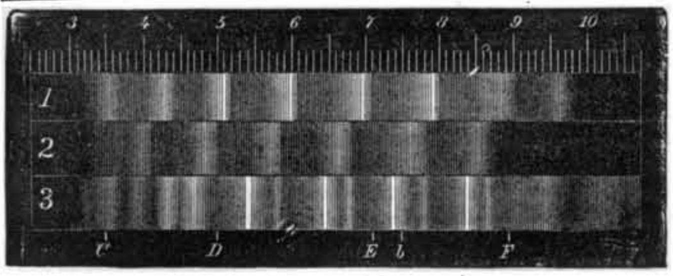


Fig 7.

usual spectrum, shown at 1 of Fig. 5, it showed, as in 2 of Fig. 8, one in which, to the former bands, were added as many more, each located a little further down in the spectrum than its companion in the original spectrum. Now it was evident that water was being driven off from the salt in the process of heating, and therefore natural to suppose that these new lines belonged to a spectrum of the anhydrous salt which was being formed and mixing with the other. By continuing the heat until no more vapor escaped, the body was found to yield the spectrum shown in 3 of Fig. 6, which was thus probably the spectrum of the anhydrous salt; and, in fact, the salt in this state, being submitted to Dr. Bolton for analysis, proved to be the anhydrous ammonio-sulphate of uranium. But this was not all. On further heating to a

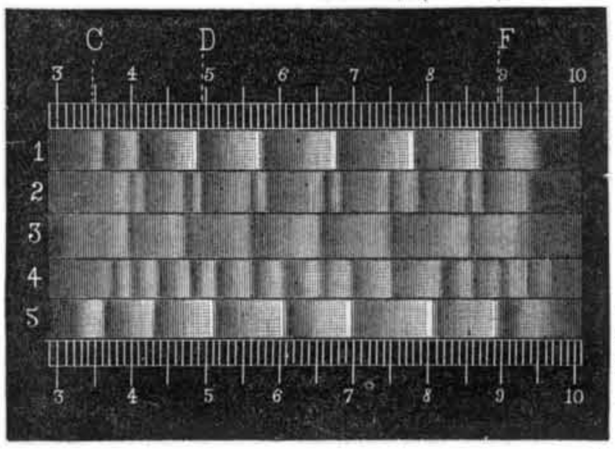


Fig. 8.

temperature approaching redness, the spectrum changed to the appearance shown at 4 of Fig. 6; fumes, evidently consisting of ammonium sulphate, being given off; and on continuing the heat until these fumes were no longer evolved, the spectrum assumed the character shown in 5 of Fig. 6. This material, again being submitted to Dr. Bolton, and analyzed by him, proved to be an ammonio-di-uranic sulphate, a salt not before known to chemistry.

Treatment, more or less parallel to the above, has developed a number of similar facts, and has shown that some of the spectra observed by Becquérel are not those of he salts named, but of mixtures of various hydrates, or even, in some cases, of different salts.

Thus, for example, the annexed engraving (Fig. 9) represents four distinct spectra, shown by perfectly pure sodio-

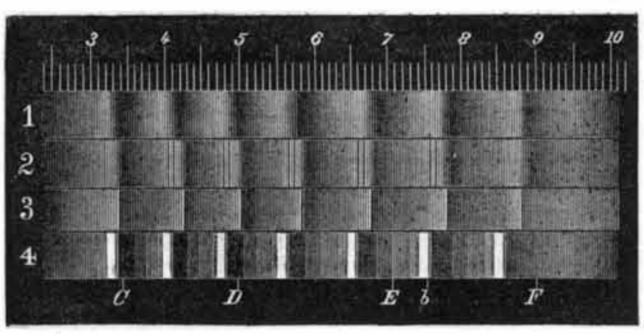


Fig. 9.

uranic sulphate. No. 1 is the spectrum of the normal salt, holding, in combination, five equivalents of water; 2 represents a mixture which was one of the first observed, and caused no little perplexity; it is now known, however, to owe its complex character to the overlapping spectra of several different hydrates. No. 3 is the spectrum of the mono-hydrated salt, or that containing only one equivalent of water; 4 is the spectrum of the anhydrous salt, or that from which all the water has been expelled.

Again, in Fig. 10, we have, in 1, the spectrum of the normal uranic sulphate which contains three equivalents of water; in 2, that of the mono-hydrate, while 3 is that of a mixture of the mono- and bi-hydrate into which the normal salt is apt to pass if suddenly heated, placed in a vacuum, or treated in several other ways.

