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(Illustrated articles are marked with an asterisk.)

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THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 342,

For the Week ending July 22, 1882.

Price 10 cents. For sale by all newsdealers.

THE BOMBARDMENT OF ALEXANDRIA.

The Egyptian revolt, under Arabi Bey, against the government of Egypt by European powers in the interest of European creditors, has ended in war. As the party chiefly interested—through the ownership of the Suez Canal and otherwise—England has assumed the responsibility of "restoring order," and has proceeded in the usual way, by bombarding Alexandria, the chief commercial city of the country. The bombardment began at 7:45 on the morning of July 11. The attacking fleet comprised seven powerful ironclads and the gun-vessels Bittern, Condor, Beacon, Decoy, and Cygnet. The strength of the ironclads is shown in the following table:

Vessel.	Inches armor.	Guns	H. P.	Tons.
Inflexible	16—24	4—81-ton	8,000	11,406
Superb	10—12	4—25-ton	7,430	8,760
Monarch	8—10	4—25-ton; 2—6½-tn	7,842	8,322
Sultan	6—9	8—18-ton; 4—12-ton	8,629	9,286
Alexandra	8—12	2—25-ton; 10—18-ton	9,492	8,615
Téméraire	8—11	4—25-ton; 4—18-ton	7,700	8,540
Invincible	6—8	10—12-ton	4,832	6,034
Penelope	5—6	10—12-ton	4,702	4,394

The defenses consisted of forts and shore batteries, mounting for the most part guns of antiquated patterns, firing round shot only, and unskillfully handled. The Egyptians showed great stubbornness, but the weight of metal was overwhelmingly on the side of the fleet. The Inflexible did good work at ranges varying from 3,000 to 5,000 yards, shelling forts right and left from her two turrets. The Monarch fired 200 heavy shells and 6,000 pounds of shot from Gatlings and Nordenfeldt machine guns.

The effect of the electric broadsides fired from the Sultan and the Alexandra was very destructive, and excellent work was done by the gunboats. In the course of the forenoon nearly all the Egyptian guns were silenced and the forts badly battered. The loss of men by the English was slight, five killed and twenty-seven wounded. The Egyptian loss was apparently heavy. None of the ships was materially damaged; few were hit at all.

The next day (July 12) the sea was too rough to allow the fleet to do much execution; and at night the city was evacuated by Arabi Bey, after it had been given over to fire and pillage. The city had been much damaged by the shells of the fleet, and the natives retaliated by burning the European quarter, with a general massacre of the remaining Christians.

It is of course too early to determine how far this bombardment has contributed to advance the art of war. Important results are naturally expected, as it is the first time that the later types of guns and armor have been practically tested.

It is reported that the foreign military observers of the fight say that the English artillerists did not greatly distinguish themselves by the rapidity or the accuracy of their fire, and the judgment of many is that lighter guns, more quickly served, would have ended the action sooner.

It is believed that Arabi Bey will retire with his army to Cairo, a fortified city of 350,000 inhabitants, 108 miles up the Nile.

THE CITY OF ALEXANDRIA.

Previous to the political disturbances which caused a general exodus of Europeans from Egypt and led up to the bombardment and practical destruction of Alexandria, the city had a population of about 215,000 inhabitants, nearly 50,000 of them Europeans.

The city lies on the Mediterranean, near the mouth of the westernmost arm of the delta of the Nile, and occupies a peninsula, anciently the island of Pharos, and the neck of land connecting it with the mainland.

On each side of the isthmus is a good harbor, that on the west being mainly artificial. Its excellent position for trade made it the chief commercial city of Egypt and the great central station for passengers east and west, the steamers to and from India, the Levant, and Western ports all stopping there. It is connected with Mansoora and the Suez Canal by railroad, and with Cairo by rail, canal, and river. In its newer portion Alexandria had the appearance of a European city. It was lighted with gas and supplied with water from the Nile. Besides its large export and import trade the city was the seat of large government and private manufactures run by steam. It had many fine residences. Among the prominent buildings were the palace of the Khedive at Ras-el-Tin, the large naval arsenal, the naval and military hospitals, the Custom House, Tribunal of Commerce, Italian College, and the various schools.

Alexandria was founded by Alexander the Great in 332 B.C. Under his successors, the Ptolemies, the city contained 300,000 free inhabitants and as many slaves. It became the center of learning, and schools of Grecian philosophy flourished there. Magnificent monuments were erected, among them the Pharos, the Museum, and the Temple of Serapis, and there were many gorgeous palaces and public buildings.

