piston, and the car and piston cannot move any faster than the gates and valves will allow this flow to take place. These valves can be fixed so that the speed at which the car is to move can be exactly regulated, independent of the will of the operator in the car, who, by opening and closing them with the hand rope, governs the running. As a further provision, however, against too rapid movement, either ascending or descending, a governor is run by the passage of the elevator which can be set so as to regulate the speed as desired, and the maximum speed desired by the proprietor can in no case be exceeded.

What this rate shall be is to some extent a matter of choice with users of the Otis hydraulic elevator, for while many other machines are so made that they must be run slow, the Otis elevators may be readily run as fast as 250 feet a minute, and everything work smoothly, without jar or friction, and with no excessive wear on any of the parts.

Of course, the size of the cylinder and the head under which the water is supplied to it must determine the maximum load. The usual arrangement for passenger elevators is to have the motion of the car only twice, or at most three times that of the piston. This reduces the friction and the wear to a very small item as compared with what it is when the car is made to move from eight to twelve times as fast as the piston, as is the case in some of the elevators used. The cylinders are of cast iron, three-fourths of an inch thick, bored out true and smooth, and, from their upright position, they experience but slight wear, and no lodging place is afforded for sand or gritty matter in the water to make trouble with the packing.

No higher commendation, indeed, could be given for any system of elevators than was awarded this machinery by a board of United States officers which reported in favor of their adoption in the Government buildings at Chicago. In their report they say:

"One source of accidents, which we are told are the most frequent in elevators with the usual steam-hoisting drums, and are very dangerous, is the holding up of the car while descending, caused by obstructions which may be accidentally placed so as to project beyond the floors at the doors of exit, perhaps temporarily holding the car up while the engine continues to run, thereby unwinding the ropes until they become slack, leaving the car entirely without their support; then, of course, when the temporary obstruction yields, the car must fall. Such an accident cannot possibly occur with the Otis machine, as the piston in the hydraulic cylinder is in such cases held in position by the solid column of water above and below it; consequently the ropes are kept perfectly tight under strain, and no motion of the car can take place until the car is released from the obstruction. No water can escape when the valve is set to now the car to descend, so the car must be held; and, when allowed to move, can only descend as fast as the water can pass through the pipes and valves. If the 'shipper' or starting rope breaks or becomes detached so that the valves cannot be closed by the operator in the car, the piston can only descend to the lower part of the cylinder, raising the car to the top of the lift, where it will be held safely until the rope can be readjusted or the valve be opened by hand. For the same reason the car cannot by any means be raised too high."

The factor of safety in these elevators, and this is the first condition in all devices of this class, seems to be so large that no accident can possibly happen for which the machinery will be at fault. One of the most approved forms of safety catches is provided, and the number of cables is many times greater than are actually needed. There are no cogs, racks, belts, or shafts liable to fracture, and the power is exerted in a direct up and down motion. The economy of the system is also well shown by the operation of the four elevators used in the Boreel Building, where the constant flow of business in its 150 offices makes the crowds in its halls and corridors often equal to those on the Broadway sidewalks. A pump in the basement keeps a 4,000 gallon tank on the roof supplied with the water necessary to run all these elevators, and a similar tank at the bottom receives the discharge, the same water being used over and over again, with scarcely a perceptible loss from evaporation. It is believed that from 80 to 90 per cent of the power of the water is actually utilized in these machines, and their smooth and noiseless working certainly goes to show that the amount of friction has been reduced to a minimum.

Beside their hydraulic elevators the Messrs. Otis Brothers have been for many years prominent in the manufacture of steam hoisting machinery, in which they have introduced many improvements, covered by a wide range of patents. These machines, as they now offer them, represent the results of over twenty years' investigation and experience, and their universal or factory elevator is to be found in nearly every manufacturing town in the country. They are provided with governor attachment, cut gear and pinion, safety drum grooved for wire rope, self-oiling loose pulleys and boxes, safety ratchets, wire lifting and operating ropes, with all necessary chains and connections. They do not recommend these machines as passenger elevators, giving the preference to the hydraulic system for this purpose, but in factories where a large amount of power is in constant use they are in great favor, and are employed for both freight and passengers. Where the only power needed in a building, however, is that which is required in running the elevator the hydraulic system is much cheaper, as a comparatively small pump, working all the time, will keep the tank supplied, and the elevator can at any time by called upon to lift its maximum load. Their self-oiling loose pulley, patented in 1865, has proved a most important adjunct in this branch of their business, and it has now been in use for a sufficiently long period to thoroughly demonstrate its practical usefulness. These pulleys are now used on all the hoisting machines of the firm.

