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(Illustrated articles are marked with an asterisk.)

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SCIENTIFIC AMERICAN SUPPLEMENT

No. 685.

For the Week Ending February 16, 1889.

Price 10 cents. For sale by all newsdealers.

THE CELESTIAL WORLD.

A STARRY LOZENGE.

An interesting geometrical figure may now be traced in the heavens on starlit nights. It is an irregular lozenge formed by four stars of the first magnitude. Sirius, which is on the meridian about 8 o'clock on the last of February, may be taken as the starting point, occupying the southeast corner of the figure. A line drawn northwest from Sirius will lead the eye to Betelguese in the shoulder of Orion. Rigel, in the foot of the mighty hunter, is opposite Betelguese, and a line extending from Sirius through the belt of Orion will reach Aldebaran in the constellation Taurus. These four stars—Sirius, Betelguese, Rigel, and Aldebaran—form the corners of the celestial lozenge, a figure which once traced will never be forgotten, and whenever on winter nights the eye is turned toward the sky, the superb combination will be recognized.

Each star of the shining quartet has a history. Sirius shines with a transcendent luster, so far exceeding all other stars of the first magnitude that it seems to belong to a class of its own. It is a white star, rejoicing in the glory of its highest period of development, its *grande jeunesse*. It is made specially interesting by the discovery, in 1862, of a dark companion star. Betelguese, the leading brilliant in Orion, is a singularly beautiful star, in color a rich topaz with a reddish tinge. It shines with an irregular light, for, like our sun, it is a variable. Rigel is a brilliant star, its light in striking contrast with that of Betelguese. It is a noted double, the companions being pale yellow and sapphire blue.

Aldebaran is the brightest star in the constellation Taurus, and resembles Betelguese in color. It is a double star, with a minute companion. It is frequently occulted by the moon, for its position in the heavens is in or near her path.

This geometrical figure is not only interesting for the brilliants that form its corners, but also for the charming collection of stars contained within the boundary lines. The whole constellation of Orion, first in rank among all the clusters of stars, here finds place. The observer will perceive with the unaided eye the belt symmetrically placed in the center, the sword slanting downward from the belt with its nebulous star, and the irregular parallelogram made up of the four brightest stars—Betelguese, Bellatrix, Rigel, and Saiph.

The telescopic observer has a rich field for study in this marvelously beautiful constellation, abounding in double, triple, and quadruple stars, variables and nebulæ. A powerful instrument transforms the nebulous star in the sword into the Great Nebula of Orion, the most impressive and awe-inspiring vision of celestial loveliness that the boundless star depths reveal to mortal sight.

It is sometimes difficult to trace stars by triangulation or alignment, the surest way of impressing them upon the memory; but the stars forming the combination here described come into view at a glance without exertion on the part of the observer, with the radiant gems they inclose, draw forth a spontaneous tribute of admiration for the exceeding beauty of this portion of the star-spangled firmament.

PROGRESS OF NEW ARMAMENTS.

The Secretary of War has awarded a contract to the Pneumatic Dynamite Gun Company for seven guns for coast defense. Five are destined for the defense of the harbor of New York.

The contract calls for three guns for Sandy Hook, two for Fort Schuyler, and two for Fort Warren, Mass. All the peculiarities presented by the 15-inch gun now mounted at Fort Lafayette are virtually specified. The guns must be capable of elevation and depression by either pneumatic or hydraulic power, and have an extreme elevation of at least 35 degrees. They must be capable of an all-around fire, or through 360 degrees, the training and elevating to be wholly under the control of the gunner in charge. The range of fire is also specified, the extreme demanded being a mile Rapidity of fire is also called for, being a requirement not demanded in the recent tests of the stationary gun. The delivery of the guns ready for mounting must be made within eight months of the time of execution of contract. The sum of money as bid by the Pneumatic Dynamite Gun Company is $395,500.

The guns will be able to deliver upon an enemy projectiles that contain 500 pounds of dynamite, the explosion of which, on or close to the strongest ironclad ship now afloat, would knock down every man on deck, and probably sink the vessel. Our new torpedo boat Vesuvius, 725 tons, is armed with these guns, and, speaking of her recently, the *Engineer*, London, says: "We may allow something for pardonable exaggeration, and still we have enough left to induce the belief that Uncle Sam has got hold of a craft which an ironclad would not care to fight for the fun of the thing."

