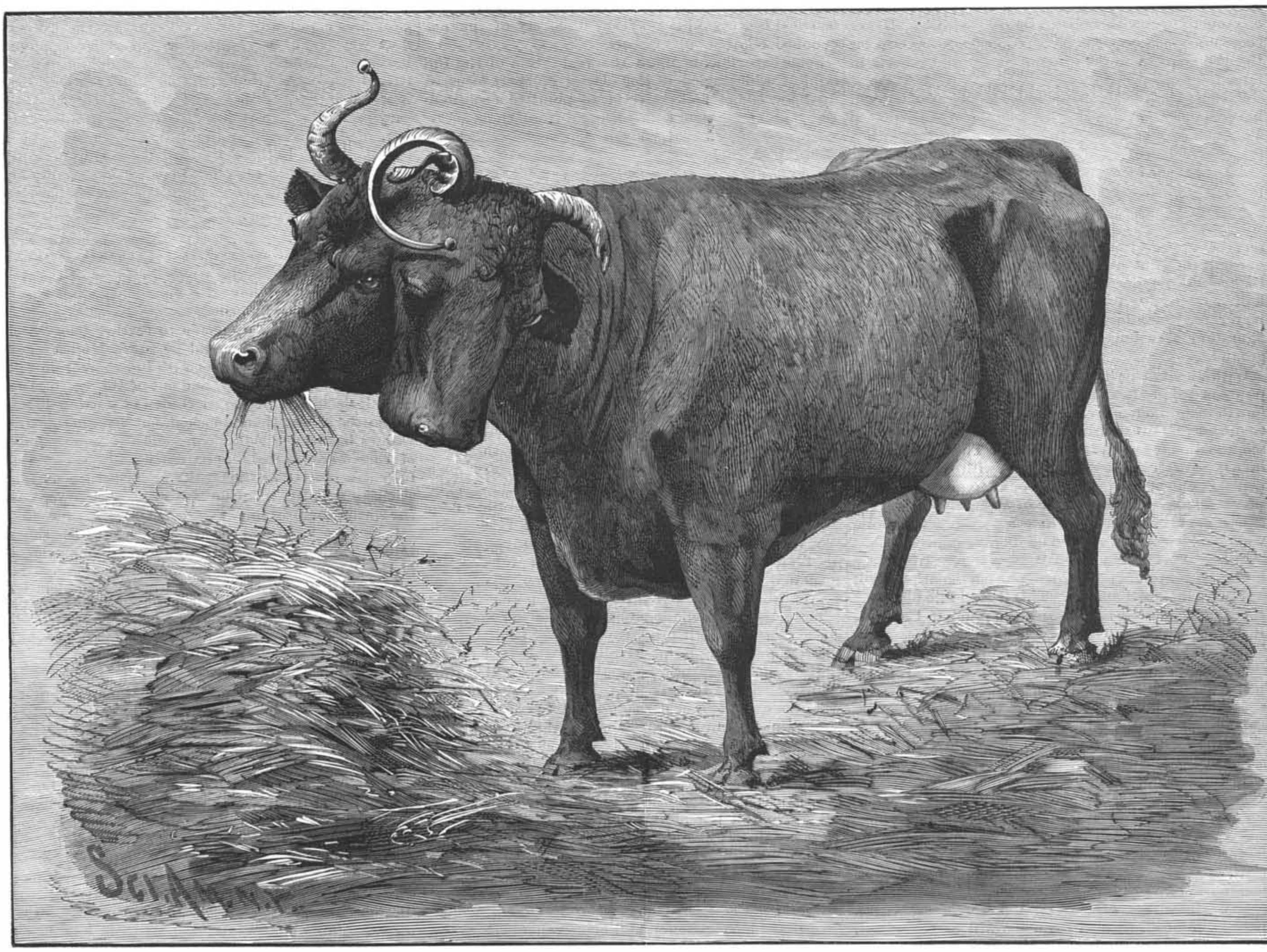
THE TWO HEADED COW.