These elevators are now in daily use in most of the large cities of the United States and Canada. They are at present being put in three of the most notable structures just approaching completion in New York city—the United Bank building, corner of Wall street and Broadway, the London, Liverpool, and Globe edifice in William street near Wall, and the "Post" building in Beaver street, of which George B. Post is the architect. They are to be found in most of the recently erected prominent buildings devoted to public use, or for business offices, hotels, apartments, or private residences, as well as in factories and warehouses, and their simplicity, economy, and efficiency, united with the growing public conviction of their entire safety, render it extremely probable that the field of their future use will be rapidly and greatly enlarged.

The New York office of Messrs. Otis Brothers & Co. is at No. 348 Broadway.

Danger of Lightning from Telephone Connections.

The Cantonal Government of Zürich, having been applied to by a telephone company for permission to fix the supports of insulators on the tops of certain public buildings, applied to Prof. Kleiner for an opinion. The following is a summary of the chief points in his report:

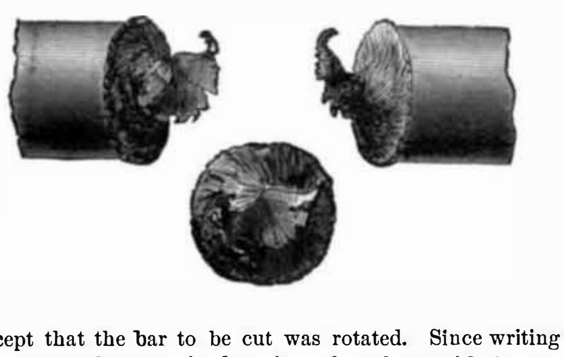
1. The danger of lighthing in houses over which telephone wires are stretched is not increased, but lessened, if the total conductivity of a wire is approximately equal to that of a lightning conductor. This condition is not always fulfilled under existing arrangements. It may be insured by very simple arrangements, such as the introduction of a special wire for the conduction of lightning wherever the number of wires of two millimeters in thickness running in the same direction is less than sixty. This should be insisted upon in all cases. Single connections running along the houses should be stronger than at present—as least as strong as telegraph wires.

2. As the properties of a telephonic plexus for attracting and conducting lightning extend over far wider tracts than those of a lightning rod, a strict regulation of their make and condition is necessary.

The use of telephones should be suspended during thunderstorms.—*Neue Zurich Zeitung.*

THE REESE FUSION DISK.

A few weeks ago we referred to a letter published in *La Nature,* and written by Mr. Jacob Reese, on the subject of his so-called fusion disk. This letter, it will be remembered, contained detailed statements of the alleged remarkable phenomena attending the severance of a bar. The inventor maintained that when a circumferential velocity of 25,000 feet per minute was given to the disk, and the bar to be severed was brought into close proximity, but not in contact, with the edge of the disk, a narrow groove was fused in the bar, which rapidly deepened, and ultimately divided it, but the melted metal was cold, would not burn the fingers, discolor paper, etc. The theory set forth was that the particles of air in proximity to the disk were propelled with a "melting velocity," and that in this way the bar was severed. We suggested that—giving all credit for sincerity—Mr. Reese was mistaken as to the action of the disk, and that it was nothing more or less than an ordinary cold saw,



except that the bar to be cut was rotated. Since writing this note we have received a piece of steel cut with the machine, and we annex an illustration of the work done, which we think—unless Mr. Reese can offer some satisfactory explanation—will prove conclusively the fallacy of all that he has advanced in this respect, as well as the very wild statement that hundreds of thousands of revolver chambers are finished off by it. The bar illustrated was cut in the manner prescribed by Mr. Reese, and with one of the machines he had supplied and received royalty for. It was found that until contact was established between the surfaces no effect of any kind was produced, but that when the disk was kept in contact with the bar, the latter was cut through in the rough manner shown in the drawing. None of the phenomena so minutely described by Mr. Reese were present, and the purchaser of the machine has been always unable to detect any indication of their existence. It will be noticed that the characteristics of the severance are: a burr around the circumference of the bar, radial lines upon the cut face produced by the hard contact of the disk, and a broken tongue of metal with sharp edges drawn out from the center. We shall be very glad to receive from Mr. Reese any explanation he may have to offer on the subject, and to give publicity to any well authenticated experiments which will serve to refute the conclusion to which the illustrations we have given incontestably point.—*Engineering.*

The Reese letter above mentioned was published in the SCIENTIFIC AMERICAN of April 2, 1881, and an engraving of the Reese machine was given in our SUPPLEMENT, No. 260.