The New York *Times* says: "The success of the Vesuvius has contributed to the success of the dynamite gun, inasmuch as vessel and gun appear inseparable. This dual success is looked upon by foreign governments as a matter of the very greatest importance, and military men in this country feel sure, from the number of emissaries of foreign governments now in this country inquiring into the features of gun and vessel, that Italians, Russians, Spaniards, and French will have dynamite guns in their coast defense system before many months have passed."

A successful trial of a new cast steel gun was made at Annapolis, Md., on the 7th inst. Two rounds were fired with a charge of thirty-six pounds of powder to set the gas checks and warm the gun. At 2:15 P. M. the first round with a full charge was fired. The shell struck the butt with great force, throwing up much mud, but the gun was uninjured. After sponging, the gun was loaded again, and in two minutes the second round was fired; the gun was still as solid as ever. Eight other rounds were fired at intervals of about two minutes, with complete success. This is the first high-powered American cast steel gun that has successfully passed the test of ten rounds with full charge delivered rapidly.

It will be remembered the first gun of this character burst on its trial. Both guns were made of open hearth steel and were cast by the Standard Steel Casting Company, of Thurlow, Pa. The gun tested on the 7th is 195 inches in length; diameter at breech, 22.2 inches; diameter of chamber, 4.5 inches; diameter of bore, 6 inches; weight of gun, 13,125 pounds; weight of shell, 100 pounds; weight of charge, 48¼ pounds.

MEETING OF ELECTRIC LIGHT MEN.

The National Electric Light Association meets at Chicago, in the Exposition Building, on the 19th, 20th, and 21st instants, and, from what can be learned, is likely to be more than usually interesting. There will be at the same time a large exhibit of electrical and kindred apparatus, the most interesting of all, perhaps, a 900 foot track, with curves of 90 feet radii, on which it is expected the various types of electric motors will be tried. The principal magnet—we speak figuratively—to attract the electrical men will be the papers to be read and the discussions following them; notably, "Current Meters," "Static Charge in the Puncturing of Underground Cables," "Relation of the Material of Conduits to the Insulation of Cables."

These discussions are unique in their way, and, perhaps, it is not going too far to say that the manner of conducting them is quite as novel as the apparatus which is their inciting cause. At the meeting of scientific associations—there are exceptions, of course—one must needs listen to much which, though often good and sometimes true, is not always new, and again to what is new, but neither instructive nor entertaining; for, as in a society of artists, there is the old academician, who is *hors concours*, and whose pictures must be accepted and hung "below the line," whether good or bad, so in the long established scientific association there are those who have the right to talk, to occupy the time of a meeting, whether or no they have any information to impart. But, in the electrical field of to-day, apparatus and methods change so quickly that a new device or idea is scarcely arrived when that which is still more novel is treading upon its heels.

The electrical men come from all parts of the country at stated intervals to compare notes concerning these; it being of vital importance, and by no means an easy task, to keep abreast of all that is going on in a particular line. There is no time for idle talk, for oratory, for ancient history, for dissertations on things in general, with an occasional remark on the subject under discussion. The chairman has no traditions to follow, and no mercy; the committee, to whom all papers must be submitted, rarely pass one that does not treat of a live issue. When it is remembered that many of the best practical minds of the country gather at these conventions, and that in their line they are, it is conceded, leading the world, it is not, perhaps, going too far to say that to attend these conventions is to get a liberal education in applied electrics.

ELECTRIC WIRES IN GAS MAINS.

The Consolidated Gas Light Co., of this city, some years ago, in laying a gas main, took advantage of the opportunity to introduce a telephone line in it, suspending it from insulators within the main. Excellent results were attained. On recently opening the main the wire was found to be coated with naphthalene, but the line as such was intact. Such a line is proof against the severest blizzards, and insures communication under all conditions. Recently they have extended the system, and have laid about five miles of three-conductor lead-covered lines within some new mains, so as to act as a basis for quite a complete system of telephonic intercommunication between the different offices. The wires are supported by short boards laid across the interior of the main at intervals of twelve feet, or one for every length of pipe. The wires enter and leave the main through stuffing boxes, plaster of Paris being used as packing and glass as insulating material. It forms an interesting instance of subway work—one which is of a class that will necessarily always be limited in application.

