

Correspondence.

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SUB-AQUEOUS AND OTHER TUNNELS.

(Concluded from page 35.)

THE THAMES TUNNEL.

England is full of tunnels, and some are of wonderful length. Before the introduction of railways, when canal transportation was all the rage, the construction of tunnels through hills and mountains was very common. Among the most remarkable of these canal tunnels were those at Worsley, on the Bridgewater Canal, which were eighteen miles length.

The most difficult and expensive tunnel ever constructed, considering its length and size, was the Thames tunnel. The time occupied in its completion was eleven years, and its cost was £454,714, or about \$2,273,570. The total length of the tunnel, from shaft to shaft, is 1,200 feet. The immense difficulties experienced, and the great outlays involved in the construction, were not due to the hard nature of the soil through which the tunnel was laid. We have already described the previous construction of the drift way or small tunnel, which was readily carried through nearly the same route, at a small cost. We have also described several different plans which would have been much cheaper, quicker, and better. The Thames Tunnel Company deliberately selected at the outset the most ponderous, massive, costly, and difficult scheme of construction that could possibly have been chosen, and then adhered to their choice with a dogged pertinacity characteristic of John Bull. The company might have abandoned their plan for a simpler one at almost any stage of the work, and could have saved money by the change. But they stuck to it heroically until their treasury was exhausted; they then applied to government and obtained aid to insure the completion, or rather almost the completion; for the tunnel is still unfinished. Only one of its two divisions has been finished inside, and the spiral roadways for teams, in the shafts, have never been erected. Only foot passengers can pass through, and from these a small revenue is derived, little more than sufficient to pay the expenses of attendants, cleaning, and repairs. But this wonderful structure, solid and magnificent as it is, will not always remain an idle curiosity. All that is wanting to render it useful is the construction of proper and convenient approaches. The progress of metropolitan population and enterprise is so rapid that every possible avenue of communication will soon be overloaded, and the Thames Tunnel will probably become a great and important railway thoroughfare.

Mark Isambard Brunel was the projector and engineer of the present Thames Tunnel. He was the inventor and patentee of a novel shield intended to cover the head of the tunnel and protect the workmen while they excavated the earth under the bed of the river. The construction of the shield was such that as fast as the excavation was made the shield could be pushed forward and the masonry of the tunnel built up in the rear of the shield. The directors of the company appear to have been greatly struck with the merits and novelty of Brunel's shield. It was an immense machine. Its face was 38 feet wide and 22 feet 6 inches high. It was larger and heavier than many of our country dwelling houses; and the plan was to excavate an aperture under the river bed large enough to receive the structure and then move it through as the excavation progressed. It almost passes belief that such a huge, unwieldy machine could be pushed through the bowels of the earth, underneath a river, its waters pressing down with a force of 2,000 pounds to the square foot. But the feat was actually accomplished, though at snail pace, the annual average movement being only one hundred feet a year.

Mr. Brunel once stated before the Royal Academy of Sciences at Rouen that the idea of his shield suggested itself to him upon an examination of the insect called the Terebrant, well known for its ability to bore through the largest timbers under water. Its head is protected from the water by a species of shield.

Dr. Tomlinson gives some interesting particulars concerning the building of the Thames tunnel. A vertical shaft of masonry, over 3 feet thick and 50 feet in diameter, was first sunk in the river bed, to a depth of 80 feet. This was a most laborious and expensive work. A similar shaft was subsequently sunk on the opposite side of the river, with which the tunnel connects. During the progress of the tunnel the river burst through between the brick work and the shield several times, and a number of lives were lost.