Correspondence.

The Reese Circular Saw.

To the Editor of the Scientific American:

Gentlemen, in your issue of April 2, I notice a very interesting communication from the pen of Jacob Reese, Esq., on the phenomena of his metal cutting disk, and after stating that a person may put his "hand in the stream of white and apparently molten sparks without being burned, and even white paper without discoloration," etc., while at the same time the sparks thrown into the atmosphere "more than five feet burn like a hot poker," he calls upon French and German scientists to explain "so wonderful a phenomenon." It appears to me that it may be thus explained. The periphery of the disk traveling through space of 25,250 feet per minute coming in close contact with a metal bar traveling in an opposite direction creates heat by friction sufficient to ignite the oxygen of the atmosphere, which is the supporter of heat, while nitrogen is the exact opposite. The intense heat produced creates at once a vacuum, and the air rushes in (or is forced in by atmospheric pressure) to fill up the vacuum produced, thus supplying a rapid and constant flow of oxygen, which is as rapidly consumed, so that the space below the point of fusion is largely nitrogen, which is heat extinguishing, so that the molten sparks are caught in a heat-extinguishing atmosphere and cool instantaneously.

The sparks, however, that happen to fly off instantly into the natural atmosphere come in contact with oxygen in its flight, which supports their heat until their velocity is so diminished that oxygen ceases to be its supporter.

For example, electricity is not heat, nor the supporter of heat, but in its rapid flight through the atmosphere, compressed at about fourteen pounds to the square inch, the friction produced ignites the oxygen, before which the most obdurate metals yield. Again, heat the end of a bar of iron at a forge or furnace to a white welding heat, and while at this high heat at once place it in a cold blast from a blower or bellows, which gives a large flow of oxygen, intensifying the heat, and the iron is not only fused but runs down into a pile, appearing like slag, the principle being substantially the same as the forcing a blast of air through molten iron metal and so intensifying the heat as to burn out the carbon as well as base metals and minerals, this being the first step in the Bessemer process; and it matters not whether the heated metal is forced through the atmosphere or the atmosphere through the metal, the result is the same. Whether you swing the firebrand in the air or blow it with the bellows the result is the same; either intensifies the heat.

Mr. Reese claims that the metals do not touch each other in the fusing process. Well, if he makes this statement on the principle that no atomic particles touch each other, I have no argument to offer. But if he claims that the cutting or rotating disk is not affected by the cutting, *i. e.,* worn, I must decidedly take exceptions. If Mr. Reese will turn or dress the face of his disk flat, so as to present cutting or sharp corners, and then put it into use, he will find that the corners are soon worn rounding, and that in a short time the face will become rounding also, and the disk burr on its edges, so that it will make a kerf a full one-sixteenth of an inch wider than the thickness of the disk.

He may claim that this is caused by the heat fusing the edge of the disk, but this theory is very questionable, because if the disk fuses a particle it must of necessity melt away very rapidly on account of its great velocity.

But such is not the case, for the disk wears very slowly, for the simple reason that nearly its entire periphery is traveling in the air without heat enough to create combustion with the oxygen. Another evidence that it comes in direct contact with the metal to be cut is proven in the fact that while running in open air but little power is consumed in comparison with the power required while in the act of severing a bar of metal, and the larger the bar to be severed the more power is required. I have had experience in severing metal with rotary disks, and think that I know something about the principle. In 1870 I suggested the adoption of toothless disks to the manager of Messrs. Jones & Laughlin, at the American Iron Works, which was successfully adopted in cutting large bars of iron, and I think this was the first ever used in Pittsburg. At that time I recommended 23,000 feet per minute for the rim of the disk to run. Since that time they have come into general use.

J. E. EMERSON.

Professor Bell's Reception.

To the Editor of the Scientific American:

In a recent issue of your paper you notice a "reception given to Professor Bell by the Mayor and Corporation of Brantford, England." For the credit of our little city, permit me to correct you. It was Brantford, Ontario, that tendered Professor Bell the reception. It was here also, I understand, that Professor Bell's first experiments were made, and Brantford claims the parentage of the telephone.

W. T. MAIR.

Brantford, Ontario, March, 1881.

American Arctic Research.

One of the items of the Sundry Civil Appropriation Bill of the late Congress was $175.000 for an expedition to the regions north of Behring's Strait for the relief of the Jeannette and the missing whalers. The steam whaler Mary and Helen, of New Bedford, now at San Francisco, has been purchased for the purpose. The price paid was $100,000, thus leaving $75,000 to be used in making the vessel ready for the new service and in providing for her outfit.

