Communications.

Lamp Explosions.

To the Editor of the Scientific American:

Many of the lamp explosions we are constantly hearing of are not oil explosions at all, but glass explosions, if "explosion" is the proper word, which I am inclined to doubt; and it may be that the so-called lamp explosion, referred to in an article on this subject, in No. 12 of your current volume, was of this class, as it was stated that there was no more noise heard than would result from the breaking and falling of a lamp chimney, and that the "explosion (?) did not throw any pieces of the lamp more than a few inches, and the oil was not scattered at all." This seems to show that the lamp did not explode, but simply "went to pieces," as your correspondent stated; whereas, if there had been any explosion sufficient to break the lamp, the oil would certainly have been scattered in every direction.

From some reason not fully understood, but believed to result from imperfect annealing, glass articles are liable to crack and fall to pieces without apparent cause. Glass vessels, when used for other purposes than lamps, do not cause any damage when they "explode," beyond the loss of the article and its contents, and, it may be, a stain or two on the clothing or carpets; and no one therefore pays any attention to this matter. But when a glass lamp falls in pieces in this manner, it generally spreads the warm oil over the surrounding objects, such as clothing, the table cloth, or the carpet, and these, being of a fibrous nature, act as wicks, causing the oil ignited from the burning lampwick to readily burn, and thus a disastrous fire is the result, and we hear of another "coal oil explosion." Coal oil has sins enough of its own to answer for, as every one knows; but it is a good servant when properly managed, and it is not fair that it should be credited—or rather discredited—with more than its proper share.

Glass is one of the most treacherous substances that we know of, and should not be depended on to contain such a dangerous material as the coal oil usually sold for illuminating purposes. Glass articles may be used for years in safety, and yet are liable at any time—to say nothing of the danger of breaking from an accidental blow or fall—to fly to pieces, causing (when used for oil receptacles for lamps) immense damage to property and frequently loss of life by the most horrible of deaths. The writer has known several instances of glass articles other than lamps breaking in this manner, one of which was a large fruit dish that broke into an immense number of small fragments.

Occasionally there may be seen, in closely examining glassware, a flaw or speck resembling a white stone, from one sixteenth to an eighth of an inch, or even more, in diameter, imbedded in the substance of the glass. This is believed to be a portion of the silica that has not properly combined with the other materials and is not therefore glass. It probably has a different rate of expansion from the glass with which it is surrounded; for it is found that glassware is extremely liable to crack at the place where such flaws are found, and some glassmakers say that such ware is sure to fly at some time under the varying degrees of temperature to which domestic utensils are subjected. In view of this, glass buyers should always avoid purchasing an article of this class, and particularly so if the object to be bought is a lamp.

Glass has its advantages over metal in some respects, being more easily kept clean, as it is not liable to oxidation, and, being a poor conductor of caloric, does not heat up the oil as quickly as metal; but its superiority in these respects is more than counterbalanced by the liability to fall to pieces without warning. Glass lamps can, however, be made safe if provided with metal oil receptacles inclosed in the glass, which would then form merely an ornamental stand or casing for the oil vessel. Several patents have been granted for lamps on this principle, some of which, I believe, have expired, and the inventions covered by them may be manufactured by any one who chooses to do so without fear of infringement.

Washington, D. C. OCCASIONAL.

On the Shape of the Earth.

To the Editor of the Scientific American:

In your paper of March 10 there is a communication on the above subject, in which the author maintains that the shape of the earth would be what it is at present even had it always existed as a solid mass. His reason is that, owing to the rotation of the earth, there would be a pressure at the poles, in excess of that at the equator, by an amount equal to the pressure of a column of iron thirteen miles high; and this, he thinks, would cause the poles to sink in. Let us assume for the present purpose that the highest mountain rises five miles above the level of the sea, and that the greatest sea depth known is three miles. Here is a variation from the form of equilibrium for a fluid globe of eight miles, and yet the earth is stable. Now it is a well known fact in physical geography that the highest mountains are in general contiguous to the deepest seas, or, more exactly, the largest mountain systems are contiguous to the largest oceans. Hence these changes of outline are much more abrupt than would be those in a globe of iron, where the variation from the form of equilibrium was gradual from the equator to the poles. Your correspondent loses sight of the fact that, in order to crush a solid, there must be an excess of pressure in some one direction equal to its crushing strength. A vertical column of any known solid five miles high would undoubtedly crush its base; but a mountain five miles high stands secure, simply because the vertical pressure at the center of its base which tends to crush out the material, is resisted by the lateral pressure of the surrounding material. So, were the earth solid and a perfect sphere, although it would be about twenty-six and a half miles above the outline of equilibrium for a fluid earth at the poles, it would still be able to maintain this figure, since there would nowhere exist in its interior an unbalanced stress capable of crushing its material.

Woburn, Mass. W. E. BUCK.

Icy Fringes Around the Stems of Plants.

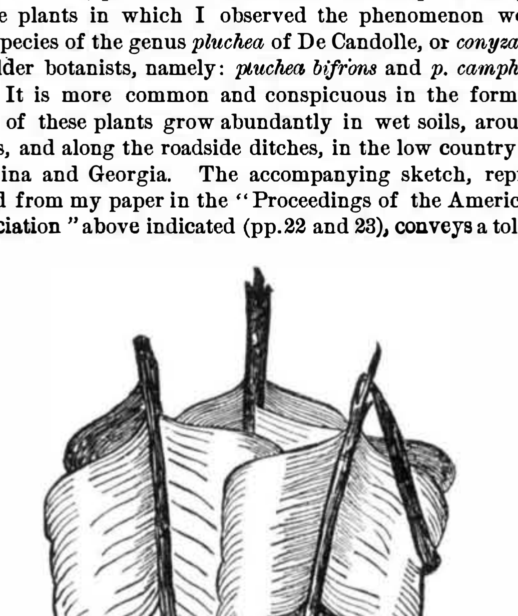
To the Editor of the Scientific American:

Under the heading "The Frost Plant of Russia," your correspondent, Mr. J. Stauffer, of Lancaster, Pa., calls attention, in the SCIENTIFIC AMERICAN for February 24, 1877, p. 116, to the remarkable accumulation of ice around the stems of the *cunila Mariana* (Maryland dittany).

As long ago as 1850, it was my privilege to call the attention of the scientific world to an identical class of phenomena in a paper entitled "Observations on a Remarkable Exudation of Ice from the Stems of Vegetables, and on a Singular Protrusion of Icy Columns from certain kinds of Earth during Frosty Weather." This paper was published in the "Proceedings of the American Association for the Advancement of Science," third meeting, Charleston, S. C., March, 1850 (pp. 20–34), and likewise in the *London, Edinburgh and Dublin Philosophical Magazine* for May, 1850 (third series, vol. 36, pp. 329–342).

As far as I am aware, this paper contains the first attempt at an explanation of the phenomena as manifested in vegetables, as well as their co-ordination with the protrusion of icy columns from the earth. So far as the notice of the fact of such accumulations of ice around the stems of plants is concerned, I was anticipated by several observers. Stephen Elliott, in his "Sketch of the Botany of South Carolina and Georgia," published in 1824, notices a remarkable protrusion of crystalline fibers of ice from the stems of the *conyza bifrons* (vol. 2, p. 322). Sir John F. W. Herschel published a short notice of a similar exudation of icy fringes, occurring around thistle stalks and stumps of heliotropes, in the *London and Edinburgh Philosophical Magazine* for February, 1833 (third series, vol. 2, p. 110). Professor S. P. Rigaud, of Oxford, notices the occurrence of an analogous phenomenon on a recently built stone wall, in the succeeding number of the same journal (third series, vol. 2, p. 190, March, 1833). Professor J. D. Dana appears to have noticed similar phenomena on the twigs of plants (*vide* "Manual of Mineralogy," second edition, p. 46, New Haven and Philadelphia, 1849).

