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Contents.

(Illustrated articles are marked with an asterisk.)

TABLE OF CONTENTS OF

THE SCIENTIFIC AMERICAN SUPPLEMENT,

No. 299,

For the Week ending September 24, 1881.

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STORAGE OF HEAT.

Among the many curious phenomena connected with crystallizable metallic salts, especially those of the alkaline bodies, one of the most interesting is the great influence exercised upon temperature during the solution of such crystals.

It is known that when, for example, a glassful of crushed sulphate of soda (Glauber's salts) is sprinkled with muriatic acid, it becomes liquid, and its solution is accompanied by a degree of cold so intense as to cause any water placed therein, in a second vessel, to freeze; and almost every schoolboy is aware that when common salt is allowed to become dissolved with a quantity of snow or crushed ice the temperature is reduced many degrees below the freezing point. Without going into the subject of the conservation or even the correlation of force, which underlies all actions of this nature, it may be stated that by reversing the experiments just cited *heat* is produced. Take a thin glass bottle, fill it nearly full of hot water, and dissolve in it sulphate of soda to saturation; then, while nearly boiling, cork it tightly and allow it to get quite cold. It will be seen that no crystallization takes place, although the water is supersaturated. Now remove the cork, and speedily the whole becomes a solid mass. What we desire here to be noted is that the act of solidification is accompanied by heat, a fact palpable to any one grasping the bottle.

The presence in water of solid bodies, no matter in how fine a state of division, does not alter its boiling point; but no sooner is a crystallizable salt dissolved in water than the boiling point is at once raised, and different salts raise it to different degrees. By direct experiment Professor Tomlinson ascertained that by making saturated solutions of the following salts the boiling point was raised from 212° Fah. to that degree placed opposite to each:

Acetate of soda	256 degrees.
Nitrate of soda	246 "
Nitrate of potash	238 "
Sal ammoniac	236 "
Common salt	224 "
Sulphate of magnesia	222 "
Alum	220 "
Chlorate of potash	218 "
Sulphate of copper	216 "
Sulphate of iron	216 "
Acetate of lead	215 "
Sulphate of soda	213 "

An examination of this table shows that there is one salt which far excels all others in its property of raising the boiling point, namely, acetate of soda.

Quite recently an invention of an interesting nature has been made in which this salt is the chief factor; an invention which, divested of scientific language, may be stated to consist of the property of the acetate to absorb heat when subjected to it for some time and then to give it out afterward over a prolonged period—in effect to store up heat, which, owing to crystalline changes in the salt itself during the act of cooling, is continued to be evolved from the latent into an active form. That this is the case is indicated by the fact that the vessel containing the salt, after having been two hours removed from the source of heat, has its temperature raised about 6 degrees Fah. during the third hour by its own inner forces alone.

The physical principle upon which this curious invention is based is old and well known, although the application of the principle is novel. The form in which we have obtained a specimen "heater" consists of a somewhat large flask formed of thin sheet brass having its mouth soldered up, for it is never intended to be opened. There is also a metallic loop by which to suspend it in the vessel of boiling water from which it is to derive its store of heat. The length of time required for immersion in the hot water depends upon the size of the heater; for example, if it be so small as to be suitable for being carried in a lady's muff, by which to keep her hands warm, four or five minutes will suffice; but if, on the other hand, the dimensions be such as enact the part of a foot warmer, this time would have to be increased by six or eight times. There are some so large as to require immersion in boiling water for an hour before they are fully charged with all the heat they are capable of storing.

While the length of time over which heat is given out depends entirely upon the dimensions of the flask containing the acetate of soda, it may be roughly estimated as about four times as long as hot water will retain its heat. A foot warmer which upon removal from a vessel of hot water was found to register 153° Fah., at the end of eleven hours registered 111°. The most sudden fall took place during the first two hours, after which the temperature rose a few degrees, gradually subsiding afterward until it became quite cold. In the case just adduced the foot warmer fell from 153° to 126° in two hours; it then rose during the next hour to 131°, taking eight hours to fall from 131° to 111°, which it did with uniform regularity.

There are various purposes to which M. Ancelin, of France, the inventor of this new application of acetate of soda, intends to apply it. One or two have been hinted at in course of these remarks; others, such as keeping food or dishes warm at a distance from a fire, will suggest themselves.

THE Upper Ohio River steamer Telegraph lately left Huntington, W. Va., with twenty car loads of freight on board, drawing 3½ feet of water. The Telegraph is one of the finest and fastest passenger steamers on the river. Her length is 290 feet.

