SCIENTIFIC AMERICAN

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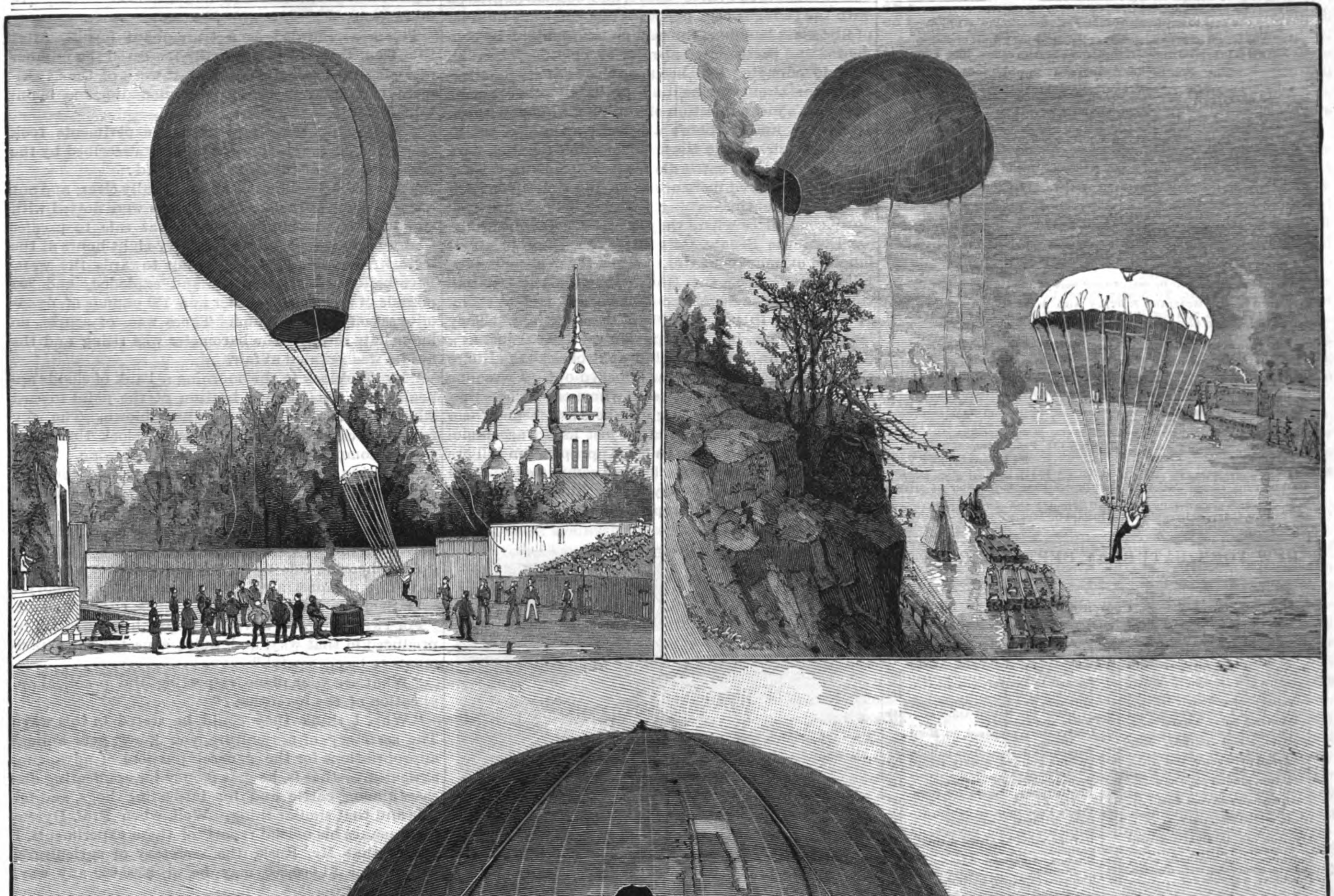

The ascent. Inflation of the balloon with hot air. The descent.

HOT AIR BALLOONING, WEEHAWKEN, N. J.—[See page 147.]

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NEW YORK, SATURDAY, SEPTEMBER 5, 1891.

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(Illustrated articles are marked with an asterisk.)

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SCIENTIFIC AMERICAN SUPPLEMENT

No. 818.

For the Week Ending September 5, 1891.

Price 10 cents. For sale by all newsdealers

THE ARTIFICIAL PRODUCTION OF RAIN.

At the instance of the Hon. Charles B. Farwell, Senator from Illinois, an appropriation of $10,000 was made by the last Congress for experimental purposes relating to the artificial production of rain by firing explosives.

Senator Farwell has given an amusing account of how the appropriation was secured and his reasons for urging it. He makes no pretensions as a scientific man; he never, like Espy and others, made a complete study of the meteorologic laws and phenomena, but he learned that in the high regions above the earth there were air currents charged with moisture, and became impressed with the thought that by means of a sufficient number of first-class bangings the said moisture might be condensed and precipitated as rain. "This idea," he said, "is old enough. I've been convinced of its practicability for twenty years, and probably other people have. It's just a question of applying what you know. Everybody knows there's a certain amount of moisture in the air all the time. The people see their corn burn up and their cattle die for lack of moisture. They know the required moisture is passing right over their heads all the time—going off, may be, to rain itself down some place where they're already drowned out.

"Even the Senate Committee on Appropriations laughed at me about this. When the Appropriation bill came over from the House, I went around to my colleagues of the Senate committee and said to them, 'I want you to put $10,000 in there for rain.' They laughed at me, but they put in the $10,000 just as a personal favor. When the bill went back to the House that $10,000 amendment was knocked out. I was one of the conference committee to whom the bill was referred. I went to the other members and asked them to put in the rain appropriation just as an accommodation to me. The items in the Appropriation bill are numbered, so when the conference committee reported favorably on No. 17, nobody in the House cared to see what No. 17, a little appropriation anyhow, was, and it passed."

PRECIPITATING RAIN BY EXPLOSIVES.

In accordance with this appropriation the Department of Agriculture has lately instituted the required experiments, the same being under the immediate charge of Gen. R. G. Dyrenforth, assisted by Professor Carl Meyers, the balloonist, Professor Powers, author of "War and the Weather," Mr. John T. Ellis, and George E. Casler, balloonist.

The place selected for the experiments was the cattle ranch of Mr. Nelson Morris, a few miles distant from Midland, Texas, a quiet and far out of the way place, where the experimenting party were offered unlimited space and facilities for the undisturbed execution of their peculiar enterprise. Moreover, it is alleged this was a particularly dry spot, where little or no rain had fallen for three years. To this thirsty region came the rain makers, bringing with them a strange paraphernalia, consisting of several dozen balloons, kites, retorts, acids, iron filings, chlorate of potash, sulphuric acid, manganese, rackarock, dynamite, fuses, pipes, electrical wires, dynamo machines, electric exploders, etc. It was August 5 when the party reached the ranch, and from that time onward they were very busy. After much toil their explosive supplies, gas apparatus, balloons, kites, and electrical devices were got into working order, and used as follows: By means of retorts charged with chlorate of potash and manganese, oxygen gas was produced; hydrogen was generated by means of iron filings and sulphuric acid. With these gases forming a highly explosive mixture, the balloons were filled and time fuses applied.

It required four hours to charge the first balloon, and when it was ready, a dispute arose as to who should light the fuse. The chemist said the balloonist should do it, and the latter said it was the duty of the chemist. Finally the chemist touched off the fuse and the balloon sailed away and exploded at about two miles from the point of ascension. A few sticks of rackarock were exploded on the ground, and that night rain fell at Midland and Stanton, twenty-five miles away.

This was regarded as a triumphant result. After that Gen. Dyrenforth gradually increased the number of explosives until during the last week of the experiments an almost continuous cannonading was maintained.

The last of these rain-making experiments took place Aug. 26 and is thus graphically described by the correspondent of the New York *World:*

"Aug. 26.—The night was beautifully clear, and not a cloud could be seen. The heavens were dotted with stars, and from all indications it was safe to predict that no rain would fall within forty-eight hours at the least. A strong gale was blowing towards the west. Five balloons were sent up and exploded, and 200 pounds of rackarock powder and 150 pounds of dynamite set off on the ground. There was, of course, no immediate result. The barometer was rising and the needle was pointed at fair.

"By 8 o'clock in the morning a bank of clouds appeared on the western horizon at the point toward which the smoke and noise had blown. The sky rapidly became overcast, and by 4 o'clock there was rain, accompanied by thunder and lightning. When the sun rose, it was seen that the storm had come directly out of the west, and on the horizon the clouds rose in a funnel shape, like the smoke from a volcano. There was a beautiful rainbow visible at sunrise. It ceased raining at about 8 o'clock."

After hearing this news, "I think the experiments have now demonstrated the soundness of my theory," said Senator Farwell to the *World* correspondent. "For twenty years I have had no doubt rain could be produced in that way, and quite expected the experiments to be successful."

"What are your plans respecting the practical application of the invention?"

"Why, I think they could be stated in this way: The secretary of agriculture, you know, gets annual appropriations for the general purpose of advancing agriculture—that is, he gets money for eradicating diseases among cattle and for inspecting hogs, and for this and that similar thing. Well, when Prof. Dyrenforth makes his official report of these experiments, I expect that Mr. Rusk, the secretary of agriculture, will ask for $1,000,000, may be, or $500,000 any way, for rain making."

"The Department of Agriculture has its inspectors and employes in the West, and when an inspector reports that rain will be needed at a certain time in a certain region, the secretary will send on his men and appliances and make the rain. That's my idea of how it will be practically applied. Of course, I seek no control of any sort over the invention. If any State or other community wants to make rain on its own hook, there could be no objection to its doing so."

To us the most practical result likely to follow from these experiments is the extraction of money from the public treasury. We have seen how easy it was to obtain the first ten thousand dollars to aid the chimera. "I asked them to put in the rain appropriation just as an accommodation to me," says the senator, and they did it. "Nobody in the House cared to see what No. 17, a little appropriation anyhow, was, and it passed."

The idea that rain can be precipitated by cannon firing is almost as old as gunpowder; but while there are many curious coincidences, there is no satisfactory evidence that rain was so produced. It is on a par with the Chinese mode of conquering the enemy by making a loud noise.

It is true a downpour often follows a clap of thunder; but this does not prove the rain was produced by the concussion. On the contrary, we know that rain probably results from the cooling of moisture-laden air, and simultaneously electricity may appear. Hence in thunder storms the aerial concussions are most probably the results, not the cause, of rain formation.

Nature works on a vast scale in producing rain; and it is idle to suppose that the burning of a little explosive matter can materially affect the boundless atmosphere of the skies.

In a certain sense it may be claimed that rain always follows an explosion; since all atmospheric changes are successive. If to-day is fair, fire a gun, and it will rain either to-morrow, or some following day. If to-day is rainy, fire a gun, and it will be fair either tomorrow or afterward. There appears to be just as much sense in appropriating public money for explosives to produce dryness in Alaska as to make rain, by similar means, in Texas.

In conclusion, we would warn Senator Farwell and his coadjutor rain makers that they have infringed upon a patented article, and are liable in damages. The precipitation of rain by firing aerial explosives is the invention of Mr. Daniel Ruggles, of Fredericksburg, Va., and was patented by him eleven years ago, to wit, on July 13, 1880, patent number 230,067. His patent claim is as follows:

"The mode herein described of producing rainfall, said mode consisting in conveying and exploding torpedoes or other explosive agents within the cloud realm substantially as described."

Mr. Ruggles' invention was illustrated and described in the SCIENTIFIC AMERICAN of Nov. 27, 1880. We here reproduce the engraving and description then published. "Novel Method of Precipitating Rain Falls. A patent has been recently issued to Daniel Ruggles, of Fredericksburg, Va., for a method of precipitating rainstorms, which, judging from a well known precedent, is not entirely chimerical. It has been frequently noticed that heavy cannonading is followed by a fall of rain. Profiting by this suggestion, Mr. Ruggles has invented a method of producing a concussion or a series of concussions in the upper regions of the atmosphere which he believes will induce rain."

The invention consists, in brief, of a balloon carrying torpedoes and cartridges charged with such explosives as nitroglycerine, dynamite, gun cotton, gunpowder, or fulminates, and connecting the balloon with an electrical apparatus for exploding the cartridges.

"Our engraving represents an individual in the act of bringing down the rain."

Mr. Ruggles' patent is still in force, and if the invention has anything like the value which Senator Farwell places upon the obtained results, then the million dollars the senator speaks of should go to the patentee. Let justice be done to inventive genius.

For the convenience of our readers and the further elucidation of the subject, we reprint the article we published a few months ago.

[From the SCIENTIFIC AMERICAN of Dec. 20, 1890.]

"THE ARTIFICIAL PRODUCTION OF RAIN.

"The question as to whether rain can be produced by artificial means is to be tested by the United States government. On motion of Senator C. B. Farwell, of Illinois, a clause was added to the appropriation bill which provides that, under direction of the Forestry Division of the Department of Agriculture, $2,000 shall be expended in experiments having for their object the artificial production of rainfall by the explosion of dynamite.

In a communication from Senator Farwell the following theories are advanced: "My theory in regard to producing rain by explosives is based partly upon the fact that after all the great battles fought during the century heavy rainfalls have occurred. This is historical and undisputed. Senator Stanford, one of the builders of the Central Pacific Railway, informed me lately that he was compelled to do a great deal of blasting through a part of the country where rain had never been known to fail in any useful quantities and where it has never rained since, and that during the period of the blasting, which was nearly a year, it rained every day. I feel almost convinced that rain can be produced in this way. The dynamite could be exploded on the ground or up in the air, and I think I would prefer the latter. The experiment should be made in eastern Iowa, Colorado, or in western Kansas, somewhere along the railway, and my own idea would be to commence early in the morning and explode continuously for seven or eight hours."

The subject of rain production by means of concussion has been frequently disussed during the last twenty-five years. A great number of instances were stated by Francis Powers, C.E., in a volume entitled "War and the Weather, or the Artificial Production of Rain," 1871. Many cases are cited in which great battles have been followed by speedy rain. Six occurred during our war with Mexico in 1846 and 1847; nine cases of battles or skirmishes are given which occurred in 1861 in the war of the rebellion, and which were followed by rain at no great interval; forty cases are cited in 1862; thirty for 1863; twenty-eight for 1864, and six for 1865. Eighteen similar cases are also cited from among the great battles which have occurred in Europe during the past century, making a total of 137 cases. In a criticism of Mr. Powers' theory, *Silliman's Journal* said: "To this argument it may be replied that throughout the region from which his examples are mainly drawn rain falls upon an average once in three days, and probably a little more frequently; so that from the conclusion of one rain to the comencement of another, the interval is on an average but little over two days. Now, battles are not usually commenced during a period of rain; generally not till some hours after the conclusion of a rain. Rain, therefore, ought to be expected in about one day after the conclusion of a battle. Now, the argument of Mr. Powers is lame in this point. He takes no precise account of the length of the interval between the conclusion of a battle and the commencement of rain; nor does he show that the interval is less than it should be if the battle had no influence in the production of the rain; and in particular he takes no account of the cases unfavorable to his theory, in which rain follows a battle only after a very long interval."

Some of the cases, however, which may be cited where the fall of rain seems to have been caused by the discharge of cannon are very striking. During the siege of Valenciennes by the allied armies in June, 1793, the weather, which had been remarkably hot and dry, became violently rainy after the cannonading commenced. Two hundred pieces of heavy artillery were employed in the attack and one hundred in the defense of the city, the whole of which were frequently in action at the same time.

At the battle of Dresden, August 27, 1813, the weather, which for some days had been serene and intensely hot, during the progress of the battle suddenly changed. Vast clouds filled the skies, and soon the surcharged moisture poured itself in a torrent of rain. At Waterloo, according to Siborne, the weather during the morning of June 17, 1815, had been oppressively hot. It was now a dead calm; not a leaf was stirring, and the atmosphere was close to an intolerable degree, while a dark, heavy, dense cloud impended over the combatants. The 18th Hussars were fully prepared and awaited the command to charge, when brigade guns on the right commenced firing for the purpose of breaking the order of the enemy's advance. The concussion seemed instantly to rebound through the still atmosphere and communicate like an electric spark with the heavily charged mass above. A violent thunder clap burst forth, which was immediately followed by a rain which has never probably been exceeded even in the tropics. In a few moments the ground became perfectly saturated.

Humboldt says that when a volcano bursts out in South America during a dry season, it sometimes changes it into a rainy one. It is well known that in very hot calm weather the burning of woods, long grass, and other combustible materials produces rain. Very extensive fires in Nova Scotia are so generally followed by heavy floods of rain that there is ground for believing that the enormous pillars of smoke have some share in producing them.

Captain James Allen, acting signal officer of the War Department, in reply to interrogatories recently addressed to him regarding the probability of producing rain by artificial means, said: "One fact would seem to be easily admitted, that an attempt to explode gunpowder in order to practically demonstrate the advisability of attempts in rain production should at first be made after most careful consideration of the atmospheric conditions. For example, if these explosions should be made in the center of a high area, as shown by our weather maps, or even after a low area has passed any point, we may be absolutely certain no rain will follow. The first experiments should be undertaken to the southeast or east of a low area, and 300 to 600 miles from the center.