The plants in which I observed the phenomenon were two species of the genus *pluchea* of De Candolle, or *conyza* of the older botanists, namely: *pluchea bifrons* and *p. camphorata*. It is more common and conspicuous in the former. Both of these plants grow abundantly in wet soils, around ponds, and along the roadside ditches, in the low country of Carolina and Georgia. The accompanying sketch, reproduced from my paper in the "Proceedings of the American Association" above indicated (pp. 22 and 23), conveys a tolerably good idea of the appearance presented by the friable sheets, or ribands, of semi-pellucid ice around the foot stalks of the *pluchea*.



This is hardly the proper place to reproduce my explanation of the ice phenomenon in plants, or to show its co-ordination with the more general phenomenon of the protrusion of columns of ice from certain kinds of earth during frosty weather. In the paper referred to will be found a full discussion of the possible sources whence the large supply of water is derived, which, by freezing, forms the accumulations of icy fringes in the one case, and the icy columns in the other. Suffice it to state that I have there shown that, in both cases, the phenomena are purely physical, having, in the case of plants, no connection with the vitality of the stem; and that the appearances "are quite at variance with any idea of the deposition of these icy fringes from the store of aqueous vapor in the general atmosphere, in the manner of hoar-frost."

If your correspondent will consider all of the facts which are established in relation to the phenomenon in question, he will, I am sure, be convinced of the untenability of his explanation. The explanation given by Dr. Darlington, in his *Flora Cestrica*, in 1853 (as quoted by your correspondent), is more in accordance with known facts.

JOHN LE CONTE.
University of California, Oakland, Cal.

State Legislation on Patents.

To the Editor of the Scientific American:

I notice in your issue of March 3 an article from Mr. J. Pusey, of Philadelphia, in reference to legislation by the States upon patents granted by the United States.

The bill introduced in New York appears to be similar to that passed by the Legislature of this State in 1871 ("Compiled Laws of Michigan," p. 519), and one of the same character was held in Indiana (43 Ind., 167, 13 Am. Rep., 395) to be unconstitutional, as interfering with the exclusive power of Congress to regulate patents. See also opinion of Davis, J., *ex parte* Robinson, 3 Ind., Stat. 365: "If the patentee complies with the law of Congress on the subject, he has a right to go into the open market anywhere within the United States, and sell his property." "The law in question attempts to punish, by fine and imprisonment, a patentee for doing with his property what the National Legislature has authorized him to do, and is, therefore, void."

See further upon this subject, Pendar *v.* Kelley, Supreme Ct. of Vermont, Am. Law Register, Sept., 1876, 511.

JAMES B. ROMEYN, Counsellor at Law.
Detroit, Mich.

Boiler Explosions.

To the Editor of the Scientific American:

The cause of boiler explosions is nothing more nor less than carelessness and incompetency of owners and engineers in charge. There are men in charge of machinery and boilers who know nothing about either. I do not blame the men; the owners and operators are to blame for the explosions and loss of life. Many men put in charge of boilers have no idea of the amount of pressure in a boiler; and they will put up a new boiler and let it run until it blows up or burns out. It is seldom that we hear of any person here cleaning out a boiler—not one out of one hundred. When the boiler gets too full of water, they open the blow-off cock and blow some of it away.

I would recommend that surface cocks be placed in line with the middle gauge to blow off the sediment that accumulates on top of the water. The sooner there is a boiler inspector appointed, and engineers put through a thorough examination, the better it will be for owners, operators, engineers, and the community at large.

Turkey City, Pa. J. T. C.

Lightning Rods.

