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(Illustrated articles are marked with an asterisk.)

GOVERNMENT AID TO SCIENTIFIC INVESTIGATION.

Those who had the good fortune to hear the closing lecture of the series delivered by Professor Tyndall in this country will not soon forget the eloquent tribute he paid to scientific investigators, intent on the discovery of truth regardless of its bearing on practical ends, or the earnestness with which he insisted on the public duty of supplying them with means for their work.

The appeal was as plausible as eloquent. At first sight nothing would seem more reasonable than that the public at large, whose indebtedness to Science is so great, should do something towards supporting those who carry on the work; or that any means which should honorably relieve original investigators of the daily drudgery of earning a living, and at the same time supply them with the fullest apparatus for their researches, would immensely increase their productions.

But when we remember that in every age there have been plenty of scientific men who have had at command all that money or position could give, yet have remained comparatively barren, while the great discoveries, more especially the original views opening up new lines of thought and giving new directions to human industry, have usually come from seemingly less favored workers, we cannot escape the suspicion that original thinking is quite as likely to be hindered as helped by easy circumstances. Besides, the best work in Science has rarely been done by men either dependent or very closely allied with the ruling clique of their day, freedom from class prejudice being an essential condition of independent thinking.

No doubt a good deal of honest work might be furthered by aiding the right men at the right time: but such men are rarely the ones that would be reached by public enactment, even if it were possible for them to maintain intellectual independence in connection with personal dependence. Radically new truths are inevitably unpopular, and none but popular men would derive much assistance from the public funds. The endowment of Science would therefore act very much as the endowment of religion has always done, by creating a class of nominal "leaders" whose instincts would be opposed to progress. Having risen to place and power by the advocacy of certain views, how could they give their countenance to men laboring to overthrow such views?

Run over the list of names—from Copernicus to Darwin—of those whose influence has been greatest on the progress of human thought. How long would their owners have been allowed to continue their work at public cost, in the face of popular clamor against their heresies? Had Professor Tyndall's plan been adopted a few hundred years ago, the world would still be flat, the center of the Universe, and only six thousand years old.

In applied Science, the case is equally strong. How long would Fulton have been allowed to squander public money in his "crazy" attempt to propel shipping against wind and tide with "boiled water"? Or Stephenson, in the equally wild project of drawing wagons across the land at the extravagant rate of twelve miles an hour? What administration could sustain the sarcasm of the opposition party after supplying Draper with money to waste in foolish experiments for painting with sunshine, or Morse with means to develop his impious scheme of annihilating time and space? What committee of wise men, having to render an account of their expenditures, would have dared to aid the experiments, of Goodyear in rubber, Young's attempt to make candles out of shale, Bessemer's scheme for making steel direct from the ore, or any one, in short, of the great achievements which, until the events proved their practicability, were accounted visionary, if not impossible, by practical men?

There is another fallacy underlying Professor Tyndall's proposal—one that he has strikingly exemplified in his own person quite recently—and that is the assumption that abundant and complicated apparatus is required for, or at least helpful in, the work of discovery. In some cases it may be; but ordinarily it is quite as apt to absorb the experimenter's attention so that he misses the point of the phenomena entirely. That was a brave array of steamers, fog whistles, artillery and the like, which Professor Tyndall took down to the coast to study the effects of different atmospheres on the transmission of sounds; but he had scarcely published the results of his costly observations when Professor Reynolds made known a few experiments with a hand bell which upset entirely the conclusions the government-aided observer had so jubilantly arrived at.

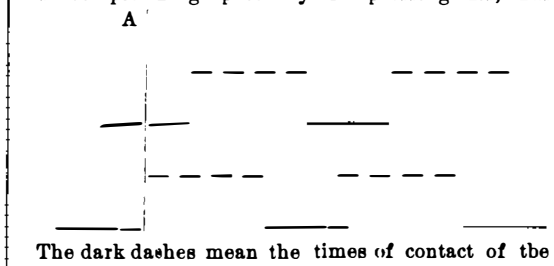
As a rule, the greatest discoveries are made with the simplest apparatus, the keys which have unlocked the grander mysteries of the Universe being mental rather than material: or, if material, have proved effective through simplicity and skillful handling rather than because of their complexity.

FOUR FOOTED MOTION.

The present exhibition of paintings of the Royal Academy in England contains a picture, by Miss Thompson, entitled "The Roll Call," which depicts a muster of soldiers on the day after a battle.

