

AA000856062



UC SOUTHERN REGIONAL LIBRARY FACILITY

# REMINISCENCES.

---

---

*Ex Libris*

C. K. OGDEN



THE LIBRARY  
OF  
THE UNIVERSITY  
OF CALIFORNIA  
LOS ANGELES

To Jack Clements  
With kind regards  
From C. F. P.



# Reminiscences

OF AN



# Engineer

At Home and Abroad.



BY RICHARD WINDER.



SECOND EDITION.



Louth:

A. H. BURTON, LTD., EASTGATE.

## Preface.

---

*These Sketches show what varieties and casualties happen in almost every one's life and experience. They pass over a life of more than fifty years, and the memory has been assisted by notes taken at the time the several occurrences happened.*

*Patience and forbearance of the reader is asked for, rather than severe criticism, on account of my inexperience as a writer. I have done my best.*

**RICHD. WINDER.**

**BENNIWORTH, VIA LINCOLN.**

SRLF  
URL

TA  
140  
W72A3

**By Permission.**

---

I BEG MOST RESPECTFULLY TO DEDICATE THESE  
PAGES TO  
THE RIGHT HON. LORD HENEAGE, P.C.,  
OF  
HANTON HALL, LINCOLN,  
AS SOME SLIGHT RECOGNITION OF MANY FAVOURS  
RECEIVED.

1910369

# Contents of Second Edition.

	PAGE
CHAPTER I. . . . .	5
In Ireland. Attending a Wake and Wedding. Poverty of the Country. Journey by Car from Cork to Youghal. Voyage to Ireland and Return by Way of Bristol.	
CHAPTER II. . . . .	11
Apple Orchards in Devonshire. Small, but Good Cattle. Clotted Cream. Steep Hills. Construction of Lines in England. Voyage to Pernambuco. Crossing the Equator.	
CHAPTER III. . . . .	17
Adventures in Brazil. Remarks of Good Emperor. Mosquitoes. Ants. Vampire Bats. Bridge of Monkeys. Marmosets and Their Affection for each other. Humming and other Birds. Alligators. Coconut Trees. Large Black Beetles. Scorpions. Timber of the Country. Speaking Ships at Sea. Native Plan of Building Bridges over Waterways. Carapattas. Bishus. Snakes. Fruits. Chain of Monkeys. Yellow Fever. Tropical Rain. Swimming Across Rivers. Attacks of Ague. Large Size of Spiders. Mode of Killing Bullocks.	
CHAPTER IV. . . . .	33
Up in the Front Setting Out Line Through Wood Ten Miles Across. Cooking Green Lizard. Fresh Attacks of Ague. Absolute Power of the Emperor. Night Attack of Beetles. The Horses of the Country. Vultures. The Prairies. Chase After Bullocks. Murder of Two Farmers in a Wood. Murder at Affogados. Another Murder by a Professional. Conscription for the Army. Brazilian Family Kind to the English. Sugar Making. Sale of Slaves by Auction and Privately. A Slave Chase with Bloodhounds. Bad Attack of Ague. Obligated to Leave the Country. The Homeward Voyage.	
CHAPTER V. . . . .	45
Exploration of a Natural Cave. Cooking Stove at Inn. Water-spout off the Bay of Biscay. Final Measurements for English Contractor. Murder by Spanish Highwaymen. Wolf Met on Railway. A Travelling Draper and Four Mules Attacked and Killed by Wolves. Dogs Guard Cattle against Wolves. Escape of Smuggler from Civil Guard. Inhabitants of Biscay. A Spanish Bull-Fight. Accident on Railway.	
CHAPTER VI. . . . .	62
Adventure at St. Nazaire. Man Taken Prisoner at Havre. System of Espionage in France. Return to England. Voyage to Lisbon. Description of Iron Bridges. Torres Veiras. Day at Cintra. Public Gardens and English Church at Lisbon. Cork Plantations. Floods in Portugal. Description of Diving Dress. By Boat on Tagus to Constantia. Mode of Reclaiming Land from the Tagus. Rebellion Amongst English Workmen.	
CHAPTER VII. . . . .	76
Start of Steam Plough in West Kent. Hop Presser—Two Designs. Sheep Folding Machine and Tarring Trough. Improved Steam Plough.	
CHAPTER VIII. . . . .	84
On Drainage as to Health; and on Sewage, and Its Value as a Fertilizer.	
CHAPTER IX. . . . .	97
Description of Elastic Horse-shoe.	
CHAPTER X. . . . .	102
Description of "Carrago" Nose Band for Horses, with Testimonials from Buyers.	
CHAPTER XI. . . . .	108
Voyage to Christiania, Norway. First Block From Not Knowing the Language. Tivoli Gardens. The Emperor of Germany Visits Christiania. King Oscar and the Emperor Publicly Open a New Road to Holmen Kollen Hotel. Visit to the Hotel Afterwards, and Notes By the Way. Description of the Viking Ship. Oscar's Hall. The <i>Fram</i> and Dr. Nansen. Extracts of Dr. Nansen's Experience in the North Pole Expedition. Andree's Adventures in Journey Towards the North Pole by Balloon. General Description of Christiania. Further Trouble From Want of the Language. Elk and Reindeer Hunting. Horses and Harness in Norway. About Wild Bears and Wolves. Splendid Salmon. Small Chickens Killed for the Table. Description of Cow Barn and Haymaking. Costumes of Peasants.	



# Reminiscences of an Engineer.

---

## CHAPTER I.

MY HISTORY begins at 1836, at which time I went to one of the largest manufacturers then in London of Marine Engines. There were two factories belonging to the same firm; one at Ratcliff employing about 500 hands; the other at Millwall employing about the same number. I started in all the glory of white moleskins, and had to work daily from six to six the same as any other apprentice (for six years). When this time was out I went to a college of Civil Engineers (at that time at Putney) to learn mathematics, mechanical drawing and other theory for three years. I then went to Ireland levelling and surveying for contemplated railways—I went by rail to Liverpool and across the Irish Sea to Dublin, and in that passage experienced the roughest sea I ever was in. It had been told me no wave ever rose or fell more than thirty feet above or below the level line. To me the steamer seemed to go double that. Steamers in those days were mostly fitted with paddle-wheels, and when at the top of a wave amidships, the velocity of the wheels for the short time they were out of water was very great, and almost stopped for a moment when they again touched water; then, when going down the wave, all looked much like going to the bottom; but on reaching the bottom of the wave, there was a great splash at the bows and we commenced to mount the next wave, and so on, we were buffeted about for most of the passage across until I found out I was not a good sailor; eventually we reached Dublin without an appetite. After a night's rest at the hotel, and a breakfast there, I felt all right: able to enjoy the sparkling wit and quick repartee of the Irish character. I went for a walk around Phœnix Park, which contains 1,760 acres; noted the river Liffey, and had a general look at the great Irish city: I also tested Guinness's celebrated Irish stout, and Irish whiskey. I then went by the four-horse mail coach through Wicklow to Waterford where our work began. I engaged a room at the hotel there and started levelling and surveying the contemplated line from Waterford to Cork *via* Dungarvon, Middleton and

Youghal, with a branch to Tramore. Here was our first experience of bog-trotting, bog peat fires, potatoes, pigs, and the real Irish cabin where smoke came out of the doorway because there was no chimney. On one side of the fireplace a donkey was housed, chickens roosting amongst the rafters at night, mud wall divisions separating the sleeping apartments; the potato tub, out of which the pig fed, and sometimes the children; the ground was the floor, and stepping-stones laid between the front door and the road, with a manure heap on each side; and with all these evidences of poverty, the occupier of the cabin has pride; fond of telling of his ancestors, sometimes traced from William the Conqueror—grand people of course—and the descendants always proud to recount their history. You are apt to offend their dignity if you offer money, the best and least offensive course is to leave with them a few cakes of Cavendish tobacco. The children, too, followed the car from the hotel in numbers, begging. Their poverty was so abject that we threw a few coppers to them. We had some ham sandwiches for lunch; we gave them one, and never saw greater surprise expressed in any countenance, evidently it was the first time they had tasted such food. One took a piece, bit it, looked on with wonder; gave another a piece, and looked at the expression of his face while eating it, seeming in doubt whether we were feeding or poisoning them. Their principal food is the potato; in this the pig joins because "he's the boy that pays the rent." After leaving Waterford, you lose all luxuries till you reach Dungarvon, Youghal and Cork. Staying at a little inn at Stradbally I asked the landlady if she could provide something extra for dinner, as I expected a friend. She, after some hesitation, promised to do her best. In the morning there was noticeable a very melancholy-looking fowl wandering along the street in search of anything to be picked up. That fowl was our dinner, and tough enough it was. The girl who ordinarily waited, went about quietly in her bare feet; but as there was company on this particular day, she must don a pair of strong boots, that went clattering about to our utter dismay. Presently we reached Dungarvon, and got on better. While there, a beast fair was held. One man had a cow to sell, another wanted to buy this cow, but wanted it at a lower price than the seller asked; argument rose very high, many reasons were given for and against the price, until they fought about it; the "shellalees" went to work. After a time friends of each stopped the fight, and eventually the combatants made friends, rushed at each other and kissed; thus ended the matter, according to Irish fashion—not English certainly.

Leaving Dungarvon, and making for Youghal, the road is most interesting. After passing over a bridge across the river

Blackwater, you commence ascending a road zigzagging backwards and forwards on the face of a mountain, till you reach the top or table-land. All the while you are ascending, Dungarvon remains in sight. It was a bitterly cold day when I first took this journey, and I made the remark to the driver, "What would I give for a drop of whiskey to keep out the cold." The driver's ears were open in a moment at the sound of whiskey. "What's that you say? Here's the boy that knows where it's to be had;" accordingly he stopped the horse, knocked at an old cabin door, and called out "Biddy"—Biddy soon appeared, and asked if it was Tim. "Right you are" was the answer. With that they understood each other, and we had whiskey all round. It was free of duty, was made in the cabin, and goes by the name of "poteen," and very good it is, although it does taste smoky. When we reached the top, the road ran very level for miles. We passed Lismore Castle, belonging to the Duke of Devonshire; fine salmon is caught here, and the surrounding grounds would be magnificent if kept up, and if the Duke lived there. I expect however he feels safer at Chatsworth. There are many other fine old mansions and grand laid-out gardens around, with large and well-designed stabling, some with clock towers, all going to decay from the landlord being an absentee. The resident agents send out an annuity to England, Italy, France, or wherever he may be living. This annuity is spent in the country where the landlord lives, to the impoverishment of Ireland. The agents also get their living out of the estate, and the poor tenant is ground down so low as to be hardly able to live at all. While speaking of absentee landlords, the people are themselves much to blame, a thing easily to be understood, after reading from time to time of the shooting that goes on by the moonlighters, the mutilation of cattle, and the cold-blooded barbarities reported as having taken place. The murder of Lord Cavendish and Mr. Burke, in Phoenix Park, illustrates the bad state of the country. And also to illustrate how badly advised the poor people are.—The Marquis of Waterford kept up a large establishment at Curraghmore, near Waterford; he kept also a pack of fox-hounds there, and spent an annuity sufficient to keep up the village. One day his fox-hounds were poisoned, and he, in disgust, gave up living there, to the complete ruin of the village. The working people are without education, ignorant and superstitious, guided by the priest, whose power is immense amongst them. Even with the wealthier tenants, the priest's rooms are kept for him in the house, to occupy when he chooses. There is a hearty welcome free of charge, and they feel favoured when he is there.

