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 $\frac{3}{4}$ 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.

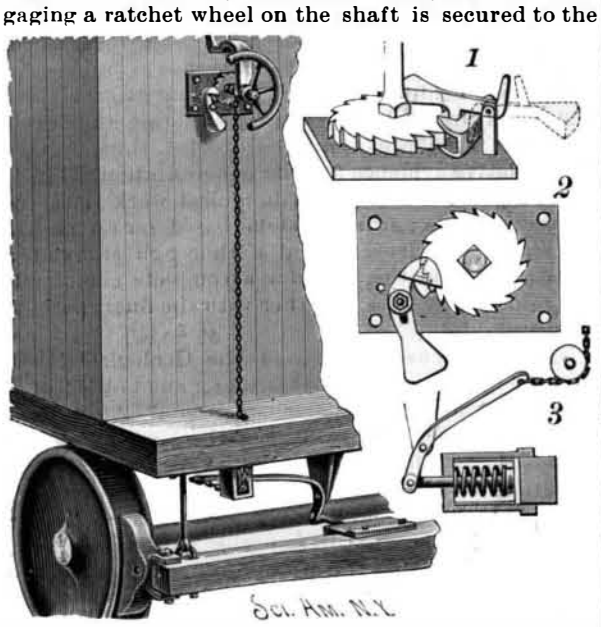
(To be continued.)

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 overa 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

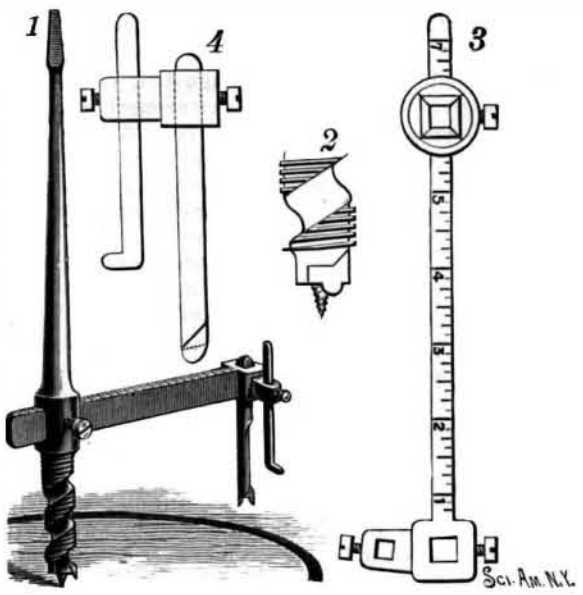


RAUB'S CAR BRAKE ATTACHMENT.

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 Beauchéne, 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.