"Observing stations should be established every 5 or 10 miles for 200 miles to the eastward of the point of explosion. If the explosions are made in a comparatively clear sky, and after that unmistakable clouds are observed to the eastward and not to the westward, some connection may be surmised. It must be said, however, that even if the production of rain be practicable, it can only be for a very limited area, and it is believed that any benefit which can possibly arise from such rain can never amount to the expense of the enterprise."

The opinion of Captain Allen is similar to that of President H. C. Russell, of the Royal Society of New South Wales, contained in an anniversary address delivered in 1884. He says: "It would seem unreasonable to look for the economical production of rain under ordinary circumstances, and our only chance would be to take advantage of a time when the atmosphere is in the condition called unstable equilibrium, or when a cold current overlies a warm one. If under these conditions we could set the warm current moving upward, and once flowing into the cold one, a considerable quantity of rain might fall, but this favorable condition seldom exists in nature."

The experiment of producing rain by exploding dynamite is about to be tried, and the result will be awaited with much interest."

THE WEATHER DEBATING SOCIETY.

There are now so many cloud compelling rain producers turning up that any opulent person who is interested in the weather can hire one of them for his own convenience. But suppose a man who would like to enjoy a shower on a warm afternoon orders his cloud compeller to produce one at a time when his next door neighbor desires to take a walk in his garden under the sunshine, what will ensue? Will the rain producer be liable to be sued for damages by his neighbor, or will the case be settled by arbitration?

These questions are fit to be taken up by the Weather Debating Society, now that so many rain producers are offering their services at a low price.—*N. Y. Sun.*

Meeting of the American Association.

The American Association for the Advancement of Science adjourned on Tuesday, August 25, to meet again at Rochester, N. Y., on the third Wednesday of August, 1892. The president for next year is Prof. Joseph Le Conte, of California. Secretary Putnam reported that 653 members had been enrolled at the Washington meeting, of whom 371 were new, the latter number alone exceeding the total attendance for last year. Addresses, papers and memoirs were offered and read upon 291 distinct subjects, these communications varying in length from five minutes to an hour each. Most of these were read in one or another of the eight sections into which the association is subdivided. From a programme members learn what is going on.

In our columns it will be impossible to give more than an epitome of the proceedings, beginning with brief abstracts of the addresses made by the vice-presidents in opening the sections of which they are the chairmen.

Prof. Nipher addressed the Section of Physics on the "Functions and Nature of the Ether of Space." It was once taught that light was an elastic pulsation in an incompressible medium. Then the theory found favor that it was an electrical displacement at right angles to its line of propagation. Then the elastic and electric theories were ingeniously put on the same logical basis by suggesting for the former a rigidity zero for the compression wave—an audacious idea that created pleased surprise. Light in matter must be either more dense or less elastic than that in free space. Ether at the earth's surface moves with it, being dragged along as if it were a vivid liquid. Ether in water seems to be condensed to $\frac{7}{16}$ of its volume in air. Yet after all the fine theories and beautiful experiments, it remains an open question whether ether or any part of it is at rest in space, or whether it sweeps through the interior of bodies as the wind sweeps through the leaves and branches of a tree.

"The Evolutions of Algebra" was Prof. E. W. Hyde's topic in opening the Mathematical Section. He traced the progress of algebra from its rhetorical form in India, Egypt, Arabia and Greece, through the syncopation stage of the middle ages, to the modern purely symbolic form. These three stages were explained as being originally mathematical reasoning by words, next by abbreviations, and finally by signs altogether, by which the amazing progress of the past 200 years had been made possible, and the ultimate value of which remains to be determined by its future.

President J. M. Coulter, the newly elected President of the Indiana University, addressed the Biological Section on the "Future of Systematic Botany." Many who style themselves systematic botanists have only pigeonholed plants for study; and too often regard the temporary pigeonholes as more important than the facts. Three distinct lines of work are to be recognized as of equal importance, each of which should turn over its completed product to the next. Field work comes first; which, instead of being sporadic, or ending in a mania for new species, should make the collection and description of plants as distinctly a biological survey as any made by topographical engineers. It should be done by men trained and equipped for it. Nothing requires a broader grasp of facts than the proper discrimination of species. Each true species is highly composite, being made up not only of gross organs, but of those that are microscopic. The best field work is but preliminary to the further study of the life history of plants, noting the development of each organ at every period, thus obtaining cumulative evidence for safe generalization. The last and highest expression of botanical work is the construction of a natural system based on an accurate description of species and a thorough study of life histories; and this calls for a complete command of botanical literature, together with the finest powers of generalization.

Prof. Stevenson addressed the Geological Section on the "Relations of the Chemung and Catskill on the eastern side of the Appalachian Basin." After tracing historically the studies made of these groups, he concluded that the series from the beginning of the Portage to the end of the Catskill form but one period, which should be designated as the Chemung, and be divided into three epochs, Portage, Chemung, and Catskill; that the disappearance of life from this area was due to the fact that the deposits were made, not in a closed sea, but by the influx of great rivers loaded with debris in which life could not exist, and that we are not justified in including the Chemung period in the carboniferous age.

"The Natural History of Analogy" was discussed by Prof. Jastrow before the Section of Anthropology. Though cautiously used by modern scientists, analogy was the main argument of primitive man, and explains savage customs and beliefs, popular superstitions, folk-lore, magic, astrology, and all pseudo sciences. The serious reasoning of our forefathers only amuses us; yet historically there is a connection between modern civilization and the primitive culture from which it is largely an outgrowth.

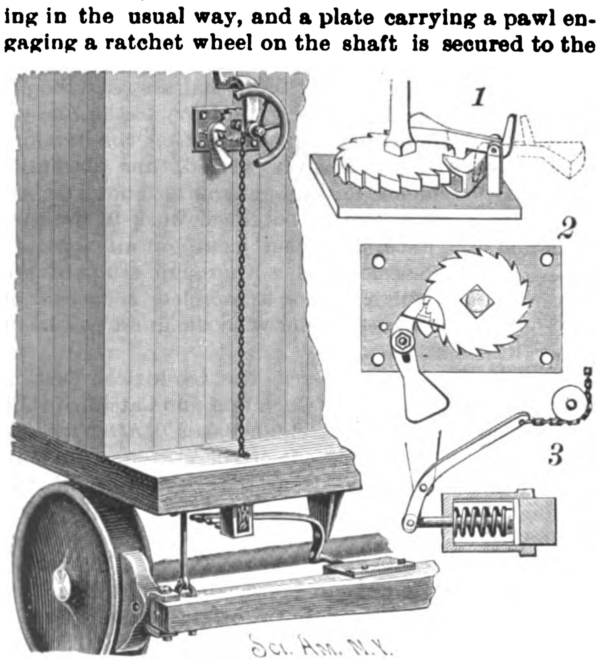
(To be continued.)

Mixed Material for Glass.

A new use has been found for waste glass by Messrs. Rostaing, Garchey and Geille, of Paris. Any fragments of broken glass of various colors are mixed together, after having been broken to a suitable size; they are then placed in moulds lined with silica, talc, or some other resisting material and fired. A coherent mass is produced which can be dressed and cut into blocks, which are, of course, irregularly colored. Such blocks may be used as artificial marble. The blocks are usually rough on one side, owing perhaps to incomplete fusion; this gives a surface which is admirably adapted for causing them, especially if they are slab-like in form, to adhere to walls with the addition of a little mortar. Fine decorative effects can thus be produced. Designs in relief can be obtained by pressure while the block or slab is still plastic. If a suitable mould be prepared with movable partitions, then pieces of glass can be arranged in such a way that, upon firing, a very effective "stained glass" window is produced, the necessity of using "leading," as in the ordinary way, being thus obviated.

A SAFETY ATTACHMENT FOR CAR BRAKES.

The illustration represents a convenient means of setting brakes by hand, with a safety attachment therefor, together with a spring attachment for the brake beams, so that the brakes shall not be set so hard as to prevent the wheels from turning. The improvement forms the subject of a patent issued to Mr. Lincoln H. Raub, of South Easton, Pa. The perspective view represents the attachments applied to the brake of a freight car, although they may be used in connection with any of the brakes in common use. Secured to the brake beam is a casing, through which extends a rod having next the brake beam a collar, while its outer end is pivoted to a bent lever, as shown in detail in Fig. 3, there being a spiral spring around the rod, so that when the brake is applied, the spring will prevent it from being pressed so hard against the wheels as to stop them from turning. The other end of the bent lever is connected to a chain extending over a guide pulley supported in a depending bracket on the bottom of the car, the upper end of the chain being attached to a shaft in a bracket on the end of the car. The outer end of this shaft has a hand wheel, and its inner end is pivoted in a plate secured to the car. There is a ratchet wheel on the shaft, and pivoted to the plate is a pawl, as shown in Fig. 2, the lower end of the pawl being enlarged to serve as a weight and hold its upper end in engagement with the wheel. The pawl is pivoted on a pin, which rides in a slot of the pawl, permitting vertical movement of the latter, and at its toe end the pawl is flanged to overlap the sides of the ratchet wheel, thus guiding the pawl to a sure engagement. The plate also has a projecting pin in the rear of the pawl, to prevent the latter from being tipped out of place, and between the pawl and the wheel is a fixed block, adapted to engage a flange of the pawl, should the pin break on which the latter is pivoted, and hold the pawl in engagement with the wheel, so that the brakes would be held in place. In applying the improvement to a passenger or platform car, the brake shaft is mounted in the railing in the usual way, and a plate carrying a pawl engaging a ratchet wheel on the shaft is secured to the

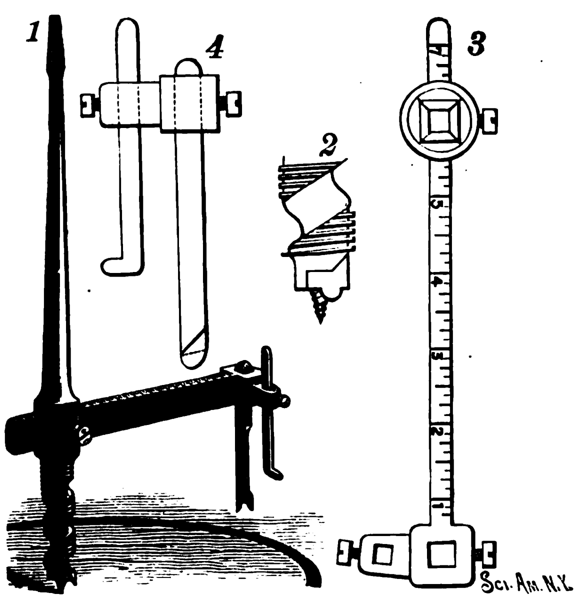


RAUB'S CAR BRAKE ATTACHMENT.

platform. Fixed to the plate behind the pawl is a post in which is pivoted a bent lever, its outer end weighted and its inner end bent to form a finger adapted to press against the outer side of the pawl, while on the other side of the lever is an oppositely projecting finger, so that when the lever is tipped in one direction, the finger will press the pawl into engagement with the ratchet, and when tipped the other way, the other finger will hold the pawl away from the ratchet. In Fig. 1 this lever is shown in full and in dotted lines in both positions, its weighted end in each case holding it securely in place.

A BIT FOR BORING LARGE HOLES.

In the expansion bit shown in the illustration, Fig. 1 represents the device in perspective, Fig. 2 showing the point of its central portion, and Fig. 3 being a plan view, while Fig. 4 is an end view of the extension arm. The shank is squared and tapered to adapt it to a bit stock, and its spirally grooved lower end has a gimlet point and cutting lips, a screw thread being formed on the body of the spirally grooved portion. In a mortise in the shank an arm is clamped by a set screw, the outer end of the arm having two mortises, in one of which is clamped a cutting tool, while the



BEAUCHENE'S EXPANSION BIT.

other carries a guide bar. The tool has at its lower edge a pair of spurs, between which is formed a cutting edge, the spurs being arranged divergently to enable them to cut without pinching the wood, while the shank of the tool is cut away above its cutting edge so that the ascending chips will ride up and off the edge of the tool. The upper surface of the arm has a graduated scale to facilitate setting it for boring a hole of the desired size, which is effected by placing the gimlet point on the center from which the hole is to be struck and turning the bit, when its threaded portion screws into the wood, as the cutting tool on the extension arm forms a channel by which a circular piece is separated from the main body of the wood.

Further particulars relative to this invention may be obtained of the patentee, Mr. Charles Beauchêne, Lake Linden, Mich.

Fossil Flour.

Since the time of the invention of sulphur vulcanization, almost everything in the way of the cheaper metallic oxides, sulphides, or earths have been tried as fillers for rubber. So careful has the experimentation been in these lines that any practical rubber man can tell exactly what results are attained by these different materials.

A curious earth that has not as yet received much attention from the rubber men, partly because the supply has not been regular, and partly because when it could be secured it was found in connection with other substances that made it of little use, is what is known as "fossil flour." Quite recently a vast deposit of this has been discovered in the State of Maine, and that too of such purity as to arouse the wonder of the best analysts. In investigating the properties of this new earth, one is impressed at once by its wonderful faculty for resisting the action of acids, alkalies, oils, and especially by its remarkable quality as a non-conductor of heat. A simple test of this latter quality made by one interested in the company was to take an inch cube of the material and place it on a bar of iron. The iron bar was then put in a blacksmith's forge and heated until it was melted away from the cube of earth. So little did the heat penetrate this cube that one could easily place the fingers upon the upper part of it without inconvenience from the heat.

Exactly what value this non-conducting property might have in rubber is not, perhaps, at first apparent, until one reflects upon the clammy, repulsive feeling of ordinary rubber clothing, and indeed of rubber goods in general. To use a common illustration, we might cite the case of the old-fashioned oilcloth, which has much that feeling, and which is being practically driven out of the market by the later invention of linoleum, the latter being entirely free from the inconvenience described. If rubber garments could be made of a compound of India rubber and a first-class non-conductor, there is no doubt but a surface much more agreeable to the touch would be produced; and that one objection to rubber clothing would be done away with.

It is not in clothing, however, that the strongest points of the new adulterant would be developed. For valve work it is said to be far ahead of anything made in rubber; valves made of it have been subjected to the severest tests, and are said to be almost indestructible.

Fossil flour is almost as white as oxide of zinc. It is so light in weight that a flour barrel of it in its natural condition will weigh not over 50 lb. It is, as we have already stated, absolutely unaffected or unchanged by any sort of mechanical manipulation, by acids, alkalies, or heat. As it is mined, it comes out of the ground a pure white powder, so fine that it cannot be ground any finer. A careful analysis of it shows about 95 per cent pure silica.

In speaking of this as silica, one would perhaps at first get an idea of particles that have sharp edges, and a feeling similar to that of corundum or emery. That, however, is not true in this case, as the earth is what is known as a diatomaceous earth, made up of a vast number of infinitesimally small shells, each individual shell having been the home of a diatom, built for it from silica, held in suspension in water.

This kind of earth has been used in Europe very largely for a variety of purposes; one of the most curious of which was in Sweden, where the poorer classes mined it and mixed it with wheat flour, in order to make bulky loaves of bread, not for sale, but for their own eating. In belting, packing, hose, and boots and shoes, this adulterant has many advantages which, no doubt, the rubber trade will readily discover.—*India Rubber World.*

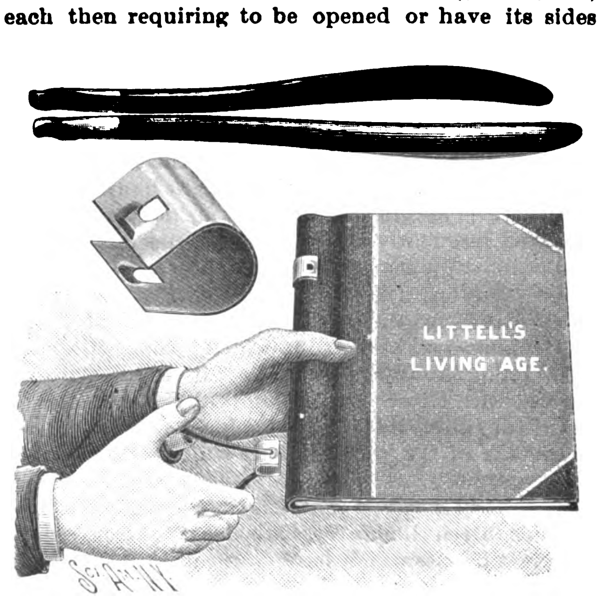
Alloy for Hermetically Closing Glass Tubes.

It is claimed by F. Walter that an alloy consisting substantially of 95 per cent of tin and 5 per cent of copper may be used for connecting metals with glass, for electrical and other purposes, hermetically sealing glass tubes, etc.

The alloy is prepared by pouring the proper proportion of melted copper into the molten tin, stirring round with a wooden stirrer, casting or granulating, and remelting. It adheres strongly to clean glass surfaces, and has nearly the same coefficient of expansion as glass; it melts at about 360° C. By alloying it with 0·5 to 1 per cent of lead or zinc it may be rendered softer or harder or more or less easily fusible as required. The alloy may also be used for coating metals or wires, as it imparts to them a silvery appearance.

A SIMPLE CLIP FOR PAPERS, DOCUMENTS, ETC.