It is announced that two other expeditions, under the direction of General Hazen, Chief Signal Officer, will be dispatched to the north next summer for purely scientific investigations. One of these, to be commanded by Lieutenant Greeley, of the Signal Corps, will go to Lady Franklin Bay; the other to the north coast of Alaska. The Washington correspondent of the *Tribune* says that Professor Baird, of the Smithsonian Institution, and Captain Patterson, of the Coast Survey, are co-operating with General Hazen and will each be represented in one or both of these expeditions. These enterprises are a part of polar observation in which several European nations are participants with this country. Russia has promised to occupy two stations, one at the mouth of the Lena in Eastern Siberia and the other on the New Siberian Island, which is some distance east of Wrangel Land. Sweden has promised to occupy North Cape in Finland. Denmark will establish a station at Upernavik, Greenland. Germany—though she has not made an absolute promise to do so—is expected to send an expedition to the island of Jan Mayen, east of Greenland. Holland will occupy the mouth of the Ob and Spitzbergen. Austria, represented by Count Wilszek and Lieutenant Weyprecht, will occupy Nova Zembla. Canada will probably occupy Melville Island. Italy will fit out an expedition to the Southern Hemisphere, and will probably select its location on Cape Horn. It is also expected that the Island of Georgia, in the Southern Hemisphere, will be occupied by an expedition from some other European nation.

Lieutenant Greeley's expedition will consist of three officers of the army and twenty-one enlisted men. It will be assembled at Washington, not later than the 15th of May, and in St. John's, Newfoundland, about one month later. It is expected that the expedition will leave St. John's about the 1st of July, and, touching at Disco, will take on board Dr. Pavey, the naturalist of the expedition, who has been in Greenland during the last winter collecting dogs, sledges, and other material for the expedition. Several teams of dogs will be taken from Disco and Upernavik with two Esquimau hunters. The vessel is expected to reach Lady Franklin Bay by the last of August, when, disembarking the party, it will return to the United States.

In addition to the scientific observations to be made by the permanent party, the northern coast of Greenland probably will be explored, and it is believed that the question as to whether Greenland is an island or a continent can be settled, and also whether land exists to the northward of Cape Britannia, the furthest point seen by the English expedition of 1865. The station is to be visited annually by vessels which will bring fresh supplies and a number of new recruits, in order that those unfitted for the work by reason of disease or otherwise may return to the United States. Lieutenant F. E. Kislingbury, of the 11th infantry, an officer who has already made a creditable record as a scientific man, has been designated as the geographer of the expedition. The third officer of the expedition has not yet been selected.

The meteorological observations of the expedition will be made by a party of four Signal Service observers specially trained for it. Mr. William Rice, of Washington, who will probably be the photographer of the expedition, has already had experience in photography within the Arctic circle. The enlisted force is to be selected from a large number of volunteers who have seen difficult service in the extreme Northwest, and who for that reason are better prepared to resist the rigors of the Arctic winter. Lieutenant Greeley's experience as a Signal officer will, it is expected, be found of great value in making communications from point to point. For this purpose he will use the Myers signal code, sending signals by the heliograph for distances of forty miles when the sun shines, and by flags and lanterns for shorter distances at other times. This will be an advantage which former expeditions have not possessed.

The Isthmus Ship Railway.

Captain James B. Eads has gone again to Mexico to have his Tehuantepec grant confirmed by the Mexican Congress. He will then go to Tampico, where some of his engineers are surveying the harbor for the United States Government. Thence he will proceed to the Isthmus, where he will spend a month and make a thorough inspection of the route for his ship railway. This done, he will sail for San Francisco, and, as consulting engineer of the State of California, examine the mouth of the Sacramento River. From there he goes to Oregon, where he will inspect the mouth of the Columbia River and Humboldt Bay. He will then return to St. Louis, and shortly afterward visit Toronto, where he will inspect the harbor at the invitation of the British Government, after which he will sail for England and Holland.

Captain Eads is thoroughly sanguine that his ship railway scheme will be successful. His advices from Mexico are even more favorable than he anticipated. He has three parties of engineers now at work on the Isthmus, and rapid advance is being made in the surveys. The Mexican Government is also aiding him in having eight engineers and a gang of seventy laborers engaged in surveying and cutting a passage 12 feet wide through the forest from a point on the Uspanara River, 35 miles from the Gulf, where the railroad is to begin, to the pass in the Cordilleras, 60 miles distant.