Julius Cæsar besieged and took the city in 48 B.C., and eighteen years later Augustus made it an imperial city. It now began a new season of prosperity, continuing till the establishment of the seat of empire at Constantinople. The Catacombs, public baths, and Pompey's Pillar, with the Roman city wall were erected during this period. In the year 215 the Roman Emperor Caracalla visited the city and ordered a general massacre, and under the rule of Gallienus a famine swept off half of the population. In 273 an insurrection resulted in the destruction of the great library of the museum. In 296 another revolt ended in a general slaughter, and in 365 an earthquake destroyed 50,000 persons. The Persians captured the city in 616, and yielded it to the Arabs in 641. It then contained 400 palaces, 400 theaters, 4,000 public baths, and 12,000 gardens.

From this time on it rapidly decayed, and its population and trade diminished. Cairo took its place as the chief city of Egypt. It finally sank so low that in 1777 its population was only 6,000.

FIRING ALLEGED TO BE HEARD 1,000 MILES.

For the first time in history the progress of a great naval engagement has been consecutively reported by telegraph. A novel member of the fleet before Alexandria was a telegraph ship, through which, by means of the Mediterranean cable line, the War Office in London and the civilized world were kept informed of the movements of the war vessels and the results of the firing.

The nearest cable station from Alexandria was at Malta, distant about 1,000 miles from the scene of the battle. A press dispatch says that when a telephone was attached to the Malta end of the cable the firing of the guns at Alexandria could be distinctly heard, though no oral communication was possible over that length of cable. It is not stated whether a telephone transmitter was used at the Alexandria end, or whether the general electrical disturbance, caused by the explosion of the great guns, so affected the cable as to report the shots, through the telephone, at Malta.

REMARKABLE DEVELOPMENTS IN OIL.

The history of the oil trade of this country does not furnish a parallel to the effect of recent developments. The result of the penetration of a certain rock 1,600 feet below the surface, in the wilderness of Warren Co., Pa., has been to form anew the map of the oil regions, to depreciate the value of oil above ground (30,000,000 barrels) 30 cents per barrel, or a total shrinkage of $9,000,000, and to enrich a few and impoverish many. The history of well "646" would read like a romance, but the reality of its effect upon the trade is grim and matter-of-fact to the last degree. On the 1st of April last crude oil was selling at 80 cents per barrel. The producers had good grounds for encouragement in the general situation. Consumption was increasing, and one of the old producing regions (Bradford) was rapidly declining. Its young rival (Richburg, N. Y.) had reached its highest point, and everything in reason pointed to "dollar oil." Meanwhile a patient and often disappointed driller was nearing the end of his cable and his credit, in the dense hemlock forest of Cherry Grove township, Warren Co., six miles from any oil well, four miles from the nearest gas well, and two miles from a "dry hole." At 1,612 feet the sand pump brought up that which threw the owners of the well into a fever of excitement. They suspended all operations, boarded up and locked the derrick, and employed a patrol of armed men to keep out every intruder. Every available acre of land in the vicinity was quietly bought up by the few favored ones, and on May 18 the owners were ready to start the drill into the oil rock. In the interval, the fame of the "Mystery, No. 646" had traveled throughout the region. Producers in general regarded the whole affair as a deep-laid plot, but were uneasy nevertheless, and oil had dropped to 73 cents. Since the "Mystery" had exerted an influence on the market, 10,000,000 barrels had been sold "short," and every producer heartily wished "646" in Jericho. On the date named the fires were lighted and the drill started in the bottom of the well. By the time the soft pebble-filled rock had been pierced 8 feet the oil was flowing from the top of the well, through two two-inch pipes, at the rate of 1,400 barrels per day, and the entire trade was, for the time, paralyzed. To-day this well is rated at 800 barrels, and, since May 18, a 3,000, a 2,500, and a 2,000 barrel well have each added their production to the original "Mystery;" a town has grown up in the hemlock forest, and a score more drills are nearing the same long neglected storehouse. The price of oil has reached 52 cents, and the older oil regions are being depopulated to fill the new field with excited multitudes. One thousand dollars an acre and half the oil is the price for all the land on the "45 degree line" along which the larger wells have so far been developed. Garfield City is to-day the Mecca of the oil producer, and is as strange a creation itself as can be noted in the entire oil country.

Breaking Iron with Dynamite.

The application of dynamite to the breaking up of masses of iron too great to be broken by other means, was successfully tried near Chicago recently. A refractory chunk, "salamander," of twenty tons weight, was placed in a pit. A hole was drilled in the iron, and a charge of dynamite was inserted. Several bars of iron, weighing tons each, were placed over the pit in order to prevent small pieces of the metal from flying heavenward. The cartridge was connected with a battery, stationed one hundred feet from the pit, and after the spectators had found secluded places, the word was given, and in an instant the twenty tons of iron that had previously stood all kinds of hammering, was reduced to fragments. The steel men were completely surprised, and admitted that a feat was performed that before was held impossible.

