots of various shades which the extracts of dye-woods and of astringents have produced. Pure madder, madder-flower, and garancin produce no spots, but if the smallest quantity of dye-woods or of astringents has been added, one or other of the papers will betray the fraud by spots more or less numerous. The green tannin of certain resinous woods, and especially of pine-bark, is not easily detected by this method. The following method may therefore be used:—5 grms. of the madder, etc., in question are weighed out, mixed with 65 grms. of distilled water at 50°, and 35 grms. of commercial alcohol are then added. The infusion is stirred, and let stand for fifteen minutes, then filtered into a porcelain capsule. Strips of filter-paper are steeped in this liquid as uniformly as possible, dried in the air, and when perfectly dry submitted to the following reagents. A paper should always be prepared for comparison with a perfectly pure specimen. The reagents are:—(1.) Acetate of copper obtained by the double decomposition of—

Sulphate of copper.....	10 parts.
Sugar of lead.....	10 "
Distilled water.....	100 "
(2.) Acid chloride of tin, prepared with—	
Stannous chloride.....	20 parts.
Hydrochloric acid.....	5 "
Distilled water.....	100 "
(3.) Nitrate of silver, at 10 per cent. of the salt.	
(4.) Copperas, at 10 per cent.	
(5.) Carbonate of soda, at 10 per cent.	

A piece of white calico is rolled up so as to form a kind of brush, dipped in each of the test-liquids, and with it one or two transverse strokes are made upon the paper saturated with the alcoholic extract. The paper is then allowed to dry for three-quarters of an hour without exposure to the sun. The colored reactions upon the papers are then compared with those of the standard sample. The better to detect pine-bark, the infusion of the suspected madder may be previously allowed to ferment. 100 grms. of the sample are infused in 375 grms. of water at 40° C.; grms. of beer-yeast are then added, and the mixture is allowed to stand over night at 40°. In the morning 500 grms. of water at 50° and 200 grms. of alcohol are added, allowed to stand for half an hour, filtered, and in the filtrate slips of paper are steeped, and examined as above. Or slips of filter-paper may be suspended so as to dip into the alcoholic liquid, and left hanging over night. The liquid ascends by capillary attraction, and the coloring matters becoming oxidized give the paper a different shade, according to the nature of the foreign bodies which have been added to the madder.

ON A DISTILLATORY APPARATUS.

By JOSEPH P. REMINGTON.

HAVING occasion to use frequently the ordinary forms of pharmaceutical stills, for recovering alcohol, in making fluid extracts, and for other purposes, and noticing some defective points in their practical operation, the writer finally contrived the apparatus which is figured in the cut, and a continuous use of over three years having proved its efficiency, it is herewith submitted.

The greatest objections to the pharmaceutical stills usually sold by the makers are the use of the water joint, and the short distance remaining between the delivery-pipe and the source of heat when the still is in position. The water-joint is always objectionable; when the still is in use, constant care and attention is required to keep it full of water on account of evaporation, and a sudden tilt or shake requires a readjustment. In some of the stills, where the spirit is condensed upon the dome, the water in the joint gradually evaporating is replaced by the condensed alcohol, which is wasted by the evaporation, even if more serious consequences do not result, *i. e.*, the sudden bursting into flame by contact with the fire used as a source of heat. The second objection may be counterbalanced, if care is used; but it sometimes happens that the water-supply, used for condensation, suddenly fails, and if alcoholic vapor issues from the delivery-tube, instead of condensed spirit, explosion will likely ensue if it comes in contact with flame.

As expense has usually to be considered in the construction of apparatus for pharmaceutical use, especially if intended for occasional employment, the effort was made to keep the cost down to the lowest point consistent with utility and convenience of application.

It is presumed that most pharmacists use a low stove, such as here figured, or a gas stove, or have access to a kitchen range or furnace. The still proper, A, thirteen inches in diameter, may be constructed of copper, and if a coppercan, in which oils of lemon, bergamot, orange, etc., are imported, can be procured, a new bottom may be brazed into it by a coppersmith, and the whole tinned inside; the top is cut off, and two flat brass rings, B and C, one and a half inch wide and half inch thick, are obtained and soldered or riveted to the top and body of the can, as shown in the cut; two half inch short copper tubes, D and E, are fastened to the body of the still, communicating with the inside for use as a water level; a glass tube bent at right angles at top and bottom is fastened by two short pieces of rubber tube to the copper tubes for this purpose; when the water bath is used (hereafter described) the upper end of the glass tube is drawn out of the rubber tube, in order to afford egress for the steam through the upper tube D. A three-quarter inch copper tube is let into the top to supply the liquid to be distilled, of course furnished with a cork, when the still is used. A water bath of tinned copper or tinned iron of the shape shown in F, with a flat rim, which accurately fits the flat ring, should be provided.