OPENING OF GREAT INDUSTRIAL EXHIBITIONS, BOSTON.

Boston has for many years had an annual Industrial Exhibition of some importance, under the auspices of the "Massachusetts Charitable Mechanic Association." This year it will have two of these "grand fairs," one having been inaugurated Aug. 18, and the other promising to open its doors Sept. 13.

The one first in progress is under the auspices of the "Manufacturers' and Mechanics' Institute," which is in some sense an offshoot or rival of the older organization, though only in a friendly way, and the result is that Eastern industries and progress will be represented in these fairs more completely than ever before, as the men at the head of each have worked hard to make the best show possible. Two large and beautiful buildings have been erected, both of them with some architectural pretensions, the newer association, however, having the largest, covering five acres of ground, and giving with the galleries nearly ten acres of floor space, and the Exhibition now open is much more imposing than any the country has had since the Centennial.

There are so many specialties of great interest to all inventors, mechanics, and manufacturers, as well as the general public, in any great show of this kind, that it is difficult to pick out for mention only such things as would be novelties to one who had kept fully abreast of the progress of invention and the improvements in machinery. The fair is, however, particularly representative of the cotton and woolen factories and machine shops of New England. The great corporations of Lawrence, Lowell, and Fall River, Mass., Manchester and Nashua, N. H., Providence, R. I., and other places have on exhibition probably the best display of their productions that was ever made. But to properly appreciate the variety and beauty of the fabrics they must be compared with those made at the same mills or imported from abroad only a few years ago, when the greatly enlarged capabilities and improved workmanship of the factories to-day stand out in high relief.

In the machinery for the manufacture of these goods the exhibition presents a comparatively small assortment, although covering some important and recent improvements in looms, carders, and mules. The deficiency in this department is due to the fact that many who would otherwise exhibit here are to be fully represented at Atlanta, but it will be somewhat amended in a few days by the tardy ones who are late in putting up some novelties in cotton and woolen spinning.

In the boot and shoe manufacture the Exhibition leaves nothing to be desired. This is by far the leading feature of the show and attracts crowds of visitors, for never before was this industry, in all its departments, so completely arranged to give the public ample opportunity for an examination into the way in which boots and shoes are made. By a happy conceit also, an aged shoemaker, working by hand after the old style and sitting on a shoemaker's bench which had been used by two workmen for a hundred years, occupies a prominent position, as he laboriously "pegs away in the midst of these modern surroundings." About 100 men work here, the machinery running from 9 A.M. till 9 P.M., and the production being about 600 pairs a day.

The leather comes to the Exhibition building direct from the tanneries and currying shops, the sole leather in sides and bundles, and the upper in rolls. The latter is all cut out by hand after patterns, as the workman has to examine the leather carefully to see that particularly strong and good parts come on the vamp or forepart of the boot or shoe. The soles, insoles, and taps are died out by machines which, to an outsider, look far larger than they need be, but this is so that a whole side may come under a cutter's eye at once, and he can place his die so as to save stock, cutting first the thickest parts into outsoles, and the remainder into taps, insoles, and heels.

The uppers, after cutting, are wet, and then passed through a powerful machine which crimps and forms them, drawing the leather out so that it can be lasted easily into proper shape. There are four of these machines. The fronts and backs of the uppers are then sewed together by a machine, which, after a long process of development, has been made about perfect for this kind of work; after which, with the inner sole, it is taken to a lasting machine, and these two parts made temporarily firm over the last. This last part of the work is something for which inventors have long been trying to perfect machinery, but nothing so far brought out has yet been generally adopted, and the machine here in use for this purpose leaves much to be desired.

After the boot or shoe has been lasted there are four different ways shown here of putting on the sole—screwing on with brass screw wire, pegging, sewing direct through from inside to outside, and sewing on with a welt in imitation of handwork. The brass screwing makes the firmest fastening for heavy work, while it does not make the sole unduly stiff and hard; the wire is actually screwed in, so that it does not break and tear the leather. The pegging machine has long been a familiar object at exhibitions, but it is always interesting to the public. The putting on of the bottom with a welt requires two machines, one of which works with a curved needle in a section of a circle, the inner sole, upper, and welt being first sewed, and then the outsole to the welt. This machinery has been improved through several years, until the goods made by it are now meeting with considerable public favor, for they meet that demand for flexibility with firmness of sole which many people think are only surely obtained with handwork.