Our next important halting place was Youghal, where there

is a good inn. While there I became acquainted with a young Irishman, and we became great friends. His father appeared well off, and lived in very good style. The son introduced me to the family. I spent many a pleasant evening there, without much ceremony; the son's introduction seemed the free pass. One day the father lent us the dog-cart, we drove over to see the farm and establishment of Trappist monks on a mountain not far away. The monks do not speak to each other, they are refugees from France; some of them work upon the farm, which they have reclaimed, some perform priestly offices; they have reclaimed about 200 acres of ground, they have built buildings for their accommodation, as well as outbuildings for cattle; also a church, and pretty gardens, surrounded by walls for privacy, as well as for growing fruit. Those who do speak, are the man at the gate, the man who takes you round the premises, and the man who attends markets and buys and sells. In these duties, each takes his turn fortnightly. You are expected to leave a gratuity after seeing over. These, and the profits of the produce of the farm, keep them going.

While at Youghal, we English attended an Irish wake, it was of a young man. Downstairs in a parlour, pipes, tobacco and whiskey were upon a centre or round table, chairs were placed around this table for the accommodation of the more distant relations or friends. Upstairs, where the body lay, those more nearly connected, or more interested in the deceased, were assembled. On each side of the bed, professional keeners or chanters were engaged; the poor mother was at the foot. The audience was seated on stools around. The keeners rose, singing the praises of the dead, rising higher and higher in voice and excitement, until the mother at the foot cried out in utter grief and despair. The keeners then sat down, rested, and had some whiskey, as did the audience around. This proceeding goes on in both rooms, for three nights. One night for us was sufficient. We paid liberally towards expenses, and left in peace.

Another time we joined a wedding in the kitchen of our inn. The priest was there, and drink abounded. Things were getting a little fast when we left, giving money to keep the game alive. The bride was the chambermaid of the inn; the bridegroom the boots. The whole proceeding was a thorough case of high life below stairs.

Our next stopping place was Cork, a famous city. Patrick Street, the chief street, is wide, with noble-looking shops, after the style of Oxford Street. I bought a pair of ladies' kid gloves for curiosity. So thin is the skin, that the two gloves were packed in two walnut shells, and they were of a size to fit the lady I gave them to in England. I had a sight of

Blarney Castle, but had not time to go to the lakes of Killarney, which is much to be regretted. The Cork girls are pretty, with dark sparkling eyes, like the Spanish.

Journeying by car one day from Cork to Youghal, we started kicking all through Cork: the driver got down and fastened a rope-halter for a kicking strap. The kicking continued, though not so high; still the jerking shook me a good deal. At last I complained and threatened to return. "Hush," said he, "if she hears you she won't go another step, it's only her playfulness at first starting, presently you'll say you never sat behind a better horse." We tried a second time with the kicking strap tightened up till the thing could hardly trot. From sheer exhaustion she took us to Youghal, the driver boasting of his conquest, and I with my neck almost dislocated.

There was necessarily a great deal of night travelling, on outside cars, and also some miraculous escapes. On one occasion we passed over a road near the sea, on the way from Waterford to Dungarvon. All passed off well, and I reached Dungarvon safely, but the first news on the following morning was, that a slip had occurred in the night, taking away a considerable portion of the road to the beach, about 100 feet below. Had I been passing at the time, or followed on after the slip, instead of before, certain death must have been the result. On other occasions on these night journeys, robberies have been committed before and behind, but as luck would have it, I have passed at the proper time, and have been unmolested.

Our return journey to Waterford was by the same route we came. At Tramore, races were being held on the flat sand beach.

At Waterford we took passage by steam vessel, going round by South Wales, up the Bristol Channel, the river Severn and the river Avon, to Bristol, and, my word! what a noise the pigs made on deck. They were fenced off, and planks laid upon the fencing for the attendant to walk over the pigs, to stir them up with a long pole, pointed at one end. Pigs get sea-sick, like human beings, and when in this state, push their noses as far as possible under the bodies of other sick pigs, and so would smother, but for the attendant, with his long pole, shifting them. Then comes the same squeaking that takes place while being loaded at Waterford, quite early in the morning, when we, at the hotel close by, would like to be sleeping, but do not get the chance.

Our voyage to South Wales was not so rough as in crossing from Liverpool to Dublin. In going up the Avon river, we saw the two piers, built with the intention of crossing by a suspension bridge. Funds were short, and so the work stopped at the piers. As a temporary plan for crossing, a

strong iron bar went from pier to pier ; a ring made to pass freely over the bar, and a basket hung from the ring ; one person could get into this basket, and pull himself across by ropes secured at each pier. Since then the old foot suspension bridge has been fixed, that was taken down at Charing Cross, London, to make way for the present railway, where trains now cross to the Charing Cross Station, from London Bridge and Cannon Street. For this cause Hungerford Market was done away with, Northumberland House pulled down and a new street made from Charing Cross to the Thames Embankment.

## CHAPTER II.

I NEXT went on Parliamentary work, making plans and sections of contemplated railways in Devonshire, straining every nerve to get all done, and deposited at Somerset House by the thirtieth November, in compliance with standing orders. The principal hotel we stayed at in Devonshire, was at Barnstaple, where in the assembly room hung a grand specimen of tapestry, reaching from ceiling to floor. I also went to Ilfracombe, and along the south coast, Sidmouth, Teignmouth, Plymouth and Torquay, and certainly never saw a more romantic and picturesque county in England. A great part of the earth in this county is red. There are large apple orchards from which the well-known cider is made. This county is also noted for its compact and well-formed cattle, mostly red in colour; many times very successful in competition at the Christmas fat cattle show at Islington, London. The beef of a three-year-old bullock is tender, close in the grain, and of flavour equal to the Highland Scot.

The clotted cream comes from Devonshire. There are many steep hills about, so steep indeed, that wagons may be seen having four horses holding back by the breeching, as well as the skid to the wheel; namely two in the shafts, and two behind secured to a pole fastened under the wagon body, and a cross-bar at the other end to fasten the shafts to; these horses' heads being at the back of the wagon, secured by a leading rein to each. Indeed so hilly are some of the fields, that they are manured by boxes grinding on the ground for friction in place of wheels and ordinary carts.

I then went to the South Eastern Railway, at the time when Mr. P. W. Barlow was chief engineer, and my first job was to check the levels of an opposition line to Dover (now the London, Chatham & Dover Railway). I began at London, and worked through to Dover, stopping at the several hotels on the route. This done, I gave evidence in the Committee rooms of the House of Commons as to these levels. I then went on the line in construction from Tunbridge Wells to Hastings, set out the centre line, took levels and made the permanent section of a great portion. I then superintended the making of the tunnel at Wadhurst, where, while sinking the shafts to the formation level, we came upon an interesting deposit of sea-shells, about 200 feet below the surface; and Wadhurst is some distance from the sea now. The railway was a straight line through the tunnel, several shafts were

sunk down to formation level. From each shaft, headings were driven each way, and at the same time, to hasten on the work, the earth was drawn up each shaft to the surface, by windlass, until the several shafts met, and we got a passage through, about six feet by four feet. We then made the full-sized tunnel, working from each end, depositing the earth either on spoil banks, or to make up adjoining embankments as required, following close on with the brickwork. A high brick tower was built on the surface, midway between the tunnel faces at each end. On this tower was placed a transit theodolite to keep in adjustment the centre lines hung down each shaft. A wooden framework was erected around the tower, so that the instrument should not be affected by wind or rain. At some distance beyond each tunnel face, short brick piers were built, with the centre line marked thereon. By these we could at any time test the adjustment of the transit. I next set out six miles of the centre line at the St. Leonard's end.

I then went on the Reading, Guildford and Reigate Railway, till it was finished.

Next, to the Staines and Wokingham Railway till it was finished. I set out the seventeen miles of centre line of railway, levelled the same, made a permanent section, fixed the gradients, calculated the depths of cuttings and embankments at each chain, calculated the quantities of earthwork throughout, set out side widths on the ground and then set out the bridge and culvert foundations for ten miles out of the seventeen, as well as other necessary works from time to time during construction; walking through ten miles almost daily, with a man and tools to set out necessary work as we went along; measured the works each fortnight for payment of the sub-contractors, and once a month for payment of the chief contractor. Another responsibility incurred was to get married while on this work. At the completion of this work, I entered into a three years' engagement to go to Brazil, and in August, 1856, left the Victoria Docks, Blackwall, in a steamer that was going to trade on the Brazilian coast. Our captain was a young man, not more than thirty-five years of age, but he was a clever, able seaman, well qualified to fill his position; he was withal a very agreeable companion to me, his chief passenger. He taught me how to take latitude and longitude, and the use of the chart on which he fixed our course after every observation.

We had a boy, too, amongst the crew, the most daring and fearless. He would start amongst the rigging and challenge any sailor to catch him. We offered prizes, and saw some very spirited chases, yet he was not to be caught; some of his jumps were most daring.



On one occasion he took a loose rope into the rigging, went with it along another horizontal rope connecting the main and foremast. He made his rope fast at the half distance between foremast and mainmast, went back to the foremast, and sprang in the air, and alighted hanging by his rope till he reached the mainmast, thus showing his utter fearlessness and accuracy of eye.

On another occasion, while we were at anchor in harbour, he went up the mainmast, climbed to the truck at the top, and balanced on it on his head.

The sailors made him steal some bottled stout that was in casks between decks, taken out as cargo to Brazil. He got caught at this. The captain found out he was the tool in the hands of the men, yet he had to make a show of punishment, so he had him put in irons and placed in front of the man at the wheel all night, with his hands behind his back. He was found in the morning with his hands in front of him, the handcuffs being still fast; he, therefore, passed his body above his fastened hands. The captain admitted the movement was most elastic, and after a time let him go free. I have often wondered whatever became of such a boy.