Fig. 10.

Yet, again in Fig. 11, we have, in 1, the spectrum of the normal potassio-uranic sulphate, and, in 2, that of the same salt in its anhydrous condition.

One of the most remarkable developments, however, is that which has been obtained by a comparison of the absorption bands seen in various salts and their solutions; thus seventeen double acetates have been examined, and a different arrangement of these bands has been discovered in each case; but when they are dissolved in water, all are exactly alike, and are likewise identical with the solution of the simple acetate, thus seeming to prove that no double acetate exists as such in solution, but that all are reduced to the simple salt.

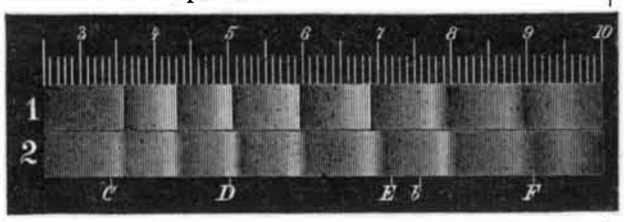


Fig. 11.

In Fig. 12, 1 represents the bands of the solid normal acetate; 2, those of the same salt when anhydrous, and 3,

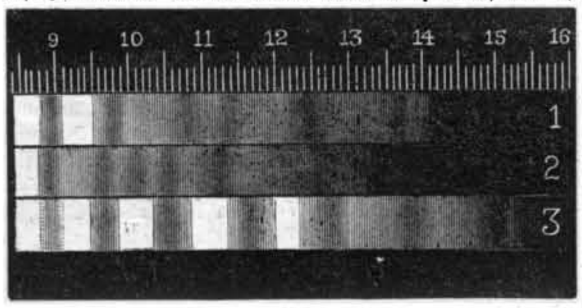


Fig. 12.

those given by a solution of the simple acetate or any of its double salts.

Another very interesting result was obtained in observing the effect of a rise in temperature upon the position of the fluorescent and absorption bands. It was found in a vast number of cases that a rise of temperature lowered the position of the bands both of absorption and fluorescence. When we remember that the heating of a tuning fork lowers its note, and that, wherever bodies change their color by heat without involving some chemical action, the tint is depressed in the spectrum, we see how this observation fits in with general theory.

There were no cases in which the displacement was opposite in direction; the exceptions were simply instances in which no displacement could be detected, and the observations were made as well with solutions as with the solid salts.

Another application of this method was to the determination of the moment at which combination in the case of double salts actually took place; and it was found that in all cases the spectrum of the simple salt changed into that of the double one only in the act of crystalization.

The effects of change of state by freezing solutions, of great pressure, and of solution in various solvents have been extensively studied; and indeed more has been done than we can well afford space to enumerate, and with results which, as we have shown, are already important and promise to be more so.

THE SHOE AND LEATHER CHRONICLE.—The already long list of contemporary journals devoted to special interests has, this week, been increased by the appearance of a well arranged and neatly printed sheet under the above title. The extent and importance of the shoemaking industry is a guaranty for its extended circulation. Mr. W. A. Van Benthuysen, of 6 Ferry street, New York city, is the editor and proprietor, who will please accept our good wishes for its success.

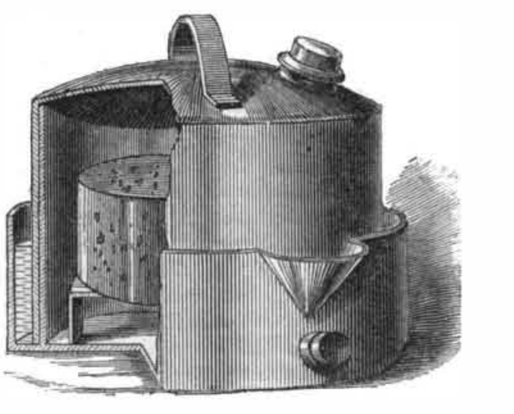
PARAFFIN GAS.—Paraffin oils are now produced at a very low price in Austria and Saxony, from peat. These oils may be used for the manufacture of illuminating gas instead of coal. The gas gives a light three times brighter than coal gas, and the apparatus for making gas from paraffin is simpler and less costly than the coal gas apparatus.