For the trimming, blacking and staining, buffing, and burnishing of the soles and heels, a number of very ingenious machines are kept at work; but an entirely new thing in the finishing process is a treeing machine, here shown for the first time. It is so arranged that a dozen boots can be operated on at a time and moderately heated by steam while on the trees, so that the stuffing is warmed through with the leather, and the boot can be made to look, as one manufacturer said, "a dollar a case better."

Of the arrangement of goods and machinery, alike for convenience of access, facility in operating, and effectiveness of appearance, as well as the general management of the Exhibition, it may be said that too much praise cannot be awarded the officers and the executive committee. They are public-spirited men, manufacturers and merchants who have inaugurated the enterprise for the pride they have in Boston and in New England manufactures, and in such a spirit they are carrying it on.

PROMOTIONS IN THE PATENT OFFICE.

The following changes were made in the staff of the Patent Office, July 1, 1881:

Marcellus Gardner, of New York; John W. Babson, of Maine; and Schuyler Duryee: from fourth class clerkships to be chiefs of division—salary $2,000.

Samuel B. Roane, of New York; Reuben S. Parks, of Ohio; and Louis W. Sinsabaugh, of Ohio: from second assistant examiner, to be first assistant examiner—salary $1,800.

David G. Purman, of Wisconsin; Marshall B. Cushman, of Massachusetts; Edward M. Bentley, of Connecticut; and Albert C. Fowler, of District of Columbia: from third assistant examiner to be second assistant examiner—salary $1,600.

William L. Augenbaugh, of Ohio, from first class clerk to be second assistant examiner—salary $1,600.

The following have been promoted or newly appointed to the office of third assistant examiner—salary $1,400: John W. Clements, District Columbia, from second class clerk; James B. Littlewood, of Illinois, from first class clerk; Rufus A. Morrison, of Pennsylvania, from copyist; Robert G. Read of Pennsylvania, and Walter F. Rogers, of Pennsylvania, new appointments. George R. Byington, of Cincinnati, promoted from first to second class clerk—salary $1,400.

The following have been promoted to first class clerkships—salary $1,200: William Hendlay, District Columbia; Frederick W. Crocker, New York; St. Clair F. Sutherland, Mississippi; Frank P. McLean, New Hampshire; Thomas Hoge, Pennsylvania; Mrs. Frank R. Lybrand, Ohio; Daniel Clarke, Maryland.

Frederick R. Gantt, from draughtsman, at $1,000, to skilled draughtsman—salary $1,200.

The following rise from copyist, at $900, to first class—salary $1,200: Henry E. Baker, of Mississippi; Julian C. Dowell, North Carolina; Milnor R. Sullivan, Ohio; Frank M. Ward, District Columbia; Thompson J. Hudson, Ohio; George H. Evans, District Columbia. To a salary of $1,000, the following: Gormond Crandall, New York; William B. Atkinson, District Columbia; William A. Redmond, District Columbia; James M. Pollard, Louisiana; Thomas H. Mitchell, Tennessee; Archibald McNaught, Wisconsin; Mrs. Mabel Hatch, New Hampshire; William H. Chapman, Ohio; Thomas R. Stuart, California, to draughtsman.

REVIVING OLD REJECTED CASES.

Under the former practice of the Patent Office cases occurred in which widely established industries, worked for years free of any patent, were suddenly injured and crushed by the unexpected reissue and grant of some aged, long slumbering, rejected case.

It would appear from a recent decision by the present Commissioner of Patents, Mr. Marble, that he is not one of those who favor such revivals.

In a recent appeal to the Commissioner of Patents, in the case of F. W. Smith, applicant for a patent for a sweat leather, it appeared that the application was originally filed and rejected in 1871. In 1879, nearly eight years having elapsed, the inventor files a new application, intending thereby to revive the old case.

The Commissioner says:

"The law applicable to this case is section 32 of the act of 1870 (Rev. Stats., sec. 4,894), which reads as follows:

"'All applications for patents shall be completed and prepared for examination within two years after the filing of the application, and in default thereof or upon failure of the applicant to prosecute the same within two years after any action therein, of which notice shall have been given to the applicant, they shall be regarded as abandoned by the parties thereto, unless it be shown to the satisfaction of the Commissioner of Patents that such delay was unavoidable.'