The excavation for the tunnel was thirty-eight feet wide, and twenty-two feet six inches high, and in order to leave a sufficient depth of ground in the middle of the river above the brickwork, the tunnel was formed with a declivity of two feet three inches in 100 feet. The ground above was supported while the excavation was going on by a shield, consisting of twelve massive iron frames, placed side by side, and capable of being slid forward, independently of each other, for a short distance, by means of screws abutting against the end of the completed brickwork, which followed closely on the excavation. The shield was supported on flat soles, capable of being easily moved forward; the top and sides were also closed in by flat plates, which were supported by massive framing, and also fitted close to the brickwork, by which means the soft earth was prevented from falling in. Each frame of the shield consisted of three stories, with a cell in each, in which one man could work; the front of each cell protected by a series of narrow poling boards, each of which was held in its place by an arrangement which allowed it to be fixed in a vertical line even with the face of

the shield, or a few inches in advance thereof. Each miner began operations by removing the upper poling board in his division of the shield, and excavating the small portion of earth thus exposed to the depth of about six inches; he then replaced the poling board, and caused it to press, by means of jack screws, against the face of the excavation; he next removed a second board, whereby a fresh portion of earth was exposed and excavated as before. When all the poling boards in one frame of the shield had thus been advanced six inches, the frame itself was moved forward, and the same series of operations repeated. The frames of the shield were thus alternately moved forward, slowly and with great caution, the brickwork following close upon the shield, and inclosing two arched passages, twenty-six feet four inches in height from the invert to the crown of the arch, and thirteen feet nine inches span at the springing of the arch. This shield was so damaged in the course of the work that it had to be taken down, and a new one raised. The arch, the invert and the curved side walls, are laid in concentric rings either a whole brick or a half brick in thickness, each ring presenting a plain face, no bond being employed between the successive rings. The tunnel is built with the hardest picked stock bricks; the first or inner ring of the arch is laid in pure cement, and the other portions of the work in half cement, and half clean sharp sand. The bricks for the semi-circular portion of the arch were molded to the true wedge form, so that the bricks radiated with parallel joints between them. The total thickness of the brickwork at the thinnest points where the inclosed arches approach nearest to the boundary of the rectangular mass of brickwork, is three feet. A solid wall, three feet six inches thick at the top, and four feet at the bottom, was constructed between the arches; small transverse arches being afterwards cut through it at intervals to form openings from one tunnel to the other. The whole of the brickwork is laid in Roman cement, and each archway is to be finished with a lining of cement, a carriage road, and a narrow footpath adjoining the central wall. Only one archway, however, has been thus completed. A brick drain is laid down from the center or lowest point of the tunnel, to the Rotherhithe shaft, by means of which any water that percolates through may be removed. The inclination of the roadway conducts the water from the other half of the tunnel into the drain.

THE SECOND THAMES TUNNEL.

A new, smaller, and cheaper, tunnel under the Thames is now in progress of construction by the Waterloo and Whitehall Pneumatic Railway Company. This tunnel is to be put down substantially on the Wyatt and Hawkins plan, heretofore described. That is to say, the tubes after completion are to be floated to the required line, then sunk in a ditch below the bed of the river. The tubes are built upon ways and launched like a vessel. The reader will find an engraving of one of these tubes taken from a photographic view as it appeared before launching on page 165 of this paper, Vol. 16, March 16, 1867. The tunnel is to be composed of a series of 4-inch boiler iron tubes, each 221 feet long, covered and lined with brick work. The extremities of the tubes are to be sustained in massive iron cradles, sunk in the river below its bed, upon foundations of masonry. The internal diameter is to be 12 feet, 9 inches.

THE WEYMOUTH TUNNEL.

This tunnel is 450 feet in length, excavated under the bed of the Backwater at Weymouth, England. It was commenced by sinking a shaft 50 feet through gravel and clay, of 14 inch brickwork, laid in hydraulic cement; the tunnel then strikes off horizontally a distance of 450 feet with a gentle rise to the other end. The tunnel is 7 feet high, 4½ feet wide. For fifty feet near one end where the clay is strong and retentive the walls are only nine inches thick. The opposite shaft is forty feet deep. The depth of water over the tunnel is 13 feet at high tide, 7 feet at low tide. There was but little leakage.

The construction of small tunnels under rivers is a very easy and comparatively cheap work. It is only when we come to gigantic structures of immense weight, such as the Thames tunnel, that the costs and difficulties become serious. The Weymouth tunnel was begun in 1834 and completed in a year.

PROPOSED TUNNELS BETWEEN NEW YORK, BROOKLYN AND JERSEY CITY.