Raw Silk Culture and the Manufacture of Sewing Silk.

The subject of silk culture has ever been strangely fascinating to those who gave it attention, and the present high state of perfection in the culture and manufacture of silk has been attained through the efforts of enthusiasts during a period of more than two thousand years. More than a thousand years since raw silk was brought from the Chinese Empire to Greece and Syria, and there wrought into fabrics by manufacturers who did not know the origin of the fiber they so wrought, and notwithstanding centuries have elapsed since the mystery was solved, and many volumes have been written and published explaining and teaching sericulture, yet many people in this age, who buy and sell or handle silk fabrics daily, appear to know but little more of its source than did the Greeks and Syrians. Certainly very few outside of silk-producing countries realize the amount of labor, as well as sacrifice of insect life, represented in a single pound of this wonderful fiber, to produce which about three thousand silk worms contribute their beautiful robes, and necessarily their lives. The number of species of silk-producing insects is very large, probably more than two hundred, very few of which are of any practical value to mankind; on the contrary, that portion of the caterpillar family which unite their silken tissues to form a family tent have not only defied the ingenuity of man to unravel their handiwork, but have made his industry contribute to their support by foraging upon fruit-bearing and ornamental trees. The spider family, notwithstanding many attempts to reel their beautiful threads, still monopolize their product for purposes of locomotion and snares for unlucky insects.

Of the family "Bombycidæ" probably fifty species form cocoons, some of which feed upon a species of milk-weed, others on the castor oil plant, mango, oak, Osage orange, etc.; but only those feeding upon mulberry leaves have been profitably raised, owing to inferior quality of silk or difficulty in reeling other species of cocoons. (S. Bertézen states in his book entitled "Thoughts on the Different Kinds of Food Given to Young Silk Worms," published in London A.D. 1789, that one worm fed on black mulberry leaves is worth more than two fed on white mulberry leaves, and that in the sixteenth century the former leaf was sold in Italy and in France three times dearer than the white.) Having made silk, and illustrated its utility, more could not be expected of the lowly worm, and it remained for mankind to discover means whereby the cast-off robes of these insects might be unraveled and manufactured into fabrics fit for ladies of high degree, as well as into sewing silk and twist for all.

It is said that the art of reeling silk was known in China nearly two thousand years B.C., it having been discovered by "Siling Chi," wife of Prince "Hoangti," third Emperor of China, and that homage is still rendered to her as "Goddess of silk worms." So well did the Orientals guard the secret of silk culture that the nature of the fiber was unknown in Europe for more than a thousand years after silk fabrics had been introduced there, and as late as the Christian era some silk fabrics were worth their weight in gold; but notwithstanding a Roman emperor once refused to purchase a silk robe for his empress on account of its expense and the bad example of extravagance, the silk worm now spins for all, and whether fashion decrees that garments be made of silk or wool true economy dictates that they be joined with Corticelli silk, to supply which the Nonotuck Silk Co., of Florence, Mass., use over 100,000 feet of floor space on which the various processes of winding, doubling, spinning, reeling, dyeing, skeining, spooling, including the knitting of silk hosiery and underwear, as well as the manufacture and printing of spools are carried on, giving employment to about eight hundred hands, and requiring a weekly supply of between three and four thousand pounds of raw silk, yielding an aggregate length in finished sewing silk, twist, embroidery, and Florence knitting silk of more than 25,000 miles. The average length of fiber produced from a single cocoon is not over one-fourth of a mile, and as fully 100 fibers are required to produce sewing silk of average thickness and strength, it appears that fully 2,500,000 miles of this gossamer fiber is consumed weekly in the manufacture of Corticelli silk, to produce which more than 10,000,000 silk worms are stripped of their robes.

Surprising as these figures appear when separately considered, they seem inconsiderable when compared to the quantity of raw silk required for purposes other than the manufacture of sewing silk, to describe which volumes might be written without exhausting the subject. The manufacture of sewing silk being comparatively simple, we will briefly describe the processes necessary to its production, including those performed by the chief workers, the patient *silk worms.*

At the expiration of from twenty-five to forty days, according to circumstances and species of worm, they cease to eat and seek convenient places to commence the formation of a castle which shall protect them in the changes incident to caterpillar life. Having selected a site, the insect ejects from two small tubes near the mouth, called spinnerets, a liquid gummy substance secreted from their food, which at their volition adheres to whatever substance may be within their reach, and, being so anchored, the next movement of the body in the opposite direction draws out the filaments, which unite and form a single thread, which is again cemented to a suitable anchor, and thus by crosswise and zigzag motions continued for from three to five days, the worm is inclosed within from 300 to 500 yards of gossamer web. Thus self imprisoned the insect, if undisturbed, remains about fifteen or twenty days, undergoing nature's wonderful changes, during which it assumes the chrysalis form, then that of the moth.