"The authorities cited in behalf of Smith (*Colgate vs. Western Union, Smith vs. Dental Vulcanite Company*, and others) to show that this diligence has been reasonable, and that he has not abandoned the invention, were cases under the law of 1836, and are therefore inapplicable to the present case. Under that law an application might be renewed after a lapse of any period of time unless it appear that the invention had been in the meantime abandoned (*Bell vs. Daniel*, 1 Bond, 212), and that, too, though the first application had been withdrawn. (*Godfrey vs. Eames*, 1 Wall., 317.)

"The present law was devised to overcome the many evils which had sprung up under this practice, and provided that all applications filed and rejected previous to the passage of the law would be presumed to be abandoned by the parties at the expiration of six months from the date of the passage of the act, unless in the meantime they should be renewed (section 35, second proviso), and that for the future all applications for patents not prosecuted within two years after any action therein shall be presumed to be abandoned by the parties, unless it shall be shown to the satisfaction of the Commissioner of Patents that the delay was unavoidable. I am not aware that this section of the law has as yet received judicial attention, but I find no difficulty in discovering the application of the law to the facts of this case. It is clear that only an extraordinary combination of circumstances could unavoidably prevent an inventor from taking some step in connection with his application for a period of nearly eight years.

"Attaching full credit to the statements of the affiants that Smith was continuously in straightened circumstances, and that he expressed at various times his desire to obtain a patent for his invention, I do not find that at any time he made any serious efforts to obtain assistance in prosecuting his application, or that it is clear, as a matter of fact, that it was his constant intention to renew the application or procure a patent for his invention.

"I must hold that Smith's application, filed in 1871, was abandoned by operation of section 4,894 of the Revised Statutes, and that he must stand upon his present date of filing.

STEAM-BOILER NOTES.

The percentage of active steam boilers that violently explode with fatal effect is not at any time very large; statistics show that there is but about one in two thousand annually of those in use in England, equal to one per cent in twenty years. The number of cases, therefore, that may be actually observed by any one person in a lifetime that is devoted to the common business of life is very small, so, there being not more than one person in a thousand of those who do observe these accidents who is capable of forming a reasonable opinion as to the cause, and not more than one in a hundred thousand who, being capable, does actually see and study more than his quota of cases, it is not strange that there are differences of opinion that result in bickering and recrimination among those who are accustomed to have their opinions respected and who have set up in the business of teaching a branch of engineering that they themselves have not practically studied.

The number of persons who attempt to make a thorough study of boiler explosions that have the opportunity to see one in the act is still smaller, and perhaps not a single one qualified by previous experience and by scientific attainments to be a good judge, and devoting sufficient time to the subject, has even favored the public with his views.

It seems to be a defect in the means of getting information that the informants are not reliable, being frightened out of their wits by the explosion or interested in making out that they had done their duty faithfully in the management before it occurred, and their testimony is, therefore, of the most unreliable sort, although they appear while giving it before juries to be respectable and reliable witnesses. Many times, perhaps most often, a careful examination of the remains of the boiler and its attachments would show that some of them are mistaken; that without a reversal of the laws of nature their statements could not be true; but being accepted, the whole thing becomes an inexplicable mystery. Some theory must be applied to the case by the wiseacres who should have carefully examined every detail of the wreck and eliminated all impossible and contradictory elements before giving their opinions as experts, weighing carefully all the possibilities and discarding all alleged phenomena that are in contravention of natural laws and depend on human acts, perceptions, or emotions.

DR. HEATH'S DISCOVERIES IN SOUTH AMERICA.

In the SCIENTIFIC AMERICAN of June 18, 1881, an account was given of the successful journey of Dr. E. R. Heath down the previously unexplored portion of the Beni River, Bolivia, and his discovery of abundant rubber and cinchona forests there. The Kansas City *Review* for September contains further particulars of the expedition, compiled from Dr. Heath's letters to his brother in that city, with a sketch map of the part of the river now for the first time opened up to geography and commerce.

Dr. Heath writes that the news of his successful passage through the country of the cannibals spread like wildfire. New rubber forests are to the people of that region what new gold fields are to the inhabitants of North America, and immediately something like a stampede occurred. Everybody talked "Beni," and 10,000 men had gone down to the new rubber region. Last year the export of rubber from the Beni was 15,000 pounds; this year it will be 750,000 pounds; and next year it will probably rise to 6,250,000.

Dr. Heath has proved himself to be not only an enthusiastic but an exceedingly plucky and capable explorer. He writes that he intends to return home this fall to organize an expedition for exploring the Madre de Dios, a river much larger and longer than the Beni, and quite as little known. His plan is to begin his survey at the ancient Inca capital of Cuzco, in Peru, and descend the Madre de Dios from its smallest beginnings, spending at least two years in the work. Besides the work of exploration he hopes to discover rich deposits of the precious metals, new forests of cinchona trees, valuable textile and medicinal plants, rubber forests, and other contributions to commerce and science.