An organization has been made for the purpose of procuring legislative authority for the laying down of tunnels upon the general plan just described between the cities of New York, Brooklyn and Jersey City. The proposed tunnel will be cheap in construction and is to have an interior diameter of about eight feet. The New York termini are intended to be at or near the City Hall Park, the terminus in Brooklyn being at or near the City Hall or the junction of Fulton and Court streets—a distance of less than two miles. Trains of passenger cars will pass through this tunnel from end to end in one minute and may be propelled by atmospheric pressure. The cars will be of about the same dimensions as the ordinary street passenger cars, will be brilliantly lighted, and run with very little noise or vibration. Experience has shown that air pressure is preferred as a motor to locomotive or horse power, as all jerking is avoided and the atmospheric car glides along with a smoothness resembling that of a vessel upon the water.

The number of passengers now annually carried upon the ferry boats between New York and Brooklyn is 40,000,000, being an average of 110,000 per diem, or 10,000 passengers per hour, reckoning the day at eleven hours, during which period the great majority are at present carried.

In the transport of passengers through the proposed Brooklyn tunnel trains capable of carrying 1,000 passengers will

be started from each terminus every five minutes. 24,000 passengers will thus be carried every hour, which is more than double the amount of transportation now required.

The area of the cross section of this tunnel would be about the same as the Croton Tunnel or Aqueduct, which is 53½ square feet. The Croton Aqueduct from the dam to the reservoir is 40½ miles long, built of brick and stone. The whole cost, including dam, land, right of way, bridges, reservoir, etc., was \$12,500,000. Of this amount nearly \$2,000,000 was for distributing pipes. The time occupied in construction was only five years.

THE CHICAGO TUNNEL.

Probably the longest sub-aqueous tunnel in the world is that at Chicago for supplying that city with pure water. It extends for a distance of two miles under the waters of Lake Michigan. This tunnel illustrates the cheapness and rapidity with which tubular structures of small dimensions may be cut in easy soil. The problem was to go horizontally through a strata composed chiefly of clay. The original contract price for the entire work was \$315,000. But in consequence of the sudden great rise in prices the amount proved inadequate. Changes were also ordered in the construction of the piers and vertical shafts to give them greater solidity, and the contractors are understood to have received much more than the contract price. Perhaps the largest share of the whole cost was involved in the construction of the two vertical shafts, as the horizontal tunnel was easily made. The outer shaft is 66 feet deep, 9 feet in diameter, composed of cast iron, set within a coffer dam which is 90 feet in diameter and 45 feet deep. The interior space between the dam and shaft is to be filled with solid stone work, and the pier thus formed is to be surmounted with a light house. The horizontal tunnel two miles in length was constructed in a little more than one year. It is 5 feet in diameter, composed of 8-inch brick laid in the best cement.

TUNNEL UNDER THE CHICAGO RIVER.

The tunnel under the Chicago River, Washington street, is now progressing rapidly and favorably. The contractors are Lake, Clark and Farwell. There is every prospect that the tunnel will be completed during 1868, when the people of Chicago will enjoy uninterrupted communication with the opposite bank. The whole length of the work from the center of Franklin street to the center of Clinton is 1,605 feet of which 932 feet is the length of the tunnel; the remainder consists of the open approaches.

TUNNELING THE TEES.

A late number of *Engineering* describes a plan proposed by Mr. Head, of Middlesboro', England, for tunneling the river Tees for the purpose of connecting Middlesboro', with Norton Junction by rail. He says:

"I propose that it should be a single wrought iron tube, but divided into two passages by a water-tight web or bulk-head. This division should be strong enough to resist the pressure of the water, and preserve, at least, one side for traffic in case of accident to the other.

"As to the construction of the main tube, I would recommend something on the same principal as that exhibited in the hull of the *Great Eastern* steamship, i. e., an outer and inner shell, for security and strength. The bottom should be made flat, or slightly arched downward. The whole section would thus resemble that of a gas retort or culvert.

"The best plan for placing the tube in position seems to be as follows: As near as possible to the point of crossing it should be constructed by the river side, in a temporary dry dock formed by earthen embankments, and at such a level that the tide would float it, if admitted by the removal of a dam. The tube should be erected upon timber balks placed crosswise at intervals of 5 feet, and bolted to the structure.

"These would be floated away with it, and afterward serve as sleepers.