We present a sketch from life of the two headed cow that has been exhibited in this city and elsewhere with one of the leading circuses. The animal, except as regards its cranial peculiarity, is of normal appearance. It is well kept, and has a well developed body. The left head, the one nearest the front of the picture, is, as regards its external function, inferior to the other. It eats and drinks with the right hand mouth, having full command of its jaw. The jaw of the other head has hardly any power of motion, as it is embedded in the neck. It has three good eyes, and but for an accident, when the vehicle containing it was upset by an elephant, would possess four. The same occurrence broke one of its central horns. Although the left head is comparatively passive, yet under certain circumstances, as when the animal is eating, the mouth belonging to that head emits saliva. Although it cannot eat, this mouth can "water," as the epicures say. In the center of the forehead of the right head is a deep depression that does not appear in the left head. This would seem to indicate a deficiency in development of the brain on that side. But naturally all speculation on the inner structure cannot well pass the limits of conjecture until a post mortem examination can be had. The bony front in the region of the bases of the horns is continuous apparently for both sides.

For about one hundred years the subject of animal and human monstrosities has been systematically studied. Goethe remarked that "it is in her monsters that nature reveals to us her secrets." The elder Geoffroy St. Hilaire, the contemporary of Hauy the great mineralogist, and of Cuvier, whom indeed he antedated in the acquisition of renown, formed an elaborate classification of these abnormal growths. He gave the science a name, "teratology." His work, "Histoire des Anomalies," etc., was published in Paris, 1832–36. It is in three octavo volumes. He endeavors to bring the varieties of monsters into a sort of Linnean classification, using the divisions of classes, orders, tribes, families, and genera. Thus this cow would come within his second class, and in the second order, the *parasitaires*, of that class.

Except for its cranial peculiarities, this cow would probably be found perfectly organized; other monsters having repeatedly proved free from other than the local deformities or weaknesses. Among human monsters, the famous Siamese twins may be cited as an instance of this fact. In spite of their deformation, they lived in good health to the age of 63. They were married, and each had several children, who were free from deformity. It is very rare that true monstrosity is transmitted as an hereditary quality. It is also noticed that among animals, monsters predominate in the female sex.



THE TWO HEADED COW.

Vibrations of the Telephone Diaphragm.

M. E. Mercadier has recently contributed the results of some additional experiments on this subject to the *Academie des Sciences* of Paris. He distinguishes two classes of vibrations in the plate. One is molecular, independent of the form or dimensions of the diaphragm, and reproductive of all sounds. This he calls *pantelephonic* vibration. The other class of vibrations, affect the mass of the plate taken as a whole, depending on its form, elasticity, and structure. This vibration corresponds to the normal note of the plate and to its harmonics. The latter class is injurious as regards the action of the telephone. The experimenter arranged a telephone diaphragm so that it was held by three points of its circumference corresponding to the nodal lines of the first harmonic of a circular disk. The instrument with this modification in reproducing musical sounds produced only this particular note with any degree of strength, and the telephone was *monotelephonic* in action. But when the diaphragm was prevented from acting thus, by damping either with the fingers or by placing the ear directly against its surface, the molecular or *pantelephonic* vibration predominated, and all sounds were heard, including the first harmonic. The paper describing these experiments was presented at the *seance* of April 4, 1887.

Power of Sunshine.

Public Opinion condenses from the *Chautauquan* an interesting article by Charles Barnard, in which he shows that the great star which we call the sun is literally the stove that keeps the whole world warm. In conclusion, he gives the following facts, most of which are known to the readers of the SCIENTIFIC AMERICAN, but are none the less curious and interesting to the general reader.

Heat expands and cold contracts, and everything warmed by the sun expands under its gentle heat. Every rail on all our railroads expands and grows perceptibly longer in bright sunshine, and contracts and grows shorter whenever a cloud cuts off the heat or the earth in turning moves away from the sun. So it is found necessary to leave a little space between every rail, wherein it can stretch itself in hot summer days. Were all the rails pushed close together in laying the track, the first day of hot sunshine would pull the track to pieces, or render it so uneven that it could not be used. Every iron bridge stretches in the sunlight, and would tear itself to pieces were it not carefully adjusted for this expansion in the sun, and given a chance to freely move on its foundations whenever the warm fingers of the sunshine are laid upon it. Brooklyn bridge is in four distinct pieces, with plenty of room between to move, and it does move every day. In warm sunshine it is longer by several inches than on a cold night. The cables of the bridge are continuous, but the expansion caused by heat lengthens the cables, and they let the bridge sink two or three feet in the middle. Even a passing cloud, hiding the sun for a few moments, will cause the entire bridge to rise in the middle by cooling and contracting the cables. I have personally measured the movement of Brooklyn bridge on a hot summer's day, between bright sunshine and the shade caused by clouds, and have seen that it moved over one inch in less than two hours. In building the great bronze Liberty in New York harbor, the same thing had to be guarded against, and provision is made to allow the whole vast figure to move under the expansion caused by the heat of the sun. The movement, owing to the irregular surface of the statue, is not visible, as in the Brooklyn bridge, yet it is there. Even Bunker Hill monument, which is built wholly of stone, is distorted out of shape every day by the sun, though the movement cannot be proved except by certain experiments made for that purpose. What will finally become of our stellar stove no man can positively say. Yet, judging from what we know already, it is quite possible that it is burning out. When its fires finally die down, the end of our planet is at hand, and all life here will slowly, or suddenly perhaps, become extinct by freezing, and our planet will meet its end as a dead star swinging through the awful cold of the stellar spaces. People of fervid imagination have thought the world would come to an end in a general conflagration. It is much more likely our stellar stove will go out, and the world will calmly freeze up. Of the two methods of ending earthly history, the latter will be evidently the more comfortable.