A four inch opening is made in the copper top G, to which is fitted the elbow H; this elbow is best made of tinned copper, but this may be replaced by a tinned iron, "lobster back," gutter-pipe elbow, if first cost must be curtailed. There is an advantage in widening this tube: first, in affording more space for the accommodation of vapor rapidly forming, and, secondly, for the greater facility with which it may be cleaned, there being no difficulty in getting the hand inside to scour it out.

DISTILLATORY APPARATUS.

The condenser, J, however, is the most important part of the apparatus, and consists of seven tubes one inch in diameter, thirty-two inches long, surrounded by a cylinder five inches in diameter and twenty-four inches long; the seven tubes are arranged as seen in sectional view I. A cap, K, two inches deep, soldered to the condenser, fits tightly over the elbow H, so that a tight joint is made here—this may be rendered perfectly tight by tying around it a strip of moistened bladder.

A short tube, L, at the bottom of condenser is connected with a rubber tube from hydrant for supplying cold water, and a similar tube at M conveys the heated water into the sink.

The ends of the condenser tubes are drawn together and tapered so that a bottle with an inch and a half mouth may be used for collecting the distillate.

An iron stand, N, adjusted by raising or lowering the U-shaped support, and fastening at any required angle, by means of the screw in the center, is a convenient way of supporting and keeping in place the whole apparatus—but this may be replaced by a wooden box, cut so as to receive the condenser, and blocked up from below to the proper height as required.

The joint between the still and dome is best made by inserting a wetted hempen cord—as used in Dr. Squibb's laboratory, Brooklyn (the thick twine which is used by the paper manufacturers to bundle reams of wrapping paper answers very well)—between the two brass rims, B, C, and clamping together, placing the clamps at equal distances, and arranging alternately, so as to secure a uniform pressure.

The advantages which seem to be possessed by this distillatory apparatus are as follows: All parts may be readily cleaned, and, as it is intended for the use of the pharmacist, in the limited space usually afforded for manipulations, care has been taken to make it as compact as is consistent with safety and efficiency. The condenser has the advantage of the worm in affording extent of surface to the refrigerating action of the cold water, and is seven times more efficient than the ordinary Liebig's condenser, from the fact that seven tubes are employed instead of one. The advantage of the Liebig is retained—that of the facility with which it may be cleaned, by simply passing a rattan, armed with a sponge or muslin rag, which is tied around the end, through each straight tube in turn, and rinsing with warm water or suitable liquid. The disadvantage of the worm for pharmaceutical use, *i. e.*, the great difficulty in cleaning, especially when the still is needed for a variety of purposes, is thus avoided.

The principle of increasing the extent of surface to obtain greater efficiency without adding materially to the size, which has been used so long in the construction of locomotive boilers, was taken advantage of here, with the view of getting similar advantages by the reverse effect. The diameter of the tube being 1 inch, and length exposed to the refrigerating action of water 24, the area would be slightly over 75 inches; this, multiplied by seven, gives the whole extent of surface, 525 inches. Now, the diameter of the outside cylinder surrounding the tubes is 5 inches; this multiplied by 3-1416, and this by 24, would give the surface of the cylinder, nearly 377 inches, and this lacks about 30 per cent. of the extent of surface of the seven inside tubes; so that there is 30 per cent. more surface exposed by the condensing tubes than is possessed by the containing cylinder.

To the pharmacist, occupied by many various duties, it is an object to be able to save time and trouble, and, with a little practice, it is not difficult with a good fire and the ordinary water supply, in moderate weather (water at 50°F.) to recover a gallon of alcohol from weak tincture in fifteen

minutes; the whole apparatus may be set up, the distillation finished, and all finally cleaned and put away easily in thirty minutes. Seven streams issue from the delivery tubes of the condenser instead of one, and the danger arising from alcoholic vapor issuing uncondensed on account of urging the fire, and communication with flame, is almost prevented by the increased power of the condenser.

The condenser should have the inside surface protected from rust by a thick coat of red lead and oil, if made of tinned iron.

SEPARATION OF A MIXTURE OF LEAD, ZINC, AND SILVER.

By F. MAXWELL LYTE.

THE ore, ground and calcined, is treated with dilute hydrochloric acid in troughs of resinous wood, into which steam is blown to raise the temperature. The zinc, lead, and silver are thus converted into chlorides, the argentic and a part of the plumbic chloride remaining mixed with the gangue. The liquid is then run off, and allowed to cool, when nearly the whole of the plumbic chloride is deposited. The clear mother-liquid containing zinc chloride and excess of hydrochloric acid is siphoned back into the first tank, where it takes up a fresh quantity of chlorides of lead and silver, the gangue being thus exhausted after three successive decantations. To the entire solution now existing in the second tank scrap-zinc is added, when all the lead and silver is deposited as a metallic sponge. (It must be remembered that silver chloride is soluble in concentrated solutions of lead chloride.) From the residual liquor the zinc is precipitated as oxide by the addition of milk of lime.