"Meantime, the groove in which it was intended to lie would be cut across the channel of the river by dredgers. It is no new thing to dredge to an increased depth of 30 feet. It is, in fact, the cheapest method of excavating in all cases where it can be applied. The new Suez Canal has been greatly indebted to the use of dredging in the formation of its approaches. Dredgers have even been made to cut their way into the solid shore, the water following to float them as they made a channel for it.

"In the bottom of the groove so prepared concrete must be tipped from barges, and spread to a level by the aid of diving bells.

"When the tube was completed it would be necessary to cover over the ends temporarily to make it water tight. It would then easily be floated out of the dock to its permanent position. To let in sufficient water to sink it would not occupy many minutes more. The interval between the ebb and flow, which at spring tides is about an hour, would be ample to accomplish everything necessary. Concrete might then be teemed at the sides and over the top, and in this way, assisted by the natural tendency to silt up, it would soon become permanently fixed. Embankments of clay would now be thrown out from the shore on each side of the line of the approaches, and would join across the end of the tube. As soon as they were made water tight with clay puddle, the water between must be pumped out and the approaches built in the intervening space.

ROWLAND'S PLAN FOR SUB-AQUEOUS TUBE.

Mr. T. F. Rowland of Greenpoint, N. Y., is the inventor of a method of construction which has the merit of strength and solidity. A strong tube is first made of boiler iron, which is covered and protected by means of blocks of hydraulic cement, of segmental form, fifteen inches thick. These blocks are secured by means of screw bolts to flanges upon the ex-

terior of the tube, the arrangement being such that the bolts and iron work are wholly covered by the cement and carefully protected from the corrosive effects of the water. The exterior of a tube thus made would present a solid surface of hydraulic cement.

EDITORIAL CORRESPONDENCE.

Moorish and Spanish Andalusia—Cordova and its Christianized Mosque—Seville, its Cathedral and other sights—Malaga, its Climate, Beggars and Dry River—A Trip to Granada in a Dilligence—Curious Sights—Splendid Scenery—The Alhambra.

MALAGA, Dec. 14, 1867.

Andalusia, about which poets have sung and historians have written so much, comprises eight of the principal provinces of Southwestern Spain, and contains its most ancient and interesting cities. The country is also most oriental in its character, and possesses some fine scenery, and luxuriates in an abundance of tropical productions. The venerable olive with its scragged trunk and pale green leaves, the orange, the lemon, the graceful palm, the mournful cypress, and the mulberry, impart to the whole country a charming variety and loveliness. The aloe and cactus are abundant, and are planted in hedgerows along the railways, and sometimes for the division of farm lands. The valleys are sheltered by ragged, desolate mountains of gray granite, treeless and shrubless, and by brown hills, with intervening gullies, which often resemble vast battresses or ridges of dirt thrown up by human hand to support some structure or earthwork. The vine is extensively cultivated upon these hills, and what adds much to the picturesque character of the scene are the white houses of the peasants, which are often perched upon these ridges like a dovecot upon the top of a barn. The villages are usually built upon a steep hill, or rugged crag, with moldering battlements and ruined watch tower, within which the people, in olden times, congregated for mutual protection in times of civil wars or against the roving bands of freebooters which, unhappily, are not extinct to this day. We have been in Spain upwards of a month, during which time it has rained but two days and one night. The sky is usually cloudless, resembling in color that our beautiful October. The sunrises are exquisite; the sunsettings brilliant beyond description. To compensate for the absence of rain, which rarely ever exceeds thirty-five days in a year, the nightly dews are said to be abundant, especially near the Mediterranean, and the land is channeled into watercourses for irrigation, and irrigating wells, worked by mules, are very numerous. The water is usually raised into tanks by the rudest possible contrivances, and then emptied into conduits, which are frequently built up of brick or stone, on an incline, and carefully cemented, so that the water can easily be carried to refresh any part of the land. The labor connected with this general irrigation of land is prodigious, but without all this care, Andalusia would soon become a sterile waste—forsaken and tenantless. Barns are seldom seen in Spain as there is but little hay raised. The land is chiefly devoted to the raising of grain, which is threshed upon a circular brick or stone threshing floor, by means of a heavy wooden boat or drag having pieces of flint inserted in the bottom. This machine is dragged about over the grain by mules, and thus, by the joint operation of stone-boat and mule's feet, the grain is got out, and afterward winnowed by natural currents of air.