From the drawing of a horse in the painting, a very interesting discussion has arisen, extending even to eminent naturalists, regarding the motion of four footed animals while walking. The horse, in the picture, is represented walking, and has its left foreleg raised, bent, and nearly extended, its right foreleg on the ground and perpendicular to the same, its left hind leg also on the ground, full forward, and its right hindleg on the ground and well back. With Professor Garrod's able elucidation of the subject, published *in extenso* in *Nature*, as a guide, the problem quickly loses its perplexing features.

Let two men be supposed to place themselves so that the hinder one has his hands on the shoulders of the man in front, and that both walk in step—State's prison gait. Reverting this to the horse, we have the amble, a mode of progression natural to the giraffe, but only acquired by special training in the horse. Again, suppose the two men to put the opposite feet forward simultaneously, in other words, to walk out of step. This will exemplify the trot. Suppose, however, the two men to walk out of step; but instead of the diagonally opposite feet being set down at the same moment, imagine the first man to begin his step a little in advance, so that, by the time the forward man has got his right leg entirely raised, the rear man has just begun to lift his, although they keep the same number of steps. Then the sequence of steps would not be right front and left hind, left front and right hind, coupled; but right front, left hind, left front, right hind, separate and distinct. Professor Garrod has a simple and graphic way of expressing this, thus:



The dark dashes mean the times of contact of the right foot, the dotted lines same of the left foot. The two upper horizontal rows refer to the fore legs; the lower, to the hind. The dotted lines, beginning exactly where the continuous ones end—considered horizontally—indicate that one foot is lifted exactly when the other is put down.

From this it will be seen that, in walking, the horse never has more than two legs on the ground at a time. Draw a vertical line through any portion of the diagram, as at A, and it will be clear that only two of the horizontal foot lines are cut. The same line shows the picture referred to in the beginning to be correct, with the exception of one slight error. Following line A down, we find the first dotted line at the top, meaning the left fore foot, not cut; hence it is off the ground. The next line is divided squarely in the middle, and hence the right fore foot must be firmly planted. The dotted line below is just met at its beginning, consequently the left hind foot is about to commence its step; and the next line being at its rear end indicates that the right foot has just finished, and is being removed from the ground. If the reader will compare this with the foregoing description of the painting referred to, he will find that the correspondence is complete, excepting as regards the right hind foot, which, instead of being on the ground as represented, should, according to our diagram, be just leaving it. This also would be in accordance with the rule that no more than two legs can be down at a time, and thus the mistake which the artist makes in fixing three would be avoided.

We would commend the diagram herewith presented as a very simple guide for artists and draftsmen generally, as, by following its indication, they can hardly fail to depict the horse correctly. A general idea of the position of the animal being first settled upon, it is only necessary to draw perpendicular lines at various points, and try the results until a suitable *pose* is obtained. The figure very clearly solves a question over which many heads, wise and unwise, have often puzzled.

THE RAILWAYS OF THE UNITED STATES.

The seventh annual "Manual of Railways of the United States," by Henry V. Poor, 68 Broadway, New York, has just been published. It is a work of over eight hundred pages, and contains a large amount of carefully prepared information, including official particulars of all railways in operation, their extent, cost, capital, earnings, dividends, indebtedness, names of officers, directors, etc. The tabulated general statements concerning the American railway system afford valuable and instructive information.

The inauguration of railways in this country may be said to date from the year 1830, when railways were in operation to the extent of 23 miles. At the close of 1873 there were *seventy thousand, six hundred and fifty one miles* of railway in operation. This great increase, during the brief time of forty-three years, is something marvelous to contemplate. The grand average cost is put down by Mr. Poor at $60,000 per mile, or upwards of four thousand millions of dollars in the aggregate. The total earnings were over $526,000,000, and the operating expenses 65 per cent thereof, or $342,600,000, leaving as net earnings the sum of $183,810,000, out of which interest on bonds and stock dividends were paid. The average of the latter were 3 45 per cent on the capital stock, the aggregate of which is one thousand nine hundred millions of dollars.

During the year 1873 the increase in railway construction was 3,916 miles, against 6,167 miles for 1872. The expenditure for construction in 1873 is less by 50 per cent than in 1872. This sudden great contraction in payments, amounting to more than $120,000,000, was disastrous in its effects upon the various branches of industry connected with railway building. But as soon as Congress shall fix upon some decisive settlement of the national finances, whereby a lower rate of interest for the American indebtedness can be established, then railway bonds will improve in value, and a more extensive construction may be expected. As compared with Europe, the United States are considerably in advance in the matter of railway mileage.