The illustration represents an extremely simple form of spring binding-clip, having no attached handles for opening it, but provided with apertures to receive independent handles or levers, as shown, by means of which the clip may be readily opened for placing files, etc., within its grip, or releasing them therefrom. This device has been patented by Mr. Harlan H. Ballard, Librarian of the Public Library, Berkshire Athenæum, Pittsfield, Mass., its invention having naturally followed his appreciation of the need of such a clip for the binding of pamphlets, papers, etc., and the holding of covers on magazines and periodicals in reading rooms. The clip is made of spring steel or brass, and a number of them may be made in series of a single strip of spring metal, when desired, to hold an accumulation of magazines, etc., each then requiring to be opened or have its sides



BALLARD'S BINDING-CLIP FOR PAPERS, ETC.

sprung apart in applying it, as with the individual clips. The detachable handles or levers are readily brought into engagement with the aperture in each side of the clip, the aperture having a loop-like seat in one side approximately fitting the bent end of the lever, and only one pair of handles is required by an individual for any number of clips. With suitable wooden rods these clips are adapted to form excellent newspaper files, and they may also be employed to hold bed clothes on children by clipping the clothes to the edges of the crib. Their simplicity, durability and cheapness recommend them for a great variety of uses.

Minneapolis Electric Street Railway.

The electric system of the Minneapolis Street Railway and the St. Paul City Railway companies is without doubt the most complete and one of the most extensive systems in the world. Among other innovations introduced on these roads has been the burying of the feed wires, thus removing from sight and danger the most obtrusive portion of the overhead structure. These feed wires have been buried elsewhere, but the particular feature of interest that attracts attention in this case is the fact that the wires are drawn *bare* into the ducts.

The conduit is located between the tracks and is built as follows: Two-inch plank, first treated by boiling in fernoline, is used for constructing a long trough of the desired size. This trough is so nailed together as to be continuous and without joints from manhole to manhole, a distance of 408 feet. The trough is placed below the surface at such a depth that the top is six inches below the paving blocks.

The conduit proper consists of a number of heavy paper tubes of the Interior Conduit and Insulation Company's make. The tubes employed are one inch and one inch and a quarter inside diameter, laid in the trough in ten foot lengths, and separated from each other and the sides and bottom of the trough by rings or spacers. The tubes are made continuous from manhole to manhole by use of a telescopic joint. After the tubes have been properly put in place, pitch, liquefied by heat, is poured in, filling the interstices and leaving a series of highly insulated raceways with a solid insulating filling, impervious to moisture, around them.

A large amount of this conduit has been in service since September, 1890, and has not as yet developed a single fault. In fact, notwithstanding the conduits have passed through the rigors of a Minnesota winter, recent tests of the various feeders show a maintenance of the originally high insulation resistances, which certainly speaks well for the plan adopted.

With these practical results before them it is not unlikely that others having roads under their charge may do likewise.—*Electricity.*

Tampico Harbor.

Concerning the work at Tampico harbor, Resident Engineer Wrotnowski, in charge of the work, says the north jetty is now 5,835 ft. long and the south jetty 5,340 ft. When 7,000 ft. long the jetties will be in 24 ft. of water, which will be reached by October next. The distance between the two jetties is 1,000 ft. The bar is of sand and mud. The river when in flood has a force of 225,000 cubic feet per second. This enormous force of water will quickly deepen the bar to about 25 ft. when the jetty works are completed. Work was commenced on June 1, 1890. Since that time 1,400 ft. of beach have been gained on each side of the jetties, and from 1,000 to 1,400 hands are now engaged in the work. About 700 cubic yards of stone are dumped daily. An inexhaustible supply of stone is had about 61 miles from Tampico, in the State of San Luis Potosi. The pilings are brought to Tampico from Pensacola and Pascagoula, Fla. The mattresses of brush are from 70 to 85 ft. at the bottom and about 30 ft. at the top. The average current of the river is five miles per hour. The Panuco river has a depth of 25 ft. a distance of about 80 miles inland to the town of Tamos. It is calculated by the engineers that vessels of the largest draught may enter in the fall. When the work is completed Tampico will be the only safe deep water harbor on the Atlantic coast.

A Chance for Inventors.

A well known railroad man declares that one of the most useful inventions that can be thought of in connection with operative railroading is one that will automatically take the rear brakeman by the nape of the neck, and shoot him back from the train a sufficient distance to protect it, when, for any reason, an unusual stop is made. He declares, as a result of considerable experience with the genus brakeman, that nothing short of this will suffice to make it at all sure that trains will be protected under such circumstances, because nothing short of some such device can compel brakemen to go back a proper distance with the flag or lantern.—*Industrial World.*

HOT AIR BALLOONING, WEEHAWKEN, N. J.

For some time past an exhibition of much interest to those interested in aeronautics has been produced daily at El Dorado, a pleasure resort upon the top of the Palisades on the Hudson River, just above Hoboken. It consists in the ascent of a Montgolfier balloon, to which a ribless parachute is attached. The aeronaut ascends with the two, and when a sufficient height above the earth is attained, cuts loose from the balloon, effecting his descent to earth in the parachute. We illustrate the principal features of the inflation, ascent, and descent with the parachute.

THE CUTTING LOOSE BLOCK.

The balloon is made of sheeting. This is one yard wide, and in the balloon which we illustrate forty segments of it were required for the circumference. For 16 ft. from its top each segment was tapered nearly to a point. The next 15 ft. were untouched, and then the last 29 ft. leading to the neck of the balloon were also tapered to about one-fourth their width. The segments were sewn together, as in making a regular seam; a cord was then laid along side the seam, and the double edges bent over and resewed, making a sort of felling. The top was made of double thickness. The sheeting was sized with a mixture of glue, alum, soda, salt, and whiting, in water.

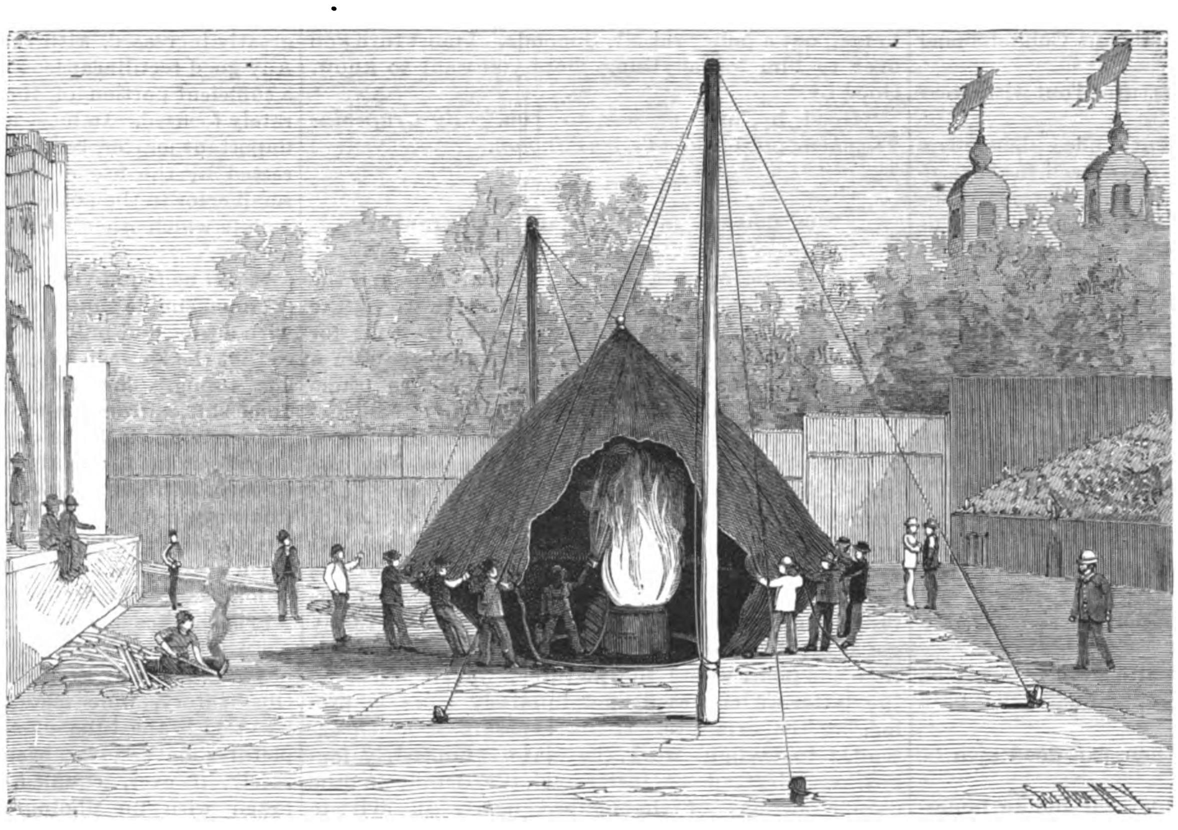
At the mouth of the balloon a hoop 8 ft. in diameter made of buggy wheel felloes is attached; from this hoop four ropes, called quarter guys, are brought down, to which the parachute is attached.

The parachute in general structure represents the cover of an immense umbrella. When expanded it is about 28 ft. in diameter. It is made in gores, and in its center has a 12 in. hole. From its periphery thirty-two cords lead down to what is known as the concentrating hoop, a strong wooden ring 18 in. in diameter, which the aeronaut grasps in making his ascent. The construction of the balloon with cords felled into it is such that no net is required. As the performer goes up clinging to the hoop of the parachute, it is necessary that he should have some means of detaching himself, at will, from the balloon. This is afforded by the arrangement shown in one of the small cuts. To the quarter guys of the balloon is attached a block of wood by means of a rope passing through a hole in it. Above this hole a knife blade is pivoted, which works in a slot in the block, and held out of contact with the rope by a rubber band. To the end of this blade a rope is attached leading down to the aeronaut's hand. By a second rope the parachute hangs from the same block. It is obvious that on pulling the cutting line the rope will be severed and the parachute detached. One more appendage remains to be noticed. Within the parachute, near its mouth, a wooden hoop 4 ft. in diameter is suspended, and by a proper system of guys is held in a horizontal position. The object of this is to insure the opening of the canvas.

The inflation is thus conducted: A trench about 18 ft. long, 2 ft. deep, and 2 ft. wide is dug in the earth where the balloon is to be inflated, and, except a small portion at each end, is covered with iron, boards, and earth. Over one end an iron cylinder 3 ft. high and about 3½ ft. in diameter is erected. Around this cylinder barrel staves are placed with earth between them and the iron, forming a sort of rough lagging. On each side of the chimney thus provided, and at a good distance therefrom, two poles 38 ft. high are erected; each carries a pulley, and a rope is rove through the pulleys and carried through a ring on the top of the balloon. The mouth of the balloon is placed over the chimney, and, by means of the rope, the top is hoisted well up from the ground.

A wood fire is started in the distant entrance of the trench; this gradually heats the trench and smokestack, the draught at first being about as much one way as the other. After a few minutes, however, the draught begins to tend strongly toward the chimney, which is encircled by the mouth of the balloon, the sides being held well out from the center by a corps of assistants. From time to time a little kerosene is thrown on the fire. All this while an attendant stands within the balloon, by the side of the chimney, armed with a circular board to act as fire screen, and with a pail of water and a cup near him to throw water upon the cloth should it become ignited. The balloon gradually feels the buoyant effect of the heated products of combustion, and as it tends to rise, more and more cloth is fed out, the assistants shifting their hold lower down upon the sides of the balloon. After ten or fifteen minutes the suspending rope is cast off and pulled away from the balloon, and four guy ropes leading from its top are used to keep it in position. It swells continually, and the canvas rises until only the hoop rests upon the ground. A number of the assistants now stand upon this hoop.

The last heating remains to be done. At short intervals kerosene is thrown upon the fire, by this time largely consisting of a mass of very hot embers. The oil is at once volatilized and rushes as a gas into the balloon, within which it suddenly bursts into ignition, producing a great sheet of flame, plainly distinguishable through the cloth. This is repeated over and over again, each addition of kerosene producing a great flame as it ignites, almost with explosive violence, within the expanded canvas, now straining violently upward. The upper end of the parachute during the inflation has been attached to the balloon, and the aeronaut, Mr. M. L. Macdonald, of New Haven, Conn., professionally known as "Daring Donald," stands off to one side, as the balloon is nearly ready, grasping the concentrating ring. When all is prepared, the word is given, and the balloon is released. The chimney is covered, and, as the balloon rises, the aeronaut walks or runs forward under it, and is carried up clinging to the parachute ring. A loop of rope is attached to the ring, and, when some distance up, he steps into this loop and thrusts his head up through the concentrating hoop, so as to leave his hands free to manipulate the cutting rope. When a sufficient height has been attained, and he deems himself over a favorable ground for a descent, he pulls the cutting rope and severs the connection between himself and the balloon. He commences to drop with accelerating velocity until the air, catching the parachute, suddenly opens it just as an umbrella is opened by hand. The velocity of the descent is checked. With some oscillation the earth is approached quite rapidly; in half a minute or less the surface is reached. The object of the aperture in the center of the parachute is to make these oscillations as slight as possible. The earth is struck with some violence, about as if the jump was from six or eight feet elevation, indicating a velocity of about twenty feet per second. The deserted balloon capsizes, owing to the greater weight of its top, the hot air and products of combustion with considerable smoke escape, and it collapses and rapidly falls.



COMMENCING TO INFLATE THE BALLOON.

As the ascent is made, the entire distance from the top of the balloon to the aeronaut hanging to the parachute is about 175 ft.; the inflated balloon is about 40 ft. in diameter. The general operations of the inflating and of the ascent are in charge of Mr. Mortimer McKim, aeronautical engineer, of this city, himself an experienced aeronaut. Accidents in the descent are often to be anticipated: sometimes the parachute falls among the trees, from whose branches the operator drops to the ground, the parachute losing its effect the moment his fall is checked. Immediately under the Palisades are the cars and track of the West Shore Railroad, a descent among which might be the cause of very serious consequences. The descent is frequently made into the river. When this is anticipated, a life preserver is worn, to provide against sinking.

The cubic capacity of the balloon is about 28,000 cu. ft. Its lifting power is greater than would be the case with a similar gas balloon, on account of its extreme lightness. The absence of net and car and of heavy varnish conduces to its power.

Ex-Commissioner Mitchell tells about the Patent Office.

"Halloo! Is this Hon. Charles E. Mitchell, Commissioner of Patents?"

"Mitchell is my name, but I'm no longer Commissioner. I have resigned."

"I'm sorry to hear it. Why did you leave your post?"

"To attend to neglected private business, and because I am unwilling to do such an amount of judicial work that I cannot do justice to the office or myself."

"I have heard it whispered that you could not afford longer to accept so small a salary."

"That is not quite true; nevertheless, the emolument is totally inadequate to the position."

"Will this deter first-rate men from accepting the office?"

"Not from accepting it, but from remaining long in it. The Commissioner of Patents occupies a position of the greatest responsibility, and should be as permanent as a judge, with a salary equal to that of the higher courts."

"I see why you make this plea. On his decisions depends the validity of patents, and patents often involve millions."

"Sometimes they do. The Commissioner must judge between applicants and people, whether patents shall be granted. In interference cases, too, the value of the contested inventions is often large, not to say enormous."

"Is there no appeal from the Commissioner?"

"None whatever in interference cases. So you can readily understand the importance of his trust. Last year the Commissioner and Assistant Commissioner gave 900 written opinions."

"Are all the important officers turned out with every new administration?"

"Fortunately, no. The Patent Office demands a force of experts, many of whom have been in government employ 20 years or more. It would otherwise be impossible to get the work done satisfactorily. The three examiners-in-chief have a permanent tenure. One of them, Judge Clark, came in, I think, during Grant's first term."

"They, in their turn, have experts under them, I presume?"

"Yes. There are 32 principal examiners, each one at the head of an examining division; and the principal examiner, by nature of his employment as well as training, becomes the best informed person in the country on the science and art pertaining to his department."

"How many assistant examiners are there?"

"About 170. They also are accomplished. Many are graduates of polytechnic schools, and all pass a very rigid examination."

"Are these experts paid in proportion to their ability?"

"No. The salary of a principal examiner was fixed at $2,500 more than 40 years ago, and has never been changed."

"What an outrage! How, then, can good men be secured?"

"The fact of permanent employment and an honorable position compensates, in a measure, for the absence of shekels; but human nature is human nature, and clever employes leave quickly enough to take better places; whereas, with adequate salaries, they would gladly remain."

"A nice state of things! But just like our Congress, ever penny-wise and pound-foolish, utterly reckless in wrong directions and as mean as a miser when money ought to be spent. How many patents were issued last year?"

"Twenty-five thousand. The number of applications for patents number nearly 45,000 a year. During the last two years there were 10,000 more applications than during the two years immediately preceding."

"Why are 20,000 rejected?"

"Because they either are not original or lack patentability."

"I suppose electrical patents predominate?"

"Two out of 32 examining divisions are devoted exclusively to passing on applications relating to electricity."

"How many models are exhibited at the Patent Office?"

"One hundred and fifty thousand. Fire destroyed a large proportion of the models deposited prior to 1877, and since 1880 models have not been required."

"Not required? How extraordinary? Why not?"

"I fancy on account of lack of accommodation. I am in favor of models, and think room should be made for them. If the government possessed suitable models of electrical and other great inventions of the last ten years, there would be a permanent exhibit at Washington which would rival the World's Fair of '93, in one respect at least."

"What shameful ignorance on the part of our legislators! I should think, too, that models would be vastly better for inventors."

"Certainly. They come here with paper inventions, and often don't know whether they work or not."

"I've visited the Patent Office, and know how abominably crowded the rooms are and how foul the air is in consequence. To ask human beings to breathe it is a crime. To abolish models is a blunder, so Congress is impaled on both horns."