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Limit of Available Power in Great Telescopes.

BY G. D. HISCOX.

According to accredited formulæ, the minimum diameter of the optic pencil at its emergence from the eye piece of a telescope is equal to the diameter of the object glass divided by the magnifying power; and by inversion, the magnifying power equals the diameter of the object glass divided by the diameter of the emergent pencil.

As it is often desirable to observe nebulæ and clusters, as well as search for faint comets, under very low powers, for the purpose of obtaining a larger and more brilliant field, and for bringing out the fainter companions of double stars, the fact becomes important that in great telescopes an observer may only obtain the value of two-thirds, one-half, or even one-third of the total light-grasping power of the telescope. This failure comes from the disparity in the size of the pupil of the eye and the emergent pencil of light from low power eye pieces.

The eye aperture in different individuals varies from one-eighth inch to one-fourth inch in diameter under the same light intensities; and the pupil of a single individual may vary in diameter from one-eighth inch to one-fourth inch with varying light intensities. Hence there must be a larger personal equation to account for the discrepancies in the recognition of faint objects in large telescopes.

By the rule, a telescope of twelve inches aperture will have an emergent pencil, with a power of 100, equal to 0·12 of an inch or one-eighth inch in diameter; with a power of 50 it will equal one-fourth inch.

An eighteen inch aperture with power of 100 has a pencil 0·18 inch, or about 3-16 of an inch in diameter.

A power of 150 gives a one-eighth inch pencil, so that with the Chicago telescope a power of 100 is the lowest possible, while a power of 50 would shut out more than one-half the light from any ordinary pupil. But here the trouble only begins. A power of 100 with a field of half a degree, or possibly more, is a good working power for searching, and for bringing out the configuration of nebulæ by contrast with a dark background.

With the twenty-three inch Princeton telescope a power of 100 produces a pencil 0·23 inch, or nearly one-fourth inch in diameter, about the largest that can be compassed by eyes with large pupils, when the telescope is directed upon faint objects. The lowest power in use with this telescope is 158, with an emergent pencil of 0·15 of an inch, or about equal to the diameter of the ordinary pupil in daylight. Here the equation of the eye comes in as a factor determining what one person can see and another cannot.

In the Washington twenty-six inch equatorial the lowest power in use is 155, giving an emergent pencil of 0·17 of an inch in diameter. This is too large for many to compass, and it is only with the pupil of Professor Harkness, which is 0·22 of an inch in diameter when looking at a distant light, that assurance is had that the whole power of the telescope is made available with this magnification. With a power of 100 the pencil would be increased to 0·26 of an inch, placing its full power beyond the scope of the human eye. So with such a telescope 155 is the lowest power available for the delicate work of studying the fainter wisps and minute stars of the nebulæ.

The thirty-six inch telescope of the Lick Observatory will be somewhat crippled by this difficulty, unless some new form of eye piece is made to overcome it, for with a power of 100 the pencil will be 0·36 inch, or nearly three-eighths of an inch in diameter, making it impossible to use the leviathan for all that it is worth with low powers. A power of 200 with a pencil 0·18 of an inch in diameter will be the lowest that will give the full value of its light-grasping power to an ordinary pupil; the measurement of the latter ranging from 0·12 to 0·20 of an inch in diameter when in a normal condition. Now, 200 is an unsatisfactory power with which to view a nebula and comprehend its beauty and delicacy.