Having entered upon this new life, which at most does not exceed seven days, the moth escapes from the cocoon by moistening one end, and pushing aside the fibers, thus snarling and destroying it for reeling purposes. Thus transformed these insects appear again upon the stage, not as voracious worms, but as radiant society bugs, who promptly choose partners for short but useful lives, no part of which is allotted to eating. Assuming, however, that cocoons are to be reeled into "raw silk," it is necessary to kill the insect before the cocoon is perforated; this is done by the application of a suitable amount of heat, after which the reeling may be done at a convenient season. This is done by placing from six to ten or more cocoons in a bowl of hot water, thus softening the "gum" in the fiber, after which the outside end of each thread is readily found, and they are collectively placed on a reel, operated by hand or other motive power, and rapidly drawn on to the reel, the fiber varying from 300 to 500 yards in length, and as the end of each cocoon fiber is so reached another should be added, in order to produce uniformity in thickness of thread, a requisite indispensable in first-class raw silk.

This operation is tedious and necessarily expensive, as four ounces of *well* reeled silk represents about ten hours' labor of an expert reeler. The reels used are usually 70 or more inches in circumference, and have a traverse rod to properly distribute the thread over a surface two or three inches wide. The thread being thus rapidly crossed from side to side of the skein in reeling facilitates handling and unwinding without tangling. Skeins so reeled weigh from one to several ounces, as desired, and on being removed are dried and neatly packed into "books" (bundles) weighing from five to ten pounds. In China and Japan the books are usually packed and sold in bales of 133⅓ pounds, called "picul" bales, a very small export duty being charged.

In the process of manufacture, the skeins are soaked in tepid soap-suds for several hours to soften the "gum," after which they are placed upon light swifts and wound off on to bobbins, which are then placed upon pins projecting from the bobbin-board of a doubling-frame, and from two to ten or more threads drawn off collectively on to one bobbin, which is next placed upon a rapidly revolving spinning frame spindle; the requisite amount of twist is given while the thread is being drawn from this to the take-up bobbin, which has motion imparted sufficient to give the desired twist, after which it is again doubled, two threads being used for "sewing silk" and three for "twist" or "three-cord sewing silk," and again similarly twisted, but in the opposite direction. The next operation is reeling into small skeins, for "skein silk," or large "hanks," to be dyed and wound upon spools as desired. This operation is rapidly performed on a partially automatic machine, on which an expert attendant can wind 1,000 to 1,200 spools of 100 yards each, in ten hours, the requisite number of yards being gauged by the number of courses, or layers of silk wound upon each spool. This is done with surprising accuracy at the "Corticelli" manufactory, as shown by daily tests made by a person employed for the purpose, and recorded in book form, many volumes of which have been filled. The record for 1881 shows that 13,628 tests were made of "Corticelli," 100 yard, 50 yard, and 10 yard spools of silk yielding an aggregate of 1,122 yards in excess of those stamped on the spools, an average of one-twelfth of a yard on each spool over the standard claimed. Well may the manufacturers of "Corticelli" silk point with pride to their record. "Deserve success, and you shall command it." As the subject of silk culture in the United States is now assuming its old-time importance in the estimation especially of people in the Southern States, it may be well to realize in advance the probable amount of labor and expense required to produce a given quantity of silk. Assuming that mulberry trees have been grown, and suitable buildings provided in which to rear worms, the next expense will be for silk eggs, say for one ounce (about 40,000), from three to five dollars. Each worm will require during its short life, at least four-fifths of an ounce of leaves, which must be gathered as needed, "rain or shine," dried if wet, and properly distributed over the space occupied by the worms, care being taken to keep the spaces so occupied clean, dry, and wholesome. The amount of labor thus required must vary greatly, according to the abundance of leaves and the facilities for gathering, which may partially account for the discrepancy in the estimates of writers on the subject, in reading which we are impressed with the apparent candor of the Rev. D. V. McLean, of Freehold, N. J., in a report of his experience in silk culture which was prepared for and laid before the executive committee of the "American Silk Society" at their annual meeting in Washington, D. C., December 11, 1839, wherein he states that "40,000 worms consumed 2,576 pounds of leaves, and produced 130 pounds of cocoons (126 pounds after flossing), these produced 12 pounds of reeled silk. My experiment was made to get at a fair estimate of what could be calculated an average result."