"The quarters allotted to the Patent Office have for years been entirely inadequate. My predecessors, Commissioners Marble, Butterworth, Montgomery, and Hall, have protested in their reports. So have I. We have merely asked for suitable room in the noble building erected out of the money paid into the Treasury by inventors."

"When you reflect that inventors have actually paid for the Patent Office building, it is adding insult to injury to devote any part of it to other bureaus."

"Congress has appropriated $16,000 to pay rent elsewhere for the General Land Office, which, when removed, will leave room to meet the present need of the Patent Office. Secretary Noble is very friendly to the Patent Office, and I'm sure will do everything in his power to carry out the intent of Congress."

"I hope so. What do you think of your successor, ex-Congressman William E. Simonds, who comes from your State of Connecticut? Mr. Simonds did splendid work in the international copyright struggle."

"It affords me great pleasure to know that the Patent Office will be in such excellent hands. Mr. Simonds has had an extensive and successful practice in patent cases. Moreover, for years he has lectured on patents before the Yale law school, so he comes to Washington fully equipped for his office."

"Very glad of it. Do you think—"

"No, not another word. You'll be asking me next to map out a policy for Mr. Simonds. I must turn you over to him for anything more you want to know. Good by."

"Good by, and success to you."—*By Grapevine Telephone to Kate Field's Washington.*

The Camera for Celestial Photography.

BY S. W. BURNHAM, LICK OBSERVATORY.

Every possessor of a good rectilinear lens and the ordinary landscape camera may not be aware of the fact that he has the best kind of an instrument for making pictures of the sky. The requirements in a lens for landscape photography are exactly the same as those which have to be considered in the department of celestial photography. About the same angle of aperture is desirable, and in a general way, the same class of lens as in landscape and outdoor photography. To get a satisfactory picture of a portion of the heavens at night, as we see it with the naked eye, the picture should include an angle of not less than 30° or 40°. There is this difference between terrestrial and celestial pictures: in the former we rarely get as much as we can readily see with the naked eye from the point where the picture is taken, while in the latter we can easily get infinitely more by prolonging the exposure. If the exposure is much extended in daylight work, the plate is hopelessly fogged, and instead of increasing the details in the darker portions of the picture, nearly all delicate details are lost, and the negative becomes flat and valueless; but with the plate exposed to the dark sky of a clear night, where the light emanates only from minute points, the exposure may be continued for hours, and when the plate is developed it will be almost clear glass except where those specks of light have made their impression. Negatives of this character possess this unique peculiarity, that no matter how long the exposure may be continued, they are always under-exposed with reference to the great majority of the stars shown; and at the same time, unless the exposure is very short, they are over-exposed with regard to the brighter stars visible to the eye. The longer the exposure, the more stellar points we get on the plate, and this could probably be continued far beyond the time one would be likely to give to the following of the stars as they move across the face of the sky.

Almost every amateur photographer has a lens and camera well adapted to do this work, but unfortunately not many have the means of mounting such an instrument so as to hold the stars fixed on the plate during the necessary time of the exposure. For this purpose an equatorial mounting, driven by clock work, is indispensable. In other words, the photographer must have the use of an equatorially mounted telescope of some kind, with a driving clock so adjusted as to compensate for the revolution of the earth on its axis, and keep the camera and the stars relatively fixed, the telescope itself being used as a sort of a finder, to keep the star selected for following exactly in the same place in the instrument, by changing the position of the telescope and the camera attached to it, with the slow motions with which all such instruments are provided. No driving clock, however perfectly made and adjusted, can be trusted to hold the star exactly on the fine wire or spider web in the focus of the telescope for any considerable length of time. This must be done by watching the finder, and whenever the star shows a tendency to get ahead or fall behind the bisecting wire, bringing it back to position by the slow motions which move the instrument independently of the clock. Everything depends on careful following and keeping the images of the stars all the time on exactly the same places on the plate. If this is not attended to, the stars will be elongated in the direction of their motion across the plate, and the negative will be unsatisfactory for any purpose. In addition to this, the fainter stars will be lost by the images spreading over the greater area on the plate. If the following is perfect, and the camera is accurately focused, the smaller stars will be exceedingly minute specks, and if the exposure is an hour and upward, there will be thousands of these tiny points scattered over the plate where perhaps only a score or two of stars are visible to the naked eye, while not a dozen of them could be seen at all on the ground glass of the camera.

Of course not many photographers have the necessary facilities for making pictures of this kind. If, however, some friend or good-natured astronomer has a small telescope of the kind referred to, which can be made available, the thing is easily managed. The camera can be strapped or tied to the tube of the telescope in a few minutes, and then everything is ready to proceed with the exposure. The camera should be focused previously with the utmost care, using the full aperture on a well-defined distant object, and then marked or clamped in such a way that nothing can be changed when the camera is attached to the telescope. It is almost indispensable that the full aperture should be used if the exposure is to be continued long enough for the fainter stars, as otherwise the time would be greatly increased, with very little corresponding gain. Any good rectilinear lens will give sharp images over a sufficient portion of the plate, provided it is accurately focused. In most uses of the lens this is not an important matter, because any ordinary error is corrected by the use of stops, but in stellar pictures a small error in the position of the lens will utterly spoil a plate which otherwise would have been entirely satisfactory.

It will be found very convenient to have one of the common simple shutters attached to the camera lens, with a tube and bulb running down to the eye piece, so that the lens can be closed in an instant if anything goes wrong. The clock may need winding, and the dome shifted from time to time, and, although with a good driving clock the observer can leave the instrument long enough to attend to such matters, it is safer to be able to shut off the light in the event of the clock stopping, or any accident occurring. Then the instrument can be brought back to the original place, and when everything is all right, the exposure continued as long as may be desired.

It is perhaps now generally known that the exquisite pictures of the Milky Way, and other portions of the heavens, made by Professor E. E. Barnard, of the Lick Observatory, were made with an ordinary portrait lens tied to the tube of a six inch telescope. These pictures have never been excelled by any one, and rarely, if ever, equaled. They show, as pictures taken with no photographic telescope could, the wonderful structure of the invisible heavens, with the millions of stars lying beyond the reach of the unaided eye. The number of individual stars shown on a single 8 × 10 plate, and that of a region not in the Milky Way, and in which but few stars are seen with the eye, is estimated to be not less than 60,000. This required an exposure of about four hours, using an aperture of about one-sixth of the focal length of the lens. Such pictures require the greatest care in making the exposures, and extreme skill in developing the plate to get the best results. But very interesting pictures can be made in less time. With an hour or an hour and a half, a vast number of telescopic stars will be shown, and such a negative of a prominent constellation, like Orion or Ursa Major, will repay the amateur for all the trouble it may cost to get it. Lantern slides from such negatives are more wonderful and interesting than any other stellar photographs. When thrown upon the screen, it is difficult for many to believe that such a wilderness of stars could be really photographed with a lens through which not one in a thousand could be seen on the ground glass.—*Anthony's International Annual of Photography*, 1891.

Combating Insects with Disease.

A few weeks ago we published an article in reference to destroying chinch bugs in sorghum fields by introducing insects infected with contagious disease. By the kindness of Mr. M. B Clement, of Sterling, Kan., we have received a small bundle of forage stuff, having many dead bugs attached to the leaves where they died from the effects of contagious disease intentionally introduced.

In this case, as we are informed, myriads of chinch bugs hatched in a wheat field, and as soon as they were able to move about, migrated to the adjoining corn and cane fields, literally covering the plants and destroying them, row by row, as they advanced. A few chinch bugs which had been exposed for twenty-four hours to infection, by being put into a jar containing diseased chinch bugs, were scattered among the destroying insects.

In five days after the introduction of the contagious disease, the destruction of the crop ceased, the myriads of moving insects were motionless, and it was difficult to find any living chinch bugs in the field.

As chinch bugs sometimes injure sorghum, by invasion in countless numbers from the wheat fields where they principally breed, it is a matter of interest to sorghum growers to know whether there are any practicable means of preventing the losses caused by these insects, and for this reason repeated experiments have been made this season in this line at the Sterling Sorghum Experiment Station.

When young the chinch bugs migrate on foot in countless numbers. When winged they fly. Having double means of locomotion, there appears to be no way to bar their entrance into a field of cane. It appears to be impossible to poison these insects in a wholesale way. They live through the coldest winters, they thrive most in the hottest and driest summers. They find a home in the foot stalks, or the funnel-shaped parts of the sorghum leaves which encircle the canes and suck the sweet sap of the cane. A very moderate estimate of the loss caused by chinch bugs in Kansas for a single year is $11 for each man, woman, and child in the State.

The legislature of Kansas appropriated several thousand dollars to be expended, under directions of Prof. Snow, in cultivating and spreading contagious chinch bug diseases. Infected bugs have been sent by thousands all over the State of Kansas, and the evidence which is now accumulating seems to point very strongly to the welcome fact that the losses caused by chinch bugs may be greatly reduced by cultivating contagious chinch bug diseases, and by causing infected insects to spread the disease.

Prof. Galloway, of Washington, is now propagating myriads of germs of a disease which is deadly to the caterpillars. It is said that when a diseased caterpillar is stabbed with a needle, and the needle is put into gelatine or extract of beef, the germs of the disease are transferred to the liquid, and soon every drop contains thousands of the germs of the disease. It is believed that, having the germs of disease, a farmer can prepare quantities of such solution and can distribute it in his fields with an atomizer. Any worm touched must die, and must give the contagion to other worms.

It may be that the cotton boll worm may thus be checked. By cultivating disease we may, perhaps, be relieved of the plague of flies and other noxious insects.

The ethics of the twentieth century may consist in avoiding diseases which now afflict humanity and in giving deadly disease to all living creatures whose interests conflict with ours.—*La Planter.*

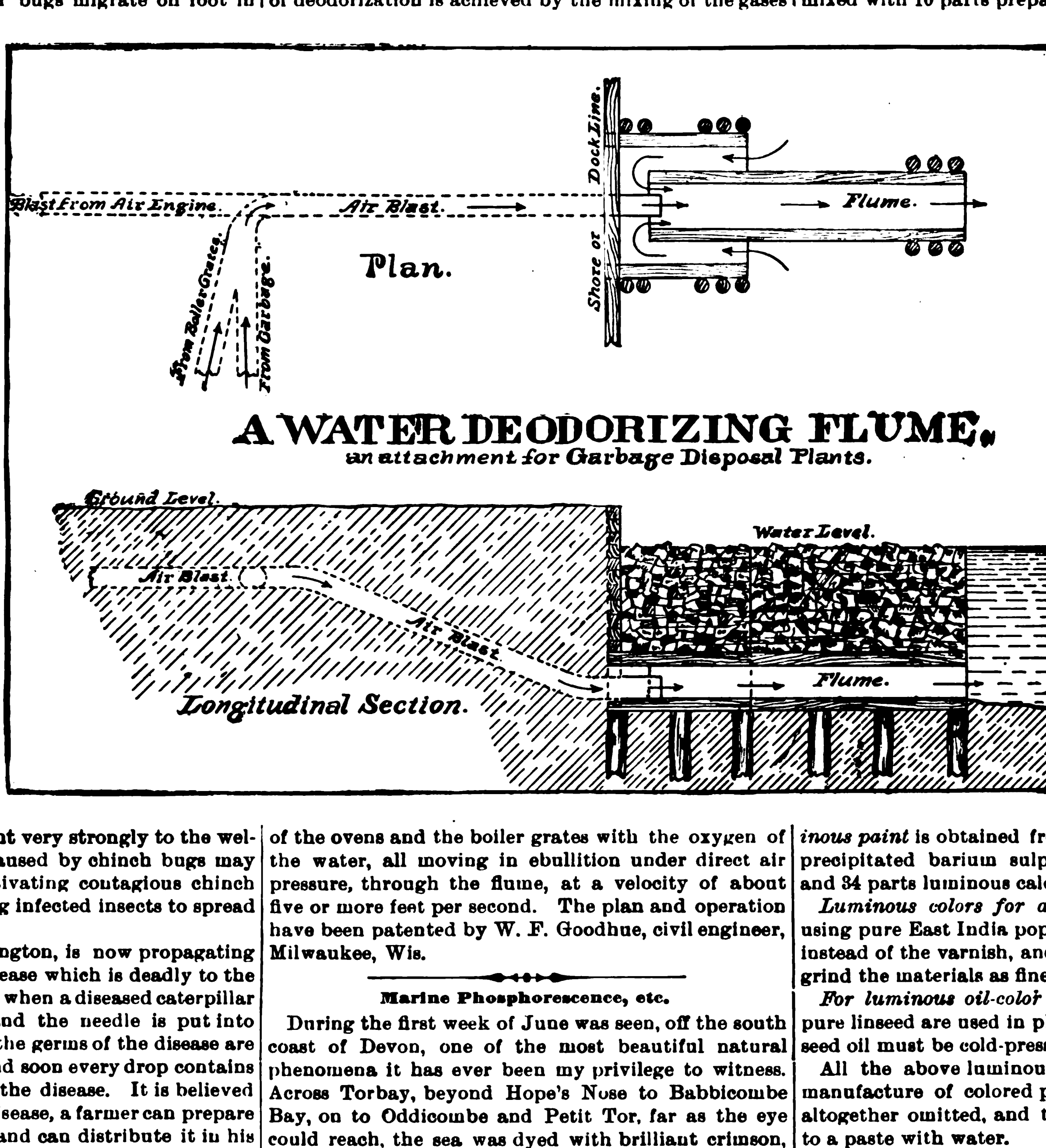
Scallops.

They like the long sedges, or eel grass, and at low tide can easily be taken with a crab net or with the hands. They often have their shells open, and when they see you they seem to give a spring, that is, they shut their shells quickly, which gives them an impetus that makes them rise a little, and they fall about twelve inches farther away than they were at first. The line of motion is a curve, and they generally turn over just as they commence to fall. When caught they seem quite indignant, spit out a stream of water, and open and shut their shells quite rapidly. The part which is eaten is the hard muscle which controls the shells; all around this muscle is soft flesh, like the edges of an oyster, and this extends to the edges of the shells. All around are rows of spots of the most beautiful steel blue. These are probably organs of sight.—*J. Husson.*

A WATER DEODORIZING FLUME.

The illustration represents an attachment for garbage disposal plants, to render inodorous the gases and smells which arise during the process of reduction of the garbage, whether the garbage be burned or dried. All the garbage drying or burning ovens are connected with a pipe leading to the air blast pipe, also the flues from the boiler grates are connected in the same manner, causing a suction of all the smoke and gases from the boiler grates and the garbage ovens, which are delivered into the air blast pipe and are thence driven into the flume, located in twelve or eighteen feet depth of water.

The pressure of air from the air engine causes an outward current from the flume, and the wings upon either side of the flume supply fresh water to assist the operation. The flume may be extended into the water any length desired, and can be used in any stream or body of water where the necessary depth can be obtained naturally or artificially, or by the erection of a tank or reservoir. In the latter instance the flume and wings would be set vertically, not horizontally as shown in the illustration. The process of deodorization is achieved by the mixing of the gases of the ovens and the boiler grates with the oxygen of the water, all moving in ebullition under direct air pressure, through the flume, at a velocity of about five or more feet per second. The plan and operation have been patented by W. F. Goodhue, civil engineer, Milwaukee, Wis.



A WATER DEODORIZING FLUME.
an attachment for Garbage Disposal Plants.

Marine Phosphorescence, etc.

During the first week of June was seen, off the south coast of Devon, one of the most beautiful natural phenomena it has ever been my privilege to witness. Across Torbay, beyond Hope's Nose to Babbicombe Bay, on to Oddicombe and Petit Tor, far as the eye could reach, the sea was dyed with brilliant crimson, which in the bright summer sunshine looked as if the water was turned into arterial blood, reflecting the light with a weird and wonderful effect. But it was at night the strange phenomenon revealed its full splendor. Then, right and left, far and near, the sea looked like molten silver, tinged with amber, and rich with gold. The far-off horizon was one long bar of glorious light, and as the waves broke upon the rocks, and the surge dashed upon the white pebbles of beautiful Babbicombe Bay, showers of phosphorescent spray were hurled high into the air, producing a spectacle grand in the extreme. The phosphorus which produced this magnificent sight was caused by the surface of the sea being covered with the spawn of the common mussel. When the tide was out, rocks, pebbles, and sand were coated with a thin film of transparent gelatine, which speedily vanished with the light and heat of the noontide sun. What renders the phenomenon peculiar is that I could find no trace of mussel beds in the neighborhood. The phosphorescent effects were greatest on the third night after the spawn was seen upon the water. In another forty-eight hours it had completely disappeared.—*Th. S. King, Science-Gossip.*

Asphalt and Coal Dust Fuel.

The Southern Pacific Company has long had a serious problem to consider in obtaining a proper and cheap fuel for its locomotives. No large bed of coal has ever been discovered in California that could furnish a supply of proper fuel sufficient for this company. The coal now used comes most from Victoria, and is brought to West Oakland in steamers built especially for that trade, and from West Oakland the coal is sent over the road.

The company has now turned its attention to the manufacture of artificial fuel.

A plant has been purchased in England, for the manufacture of an artificial fuel brick from coal dust and asphaltum; capacity five tons per hour. If this process is as successful on this coast as it has been on the Continent, it will be an enormous saving for the Southern Pacific Company.

The machinery will be set up alongside of the coal bunkers on Long Wharf and the coal bunkers will be utilized.