The aggregate of railways in 1873 in the various countries of Europe was as follows: Germany, 12 207 miles; Austria, 5,865; France, 10 333; Russia, 7.044; Great Britain, 15,814; Belgium, 1,301; Netherlands, 886; Switzerland, 820; Italy, 3,667: Denmark, 420; Spain, 3 401; Portugal, 453; Sweden and Norway, 1,049; Greece, 100

	Miles.	Population.
Railroads in 1873 in Europe.....	63,360	282,456,742.
" " United States....	70,650	40,232,000.

SOME OF THE USES OF PARAFFIN.

In addition to the properties which have brought it into such extensive use for illuminating purposes, paraffin has qualities which give it an exceedingly wide range of useful applications. White, clean, incorruptible, odorless, tasteless, plastic, water repellent, a non-conductor of electricity, and but slightly affected by most chemical agents: it needs only to be better known to become the most variously useful of the hydrocarbons.

For waterproofing fabrics for wearing apparel, military equipment, and the like, it is much better than rubber, since it is odorless and does not become sticky with heat. Among the most gratefully acknowledged of the many gifts sent out to Livingstone in the wilds of Africa, were boots and blankets thus prepared, the one enabling him to travel through mud, the other to sleep in it with comparative comfort. For the waterproofing of tent cloths, ground sheets for soldiers, and other articles of the sort, it has been found equally serviceable.

A more generally useful application of paraffin is for the lining of casks and other wooden vessels, to keep them sweet and to prevent either the absorption of their contents by the wood or their escape through the pores. Already it has been largely applied to beer barrels, wine casks, and other vessels of the kind, with the happiest results. It keeps them from becoming musty and foul; and still more, by filling the pores and joints of the staves, it prevents the escape of the life of the liquor, carbonic acid gas. Water buckets, butter firkins, and other wooden articles of domestic use might be similarly treated; and as the material is cheap, easily obtained, and easily applied, it can be tried on as large or small a scale as one may feel disposed.

Being indifferent to most chemicals, paraffin serves the same purpose equally well in the laboratory of the chemist and chemical manufacturer. In the manufacture of gun cotton, for example, wooden tanks lined with paraffin have been used for holding the mixture of concentrated sulphuric and nitric acids employed in that process, the protection of the wood being complete and lasting. Wooden boxes, protected in the same way, have been similarly employed in the construction of voltaic batteries. As a non conductor of electricity, paraffin is further useful, as an insulator, for which it is now extensively employed in electric telegraphy; also in connection with batteries for medical use, especially as an acid-proof coating to insulated conducting wires. In surgery, it has been found an excellent material for covering for splints in cases of fracture.

Those troubled with loosely fitting plates of artificial teeth, owing to absorption of the gums, can easily remedy the defect by dropping upon the plate a little melted paraffin, from

a lighted candle or otherwise, replacing the plate while the paraffin is yet warm. Being clean, tasteless, plastic at a low temperature, and unaffected by saliva, this substance will be found much superior to wax or any other material for the use, a few drops rightly placed making a perfect fit with a plate otherwise unwearable.

In the laundry, paraffin rubbed on the hot flat iron imparts a beautiful gloss to starched goods, greatly lightens the labor of ironing, and leaves no greasy stain. For this use it is much superior to spermaceti. Friction matches are now prepared with paraffin in place of the sulphur formerly employed; it burns without odor and goes out instantly, greatly reducing the dangers of accidental fires. Dissolved in naphtha, paraffin has been applied with excellent effect to decaying brick and stone work, filling the pores of the brick or stone and putting a stop to the destructive action of the weather. Fine wood work exposed to the elements might be protected in the same way. Heated with sulphur to a moderately high temperature, paraffin is decomposed, with the evolution of abundance of sulphuretted hydrogen. A steady and copious flow of this indispensable reagent in the laboratory is thus easily and cheaply obtained.

REFRIGERATING MIXTURES AND THEIR PHYSIOLOGICAL EFFECTS.