The Exhibition of Electric Light at Paris.

To the Editor of the Scientific American:

The first public exhibition of electric light, which took place on the evening of Saturday, Aug. 27th, was, in many respects, a failure, but few of the systems being in good order, and many of them unable to be exhibited at all. Notwithstanding this fact, those who were present were forced to admire the brilliant display of the new and wonderful progress of electric lighting, and to speculate upon its future career.

It is thought by some, it is true, that the gas companies will be encouraged rather than otherwise by the exhibition of electric light, and will have confidence in their security for some time to come; but whether electricity is to take the place of gas or not, depends in a great measure upon the final decision of the general opinion of the public. At the present moment I am inclined to be of the same opinion as the gas companies themselves. Those portions of the exhibition of lights which are worth mentioning, are first, and above all, the Siemens and Halske lamps. It is only fair to say that there was nothing in the whole exhibition to compare in brilliancy and effect with the luster of the two great lamps of this firm. The Jablochkoff lamps which we have heretofore so much admired were quite thrown in the shade and actually had a mean appearance before these exquisite burners.

Next in order to the Siemens and Halske lights must be mentioned those of Brush. This was a truly fine display, and attracted general admiration and wonder, not only on account of the great number and perfect working order of the lamps, but also because that the system is said to be by far the least expensive, and, therefore, the most practical on exhibition. Next in order may be mentioned the Jaspar lamps, with immense reflectors. These lamps gave a very agreeable, steady light, and for some purposes may be considered very practical. Before going further, I must speak of a new system which gave great satisfaction and was much admired by the visitors, viz., that of the Austrian engineer, Gulcher.

This exhibition consisted of eight fine lamps, which gave a steady, soft, mellowy light of a yellow color and of great strength.

The light of the Siemens and Halske firm, as also that of Brush and of Jaspar, is more white in color.

The exposition of the Swan and Edison and Maxim lamps of incandescence afforded a particular surprise and pleasure to those who had not heretofore witnessed them. They gave an impression of elegance and taste which recalled vividly to mind the candle chandeliers of our ancestors, which still retain the post of honor in many European mansions. But of the practicability of these systems we are not yet informed.

To the unprejudiced eye of the general spectator there were no other systems on exhibition which were worthy of note. However, as we have said, many of the lamps of other systems were not yet in order, and there may be occasion for a different opinion in future, in case some of these unfinished systems should excel those we have named.

The French department was a cause of regret and wonder as far as regards their exhibition of lights, that department being quite thrown in shadow by the more successful and brilliant foreign departments.

The light-house, which was intended as a great addition to the general display, proved in fact to be a perfect nuisance, its colored, revolving lights casting a ghastly and ominous shade over the different systems of lamps in the gallery and prohibiting the spectator from forming any just estimate of their value.

Some of those systems which were ill worked made a most ludicrous display, puffing and winking, now darting fire, now presenting a mere dull coal to the looker on, sometimes even going entirely out.

Finally, whatever else may be said in favor of electric light, there remains one serious and insurmountable objection to it, which will place one half the human race in direct opposition to its adoption, and that is, that it lays bare all the secrets and defects of the complexion, nay, even adds hideousness to it, whereas the mellow gaslight added many a charm and smoothed many a wrinkle.

Whether our scientists and speculators in the scientific mines will take this last-mentioned fact into consideration remains to be seen. One thing is sure, the pleasure felt in gazing upon the electric lights is much destroyed by the disagreeable feeling experienced in looking upon each other, though it must not be forgotten that the incandescent lamps are an exception in this respect, and, therefore, if practical in other respects, will no doubt take the palm for all indoor use.

GUSTAVE GLASER.

Look Out for the Pilgrim.

A mysterious star, called the Pilgrim, which was observed in 945, 1264, and 1572, is expected by astronomers to appear before long. It was described in 1572 as brighter than Jupiter, and "such was its brilliancy that persons were able to detect it at noon in a clear sky, and at night when the sky was so overcast as to hide all other stars." If it appears it will probably be visible for several weeks in the constellation of Cassiopeia.

DEEP SHAFT IN VICTORIA.—The Melbourne *Age* states that the Magdala shaft, Stowell, has a total depth from the surface of 2,930 feet, or 1,566 feet below sea level. This is the deepest shaft in Victoria.