An objection, possessing some force, has recently been made against the use of overhead trolly lines for electric railways. It is to the effect that these lines,

necessarily of bare wire, are a perpetual menace to person and property. If an ordinary telegraph wire falls or sags so as to cross one of them, it may readily carry off current enough to set a building on fire, or to injure or kill some person. The most obvious remedy for this state of things is to use an underground line or storage batteries. The danger may be modified and diminished by using current of low electro-motive force. This will reduce the danger from incandescence, or arc formation, and may make the current almost innocuous in its effects upon the human system. The gas main system just spoken of certainly is an example of a safe method, though unfortunately inapplicable to industrial uses. The slotted subways as used for electric railways are also apparently quite safe in character, whether high or low tension currents are used.

The Paris Exhibition.

(FROM OUR SPECIAL CORRESPONDENT.)

PARIS, January 17, 1889.

American exhibitors of small tools ought to reap a good harvest at the Paris exhibition, not only because their tools are superior, but also because they are beginning to be recognized as superior in France as well as in England. Yesterday I saw, in the exhibition buildings, a French carpenter using, among other tools of American origin, a Backus brace for bits, augers, etc., which, in the course of conversation, I found he praised highly, supposing it to be a French tool, and so perhaps it was, as far as its make was concerned, but the design was the Backus pure and simple; indeed, it had the ratchet movement and the patent angular wrench attachment complete.

In the course of my experience, both here and in England, nothing has struck me so forcibly, as far as mechanics are concerned, as the superiority of American small tools.

I do not expect this superiority to be brought out very strongly at the Paris exhibition, so far as the exhibits are concerned, for Europe is in a somewhat peculiar position in this matter, which arises, in the first place, from the conservatism of the masses, and in the second, perhaps, from the apathy of Americans with regard to foreign trade. But let the causes be what they may, the facts are as follows: Tools of American design, if not always, nor even often, of American make, are to be found in the better class of both English and French tool sellers' shops, and they are highly recommended by the salesmen. They are, therefore, certain to be found among the exhibits at the exhibition. But it is not always, nor even often, that they are to be found in the ordinary workshop or the hands of ordinary workmen. Now, in the case of those that are made in the United States and imported here, the cost may have something to do with this, but that cannot be the case with the English and French copies of American tools.

It is quite true that both these copies are, as a rule, not up to the American standard as regards either fit or finish, and are sometimes mere travesties of the originals. The fact remains, however, that the great mass of workmen here have little or no acquaintance with the advantages of these tools; but at such exhibitions as this they get an education that will create a demand for the best, and I feel quite sure that with a sufficient demand to make it worth while, American small tool makers could compete with their rivals here in their own markets, and that there is enough demand now to make a good representation at this exhibition a sound commercial venture.

There is, however, another and important consideration in this connection, inasmuch as that in proportion as American tools become known here as of American origin, French patents will increase in value to American inventors, and there is in my mind no doubt that European patents will become of more value to Americans every year.

There are some American tools that are so far superior to either French or English that it is altogether astonishing that they have not been copied, and threading tools may be taken as an example. Sir Joseph Whitworth, to whom the mechanical world owes so much, by making a specialty of threading tools, adopting a standard form of thread, and using standard gauge diameters, some forty or more years ago, managed to control the screw tool trade of Europe, and it has remained pretty much as he first introduced it, in all countries save in the United States, where the fallacy of three flutes in a tap or three cutters or chasers in a die head is pretty generally known. I forbear further remarks on this head, however, until I have the French, English, and American exhibits before me.

France, like England, has, as far as I can at present see, failed to appreciate the boon America gave to machinists in the form of the emery wheel, and as a result has, at the same time, failed to appreciate the full value of the milling machine. The French, like the English, have, to a certain extent, adopted and copied the Brown & Sharpe universal milling machine, and they have, to a certain extent, adopted the emery wheel; but it is sufficient to illustrate my point to say that in a shop of five hundred men I have seen milling cutters softened and filed up to resharpen them, and I could enumerate many other similar circumstances, all pointing to the fact that there is a field here for American tools and American information as to how to use them.

