before commencing operations—a sum considered prohibitively excessive—her captain abandoned her, and she rapidly became a total wreck.

## CHIMNEY DRAFT.

BY EGBERT P. WATSON.

A column of rarefied air is lighter than a similar column of cold atmospheric air, volume for volume, and from this fact a theory has been deduced to account for the existence of draft so called in chimneys. The velocity of an ascending current in them is based upon the difference in weight of rarefied and unrarefied air, but, unfortunately for the stability of the theory, the same phenomenon, if it may be so called, exists in a cold tube which has no rarefied air in it. I have just taken a length of stove pipe, cut a small opening in the bottom, and set it on end; when a lighted match was applied to the opening, the flame was strongly drawn in, showing the existence of an upward current in a cold tube. If there was not such a current, it would be a tedious task to rarefy the air in a large chimney; but every housewife knows that so soon as a fire is started, it commences to burn. Chimneys that never had a fire in them work well when properly built.

In a certain sense this is peculiar, paradoxical even, for from the latter postulate there does not appear to be any reason why setting a tube on end should cause a circulation of air through it; and if it is desirable to have a theory to account for every occurrence in nature, it will be necessary to construct a new one for the draught of chimneys, for they do not follow the present alleged law in all cases; in some they act entirely contrary to it. Currents of air move in all directions in nature, horizontally and downward; sometimes it seems, in a chimney which does not work well, as if all these things occurred at one and the same time. Opening a door or a window causes a draft, the heated air in the room being displaced by the colder air outside, and external objects, both natural and artificial, cause barriers which deflect currents so that they literally fall down the chimney, or drive the heated air down, which is the same for practical purposes.

The conditions under which draft exists or does not exist are very puzzling sometimes, in practice, and give rise to much speculation as to the causes. Take the case of a flue which has been used for forty years, and during that period has had five or six different stoves attached to it; every one of these stoves gave trouble, and would not burn the coal properly until they were adjusted to the conditions prevailing, whatever they were. This flue was crooked; that is to say, for reasons connected with the building it was carried up straight ten feet from the bottom, and then run at an angle of forty degrees for ten feet more; the flue was then carried up straight for ten feet to the roof, through which it projected six feet. The mason who built it said it would not draw, but in spite of his prediction it drew admirably, and continued to do good service until some alterations were made in the building, when the chimney was run straight for the entire length. Then trouble began. A stove that had always worked satisfactorily, sulked and protested against the new chimney.

This last was thoroughly dried out, and being of glazed pipe was absolutely clean and true throughout. The smokepipe entered the chimney near the bottom and had a straight shot clear to the upper end; there was every reason why it should have had a great pull on the fire, but there was a very feeble one. Not knowing what else to do, I had the pipe taken out of the bottom of the flue and run off at an angle, entering the flue by short-connected elbows ten feet higher up, giving a crooked flue again. This started everything going in great shape, and the stove had to be checked in every possible way in order to prevent it from getting white hot in no time, so to speak. This is contrary to all precedent and common sense, but the sequel to the history of this flue is still more surprising. The stove was changed in due time for another of different make, but with the same sized flues in it as the discarded one, and of the same general design; when it was attached or connected in the same way that the other one was, nothing could be done with it, the fire smoldered instead of burning, and was useless for cooking.

There was a fire-brick in the back end of the new stove, which had been loosely put in, so that one end was cocked in toward the furnace, or firebox, leaving an opening of about three-eighths of an inch by nothing on the other end. It did not seem possible that such a small leak could seriously affect the action of the stove, but it did materially, for after stopping it with fire-putty it worked well and is now all right. The reason for this improvement is that the cold air entering the ashpit was short-circuited; instead of going through the fire it went through the leaky fire brick, not only cooling the smoke-pipe, but also robbing the fuel of the oxygen it required for combustion.