When we rise to the sphere of the great reflectors, we meet an insuperable stumbling block. A forty-eight inch reflector cannot use economically a power of less than 250; while the great seventy-two inch reflector of Lord Rosse is restricted with a power lower than 350, which produces a pencil of 0·20 of an inch diameter, the utmost capacity of the average eye; so that but few persons can compass the light-giving power of this great telescope even with this power, which is far too great for nebula work. With a power of 500 the pencil, 0·14 of an inch, just comes within the light-grasping power of the average eye.

With such an unwieldy instrument and great magnification, it is no wonder that stars are unsteady and seeing unsatisfactory, as has been often asserted; nor is it a wonder that the great reflector has done so little work, when a power of 200 produces an emergent pencil of 0·36 of an inch in diameter, and with such a power only one-fifth the light-giving power of that monster telescope can be utilized. The part thus shut out would naturally be the marginal cone, which gives the sharpest definition by producing the smallest star disk; leaving for the observer's gratification the poorest offering within the gift of so great and costly an instrument.

In celestial photography this difficulty is avoided, and this may account for the late photographic discoveries of faint objects by some of the large telescopes in France and England, the forty-eight inch reflectors of the Paris Observatory, and of Mr. Common in England, being now used for this purpose. The photographic plate utilizes the whole light of the largest emergent pencil, and with the quick process will no doubt realize large and satisfactory results in the near future.

The method of overcoming this optical defect in the low powers of great telescopes is worthy of our best efforts, and its remedy may lie within the scope of mechanical optics; although in a slight correspondence with Professor Young on this subject, he casts some grave doubts on the possibility of its accomplishment, or the *dodgeability* of its geometrical considerations. I do not think that theoretical geometry is at fault for this suggestion, for it has always been found to swing into line in the face of mechanical facts; not that geometry is at fault or untrue, but that the human mind has not always recognized the geometrical bearing until after the discovery of the mechanical relation of its factors.

Some experiments upon the realization of the full light of wide-angled object glasses of short focus, as used for comet seekers, seem to point to a solution, which at a later time I may bring before the Society.—*Read before the American Astronomical Society, January* 10, 1887.

Patent Lessons from the Telephone Litigation.

In a letter to the *American Engineer*, Mr. John McClary Perkins writes as follows:

The discussions which have been going on before the people of the United States and before certain federal courts during the past few years, regarding the so-called Bell telephone patent of March 7, 1876, are now all closed, and five appealed cases are now under consideration by the United States Supreme Court, and the decision of this court may now be expected on any day. There is no possibility of a doubt even as to what the decision of the Supreme Court will be as far as the Bell patent of 1876 is concerned. It will be wholly wiped out so far as the telephone is concerned. There are so many conclusive reasons for this opinion that it is puerile to discuss the matter. Of course, very much comment, thought, and discussion will follow. The history of this so-called Bell telephone patent has been so very remarkable in the courts that it is probable that there will be no little discussion as to the pressing need of some change in the patent law, and probably also some radical change in the constitution of the federal courts, which alone have jurisdiction of patent suits.

The system of preliminary examination in the Patent Office is attended with so many evils and so little good that the first thing proposed will probably be a return to the system of granting patents as it existed in this country before 1836. Then a patent was granted to whomsoever asked for it—as it always has been in England—and the burden of proving the validity of his patent before the courts devolved upon the inventor. But this will be no hardship, nor will the burden of proving the validity of his patent before the courts be any greater than it now is.

At present a patent has no real value until it has been sustained by some federal court in a bona fide infringement suit. It will have only the same result by a return to the patent system as it existed in this country before 1836, and as it now exists in England and the rest of the world. All chance for fraud, corruption, favoritism, incompetency, and many other evils in the Patent Office will then be cut off. It will only be an illustration of the good old Democratic doctrine that the simplest government, that which has the least machinery and consequent friction, is always the best government.

As the outcome of the lessons which will be learned from these remarkable telephone trials in the federal courts during the past seven or eight years, the second probable conclusion will be that the tenure of judicial office by federal judges should be changed to a term of years instead of for life, as it is now fixed by the Constitution. Of course this will require an amendment to the Constitution. But that will require but a short time if the people are ripe for such a change in the tenure of federal judicial office. It is now partly published and known by the American people in regard to what painful and well grounded suspicions exist as to the doubtful manner in which the two first and principal decisions were obtained here in Boston in favor of the validity of the Bell patent of 1876. This should permanently settle the matter that no federal judge should ever again hold a life office, and be so far removed from the people as to be practically irresponsible to the people. In other words, to use the words of the Massachusetts Bill of Rights, this should be a government of laws and not of men.

