Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

No. 361 BROADWAY, NEW YORK.

O. D. MUNN. A. E. BEACH.

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NEW YORK, SATURDAY, SEPTEMBER 3, 1887.

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SCIENTIFIC AMERICAN SUPPLEMENT

No. 609

For the Week Ending September 3, 1887.

Price 10 cents. For sale by all newsdealers.

ISTHMIAN SHIP TRANSIT.

The interesting question as to a means of ship transit across the American isthmus was discussed at the recent meeting of the American Association at Columbia College, this city. The most important paper on the subject was by Commander Taylor, U. S. Navy, who expressed himself strongly in favor of a canal at Nicaragua, which locality he has visited. His remarks upon the proposed ship railway at Tehuantepec show him to be less familiar with this project; his opinion thereon being directly opposed to that of experienced engineers who have devoted time and thought to the matter. He says the ship railway project at Tehuantepec promises to be as disastrous in its ending as that at Panama. Most engineers and ship builders, he says, doubt the practicability of the project, and fear the sinking of embankments and the racking of hulls of heavily loaded ships. He fears that the earnest belief in this project held by its promoter, the late Mr. Eads, and his past successes, would cause credulous persons to enter into the visionary project.

If Commander Taylor, or any other who may have similar doubts as to the practicability of the ship railway project, will take the trouble to inquire into its details, they will not discover any grounds for their fears. The principal objection to the ship railway scheme would seem to be its novelty. There was a like objection to the employment of a jetty system at the mouths of the Mississippi. The dredge had been used so long on this river that the engineering world had come to look on its use as almost statutory, and though it had never accomplished anything of lasting advantage, other means of clearing channelways, if not based upon dredging, were regarded as hazardous and visionary. Mr. Eads constructed his jetties on his own responsibility, and showed popular expert opinion to be founded in error by permanently deepening the channelways of the passes and making New Orleans once more a sea port.

Commander Taylor's objections to the ship railway scheme may be classed under two general heads: 1st, because of the method of handling ships while *in transitu;* and 2d, because, in his own words, "the cost of a railroad nobody can tell." Now, Commander Taylor, who is a skillful navigator, would not hesitate to put his ship into a floating dry dock, and would look on with complacency while the water was being pumped out of the pontoons and the structure, gradually rising out of the water, lifted her high and dry. He has forced his ship through driving seas without a qualm, as every other experienced sailor has. No one knows better than he that a well constructed ship is practically a girder, specially adapted to bear severe strain. A big steamer in a heavy seaway often rests upon two waves, one under her bows and the other under her stern, while the 'midship section has practically no support from the water; and, again, her bows will be almost out of water and her screw "racing." Her constructors prepared for this, and in putting her parts together they got unity out of multiety. It does not require a knowledge of navigation, neither of mathematics, to discover that a ship laboring in a heavy seaway is called upon to bear a far greater strain than she would be while being lifted out of water in a dry dock, into a cradle, and then wheeled over a level railway. This is so obvious as not to require any mathematical demonstration.

If there be any who do not think so, let them resort to figures. It is not enough to say a thing cannot be done or is impracticable. There ought to be some specific reason, some data or figures, to sustain the assertion. The big iron steamer Amerique ran up on to the New Jersey coast at Seabright some years ago, and after pounding her loaded hull on these sands for a fortnight, lay exposed to the buffeting of winter gales for nearly three months. The wooden ship Lornty, sunk in New York Bay, withstood all the wrenching of the chains passed around her bottom by the wreckers, and was finally brought to the surface unscathed, while the iron steamer Welles City, sunk in the North River, underwent similar treatment in a wrenching tideway, unharmed.

So far as the cost of the ship railway is concerned, it seems surprising that so well-informed a man as Commander Taylor should assert that a ship canal, which must be constructed, for at least a part of its way, through a river filled with rapids and falls, in a country annually visited by floods, may be estimated with more certainty than a railway. Ship canal construction is rare the world over, but so much has been done in the way of railroad building, that it has virtually become a science, and once a careful survey is made of a proposed line, a first-rate engineer will compute the amount of cutting and filling and ballasting and the cost of rails and rail laying with something approaching exactness. Commander Taylor very reasonably looks upon the geographical position of Nicaragua as superior to that of Panama, because ships following the most frequented tracks would save hundreds of miles by crossing the isthmus at the former. For the same reason, Tehuantepec is vastly more convenient than Nicaragua, being hundreds of miles further north; indeed, it is at the extreme upper end of the isthmus, while Nicaragua is not far distant from the lower end. Panama, he truly remarks, is in the zone of calms, in the doldrums, and Nicaragua in the "trades." So is Tehuantepec.