He estimated that 160,000 worms could be reared from one acre of trees, which would produce 48 pounds reeled silk, and that the labor of picking leaves and attending to the worms would not exceed the value of the labor of two females and one male twelve weeks. He says in respect to his experiment: "My deliberate opinion is that more will fall below this standard than will exceed it, and in one case where a less quantity of leaves will give the above quantity of silk, two cases will occur that will require a greater. I have read with great regret many of the calculations of the day on the subject of silk profits; some of them, I greatly fear, are made purely to subserve selfish ends, regardless of the ultimate consequences to the public."

Among the large number of people engaged experimentally in silk culture in 1839 to 1840—as then reported in "American Silk Society," vols. 1 and 2—the Messrs. Cheney, then located in New Jersey, were about the most successful, producing in 1839 from 80,000 worms in twenty-four days' feeding, 356 pounds cocoons from 3,970 pounds leaves, yielding 1 pound reeled silk from 9 pounds cocoons; the average quantity required in ten other cases reported from different localities being nearly 12 pounds or 4 pounds when dry (equal to 1 bushel by measure). The system of feeding adopted by Messrs. Cheney was that of M. C. Beauvis, with M. Darcet's process of ventilation. The amount of labor required in this case is not stated, but according to the estimate of the reverend gentleman above quoted, four and a half days' labor is ample to rear worms sufficient for 1 pound of silk, the reeling of which, *if equal to fine Italian or French silk,* would call for four days' work of an experienced reeler, thus requiring about eight and a half days' labor to produce 1 pound of silk, the value of which has not averaged over $600 for a few years past.

In the above estimate, leaves from Morus Multicaulis trees were used, which are much larger and more readily gathered than those from the white mulberry tree, the former having been known to reach the dimensions of 15½ by 14½ inches exclusive of stem. In this estimate no allowance has been made for labor in cultivating trees, interest on capital invested, or risk attending the rearing of a crop of worms. But enough has been demonstrated by the repeated experiments made in the United States since James the First sought to substitute silk culture for that of tobacco in Virginia, in A.D. 1623, by offering a bounty on every pound of cocoons raised, and by imposing fines on land owners who did not plant mulberry trees, to show that the climate is favorable for silk culture, and that the problem is simply this: Can we afford to compete with the Chinese or Japanese who are now driving the not over-fed Italians out of the trade they know so well, and necessitating their seeking the more lucrative business of Indian corn growing?

The adage, "history repeats itself," is especially suggestive in respect to the failure in all previous attempts to make silk culture profitable in the United States, from the fact that while the labor market here has advanced, the price of raw silk has receded, quality considered.

The regrets expressed by the Rev. D. V. McLean, in respect to over-estimating the profits of silk culture, seem to us strikingly appropriate to the present time, considering the misleading statements frequently published, some of which we quote from a pamphlet received lately, published in St. Louis, and entitled "A Pamphlet to Introduce and Generalize Silk Culture," wherein it is stated that "a family of two grown persons and three children can rear in about forty days 38,000 silk worms." 38,000 cocoons weigh about 200 ounces. "The average price of cocoons is about $1 per pound; when very good and heavy it is about $1.50 per pound." If these statements are correct, and we think the estimate of the labor required is correct, the 200 days' labor quoted would yield from $200 to $300. On the contrary, experienced silk raisers know that an average yield of cocoons from 38,000 worms will not exceed 125 pounds when fresh, or 42 pounds when dry, and that the amount of silk obtainable therefrom would not usually exceed 10 or 12 pounds, 85 per cent of the weight of fresh cocoons being chrysalis; and as the reeling, *if well done,* costs nearly as much as the rearing of worms, it follows that fresh cocoons at $1.00 to $1.50 per pound would not be a paying investment for reeling purposes.

In striking contrast to the picture drawn by the St. Louis author, we quote from the *American Silk Journal* of May, 1882: "In the silk reports coming from Upper Italy there are complaints that the peasantry in that part of the country are very much discouraged, since silk culture has, from all appearances, ceased to be a paying industry." "The times when they used to get between 6 and 7 lire per kilogramme for cocoons seems to have gone forever"—(6 or 7 lire depreciated currency equal to $1.00 to $1.17 for 2⅕ pounds, or about 50 cents per pound)—"and they gradually abandon this pursuit and turn their attention to other more profitable branches, like tobacco, for instance. This is particularly the case with the smaller farms hitherto devoted to raising silk worms. It is estimated that last year one-third less silk eggs were hatched in Upper Italy than in 1880. If the quantity of cocoons obtained was nevertheless large, it was merely due to the casually good yield. As this year even less eggs will be hatched a deficiency in that region is quite likely to occur."

Canadian Fisheries.