The Moors once inhabited this whole region, and there still exist abundant evidences of their taste, civilization, and learning. They came over from Africa upwards of a thousand years ago, and expelled the Goth from the land, driving him Northward, so that at one time even Madrid was an outpost of the conquering Arab.

The dull old city of Cordova may possibly contain forty thousand inhabitants, but what must it have been in the days of its pomp and pride as the Moorish capitol! History, or tradition—which is often a clue to correct historical data—says that in the 10th century, under the dynasty of the Moorish princes, Cordova and its suburbs contained 300,000 inhabitants, 600 mosques, 50 hospitals, 800 public schools, 900 baths, and a library of 600,000 volumes. The arts and sciences were cultivated with assiduous care, and Moslems though they were, they never practised the *auto de fe*, nor encouraged the horrors of Inquisition. On the contrary it was their custom always to respect the liberty of religion, and to inscribe upon the doorpost the declaration of "impartial justice." The Cathedral, or more properly speaking, the Christianized Mosque of Cordova is doubtless the finest specimen in Europe of the true temple of Islam. Its proportions are vast, massive, simple, elegant, and impressive. It has not the overpowering sublimity of Gothic Cathedrals, owing to the fact that all Moorish structures were intended to impress a lowly humility upon the minds of its believers, and as a natural consequence, this cathedral mosque, though covering more ground than St. Peter's, at Rome, resembles a vast undercroft to some gigantic building above it. The interior is divided into nineteen naves, resting upon one thousand variegated marble columns, which support the Moorish or horseshoe arches. Spanish daub and whitewash have obliterated much of the rich Arabesque ornamentation, but enough still remains to testify to the exquisite taste and skill of the Moorish artificers. There are forty-five chapels in the cathedral, but the only ones worthy of notice are those that were left by the exiled Moors. The Sanctuary of the Mosque still remains, and its marble pavement mutely bears witness how faithfully the the Moslem performed his religious vows by going around it upon his bended knees. Recently a most touching scene occurred in this little sanctuary, on the occasion of a visit of a Prince of Morocco, who went on his knees seven times around it, praying, and weeping like a child. The gorgeous work-

manship of his ancestors had been stripped of its brilliant decorations by a people who could not even read the Arabic inscriptions. The cathedral is surrounded upon three sides by some ecclesiastical buildings and a high wall, inclosing a fine large court which contains some beautiful palms, and a grove of noble orange trees, upwards of three hundred years old, and now fruitful even in their old age. In the center stands the very cistern that was used for ablutions by the Moors in the 10th century. Every day this beautiful court is thronged by priests, who smoke, and sun their sleek black garments, and by hideous beggars who watch and wait and annoy all visitors by their piteous cries and dissembled prayers. Such beggary and distorted misery I never before saw in any other country; and who can wonder that it should be so, when so many idle, well dressed priests are permitted to eat up the substance and hard earnings of the people. The revenue of the Cathedral of Seville supports, as I was informed, over one hundred priests, with a corresponding heavy distribution among the other twenty-six churches of the city. The Archbishop lives like a prince, and the poor people support all this idleness and extravagance in the name of religion. The streets of Cordova are very narrow, and the houses are usually two stories high, having patios or interior courts, paved with marble, after the Moorish style, provided, also, with galleries and fountains to shelter and cool in warm weather. Oranges, lemons, bananas, and rare plants and flowers are usually cultivated in these courts, and are always to be seen through grated iron doors—a most cheerful and refreshing sight. Moorish mills and other remains abound in Cordova, but their glory has departed, never to return. The beautiful Guadalquivir runs under an old stone bridge, the piers of which were built by Octavius Cæsar.