The outfit will cost $75,000, and will have a capacity of five tons of coal bricks an hour.—*Enquirer.*

Luminous Paints.

For orange luminous paint, 46 parts varnish are mixed with 17·5 parts prepared barium sulphate, 1 part prepared India yellow, 1·5 parts prepared madder lake, and 38 parts luminous calcium sulphide.

For yellow luminous paint, 48 parts varnish are mixed with 10 parts prepared barium sulphate, 8 parts barium chromate, and 34 parts luminous calcium sulphide.

For green luminous paint, 48 parts varnish are mixed with 10 parts prepared barium sulphate, 8 parts chromium oxide green, and 34 parts luminous calcium sulphide.

A blue luminous paint is prepared from 42 parts varnish, 10·2 parts prepared barium sulphate, 6·4 parts ultramarine blue, 5·4 parts cobalt blue, and 46 parts luminous calcium sulphide.

A violet luminous paint is made from 42 parts varnish, 10·2 parts prepared barium sulphate, 2·8 parts ultramarine violet, 9 parts cobaltous arsenate, and 36 parts luminous calcium sulphide.

For gray luminous paint, 45 parts of the varnish are mixed with 6 parts prepared barium sulphate, 6 parts prepared calcium carbonate, 0·5 part ultramarine blue, 6·5 parts gray zinc sulphide.

A yellowish-brown luminous paint is obtained from 48 parts varnish, 10 parts precipitated barium sulphate, 8 parts auripigment, and 34 parts luminous calcium sulphide.

Luminous colors for artists' use are prepared by using pure East India poppy oil, in the same quantity, instead of the varnish, and taking particular pains to grind the materials as fine as possible.

For luminous oil-color paints, equal quantities of pure linseed are used in place of the varnish. The linseed oil must be cold-pressed and thickened by heat.

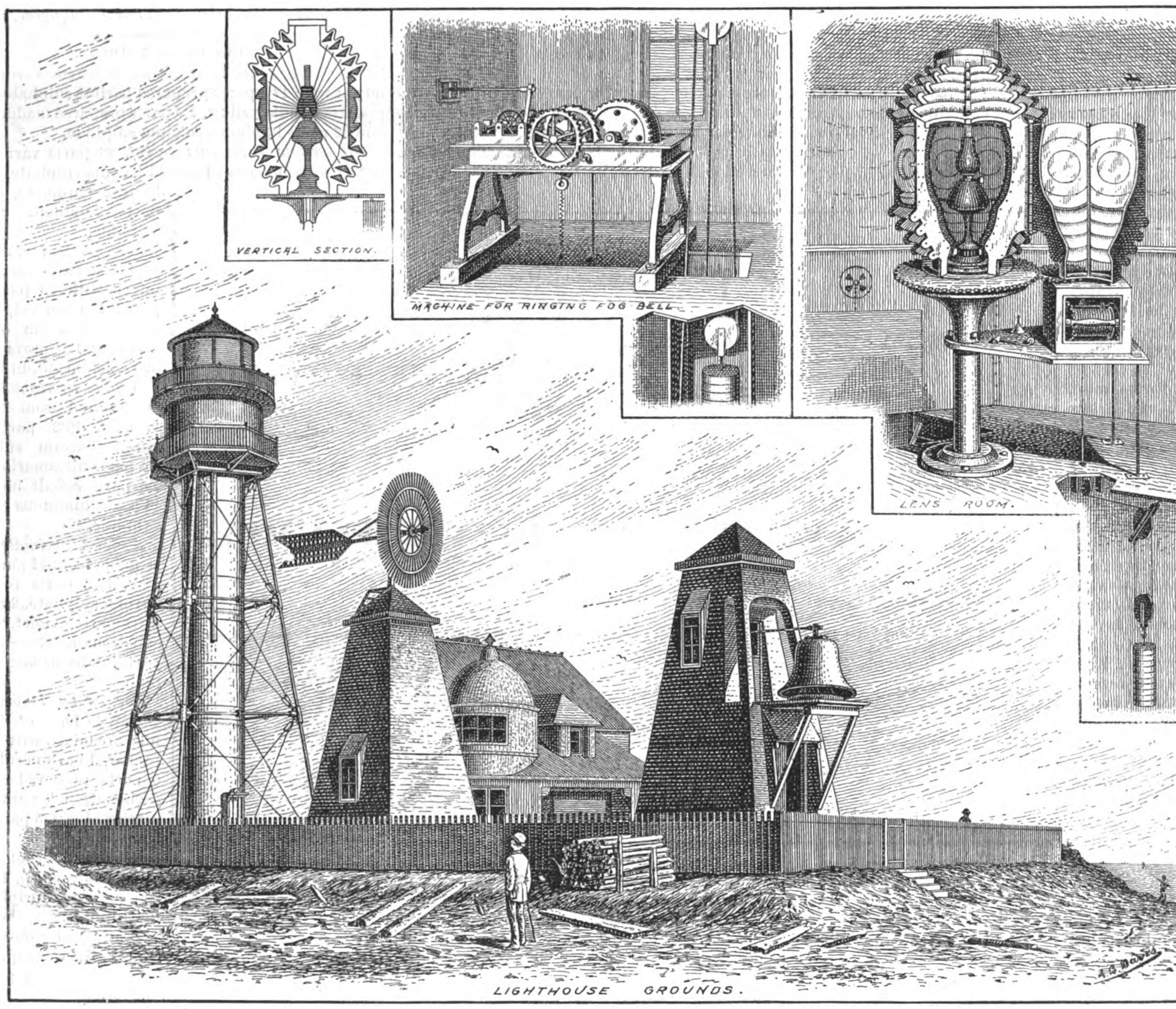
All the above luminous paints can be used in the manufacture of colored papers, etc., if the varnish is altogether omitted, and the dry mixtures are ground to a paste with water.

The luminous paints can also be used as *wax colors for painting on glass* and similar objects, by adding, instead of the varnish, 10 per cent more of Japanese wax and one-fourth the quantity of the latter of olive oil. The wax colors prepared in this way may also be used for painting upon porcelain, and are then carefully burned without access of air. Paintings of this kind can also be treated with water glass.—*Ztschr. Oest. Ap. Ver.*

THE list of articles to be admitted free of duty to Cuba and Porto Rico from the United States, under the new reciprocity treaty with Spain, on and after September 1, includes the following: Woods of all kinds, in trunks or logs, joists, rafters, planks, beams, boards, round or cylindrical masts, although cut, planed, and tongued and grooved, including flooring; woods for cooperage, including staves, headings, and wooden hoops; wood boxes, mounted or unmounted, except of cedar; woods, ordinary, manufactured into doors, frames, windows, and shutters, without paint or varnish, and wooden houses, unmounted, without paint or varnish.

NEW FLASH LIGHT AND FOG BELL AT CONEY ISLAND POINT.

This new lighthouse is 81 feet in height above the foundation, and is 76⅛ feet to center of light above low water. The cylinder on which watch and light rooms stand is 60 feet in height and 6 feet in diameter, and is made in nine courses of ¾ inch wrought iron. The four supporting rods are 6 inches in diameter. These are braced every 20 feet on the four sides by 4 inch girders and 1½ inch cross braces. The four upright supports are each bolted to the foundation by four 1⅛ inch bolts. The foundation is 24 feet square at the top. Piling of white oak was first driven down to the depth of 32 feet. On the piling were placed two rows of yellow pine timber 12 × 16, one row crossing the other, leaving an opening between each timber of 12 inches. The open spaces were then filled up with concrete. The timber was then covered over with 18 feet of concrete. The watch room above the top of cylinder is about 9 feet in height and 9 feet in diameter. It is fitted up with closets for keeping lamp chimneys, oil, etc. Above this is the light room, containing the lens. The room is about 7 feet in diameter and about 6 feet in height up to the top of the windows, where it runs up to a point about 2 feet, making the height of room from the center about 8 feet. The lens is of the fourth order, and is 2 feet and 10 inches in height and 20 inches in diameter. It is made entirely of brass and glass, and contains 90 curved prisms and 10 mirrors. The lens is bolted at the bottom to a 20 inch gearing wheel which revolves around on a ball socket inside of the pedestal. The pedestal stands in the center of the room and is 3 feet 6 inches in height and 6 inches in diameter. The lamp holds two quarts of kerosene oil and will burn 7 hours. The lens makes a red flash by means of a red globe on the lamp every 10 seconds, and one revolution in 1 minute 10 seconds. The light can be seen 16⅛ nautical miles. It is run by clockwork connected to the gearing wheel holding lens. The weight used is 60 pounds. The lens will revolve four and a half hours with one winding up of weight. The keeper visits the light every four hours. To see the full force of light a person must stand directly in front of the mirrors. As soon as each mirror gets at an angle, the light disappears gradually and makes a red flash. The fog bell is rung by a Stevens machine. The weight used for ringing bell is 540 pounds, and will ring the bell with one winding up for three hours. The bell rests on a pedestal running up on the inside and fastened to the top. The hammer works on a pivot at the top, striking the bell on the inside. The bell weighs 1,482 pounds and can be heard from 1 to 5 miles, according to the state of the weather. The size of lighthouse grounds are one and one-sixth acres. There is also a wellhouse and cottage upon the grounds. The depth of sunken well is 21 feet. The cottage contains 8 rooms with cellar. The grounds about the buildings had to be remade. They were first covered with 18 inches of yellow clay, over the top of which was added 12 inches of soil and then sodded. The lens was made by Sautier & Co., Paris, France. Cost $1,500. The entire grounds and buildings cost about $28,000.



NEW FLASH LIGHT AND FOG BELL AT CONEY ISLAND POINT.

A New Harlem River Bridge.

Work has been begun on a new bridge over the Harlem River at Seventh Avenue, New York City. The plans have been prepared by A. P. Boller, C.E., 71 Broadway, New York City, and it is estimated that the cost will be about $1,250,000, the full amount appropriated by the legislature. There is one draw span of 412 feet in length, giving a clear water way of about 160 feet on either side of the central pier. It is estimated that this draw will weigh about 2,400 tons, and it will be operated by a 60 horse power engine. It will be one of the heaviest draw spans in the world. The stone work of the central pier is to be rock-faced ashlar in two-foot courses, the copings being all cut stone. The superstructure will be entirely of mild steel and the floor of the bridge will be of the buckle plate type covered with asphalt laid in bituminous concrete. The width of the bridge will be 67 feet over all, 40 feet of which is devoted to a roadway, with two 10 foot sidewalks on either side. The length of the bridge proper will be 731 feet, and the approach 1,740 feet, making the total length 2,471 feet.

The Electrical Pyrometer.

It appears from a paper by Mr. H. L. Callender, published in the *Philosophical Magazine*, that at last something like precision has been secured in a thermometer for high temperatures. This much-needed instrument is made by Mr. Callender in the form of a platinum resistance, the simplest shape of which consists of a coil of fine wire welded to leads of comparatively low resistance. The electrical resistance of such a wire varies according to its temperature; so that the reading of the one gives the other by consulting a table prepared with reference to the zero of the instrument. The well known Siemens electrical pyrometer depends upon the same principle; but in this case the zero is known to change largely and continuously. Mr. Callender, however, indicates that this effect is due to the imperfect design of the Siemens instruments; and he declares that if the wire is pure to start with, and is protected while in use from strain and from contamination, its resistance, after having once been annealed, is always very near the same at the same temperature. Mr. Callender's improvements in the platinum resistance thermometer, or pyrometer, seem therefore to consist in the better protection and treatment of the platinum wire. This is differently treated according to the heats to which it is to be exposed. For use at temperatures below 700° C., the leads may be of copper or silver, and the tube of hard glass. For rough work at temperatures below 1,000 C., very fair results may be obtained by the use of a wrought iron tube. The instrument is the size of an ordinary thermometer.

An Aluminum Boat.

Interesting experiments have recently been made on the Lake of Zurich with a boat built entirely of aluminum. The boat weighs only about half a ton—viz., about half the weight of an ordinary boat of the same size. It was built at the works of Messrs. Escher Wyss & Co., of Zurich, the metal having been furnished by the Aluminum Works, of Schaffhausen, where it is obtained by an electrical process, the dynamos being driven, not by steam engines, but by turbines, which utilize the water power of the celebrated falls of the Rhine, so that the boat claims to be exclusively the product of Swiss labor and power. It carries eight persons, and, with a petroleum engine of only two horse, easily makes six miles an hour. Aluminum not being subject to rust, the permanent color of the boat is a beautiful dull white, while the chimney, being of polished aluminum, shines like silver. The trial trips of the boat were eminently successful, and it is anticipated that the construction of aluminum steamers, having the same capacity and only half the weight of the iron ones now used on Swiss lakes, has a great future before it.

REFRIGERATION FOR TOWNS AND CITIES BY STREET MAINS.

The Colorado Automatic Refrigerating Company, of Denver, is, we believe, the first and thus far the only company to successfully introduce a method of supplying refrigeration to families, restaurants, saloons, hotels, meat markets, commission houses, etc., by means of street mains. Established in 1889, at a cost exceeding $130,000, it is already a demonstrated success. The plant of the company, as shown in our illustration, occupies a room 40 by 180 feet in size. Over two miles of street mains have been laid. Numerous applications for street service, beyond its capacity, have been necessarily declined. An extensive cold storage warehouse, issuing negotiable warehouse receipts, is operated in connection with it. It is the business of this company to furnish thorough refrigeration at lower cost than the same could be obtained, in an inferior and imperfect manner, from the use of ice. The company have secured a franchise from the city to lay mains in its streets and alleys. About one hundred and fifty service connections can be made to the mile, service boxes being provided at the sidewalk, similar to those supplied by water and gas companies.

The street piping is virtually a part and an extension of piping surface supplied and according to the amount of ammonia allowed to flow through.

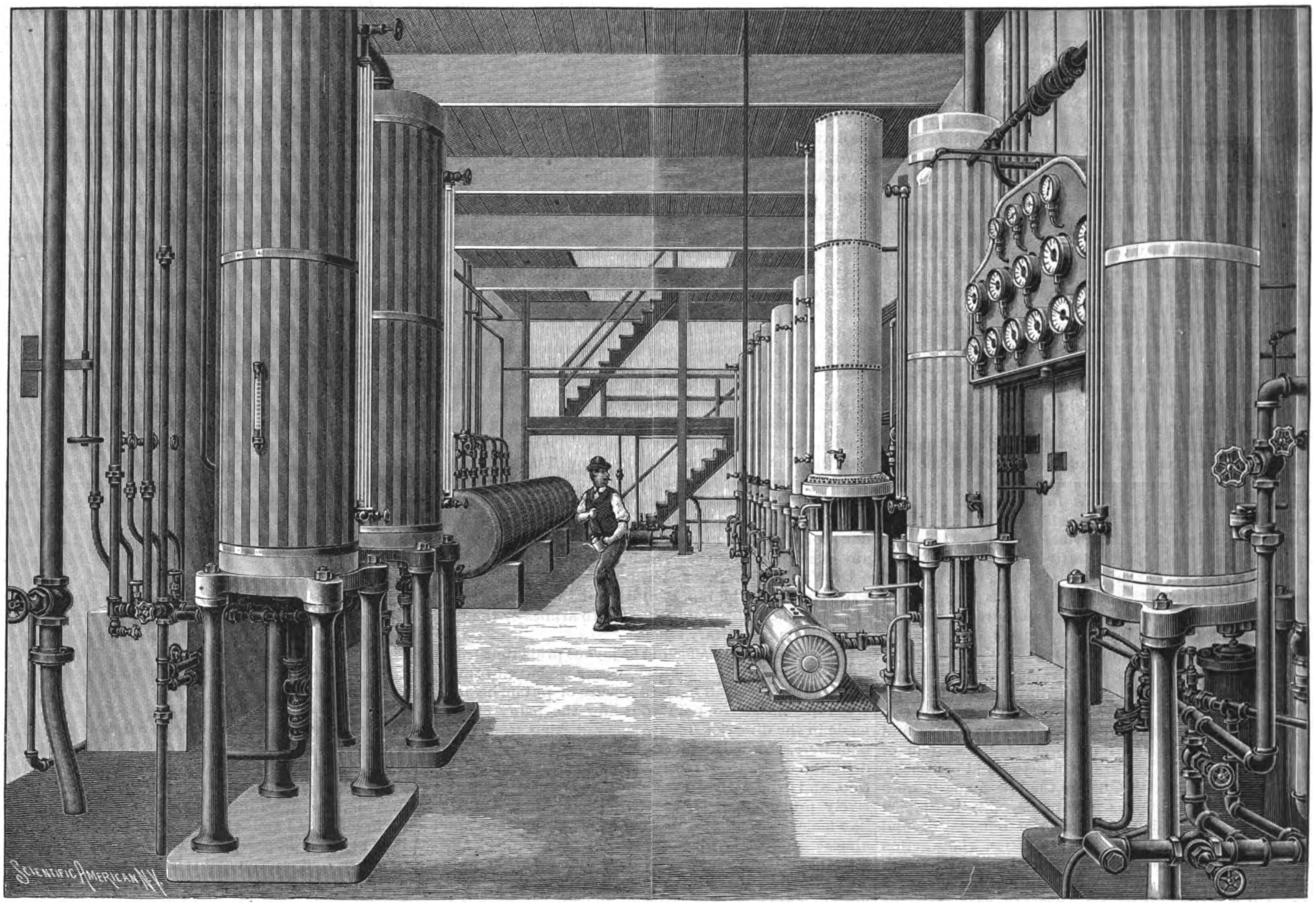
No refrigeration is done in the conduits in transit to the consumer because a pressure is maintained to hold the ammonia in liquid form, therefore no refrigeration is lost. The entire amount is delivered where it is utilized and paid for.