The question of harbors must take a principal part in any discussion of isthmian routes; and though Nicaragua once had a fine harbor at Greytown, it has filled up, and will cost millions to recover even in part, whereas the roadsteads of Tehuantepec call for no unusual skill, no extraordinary outlays, to make safe for ships to ride in.

DUPLICATION OF GOVERNMENT SCIENTIFIC WORK.

It appears that the government is now employing three different scientific corps to investigate and report on one and the same matter, namely, the characteristics of genuine butter and its imitations.

In the first instance, we have the division of microscopy of the agricultural department, represented by Dr. Thomas Taylor and his assistants; then we have the division of chemistry of the same department, represented by H. W. Wiley and his assistants; and lastly the office of commissioner of internal revenue, represented by a chemist and a microscopist, each lately appointed under the oleomargarine law, whose salaries amount to $5,000 a year, the two last being specially appointed for this special work.

Thus we find three distinct and separate corps of scientists, each with costly scientific apparatus, all employed on the same work, and each putting the country to the expense of printed illustrated reports, costing thousands of dollars.

Professor Wiley the chemist is first in the field with a printed report. It is bulletin No. 13 of the agricultural department, division of chemistry, and constitutes a book of 130 pages, and has 12 pages of photogravure illustrations. It is not our purpose now to pass it in critical review, but we may say that it substantially states that the chemical test is the only practical one for distinguishing butter from its imitations, but it admits that the microscope is useful as an adjunct in making the investigations, but he takes pains to belittle Dr. Taylor's microscopical work, by quoting authorities which state that "little dependence can be placed on *any* microscopical test;" and on the subject of the crystals formed by "the melting and slow cooling of butter," which was Dr. Taylor's discovery, and forms the groundwork of all Dr. Taylor's work, Professor Wiley says, "I consider it a much less valuable indication than the simple observation."

If Professor Wiley is correct in this statement, then all Dr. Taylor's work is void and his reports so much waste paper. And yet the government has in the press a costly printed report of Dr. Taylor's work, the Moss Engraving Company having just printed two million pages of photogravure plates to accompany the report, the edition being, we believe, over 400,000 copies.

All this report is devoted to the microscopical aspect of the question, upon which, as we have shown, one official of the same department claims "little dependence can be placed," and all based on a discovery which Professor Wiley says is "not valuable."

Such being the estimation of the work of Dr. Taylor by the chemical division, the public may be curious to know what the microscopical division think of Professor Wiley's report and scientific work.

Dr. Thomas Taylor says he "thinks it would be more creditable in the eyes of the public if Professor Wiley would stick to his own business. The bulletin, in my estimation, is *of no especial value* in its microscopical aspect, because Professor Wiley has not been careful to select types nor observed uniformity in his treatment of the fats."

So here we have two reports on the same subject issued from the same government department utterly at variance with each other, while both are condemned as worthless by the department which has ordered the work and the publication of the reports. We have offered no opinion on the merits of the two conflicting reports, but will endeavor to do so on another occasion. One of them must be false and deceptive, and we can only regret that many thousands of dollars have been wasted on their preparation and publication.

We have yet to hear from the chemist and microscopist of the internal revenue office. We presume that we may look to them for a report of their work on this subject. We hear informally that they are not working in the best of harmony, and that the microscopist first appointed resigned, and was replaced by another; but we trust they are doing good original work, and will arrive at some solution of the question which will be satisfactory to the public and those specially interested.

At the recent meeting of the American Association for the Advancement of Science, Dr. Taylor exhibited, in four large frames, the original photo-micrographs of the crystals of butter and fats, copies of which will appear in the annual report of the Department of Agriculture, now in the press. The crystals of the various fats examined are over a hundred in number, comprising butter derived from various breeds of cattle, under many kinds of feeds. The crystals of fats show specimens taken from many animals, birds, and even the human subject, both in health and disease. It is certainly a most creditable exhibit of intelligent work, and will be a decided advance in our knowledge of this subject. It also shows what can be done with the microscope in the hands of one capable of using it to the best advantage.

