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(Illustrated articles are marked with an asterisk.)

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THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 470,

For the Week ending January 3, 1885.

Price 10 cents. For sale by all newsdealers.

The New Orleans Exposition.

Although the work of getting the Exposition in good running order has seemed to progress very slowly since the official opening, December 16, the magnitude of the task imposed upon the management is thereby made more apparent. The enterprise is a far larger one than anybody had anticipated would be the case. There are from nine to ten thousand exhibitors, and the buildings were by no means ready to receive all the exhibits on opening day. Many of the exhibitors were themselves much behind time, but probably the worst cause of complaint has been the delay of the railroads in promptly handling the five thousand and more car loads of exhibits.

Among the most important of the exhibits shown is that of the Baldwin Locomotive Works. It includes specimens of the leading types of locomotives made at the works, both passenger and freight, illustrating the various patterns which have been most popular, as the "American," the "ten-wheeled," the "Mogul," and others. In connection with their exhibit the firm publish a handsome catalogue giving particulars of the dimensions, weight, and tractive power of their different sizes and patterns of locomotives, with indicator diagrams and statistics of performance.

The Panama Canal and its Climatic Results.

Considerable has been written on the possible results of the Panama Canal upon the ocean currents, and its likely effect upon the climate of the Pacific coast.

Dr. M. O. Baldwin, in the Kansas City *Review of Science* for December, has an article on this topic, in which he says that the attention of the whole civilized world is, and deservedly so, directed at the present time to this great work and the benefits to commerce and civilization which will result therefrom.

"It is not the purpose," the writer adds, "to treat of these, but to direct attention to the possible physical changes upon the earth's surface which may be brought about by the completion of this canal."

"The surface of the ocean on the Pacific side of the Isthmus is about fifteen feet higher than it is on the Atlantic. This elevation of the waters of the Pacific above those of the Atlantic is maintained, it is probable, by the peculiar direction of the Pacific Ocean currents, which, while they carry forward to this point very great bodies of water, impede, and to a great extent obstruct, their return. The consequence of this must be that upon the completion of the canal, which is to be, it is understood, a tide water canal, there will be created a current from the west eastward, through the Isthmus.

"The length of the canal will be about thirty-three miles, consequently there will result a fall approaching closely six inches per mile. The pressure of so great a body of water as is found in the Pacific will give to this current in the canal a much greater rapidity than will exist in the current of a stream wherein we have the same degree of inclination. The result of this will be that the shores and bottom of the canal will be rapidly cut away.

"Now let us consider briefly the currents of the ocean. There exists in the Pacific Ocean the great Japanese current, which sweeps from the coast of Japan northward, and is divided upon the Aleutian Islands, on the coast of Alaska, a portion passing through Behring Straits and a portion finding its way down the western coast of the continent as far south as Central America, where it is deflected westwardly to join and again return with the currents from the South Pacific which are diverted from Australia and the Philippine Islands and form a current which passes directly eastward to the Isthmus of Panama. This current in its passage eastward is joined by yet other currents from the great South Pacific currents which sweep up the west coast of South America, and together these form the great equatorial counter current, and the entire force of this mighty stream is broken and expended upon the western shores of the Isthmus.

"It is an evident condition that these ocean currents are directed in their course by the coast barriers with which they are brought in contact. If then these barriers are by any means removed or changed, there will result a corresponding change in the direction of the currents.

"We have then this condition: with the waters of the Pacific already at a considerable elevation above those of the Atlantic, a current from the west eastward seems inevitable, and with the added force which will be thrown in by the currents from the Pacific, the canal must be rapidly worn away until it is probable a considerable portion of the Isthmus will have been destroyed, and the great Pacific current, the force of which is now expended upon the western shores of the Isthmus, will find its way through into the Gulf and be joined to the Gulf Stream.