The liquid anhydrous ammonia used is contained in strong reservoirs under a pressure of 150 pounds, and in expanding absorbs heat from the coil and from the air surrounding it and from the material to be refrigerated. The ammonia gas resulting from the expansion of the liquid ammonia is returned to the central station, through another pipe, where it is absorbed by water, which has a great affinity for ammonia. It is then separated from the water by distillation, and cooled and reconverted back into liquid ammonia, being held in that state in the receiver ready again for use. The ammonia is, in this way, carried through pipes at small expense, as the quantity required is small, an inch and a quarter pipe being sufficient for the street main of an entire district. When refrigeration is desired, ammonia is turned on by opening a cock in the supply pipe. This is automatically turned on and off by an electro-magnet connected with a thermostat. When the temperature of the box or room falls below a standard, the valve stops the flow. It also opens it when the temperature rises above a standard, obviating the necessity of any attention from the engineer in charge.

manufacturing artificial ice in closets adjoining the kitchens, freezing ice cream and carafes of table water, and cooling bottles of champagne.

The Denver Club, an extensive institution well known among club men thoughout the United States, and located a mile distant from the central station, has six different compartments refrigerated by the company, maintaining six different temperatures. One for fruit at about 45° Fah., one for meats, fish, game at 36° Fah., one for wines and liquors at 40° Fah., and one for freezing carafes of water, ice cream, and wines at about 10° below zero. Fresh meat, poultry, game, fish, and all kinds of delicate food are thus readily preserved for weeks, in the warmest weather, obviating the waste heretofore attendant upon the use of ice in the old-fashioned way, it being possible when necessary to hold refrigerators or cold storage rooms at a permanent temperature of 20° below the Fahrenheit zero. The system is also readily applicable to hospitals, theaters, sick rooms, and wherever it may be desirable to reduce temperature.

The system operated by this company is covered by a combination of twenty to thirty patents, the most important of which applies to the storage of the surplus refrigerant in receivers to be drawn upon as wanted, obviating the necessity of the continuous operation of the machine used in the manufacture of the anhydrous ammonia.



PLANT OF AUTOMATIC REFRIGERATING COMPANY, DENVER, COL.

of the storage tanks located at the central station, and consists of three lines of extra strong ammonia pipe, laid in cement and connected by special steel fittings. One pipe is called the "liquid line," for the conveyance of anhydrous ammonia under pressure, and is about one and one-quarter inches in diameter. Another, two to three inches in diameter, according to its distance from the central station, is called the "vapor line," or return main, for returning the expanded ammonia in gaseous form after having performed refrigeration. The third pipe, known as the "vacuum main," is about one inch in diameter, and is connected at each customer's service box with both the liquid and vapor lines. Its office is to remove any accumulation of gas from main or branch lines.

A suitable amount of piping, called the "expansion coil," is placed in each refrigerator, or apartment intended to be refrigerated, one end being connected with the "liquid line," the other with the "vapor line." A valve, when opened, allows a trickle of ammonia to enter the expansion coil, and the liquid ammonia, when relieved of pressure, boils or vaporizes at 25 degrees below zero of Fahrenheit, thus cooling the piping and producing an exterior covering of white frost, refrigerating the box or apartment inclosing it to any desired temperature, according to the amount

Exhaustive experiments are said to have resulted in establishing the fact that one pound of anhydrous liquid ammonia has the same refrigerating power as three pounds of ice. Water and vapor from melting ice saturate with moisture the contents of the most expensive and perfect of modern improved ice refrigerators. The odors of the various foods deposited in them is absorbed by the damp air so that the flavor of each is injured, recognizable as the "ice box taste." The *absolutely dry refrigeration* of this system is one of its most important features.

A walk along the line of the mains now in operation and a glance at the results is interesting. At one place the temperature of a large butter room of a commission house is held by contract at 42° F. Near by is the meat room of a wholesale market with a constant temperature of 36° F. Adjoining, the beer vault of an extensive brewery is properly cooled, while on the principal retail streets are found numerous saloons, restaurants, hotels, and club houses availing themselves of similar facilities in a variety of ways, such as

The machinery which we illustrate, and which was photographed specially for us, is a modified type of the refrigerating apparatus known as an absorption machine, the essential process of which is the separation by heat of the ammonia from its water, the cooling and condensing of the same to liquid anhydrous ammonia, the use of this liquid in street lines, and the absorption of the expanded gas from the return main back again into its water, to be again distilled, reliquefied and sent out, the waste of material in the cycle of operations being very slight. The construction of machinery suitable for pipe line work necessitated a number of costly experiments, as the variations in the rate of the refrigerating load are often sixty-five to seventy per cent above or below a daily rate, and such changes often occur within a very short space of time. Such perfection has been attained in this particular that the machine equalizes the pressure automatically without attention from the engineer and adjusts itself to the irregular use of the liquid. The company claims that its safety devices and its system of operation are such that any serious accident is an impossibility.—*W. Y. Beach.*

Correspondence.

Wolf's Comet.

To the Editor of the Scientific American:

Wolf's periodic comet is now well placed for observation, and it is bright enough to be visible in telescopes of moderate aperture. I send the following places to enable any who may wish to see the comet to pick it up without difficulty.

September	R. A.	Declination.
1	3 h. 33 m.	+ 24° 51′
4	3 h. 40 m.	24° 5′
8	3 h. 49 m.	22° 57′

It will be seen that the comet is moving in a southeasterly course, and from the above its path in the heavens may be traced for future dates. On September 3 and 4 it is in the Pleiades, where it may be easily found. From the Pleiades the comet moves toward the bright star Aldebaran. The comet is small, with a bright nucleus and short tail.

WILLIAM R. BROOKS.

Smith Observatory, Geneva, N. Y., Aug. 26, 1891.

The International Congress of Hygiene and Demography.

One of the most interesting and important gatherings of scientific personages that has taken place in these later days is the congress now in session in London, in the rooms of the Royal Society. The science of demography, we may here remark, relates to the statistics of population, mortality, etc. The opening address was made by the Prince of Wales, who said: "My hope is that the work of this congress may not be limited to the influence which it may exercise on sanitary authorities. It will have a still better influence if it will teach all people in all classes of society how much every one may do for the improvement of the sanitary conditions among which he has to live. I say distinctly 'all classes,' for although the heaviest penalties of insanitary arrangements fall on the poor, who are themselves least able to prevent or bear them, yet no class is free from their dangers or sufficiently careful to avert them. Where could one find a family which has not in some of its members suffered from typhoid fever or diphtheria, or others of those illnesses which are especially called 'preventable diseases'? Where is there a family in which it might not be asked, 'If preventable, why not prevented?' I would add that the questions before the congress, and in which all should take a personal interest, do not relate only to the prevention of death or of serious diseases, but to the maintenance of the conditions in which the greatest working power may be sustained."

At the conclusion of the Prince's address, speeches were delivered by representatives of France, Italy, Austria-Hungary, Saxony, and Prussia, in which all bore high tribute to the part which has been played by England in the promotion of measures calculated to preserve and improve the public health. Dr. Brouardel (France) was indeed specially emphatic:

"In the year 1837 appeared the act which rendered obligatory the registration of deaths. This act did not long remain alone. Under the impulse given by two of your most illustrious patriots, William Farr and Edwin Chadwick, you have organized a system of registration of the causes of diseases and of deaths. Certain important cities, before the law made it obligatory, obtained supplies of water beyond all suspicion of pollution, and adopted systems of removal of foul water and waste matters. In these cities, whose action cannot be too much praised, the sickness and death rates diminished rapidly; this furnished the necessary proof it was time for reform. Twenty years ago the local Government Board was established, and in 1875 had submitted to Parliament a bill for the protection of the public health. During its discussion in Parliament one of your greatest ministers (Disraeli) pronounced in the House of Commons these memorable words, which should be repeated in all countries and in all Parliaments: 'The public health is the foundation on which repose the happiness of the people and the power of a country. The care of the public health is the first duty of a statesman.' Since this, each year you have made fresh improvements in your sanitary laws; if in your eyes they are not perfect, in the eyes of the nations who surround you they are an ideal toward which all their most ardent aspirations tend. It is your example they invoke when they claim from the public authorities the powers necessary to oppose epidemics, to combat the scourges which decimate their populations. You have taken the first rank in the art for formulating laws for the protection of health; this is not all that you have done in the domain of hygiene.

"Among the diseases which one can properly term pestilential, there are, thanks to the work of the hygienists of all countries, certain ones which from the present time may be considered as preventable: such are small pox, typhoid fever, dysentery, and cholera. For one of these, the most terrible, the immunity conferred by vaccination is absolute. The person upon whom this immunity is conferred can pass through the most severe epidemics and expose himself to all sources of contagion without being affected. Who is it that thus preserves from death, from blindness, from infirmity, millions of human beings of all countries and of all races? On May 18, 1796, a date which might well be the date of a great battle, Jenner inoculated with vaccine matter, by means of two superficial incisions, the youth James Phipps. Protection against small pox belongs to you; the world will be to you forever obliged.

"Let us consider two other epidemic diseases. Is it possible to establish the conditions of propagation of typhoid fever without quoting the names of Budd or of Murchison? I am aware that in 1855 Dr. Michel de Chaumont had for the town in which he lived experimentally established the *role* played by drinking-water in the propagation of this disease. Unhappily, public opinion was not prepared, and his discovery was not listened to. In the work which we are considering, the efforts of the English school were most fruitful. May I recall the fact that it was the epidemic of cholera in 1866 in England which gave birth to the theory of its propagation by drinking-water? Was it not at that date that, under the influence of your hygienists, the lords of the Privy Council issued an order formulating the laws of prevention which we adopt to-day? Certain it is that even in England these discoveries have not immediately borne all their fruit. The anti-vaccination leagues are not yet dead. Proofs accumulated during a century have not sufficed to cure that mental blindness which is congenial. . . . Can France be represented in a congress of hygiene without recalling the name of M. Pasteur? For centuries we have asserted that epidemic diseases were propagated by means of contact, by the air, by the effluvia, by miasmata. The idea of morbific germs, if not the name, is even found in the works of Hippocrates, but in what an uncertain sense.

"The theory of contagion has passed from century to century with strange modifications; the uncertainty of the methods of research and the difficulties of observation bound up together truth and error. It remained for Pasteur to prove the existence of these germs, their form, their life, their mode of action, and by their attenuation to solve the problem of immunity. Thanks to his work, and thanks to those of his pupils, realities have succeeded to contingent possibilities. We know some of our enemies, their habits, and their mode of penetrating the body; up to this time man was conquered by these infinitesimal beings, but, thanks to recent discoveries, he will be their conqueror. When, at the beginning of a century, one can inscribe the name of Jenner, and at its end that of Pasteur, the human race may rejoice. More has been done for it against misery, disease, and death than in any one of the centuries which have preceded it."

Dr. Van Coler, the medical director-general of the Prussian army, the representative of the German government, showed the aid rendered to armies by the improvements in sanitary science.

"It is indeed with a feeling of joyous pride that from this place and in this country, where we have to trace the very cradle of all modern science of public health, I am permitted to point out how the many efforts made in the direction of hygiene radiating from England were, especially in Germany, hailed with much delight; where they received the most careful attention, and where they ever since have been most actively promoted. . . . If from our army diseases like malaria, small pox, dysentery, have completely, or almost completely, disappeared; if typhus fever and diphtheria become more and more diseases of the past, we have to be thankful for these attainments to the development and application of hygiene. . . . It is now an established fact that infectious diseases are by no means a necessary evil in the army. They are simply diseases which can be avoided, which can be powerfully opposed, and against which the science of our days battles victoriously with ever increasing success."

Proposed Observatory on Mont Blanc.

Particulars of the observatory which it is proposed to erect on Mont Blanc are given in the *Neue Zuricher Zeitung*. It will be remembered that last year M. Joseph Vallot erected an observatory and hut of refuge on Mont Blanc on the Rocher des Bosses, 1,312 ft. from the summit of the mountain; but this undertaking is now to be eclipsed by the construction of an observatory on the very summit of Mont Blanc (15,781 feet above sea level). The idea originated with M. Janssen, who stayed on the mountain some time last summer for the purpose of making meteorological observations. In conjunction with M. Eiffel, and with the support of M. Bischoffsheim, Prince Roland Bonaparte, and Baron Alfred de Rothschild, he has now elaborated a plan which is as daring as the Jungfrau Railway scheme. The observatory is to be entirely of iron, and is to have a length of eighty-five feet and a breadth of twenty feet. The iron roof is to have the spherical form of an ironclad turret, which the construction will much resemble. The erection of such a building on the highest point of Mont Blanc naturally involves thorough preliminary studies, with which a Zurich engineer experienced in works on high mountains has been charged by M. Eiffel and M. Janssen. In the first place, it is necessary that a firm foundation should be found for the supports of the building on the rock of the mountain. For this purpose a horizontal gallery is to be driven through the ice of the highest glacier until rock is met with, and by means of this gallery the formation and position of the rock buried beneath the ice and snow are to be ascertained and examined. If once this has been accurately determined, a structure is to be designed which will give to the observatory a firm hold by iron pillars founded in the rock. It is not stated how these pillars are to resist the movements of the ice. The question of how the heavy materials are to be moved to the top of the mountain does not appear to give much concern, but, whatever method is adopted, it will certainly prove laborious and very costly. More is thought of the work of surveying, which was to have been commenced this month. Should the surveys prove the practicability of the plan, it is intended to proceed with the erection in September.

Pictet's Fluid.

Carbonic acid, or, as scientific purists will have it, carbonic anhydride, in the solid state, has now been employed for a good many years past in the production of intense cold; but inasmuch as the snow-like substance (partly from its rapid evolution of vapor, partly owing to its flocculent physical condition) is not easy to bring into very close contact with a solid body, it is generally necessary to mix it with some liquid. Thus it is difficult—almost to impossibility—to freeze mercury by merely surrounding it with solid carbonic acid. When, however, a little pure, dry ether is mixed with it, solidification of the metal takes place within a very few minutes. This, in fact, is a very favorite lecture table demonstration, and is accomplished without any trouble whatever. The comparative high boiling point of the latter, nevertheless, detracts largely from the effect, and hence the mixture in question is not so suitable for the production of very low temperatures as it might otherwise be.

It has recently been found by M. Raoul Pictet that when a mixture of the anhydrides of sulphurous and carbonic acids is liquefied by cold and pressure, the fluid thus obtained is more manageable than the carbonic acid-ether mixture just referred to. It produces, by its rapid volatilization, an extremely low temperature, and, for purposes of this kind, is now known as "Pictet's fluid." Aided by a mechanical pressure of four to ten or twelve atmospheres—for most purposes one of about nine is amply sufficient—gaseous nitrous oxide is readily liquefied by the cold resulting from the evaporation of "Pictet's fluid." Then by the use of this liquid nitrous oxide a yet more intense cold is obtained, and, under pressures of from 120 to 200 atmospheres, hydrogen, oxygen, nitrogen, and common air are rendered fluid. Fluid air, the temperature of which is not much above 200° C., is described as a blue liquid; and on letting a little escape, a distinctly blue cloud is formed in the air, disappearing very quickly as the vapor diffuses in the air.

Ground Bone as a Fertilizer.

In a report on experiments made at the New Jersey Station with ground bones as a fertilizer, it is pointed out that ground bone is both a phosphate and a nitrogenous manure, insoluble in water, but when in the soil is decomposed and yields its constituents to the feeding plant in proportion to the fineness. It varies but little in composition and is less liable to adulteration than most fertilizers. They, in fact, are usually pure. Ground bones have a tendency to cake, and to avoid this the manufacturer may use other substances which, while aiding mechanically, reduce the chemical value of the mixture. Raw bone is most usually pure, but the fat it contains renders it less easily decomposed. Bones having served the purpose of the glue maker are low in nitrogen and very high in phosphoric acid. The method now employed of steaming the bones under pressure improves their quality without altering the amount of the plant food ingredients. As the value of ground bones depends upon composition and their fineness, a mechanical as well as chemical analysis is required to determine their value. The farmer must determine by crop tests which grade he should buy—whether, for example, pay a dollar for ten pounds of phosphoric acid in one condition, or for eighteen and a half pounds in another form. Average wood ashes are worth $9 per ton, but the best vary considerably.—*Fruit Growers' Journal.*

A New Disinfectant.

A recent discovery, which is the outcome of the investigations of Dr. H. Oppermann, and which he has also patented, is the application of dolomite to antiseptics. The dolomite, after a special preparation, is mixed with a certain proportion of oxide of iron and iron pyrites, and the mixture is employed in the form of a powder. According to the experiments made at the Hygienic Institute, at Kiel, it seems likely to substantiate its reported efficacy.

A FAITHFUL AND TIRELESS SERVANT.

The patient, tireless, hardy beast of burden forming the subject of our illustration has borne an extremely important if not always duly credited portion of the labor of opening up our new western country, both on the great plains and in the mountain regions. In our fully illustrated description of the building of the Pike's Peak railroad, in the SCIENTIFIC AMERICAN of January 24, it was stated that "all provisions, tools, and camping outfits were transported by trail to the various camps along the line on the backs of mules and burros," but, in addition to this general credit, we now present a view, from a photograph, of one of the animals so employed. Odd as the view must seem to most of our readers, it is by no means an uncommon one to those familiar with life at mining camps in the mountains and in many other places distant from the railroad lines. And, with variations in the character of the burdens, these same sturdy, diminutive equines, which would generally be classed as donkeys at the East, or as bronchos, burros, or Indian ponies at the West, have borne a large part of the labor attendant upon the advancing settlement of the plains.