One of the sailors (not especially sharp) was put to guard the stout. The duty not being very important, the man went to sleep on one of the barrels. The mate called me up to see the fun. He went below with a bucket of water, threw it over the sleeper, and called out lustily for a rope: "A man overboard!" The man's first impulse at being thus suddenly awakened and drenched to the skin, was to strike out energetically to swim on the barrel. After a time, he comprehended the mate's trick, and feeling he was himself to blame for sleeping on his watch, he bore all quietly enough.

We passed the Bay of Biscay in good weather; we then went pegging away on the Atlantic till we reached Pernambuco, crossing the Equator on the way. I was a good deal seasick. In about twenty-two days we reached Pernambuco, which has a capital natural harbour, protected by a line of rock parallel with the shore; all that was necessary was to fill up the slack places with masonry to make the breakwater complete. Upon arrival we saw in the distance a whale "spouting," which means feeding. As he draws water into his mouth, he catches the animalculæ as they pass in amongst the flexible substances that hang down from the roof of the mouth; the water is afterwards spouted out through the nostrils, so that while he is feeding he is spouting. It is recorded that a ton of oil has been obtained from the tongue of a whale; and that the flexible substance that hangs down from the roof of the mouth is the whalebone of commerce, worth about a guinea a pound.

It is some trouble to extract and clean, but afterwards forms light and stowable cargo.

When near the Equator, we saw large flights of flying fish, a little less in size than a herring. Their peculiarity is that their fins are elongated till they reach the tail, and their action of flying is that they push themselves out of the water by the strength of the tail, in the same way as a salmon jumps the weirs, when working up the river to spawn. When the flying fish are out of the water they spread out their long fins at right angles to the body. Their area is sufficient to keep the fish in the air till the force at which they left the water is expended, they then drop into the water again; they cannot use the fins as birds do wings, neither can they guide themselves when in the air; thus it was that many knocked against our vessel side, and left scales where they hit, and thus it is many are caught by lowering down a boat and picking up those that drop in the bottom. They are very nice eating; they are a most unfortunate fish, for while in the water other fish live upon them, and when they fly in the air to escape these enemies, sea birds are on the look-out for them.

While crossing the Equator, the sailors wanted to act "Neptune" on board, on the look-out for greenhorns passing the Equator for the first time, the captain, however, would not allow such pranks as shaving, tarring, feathering and keel-hauling, but as a compromise, all novices paid a bottle of rum each to the sailors. We were invited to see the view from the cross-trees or main-top, sailors clamber up the futtock shrouds to get into the main-top, novices through the lubbers' hole, and as sure as you go through the lubbers' hole, so sure are you lashed to the mast by an invisible hand; a sailor appears at your side, but he pretends he cannot undo the knots except he has the key, and that key happens to be a bottle of rum, on payment of this you are again free.

The following extract from a sailor's book gives a general idea of the ceremony upon crossing the line:—

"The day was proclaimed a general holiday, and after breakfast was over, preparations were pushed on in earnest, a sail was stretched across the quarter-deck, the corners being triced up and a small spar rigged across it, the canvas was then filled with sea-water, and it looked like a pond. Just after six bells had struck, we heard a hammering forward, and a man came aft, touched his cap, and addressed the Captain as follows:— 'Father Neptune and his missus is over the bows, sir, and they want to know if you've got any greenhorns on board.' 'Ask his majesty to step on board, and we will receive him on the quarter-deck,' replied the Captain. The procession passed along the deck as follows: Two men were rigged out as

soldiers, then several boys playing on pipes, then a gun carriage drawn by men, bearing Neptune and his wife in gorgeous array.

“Neptune was attired in flowing robes of white bunting, with long flaxen hair and beard, a bright copper crown on his head, and the trident in his right hand. Mrs. Neptune was clad in red bunting, with a Union Jack bound turban fashion round her head, fanning herself with a big wooden spoon, and refreshing herself very often from a mysterious-looking black bottle.

“At the rear of Neptune’s car were four men dressed in sheepskins, they were supposed to be bears. After being introduced, Neptune delivered the following short address:—

“‘Gentlemen, we’re werry glad to see you all, her royal ’ighness, Mrs. Neptune’s a-suffering from the ’eat as you can see. I’m well, thank ye kindly, and pleased to visit this good ship. Hair in these ’ere latitooedes is bad, so we perpose to enitiate you as is greenhorns by a-shavin’ of ye all round.’ His Oceanic Majesty then turned to those dressed as soldiers, and waving his hand towards the greenhorns, said: ‘Marines do yer dooty.’ The four bears now leapt into the sail, and began rolling about in the water, splashing everybody within reach. Neptune then ordered operations to commence. The greenhorns were lifted up on to the spar and held there by the bears. The barber then stepped up with a rusty piece of hoop iron in one hand and a tar brush in the other, his assistant standing by with a small bucket filled with molasses and coal dust. One of the victims struggling to get free, got a dab in the mouth, Neptune crying out ‘Horder, there ain’t no captain now, I’m boss on this ’ere ship to-day.’ The barber’s mate laid on his mixture, Mrs. Neptune sprinkling sticky stuff with a flour dredger; his face was then scraped with the hoop iron, and Neptune kindly enquired if he felt better, he tried to call out but the tar brush was stuck into his mouth. The bears then let go and he rolled backwards into the water. He then scrambled out on deck, when Mrs. Neptune brought him a small looking-glass. All novices were served alike.

“Then followed various sports amongst the men. They then washed down the decks, and sat down to a good meal, with plenty of grog, and so ended the day.”

For a long distance from land we see the stormy petrel, who seems to glory in the storm, sometimes riding on the water, sometimes on the wing. Sharks, too, are plentiful in the neighbourhood of the Equator, one followed our ship for days. We got a strong hook and line, put on a piece of pork and caught him. We pulled him after us for a time, then let him go, pork, hook, line and all; he affected the way of the ship and the Captain did not like it. What a hateful-looking thing he was, some said twelve feet, some twenty feet long.

The chief peculiarities of a shark are that his mouth is on the underside of the head, so that he has to turn over to seize his victim, but this is only the work of a moment; the other peculiarity is that he has several rows of pointed teeth jagged on both edges like a saw. At one year old one row of teeth is upright, the other rows lie flat; the next year the second row rises, and so on, a row rising each year, till an old fish has at least four rows of formidable teeth, all upright. Like a bulldog, they do not easily let go.

### CHAPTER III.

UPON arriving at Brazil, I was much disappointed with the City (Recife), which is very primitive in everything. The sanitary arrangements bad, the houses dirty and inconvenient, oil lamps instead of gas, sand roads, and the houses and shops very dirty, but there it was. I had to put up with it as an Englishman who knows how to meet difficulties half way. I had signed articles and must go ahead.

The chief engineer met me at Recife, and we rode together to his house three miles away, at Affogados, and stayed the night there. The house is a large one, but all is on the ground floor, the rooms are paved with tiles for cleanliness' sake (carpets harbour vermin and the heat of the country breeds vermin fast). The division walls do not reach the roof, they are built about ten feet high, all above this height is open for ventilation, the rafters are exposed, and as you lie in bed you may see a rat or a snake pass along. The roof is double tiled to keep all watertight in the rainy season. The pretty little lizards having web feet can travel on the glass windows; take care of them, they are your best friends; they pick any quantity of mosquitoes off the glass, and mosquitoes, you will soon find, are one of the greatest pests of the country. Under the heading mosquitoes and malaria: It is said the proboscis of the mosquito consists of a tube or trough within which are concealed no less than six bristle-like boring implements, two of which are somewhat broadened and sharpened at the tip to form a pair of small lancets, and the other two barbed or serrated so as to form effective saws. When the insect begins its work, it fastens the end of the trough firmly down against the flesh of its victim, it then places the bristles close together so as to form a solid boring instrument, which it plunges into the flesh and sucks up the blood. It must be borne in mind that in order to produce fever in a healthy person by its bite, the mosquito must itself have previously bitten someone stricken with illness. The greater number of them bite domestic animals, such as oxen, horses, pigs, dogs, pigeons, fowls, &c., as well as man. Quite as bad are the large black ants whose powerful nippers pinch your flesh like getting jammed in a doorway. There is not a chimney to the house except in the kitchen. In case of being extra full at night, each man travels with his "radi" or hammock behind his saddle, so he wants no sleeping accommodation beyond the loan of two hooks to hang his hammock to. It is a good plan to hang the hammocks by horse-hair ropes, as the projecting hairs prick the noses of snakes, and so prevent them passing into the hammock. Generally there are plenty of these hooks about, either in the

rooms or under the balcony outside, but I don't recommend sleeping outside under the balcony around the house; once I did this, and in moving in the night pushed a foot beyond the covering blanket, and a vampire bat got at my big toe, sucked blood to his heart's content, leaving me with somewhat of a feeling of weakness through loss of blood. Thinking of vampires makes me remember once in a cave on the sea coast, seeing a perfect colony of these bats hanging from the ceiling with their heads downwards, and the wings folded over their faces, asleep, for it was daytime. They are almost of the size of a rat; our horses suffer a good deal from their blood-sucking at night, if left out as they sometimes are on the prairies to feed.

The house, as I have said, is large; it is surrounded by a splendid garden, in which the flowers are of large and luxuriant growth and of magnificent colours, but little scent. Then there were the beautiful humming birds of splendid and various colours, and of sizes from a little larger than a bee up to the size of a sparrow. It was a rare sight to behold the bright sunshine reflected upon their ever-varied coloured plumage, more especially on the breast. They seemed ever on the wing, dipping their long bills into flower after flower.

I remember once to have seen a coronet made of the breast feathers of humming birds, in the form of roses; it far surpassed jewels in brilliancy and varied colours as the head turned. It was made by nuns, and the price ten guineas. A lady wearing such a coronet in a brilliantly lighted ball-room would fairly dazzle with brilliancy with every turn of the head.

There is another bird about the size and having somewhat the habits of the blackbird in England, but here the similarity ends, for these birds look like velvet as they fly, the body a bright scarlet, the wings and tail a shining jet black.