THE CELESTIAL WORLD.

THE STAR OF BETHLEHEM.

"Where can the Star of Bethlehem be found?" is the oft-repeated question that comes from many quarters. The fact is, no such star is visible in any part of the heavens. An observer with a vivid imagination fancied he had discovered this long-looked-for star, and announced its return in some journal of the day. The paragraph was widely copied throughout the country. The idea pleased the popular fancy, was received with almost unquestioning faith, and the sky was eagerly scanned for a glimpse of the star that once shone over the humble dwelling that enshrined the Redeemer of mankind. Even the peerless Venus was impressed into service, and was firmly believed to be the sacred star once more shining upon the earth after wandering for ages in the star depths.

The history of the so-called Star of Bethlehem is briefly this: Tycho Brahe, a Danish astronomer, discovered, in the year 1572, an apparently new star near Caph in Cassiopea. When first seen, in November, it had attained the first magnitude. It increased rapidly in brilliancy, until it rivaled Venus, and was visible at noonday. It began to diminish in brightness in December, and continued to fade away until the following May, when it disappeared from view.

Forty years later, when the telescope was invented, a small telescopic star was found close to the spot where the wonderful star was seen. It is still there, and is probably the same. It is now classed among variable stars, and is, therefore, liable to blaze forth at any time in the same extraordinary manner. After classifying the star as a variable, the next thing to be done was to find out its period of variability. Astronomical records were searched, and it was ascertained that about the years 1263 and 956 bright stars suddenly appeared near the same quarter of the heavens. It was, therefore, classified as a variable, with a period of about 309 years. Counting back three periods from 956, the exact period being uncertain, the star may have appeared near the time of the Christian era. Some imaginative observer, for this reason, christened it the Star of Bethlehem, and with scarce the shadow of a foundation the name has adhered to it ever since. It is also known as the Pilgrim Star, and among astronomers as the star of 1572.

If the star be a variable, with a period approximating to 309 years, it is now due, and liable to burst forth into sudden brilliancy at any time. No celestial event would be more welcome to astronomers. The scientific world would be wild with excitement over the substantiation of an ingenious theory and the confirmation of its hopes. Its first appearance, its exact position in the heavens, its changes from day to day, would be telegraphed all over the country, and minutely described in the journals of the day. The advent of a comet, spanning the sky from the zenith to the horizon, would be of no account in comparison with the blazing star! Meantime the telescopic star near Caph in Cassiopea shows no signs of any coming disturbance, and observers must wait patiently for developments, remembering that the outburst will be sudden, if it come.

It is generally considered that the extraordinary changes of light in stars like that of 1572 are caused by sudden outbursts of glowing hydrogen gas, which by its own light and by heating up the whole surface of the star causes the immense increase in brilliancy. The spots, faculæ, and rosy protuberances on the sun give some idea, on a small scale, of what may be going on in other suns on a much larger scale. Fortunately, the new or temporary stars observed by terrestrial astronomers number only about twenty-four, an infinitesimal number when compared with the boundless millions of stars that shine with nearly unchanging brightness. The probability is, therefore, small that our sun will be added to the list of blazing stars. He will probably shine for millions of years to come, as he has shone for millions of years in the past, and if observed from other suns and systems will be classed as a variable, with a period of about eleven years, corresponding to the cycle of sun spots.

THE GREAT SUN SPOT OF LAST JUNE.

The solar surface should, according to the sun spot theory, be approaching its most quiescent condition, for it is passing through the stage known as the minimum of sun spots. The condition of the fiery orb, however, does not always conform to the laws laid down. The sun has a way of his own that sets all theories at defiance. An immense spot appeared on his surface on the 7th of June. It was carefully observed by European astronomers during its whole passage across the solar disk. When first seen it was situated a little south of the equator, and its greatest diameter measured 50". It was observed with the naked eye and the telescope, and continued to be visible until the 17th, when it disappeared on the sun's border. The appearance of this enormous sun spot, denoting great activity of the solar force, is specially remarkable as occurring at a time when the sun is passing through the minimum of the eleven-year cycle of sun spots.