A HELPER ON THE PIKE'S PEAK RAILROAD.

Our engraving was made from a photograph sent to us by Mr. John Potter, of Colorado Springs, Col.

Synthesis of Indigo-carmine.

Heymann has succeeded in effecting the synthesis of indigo-carmine, the disulpho acid of indigo, by acting upon phenyl-glycocoll with fuming sulphuric acid. If, for example, phenyl-glycocoll be mixed in a test tube with ten to twenty times its mass of fuming sulphuric acid containing 20 to 25 per cent of sulphuric oxide, and gently warmed, it dissolves with a yellow color, evolving sulphurous oxide gas. On pouring the solution upon ice, it rapidly assumes the greenish-blue color of indigo-carmine. For its production the following method gives the best results: One part of phenylglycocoll is mixed with 10 to 20 parts of sand and then introduced into twenty times its mass of fuming sulphuric acid, warmed to 20° or 25°, containing 80 per cent sulphuric oxide; the temperature not being allowed to rise above 30°. The glycocoll goes easily into solution with a yellow color, which at once, with evolution of sulphurous oxide, passes into the deep-blue color of the indigo solution. To remove the concentrated acid, the mass is diluted with sulphuric acid of 66° B. The coloring matter is isolated by farther dilution with ice and the addition of salt. As so prepared the product is completely pure indigo-carmine. The colors obtained in dyeing with it far exceed in brilliancy those obtained from the best varieties of commercial indigo. Its identity with the natural product was established by means of its chemical reactions, by dyeing tests, and by spectroscopic examination. The yield is about 60 per cent of the glycocoll taken. —*Ber. Berl. Chem. Ges., Amer. Jour.*

The Kermes (Coccus Ilicis).

From the earliest ages this insect has been employed to impart a scarlet color to cloth. It was known to the Phœnicians under the name of Tola and to the Arabians and Persians as Kermes or Alkermes (Al signifying *the*, as in the Arabian words Alchemy, Alkali).

Dioscorides calls it *kokkos*, and Pliny *coccum* and *granum*. In the middle ages it received the epithet Vermiculatum, or "little worm," from its having been supposed that the insect was produced from a worm. From these denominations have come the Latin *coccineus*, the French *cramoisi* and *vermeil*, and our own words crimson and vermilion. The *Coccus ilicis*, or kermes, is found in great numbers in India and Persia, attaching itself to the leaves of a small oak, the kermes oak (*Quercus coccifera*), a low bushy shrub with evergreen spinous leaves, resembling holly. The kermes is also found in the southern countries of Europe and in the south of France. In parts of Spain, the kermes oak grows in great profusion, as on the sides of the Sierra Morena. Many of the inhabitants of Murcia gain a livelihood by collecting kermes. This work is for the most part done by women, who scrape the insects from the tree with their nails, which they allow to grow long on purpose.

The insect attaches itself to the young shoots of the shrub; the female affixing itself and remaining immovable, till after having reached its full size, about that of a pea, which it much resembles, it deposits its eggs and dies. It is gathered before the eggs are hatched, thrown into vinegar and then dried in the sun or in an oven. It has been, from time immemorial, used to dye cloth, and is supposed to have been the substance employed in dyeing the curtains of the Jewish tabernacle. As the color which it yielded was more beautiful than the celebrated Phœnician dye, it may have contributed to put an end to the monopoly of the Phœnician dyers.

The kermes yields a brownish red color, which alum turns a blood red tint. Dr. Bancroft showed that when a solution of tin is used with kermes dye, as with cochineal, the kermes is capable of giving a scarlet color quite as brilliant as that which cochineal produces, and to all appearance more permanent. But on the other hand, one pound of cochineal will produce as much coloring matter as ten or twelve pounds of kermes. Cochineal has supplanted kermes, and the latter is now only cultivated by the poorer inhabitants of the countries in which it abounds, especially in India and Persia, and the peasantry of Southern Europe.

Another species of kermes (*Coccus polonicus*) is very plentiful in Poland and Russia, and is sometimes called the scarlet grain of Poland. Before the advent of cochineal, this insect formed a considerable branch of commerce. In the neighborhood of Paris, and in many parts of England, the *C. polonicus* is found upon the roots of the perennial knawel (*Sceleranthus perennis*), a plant not uncommon in Norfolk and Suffolk. The color which it furnishes is nearly as fine as that of cochineal, and capable of giving the same variety of tints. The insect was formerly collected in the Ukraine, Lithuania, etc., and though still employed by the Turks and Armenians for dyeing wool, silk, and hair, but especially for staining the nails of Turkish women, it is rarely used in Europe except by the Polish peasantry.

The same may be said of other species which the cochineal has eclipsed, such as the coccus, found upon the roots of *Poterium sanguisorbis*, an insect formerly used by the Moors for dyeing silk and wool a rose color; and the *C. uva-ursi*, which, together with alum, dyes crimson.

All these species owe their coloring property to a principle called carmine.—*G. E. Cope in Science-Gossip.*

Locusts in Denver.

Our Colorado correspondent, writing from Denver, July 29th, says: "The city last night was full of grasshoppers, or rather Rocky Mountain locusts. Their stay was brief. They were apparently hastening in a bee line for the grass on the streets of Omaha. They came in immense swarms from the west, passing on toward Kansas and Nebraska, a few thousands only spending the evening here for rest and recreation."

They are supposed to breed beyond the range west of the city, and were driven across by the violent but brief storm. So abundant were they that the radiance of many of the electric lights was perceptibly obscured and many of the sidewalks were made slippery. The last visitation of grasshoppers to Denver occurred in 1874.

INDIA ink is made from fine lampblack compacted and cemented with glue. The finest black is derived from pork fat. The glue is made from buffalo hide.

Lac (*Coccus lacca*).

This insect, like its congener the cochineal insect, belongs to the order Hemiptera. Its habits and economy are nearly identical with it. When a colony of several males and females select a branch of a tree for their home, they puncture it, and a milky exudation follows, in which they are soon entombed, and which furnishes them with both food and shelter. It forms irregular dark-colored, resinous masses on the twigs of the trees which it surrounds, and which is gradually added to until they are sometimes nearly an inch in diameter. To each male insect it has been computed there are not less than 5,000 females, the males being twice as large as the females.

The trees most usually affected are the *Ficus Indica* and *F. religiosa*, which both abound in a milky juice. When the season arrives the natives collect the encrusted twigs, which in this state are known commercially as "stick-lac." It contains about seven per cent of resin and one-twentieth part of coloring matter. To separate the sticks, coloring, and other foreign matter, the stick-lac is placed in large vats of hot water, which melts the resin and thus liberates all impurities. It is then taken out and put in oblong bags of cotton, and a man standing at each end of the bag holds it over a charcoal fire. By this plan the resin is liquefied and drops through and falls on to the smooth stems of the banyan tree, placed purposely to catch it. This flattens it out into thin plates, and it is then known to us as shell-lac. If the coloring matter has not been well washed out, the resin is left of a very dark color. Thus we find in the lac market, orange, garnet, and liver varieties, that which most nearly approaches to a light brown color being the best.

When separated from impurities, pulverized, and the major portion of coloring matter removed, it is known as "seed-lac."

Sometimes it is melted up and made into small cakes. In this state it is known as "lump-lac." The water which remains behind after the lac has been softened is rich in a coloring matter akin to that of cochineal, so that when strained and evaporated, a beautiful purple residue is left. Cut into cakes this forms another important article of commerce, viz., "lac dye."

Shell-lac is soluble in anhydrous alcohol, ether, fat, and volatile oils. In the alcoholic solution it forms a fine varnish.

Hydrochloric and acetic acids also dissolve it. It is necessary sometimes to bleach it, for the manufacture of colorless varnishes, sealing wax, etc. This is effected by dissolving in caustic potash, and passing chlorine gas through the solution. It can then be pulled and twisted into sticks. Seed-lac is much more soluble in alcohol than shell-lac. Lac dye is soluble in sulphuric and hydrochloric acids. The mordant for use in dyeing is generally bi-tartrate of potass and protochloride of tin.

The chief use of lac is for the manufacture of varnishes and sealing wax. The differently tinted sealing waxes are produced by adding vermilion for red, ivory black for black, and verditer for blue (sometimes smalt is used). For a white wax, the lac is simply bleached as before mentioned.

To obtain the fine golden color sometimes seen, powdered yellow mica is incorporated with it. Shell-lac is imported from Assam, Siam, and an inferior quality from Bengal.

Pegu stick-lac is exceedingly dark, and therefore not fitted for the finer uses of lac; but the finest lac, of a very light sherry color, comes from Cicar.

We receive something like 1,000,000 pounds annually, but a large portion of this is again exported to Germany, Italy, and other foreign countries.

After the first melting of the lac it is usually more tenacious than after subsequent meltings, which tend to make it hard and brittle. The ancient Chinese were well aware of this property, as is evinced in some of their works of art, which remain perfect to this day. They are usually small boxes, either in wood or metal, which have had a thin coating of lac, and while soft and plastic, had been moulded into various beautiful forms. Some of these works of art fetch considerable prices.—*H. Durrant, in Science-Gossip.*

Improvements in Water Gas.

BY J. C. REISSIG, LA PLATA, AND J. LANDIN, STOCKHOLM, SWEDEN.

When steam is passed through incandescent carbonaceous fuel maintained at 550°—750° C., a gas is produced which consists mainly of hydrogen and carbonic acid, with only small quantities of carbonic oxide. When the fuel is maintained at a higher temperature, the proportion of carbonic oxide increases until, at a temperature of 1,000°, the resulting gas consists of a mixture of about 40 per cent of carbonic oxide and 50 per cent of hydrogen, with only about 5 per cent of carbonic acid. This is known as water gas, and its use is often objected to on account of the poisonous properties of the carbonic oxide contained.

The main object of this invention is to produce a gas containing but little carbonic oxide, and to increase its calorific power by removing the carbonic acid from the combustible gases. The process consists in passing steam (preferably superheated) or water through fuel contained in externally heated retorts, or in water gas generators, maintained at 550°—750° C. The resulting gas, consisting of hydrogen and carbonic acid, in the proportion of 2 to 1, is cooled and freed from sulphur impurities in the usual way. It is then passed through an absorbing apparatus containing carbonates of alkali or alkaline earths, preferably solutions of sodium carbonate (soda) or potassium carbonate (potash). These substances readily absorb (especially under pressure) the carbonic acid, forming bicarbonates, from which the carbonic acid is easily removed by the action of a moderate vacuum, especially if aided by heat. The remaining gas consists principally of hydrogen, and is ready for use, while the solutions are again available for unlimited repetition of the absorbing operations, etc.

RECENTLY PATENTED INVENTIONS.

Engineering.

ENGINE CROSS HEAD. — William S. Hughes, New York City. This cross head is made in two sections with aligning tapering bores and diametrical channels, the piston rod having one end tapered to enter the bore and having annular ribs to enter the channels in the walls of the bores, with other novel features, whereby the rod may be attached without threading it, or employing a key, cotter, or similar device. The cross head is so united with the piston that a secure connection is effected, and the piston rotated to another position without altering the distance from the center of the cross head to the face of the piston, the cross head and piston being quickly and conveniently disconnected when desired without injury to either.

GAUGE FOR ALIGNING ENGINES. — George J. Hunt and Thomas F. McKechnie, New Westminster, Canada. This invention provides for adjustable heads with central openings adapted to be secured in the ends of the bore of the cylinder, in connection with a cord holder adapted to be vertically or laterally adjusted to bring it in line with the central openings of the heads. The device is especially designed for use in assembling the parts of an engine to bring them in proper alignment, readily locating in the proper place also the bearings for the main driving shaft and the slides for the cross head, without going through the tedious processes now ordinarily followed.

Mechanical Appliances.

LATHE ATTACHMENT. — Martin L. Weeks, Yantic, Conn. This invention relates to attachments to facilitate cutting threads on small pipes, rods, etc., and doing miscellaneous work of this kind, providing therefor a die holder comprising a flanged pipe with a chambered head at the end opposite the flange and a perforated plate or cover for the chamber, the cover having an inner marginal flange and a central socket. The pipe holder has a base resting on the lathe bed and a perforated disk pivoted on the base, with means for rigidly securing it thereto. It is a simple device, readily manipulated, to firmly hold different sizes of dies and adjustably hold different sizes of pipes and rods in position to be cut by the dies.

PUNCH. — Francis N. Simmonds, San Francisco, Cal. This is a punch for use on iron, steel, etc., and having a removable face. The body of the punch has a shank on which the face is fitted and fastened by a bolt having a pointed head extending centrally from the face. The bolt extends nearly through the shank, its rear end being engaged by nuts in a recess in the rear end of the shank, and in operation its pointed front end first enters the material to be punched before the cutting edge of the face comes in contact therewith. The face of the punch can thus be readily renewed when worn out or injured.

BELT STRETCHER. — Claude Darst, Pomeroy, Ohio. This is a device capable of ready application to large or small belts to draw their ends together to give the desired tension, and to permit the workman to conveniently lace or otherwise fasten together the ends. Combined with sets of toggle levers formed with clamping arms to clamp the belt at each end are sets of connected nuts on which the toggle levers are pivoted, screw rods having right and left hand threads engaging the nuts to move the sets of toggle levers toward and from each other, and to open or close the clamping arms. The screw rods are turned by a suitable mechanism actuated by a hand lever.

ORE WASHING JIGGER. — Thomas Rowe, Ketchum, Idaho. This is an ore washer of simple and durable construction, designed to completely separate the ore from the tailings. It comprises a main frame, and a vertically reciprocating jigging frame with an endless belt passing over it and cams for raising and suddenly dropping it, with suitable water and ore supply connections, the belt and jigging frame being highest at the discharge end and also inclined laterally.

WAVE FORCE DEVICE.—William Mulholland, Los Angeles, Cal. This is a mechanism whereby the reciprocal movement of waves of water is designed to be converted into rotary motion for the purpose of supplying power. A gallows frame on a wharf supports a walking beam in vibrating position, and there is a flexible connection between the end of the beam and a float in the water, the inner end of the beam being connected by a rope with a grooved pulley on the cross shaft of a tilting frame supporting friction drums, the latter contacting with friction wheels. A number of these devices may be arranged in series and connected to one shaft to utilize power obtained as the result of wave force and gravity.

SPINNING FRAME LUBRICATOR.—Jose Alberto McDowell-Guajardo, Saltillo, Mexico. This is a device for lubricating the top rolls of spinning, slubbing, or similar frames, and is designed to economize labor and the material used as a lubricant. It is a trundling or rolling lubricator, capable of manipulation by hand, and composed of a central oil chamber and parallel circular series of radially arranged main lubricating tubes extending therefrom, the tubes in each series being arranged at equal distances apart. If the oil chamber is of sufficient size and the tubes are suitably connected, there will be no soiling of the main body portions of the top rolls with the lubricant.

STITCHING HORSE. — Henry J. Elskamp, Leadville, Col. This is a horse more especially adapted for use in harness making, and is designed to hold large pieces of leather in position while they are being stitched. The device comprises a seat on which is secured a clamp, while levers pivoted on opposite sides of the seat have their upper ends arranged to press against the clamp, toggle levers operated by a treadle mechanism connecting the lower ends of the main levers. The treadle lever is pivoted in the frame of the seat, and may be locked to hold the jaws of the clamp firmly on the leather, the levers pressing evenly upon both sides of the clamp.

Agricultural.

WINDROWER. — Frank L. Boals, Mansfield, Ohio. This machine is designed to be simple and inexpensive in construction, and easy to operate, in raking or gathering hay or straw into a windrow. Supporting wheels are independently journaled on the main frame, which carries horizontally-revolving rake frames provided with radial arms carrying sweeping teeth, the arms and teeth successively engaging and sweeping the hay toward each other and then rising from contact with it, the mechanism for revolving the rakes being operated by the forward movement of the machine.

Miscellaneous.

THEATRICAL STAGE MECHANISM. — Elmer E. Vance, Columbus, Ohio. This invention provides an apparatus to exhibit an effect on the stage to represent a locomotive and a train of cars, while the apparatus can be folded and packed in a small compass. Wooden uprights are provided with drums and pulleys for supporting and driving an endless cable, the uprights being braced to withstand tension of the cable, and a folding scene representing a locomotive and a train of cars is supported by one strand of the endless cable and drawn forward by the other strand. The head light, escaping steam, and sparks from the smoke stack are represented by suitable fireworks.

MUSIC HOLDER. — William F. Shaw, Yarmouth, Nova Scotia, Canada. This device comprises a support or shelf having a recess in its rear side and a slot in its front face, a lever pivoted in the recess projecting through the slot, while two transverse rods having cranks connect the lever at opposite sides of its pivot with the inner cranks of the rods, spring fingers being mounted on their outer cranks. The device is adapted for almost instant adjustment to allow or prevent the turning of leaves of music, at the will of the performer, and is convenient for use at a table as well as on a piano or organ, while it may be employed as an easel for supporting pictures, etc.