The cardinal bird is here with grey body and red head, the parrots and parroquets are very common, they are green and red, none grey—they come from Africa. The parroquets go about in very large flocks like starlings or rooks in England. The mocking bird is a most amusing fellow, he can copy any sound if repeated a few times, and seems to glory in it. Monkeys are plentiful and of various sizes, down to the pretty little marmoset, that cannot live long in the Zoological Gardens, often as it has been tried, our changeable climate is too much for him, he dies of decline. I was once witness to the strong affection of the marmoset monkey for its mate. A man out shooting one day saw a pair of these monkeys comfortably sitting together amongst the boughs of a tree, he raised his gun and shot the female dead; she dropped to the ground. The male would not escape but came to the ground, wound his arms around the neck of his dead mate, and uttered the most pitiful, heartrending cries of distress. He would not go

away when approached, but allowed himself to be taken, so great was his grief.

Now then to the Affogados garden again. Down the principal path an espalier trained grove of orange trees is planted on each side of the footpath and made to arch over your head, keeping you in shade, and the luscious fruit hanging over-head. At the end of this path is a river in which are some alligators, dangerous enough in the water, but on land not so much to be dreaded on account of their being unable to turn short with their scaly sides. In water they can glide quietly along, halt and turn themselves hither and thither, wheel in a circle, and halt as they like, their flat ugly heads lying on the water like the stump of a tree. On land, as I have said, they are at a disadvantage in turning. The alligator, like the parrot, is able to work the upper as well as the lower jaw. While speaking of alligators, there was a black at Recife celebrated for attacking and killing them, I suppose for their skins. His plan was this, he would wrap folds of linen on his bare arm, as a protection against the teeth. In his hand he held a large wooden reel wider than his hand, in shape like a cotton reel, through the centre of this reel an iron rod was passed, pointed at both ends, and about six inches longer than the reel was wide. He would tempt the alligator to land and then boldly face him, keeping his arm in front of him; the alligator would make a grab and find himself gagged, the man then drew his arm back and with a sharp long knife stabbed him just behind the fore shoulder (a vulnerable part) and so end the battle.

Beyond the garden was a cocoanut plantation which was of use to us, as I, for one, preferred the cocoanut milk to tea or coffee for breakfast. The growth of the cocoanut is interesting; the tree grows in one straight stem for twenty, thirty or forty feet, then at the top, leaves branch out all round, forming a head of umbrella shape: underneath these leaves a long pod grows of the shape of a cucumber and of about two feet long; as it ripens, the outer case splits at the end, curls back gradually and exposes knotted-looking strings like a cat-o'-nine tails, many of these knots are as it were dummies, and drop off, while others develop into a bunch of cocoanuts about the size of marbles at first, these increase in size till they become full grown, the outer case or fibre thickens, the shell thickens to about a quarter of an inch, the creamy substance within deposits to half an inch in thickness, leaving some little milk inside. The milk drank in Brazil is when the shell is just beginning to form; when from one nut there is enough to fill a tumbler and it is as clear as water. There are hundreds of acres of these cocoanut plantations where the fruit ripens, falls

and rots season after season, for the reason that very little notice is taken of them. The cocoanut leaves are a good deal used for roofing in the huts of the native Indians, as well as for filling in between the uprights of the side walls, hence it seems worth mentioning the peculiar formation of these leaves. They are about as long as the banana leaf, from four to six feet, but unlike it in formation, the banana leaf is a solid leaf like most leaves, but the cocoa leaf is as though cut in strips of a parallel width of about two inches, each is apart from the other from outside to stem. In making a roof to keep out the rain, the leaves have to be laid on a good thickness, and as from their formation they lie close together, they make a good roof as well as a very cheap one, and keep the house cool. The leaves are held together by sepos or creepers that grow amongst the trees of the forest. Pines, bananas, grapes and other fruits ripen in the open air; they are very abundant. I have seen division fences of pineapples.

There are plenty of small red ants about, and black beetles about three times the size of those in England. The red ants make for themselves a glutinous tunnel outside the bark of trees: inside this tunnel they travel, and so keep out of the blazing hot sun; they are very destructive. If you have deal boxes for your linen it is necessary to keep them a little distance off the ground, or the red ants will eat the bottom out; scorpions, too, abound, so look out that one is not in your boot when you put it on in the morning, his bite is dangerous and sometimes fatal. We kept a tame racoon at one of the station houses to eat up the black beetles and mice, he was useful so far, but he had a great liking for our sugar, so we had to put it on a shelf hung by lines from the roof, and about half way down the lines, half a cocoanut shell was fixed with the rounded end downwards, so that if a rat, snake, black beetle, racoon or other enemy went down the string he could get no further than the cocoanut shell.

The timber of the country is very abundant, some is very hard and durable, and one kind is so hard and close in texture that it sinks in water.

The native Indian women of the interior know how to make pillow lace. I have visited their huts and bought a good deal of them and sent it to England, where it is spoken highly of, being strong and well made. The prices charged are reasonable, and they make strips from one inch to four inches in width. The cotton grows outside, they pick the pods as they want them, and twist the threads by hanging on a bobbin and giving it a sharp twist. The huts they live in are much after the style of those made for me, when cutting through the long wood, except the sides are covered in with cocoanut leaves like the



roof is, and would be fairly comfortable if only they were clean. These Indians are well formed, strong, hardy people, their hair is jet black and quite straight, just the opposite to the imported African, and his tight curling hair or wool.

From the heat of the country, the natives reach maturity at from twelve to fourteen years of age, and appear worn at thirty. Beauty is soon scorched up in these tropical climates—a girl arrives at puberty at fifteen.

While thinking of Brazil—what a bad day it was when the Government deposed their Emperor Dom Pedro; he was a most intelligent, highly accomplished and wise ruler, he knew several languages and held the welfare of the country at heart. It was he who visited Paris and London solely to see all the improvements there; chiefly in Paris he made himself master of the practical working of tramways by steam and horse power. He entered into details of the working of gas-making, and while in London he went to Covent Garden market quite in the early morning to see for himself practically how business was done there; he again studied thoroughly the working of the London tramways, the gas works, and the system of sewage, and on his return to Rio de Janeiro established a public market on the most improved lines; he also started trams at Rio worked by steam and by horse power, and commenced an organized system of sewage. He visited the English House of Commons, noted all that was done there, and took back the knowledge for the benefit of Rio.

He next saw the advantage of railways, and granted advantageous concessions to bring English capital into Brazil for the better development of the produce of the interior. As a start he made railways from the coast to the waterfalls, about sixty or seventy miles in the interior, at Pernambuco, at Bahia, and at Rio. The rivers to each place were fine, bold and deep, but from the waterfalls all produce had to be brought to the coast by pack-horses, a very slow and expensive process. The railways altered all this by speed of transit, and they were made with English money.

For these reasons he was evidently the right man in the right place, and if he had been left alone would have developed this grand country. He was a Portuguese of the kingly Braganza family and was of an age to do much for Brazil. He knew all about the diamond, gold and coal districts and would in time have developed all these industries. He had already freed his slaves, believing in free labour.

In such a country, large in size, only partially developed, and poor in money, the travelling (especially in the interior) was very rough and tedious; many times through woods the only road was a track, where all pack-horses had to travel in

single file; holes were worn which in the rainy season filled with water, the horses had to go step by step in these holes till they became a foot or more deep, and progress was slow and irksome. The only accommodation on the way was at the various farm houses, where all were kind and welcomed the way-worn traveller free of cost, and gave their blessing upon leaving.

In places where vegetables were grown, each bed was surrounded by a trench filled with water to keep the ants from eating the crops.

At our house at Villa do Cabo we kept bags of Indian corn for the horses (in this country the horses have neither oats nor barley).

One day the large black ants found out the corn, they formed themselves in two lines with military precision from outside the house to the bags of Indian corn. One line went to the bags empty, the other line came each ant loaded with one corn; they were diminishing our stock fast, so we laid a train of gun-powder across each line and set fire to it. It was wonderful to see their consternation; those nearest the powder fell back and seemed to communicate with those behind, and very soon all left.

We noticed our lamp oil was going very fast. We had our suspicions that the culprit was our black groom (a slave we had hired). To find him out we mixed a lot of castor oil in the can, which affected him medically. Seeing which, one of the engineers suddenly came rushing into the room to tell us the oil was poisoned, someone had partaken of it and would very soon die. The black, seeing so much apparent excitement, and understanding enough English to know what was said, coupled with his own feelings at the time, became fearfully frightened and confessed on his knees before us all. We gave him a pretended antidote, and he soon got better. The lamp oil was never drank afterwards.

In travelling through a long wood I came all at once to a mass of brilliant blossom, such as our gentry would be proud to possess in their well-kept gardens. There it was, and I, perhaps, the only person who saw it in all its splendour. It gave rise to the thought of the old poet when he said those memorable words:—

“There’s many a flower is born to blush unseen,  
And waste its sweetness in the desert air.”

We came across a great many water-courses that had been scooped out in the rainy season, but then dry; they were at right angles to our path, so we had to cross them, horse and all. There are many of these courses to pass in the hilly

districts, they are five or six feet deep, and the way to pass is to keep on the horse while he slides with his four feet well together down to the bottom, then jump off and scramble up the opposite side by the side of him. In the slide down some horses are very clever and keep the hind feet well behind the fore ones and so safely slide to the bottom. It sometimes happens, however, that the hind feet slip between the fore ones, in which case you come over the back of the saddle, you must then jump clear of the horse altogether or you will get trodden on when at the bottom. You have to be careful and keep on the alert at all times, for if you break a leg or an arm or a rib or two, no doctor is near to help you; you are alone.

The trailing and climbing sepos or climbers cross your path in the woods and if not cut with a sharp knife they are tough enough to pull you off your horse, especially if they catch you about the neck. There is also a long-leaved grass here with serrated edges that cut deeply into the face if not sharply looked after.

Snakes are abundant in Brazil, they grow to a great length and size. There is the boa constrictor, the anaconda, and many others, for the most part poisonous in their bite; all are venomous that have flat heads and wide jaws. The action of snake poisons upon the system has always been one of the most interesting subjects. Just how it kills has been determined through a series of experiments. The venom may be roughly separated into two parts: one acting upon the blood, the other upon the nerves. When injected, it immediately begins to create terrible destruction in the blood vessels, the walls of the veins are eaten away and an internal hemorrhage takes place. While this is going on, a portion of the venom is attacking the nerves. Particularly susceptible to its ravages is the "vasometer" system, a nerve centre which controls the muscles of respiration. Paralysis takes place in these organs, and the patient dies from an inability to breathe.

They have two long teeth or fangs upon the upper jaw, which, when at rest, lie backwards in the mouth, surrounded by a bag of poison on the gums; when angry the fangs rise, they drive these fangs in the body of their enemy up to the gums, the poison then runs down a channel at the back of each fang for its whole length and so inoculates the poison to that depth, making the action very quick, and death in an hour or so. The best antidote I have heard of is the juice of the "quaco" plant (*mikania quaco*) taken inwardly at once to be effective.