All solid bodies when becoming liquid, all liquids when assuming a gaseous state, absorb heat. The chemical compounds known as refrigerating mixtures are based on one or the other of these changes of condition. The Carré ice machine, it will be remembered, operates through the liquefaction of ammoniacal gas and the return of the same to a gaseous condition. At the moment of vaporization of the liquid, a lowering of temperature takes place, sufficient to cause the formation of considerable quantities of ice. Hydrated sulphate of soda and hydrochloric acid, and ordinary ice and salt, are examples of freezing mixtures, of which perhaps a score more could be cited, the effects of all of which are well known to chemists.

There is one of this class of compounds, which, although not a stranger to the chemical laboratory, has recently been found to possess greater frigorific capabilities than any other mixture yet discovered. We allude to ice and sulphuric acid, into the properties of which M. Berthelot, of the French Academy of Sciences, has recently made some interesting investigations.

It is well known that, in winter, crystals of hydrated sulphuric acid ($S^2O^4, H^2O + H^2O$) are easily obtained. These M. Berthelot mingles with ice, and he calculates the resultant cooling, first from the ice liquefied, and second by the acid also liquefying and the disengagement of heat due to its mingling with the water. On using 1·7 ounces of acid and 4·5 ounces of water, the investigator calculates the fall in temperature to be 125·6° Fah. If the mixture be made, not at the ordinary temperature, but at say 68° Fah., the mercury should fall fully 140°, so that at the end of the experiment the thermometer will mark —112° Fah. These are calculated results, but M. Berthelot is of opinion that, according to his theory, he will be able to reach —148° Fah., and perhaps absolute zero, about —516° Fah.

Substances when brought to such extremely low temperatures act very energetically as a rule upon the body. Solidified carbonic acid at a temperature of —111·6° produces serious burns when compressed between the fingers, injuring the skin in a manner similar to a red hot iron. Late discovery has, however, found that this frigorific effect varies strangely with the nature of the cold object which is brought in contact with the skin or mucous membrane. Melsens, a well known Belgian chemist, has recently called the attention of the Academy of Sciences of Belgium to the fact that brandy, frozen to a temperature of from 22° to 31° below zero Fah., by means of a mixture of ice and chloride of calcium, can be eaten with impunity and possesses a flavor superior to that of the liquor in its ordinary state. The temperature of any alcoholic beverage may thus be reduced without the material hurting the tongue. A wooden spoon must be used, as a metal one burns the mouth very quickly. The investigator says that not until the liquor is cooled to 76° below zero is any sensation of cold experienced; and it has been eaten at —95°, causing no more uneasiness to the eater than a mouthful of rather hot soup. It is remarkable that brandy at 95° placed on the arm, makes only a slight irritation, while ether paste or solid carbonic acid burns briskly.

The only explanation which seems plausible regarding these exceptional conditions would appear to be that the alcohols, when thus rendered extremely cold, remain enveloped in a certain quantity of vapor which hinders their contact with the organs, in like manner as a layer of steam prevents the contact of a drop of water with a heated plate. M. Melsens is, we understand, prosecuting further investigations, the results of which will doubtless throw more light on the curious phenomena.

PROGRESS OF THE FIRELESS LOCOMOTIVE.

On the New Orleans and Carrolton Railway, they employ the new fireless locomotives to draw the cars from Napoleon avenue to Carrolton. 3½ miles. From Napoleon avenue to Canal street, in center of New Orleans, horses are still in use.

The company are now running eighteen of the fireless locomotives, with much success and economy. General G. T. Beauregard is the president of the company. The fireless locomotive has been heretofore illustrated and described in the SCIENTIFIC AMERICAN, having been used to some extent in this vicinity. It is now employed in Brooklyn, N. Y., on the East New York & Canarsie railway. It consists of a hot water tank, which is charged with very highly heated water at the starting station, and the steam which rises from the water is used to drive the engine in the usual manner. No fire is required in connection with the locomotive, but it depends solely for its power on the supply of hot water with which it was originally charged. The object is to provide a substitute for horses in the propulsion of street cars, and to get rid of the gas and other objectionable features of the ordinary steam locomotives. The fireless locomotives of the New Orleans and Carrolton Railway Company have each a pair of 4½ inch cylinders and 11 inch stroke, fitted with link motions and slide throttles. Each machine has one hot water tank 3 feet in diameter and 6 feet long, steam dome 12 inches in diameter and 18 inches high. The tanks are so thoroughly jacketed, with felting, asbestos composition, and wood, that they only lose 3 pounds of steam pressure per hour from radiation. A locomotive charged with hot water at 6 A. M., and left standing until 9 P. M., 15 hours, will then yield steam pressure sufficient to move half a mile or more.