Alvan Clark.

One of the great masters of the mechanical arts has passed away. Alvan Clark, the most eminent manufacturer of telescopic lenses in the world, died a little after 3 o'clock on the morning of August 19, 1887. His advanced age had so weakened him that he succumbed to an indisposition that had only affected him for a few days. At the present period, when the subject of manual training is exciting so much attention in educational circles, the lesson of Mr. Clark's life is peculiarly interesting. By his extraordinary technical skill, industry, and patience, he won for himself a fame that was world-wide. In spite of the peculiar field of his work, his fame was not confined to astronomical circles. His name had become a household word.

He was born in Ashfield, Mass., on March 8, 1804. He came of the old Mayflower or Puritan stock. His father was a farmer, and young Alvan received only a public school education. He showed artistic tastes early in life, and possessed a great aptitude for sketching. In 1826 he obtained a position in Lowell, Mass., as designer and engraver for the calico printers in one of the mills. For nine years he kept to this occupation. In 1835 he removed to Boston, and opened a studio on Tremont Street for painting miniatures. His home was in Prospect Street, Cambridge. For twenty years he pursued the profession of artist. He had married on March 26, 1826, his wife being Miss Maria Pease, of Conway, Mass. Their son, Alvan G. Clark, about the year 1844 was a student at Andover, following the course in engineering. The father became interested in the son's scientific studies, and it was at this period that Mr. Clark began the work of his life. According to his own recital, he was thus led to study technical optics:

"My son, Alvan G. Clark, was at Andover, studying to be an engineer. His young mind seemed to be absorbed in telescopes. I was a portrait painter then, and I began to study mechanics and astronomy so as to instruct my boy. We experimented together, and succeeded in making a reflecting telescope. One of the Cambridge professors was much pleased with some instruments we made, and when we suggested to him that we would like to manufacture improved instruments, he gave us great encouragement, and we went ahead."

After succeeding with a speculum, lenses were the next object on which they were to try their ability. The result of their work was so good that, giving up all other pursuits, the father and son devoted themselves to making telescopes. Their reputation grew, and gradually reached England. The Rev. W. R. Dawes, a prominent astronomer of that country, heard of them, and ordered a glass. It reached him in the fall of 1853. This telescope did such fine work that it made their reputation abroad, and many foreign orders were at once received. They began by making six-inch objectives, and their telescopes furnished with these were of wonderfully fine quality. But they gradually increased the size of their work, and in 1860 received an order for a lens of 18 inches diameter. It was in this year also that their present factory was built. Up to that period 15 inches was the diameter of the largest lens in the world. The new order came from the University of Michigan. The civil war prevented its acceptance by the university, and it was sold to the Astronomical Society of Chicago, Ill. By its use, on the night of January 31, 1862, he and his son, Mr. Alvan G. Clark, discovered the companion of Sirius. In consequence of this discovery, the Lalande medal was awarded by the French Academy of Sciences. When in its final position, in which it was placed in 1862, this great glass showed twenty stars hitherto unseen in the nebula of Orion.

During the war the firm were kept busy making binocular field glasses for the use of the Federal officers. In 1870 a contract with them was authorized by the United States Congress for a telescope for the Naval Observatory at Washington. Work was begun upon it in January, 1871. In 1872 the glass was tested with most remarkable results, yet more work was put upon it, and it was only in 1873 that it was mounted. It is considered almost perfect. A duplicate of this glass was ordered by and made for Mr. J. S. McCormick, of Chicago, to be presented to the Washington and Lee University of Virginia. About the same period they began to make a yet larger lens for the Russian observatory at Pulkowa. This instrument cost the Russian government $33,000. It has a clear aperture of 30 inches, a focal distance of 45 feet, and a magnifying power of 2,000 diameters. The general increase in diameter of the firm's lenses may now be thus summarized in inches: 6, 8¼, 9¼, 12. 15½ (Astronomical Society of Chicago), 18½, 23 (Princeton College), 26 (Naval Observatory and J. S. McCormick), and 30 (Pulkowa Observatory). For the last instrument the Imperial Academy of Science gave a vote of thanks, and the Czar of Russia a gold medal.