The anaconda is active amongst trees, and will go along at a great rate in pursuit of prey. One common habit of theirs is to climb a tree, pass along a horizontal bough, hang on by a coil or two near the tail, with their body hanging downwards

towards the ground. In this way they remain patiently till some animal they fancy passes by, when, in a moment, they drop upon him and make a meal of him. There is an animal in this country he is very fond of, a little smaller than a rabbit, but he has no tail.

In riding along footpaths through sugar plantations, it is necessary to keep well on the look-out for snakes, they have a habit of lying along the path at full length, asleep, enjoying the heat of the vertical sun, for as Pernambuco is so near the equator, there is very little shadow. And woe betide you if your horse treads on one while asleep, he is round in a moment. If you wake him before you get to him he will crawl away, so make all the noise you can, sing and shout, however discordant or out of tune. If he should happen to coil round the horse or you, whip out your long sharp knife, cut him to the bone, bruise the spine, and so disable him from using his fearful crushing power.

If thirsty while passing a sugar plantation, cut off part of a cane, strip off the outside bark or cane, and masticate the middle or pulpy part, the sweet juice will effectually quench your thirst.

One of the most useful plants that grow in this country is the castor oil plant. It grows nearly anywhere, almost into a tree. The seeds from which the oil is crushed grow within a prickly casing, this casing contains two black seeds about the size of apple pips, these contain the oil, which after being crushed out is refined, it is then fit for use, and is a splendid and safe medicine for man or animal, either taken in the ordinary way or by injection.

Next comes quinine, the only remedy for ague.

From the great heat of the country all medicines have to be taken considerably stronger to take effect.

One of the prettiest shrubs is the coffee plant, quite an ornament to any garden. It has first a pretty white flower, then a green berry, which, as it ripens, becomes red, inside this are two berries, flat where they join each other, from these (after roasting and grinding) coffee is made.

Manioc (from which farinha is made) is largely grown in Brazil, this in great part takes the place of bread, especially among the poorer classes. It grows in bunches below ground like potatoes, with a stem and leaves above ground, from four to five feet high. To prepare this farinha a wheel is set up from three to four feet in diameter, and about three inches wide; a sheet of copper of the width of the wheel, and in length equal to the circumference, is punched all over and nailed on with the projections outside. One man turns the wheel, while another holds the manioc in his hand, grinding it to powder

against the copper projections, this pulp is then dried and partially roasted on a round brick open-topped oven till it is fit to eat. It can be eaten dry as it is or baked into cakes the same as flour, it is nutritious and contains much starch.

Bananas grow plentifully (they are now well-known in England). The stem is from six to nine inches in diameter, of so soft a nature that a blow or two with an axe will cut it down. I should call it about the consistency of an onion. Leaves spring out from near the ground and grow upwards, each leaf is six feet long and about nine inches wide in the middle height. The tree grows about twenty feet high, the leaves branch upwards all round the stem, and the bunches of fruit grow near the top of the tree protected by the leaves from the sun. Bananas are so nutritious that you can live upon them. They contain forty times more food per acre than potatoes, and you can get them for the picking. Out of the leaves of the banana we cut three or four thicknesses to put inside a hat, we cut them round from a saucer. Pine-apples too can be had for the picking.

As in Portugal and Spain, so in Brazil, the aloe flourishes in the open. It forms a good fence. Now and then the aloe comes into flower, after which it dies, and so makes a gap, it is then necessary to replant others. The flower is not handsome, it looks much like a long string of onions. Out of the thick leaves a fibre is formed, which is strong enough to make fishing nets.

There are many fruits nutritious and sweet, but somewhat sickly in taste. The nicest fruits are grapes, pine-apples, oranges, bananas and cashus, (from which a very refreshing drink is made); these latter are about the size of an apple and quite round in shape, the branch or stalk connecting it with the tree is like a monkey's face.

All fruits want picking after the sun has gone down, not while the hot sun is upon them; they are fermenting then, and may give diarrhœa or dysentery.

The following description of a bridge of monkeys is vouched for as thoroughly true. They hate water as they do fire.

The half-human voices sounded nearer and nearer, till they reached the edge of the brook. They were headed by an old grey-bearded chieftain. Their tails were long and very prehensile. The chief pioneer ran forward upon a projecting rock, looked across the stream as if calculating its width, and then, carefully examining the trees overhead, he scampered back to the troop and appeared to communicate to the leader. The latter uttered a cry like a command, which was answered by many individuals of the band; these made their appearance in front, and, running forward upon the bank of the stream,

collected round the stem of a tall cotton-wood tree that grew at a narrow crossing of the brook. After uttering a chorus of discordant cries, twenty or thirty were seen to scamper up the trunk.

On reaching a high point, the foremost, a strong fellow, ran out upon a limb, and, taking several turns of his tail round it, slipped off and hung head downwards. The next on the limb—also a stout one—climbed down the body of the first, and, whipping his tail tightly around the neck and forearm of the latter, dropped off in his turn, and hung head downwards. The third repeated this manœuvre upon the second, and the fourth upon the third and so on until the last one upon the string rested his fore-paws upon the ground.

The living chain now commenced swinging backwards and forwards like the pendulum of a clock. The motion was slight at first, but it gradually increased, the lower monkey striking his hands violently on the ground at each oscillation. Several others upon the branches above aided in the movement. The cotton-wood tree being free of branches on the lower part of the trunk enabled them to execute this movement freely.

This oscillation was continued until the monkey at the end of the chain was thrown amongst the branches of a tree on the opposite side of the brook. Here, after two or three vibrations, he clutched a limb and held fast.

The chain now formed a suspension bridge, over which the whole troop of monkeys could pass. The monkeys that formed the chain kept up an incessant talking, hurrying those over that were passing. When all were over, the monkey that first fixed himself let go, and the whole chain swung to the other side. Each monkey then disengaged himself, the lowest dropping to the ground. The upper ones leaped up the backs of those above into the branches and came down by the trunk. They then proceeded on their march.

Cantering on the sandy beach one day, the whole ground seemed to move to such a tremulous extent that I began to think I must be very bilious. The feeling continued, so I stopped the horse, got off and found there were millions of crabs of a kind having only one claw. They covered the beach so closely that while riding along many were crushed at each step of the horse; hence the commotion. It was a sight to see, and the wonder seemed how so many found food to live on.

Again, while cantering along where light formation work had been finished ready for ballasting and laying the permanent way, the horse suddenly dropped into a large hole two or three feet deep. This turned out to be made by the large black ants, who worked so near the surface that it gave way with the weight of the horse, and he fell.

A short distance further on the "Capine" or grass of the country used for horses, had grown so rapidly as nearly to come up to the height of the horse. It had grown this height in about three weeks, thus giving an idea of what tropical growth is.

Again, when new to the country, quietly jogging along on horseback, the sun shining very hot, I heard a low murmuring in the distance near the horizon. A cloud arose, and in less than ten minutes the rain came down in torrents. I had to gallop as fast as possible to shelter under the projecting eaves of the nearest house. In this country all houses are built with eaves projecting far enough for a man on horseback to get underneath.

The next to describe is that when outward bound we spoke several homeward bound vessels; a very interesting operation, and it is done in the following way, without hindrance to the progress of either vessel. A bag of flags of various sizes, shapes, colours and marks were brought on deck. A lot of these are made fast to a rope, working through the pulley in the truck on top of the mast. They are hauled up and left flying. Each flag means words according to a code of signals in a book on board of each ship. The ship we are speaking with looks at our flags, and looks in his book to make out what we say; he then hauls up flags to say he understands us. Then, perhaps, he hauls up other flags to ask us a question. To this we reply and say we understand him, and so the ships keep speaking to each other as long as the flags can be seen. All is then entered into each log book, the latitude and longitude are taken and each goes on its way. The usual first questions are, "Where are you bound for?" "Where from?" "All well on board?" "Has anything happened important on the passage?" and so on. If an exchange of letters is wished, more time is required. The way of each vessel is eased and boats lowered to fetch and carry the letters, passengers in the meantime writing like mad. We spoke by Richardson's code of signals.

I took out a good pair of waterproof boots up to the knee, light clothing of a woolly nature, woollen shirts, woollen socks, merino drawers to the ankle and merino vests, umbrellas of alpaca, a pith helmet, some light brown shoes, also a lot of white linen shirts; but I soon found out they were no use in this country, on account of the great heat. I took out a new transit theodolite, my level and staffs, measuring chains, and drawing instruments. I also took out a tent, which we erected in the grounds at Affogados as it soon proved inconvenient to carry it about. The system here seems to be to rise early, take a bath, breakfast, then off to business always on horse-

back (it being too hot to walk), take a siesta, or sleep in the hottest part of the day, (namely, from twelve to two), then to work again in the afternoon. Pernambuco being eight degrees south of the equator there is very little difference in the length of the days all the year round, namely from six a.m. to six p.m., very little twilight, about ten minutes; your shadow is only an inch or two long, and the thermometer in the day-time in summer is from eighty to eighty-five degrees Fahrenheit in the shade, and from 115 to 120 degrees in the sun. It is not quite so hot in the rainy season. In England we know nothing of tropical rain, or of tropical thunder and lightning. The heaviest rain comes down in sheets, the drops seem to have got mixed up; the thunder and lightning are something frightful. Vegetation is kept up in the summer by heavy dew at night; heavy enough to wet you through if you are without an umbrella. Christmas is the hottest season here, and the rainy season is midsummer in England. You must, while here, give up all English ideas, seeing there are neither birds, fish, trees, flowers, fruits, seasons, temperature, or anything else alike in the two countries.

I went on a tour of inspection of twenty miles, returning again to Affogados. Beyond twenty miles there are no roads for wheeled conveyances, only simple tracks to follow on horse-back at a slow speed. The roads for twenty miles are of sand, and the horses are not shod.

The native bridges across waterways are very primitive, and built as follows: Piles are floated to their appointed place, about a dozen blacks dive with the point downwards, and hold it in the sand, while others above wriggle the pile (by ropes fixed to the other end) till it fixes. The divers then come up, and help to wriggle the pile further down, till it is pretty firm. In the same way all the piles are driven; the tops are then sawn to one level, and the bearers laid on and secured. Upon these bearers, half-round timbers are fixed cross way on, and as there is no sand or gravel put on, you go bumping along on the rounded backs. Later on we utilised these waterways in taking up permanent materials. We made rafts of twelve inch timbers, cut in half lengthways, fixed these twelve inches apart, boarded up top, bottom, and ends with three-inch planking, caulked and made watertight; the ends were slanted off like a barge; these the blacks (up to their middle in water) pushed from behind. A cheap plan this was, especially where the roads were bad, or no roads at all. The rafts would carry about eight tons.