The fisheries statistics for the year 1881, just published, show the total value of the production of the fisheries of Canada to be $15,817,162; the value in the provinces for the year amounts to $14,499,979, exclusive of the catch in Manitoba and the Northwest territories, of which there are no returns.

High Waves on Lakes.

The recent storm wave on Lake Erie has called out the following account of earlier waves of like character, first printed in the Cleveland *Leader:*

"On Lake Superior, in 1789, opposite Isle Royal, there was a sudden fall of four feet in the waters. When they returned they did so with a rush, the vibration continuing for several hours. In 1834 the waters above the Sault Rapids suddenly receded, and in half an hour returned with great velocity. In August, 1845, Dr. Foster states that while in an open boat between Copper Harbor and Eagle River, an enormous surge twenty feet in height and crested with foam rolled toward the shore, succeeded by two or three swells. Dr. Foster observed repeated flows and reflux of the waters in 1847, 1848, and 1849, which preceded or followed storms on the lake. In 1851 D. D. Brockway reported, in a perfect calm, a sudden rise of one foot and three inches, and in another two and one-half feet. The *Lake Superior News*, of July 17, 1855, reports extreme fluctuations between the hours of nine in the morning and four in the evening. Father Andre, in 1670, while on Green Bay, reported a three foot rise, but this was accompanied by a northwester. On April 14, 1858, the Milwaukee *Sentinel* reported a change of level in Lake Michigan of six feet. May 10, 1823, according to DeWitt Clinton, at Otter Creek, on the Canada shore, a wave came in nine feet high, and the same occurrence took place at Kettle Creek, twenty miles distant. Another in 1830 reports three waves at Madison Dock, Lake Co., O., the first rising fifteen or twenty feet. In 1844 or 1845 a wave came into Euclid Creek fifteen feet in height, carrying everything before it. On November 15, 1845, the water at Cleveland suddenly fell two and eight-tenths feet during a high wind from the southwest. The Toledo *Blade* records a change of ten feet on December 5, 1856. On June 15, 1872, at Charlotte, which is at the mouth of the Genesee River, the water rose twenty-two inches. In May, 1855, the waters of Seneca Lake exhibited a like phenomenon of continued rise and fall of sixteen and a half inches to two feet through two days. Similar agitations of the waters have been observed in Lake Geneva, in Switzerland."

Electric Storage.

At a recent meeting of the London Physical Society, Mr. Bosanquet described his application of the Faure accumulator charged by a dynamo-electric generator to the working of laboratory apparatus instead of the usual Grove or other battery. The net result of his experiments is that the accumulators charged for two hours have sufficient energy to keep the apparatus employed running for a week, and hence it is unnecessary for him as heretofore to put up thirty Grove cells each day.

Prof. Perry observed that a well made Faure cell, having the minium laid on in a uniform coat, does not lose its charge nor develop local action as is done by those accumulators in which the minium is put into holes in the plates.

Prof. Clifton described some ingenious devices adopted by him in lecture experiments on electrostatics. These consisted of insulating glass stems with glass cups, to hold sulphuric acid formed on the stems; also a form of key which, by rapidly succeeding contacts, brings the spot of light on the electrometer scale to rest without tedious swinging. He also described a form of lecture galvanometer, sine, or tangent, which could be readily shown in all its working to a large class, and exhibited a simple and inexpensive apparatus for measuring the focal length of a lens in six different ways, according to what is known about the lens. The results showed that the apparatus was very accurate in its indications.

Important Patent Decision.

In the case of the Detroit Lubricator Company against the American Lubricator Company, February last, in the U. S. Circuit Court, Eastern District of Michigan, before the Hon. Judge Brown, a verdict was rendered in favor of the American Lubricator Company, confirming and re-establishing their rights.

Judge B. F. James.

Judge James was, early in 1861, appointed by President Lincoln an examiner in the United States Patent Office, faithfully serving as such for more than eight years, when he became a member of the Board of Appeals, retiring from this position to take up the practice of patent law. For years past he had been suffering from a fatal attack of heart disease, to which he succumbed, June 26, at Washington, D. C.

Ingenuity Misapplied.

For two years the officers of the National State Bank, of Elizabeth, New Jersey, have been puzzled by the disappearance of cash from the drawer of the paying teller during business hours. A change of tellers did not stop the thefts. The detectives could make nothing of the mystery further than to establish an overwhelming probability that the robbery was effected by some one in the employ of the bank.