Stoves are sometimes blamed for faulty construction when the trouble lies elsewhere—in the way in which they are connected. One large heater which had always performed well was taken down during housecleaning, but when it was erected again it would not draw at all. Investigation revealed that it was too far out from the chimney-breast; the stove-pipe barely entered the breast by an inch or so, when it should have gone clear through into the flue itself. Singular as it may seem, the up-draught from the flue constituted a cut-off for the smoke-pipe; when this was changed, there was no more trouble.

Again, a factory chimney which had always worked perfectly for many years suddenly refused duty; upon investigation it was found that the blank wall of a recently erected building in the vicinity, during the prevalence of winds from the northwest, deflected a current which came down the factory chimney, constituting a back draft. This blank wall was about three hundred feet from the factory, and it seemed scarcely possible that it could have the effect mentioned, but it did, for after the chimney was hooded there was no more trouble.

Draft, so called, even when apparently strong, is relatively of very little force, for natural draft can be of great vigor, seemingly, and show nothing on a draft gage; tinder from burned paper will so obstruct the grate bars that the fire will not burn until it is removed, and this tinder is such a flimsy material that it cannot be picked up with the fingers; it crumbles at the slightest touch. A roaring draft, so called, is not caused by the force of wind rushing through the grate bars, but results from the combustion of the air and gases; an infinite number of minute explosions merge into a continuous rumble accompanied by vibrations, which sometimes shake heavy boilers so violently that they alarm the attendants; there is no danger attending such manifestations, except that of the gases collecting in pockets or corners to such an extent that they explode in one volume, blowing the furnace doors open and scattering the fire over the fire-room. Back draft of this character is easily stopped, so soon as the humming begins, by scattering fresh coal over the black spots in the fire.

One of the most peculiar arrangements of a chimney and its connections that I have ever heard of exists in Belgium, where a factory stack is set up on a hill, and connected to an underground conduit communicating with the boilers in the valley below. The part underground is horizontal for about one hundred feet, and is necessarily cold for a long time after the fires are started; the chimney is also cold, nevertheless the stack exhausts the conduit, or underground flue, so soon as fires are started under the boilers. There must, then, be a strong upward current in the stack itself at all times in order to exhaust the horizontal flue, which is merely a drag, or baffle on the stack. Rarefied air has no part in the action of this stack until the fires are under way.

## TRADE-MARKS IN THE PHILIPPINES.

A new trade-mark, trade-name and unfair-competition law has been enacted by the Philippine Commission which repeals the royal decree of 1888 for the registration of trade-marks, as continued in force by military orders, and provides for an independent registration in the Philippines. Owners of trade-marks and trade-names who are domiciled in the Philippines, or the United States, or in foreign countries which grant similar privileges to persons domiciled in the United States and Philippine Islands, may register their marks and names under the new law.

The law defines trade-marks and specifies the requirements for their registration. Provision is also made for the registration of trade-names, which the law defines as names, devices or marks by means of which is intended to be distinguished from that of others, the business, profession, trade or occupation in which one may be engaged. It is not essential that the trade-name should appear on the goods dealt in by the person using the same, as it is sufficient if it is used by way of advertisement, or on letter heads, signs, or in any other way to furnish to the public a method of distinguishing the business.

Unfair competition, and the infringement of trade marks and trade names with intent to defraud the public or the owner of the mark or name are made crimes and the guilty party may be severely punished in the criminal proceeding, in addition to the loss which he may suffer because of the damages which the wronged party may recover in a civil action.

One of the sections of the law provides for the registration of trade marks in the Philippines in order to enable persons domiciled in those Islands to register their trade marks in foreign countries, the trade mark registration laws of which require the registration in the home country as a condition precedent to registration in such foreign countries. The persons domiciled in the Philippines may now register their trade marks in those Islands and in foreign countries, but they are still unable to register their trade marks in the United States because of the ruling of the United States Patent Office that provision for this registration is not made in our our trade-mark law, which only provides for the registration of trade marks which are owned by persons who are domiciled in the United States or who are located in a foreign country which grants reciprocal rights.