These two changes are very important and radical ones. But I think that these will be the final conclusions of the American people—as the outcome of the Supreme Court decision invalidating the Bell patent of 1876. These changes will cause a fundamental change not only in the system of granting patents, but also in the administration of the patent law, and will be a vital improvement. Other subordinate changes for the better will follow, as a matter of course—almost automatic changes.

Tight v. Slack Car Couplers.

The main results of the tests made on the Chicago, Burlington & Quincy with trains of slack and tight couplers show that though the use of tight couplings does not altogether abolish shocks, the bumps are far less severe than with the slack couplings. The slido meter was moved as follows with different styles of couplers:

Coupler.	Average slack.	Movement of slidometer.
Ames	1·7 in.	5 in. to 10 in.
Janney	0·5 in.	¼ in. to 8½ in.
Perry	2·1 in.	8 in. to 14 in.
Potter	3·1 in.	11 in. to 18 in.
"	0·3 in.	5 in. to 11 in.

The shocks were obtained in making emergency stops with trains of twenty-seven cars, including dynamometer and way car. In each case the five cars next the engine were fitted with the Westinghouse brake and Janney coupler. The remaining twenty freight cars were fitted with the coupler under trial. A consolidation was used, and the stops were at speeds varying from 22 to 44 miles an hour. Half the stops were made on a level, and half on a down grade of 53 feet per mile. In these tests all the cars were empty.

In the following tests half the cars were empty and half loaded, but the other conditions were similar:

Coupler.	Slack.	Movement of slidometer.
Perry	2·1 in.	5 in. to 8 in.
Janney	0·5 in.	1½ in. to 7½ in.

The results are on the whole in favor of the close coupler, but show that with emergency stops shocks are not yet wholly abolished.

A series of tests were made to further demonstrate whether as many cars could be started on a heavy grade with close couplers as with links. A train of 51 empty cars was made up, and out of this, with 15 feet of link slack, the engine succeeded in starting 46 cars.

The slack was then blocked out by placing iron wedges between the drawbars, and the same number of cars were started, apparently with less trouble, fully substantiating the results of former tests. Link slack apparently is of no advantage whatever over the spring compression in starting trains.

It may be remarked that the violence of the shocks cannot be altogether gauged by the relative movement of the slidometer. The blow with loose couplers was sharp and distinct, while that with close couplers was cushioned.—*Railroad Gazette.*

Fluatation.

Fluatation is the name applied by Messrs. Faure, Kessler & Co. to their process of hardening building stones through the application of hydrofluosilicates. The operation is very simple, and can be performed whenever desired, either upon the stone before it is put in place, or after the building or other structure is completed. The surface of the stone is covered to the desired degree with a solution of the fluate by means of a brush, sponge, or hand pump. Another application is made the next day, and a third one the day after. As a general thing, it requires three applications, although each time the stone absorbs less. The hardening takes place at once, and upon the third application becomes perfect. There are several soluble fluates, and each of them has its own peculiar properties, although all of them harden limestone. One darkens the color of the stone, another whitens it, another preserves the original color, and others again color the stone indelibly. The coloring fluates most employed are those of iron, which give a brown tint, and those of chromium and copper, which give two greens of different shades. Fluatation is applied to old structures as well as to new ones, and it is the true means of preserving the edifices that have been bequeathed to us by our fathers, and which our climate is daily tending to destroy.

After the stone has once been fluated, it becomes so hard that it can be treated like marbles and porphyries. Upon applying the colored fluates along with a subsequent polishing, very remarkable decorative effects are obtained, inasmuch as the intimate structure of the stone is brought to light, and as the nodules, veins, and fossils are delineated in different tints.

After the stone has been fluatated it can be easily rendered impermeable, and, as it is not attackable by ordinary liquids, it may be used for making tables, sinks, baths, and reservoirs for a host of liquids, such as wine, oils, alcohol, molasses, etc.

Fluatation is applied in the same way to cements, mortars, stuccoes, etc., provided they are more or less calcareous. It renders the alkalies of cements insoluble, and thus, after a washing with water to remove the excess of fluate, permits of a coating of paint being applied.—*Le Genie Civil.*

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