In passing along the swamps at night, the noise made by the thousands of frogs croaking in different keys was a thing to be remembered; and the effect after firing off a pistol was for a



moment equally startling by the death-like stillness. Fire-flies are just as numerous in such districts; and so are mosquitoes; and a very tormenting little sand-fly, which bites hands, face, or any part exposed. The best plan to avoid this pest is to tie a handkerchief or veil over the face and neck, and grease the back of your hands. Hundreds and thousands of crabs live in these swamps, some of a red colour; and the mangrove trees flourish too; this tree is a peculiarity; the parent stem grows a few feet high, then sends out lateral branches; from these, other branches grow downwards and take root, so that in time one tree has many roots.

You have often to cross the water-ways just mentioned, on horseback, and if it is high tide, the depth will be up to the saddle flaps, and here the high water-proof boots come in useful; they also keep off many "carapattas," after brushing past bushes that contain them; also from being water-tight the "bishus" that lie in the sand cannot so well get at your toes. The "carapattas" are like sheep ticks, that dig their heads into your skin and get all over your body. We pull out each other's "carapattas" when we bathe, the heads break off and are left behind. The bishu is an insect that abounds in the sand, and works in the skin under the toe nail—by preference the big toe. They bury themselves under the skin, make a glutinous bag, and lay their eggs in this; if neglected, a bad toe, a swollen leg, and worse results happen. But the blacks are very clever in drawing out bag and insect; they put a little snuff in the hole, and the place soon heals. The first symptom that you have a bishu is an itching sensation. The black finds a little black spot; he goes to work, lays back the skin with a knife till he can get the bag out without breaking it, then out come insect, eggs, and bag complete.

Sometimes you have to swim rivers with your horse, and to prevent the chance of drowning him, (especially if you are a heavy man) the best plan is to get off his back, go in by the side of him, lay hold of the pommel of the saddle and the reins with one hand, and swim across by his side, working the legs and the other hand in the water; you get wet through, of course, but if there should happen to be a wine shop handy, buy a bottle of the cheap rum of the country, put up each leg, to let the water run out, and pour half the bottle of spirit into each boot; there will then be no fear of taking cold. The exercise of riding will dry your clothes. The most delicious bath you can have in this country, is a hip bath in which a bottle of cheap spirit is mixed with the water; this thoroughly cleanses the pores of the skin, and makes perspiration pass freely, without any feeling of distress, the more so after you have had the prickly heat, a thing all new-comers

have, after about a fortnight or three weeks' residence in the country. You then have no more thick British blood, but thinned blood, flowing quickly through your veins to suit the climate. You then relish the refreshing fruits and the farinha more than so much meat, and have more of a tropical appetite.

I reached Recife when the yellow fever was raging; this is one of the greatest plagues that ever infested a land. It first attacked the shipping in harbour, and killed so many sailors that there were not hands enough to work the vessels out, and so they had to lie at anchor. There was a cocoanut island at the end of the harbour; on this island boat-load after boat-load were landed to live or die. Last of all one young native doctor volunteered to risk his life and remain on the island. He had a large store of quinine and other medicines put ashore with him, to do his best to save life. After a time it began to attack some of our men, that we brought from England. We rented a large house in Recife and turned it into a hospital. It was not long before there were plenty of patients, and, much as I disliked it, I had to go round every morning to see that our patients had all the attention we could give them. Some were in the first stages of cramp, some nearer death, and some with the black vomit (which is the very last stage), when there is no hope of recovery. The cries and groans were dreadful. From the contagious nature of the disease and from the great heat, it was necessary to bury on the day of death. It was some time before we could get an attendant, but presently we picked up an old English sailor, who undertook the duty, and we shut him up in the house. He never had a day's illness, and he seemed to be so thoroughly salted by his long life at sea, that nothing could touch him; he was well satisfied as long as we kept him supplied with tobacco and a drop of good old rum. He stayed with us until the disease left the country. The first symptom was a stomach-ache, so the least sign of this produced a panic amongst our men, and we were afraid of their running out of the country and getting away in some ship as stowaways—a thing not difficult to accomplish, seeing there were so many ships with short crews, and all anxious to get away out of this plague spot—so I was compelled to put on a bold front and daily visit our hospital at any risk. While this was going on a resident doctor came out from England. He was a very clever man and saved many lives. As an illustration of the fearful nature of the yellow fever, I went to our works at Recife one morning before breakfast to give orders to a foreman carpenter, and while talking, the breakfast bell rang; I told him to go to his breakfast, and he asked if I had any more orders to give—the breakfast did not matter as he was not very hungry. I went my rounds, return-

ing to Affogados in the evening to hear that the man had the fever on him while talking to me. He went to the hospital, died, and was buried that night. I took out with me from England a fine young fellow, about eighteen years of age, as a blacksmith. He worked at Recife at the time the yellow fever was about. One day he felt a stomach-ache, perhaps from eating fruit at the wrong time. Such was the panic there, that upon the least sign of such a pain, it was thought, of course, it must be the yellow fever. He went into the hospital, and what with the cries of the other patients, and melancholy surroundings, he died. The doctor was puzzled, as he had no symptoms of yellow fever. Further investigations proved he died from fright alone. The only consolation I could offer was to promise to take his watch to his poor mother in England when I returned, to show she was in his thoughts in his last moments.

The blacks do the chief work in loading sugar, Indian corn, and other export produce of the country, as well as unloading the imports. Some are slaves, some freemen. They, by nature, are better able to stand the climate than white men, their skull is thicker than ours, and their skin also thicker, so they do not blister as we do if exposed to the sun. Then the coarse, woolly hair protects them, so that they dare go in the sun without a hat on, whereas we want an umbrella, a thick pith helmet with two or three thicknesses of banana leaf inside, a great roll of linen around the helmet outside to protect the head, and a length of linen trailing down behind to prevent sun-strokes, and even then, many times the head aches. We are clothed to protect our bodies, they go nearly bare and grease their backs to prevent the sugar sticking while they carry it on board.

One native turned out a very good tipman, he kept his tips well up and was generally considered an intelligent man. However, he always wanted Saturday to himself. This was inconvenient, but it turned out he was the public slaughterer of bullocks for that district. Curiosity led me one Saturday to see the process. He chose a spot where there was a clump of trees, he lassoed one bullock round the horns, fastened the other end of the rope to a tree, set a boy to drive the bullock round and round until his head became close to the tree, the slaughterer then stabbed him with a long knife at the back of the horns, dividing the spinal cord, the bullock dropped instantly without a struggle, making it thus appear a merciful and painless death. One stab was then given in the chest to let out blood; in this way he killed fourteen bullocks that day. On account of the great heat, these had to be cooked and eaten the same day; the only way to keep meat longer is to cut long

strips and put them upon the tiles, the sun's heat forming a kind of outer crust, which is partially air-tight, and so retards decomposition. To give a better idea of the sun's heat, you cannot place your hand upon iron exposed to the sun's rays, and scarcely upon wood; and as a further illustration, an Englishman wanted a turn-out made for his empty waggons, but he had not Portuguese enough to make his wants known, so he went to work to put it in himself. He took off coat and waistcoat, but he had a shirt on that opened at the back, and in stooping, the sun blistered him for the length and width of the opening, and he had to be well oiled to ease the pain.

## CHAPTER IV.

AS time went on we went to work further up the country, more amongst the hills and healthier parts. A house was hired at each village in or near the line as stopping-places or stations for engineers and others working towards the front, also a man and pack-horse were put on to be constantly on the road, bringing up provisions from Recife, bringing letters and orders to those in the front, and taking back our reports. In this way we kept in touch with headquarters at Recife and kept in food. After some time I was sent right to the front to set out the line ahead. The first thing encountered was a wood or virgin forest, ten miles through. The Emperor sent a gang of twelve men and a headman, or lieutenant, over them, out of a village far up the country. The power of the Emperor is absolute in Brazil. He makes a requisition order when and where he likes, and the natives have to leave home, wife and family for such time as he requires them. We had to cut a passage way through about a chain wide, and splendid fellows they were at the work. I gave the headman daily orders in the best Portuguese I could muster. The men built me a hut at some distance in the wood, where I slept, cut off from all English. The hut had four uprights let in the ground, one at each corner, wall plates fastened to these, rafters on these, and a roof covered with cocoanut leaves of a good thickness. The wall plates, rafters, and roof were secured by tying sepos or creepers that grew amongst the trees, hanging in festoons from bough to bough. These sepos are very tough, contract as they die and so hold fast; we had neither string nor nails. The sides of the hut were open, and I slept upon the seats between the uprights, covered by blankets, taking care not to expose the toes for another feast for vampires; I covered the hands and face also. Mosquitoes were there, but as a good defence against them, it is well to light branches and make a good smoke before nightfall; they can't stand wood smoke, and generally clear out with this treatment. The headman called me at six, and we started work for the day. Here I had my first taste of green lizard, and very good it is, very much like chicken. The way to cook him is as follows: "Take out the inside, pepper and salt him, run a stick through him from one end to the other, make the stick longer than the animal, long enough, in fact, to rest on two upright forked sticks fixed in the ground, light a fire between the upright forked sticks and keep turning him round so as not to burn until roasted; then

eat it with farinha for bread, and be thankful. Nothing is said about knives and forks and plates, perhaps they were not to be had. Our food was changed by catching a bird now and then, or when the packman arrived with stores. He was not at all times to be depended upon, as being in the front I had only what was left after all intermediate stations were supplied.

Life in this country is very varied, the green lizard for food has just been described as an example, and only a few days before going up to the front, several of us dined with the English Vice-consul at Recife, where was present every luxury that could be wished, both as to food and personal comfort; followed afterwards by short commons or perhaps nothing to eat if the packman failed us and our guns failed to provide. On one occasion when well up in front amongst primitive people, we called at a farm-house to get something to eat, we got meat boiled, and well cooked, but could neither see knives nor forks. Looking amazed and carefully watching events, it soon became apparent such were not absolute necessities. Fingers were used to pull the meat apart in the way of the grain, so not to appear conspicuous we did as the others did. Somewhat of a contrast, we remarked, to the grand display of plate, and luxurious comfort enjoyed a day or two before at the Vice-consul's, where we were in the lap of luxury, lounging in our "radis" as though utterly unable to bear the least hardship, with the best dinners always at hand, besides every imaginable comfort.