Captain Eads says the reason why he feels so sure that his railway will be built is because there are three possibilities, either of which is almost a certainty:

"I believe Congress will give us the legislation asked for—in fact, I am almost sure of it. But, if America will not do this—the Mexican concession names no particular government—I shall carry the grant to England, and see what will be done there. They will not be blind to its advantages if Congress is, and, in the event I can get no government aid, I can build the railway by private enterprise. I have canvassed the situation so thoroughly that I know this can be done, but I do not want to take this last alternative. The route by the Isthmus is only a thousand miles longer than the average of the transcontinental railway, and this furnishes a sure remedy against a carrying monopoly. But, if private enterprise builds the road, there is no guarantee that the same syndicate might not get control of the railway as was the Isthmian route, and thus prevent the competition so desirable.

Experiments upon the Temperature of the Breath.

It having been observed that by breathing upon thermometers enveloped in silk or other similar material, a temperature considerably above that ordinarily attributed to the breath is indicated, Mr. C. J. McNally has taken up the subject, and has communicated the results of his experiments to *Nature*, from which we extract the following:

He says that the question is entirely physical, and not physiological. Wrapping the thermometer is a new factor in taking the temperature of the breath, and is, *primâ facie*, the cause of the high temperature. Some further experiments which he has just completed place the matter beyond all doubt.

1. A current of air directed upon the bulb of a naked thermometer caused no appreciable rise; neither did the mercury rise when the bulb was enveloped in silk; but when it was enveloped in *dried* silk it rose several degrees. (The silk was dried by heat, and allowed to cool in a stoppered bottle.)

2. Three thermometers (1), bulb naked, (2) bulb wrapped in silk, (3) bulb wrapped in *dried* silk—placed in a current of *hot damp* air for some minutes, marked respectively 116°, 120°, and 123° F.

3. Two thermometers, one naked, the other wrapped in silk, were placed in a flask, with their stems passed through the cork. The flask was then immersed in hot water (about 150° F.). The naked thermometer rose rapidly, the covered one very slowly. After twenty minutes the temperature of the water was 120°, and the naked thermometer marked 112°, while the covered one registered only 108°.

4. Two thermometers, one naked, the second wrapped in dried silk, were fixed in a flask as for last experiment, but a little water was placed in the flask, which was then plunged into hot water as before. The naked thermometer rose rapidly at first, but it was soon outstripped by the covered one. The following was the result after some minutes. Water, 128°; naked thermometer, 118°; covered thermometer, 136°.

5. Two thermometers, one naked, the second enveloped in dried silk, were passed through a cover fitting a glass vessel which was carefully dried and heated, and the cover was cemented on to prevent the passage of moisture from the air. After an hour the naked thermometer had cooled to 81° (temperature of air), and the covered one to 83°. They were then changed to a similar vessel containing a little water; the covered thermometer rose rapidly till it nearly touched 94°, while the naked one remained stationary.

The conclusions to which these experiments point are too obvious to require demonstration.

Fireproof Excursion Steamer.

The first of the seven iron excursion boats promised by the Iron Steamboat Company of this city, was lately launched at Philadelphia. She is called the Cetus, and is described as a side-wheeler, 220 feet long over all, and 210 feet on the water line. Her beam is 32 feet, and over the guards her width is 59 feet 10 inches. Her depth is 11 feet 6 inches. Her stem is of rolled iron, 6 by 2½ inches; the stern post of the same material, 6 by 3 inches. The keel and keelsons are of extra size and strength. Her frames are of angle iron, 4 by 3 inches. They are placed 22 inches from center to center. The channel beams are of channel iron, 9 inches deep, with angle iron, 3 by 3 inches level, to the top edge. All of the deck beams are of angle iron, 6 by 3½ inches; they extend through the hull to the outside of the guards, one to every alternate frame. On these beams is laid a deck of plate iron half an inch thick. The outside plating is of extra thickness and laid flush. The hull is divided into sixteen water-tight compartments by seven thwartship bulkheads. From forward of the boiler to the thwartship bulkhead abaft the engine, she has a longitudinal bulkhead on each side placed about 3 feet from the outer skin. This space between each of these longitudinal bulkheads and the outer skin is divided into four compartments. She is to be propelled by a vertical beam jet condensing engine, with cylinder 52 inches in diameter, and 11 feet stroke of piston, and it is to be worked up to a pressure of 50 pounds. The valves are "double poppet," arranged with Stevens' cut-off. The main shaft is 14¾ inches in diameter in the main journals. The gallows frame is of wrought iron, of rectangular form, and runs down to the engine keelson, to which it is solidly secured. The wheels are 30 feet 9 inches in diameter and 9 feet face. The engine will be supplied with steam from two boilers of the locomotive type, with cylindrical shell, and furnaces. She will have one independent steam chimney, with separate connections to each boiler and united to one another by one steam pipe. The boilers are 9 feet 6 inches in diameter and 25 feet long. The furnaces are of steel, 4 feet in diameter, able to carry 50 pounds of steam.