Should this be the result, we can only expect that the great thermal currents from the Pacific, which have heretofore so greatly modified the climate of our Pacific coast, will undergo a change in their directions, and the great body of heated waters, finding its way through the Isthmus, will pass northward with the Gulf Stream along our Atlantic coast until it is directed upon the coast of Newfoundland, and, crossing the Atlantic, it passes the shores of Great Britain and Iceland, expending itself, and upon the frigid shores of northwestern Europe will carry with it an elevation of temperature which will modify to a great extent the climate of those regions.

"It is a well known fact that an extended portion of the Arctic world has been at some time habitable and inhabited. This is shown by the finding so frequently the remains of tropical plants and animals in the far north. It is equally known that great convulsions of nature have taken place whereby continents and oceans and ocean currents have been changed, and these conditions have brought about these great changes in climates. It cannot then be considered an unreasonable hypothesis, that the results which have followed natural causes shall also succeed artificial means when the elements necessary are at hand.

"Permit a digression, to direct attention to the fact, as has been indicated above, that the current of this canal will be such that in the course of time it will result in the destruction of a considerable portion of the Isthmus. In that case the canal company will find a difficulty in making the investment a source of profit, as the canal will soon have overreached their boundaries, and will become a public highway, a great waterway for the shipping of the world."

Chemical Explosion on a Railway Train.

On Dec. 5, as a mixed train on the Kingston and Pembroke road was near Verona, Ont., running at a high rate of speed, an explosion occurred near the stove in the rear of the passenger car. It was thought at first that the stove had fallen down, but instantly the car was lighted up with a bright flame. A suffocating gas which filled the car caused an immediate rush for the door by the terrified passengers, who fled leaving their traps. The platform, steps, and doorway of the car were soon jammed, and numbers were held back, unable to get out for some time. During the panic the bell rope, by being pulled on from both sides, broke, without giving a signal to the engineer to stop. The train was rushing along at 30 miles an hour, and it was with difficulty that the passengers were prevented from jumping off. In the mean time some one ran through the baggage car and, shouting over coal cars, brought the engineer to a sense of the danger, and he brought the train to a stop.

Passengers and train hands then put out the fire with water procured in the ditches by the wayside. The accident was caused by some passenger placing a parcel near the stove which is supposed to have been a large bottle of phosphoric acid. The person who put it there declared he did not know its contents, and was bringing it to a school teacher. It was very fortunate it was placed at the back instead of the front end of the car, otherwise the passengers would have been forced to jump off the train, and great loss of life must have followed. As it was, some of them suffered severely from inhaling the gas. Several seats in the car, the floor, and the valises and clothing left by the passengers were burned.

Professor Bell.

Alexander Graham Bell, who has now been pronounced the first inventor of the working telephone by every court but the Supreme Court of the United States, and who expects to win in the latter court as in the others, is not perceptibly elated by his success, writes a Washington correspondent to the *Philadelphia Record*. He bears prosperity as well as any man I ever knew. He is immensely rich, and by his invention all the members of his family have been enriched. But Bell is just the same cheery, eager, hard working devotee of science that he was back in the old days of his poverty and obscurity. Bell cares nothing for money as money. He is not a money maker. Like Agassiz, and all other great scientists, he is "too busy to make money." Of course, he likes the things that money will provide—his handsome house on Scott Circle, with all its elaborate conveniences, its elegant furnishings, and its beautiful works of art, his workshop, the "Volta Laboratory," on Connecticut Avenue, his apparatus, and his library. But he would be just as happy without them.

His happiness lies in his family on one hand, and in his scientific pursuits on the other. When he is not busy in his laboratory, or in his library, or in the free school for deaf mute children which he has established, he is enjoying the society of his wife and children. They are a delightful family. The man who has made the Bell telephone the splendid business success that it is, is Bell's father-in-law, Gardiner G. Hubbard, a man of very great business ability, who lives in a handsome house on Dupont Circle, opposite Blaine's castle. He is as practical as Bell is theoretical. He, too, is very rich. A Boston man told me the other day that it was understood in Boston that Hubbard made $500,000 by the recent rise in Bell telephone stock. Hubbard is a very agreeable old gentleman, who still writes a good deal for the reviews and magazines, as he used to do when he was a professor in Cambridge on a small salary.

Burnt Iron and Steel.