Some time ago I went into a large and important technical institution, and found them using flat drills, and was told by the students that they could not use twist drills because they "fired." On being asked to show me one that had "fired," he brought from a tool chest a ¾ inch twist drill that had been ground on a common grindstone, the two cutting edges being at a different angle, and one side being longer than the other, while the high corner was worn completely off. Upon being asked to try the drill in my presence, he put it into a machine, ran it at a speed that was not above one-quarter fast enough, and tried to force it to cut until sparks of fire flew out and the drill softened at the end. When I ground up the drill (removing the softened point), and ran it at a proper speed, he was amazed at its work, and said he had "often wondered how the Americans made them work."

There are not wanting here, as well as in England, men who claim that the twist drill is not an American invention; that they had used such drills years before the American patent was issued. The trouble with these men is that they do not know what a twist drill is, and call their blacksmith-twisted drill, with a flat end, a twist drill, whereas it fills only one of the requirements of a twist drill, and even that one very imperfectly.

If exhibitions such as this one at Paris came every two, instead of every ten, years, American small tools would make a revolution in European workshop practice, but as it is, it will be a matter of time, unless some good missionary work is done.

The machinery department is progressing rapidly.

Waxed Paper Bags.

A new article called "The Sparks' Waxed Paper Bag" is now being extensively introduced, and is noticeable for its novel qualities. The exterior is like any paper bag, but the interior surface is lined with a thin film of fine paraffine wax, which renders the bag substantially air tight and water proof. The cost is but a trifle more than the common paper bag.

Tobacco, snuff, cigars, etc., put up in these bags are preserved in perfect condition, drying and loss of aroma being prevented. In like manner, confectionery, fruit, and other eatables are kept intact, wholesome and fresh. As these bags may be made translucent, they render the package attractive, and this adds a desirable selling quality, independent of other merits. Druggists use them for enveloping all kinds of preparations; grocers find them very desirable in preserving, in fresh condition, coffee, tea, dried beef, hams, cheese, sugar, and other foods. The difference between two packages of coffee, one put up in the ordinary paper bag and the other in a Sparks' waxed paper bag, is very striking. A pound of coffee in ordinary paper, when brought into a room or car, is scented by everybody at once; but if the waxed paper bag is used the contents cannot be detected; there is no escape of aroma, the preservation is complete. These waxed paper bags are also found to be of superior value for wheat, flour, buckwheat, oatmeal, Indian meal, etc. The contents are kept fresh, and access of moisture or other contamination is prevented. For packing cement, fertilizers, etc., the bags are also useful.

Furs stored in these bags with the smallest quantity of camphor or other insecticide are rendered moth proof. Valuable clothing may, in like manner, be conveniently preserved.

The waxed paper bags are now made by millions, of all sizes and grades, by the Sparks Manufacturing Company, 24 Burling Slip, New York, where they have a large establishment devoted to the manufacture of the above, and waxed papers of every description.

Trial of the Fifteen Inch Dynamite Gun.

The largest of the pneumatic guns yet made, and of the model designed for the new cruiser Vesuvius, was given an official test at Fort Lafayette, on January 26, in presence of the naval board of ordnance appointed for this purpose by the U. S. government, consisting of Commander Casper F. Goodrich, Lieuts. Bradley A. Fiske and Seaton Schroeder.

Among the many close observers of this important trial were the Baron Von Sternberg, of the German Legation, and Capt. Pickowski, of the Imperial German Army; Lieut. Fulton, U. S. N.; Lieut. Carden, U. S. Revenue Marine; Capt. Birney, U. S. Ordnance Department; Lieut.-Col. W. R. King, Commander at Willets Point; and U. S. Commissioner Morle, Chas. F. Emery, and others, Capt. Zalinsky taking active charge of the manipulation of the gun.

By prearrangement, the marking buoys were to be 50 yards apart, in the line of fire, at a mean distance of 2,138 yards, and the target area was to be a rectangle 150 feet by 50 feet, located on the east side of the channel in Gravesend Bay. Owing to the loss of one buoy, it was decided that the first shot should mark the target center.