After a time it became too far to go back to my hut to sleep, so another was built at a distance ahead, and so on huts were built at distances apart till last of all we reached the open country again. The huts were left standing for the next comer. After clearing a passage through the wood, I set out the centre line, nicked it, took the necessary levels, and then plotted the section. I took my natives back with me upon works in progress at about thirty miles distance, and introduced them to the art of navvying, work altogether new to them. Sending them to fetch some barrows and planks from a spot where they were not in use, they were so long gone that I got on my horse to look after them, and found them coming on the road, each with a barrow on his head with the wheel hanging out behind. I put them right in that matter, and came back with them. I tried them with barrow runs in the way navvies find most economical, but oh! what a riot and what confusion we started with; they had never before seen a pick or shovel, the implement they use to cultivate the land being a large chopping hoe. When they filled the shovel, some of the earth went into the barrow, some into each other's

faces, and there was a row. After a time we got to manage better, and filled the barrows, when all my barrow runs were ignored; off they went full tear to the tip, racing each other and shouting a kind of war whoop, such as only an Indian can do. We got them in better order after a time, but they never took very kindly to earth-work. We had them working in several places after this, but they distinguished themselves most in cutting timber; they were first-rate with the axe, and worked well. We gave each man 2s. 3d. a day, the headman having extra pay. When they got to the villages they had money by them, and could get new rum cheap; this spoilt them, they got drunk and lay about anywhere; exposed to the heavy night dews they got rheumatism and other complaints, and at last we had to send them to their homes again, broken down.

I next generally supervised the work in progress and took an interpreter with me, but he turned out a bad scamp, and his goings-on ultimately ended in prison.

I began to feel some symptoms of ague. Once I was on horseback alone, when I went through an attack on the horse, holding fast by the mane and laying my body along his neck. He was very quiet and walked gently along, I all the time fearing I should fall off and be trodden to death by a drove of pack-horses carrying sugar from the interior to Recife. These pack-horses numbered about fifty, each loaded with two packages, one on each side of the horse, and they took up all the road, so there was but little chance for me if I fell. Eventually I reached the station (Villa do Cabo), but too weak to get off the horse or to call out. Presently one of the engineers came to the door, saw the horse standing there with me lying along him, he called to his chums to come out, when they took me off and put me to bed.

The next day I went on, taking the interpreter with me, we reached the next station. I began to feel very queer again, so determined to stay the night. I went through another attack, on a bed this time, when the interpreter, seeing me helpless, ransacked all the cupboards and found drink. In a maudlin state he came to enquire after me, tumbled forward on my chest and almost stopped my breathing. I was too weak to call out or push him off. In this dilemma the engineers came home, saw what was the matter, locked the man up and held a court-martial over him. The punishment decided on was to hang him up to the rafters, passing a rope under his arms and letting his feet just touch the ground, hands tied behind him, feet tied together, a bottle hung just under his nose with spirits in it and the cork left out, so that he could smell but not drink; a pretty considerable punishment while he was feeling the re-

action and nausea of his yesterday's drinking bout. This sentence was carried out to the full, and I went on my journey alone. My next attack of ague was in a manger.

To give an idea of the spiders in this country, one walked across the table one day, we laid a sheet of paper on the table, dropped some ink upon it, made him walk in the ink so that he left a track behind him; we measured this track and found the width across from one outer leg to its opposite one was four inches, his legs were hairy and he was poisonous. It is recorded that a web of the length of two miles and a quarter has been drawn from the body of a single spider.

I was spending one evening at the house of the Company's chief engineer; on account of the great heat the windows were left open, and while playing cards a flight of black night-beetles entered the room and got so entangled in our hair, that we had to throw down the cards, start getting them out, and sent them outside and shut the windows; afterwards we spent a pleasant evening. This engineer brought out his wife and a large family, mostly daughters, but the climate killed several of them, they seemed to get weaker and thinner as they grew, no food did them good, last of all appetite left them, they pined away, obstinate sores came on their legs, supposed to be from poorness of blood, and it was not long before they died.

The horses here are a small, active galloway; they are fed on a quick-growing long grass, called "capine," which is fit to cut a second time in about six weeks or two months; for corn, they have Indian corn, softened in water; oats are never used; and for endurance, molasses are mixed with the water they drink, the horses in general use are entire; the mares are kept at farms for breeding alone or almost alone, sometimes they are made to turn the gin that raises water in earthen buckets from wells; these buckets are fastened to an endless rough webbing band passing over a pulley at the top, in passing over the pulley each bucket discharges the water into a trough leading onwards to a tank or pond. Except for this work the mares roam of their own free will over many acres of flat prairie land, where (as at sea) you can see for about three miles round to the horizon; bullocks also graze on these lands in large numbers, some die, and such is the heat that the carcase would be putrid by night, but the vultures find it out and feast upon it, though whether from sight or smell does not appear to be clearly known; certain it is that small specks appear in the clear sky, and as these specks get nearer they turn out to be vultures, who come straight to the spot to their feast, and gorge themselves so that they can scarcely fly; they remain in a dreamy state till digestion is complete, when the carcase is again attacked till consumed. Though repulsive-



looking and bad-smelling, Government protects them for the good they do in staying fever; you are fined if you shoot one. It has lately been discovered that the organs of smell in a vulture and a carrion crow are so keen, that they can scent their food for a distance of forty miles, and supposing them to be flying one hundred feet high, their range of sight to the horizon would be twenty-three miles.

In riding along one of these prairies alone, thinking of England and those left there, I saw all at once the skeleton of a bullock move, this raised my curiosity enough to ride up to the carcase to see the cause, and on nearing it a dog from within showed a set of teeth too good to attack and a defiant expression of countenance as well; discretion being the better part of valour, I made back tracks and left him to enjoy his feast. He was almost a wild dog; originally he belonged to one of the farm-houses (or his ancestors did), but finding so much food about he did not care to return, and in time became wild, or as bad as wild, in his habits; others left home from the same cause, and now they are to all intents and purposes wild beasts, and have no home. There are now whole packs of them wandering about like wolves, from prairie to prairie.

I held up to the wondering gaze of a black boy, a milrea (2s. 3d.) and said he should have it if he would jump on to a mare that happened to be grazing close by, he understood me in a moment and sneaked up quietly from behind, and when at a proper distance took a flying jump, opening the big toe with the same facility that we could open a finger. He lit on the hock, grasped it and sprang to the back; away the mare went, boy and all, as comfortable as if he had reins and saddle, he had a light stick with him by which to guide, and when he thought he had gone far enough he slipped easily down on to the ground and walked back to me for the money. There was plenty of kicking as well as galloping, but all to no purpose, the boy held fast and seemed to enjoy the fun.

I had heard that every black was a good swimmer as well as a good rider, I had seen their swimming performances before and now it was clear they could ride equally well. The boy had his money and went away delighted.

Once I met a pack-horse that had been left behind with one hind leg broken. There were indications to show it had been there a considerable time; the vultures were flying around waiting to begin, and perhaps did so before death had taken place. By law I dare not shoot the horse.

Vultures are always in attendance at the public slaughter-house in Recife, they are never molested.

The natives up-country are capital horsemen, mounted on active, clever ponies or galloways. When they collect the

bullocks that have been out on the prairies till three years old, they are very wild, but the man on horseback can run them down ; he is encased in leather, his fantail leather cap reaches to his shoulders (a good deal like those the coal heavers in London wear), his coat is leather, as are his leggings. The bullock runs away as hard as he can, man and horse follow and where the bullock leads through bushes or brushwood man and horse follow through the same holes, the man lying flat on the horse, the bushes scratching on his strong leather suit ; the chase continues till the bullock shows symptoms of tiring, the horse closing up till the man gets hold of the tail, he works his hand upwards towards the tail root while they go along at a full gallop ; by a sudden jerk upwards the man throws the bullock on its head, he is off his horse in a twinkling, puts one foreleg over the horn and lashes it there, the horse quietly looking on close by. The bullock is so left till quite exhausted, he is then lassoed, and led back to the farm. In this way all are collected till a good-sized herd is gathered, they are then driven to market in a similar way as they do in Australia. The skins are of most value when three years old and the beef is at its best then.

About twenty miles up-country the main road passes through a long wood, we had to pass this way with the money cart once a fortnight to pay the workpeople. The Emperor allowed us a cavalry escort, besides which we had four men on the cart and the driver, all well armed. A pair of horses worked the cart at a full trot pace. This wood was a dangerous place for highway robbers. Once two farmers took a large herd of cattle to Recife market, they were watched by highwaymen and when they were seen to have sold the bullocks they were never afterwards lost sight of. They were seen to start on their homeward journey, the robbers in numbers hastened onwards to this wood, hid up and laid a rope across the road, having first fastened one end to a tree at about a foot high, the rope lying on the road across it ; when the farmers came quietly jogging along, perhaps thinking of the home comforts they were bringing back with them, the rope was pulled tightly across the road and made fast to another tree at the same height ; this tripped up the horses and they and the farmers came toppling over together, out rushed the robbers, bound them hand and foot, led them to trees, bound them to the trees, robbed them of all their money and left them. Their bodies were not found for many days afterwards, and then partly eaten by vultures ; the robbers escaped.

Another murder was committed in open daylight at Affogados. The house we lived in formed part of one side of a square enclosing a large space of ground, other houses were

built on the other three sides of the square. We were calmly taking our mid-day rest one Sunday when all at once a great scream was heard, we rushed to the front door to see what was the matter, when we saw a man running out of a house and presently fall flat on his face; he was stabbed. From enquiry it turned out two young men were courting one girl, both happened to meet and one stabbed the other. The stabbed one had already got his quietus, the other, one year imprisonment.

One other murder was committed also in open daylight by a professional hand for £4. He did not even know his victim, he had to be pointed out to him.

The particulars are as follows: The owner of an estate there was a widow; an adjoining land-owner kept encroaching on her boundary, piece by piece, year by year, and in this country boundaries are not always well defined and maps are not always made of properties. The widow employed an agent and manager who was a just man and went so strictly into this boundary question that he became an inconvenience, so the other employed the professional, who shot the agent as he was quietly riding along the road in mid-day; he threw the body in an adjoining wood for the vultures and showed his employer what he had done. He eventually was taken prisoner, tried and sentenced to two years' imprisonment, this being his eleventh murder as a professional.

Soldiers are obtained in Brazil by conscription and I once witnessed the hardness of such a law. A family quietly sitting together enjoying home life in the evening were surprised to find the house surrounded by soldiers, they entered and took away two young men, who in all probability would never see the rest of the family again.