To the Editor of the Scientific American:

In last June, an elm tree standing 10 feet behind my house was struck by lightning. On the comparatively smooth upper limb, which was thoroughly drenched by the falling rain, no marks are visible. As the descending fluid encountered the rough bark—which was more or less dry underneath—of the larger branches, its effects became manifest. The rough bark was scaled off a place three or four inches in width. On the body of the tree, which was very shaggy, the bark was split through to the wood in three places. At the base of the tree, for about two feet above the ground, no effects are visible, which may be accounted for in this way: The upward spattering of the raindrops upon the surrounding stones had thoroughly saturated the bark at the base of the tree, and so afforded a good conductor for the electric fluid. To all appearance, the lightning left the tree as soon as it reached the ground, and ran off upon the surface. Had it followed a root, it would most likely have thrown up the dirt, as it usually does in such cases.

I maintain that it is just as well for a lightning rod to terminate at or just beneath the surface as it is to extend down several feet. For, in the first case, inasmuch as it almost always rains during a thunderstorm, if the rod were struck, the fluid would find no difficulty in passing off upon the wet surface; but in the second case it would often—and especially near a cellar wall—be very apt to find a dry terminus.

Franklin, N. Y. P.

Feeding Poultry.

To the Editor of the Scientific American:

In raising poultry, it is not sufficient merely to provide proper food; but the food must be properly given. Some persons have an idea that, if they throw down a heap of corn once or twice a day, that is all that is required; but no plan is so extravagant nor so injurious as this. The corn or other food should be scattered as far and wide as possible, that the birds may be longer employed in finding it, to the benefit of their health; and that they may not accomplish in a few minutes that which should occupy them for hours. It is the nature of fowls to take a grain at a time, and to pick grass and dirt with it, which assists digestion; but if, contrary to this, they are enabled to eat corn by mouthfuls, their crops are soon overfilled, and they seek relief in excessive draughts of water. Nothing is more injurious than this; and the inactivity that attends the discomfort caused by it lays the foundation for many disorders.

Yarmouth, Me. B. D. ALLEN.

New Fac-simile Printing Process.

We have lately examined, says the *Paper and Printing Trades Journal*, a novel fac-simile printing process (Byford's patent) introduced by Messrs. S. Straker & Sons, of Fenchurch street, London, E. C., by which useful invention a number of fac-simile copies of circulars, drawings, or any matter that can be written on ordinary paper, may, with the aid of an office copying press, be printed in a few minutes, and with little or no preparation, and on any description of dry paper, the original document or drawing remaining unimpaired. The fac-simile printing process is based on the well known and remarkable qualities of aniline. The document from which a number of copies are required is written with a patent aniline ink of immense strength, which is allowed to dry without being blotted up. A sheet of transfer paper is damped, the document is laid on its face downward, they are then placed in the "printing pad" (which is a leather portfolio of peculiar construction), and subjected for a few moments to pressure in the copying press. On removing the original document, a copy in reverse will be found on the transfer paper, and the operator can at once proceed to print the required copies, which is done by laying a sheet of ordinary paper on the transfer paper, the impression plate over it, and pressing for a few moments in the copying press, when it will be found that a duplicate or facsimile of the original document has been produced; and so the process goes on until the impression becomes faint, when it is at once revived by damping the under side of the transfer. If a large number of copies are required, a second, and even a third, transfer may be taken from the original document, and printed from in the same manner as the first. The fac-simile printing process is somewhat analogous in its results to, but far simpler than, lithographic printing, and is being extensively used in government and public offices. It is so simple that the smallest or dullest office boy can work it without any fear of coming to grief; and as a useful adjunct to the counting house it will be thoroughly appreciated by all classes engaged in commercial pursuits.

Blue Glass Photography.