The nature of the change called "burning" in iron and steel has been treated of in the *Jahrbuch fur den Berg- und Huttenmann.* Iron that has been raised to near its melting point, and then slowly cooled, is both hot short and cold short, and shows a coarse, crystalline structure and a glistening fracture. The iron contains oxygen; though the oxygen is not derived from the hot air in the fire during the process of burning, but is developed from the slag previously mixed with the metal. When the iron is near the melting point, a chemical reaction goes on in its substance, whereby the sesquioxide is reduced to protoxide, and this is dissolved through the bulk of the metal, and alters its properties. The coarse, crystalline quality of the iron already mentioned is not due to the presence of oxygen, but to the phosphorus, which causes crystallization while the metal is cooling. The greater the proportion of phosphorus, the more danger there is of burning the iron. The phosphrous renders the metal cold short; and oxygen, though it does not greatly affect the working of the metal when cold, acts like sulphur on its malleability when hot.

Steel is burnt through the presence of carbon; the richer it is in carbon, the greater the risk of burning. This is as much as saying that the harder the steel the more carefully it is to be worked in the fire. Steel, when overheated, becomes coarse grained and brittle; if the temperature is increased still more, showers of sparks are thrown off, and the metal is said to be burnt. Burnt steel does not show, upon analysis, a diminution in the proportion of carbon; but the presence of manganese and silicon is more important than carbon. If steel containing all three substances is heated, it is the two former that first become oxidized. An important change is thus made in the properties of the metal. The carbon is oxidized later, and escapes; while the oxides of manganese and silicon remain, and the whole molecular structure of the steel is changed. If the heating process is continued, the iron itself is next oxidized. Every one must have noticed the altered appearance of cast metal that has been subjected for any length of time to intense heat.

A cast iron furnace door, after having been exposed for many years to the flame of a coal fire, was found to contain 27·8 per cent of oxygen in combination with iron, sulphur, nickel, copper, phosphorus, and arsenic. The cause of the sparking when steel is burnt is not, as might be supposed, the combustion of the carbon, but the escape of gases previously imprisoned in the metal, or rather developed by the heat which it endures. The alteration of the nature of steel may be brought about by exposure for a lengthened time to heat below that required to visibly burn it. The metal is killed all the same by the violent or slow process. No restoration of burn iron or steel by mere mechanical means is practicable, since its original chemical constitution cannot be recreated in this way.

Home Nursing.

Among many other excellent suggestions on this subject, a lady contributor to *Chambers's Journal* urges the importance of a written record being kept by the sick room attendant. A watchful nurse will be quick to notice any change in her patient; but it is quite one thing to notice, and another to give, a faithful report of what has been observed; and every experienced nurse, at least, should be very particular in jotting down at once all that strikes her attention. The simplest way of doing this is to keep a sort of diary of all that happens. Take a piece of writing paper, keep one side for day and one for night, write the date at the top, crease it down the middle, and note on one-half all the patient takes and does, and on the other anything you think demands notice. The following is a specimen of the sort of chart suggested:

October 4.

A.M.	A.M.
8. Cup of tea and toast.	
10. Four ounces of milk.	10. Milk taken with difficulty and dislike.
11. Medicine.	
11.15. Poultice to chest and back.	
11.30. Slept twenty minutes.	11.30. Turned on right side before going to sleep.
12. Four ounces beef tea.	
12.30 Mrs. A. called, stayed quarter of an hour.	12.45—1.30. Excited and depressed by Mrs. A.'s call.

Are visitors to be allowed?

The reverse side might read thus:

October 4.

P.M.	P.M.
8. Four ounces milk.	
9. Jacket poultice.	
9.30. Dozed half hour.	9.30. Skin hot and dry, face flushed; woke excited and restless.
10. Opiate as directed.	
10.45. Slept two hours.	11.30. Began to perspire, expression tranquil; woke refreshed.
12.45. Four ounces milk.	

To keep such a chart properly requires some practice, but it is the only way of insuring accuracy, and it will also save a good deal of questioning on the doctor's part, a glance being enough to show him how matters stand.