Recently, while attending to a customer of the bank, the teller thought he heard a mouse in the cash drawer. Opening the drawer quickly a thin line snapped, and he saw

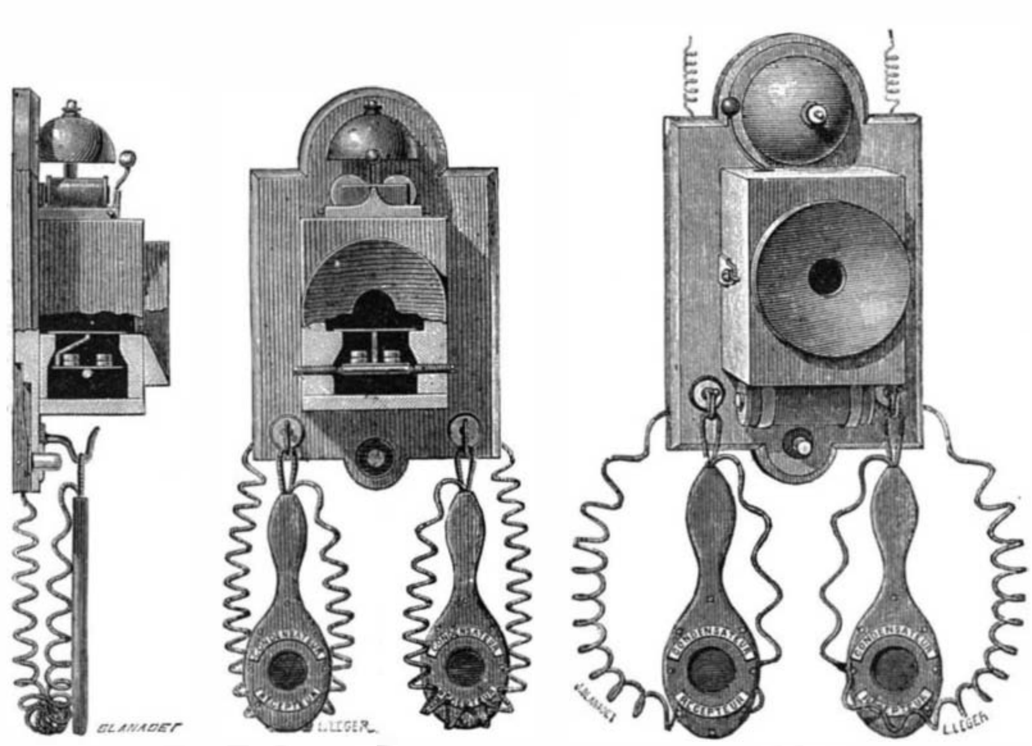

Fig. 1. Fig. 2.

HERZ'S LONG DISTANCE TELEPHONE.

lying on a pile of $20 bills a small flat piece of lead, about an ounce in weight. On examination, it was found that one face of the lead was coated with gutta percha daubed with soft shoemaker's wax. The officers of the bank were summoned, with two detectives, and the cash was counted, discovering that thirteen $20 bills had been abstracted that morning. Further examination of the drawer discovered a thin fish line running through two screw rings, one in the under surface of the counter over the middle of the drawer, and another behind the rear of the drawer. There was a space between the top of the money drawer and the counter, concealed, of course, in front. In the floor there was

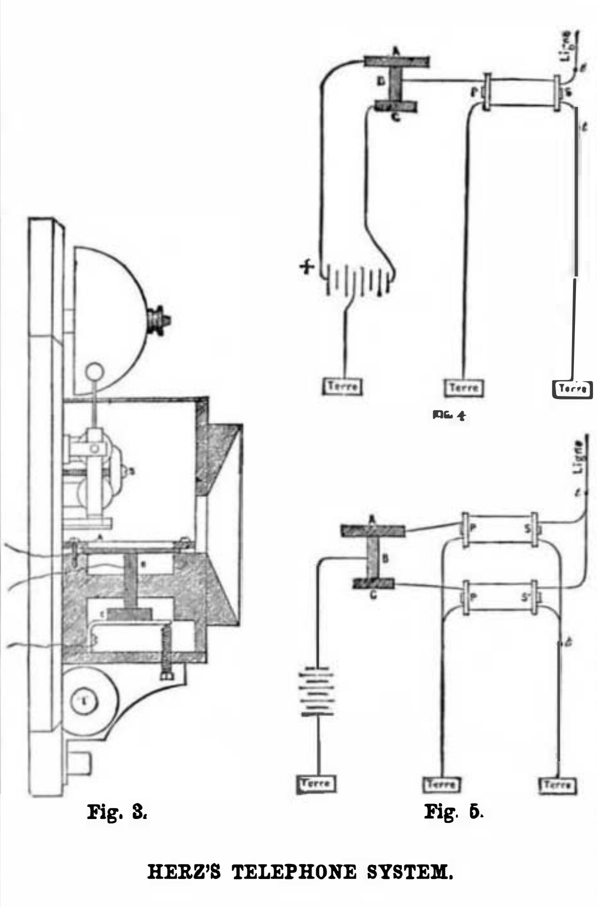

Fig. 3. Fig. 5.