The blue-violet glass mania abroad seems to be confined to the photographers, and the conflict over the deceptive theory is being waged, not on the question of the curative powers of the light transmitted, but regarding the assertion that increased chemical action can be obtained by glazing photographic studios with the cerulean panes. M. Scottelari, the blue glass defender abroad, has fallen into the same errors as his co-believers on this side of the Atlantic: that is, he confounds the blue-violet rays of the spectrum with blue-violet transmitted sunlight; while he also reaches the obvious absurdity that the violet ray, when isolated from the spectrum, possesses greater capabilities than it had when mingled with the other rays. It is perfectly true that the violet ray is more active, chemically, than the other rays; but the latter do not detract from it when combined with it, and the chemical action of white light containing violet rays is precisely as great as that of the violet rays separated and tested alone. Hence it follows, as a matter of course, that a window glazed with white glass transmits the whole of the solar rays which reach it, violet among the rest. A window of the same size glazed with violet glass would transmit one seventh part of the rays reaching it, and these would be violet-colored rays; but it would not transmit one single violet ray more than the other window.

The *Photographic News* adds that, according to Draper and others, all the rays of the spectrum probably possess photogenic power on some substances; and therefore it is but just to M. Scottelari to conceive that he has found that the rays other than violet have an antagonistic influence on that ray, and obstruct its action on bromoiodide of silver. But Mr. Thomas Gaffield of Boston, has recently made some new investigations on this very point, wherein the inferiority of the violet glass to clear glass is most clearly shown. Mr. Gaffield's conclusion relative to the photographic aspect of blue glass accords with our own relative to its employment for curative purposes. He says: "It is undoubtedly true that violet or other colored screens may be used with advantage in cutting off too much, or in making an even diffusion of, light upon the face of the sitter; but it can never be true, while two from six leave a less number than six, that the cutting off of a third, or any fraction, of the chemical rays of sunlight by a violet glass can enable the photographer to obtain more rapid or effective results."

THE "London" cement for joining broken glass, china, wood, etc., is made by taking a piece of Gloucester cheese, boiling it three times in water (each time allowing the water to evaporate), and mixing the paste thus left with dry quicklime.

STONE-WORKING IMPLEMENTS.

In stone working, as our readers are aware, the carbon or black diamond is now greatly used. The difficulty prominently encountered, however, in this particular, is that of fixing the diamond in the saw or cutter head so that it shall not work loose. In Fig. 1 (selected from Knight's "Mechanical Dictionary"*) we illustrate several modes of inserting the boot in

Fig. 1.

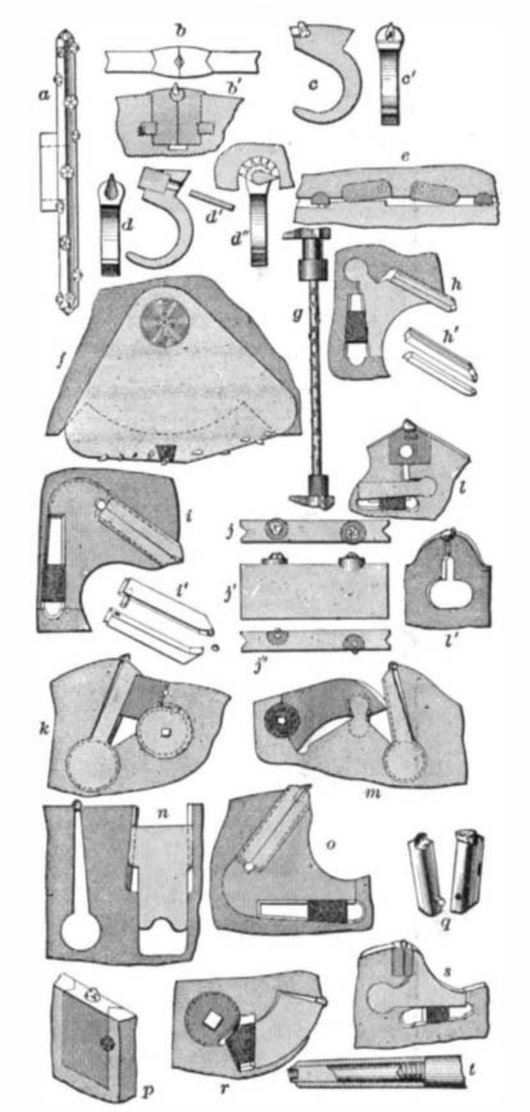


Fig. 2.