At the bottom of the first page, it will be noticed there is a question, which, unless so marked, would very likely be forgotten; and whenever the nurse is in any difficulty or uncertainty, she must never hesitate to ask for guidance. The doctor will not expect perfection from inexperience, and, even if he does not volunteer information, will certainly not object to answering reasonable questions. Of course, there is a great deal of difference in this as in all things, and there are doctors who take for granted everybody knows certain things, of which even the intelligent, who have not had their attention called to nursing, may be quite ignorant. But even when this is the case, the nurse's object being her patient's good and not the support of her own dignity, if she is not sure of her ground, it is her duty to ask for instruction.

The Inventor and the Machinist.

In the production of every machine two talents are brought into requisition—the inventive talent and the mechanical talent. The inventor and machinist may be one and the same person, but it is more frequently the case that the inventor is not a machinist, and the latter not an inventor, in the broad acceptation of that term. The skill requisite to plan and devise a machine is of a far different order from that required to fashion its parts and to assemble them. The inventor deals with ideas, with great mechanical principles. His is a work of discovery—a logical proceeding dealing with causes and effects. It is not absolutely necessary that he be able to make a single part of the machine which he invents, although it were better could he do so, as, the more familiar he is with the details of mechanical construction, the easier is it for him to accomplish his desired ends. A true inventor reads a machine as he would a book. His eye takes in every part with a glance, and the objects and purposes of the machine are as clear as day to him.

The machinist, on the other hand, may work for weeks on the separate parts of a machine and yet not know the true principle upon which it is constructed. He may be able to do his own work with skill, which work may be perfectly adapted to the object intended, and may be fashioned and fitted with the utmost accuracy and bear a finish that rivals the best workmanship; and still he may not have a clear conception of the purposes for which it is adapted. We are speaking of machinists whose mechanical skill exceeds their inventive ability. Such machinists are perhaps good workmen, understanding in a general way the ordinary uses and purposes of the articles they make; but when called to exercise their calling in the higher realms of their art, they fall short of understanding the aims of and purposes of the inventor, although they can work with a nicety to his plans. This proposition is more truly correct of the common workman than of the one who is called upon to erect the machine, for the latter must be a poor observer if he is capable of placing all the parts of a machine in correct position and yet does not understand their ultimate operation and use.

The work of the inventor is in the domain of speculative thought. The work of the machinist is, on the other hand, of the most practical character. The latter is the complement of the former. What the one conceives in his mind the other materializes in wood and iron. The inventor carries his speculations into new fields. The machinist follows him in his adventures, and at every step stands ready to execute his designs. Without the latter the inventor would be powerless to accomplish his purposes. It is a useless speculation, the determination of which position is the more valuable, that of the inventor or the machinist, because each is necessary to the other.

The more mechanical skill the inventor possesses the better is he equipped for his work. To be able to make a machine as well as devise it is a double acquirement. In fact, it seems essential that the best inventors should possess a certain degree of mechanical skill. The training necessary to obtain it is highly beneficial in showing him the properties of the material of which his machine will be made, and the difficulties in the way of adapting means to ends in bringing it forth.

The inventor not unfrequently meets with trouble in the machine shop, owing to the fact that the true principle of his invention is not grasped by those attempting to execute his orders. The result is that work has to be undone, delays occur, and the cost of construction is greatly enhanced. The fault is sometimes that of the inventor, who has not sufficient knowledge of shop work to give the proper instructions for producing the exact article desired. In such instance it is a cut-and-try experiment until the desired end is reached.

It is evident that the nearer the inventor approaches perfection in mechanical skill, and the nearer the machinist approaches the position of the inventor, the better for both. This can be done. Study and observation and the best use of particular faculties called in play, either in the workshop or in the inventor's laboratory, will accomplish the result desired.*

* *The Industrial World.*

The Washington Monument.