HOW TO MEASURE THE HIGHT OF TREES.—When a tree stands so that the length of its shadow can be measured, its hight may be readily ascertained as follows: Set a stick upright (let it be perpendicular by the plumb line). Measure the length of the shadow of the stick. As the length of its shadow is to the hight of the stick, so is the length of the shadow of the tree to its hight. For instance: if the stick is four feet above the ground, and its shadow is six feet in length, and the shadow of the tree is ninety feet, the hight of the tree will be sixty feet (6 :4 ::90 :60). In other words, multiply the length of the shadow of the tree by the hight of the stick, and divide by the shadow of the stick.

IN the digging of a well at Newark, N. J., the other day, the workmen struck " ile." About two barrels of good oil were pumped the first day. The owner proposes to bore deeper with proper apparatus, in the hope of finding a more abundant supply of the valuable liquid.

CHEESE SKIPPER EXTERMINATOR.

Many and varied are the devices which human ingenuity has provided for the extermination of the "creeping things of the earth." We have set forth at length the lyric effort of the inventor whose muse gushed into poesy on the inspiring theme of mechanical cockroach traps; we have alluded to the "deadly bug buster," by which the offending insects are persuaded into a hopper, placed under the influence of an anæsthetic and stabbed in the back with a pitch-

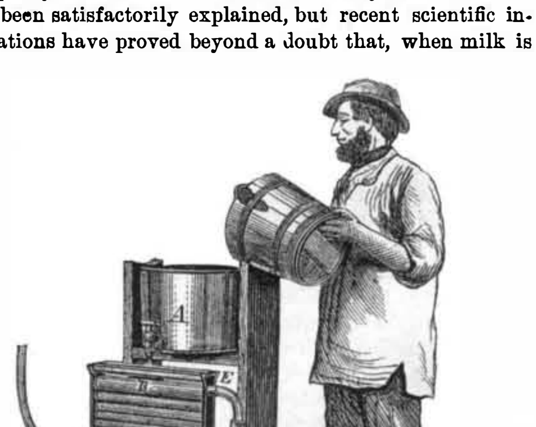


fork, or else are dosed with large quantities of laughing gas so that they meet a hilarious death in violent hysterics. Brief mention has been made of the tumbler fly trap, in which the hapless fly meets his doom in an alkaline bath; and recently, in glancing over an ancient volume of the English *Mechanics' Magazine,* we discovered a valuable recipe for poisoning bugs by a material "which they will never fail to eat while they can get it, and will as surely die; it causes them to froth at the mouth and to split in the back occasionally."

Another inventor has now joined the great army which is ceaselessly waging war upon the noxious insect tribe, and the offspring of his genius is represented in the accompanying engraving. Its object is the slaughter or, more strictly speaking, the asphyxiation of cheese skippers. The cheese is placed upon a raised grating within a circular box, the bottom of which extends beyond the sides, and is provided with a rim. The intermediate annular space is filled with water. A tightly fitting cover inclosed the entire box, its edge reaching to the bottom of the projecting flange, and is rendered airtight by the water packing. Suitable vents are arranged for obvious purposes. The unhappy mites, thus deprived of fresh air and cut off from the light of day, in the words of the patent, "all leave the cheese and drop down dead." Why they should pursue such a course, or as to the nature of the malady with which they are seized, and which invites the approach of the fell destroyer, our original researches, into the physiological constitution of the cheese skipper, are as yet not sufficiently extended to enable us accurately to determine. Suffice it that, after a period of twenty-four hours, their bodies, once so athletic and active, are senseless clay upon the bottom of the box. Mr. Caleb Green, of Osseo, Mich., patented this useful device on February 4, 1873.

IMPROVED MILK REFRIGERATOR.

This is an English invention, made by Lawrence & Co., London, who say that, by the aid of these refrigerators, the milk intended for transit, or for the making of butter or cheese, may be cooled as soon as it leaves the cow, and before any injurious change can possibly have taken place. It has long been a well known fact that milk is preserved in proportion to the rapidity with which it is cooled. Why this is so has never been satisfactorily explained, but recent scientific investigations have proved beyond a doubt that, when milk is



suddenly cooled, the infusoriæ or vital organisms, the cause of rapid decomposition, are destroyed, and the milk is consequently preserved, whereas if cooled by slow degrees, living infusoriæ will still be found in it.

By passing warm water through the refrigerator, instead of cold, the temperature of the milk may be readily raised to any degree required, which, in cold weather, is an advantage in cheese making.

The warm milk is poured into the receiver, A, whence it passes through the refrigerating box, A, in which is a coil of pipes through which cold water enters at D, discharging at E, while the cooled milk is drawn off at C.