It is to be hoped that this decision may be overruled or that the defect in the United States trade mark law may be corrected in order to enable persons domiciled in the Philippines to secure complete protection for their trade marks by registration.

## SCIENCE NOTES.

Messrs. Mueller and Kempf have discovered in the course of their photometric work at Potsdam a variable star of so short a period—about four hours—that it may fairly be called unique. Up to this time, the variables that went through a complete cycle of changes in the shortest time were two stars in the cluster *Omega Centauri*. These bodies complete their periods in 7 hours 11 minutes and in 7 hours 43 minutes respectively. *S. Antliæ* has a period of 7 hours 47 minutes. The Potsdam star has a period of about one-half as long. From minimum to maximum the light changes at a slower rate than from maximum to minimum. The magnitude varies from 8 6-10 to 7 9-10 and the length of the period is 4 hours 13 seconds. The hypothesis that best explains the observed phenomena is that two bright bodies are revolving at a small distance about a common center of gravity, the plane of revolution being nearly in the line of sight.

The Révue Scientifique gives a brief history of experiments on the segmentation of unfertilized eggs. In 1895 Hertwig exposed the eggs of the sea-urchin to a weak solution of sulphate of strychnine and obtained the phenomena of karyokinesis or segmentation. Then Morgan, in 1898, obtained the same result by simply increasing the osmotic pressure of seawater. Mead, in 1899, experimenting on another species, obtained a like result by adding chloride of potassium to the seawater. In 1899 Morgan suggested that the unfertilized egg was in a state of unstable equilibrium and that any one of several exciting causes was sufficient to break it up into a more stable state, i. e., to cause segmentation. That is, there is no specific excitement; the reaction alone is specific. Loeb, in 1899, obtained parthenogenesis experimentally by exposing the eggs of the sea-urchin for a very short time to a weak acid solution, or to an alkaline seawater. The presence of ether, chloroform or alcohol will determine the action also. The absence of certain chemical bodies may likewise determine segmentation. If seawater containing sea-urchin's eggs is deprived of its oxygen (the oxygen being replaced by hydrogen) then the eggs, when transferred to normal seawater, begin to divide. Temperature acts in a similar way. Eggs warmed to about 32 deg. C. begin to divide when replaced in seawater at an ordinary temperature. Abnormal lowering of temperature has been shown by Mr. Greeley to provoke the reaction. Mechanical agitation will do the same. Mr. Mathews points out that the foregoing results seem to show that the essence of the segmentation is the formation of localized zones of liquefaction in the protoplasm of the egg, thus suggesting an analogy with localized digestion.

In a very able *resumé* of the different methods by which the distance of the sun can be determined, and of the trustworthiness of the results, A. R. Hinks, M. A., before the British Association, warned against the proclamation of any "accepted" values, which were generally proved to be fallacious as soon as the agreement was proclaimed. There was no accepted value for the solar parallax until six years ago, when 8.80 was agreed upon. Greenwich meridian observations yield 8.802, most other methods lower values down to 8.762. The Venus transit observation, on which such strong hopes were built—while Leverrier, among others, was convinced that all the trouble was wasted—had failed; the minor planets had given excellent results; the aberration determinations at Pulkowa (near St. Petersburg) yield 8.793, Nyrén's own latest work there 8.782, other determinations elsewhere 8.806. The motion of the nodes of Venus, the secular variations of the four inner planets, and the dynamics of the mass of the earth had also afforded bases for calculations. But Eros, the peculiar planet whose orbit lies between those of earth and Mars, crossing the latter's orbit, was worth all the 480 planetoids. Eros was watched when nearest the earth in 1900 by fifty observers, and 8,000 protographic exposures were obtained. The analysis of the results will take years. Mr. Hinks himself is engaged in comparing the photographs taken at Cambridge with others, with the view of tracing errors. The distance of the sun is at present believed to be about 93,000,000 miles; we are uncertain about the hundred thousands. Prof. Turner mentioned that the twenty years' study of Jupiter's satellites at Harvard promised to give valuable results.