The only wood employed in the construction of the boat is above deck. The deck houses, except the one inclosing the galley, are of wood, and so are the bulwarks. The Cetus is provided with four iron life-boats, 20 feet long, and two life rafts. She will also be furnished with 8,000 life-preservers.

We are sorry that the ingenuity of the builders has not gone far enough to dispense altogether with woodwork. It is to the presence of this inflammable material that loss of life is chiefly due on excursion boats. We have no doubt that the company would be glad to adopt any practical substitute for wood, and it would seem as if a good opportunity for some ingenious individual was here presented.

The Causes of Heat in Mines.

Lime is undoubtedly one cause of heat in our mines, but it is not the only nor the great heat producer. Lime is local in its action; the heat produced by it is confined to certain sections of the mines, while underlying the whole length of the Comstock lode is that which causes the general heat, namely, the deposits of iron pyrites. The hottest places in the mines are where the heat is generated by both lime and pyrites; it is the heat from the lime added to the general heat from nature's workshop below.

The hot springs of Colorado may derive a portion of their heat from the decomposition of lime, but this is but a secondary cause. The great and first cause of heat in springs and mines is the decomposition of iron pyrites—masses of iron and sulphur. At Steamboat Springs and other places in this State, and at most of the hot springs in California, the heat is produced by the burning out or decomposition of iron pyrites. At Steamboat Springs the course of the deposits of iron pyrites is northeast and southwest, the same as that of the great mineral-bearing veins of the State. The line of active springs follows the course of this deposit, moving toward the northeast. At the southwest end are to be seen places where the deposit of iron pyrites and similar minerals carrying large quantities of sulphur has burned out, and the springs have died away. The process of burning out is slowly moving toward the northeast. In 1860 the writer saw a new spring just starting up through a thick growth of grass in a bit of meadow land far in advance of the older and larger ones, but on the same general line, well out to the northeast.

The base metal deposit at Steamboat Springs also has the same dip as the Comstock, and is working east as well as toward the north. By going from half to three quarters of a mile west of the present active springs at Steamboat, one may see where the springs were ages ago, along near the croppings or upper edge of the deposit or pyritic matter. As the decomposition proceeded downward and eastward along the dip of the deposit, the steam and hot water found or forced new vertical channels of escape. Some of these openings are probably natural crevices, but the majority are undoubtedly rents produced by the force of steam and pent-up gases. Even on the surface of Steamboat Springs are to be seen long rents from an inch or two to over a foot in width that have a northeast and southwest course. In California some of the hot springs are observed to be dying out at one end of their line and advancing into new ground at the other.

At Steamboat Springs we probably see a big mineral vein (like the Comstock) in process of formation. Ages ago there was probably a line of hot springs along the course of the Comstock. The mines of Europe and Mexico, which are comparatively cold at great depths, are undoubtedly ages and ages older than the Comstock. The Comstock is probably the youngest mine in any part of the world that is now known or being worked. Here, down in our lower levels, we are following close upon the heels of nature—getting well down into her workshop.

As to the heat-generating power of sulphur and iron, those who desire to do so may satisfy themselves. Take a few pounds of iron filings, borings, and drillings from a machine shop, wet them and mix in a pound or two of sulphur, then tamp the mixture firmly into a hole in the ground—like a post hole—covering with two or three inches of dirt, and in a short time there will be seen a miniature volcano, the batch of iron and sulphur taking fire spontaneously.—*Virginia (Nev.) Enterprise.*

Cement for Rubber.

Powdered shellac is softened in ten times its weight of strong water of ammonia, whereby a transparent mass is obtained, which becomes fluid after keeping some little time without the use of hot water. In three or four weeks the mixture is perfectly liquid, and, when applied, it will be found to soften the rubber. As soon as the ammonia evaporates the rubber hardens again—it is said quite firmly—and thus becomes impervious both to gases and to liquids. For cementing sheet rubber, or rubber material in any shape, to metal, glass, and other smooth surfaces, the cement is highly recommended.