The great telescope of 36 inches diameter, for the Lick Observatory of the University of California, is greatest triumph. The price was placed at $50,000. The main portions of the lens were completed about a year ago. The photographic lens is still unmade. It was nearly completed with the others, when, during an experiment, it was destroyed. Mr. Alvan G. Clark is now in Europe to secure a new disk for another attempt.

It is said that Alvan Clark had never seen a lens ground. All his skill he acquired in his own workshop. He was extremely modest, preferring to talk of his artist life rather than of his optical triumphs. To those who visited his shop he used to exhibit with pride his miniatures. These were very fine, and had he continued as an artist, there is little doubt that renown would have been acquired by his brush. Later in life he returned to portrait painting as a recreation. Up to a recent period he was in daily attendance at his shop.

Amherst College in 1854, Princeton in 1865, and Harvard in 1874 gave him the degree of A.M. His wife and two sons, Alvan G. and George B. Clark, survive him. Last year the sixtieth anniversary of his wedding was celebrated.

He made several scientific discoveries of importance, inventing a double eye piece and devising a very valuable and accurate method of measuring small celestial arcs. It is a matter of congratulation that his sons have so long been associated with him, as the extinguishment of the Clark establishment would be a misfortune to science.

Metallic Thermometers for Hot Drying Chambers.

The object of this instrument, says the *Bulletin de la Societe Industrielle de Mulhousė*, devised by Mr. H. Grosheintz, is to indicate the average temperature of a hot flue or drying chamber, in which it is necessary for success in the drying of delicate fabrics that the process of drying should take place very regularly and at an exact temperature.

The thermometer consists of a brass wire, the expansion and contraction of which supply the indications of temperature, and a system of levers outside the drying chamber, by means of which the range of action is multiplied. Thus the variations in temperature may be read more plainly. The apparatus is at work in the establishment of Messrs. Scheurer, Rott & Co., in a drying chamber 74 feet long, between walls. The wire is one twenty-fifth inch or one millimeter in thickness, and is 79 feet in length, stretched from outside to outside of the walls, passing through openings in them. One end is fastened to the outside of one wall, and the other end is connected to a system of levers outside the other wall, by means of which the variations in the length of the wire are multiplied sixteen times.

Taking the expansion of brass wire at 0·18 per cent of the length, between the temperatures 32° and 212° F., the extension on 79 feet of length is $79 \times 100 \div 0{\cdot}18 = 1{\cdot}685$ inches, and $1{\cdot}685 \times 16 = 27$ inches is the range of the pointer between the given extremes. The scale is graduated in accordance with a mercurial thermometer, placed within the chamber at about the middle of the wire. The metallic thermometer is very sensitive. For instance, when the two thermometers, metallic and mercurial, read 60° C., or 140° F., at the beginning of an operation, before the pieces to be dried can be passed in, the metallic thermometer falls 9° or 10°, while the mercurial remains stationary. The metallic thermometer has been at work for three years continuously, and gives great satisfaction.

Manufacture of Glucose with Nitric Acid.

The originators of this process, A. Seyberlich and A. Trampedach, use nitric acid for the saccharification of starchy or amylaceous matter. To eliminate, then, the nitric acid from the solution of glucose thus obtained, water saturated with sulphurous acid is added in such quantity that the sirup smells of this gas. The mixture, heated rapidly, brings about the decomposition of the nitric acid. At the expense of the oxygen contained in this acid the sulphurous acid is rapidly converted into sulphuric acid, and nitric oxide is evolved. The reaction is so perfect that no trace of nitric acid can be found with Schönbein's reagent. On heating to boiling, the excess of sulphurous acid is expelled from the saccharine solution. This last operation must be conducted rapidly, and with an abundant supply of steam, so that the saccharine solution shall not remain long in contact with the sulphuric acid formed, as otherwise the sugar would be liable to decomposition. The solution of glucose obtained is neutralized with carbonate of lime, and made alkaline with alkaline carbonates evaporated and crystallized. The crystalline mass contains only a small quantity of sulphate of sodium, and can be at once washed.—*Zeitschrift fur die Chem. Indust.*

FOUR kittens, born at Narragansett Hotel, in New London, were bound together like the Siamese twins by a ligature at the abdomen. The cords were in the form of two triangles joined at the apex, the four ends connecting the kittens, with a space of 1½ inches between.