The shells used in the trial were all of the sub-caliber class, with peripheral wings, the shells being 8 inches in diameter, with sectional guides and follower of wood, the air closure being of leather, cupped, as used for hydraulic plungers.

The hazy atmosphere and clouded sky interfered somewhat with exact observations. The firing commenced at 11:10 A. M. with a range shell charged with sand, striking at 2,138 yards.

The first trial shell, charged with 175 pounds dynamite, was delayed a few minutes by vessels sailing across the line of flight, being fired at 11:23. Time, 13 seconds; range, 2,048 yards, falling short of the target and throwing the water in a vertical column about 200 feet high. Range correct, but the shot fell short of the rectangle of target.

The second shot, with a charge of 175 pounds dynamite, was sent on its errand at 11:38. Time, 14 seconds; range, 2,032 yards. This shell seemed to explode deeper in the water, as observed by the greater volume of water thrown up. It fell short of the target.

The third shot at 12:5, with nearly the same effect as the last. Time, 14 seconds; range, 2,140 yards; striking and exploding deeply within the target area.

The fourth shot at 12:17. Time, 12½ seconds; range, 2,138 yards. Exploded within the target.

Fifth shot at 12:25. Time, 12 seconds; range, 2,160 yards. Exploded beneath the target area.

Sixth shot at 12:35. Time, 13 seconds; range, 2,114 yards; striking within the target area, exploding at a still greater depth, as observed by the great volume of water thrown up.

Seventh shot at 12:40. The charge in this shell had been increased to 201 pounds of dynamite and nitro-gelatine. Time of flight, 14 seconds; range, 2,108 yards; falling just out of the target rectangle.

The increased area of effective action of the shells was now plainly to be seen by the increased volume of the water, which was thrown to a height of between 200 and 300 feet, the extension of the *delay primer* causing the shell to sink deeper into the water before the final explosion.

The eighth and last shot at 12:50, with an extra time delay primer, proved the ability to control the time of the final explosion after the shell touched the water. Time, 13 seconds; range, 2,180 yards, and beyond the target. The explosion of this shell produced a magnificent effect, the delay primer allowing the shell to sink deeply into the mud at the bottom of the bay. The upheaval was a vast black cloud of mud and water over 150 feet high, and apparently of much larger area than the limits of the target or of any previous explosion.

The trajectory of the shells was easily observed during their entire course, and together with the singular tone of the air discharge and whistling of the projectile, seemed to heighten the scene to the realms of war.

Shells of full caliber, to contain charges of 500 to 600 pounds of high explosive, are in preparation for future trials.

The pressure in the air cylinders during the firing was about 1,000 pounds per square inch, reduced in the gun to about 600 pounds, or a total pressure of over 50 tons.

The result of this initial test in the percentage of accuracy is certainly surprising, and most satisfactory in its bearings upon the long discussed question of national defense.

That 50 per cent of the shots were intensely effective within the area of an ordinary sized ship, and 75 per cent within the area of the largest war ship, while the poorest shot would have a demoralizing effect upon an enemy by its close proximity, is an accomplishment that we may all be proud of, and which may be considered a long step forward in the defense of our harbors and coast.

C. H. Delamater.

Cornelius H. Delamater, founder of the Delamater Iron Works, of this city, died of pneumonia on the 7th inst., at his residence, 424 West Twentieth Street. Mr. Delamater was born at Rhinebeck, on August 30, 1821, and came to New York as a boy of 14 to earn his living.

His first employment was in Swords' hardware store. At 21 he became a clerk in the Phœnix Iron Works, Canal and West Streets. Three years later, in 1842, his employers retired, and young Delamater and his cousin, Peter Hogg, formed a partnership and carried on the business. In 1850 they removed to the foot of West Thirteenth Street, where the Delamater Iron Works now stand. Mr. Delamater became sole proprietor.

In the war times he built the turreted ironclad Dictator, and he did a good deal of other work for the navy.

Mr. Delamater was very active in the Society for Mechanics and Tradesmen. He was one of the first members of the Union League Club.

A WELL recently bored for gas at Pittsburg delivers fresh water, salt water, and gas at same time. There are two casings, one within the other; the outer one, 100 ft. down, taps a fresh water stratum, while the inner pipe reaches the salt water and gas at 200 feet down.