The water is supplied to the tanks of the locomotives from stationary boilers located at Carrolton, and each machine makes a round trip of seven miles upon one charge of hot water. One minute is required to charge each locomotive. The water is supplied at a temperature of 375° Fah., which produces a steam pressure of about 175 pounds to the inch at starting, which becomes reduced, by the time the machine has run 7 miles, to from 40 to 50 pounds. The charging boilers are arranged in two batteries of two boilers each, and these boilers are 26 feet long and 3 feet diameter, built of the best materials. Two boilers only are required for use at once. These fireless locomotives, as substitutes for horses, are found to effect a saving of $4 a day for each street passenger car. The new machines are easily worked, and give much satisfaction. The engineer who works the locomotive is also conductor of the car. He simply stands at one end of the car, with one hand on the throttle lever and the other on the brake. The patent fare boxes are used to receive the fares. The fireless locomotives draw their cars at the rate of 8 or 9 miles per hour.

NEW LAW CONCERNING COPYRIGHTS FOR LABELS.

Heretofore it has been the practice, under the copyright law, to grant certificates of copyrights to every applicant on furnishing a printed copy of the title of his book, work, or print of any sort; and under this practice it has become customary for medicine dealers and others to file in the titles of labels used upon bottles and other articles of merchandize. This has proved to be a very convenient and economical method of obtaining a registration, though it was not considered to be of much value. At its recent session, Congress passed an amendment to the copyright law which changes the place of registration for labels from the Library of Congress to the Patent Office; and raises the official fees on label copyrights from one dollar up to six dollars. The immediate effect of this increase of price will be to reduce the number of copyrights taken; while another feature of the bill, that which provides that the Commissioner of Patents shall only grant copyrights for labels that are not trade marks, will doubtless serve to introduce official red tapeism, vexation and delay into the business of obtaining copyrights, from which it has heretofore been free.

This last provision of the bill appears to authorize the Commissioner to refuse copyright for a label, provided that officer takes a notion that such label is a trade mark. If held to be a trademark, the applicant must pay $25 in order to apply for trademark registration; and the application for a trademark will be then officially examined, subject to the usual liabilities of rejection.

The examinations and opinions of the Patent Office in respect to trademarks or copyrights are not what the people require. They want a simple, quick, and free method of obtaining registration for labels and patterns of every kind, with liberty to contest before the courts, in the usual manner, all issues pertaining to infringements. This is also what is necessary in respect to patents. When will our legislators learn that the true and proper way to encourage authors and inventors, thereby promoting the progress of useful arts, is to make the matter of registration simple and easy, instead of surrounding it with the perplexities and expenses of official inquisitions?

The new law goes into effect August 1st. The following is the text of the bill:

A BILL TO AMEND THE LAW RELATING TO PATENTS, TRADE MARKS, AND COPYRIGHTS.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That no person shall maintain an action for the infringement of his copyright, unless he shall give notice thereof by inserting in the several copies of every edition published, on the title page or page immediately following, if it be a book; or if a map, chart, musical composition, print, cut, engraving, photograph, painting, drawing, chromo, statue, statuary, or model or design intended to be perfected and completed as a work of fine arts, by inscribing upon some visible portion thereof, or of the substance on which the same shall be mounted, the following words, namely: "Entered according to the Act of Congress, in the year ——, by A. B., in the office of the Librarian of Congress, at Washington;" or, at his option, the word "copyright," together with the year the copyright was entered, and the name of the party by whom it was taken out, thus, "copyright, 18 —, by A. B."

Sec. 2. That for recording and certifying any instrument of writing for the assignment of a copyright, the Librarian of Congress shall receive from the persons to whom the service is rendered, one dollar; and for every copy of an assignment, one dollar; said fee to cover in either case a certificate of the record, under seal of the Librarian of Congress; and all fees to be received shall be paid into the Treasury of the United States.

Sec. 3. That in the construction of this act the words engraving, cut, and print shall be applied only to pictorial illustrations or works connected with the fine arts; and no prints or labels designed to be used for any other articles of manufacture shall be entered under the copyright law, but may be registered in the Patent Office; and the Commissioner of Patents is hereby charged with the supervision and control of the entry or registry of such prints or labels, in conformity with the regulations provided by law as to copyright of prints, except that there shall be paid for recording the title of any print or label not a trade mark six dollars; which shall cover the expense of furnishing a copy of the record, under the seal of the Commissioner of Patents, to the party entering the same.