Thirty-six years ago the foundations of the Washington Monument were laid on the bank of the Potomac River, and a few days ago the structure was completed. On the 22d of next February—the 153d anniversary of Washington's birth—this monument is to be dedicated with appropriate ceremonies. It may interest our readers to know that this great shaft of stone and marble is now the highest structure in the world—555 feet. The great Pyramid of Egypt is 480 feet; the tower of the Cathedral at Strassburg, 468 feet; the spire at Landshut, Germany, 465 feet; the dome of St. Peter's Cathedral, at Rome, 457 feet; the pyramid of Chephren, 454 feet; and St. Stephen's, at Vienna, 441 feet. The monument stands on an open space, squares away from any building. There is nothing to obstruct the view of it from the rear of the White House or the east end of the Treasury Building; and there is nothing between it and the Potomac River.

A Specimen of American Progress.

Thirty-five years ago, remarks the *Commercial Advertiser*, the name of St. Paul, Minn., was unknown to map makers, and neighboring Minneapolis could not boast of a single building. To-day each of these cities has a population little short of 100,000 souls, and each is the center of of a robust growth in trade, manufactures, and intellectual activity. There were buildings erected in the twin cities during the present year at a cost of nearly $15,000,000, and there would seem happily to be no interruption of any sort in their career of solid prosperity. Truly in no other country could so amazing and proud a sight be seen as St. Paul and Minneapolis now present. Among other nations progress in city making is the growth of centuries. With us a first class metropolis may sometimes almost magically arise in the course of a single generation.

To Tan Skins with Fur On.

Inquiry is frequently made at this office for the best recipe for tanning the skins of animals without injury to the fur. Isaac H. Bailey, and he is authority in such matters, publishes the following formulas for accomplishing this in his *Shoe and Leather Reporter:*

Take two parts each of alum and salt, and one of saltpeter, all well pulverized. Clear the flesh of fatty matter. Sprinkle it white with the mixture. Fold in edges and roll up; remain four days, then wash with clean water, and then with soap and water. Pull the skin when drying, to make it soft.

Another recipe is: Lay the wet skin on a smooth slab or a hard board; scrape with a dull knife until all loose flesh and film is removed; then wash off in soft water. Take a glass or stone jar, put in an ounce of oil of vitriol and a gallon of rain or river water. Let it steep in this for about half an hour. Take it out, work it with the hands until dry, when it will be pliable and soft. The more worked the softer. Use no grease.

Chimneys.

A soundly-built chimney vibrates, or swings from side to side, as a whole, under sudden and violent shocks of wind, and is in reality safer when it does so than when it stands in sullen and unmoved resistance. The vibration indicates that the several constituent parts of the structure are firmly compacted into one coherent, continuous, and, as it were, homogeneous mass, which can sway from side to side like a steel rod or spring, without any tendency to dissolve its continuity and break asunder at some intermediate point.

The absence of vibration, on the other hand, means that there is not this integrity of coherence, and that there are, so to speak, fissures of substantial continuity in the structure, at which disruptive strain is unavoi ably developed. Sudden shocks of wind bursting upo lofty columns of brick-work in such circumstances ten to break them across at the joints where the interruption of continuity occurs. The movements of vibration are there absorbed, and converted into the less desirable condition of molecular strain.

Writing and Lettering upon Steel.

Steel can be written upon or engraved by first cleaning it with oil and then spreading a coating of melted beeswax upon it. The writing can then be done on the beeswax, with any sharp instrument, and the lines and marks thus made should be painted with a fine brush dipped in a liquid made of one ounce of nitric acid and one-sixth of an ounce of muriatic acid. When the written lines are filled with this liquid, it should be allowed to remain five minutes, and then the article should be dipped in water and afterward cleaned.

Aluminum Foil.

Beaten aluminum leaf may now be obtained in books like silver leaf, and is largely used instead of silver for decorative purposes. Mr. Levison suggest heavy aluminum leaf as a substitute for tin foil for coating Leyden jars, and similar electrical apparatus. Area for area, it does not cost much more, is much lighter, and permanently retains its polish. A book of fifty leaves of aluminum, of the ordinary thickness, costs twent five cents; of a thickness suitable for Leyden jars, fi leaves, about four inches square, costs $1.00.