HERZ'S TELEPHONE SYSTEM.

an old gaspipe hole, left there after some alterations in the arrangement of the office furniture. This was in such a position relative to the cash drawer, that lines reeved through both the screw rings could be so worked as to drop in the lead upon the bills by one movement, and carry it out again by a reverse one, a bill being attached, of course, during the latter movement. It was plain that the work was done from underneath the office, and to this place nobody had access but the janitor, who was arrested and confessed his guilt. He had stolen in this way about $2,000. The device showed ingenuity, which, if turned to honest ends, might have made the thief a useful and successful inventor.

THE TELEPHONIC SYSTEMS OF DR. HERZ.

M. du Moncel has thoroughly studied the different telephonic systems of Dr. Cornelius Herz, and the object of the present article is to describe some new experiments, and especially the efforts which have been made to simplify the apparatus and give it a practical and convenient form.

The apparatus represented in Fig. 1 is specially designed for lines most affected by induction, which renders communication impossible with ordinary telephones.

This plan utilizes two principles discovered by Dr. Herz: the alternation of the current in the line, and employing condensers as receivers. The instrument constitutes a station, completely inclosing, under a compact and appropriate form, all the parts necessary for the call and for communication.

The diaphragm is horizontal, but a funnel placed in front of the box collects the sound and concentrates it upon the diaphragm, and the instrument will transmit words spoken fifty centimeters from it.

Four pairs of microphonic contacts are placed upon an oscillating platform, under the diaphragm and connected with it by a rigid rod, communicating to it all the vibrations of the diaphragm. These contacts are of a special composition, and communicate with the battery and with the line.

In this apparatus it is not necessary to use the induction coil, but it is necessary that the number of elements of the battery in the line be proportioned to the distance of the two stations; for example, between Paris and Orleans it was necessary to use thirty elements of Daniell at each station, in order to obtain the maximum intensity. Besides, the condensers have to be charged, in order to reproduce speech, so that it is necessary to employ another battery which is interposed in the line. It would seem at first sight that the number of elements employed would perhaps be an obstacle to the use of this apparatus, but it must not be forgotten, on the one hand, that the battery designed to charge the condenser, working always in an open circuit, costs very little, and on the other hand, the instrument is designed to work over lines where the employment of magneto receivers would be impossible.

Figures 2 and 3 represent an apparatus where the alternation of the current is accomplished in a different manner, and in which the induction coil is used in order to diminish the number of elements necessary in a long line.

Originally this instrument was formed of a vibrating plate, having at each side a contact point touching the diaphragm lightly, and the vibrations increased or diminished the pressure alternately upon each one of these contacts, but this form being inconvenient, M. Herz preferred that which is represented in Figs. 2 and 3, which gives the same results.

The vibrating plate, A, is of conducting material. Below, and touching it lightly, is a cylinder, B, which rests upon a disk, C, the two being made of the same material as the plate. The disk, C, rests, in its turn, upon a thin metal spring, which is made adjustable by means of a screw, so as to vary the contact between the three pieces, A, B, C.

The plate, A, and the disk, C, are connected with one of the poles of a battery of four elements, which is grounded at the center. Finally, the cylinder, B, is connected with one of the extremities of the primary wire of the induction coil, the other end being grounded. The secondary wire of the coil passes out from one side to the line, and from the other side to the ground.

It may be seen by referring to Fig. 4 what occurs when the instrument is spoken to. The vibrations determine alternately the increase and diminution of pressure upon the cylinder, B. During the first vibration the power of conducting electricity increases suddenly at A (Fig. 4), while the inertia of the cylinder, B, prevents increase at C, the current follows the route, A, B, P, to the ground. On the contrary, in the second vibration the power of conducting electricity diminishes at A, but increases at B, and the current follows the route, C, B, P, to the ground. It may be seen that during these two phases there are alternating currents passing through the primary circuit of the induction coil, and that in the secondary circuit there will be produced four impulses, two in one direction and two in the opposite direction, passing over the line. By this arrangement the telephones are placed in a derived circuit between the line and the ground. This instrument has always given very good results upon a long line, of which the static charges are often considerable.

Another arrangement has been given to the same instrument which does not work with alternating currents, but as an ordinary microphone having great power. This arrangement is represented in Fig. 5. The current enters through the cylinder, B, and issues through the contacts, A and C, and is delivered to the primary circuit of the two induction coils, then to the ground.

The secondaries are independent, as the sketch indicates, or arranged upon the same circuit; in either case they are