Sec. 4. That all laws and parts of laws inconsistent with the foregoing provisions be, and the same are hereby, repealed.

SCIENTIFIC AND PRACTICAL INFORMATION.

NEW MEAT PRESERVING PROCESS.

M. Sacc has obtained excellent results by using acetate of soda in powdered form. The meat is placed in a barrel and the acetate placed in, when it is left for forty eight hours. Thus prepared, the meat, it is said, will keep for any length of time, and may be prepared for cooking by soaking for 12 hours in water, to every quart of which a quarter of an ounce of sal ammoniac is added.

NEW RELATIONS OF PLANETARY ORBITS.

Professor Daniel Kirkwood announces the discovery of some remarkable relations of the asteroid orbits to those of the larger planets. Near the close of the last century, Laplace noticed a relation between the mean motions of Jupiter's first three satellites; and from the results obtained by that astronomer, it occurred to Professor Kirkwood that similar relations might probably be found in the zone of minor planets interior to the great masses of Jupiter and Saturn. The investigation has led to interesting discoveries, which the author promises shall soon be published in full. As specimens of the correlations detected, he states the following:

1. Five times the mean motion of Concordia *minus* nineteen times that of Jupiter, *plus* fourteen times that of Saturn, equals zero. 2. Five times the mean longitude of Concordia *minus* nineteen times that of Jupiter, *plus* fourteen times that of Saturn, is equal to a semi circumference, or one hundred and eighty degrees.

These discoveries, while tending to throw light upon the genesis of the solar system, may, according to Professor Kirkwood, be explained by the nebular hypothesis of Laplace or equally well by the accretion theory advocated by Proctor, so that they do not tend to confirm the comparative truth of either supposition.

CURIOUS EXPERIMENT IN ELECTRO CAPILLARITY.

M. Bécquerel notes another interesting experiment in electro-capillarity. A tube of glass is closed at one of its extremities by a membrane of collodion. With the tube is placed some sulphate of copper, and it is plunged in monosulphide of sodium. Crystallized copper is deposited within the tube, and sulphide of copper outside. Eventually the membrane becomes dissolved and disappears, but without interruption to the phenomena of deposit. The crystaline crust takes the place of the collodion without interrupting the functions. It becomes constantly thicker, metallic copper continuing to form on one side, and the sulphide on the other. It is suggested that this experiment may be of importance from a geological or mineralogical point of view.

REFLECTING POWER OF FLAME.

Recent experiments by M. Sorel prove that carbon retains its reflecting capacity even at the highest temperatures. A sunbeam becomes reflected by diffusion and is polarized in exactly the same manner, whether it falls upon a brilliant flame or upon smoke.

A SIMPLE METHOD OF REMOVING THE TEETH OF CHILDREN.

The operation consists in simply slipping a rubber ring over the tooth and forcing it gently under the edge of the gum. The patient is then dismissed and told not to remove the appendage, which in a few days loosens the tooth and causes it to fall out. Grown children, who shrink from the shock and pain of the dental nippers, may also have their teeth removed by means of the rubber, which is a mild form of treatment.

ADULTERATION IN INDIA RUBBER.

The *Bulletin Thérapeutique* says that, in order to use old and worn out pieces of india rubber scraps left from factories, manufacturers having easy consciences wash the material first in a solution of subcarbonate of soda or potash, and then, when dry, pulverize between cylinders. This powder, placed layer by layer between sheets of new rubber and beated to a certain degree, forms a homogeneous mass, in which the fraud cannot be detected. The mixture is, however, weak in tenacity and elasticity, and is unfit for surgical use, while dangerous for belting or other industrial employments.

STRENGTH OF GLASS TUBES.

M. Cailletet has found that a tube of thin glass, 20½ inches in length and ¼ of an inch in diameter, was crushed by an exterior pressure of 1,155 lbs. to the square inch, while similar tubes were burst by an interior pressure one half less. In making use of very thick glass, capable of resisting a pressure of four or five hundred atmospheres, he found the glass to sustain no permanent change of form. Upon this fact, he proposes the construction of a very sensitive and very simple manometer.

THE roadway of the great steel bridge over the Mississippi is finished and a train has passed over it. The formal opening of the structure will take place on July 4.