The Transportation of Wheat.

The cost per bushel of bringing wheat from the great centers of production and distribution to the leading markets of Europe has been elaborately compared and tabulated as follows by Mr. R. Meyer, in the *Austrian Monthly of Social Science and Political Economy:*

From	To		
San Francisco	England	$0.36@	$0.39
The "Far West"	Atlantic Harbor		40
New York	Liverpool		10
Chicago	Liverpool		19
Bombay	England		13
Calcutta	England *via* Suez	18@	29
Calcutta	England *via* Cape	15@	20
Australia	England		21
Buenos Ayres	Havre	16@	20
Odessa	England or Antwerp	13@	22
Podwolocziska	Delhi		44
Brody	Delhi		42
Brody	Hamburg		39
Ibraila	London		18
Galacz	Hamburg		57
Budapest	Hamburg		31
Budapest	Liverpool *via* Fiume		28
Lemberg	Frankfort-on-the-Main		26
Vienna	Frankfort-on-the-Main		24
Vienna	Fiume		21
Vienna	Trieste		21

From Odessa is shipped the wheat of Southern Russia. Brody, in Northern Galicia, collects the wheat of the upper valleys of the rivers of Southwestern Russia. Lemberg, close by, is the capital of Galicia. Ibraila is the shipping point of Wallachia. Galacz ships the wheat of the upper valley of the Danube. Budapest is the central point of Hungary, as Vienna is of Austria. It costs nearly as much to carry wheat from Brody to Lemberg, 58 miles (no railway), as it does from Chicago to Liverpool. From Vienna to Trieste is about 250 miles by rail; in cost of transportation it is further than from Calcutta to England around the Cape. California can easily compete with Hungary in the markets of Western Europe, the cost of raising the wheat being the same.

The Blue Sky.

M. Chappuis thinks that the blue of the sky may be due to ozone present in the upper regions of the air. He argues that the electrical discharges constantly taking place will produce ozone; and the recent researches of himself and M. Hautefeuille have shown that ozone, at any rate when near its condensation point, is of a blue tint. He has examined the absorption-spectrum of ozone and finds nine dark bands in it, three at least of which correspond with known bands in the telluric spectrum.

THE VELOCIPEDE HAND CAR

A railway track offers peculiar facilities for velocipede travel, since it is perfectly smooth and has an easy grade, and no attention whatever need be paid to guiding the vehicle, nor to balancing to maintain a vertical position. A vehicle of this sort has a wide range of application, and will be found of great utility to railway men, for roadmasters, engineers, superintendents of bridges, telegraph line repairers, track supervisors, wood and tie inspectors, track walkers, and others whose duties take them over the track for various purposes. In fact the velocipede shown in the engraving is already in use by a large number of the principal roads of the country, and they are highly recommended by officials who have adopted them.

The machine may be easily propelled at the rate of eight to ten miles per hour, and it is not difficult to run it at a speed of twelve to eighteen miles. The inventor informs us that he has many times made a run of thirty miles in less than two hours with one of them.

The engraving gives a good general idea of the velocipede. It is very light, weighing only about 125 pounds, and is therefore easily removed from the track when occasion requires. The frame, wheels, and arm are of wood, all of the parts being properly braced. The arm is adjustable, and readily removable for storage or shipment. The power is applied to the rear wheel by a hand lever in front of the operator and by stirrups for the feet, which are connected with the propelling machinery by levers. The handle between the levers controls the brake. If required, the machine may be constructed to carry two persons. The tread of the wheels is cast iron, and in the construction of the machine iron and wood are judiciously combined to form a strong yet light and compact vehicle.

The confidence of the manufacturers of this velocipede is so great that they offer to send out the machines on trial, to railroad officials, to be sold on approval.

Further information may be obtained by addressing Messrs. George S. Sheffield & Co., Three Rivers, Mich.

SHEFFIELD'S VELOCIPEDE HAND CAR.

Powerful Machinery.

Speaking of the machinery used in our Western mines, a prominent mining engineer recently said that in some of the deep mines there are employed single engines capable of raising a column of water weighing 90,000 pounds a distance of 1,600 feet, seven times a minute; also, that safety cages used in mines travel at the rate of 3,000 feet a minute, and propelled by a single engine are able to hoist 1,200 tons of ore a distance of 1,500 feet in one day.

IMPROVED REFRIGERATOR.

The invention shown in the annexed engraving possesses several points of novelty, which should commend it to the notice of manufacturers and users of refrigerators, as it not only aims to maintain a low temperature, but to sweeten

TOOPE'S DRY AIR REFRIGERATOR

and purify the air and to absorb moisture and destroy all odors.