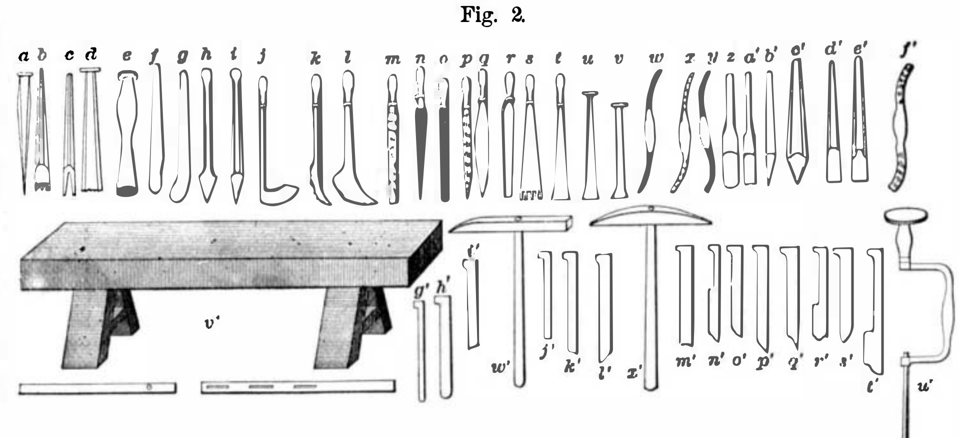
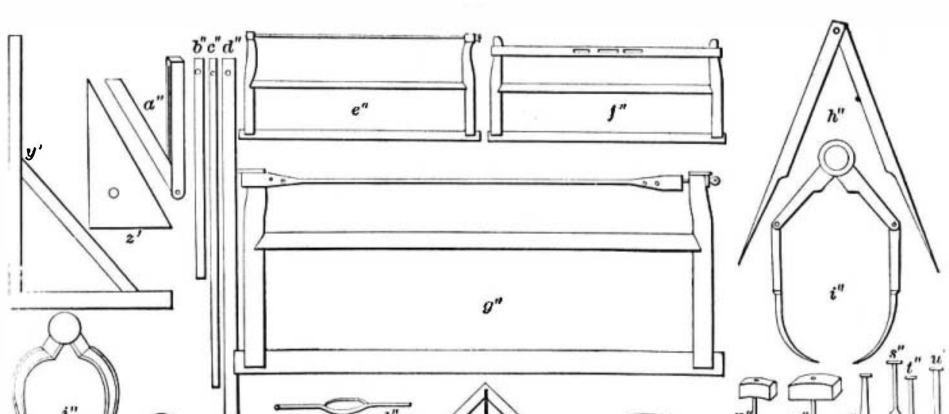


Fig. 3.



STONE SAWS.

It will be perceived that some of these imbed the diamond in the saw by sockets, rings, or solder; others grasp it by fingers which are clamped in sockets; others grasp it by wedges in the slot, or by clamps which are themselves jammed by wedges, etc.