MARS AND HER MOONS.

MARS is, of all planets, the best known to astronomers. Its physical features have been mapped in some detail, and names have been given to its principal continents and seas by Beer and Mädler, Kaiser, Proctor, and Flammarion. At times it approaches so near to the earth that during this last autumn we have been separated from it by only about 35,000,000 miles. Yet it has been near at other times, and no trace of any moon has been detected. In 1862, and before that in 1845, and again in 1830, Mars was very favorably situated, and was closely scrutinized by some of our ablest observers. The discovery of the satellites, however, was reserved for the astronomers of the United States, with their fine instruments of modern manufacture.

It was on the night of the 11th of August that Professor Asaph Hall, of the Observatory at Washington, first caught sight of what seemed to be a very small star in the neighborhood of Mars. In consequence, however, of cloudy weather, it was not again seen until the night of the 16th of August. It was then found to be following the apparent motion of the planet, and its true nature was soon detected. Clearly it could not be a fixed star, for no fixed star would keep company with the ruddy wanderer. But the very next night a second similar body was detected; and hence it appeared that instead of Mars having no moon, as had always been believed, he had in reality a couple of attendant orbs.

Still it was possible, after all, that the Washington astronomer might have been mistaken in his observations; and if this had been the case, he would not have been the first observer of eminence who had been similarly deceived. In order, however, that there might be no doubt about the matter, several astronomers at Washington, on the night of the 18th of August, looked for the same bodies, and confirmed Professor Hall's discovery; while it was also corroborated by Messrs. Alvan Clarke at Cambridgeport, Massachusetts, with Mr. McCormick's fine 26-inch telescope; and by Professor Pickering at Cambridge, Massachusetts, with the 15-inch refractor of Harvard College. The discovery having thus been placed beyond doubt, it was telegraphed from the Smithsonian Institution to Europe.

At the Paris Observatory MM. Paul and Henry Prosper soon succeeded in detecting one of these bodies—the outer satellite—by means of the 10-inch reflector. It has also been observed at Greenwich with the 13-inch equatorial; and it has been picked up by Lord Rosse's assistants with the 6-foot reflector at Parsonstown. Attention having been once called to the subject, the satellite was soon seen by other astronomers who possessed good instruments; but it does not appear that the inner moon has yet been found except by the American astronomers.

It is only with a very powerful telescope that any one can hope to see either of these additional members of the solar system. Even in the best instruments they appear only as faint points of light. It is therefore scarcely possible to say anything definitely about their size; but it is evident, by comparison, that they must be much smaller than any of the little asteroids, or minor planets, which have hitherto been discovered. Professor Newcomb says that although the diameter of the Martian moons cannot be measured, yet "one may safely agree to ride round one between two successive meals, or to walk round one in easy stages during a very brief vacation." When Mars was favorably situated for observation in 1830, Mädler so closely scrutinized it that he concluded that no satellite more than twenty miles in diameter could exist without his having detected it. The satellites just discovered are much smaller than this, and probably the diameter of each is less than ten miles. Taking this maximum diameter, the surface of one of these moons would not be much greater, as Mr. Proctor has pointed out, than the area of Middlesex. In fact, the moons of Mars are the most diminutive heavenly bodies which have yet been discovered.

While it is at present impossible to determine their magnitude, it is easy to say something about their distance. It is believed that the outer satellite is situated at a distance of about 12,000 miles from the surface of Mars, while the inner satellite is at a distance of only something like 3,500 miles. The outer moon revolves around Mars in about 30½ hours; but the inner one completes its revolution in less than 8 hours. Hence the Martians, if there be any, must see the inner moon rise and set twice in the course of a single night; but, what is more curious, its motion will be from west to east, and not, as such motions usually appear, from east to west. This arises from the great rapidity with which the satellite travels, its motion in one direction being much greater than the apparent motion of the heavens in the opposite direction.

From the observations which have already been made on the outer satellite, it has become necessary to lower our previous estimates of the mass of Mars. The elements which have recently been determined show that the mass is about one three-millionth of the Sun's mass.

A passage in the *Iliad* has suggested to Mr. Madan, of Eton College, that the names *Deimos* and *Phobos* (Fear and Flight) might not be inappropriately bestowed upon these little Martian moons.—*Nineteenth Century*.