In this refrigerator the air, in passing from the ice chamber to the provision chamber, traverses a purifying chamber and enters the provision chamber perfectly dry and pure. The air purifying chamber is located inside the space usually filled with charcoal or other non-conductor, and beside acting as a purifier it assists in preventing the entrance of heat and in preserving the required low temperature. In Toope's refrigerator the inner wall of the provision chamber and the casing surrounding the ice chamber are perforated, and the air in passing from the cooling chamber to the provision chamber is forced to traverse a layer of air-purifying material, which filters out everything objectionable, and leaves the air in the best state for the purpose of cooling and preserving the contents of the provision compartment. Beside this action of the absorbent material it receives the emanations from the provisions and destroys all odors. The action of the absorbent is continuous, and no renewal of it is required. When the cover of the ice chamber is opened it acts as a piston, and draws upward from the purifying chamber the air contained by it, and in this manner reverses the direction of the air currents in the refrigerator and ventilates the absorbent.

This useful invention was recently patented by Mr. Charles Toope, 353 East 78th st., New York city.

MISCELLANEOUS INVENTIONS.

Improvements in car brakes of that type which automaticcally apply the brakes through the movement of the draw-bar, have been patented by Mr. Henry Gallager, of Savannah, Ga. The improvements contemplate the constant pressure of the brakes upon the wheels whenever the draw-bar is in its normal position of rest, and which brakes are released or withdrawn from the wheels whenever the draught strain pulls the draw-bar out, or whenever the draw-bars are driven in by backing, so that whenever the locomotive approaches a condition of rest, whether in moving forward or backward, the brakes commence to be applied automatically, but are not applied when the power of the locomotive is being transmitted to the cars for transportation.

Mr. James M. Caraway, of Beloit, Kan., has patented a simple and effective machine for grading roads, making ditches, digging potatoes, etc. It cannot be described without engravings.

Mr. Julius Heimann, of New York city, has patented a trimming for garments which consists in two or more narrow strips of felt cloth sewed edge to edge in concentric or parallel overlapping rows. The rows may be further ornamented by embroidered stitching of colors to harmonize with the tints of the strips.

Mr. George W. Brumm, of Boise City, Idaho Ter., has patented a book protector, for containing a book and securing it from injury, and to securely fasten said case and book to desk, pew, or other permanent object.

An improved fence post, patented by Mr. Patrick Coughlin, of Prescott, Ontario, Canada, is provided with wings, which spread under ground, and prevent the post from being raised by the frost.

A nut lock, so constructed as to prevent the nuts from working loose or off bolts exposed to an intermittent or constant jarring, and which will allow the nuts to be readily screwed on and off, as required, has been patented by Mr. John W. Bunker, of Palmer, Texas.

Mr. Augustin Personne, of Paris, France, has patented an improvement in that class of electric clocks in which an electro-magnet is used to automatically give an impulse to the pendulum of the clock every time its oscillation decreases below a certain amplitude. For this purpose the electric current is, when necessary, sent through the coils of the magnet by means of a device mounted upon the pendulum, and having a differential motion caused and controlled by the resistance opposed to it by the air during its oscillation.

Mr. Max Rubin, of New York city, has patented an improvement in the class of shawl straps in which the straps are wound around a rod to clasp the package, the object being to simplify the construction and lessen the cost of manufacture.

An improved safety lamp has been patented by Mr. Mark A. Heath, of Providence, R. I. It has a chamber containing carbonic acid gas, which escapes when the lamp is broken, the intention being that the gas shall extinguish the flame.

An improved hydraulic air compressor has been patented by Mr. William R. Freeman, of San Antonio, Texas. The compressing cylinder being filled with air or gas, as the case may be, the air inlet is closed, as is also the waste water cock. The water supply cock is opened, allowing the water to rise in the cylinder, compressing the air or gas therein to a tension equal to the water pressure, and indicated by the pressure gauge. Communication being then opened by means of the three-way cock between the compressing cylinder and the nozzle, the air is allowed to pass to the place of storage or use. The air cock is then turned to communicate with the outer air or gas supply, the water cock is closed, and the waste cock opened, allowing the water to escape from the compressing cylinder, which at the same time becomes filled with air or gas, and the operation repeated.

Mr. Alvin H. Fogg, of Rockland, Me., has patented a strawberry car, designed for use in cultivating and gathering strawberries, cranberries, and in weeding and thinning out all kinds of root plants.