In Figs. 2 and 3 are represented all the various kinds of

STONE WORKERS' TOOLS,

the names of which are as follows: *a*, square etching needle; *b*, marteline chisel; *c*, toothed chisel; *d*, marteline chisel; *e*, puncheon; *f*, *g*, scrapers for sinking flutings; *h*, *i*, etching needles, called *houguettes*, partly flattened and sharp; *j*, hook for leveling cavities; *k*, round-nose chisel, for leveling cavities; *l*, sharp edged notched scraper, for sinking flutings; *m*, half-round rasp; *n*, round file; *o*, flat file; *p*, German half-round rasp; *q*, *r*, safe-side rasps; *s*, *t*, marteline chisels; *u*, *v*, puncheons; *w*, *x*, *y*, parting tools, with curved ends in rasp or file; *z*, *a'*, gravers and burins; *b'*, *c'*, houguettes or etching needles; *d'*, *e'*, gravers and burins; *f'*, parting tool, with curved rasps; *g'* to *t'*, moulding chisels and scrapers, having edges of varying patterns; *u'*, wimble, for drilling; *v'*, stone-worker's bench; *w'*, *x'*, marteline hammers; *y'*, square; *z'*, triangle; *a''*, bevel; *b''*, *c''*, *d''*, rules and straight edges; *e''*, *f''*, *g''*, saws of various sizes and construction; *h''*, *i''*, *j''*, *k''*, compasses of various sizes and forms; *i''*, sebilla, or wooden bowl for holding sand and water; *m''*, handsaw; *n''*, level; *o''*, mallet; *p''*, *q''*, sledges; *r''*, *s''*, *t''*, *u''*, chisels of various sizes; *v''*, ladle for feeding sand and water to the saw; *w''*, *x''*, hand saws.

* Published in numbers by Messrs. Hurd & Houghton, New York city.

Contamination of the Air by Artificial Illumination.

In judging of artificial light from a sanitary point of view, we must consider its effect on the visual organs as well as on the other organs, and we have to notice both the effects produced by the products of combustion on the air we have to breathe and the increase of temperature due to the flame. Frederick Erismann has made some comparative measurements in both directions with different means of illumination. The results were published in the *Zeitschrift für Biologie*, xii., 315.

The experiments were made in a portion of the laboratory inclosed with wood and glass walls, and having a space of 353 cubic feet, or 10 cubic meters. The air was drawn out of this space at different heights by means of aspirators. By the use of a forked tube, a portion of the air was conducted directly into baryta water, and another portion through a tube filled with oxide of copper and kept at a red heat, and then into baryta water. The first portion gave the percentage of carbonic acid in the air, and the second the amount of other carbon compounds. The lights used for comparison were obtained by burning stearine candles, rape seed oil, petroleum, and coal gas. They burned for eight hours in this space with as equal flames as possible, and in the experiments with the candles six were burned at a time. The results of the measurements lay no claim to absolute exactness, because a whole series of inaccuracies, difficult, if not impossible, to remove, come in here; nevertheless they are of interest for relative comparison. The figures obtained show that, under all circumstances and with all kinds of luminants, the air of an inclosed space contains more carbonic acid and carbonaceous organic substances than in the absence of artificial illumination; yet in Erismann's experiments the quantity of carbonic acid was never greater than 0·6 or 0·7 per 1,000, while the percentage of other carbon compounds was extremely variable, so that the amount of carbonic acid is not a correct criterion for the pollution of the air. The quantity of carbonic acid actually found in the air of this experimental chamber was only a small fraction of that produced by combustion, so that by far the greatest part escaped by natural ventilation.

To compare the relative contamination of the air by the four luminants mentioned, the amount of carbonic acid and hydrocarbons was reduced to the standard of six normal candles. It was shown that with lamps of good construction petroleum contributed less carbonic acid to the air than any other source of light tested; and, what is more important, less of the products of incomplete combustion. Also that by equal illumination stearine candles contaminated the air most of all.

In regard to rise of temperature, Erismann made his experiments at four different places. They show that during the eight hours of the experiment, the lower strata of air, up a height of 5 ft., increased but slightly, on an average 3·5° to 5°, while the temperature of the uppermost strata near the roof increased considerably; for gas, oil, and petroleum this increase was 19° to 19·5° Fah., and for candles only 7·12°. If we regard the photometric effect of the flames during the experiments, it showed that with equal illumination rape oil and gas increase the temperature much more than petroleum, so that the action of the latter is about equal to that of the candles.

ROPES made from sheep's entrails are now made at Oakland, Cal., to be used for hoisting in mines.