It is five hours' journey by rail from Cordova to Seville, which is perhaps the most interesting city in Spain. It stands upon the Guadalquivir, and the surrounding plains teem with the luxurious productions of the country. Like Cordova, it is ancient and Moorish; but by reason of its commerce, Seville appears to be an improving, busy, prosperous city. The chief attraction of all Spanish cities seems, first, to center in the old Cathedrals, and in this particular, Seville stands unrivalled in Spain, and second only to Rome, which disputes all competition. The Cathedral of Seville occupies the spot where the ancient Romans once had a Temple to Venus. This was substituted by an elegant Moorish Mosque, of which nothing now remains. The present edifice is Gothic, of the best period in Spain, and combines majesty, simplicity, and elegance. I always make it a rule to visit the Cathedral at the hour of Morning Prayer, when the first light of heaven begins to stream through the richly painted windows, and the incense from the altars is diffusing its cloudy vapors. At such an hour there is present a sort of mysterious influence which increases the effect upon the mind to a wonderful degree, and especially so in the Cathedral, the interior of which is truly vast in all its proportions of length, breadth, and height, and where unity and harmony seem to pervade every part. The only apparent defect—and it is a serious one—is that the high chapel and choir have since been built in the central nave, thus breaking the view and sadly marring the interior effect. People who do such things are unworthy to have so fine an edifice. The pavement of the church is laid in black and white marble, and beneath a large monumental slab is buried Fernando, a son of Christopher Columbus, who bequeathed a splendid library to the city, and was esteemed a man of piety and much learning. There are also some splendid pictures by Murillo, who lived and died in Seville, but, most unfortunately, their beauties are partially concealed by the sombre walls of the cathedral chapels. The Sacristy of the church is by far the richest in Spain, and contains valuable paintings, besides tons of silver and gold and other precious relics, some of which put the faith of skeptics to a pretty severe test. St. Ferdinand, the king who expelled the Moors from Seville, Beatrix, his wife, Alonzo, the Learned, and Donna Maria de Padilla, the celebrated mistress of Don Pedro, the Cruel, are buried in the chapel. The Moorish Giralda, or tower stands separated from the cathedral, and is a most exquisite structure. Its ascent is easily made, up thirty-four inclines, which a horse could easily traverse, and from the top the view of the city, plain, and distant mountains is truly glorious. Seville has a fine Moorish Alcazar, or Calif's Palace, which, in spite of the tinkering of Spanish Kings, still retains much of its former splendor, and certainly nothing can exceed its charming oriental gardens with their loaded orange and lemon trees, rare flowers, fountains, and long Moorish galleries which overhang them. The Alcazar is now the property of the Duke of Montpensier, son of Louis Philippe, who has a splendid palace and orangery adjoining. The residence of the late Barber of Seville is pointed out, but the goodwill of his business seems to have departed with him, as the house is now occupied for domestic purposes. The famous *roué*, Don Juan, of Lord Byron's voluptuous pen, also lived here and died in the hospital La Caridad, which was built by Don Mauara, a wealthy profligate young nobleman. It is said that Don Juan died a "perfect example of piety, humanity, and abnegation." His frail humanity lies buried in a room adjoining the chapel, where are preserved a model of his head, also, his sword, spoon, and fork; and upon a marble slab, over his remains, are inscribed the words, "Here lies the body of the worst man that ever lived. All pray for me." A sad inscription and a sad commentary upon an ill-spent life. The chapel of La Caridad contains the masterpieces of Murillo: Moses smiting the rock, and Christ feeding the multitude. Also, a most extraordinary picture, painted by Valdes Leal, called the "Dead Prelate." When Murillo looked at it, he said to the artist, "One cannot look at your picture without holding his nose;" to which the artist replied, "You have taken all the flesh and left me to work on

bones." It is a curious picture to adorn the walls of a church, but it possesses a religious idea in the prelate's hat and robes, and that is enough to inspire the reverential awe of these benighted people. The small picture gallery has several fine Murillos—all religious subjects, and it is a pity that so many of this master's great works should be buried up in old Spanish towns, where few can ever see and appreciate them. An Englishman, who was here with us, said that he intended to propose to his government to swap off Gibraltar for the works of the Spanish Masters. He thought it would be a profitable bargain to give up a big rock of expense for something really worth having. The ideal God of Spain, however, would depart with these truly noble pictures.