ICE CREAM FREEZER. — Frederic B. Cochran, New York City. This invention relates to freezers in which a cylinder holding the freezing compound is revolved in the material to be frozen, forming the subject of a previous patent by the same inventor, and provides a simple means for changing the height of the cylinder so that it will project the right distance in the material beneath. The ends of the cylinder protrude through the slots of a casing in which are pivoted levers supporting the cylinder, means being provided for fixing the position of the levers, while one of the ends of the cylinder is provided with a crank.

STOP BEAD FOR WINDOWS. — Walter Bruner and Edward W. Knemeyer, Fort Madison, Iowa. With a window frame having vertical grooves at opposite sides of its middle bead are combined tubular rectangular metallic stop beads entering the grooves, there being weights in the beads and pulleys at their upper ends, with the sashes and cords passing therefrom over the pulleys to the weights. This stop bead is designed to take the place of ordinary wooden beads, and its construction is such that it may be applied to old window frames as well as new, and will form convenient receptacles to carry the window weights.

CABINET FOLDING BED. — Arthur A. Zimmerman, New York City. This invention provides a novel construction in which the entire bed accompaniments, when in closed adjustment, will present an ornamental exterior. It contains means for adjustably counterbalancing the weight of the couch portion and its belongings, and auxiliary devices are embodied, partly automatic in their adjustment, which, when the bed is lowered, assume positions at the side of the bed, to afford the usual toilet facilities. The bed complete may be readily taken to pieces for transportation to the place where it is to be set up for use, the facility with which this is effected being one of the prominent advantageous features of the construction.

VEHICLE REACH COUPLING. — George E. Macy, Orlando, Florida. A detachable or adjustable slidable connection is provided by this invention, which dispenses with the usual front hounds and slide bars, also the usual sand bolster, thereby simplifying the construction of a wagon. A slidable bar, adjustable along the reach, has a fork at its front end to receive the front axle and bolster, which are united with it by the king bolt, and the bar has band-like clips through which the reach passes, independent locking means being provided for securing the bar and reach together. The device may be used on either one or two horse wagons, but is especially designed for one horse wagons for farm use.

COUPLING FOR SLEIGHS. — Richard Eccles, Auburn, N. Y. This is a strong and simple thill coupling to which the thills of a sleigh may be easily attached, and is also adapted to form a support for the shifting bar, that the thills may be easily changed from the bar to the coupling. It consists of a vertically apertured bar having transverse apertures and spaced ears, each extended to form a brace, one curved upwardly and the other downwardly. This coupling facilitates the shifting of the thills when desired to allow the horse to follow a well beaten path and the sleigh to follow the track.

INCUBATOR. — Frank C. Beardsley, Billerica, Mass. This invention provides an improved construction in which heat and moisture are designed to be effectively and equally distributed to insure a safe development of the embryos. The heating chamber has a metallic bottom and is arranged over a hatching chamber containing trays, the heating chamber being heated by a pipe discharging into it, while below the trays are arranged moisture boxes into each of which extends a pipe connected with the outer air, the inflow of which is regulated by a damper. The temperature is regulated by means of a thermometer arranged upon the free end of a lever, which is actuated by the expansion and contraction of the mercury.

ORANGE SIZER.—John J. McClendon, Leesburg, Florida. This is a machine for separating oranges into grades of different sizes, and consists of a rotary feed table having pockets with gates at their bottoms, which are gradually opened by one or more cams as the table revolves. The oranges are dropped through the gates into compartments for the different sizes, the extent of horizontal travel on the table and of the opening of the gates being so related that the different sizes are dropped at different points in the travel of the table, the smaller oranges first and the larger ones successively in the order of their size.

HITCHING POST.—Lafayette B. Hopkins, Council Grove, Kansas. This is an attachment for application to ordinary posts, providing for the ready hitching and unhitching of horses and operating to take up the slack, so that the horse cannot get his foot over the hitching strap. A weight box or casing is attached to the post by lugs or ears, and in the top of the casing is journaled a pulley to guide the hitching chain above the top of the post, the chain passing over the pulley and being connected at its inner end with a weight which slides vertically in the box.

GAME TABLE. — John P. W. Patillo, Greenville, Texas. This invention relates to parlor billiards, providing therefor a table on one end of which is an upright casing in which is arranged a series of vertical levers, each carrying at its lower end a ball touching neither the rail nor the floor of the table. The levers are so connected within the casing that on one of the balls at their lower ends being struck by a ball on the table, according to such rules as may be made for the play, a card containing a picture or numeral will be made to appear at one of several openings at the top part of the casing, the game admitting of many variations according to number and positions of balls played etc.

TOY BOWLING ALLEY. — John R. Pettit, New York City. This is a miniature device adapted to mechanically project the ball toward the pins when the latter are arranged after the usual style in playing, and means are also provided for stopping a ball sent to the projecting mechanism before the pins are set up or the projector adjusted. A gum band spring slides the pusher bar forward as it is released by a latch plate engaging a trigger rod.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention, and date of this paper.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(3314) Experimenter asks how the explosive used for priming cartridges is made and how applied. A. It is made by dissolving 1 part mercury in 12 parts nitric acid, and mixing the product with an equal quantity of alcohol. The liquid is heated to complete the reaction, is cooled, and the fulminate separates. It may be purified by recrystallization. In use it is mixed with sulphur and potassium chlorate or nitrate, and the mixture is secured in place by a drop of varnish.

(3315) G. A. W. writes: I have a deposit of kaolin which shows the following analysis:

Moisture	11·35
Silica	46·60
Alumina	39·30
Iron oxide	3·04

I also have a deposit of marl which shows by analysis 62 per cent carbonate of lime, and am informed that a combination of the two will make a superior cement. Will you please inform me how this can be done. A. The only way to make a cement such as you describe is to grind together proper proportions of your materials, make into lumps with water, dry and burn in a kiln. You may experiment on these lines, using an ordinary fire. The result is doubtful.

(3316) H. N. Van T. asks for a recipe for making automatic shading pen ink of various colors. I wish an ink of brilliancy, drying rapidly, and waterproof. Also a recipe for adhesive ink, used in making gold, metallic and other lettering. A. The general basis of such inks is a solution of gum arabic. This is not waterproof. An approximately waterproof body is given by a solution of shellac in borax water. An alcoholic solution of shellac may be used which will be quite waterproof if otherwise satisfactory. Color with aniline colors or diamond dyes.

(3317) G. S. asks: What process shall I have to put cow's horns through, to soften, so that I can twist them in various shapes? A. Boil the horns in soda or potash lye until soft. The horn will be brittle when pressed or moulded. Or try simple boiling water.

(3318) G. E. B. asks for a recipe to make what they call chalk engraving plates, that is the white compound that is on the steel plate. A. See our SUPPLEMENT, No. 790.

(3319) W. T. V.—The bright metallic particles in the sample sent are iron pyrites of no value. We see no indications of copper pyrites.

(3320) F. J. K. and M. J. M. ask how horn workers soften horn so that it can be made into different shapes. A. The safest way is to use boiling water. The moulds, if of iron, may be heated also by immersion in the same water. See query 3317.

(3321) G. J. H. asks how much a cubic foot of gold will weigh, avoirdupois weight. A. About 1209 pounds. It varies slightly, according to the treatment it has received, whether it is rolled or not, etc.

(3322) "Die Germania" asks for a good receipt for making printers' roller composition. A. Good proportions are 1 pound glue to 1 pint of molasses. Soak the glue in water for 24 hours, then melt with the molasses and cast in a mould previously oiled with olive oil.

(3323) W. C. P. writes: I notice in your issue of this date, page 73, the description of a static electromotor devised by Mr. Wimshurst. Is not this motor the same in action as the rotating glass globe with strips of tin foil on it, which, if I remember aright, Mr. George M. Hopkins described several years ago in his series of experiment with the Holtz machine, as published in the SCIENTIFIC AMERICAN? A. It seems to involve the same principle.

(3324) M. M. A. asks: Is there any way of patching rubber goods, such as hot water bags, etc.? If so, can you tell me what cement will do it or how to make it, one that will resist the action of hot water? A. The only effectual way to do this is to use a benzole or other solution of India rubber, apply to the surfaces and join, and then vulcanize, by Parke's cold process or otherwise. For general treatment of India rubber we refer you to "Rubber Hand Stamps and the Manipulation of India Rubber," $1 by mail. No good cement for vulcanized rubber has yet been discovered.

(3325) E. S. desires to learn from Notes and Queries what application to the human flesh would have a tendency to enlarge or extend the same, so as to make that part appear fat, or, what will hold a swelling created under the vacuum process permanently. A. Try vigorous massage.

(3326) C. M. asks for a composition for lining casks and like vessels, stoppers for bottles, etc.—For vessels and stoppers used for beers and ales, the compound not affecting or being affected by acids or other chemicals contained in those liquors. A. The ingredients are as follows, the powdered pipe clay being omitted if the composition is not to be used for moulding stoppers: Shellac 4½ pounds, resin 1½ pounds, wood carbon 4 pounds, powdered clay 4 pounds, palm wax ½ pound. These ingredients are agitated with 1½ gallons of methylated spirit, which "amalgamates all of them into a compound." Without the clay the compound is semi-liquid, and can be run or brushed over the surface to be coated, and allowed to dry.

(3327) D. D.—Waterproofing composition for stone, bricks, plaster and cement surfaces.—One pound of "gum dammar" is dissolved in 1 gallon of hot turpentine or hot mineral spirit, and 2 pounds of paraffin wax added. The paraffin dissolves, and the composition when cold can be brushed on to the surface to be waterproofed. Dirty surfaces should be first cleansed. The compound is kept in jars carefully corked.

(3328) M. T.—For furniture polish.— Mix together in or about the proportions given: Linseed oil 1 gallon, butter of antimony from ¼ to 1 pint, as desired, spirits of wine ½ pint, white vinegar 1 quart, gum cassia, a few ounces.

(3329) M. S. K. writes: Southern electrical workers seem to be scarce, so I will give you my experience in this direction. I have constructed several induction coils of different sizes, among them the one described in one of your SUPPLEMENTS, but deviated from instructions by using only eight ounces of No. 35 cotton-covered wire wound in two sections, insulating each layer with three thicknesses of tea paper; sparks realized are nearly half inch in length, without condensers, using three small bichromate cells. Have made telephone and microphone described in "Experimental Science;" they work admirably. I am now making a Blake transmitter. I have also constructed batteries, bells and galvanometers of my own design, and contemplate making simple electric motors, as soon as I can get the material.

(3330) A. W. B. asks (1) for prices of the metals named.

A. Vanadium	$9,979	per lb. avds.
Zirconium	4,536	" " "
Lithium	4,082	" " "
Rhodium	2,368	" " "
Iridium	906	" " "

2. Can you refer me to any work on the production of these metals? A. You will find the subject treated in manuals of chemistry. 3. What is the hardest known metal? A. Manganese is the hardest of twenty prominent metals, according to Bottone.

(3331) B. Y. S. asks: If beeswax is dissolved in spirits turpentine to the consistency of thick cream, how shall I color it white, also brown? A. White can only be produced by a solid pigment, such as Chinese white. You should start with bleached wax and the lightest colored turpentine. For brown use burnt sienna or prepare an aniline color by solution in water or alcohol and precipitation with a solution of soap.

(3332) W. P. B. writes: Will you kindly inform me through your paper if there is an artificial stone that will answer for posts and how it can be made. A. Best Portland cement 1 part, clean sharp sand 2 parts. Make a thick mortar, mix well, dump into a wooden box of the intended form of your post. The cement will be sufficiently hardened for removal from the box in twenty-four hours. To facilitate removal the box might be made of four separate pieces or staves temporarily held together with iron hoops.

(3333) G. H. I. writes: Will you please state what is the best gum to use on envelopes? A. First quality gum arabic is the best.

(3334) E. M. W. asks: 1. How can I remove rust from tin, say a tin pan used to hold copy cloths for copying letters? A. The rust cannot be permanently removed; the pan can be japanned, or what is better, have a tinned copper pan made, which will last years. 2. How can I prepare and apply copying ink to dried-out typewriter ribbons, either blue or green? A. Typewriter ink is described in the SCIENTIFIC AMERICAN, No. 21, vol. 59, query 15; No. 12, vol. 58; No. 7, vol. 56; query 22, No. 8, vol. 56.

(3335) G. W. O. asks: What date did the 19th century commence, and what time will it expire? A. It began January 1, 1801, and will end December 31, 1900.

(3336) T. G. D. asks: In which number of your paper will I find the explanation of firing a cannon ball from a moving train? A. No explanation should be needed. The motion received by the cannon ball is composed of the motion of the train and of the motion imparted by the firing, and may be graphically obtained by the parallelogram of forces.

(3337) M. M. W. asks: 1. In what ways and for what reasons does Siemens producer gas differ from ordinary coal gas used for lighting purposes? A. Producer gas is made by incomplete combustion combined with distillation of the fuel and at the same time by decomposition of water by the hot fuel. It is characterized by the presence of large quantities of nitrogen from the air, and carbonic oxide. Coal gas is made by distillation in a closed retort of bituminous coal, contains very little nitrogen, only a few per cents of carbonic oxide, and the rest is hydrogen and hydrocarbons principally. 2. What substances are used for lighting by incandescence? A. Oxides of the earths, magnesia, limes, zirconia, and others. Some become luminescent at lower temperatures than others, and so far are desirable. Some deteriorate more rapidly than others, which is a bad feature. Many mixtures have been experimented with. 3. How may coal gas be made to give a non-luminous flame? A. By mixing air with it before combustion, as in the Bunsen burner. 4. Why is it that ammonia is found in the products of combustion of carbonaceous fuel? By what means is it extracted and obtained in a form suitable for use in the arts? A. Because the fuel contains nitrogen already combined with carbon and hydrogen. On distilling coal ammonia is evolved, and is washed out with water, whence it is extracted by heating, first alone and afterward with lime. The ammoniacal gas evolved is collected in dilute sulphuric acid, whence ammonium sulphate is produced by evaporation. 5. In what way, and why, does coal belonging to different geological periods differ? A. No very good answer can be given. The coal of the older periods is apt to be more thoroughly compacted and altered than the recent coals and lignites. The latter are nearer in character to the wood and vegetable matter from which all were originally formed.

(3338) E. J. M. asks: What is the lifting power of gas? If a cylinder, 20 feet long, 10 feet in diameter (made of steel strong enough to hold), with a pressure of 200 pounds per square inch, what would be the upward pressure, or how much would it lift? If a vacuum could be made in the same cylinder, would the lifting power be greater or less? Also, how much? A. The more gas is compressed above the atmospheric pressure, the less will it lift. At 200 pounds to the square inch, hydrogen would be almost as heavy as air, and ordinary coal gas would be about six times as heavy, so that the cylinder would fall more rapidly than if filled only with air. Pure hydrogen will lift about 70 pounds to the thousand feet, coal gas about 40 pounds. A vacuum will have slightly greater lifting power than hydrogen, about 5 pounds more to the thousand cubic feet.

(3339) W. L. V. writes: 1. I have a fine film negative which has some small red spots on it. I think that they are silver stains, caused by printing on damp albumen paper. If such, what will remove them? A. Probably they are silver stains. J. V. Drake gives the following directions to remove: Soak the film for five minutes in clean water, meanwhile make a solution of iodide of potassium, 20 grains to an ounce of water. Immerse the film in this for ten minutes. If it is an old stain, immerse for half an hour. Dissolve half a drachm of cyanide of potassium in one ounce of water. Immerse the film in this and rub the stains with a tuft of absorbent cotton until they disappear. If the stains are very old, make the solutions stronger and immerse for longer time. 2. Give a formula for reducing negatives locally. A. To reduce negatives locally dissolve 10 grains of hyposulphite of soda and 5 grains of red prussiate of potash in one ounce of water. Apply to spot with camel's hair brush.

(3340) F. W. S. writes: 1. In your issue of August 22 is not the answer to query 3282 a mistake? I have figures which show the fusing point of platinum at from 3900° to 4000° Fah. A. The figures are erroneous. It should read 3800° Fah., instead of 3080° Fah. Such temperatures are only approximate. 2. What is the highest degree Fah. which can be obtained with ordinary gas blowpipe? A. 6000° to 6800° Fah.

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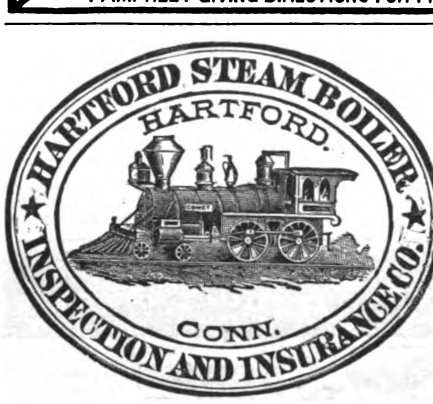

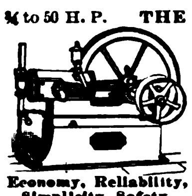

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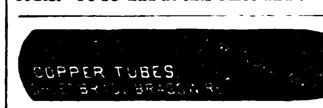

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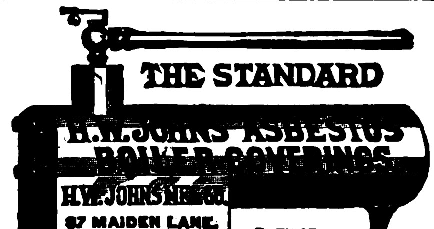

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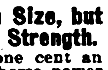

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