The Government Tobacco Factory, in Seville, employs 5000 women. The sight is the most singular spectacle of humanity to be met with anywhere. The girls earn about 50 cts. per day, and are supplied with a dinner in the building at a cost of four cents per head. They are of all ages and colors, and work chiefly in one immense hall. There were little babies lying in tobacco baskets; some were nursing, others being attended by larger children. Also, pet dogs and cats, and a general jumbling up of all sorts of things. The snuff is pounded in a wooden mill that resembled an old-fashioned fulling mill, and worked by mules blindfolded, possibly to keep the snuff out of their eyes, or to prevent them from being frightened by the ugly old mill which they are employed to grind. Persons fond of tobacco (and these girls are fond of it), may here see how their favorite weed is prepared, and of what stuff it is made. It is said that a very romantic marriage of love took place a few days ago—the union of an old tobacco maker of 102 with a tobacco damsel of 15 years. The centenarian had saved a little money, and was at a loss to know how he could bestow it in case he should ever die, therefore he fell in love with the maid and she fell in love with him—no doubt.

Near to Seville there are remains of a ruin where the three Roman Emperors, Trojan, Adrian, and Theodosius were born, besides many other things of substantial or vapory interest. But I must leave Seville after mentioning a single fact or two. It is the custom, in some of these old cities to employ a species of Nocturnal Muezzin to patrol the streets at night and call out the time and situation of things. They perform their duties in a sort of sing-song style which is often quite musical. Not knowing exactly what was going on under our window, we half imagined that we were being serenaded once in fifteen minutes; but, after a while, we found out what it all meant, and moreover, that our "Muezzin" was frequently employed to alarm the house whenever travelers wished to get off early to the cars. The Spaniards are slow, but somehow their trains all start early. One night there was a sick person in the house, and a band of religious singers, bearing the crucifix and some banners, came under the windows and sung a sweet, plaintive song, or prayer, for his recovery. It was most singularly touching, and it is to be hoped that the pious exercise, so carefully performed, reached the ear of heaven.

We left Seville with some regret. It is a beautiful, balmy spot, and we much enjoyed its delicious sunshine under the orange groves in the public plazas. To reach Malaga from Seville it is necessary to return to Cordova and thence proceed by rail on a branch line. It is a good day's work, but some portion of the route passes through a country quite remarkable for its savage grandeur. The Sierras are several times pierced by tunnels, and the valleys are crossed by high embankments, the road descending by heavy gradients to the segmental shaped valley which lies back of the city of Malaga. Here the Mediterranean first appears to us, calm and beautiful as a lake upon a summer evening and, here also is found a climate more uniform than that of any other part of Europe. The thermometer in mid-summer rarely ever rises to 85°, while in winter it seldom sinks below 45°, the mean annual range being 49°, which is many degrees less than any other city on the continent. For example the mean temperature of Pau is 68°, Rome, 62°, Nice, 60°. Malaga is therefore a resort for invalids who require a uniform temperature, but to my mind existence might become a serious burden if it had to depend upon a permanent abode in a place so far out of the way of every body and every thing. The city though possessing upward of 90,000 inhabitants contains very little to interest a stranger, while to add to the discomfort, the hotels have more show than substance and their open doors are thronged by beggars who never give up their importunities so long as you are in sight. Just on the outskirts of the city there is a well kept and well arranged Protestant cemetery—to us a sort of hallowed spot of kindred dust, as it contains the remains of some of our countrymen who have either been wrecked upon the coast or have come hither to seek for the healing gilead which they vainly sought for elsewhere.

Malaga is cut in twain by a most extraordinary river called the Guadalmedina which, according to the map, has a tail up in the Sierras and a mouth in the sea. The river is carefully walled in and spanned by fine bridges, and is navigable for omnibuses and other wheeled vehicles up for a considerable distance. It is as dry as the Valley of bones depicted by the prophet Ezekiel. Nevertheless it is subject to fits, and upon one occasion when in a paroxysm of fury, the floods came down so violently that a number of houses were carried away. Just how all this came to pass is one of those Spanish riddles which sadly puzzles the unlearned traveler. Spanish rivers, like Spanish towns, are usually either dried up or are in very reduced circumstances.

Our trip to Granada partook very much of a warlike expedition. We started off in the morning at 6 o'clock upon an old dilligence, drawn by six mules and two horses on the lead. A heavy broad-beamed Wall street banker had se-