I had now another attack of fever and ague, sufficiently strong to make it necessary to go up on the hills to recoup my strength. I visited a Brazilian family that had always shown themselves most kind to the English, and had us up at their house before when sick. The family consisted of two grown-up sons who managed the farm, one daughter then finishing her education in Paris, and one glorious old mother—the very kindest of kind nurses; it always seemed a pleasure to her to be doing good to us poor way-faring Englishmen. With my tumble-down Portuguese, assisted by signs, I made myself fairly well understood, my attempts amused her and she took delight in trying to make out my meaning. Her kind and attentive manner and fine noble face soon made me feel comfortable and at home; so although we could not hold long conversations, one thing was easily understood, her great aim was to relieve me of all the pain she could. Our feeling towards each other

(although chiefly expressed by the eye) was first-class. The sons too, often came to see me, they asked questions in Portuguese which I answered in English to our mutual amusement. Under such excellent treatment and in such a healthy spot I soon got better, and could walk about the farm a little. It was here I noticed the process of sugar making and saw the cane growing. The cane was just ripe at the time, and being cut, was carted to the powerful rolling mill to be ground, then it was boiled and clarified. The process is as follows: The bullock carts were unloaded at the mill, which was worked by water power. One slave fed the rollers all day, which squeezed out the juice from the cane, this juice passed along conduits to each boiling copper, the fires being kept up by the crushed cane as fuel. While boiling, it had to be carefully watched to keep it from boiling over, any attempt to boil over was stopped by a small sponge at the end of a long rod saturated in oil; to dip this into the over-boiling juice was to stop it in a moment—upon the principle no doubt of oil quieting heavy seas. After boiling the proper time and skimming several times, the juice was ladled into clay pots fixed in wooden frames top and bottom, the pots being about three feet high and about nine inches in diameter at the top, the bottom tapering with about a two-inch hole at the bottom with a bung or cork in the hole. The juice when cooled has a rather thin mixture of plastic clay poured upon the surface of it, this clay passed through the juice, taking the treacle before it; the bung is then drawn out and the treacle runs away along conduits and is emptied into casks for export as golden syrup; that which the clay has passed through is refined sugar as exported. The skimmings before mentioned run into a vessel of copper or iron, pass over by distillation and become rum.

All the labourers on the farm are slaves, the property of the farmer. The row of huts in which they live are also his as well as all the children. If he notices a fine young couple, he puts them in each other's company, watches them, and if he notices they show a liking for each other he asks them if they would like to marry, and if answered in the affirmative he reads a marriage ceremony over them, provides them with a hut and they commence life together. In cases of dispute he is their judge.

While here, I went to an auction sale of slaves, saw one young man put up—about twenty-five years of age, a fine, healthy, strong, well-grown fellow without blemish. The auctioneer mounted his throne in the same manner as Tattersall does in London; there is a running-ground in front like where horses are sold; a square block of wood is under the auctioneer, on this the young slave mounts; buyers come

forward, feel down his legs and arms for strains, open his mouth to see if his teeth are all right and examine well his naked body for any defect. The auctioneer then begins his description and asks for a bid; there was good competition for this young slave till at last he was knocked down at £100. Others were afterwards sold, male and female, young and old, at various prices according to their capabilities and age. Mothers and daughters, husbands and wives, parents and children were separated perhaps never to see each other again. And to show further that what is described here is no romance, I annex the following description of slaves advertised to be sold in Brazil in a local newspaper about this time. The name of the paper is the "Jornal do Commercio," published in Rio de Janeiro.

"Auction of slaves this day (23rd November, 1864) at eleven, at 71, Rua da Alfandega.

"Castro Bittencourt will sell to-day in his warehouse at eleven punctually, a number of slaves, among them small negroes and negresses, black men who can cook, wash and starch; black women for labour and for hire; will all be sold on account of the owner being in liquidation. Also sixty-seven well-conducted slaves from a coffee plantation."

There are also advertisements in the same paper of slaves for hire and for sale by private contract. For instance, the following is a sample:—

"To be sold three brown girls, two of them suitable for housemaids and the other for wet nursing, in excellent milk, to be sold together or separately."

"To be sold because the mother cannot nurse her, a child a month old."

"To be sold a black woman of the Mina tribe, perfect fruit-seller, will sell a milrea's worth a day" (a milrea is 2s. 3d).

"To be sold at 29, Rua do San Jose, a choice lot of thirty slaves, including a blacksmith, a mason, two carpenters, a barber, a perfect and clever cook, young negroes from ten to eighteen years old, negresses of the same age, blacks of both sexes for domestic service and agriculture."

"To be sold a beautiful female slave who can wash, starch and cook, price 1,000 milreas" (about £113).

"To be sold for 1,200 milreas (£135) a black girl who washes, cooks and starches."

"To be sold an elegant and very pretty choice Creole girl, well made and strong, being the most beautiful article in the market, all good qualities guaranteed, she can sew, do crochet, dress a lady, wash, cook, starch ladies' clothes and do all service to perfection."

"To be sold a lovely Creole woman, twenty-four years old,

beautiful face, pregnant, she is a perfect cook, washerwoman and dressmaker, doing all she does with much ease, and she is easily pleased, at Rua do Rosario, No. 112."

While on this subject of slavery I wish to explain a chase after a slave with blood-hounds. Some old garment that had been worn by the slave is procured and placed down for the hounds to smell and this scent they follow; there are generally two hounds started. When the fugitive finds the hounds are on his scent, he generally resorts to schemes to baffle them, sometimes he turns at bay and sells his life as dearly as he can if he happens to have a knife or other weapon. Sometimes in the chase they come to a river, he jumps in, but instead of swimming straight across and continuing to run on the other side, he swims some distance down stream, and if a tree happens to be on the water's edge he will climb into it from a branch that may be hanging over the water; thus the scent is lost and if the hunters take the hounds across the river in the hope of picking up the scent again on the other side (under the supposition that he has simply crossed) they will be baffled while the fugitive is gaining wind in the tree. It is too dangerous a position to stop long in, so he again drops into the water and swims down stream for a very long distance, and so perhaps gets clear, in which case he makes for the swamps and takes up his habitation there; he looks out for a place a little higher in level, scratches the earth with his hands, sows Indian corn or manioc, whichever he has provided himself with at his late home; the rich maiden soil will grow almost any seed, so very little care is required. While his manioc or Indian corn is growing he must live upon crabs and fish. While in slavery his chief food was manioc (or rather farinha, which is made from manioc), therefore to come back to this food is no hardship. In swamps he baffles the blood-hounds, as the scent will not lie well on account of the wet all round and about.

Many other sick Englishmen had received the same kind treatment that I did at the hands of the good people at the farm-house before described, so in gratitude we got up a subscription amongst us, bought a piano for the daughter, had it shipped from Paris to Recife, then brought it up country. For the first twenty miles this was easy enough on account of the good road, it was then lashed to a bullock cart as long as anything like a road existed, we then had it carried by relays of men in the way they carry furniture in Recife; they keep step by a kind of chant to prevent undue shaking. At last the piano arrived somewhat out of tune, considering its rough journey and that it was left out two nights on the way. One of the sons was musical, he re-tuned it and played upon it until his sister returned from Paris when she was quite charmed with the Englishmen's gift.

I was next ordered back to Recife to give the centres to lay the permanent way by, for the first section, and had to go through miles of swamp which was fatal; the miasma arising was too much for me. I was sick a good deal but continued to struggle on till I could do no more. Here too, the little sand-flies before described were most troublesome, I had to cover my face and neck with a pocket handkerchief and to cover the backs of my hands with grease to keep them off. I could not wear gloves because of having to turn the adjusting screws of level and of theodolite while using them. Last of all I was laid up at Affogados with daily attacks of fever and ague, lasting from nine o'clock in the morning till six at night, and so became weaker and weaker till our English doctor came to the conclusion that my game was played out and I must leave the country or die. Thus ended my work in Brazil, and I was led to the beach by resting on the shoulders of two men; I could not carry my weight, much as it had been reduced of late; and all this was done in six months' residence in the country. I went on board the vessel for England, and never had but one attack on the way home.

On our homeward passage we broke a crank pin, and so had to sail for several days, all went to work who could; we had a boiler maker on board, returning from Rio, who proved of the greatest use in getting out the broken pin and in putting in a new one out of spare stock. Sheets of iron were fixed under the crank, on which a fire was made to heat and expand it, and so enable us to drive the broken pin out and put in the new one; the crank when cool contracted on the pin, the key was driven and all made secure. We were right out at sea when the accident happened, and no ship passed either way while the repairs were going on.

We worked our way towards the equator, crossed it, called at the island of St. Vincent, Cape de Verde Islands, the Canary Islands and so on to Madeira. Upon entering the bay there is a gruesome sight—the English burial-ground. Some might think this does not speak much for the healthiness of Madeira; those learned in the matter say in answer that the patients do not come till it is too late, and the disease (consumption) has got too fast a hold to let its victims escape. While at anchor, boys came to us in boats to show their facility in diving after silver we threw out; the water being very clear we could see the silver working its way to the bottom, but presently a boy would dive and pick it up when about half-way down. I did not go ashore, but from the ship's deck could see that Madeira sloped upwards from the sea, the harbour was curved and well protected from rough seas. The land rose upwards, and a zig-zag road ran upon the face of it with pretty detached villa

residences dotted about at the different elevations by the roadside and facing the harbour. From Madeira we worked to Lisbon, put in there and anchored in front of Commerce Square. I will not, however, stay to describe the harbour and city here, as both will be described later on. We worked along the Portuguese coast to Oporto, then sighted Cape Finisterre and entered the Bay of Biscay; we crossed the Bay on the French coast, and then crossed the English Channel to Southampton.



## CHAPTER V.

IN 1858, I went to Spain to put some calamine mines into working order, and protect the interests of some English shareholders. I went overland to Santander by way of Paris, working through France southward to Spain. My knowledge of the French and Spanish languages was next to nothing, so my troubles began after leaving Dover. At Calais I could just ask for my ticket to Paris; arrived there safely, and put up at the Hotel Maurice, where English is spoken.

Here I got a ticket as far as one could be obtained, working southward past Bordeaux, Dax, and on to Bayonne. I kept pegging away, and became very hungry, so went into a restaurant at one of the stopping places, where an amusing performance took place between the French waitress and myself. She brought the "carte"—to me perfectly unintelligible—still, not to be done, I pointed haphazard to several items, which in turn were all brought, and a curious dinner was the result. Beginning with what looked like a raised pie, but when cut into proved to be potatoes, nicely browned over and hollow; then another dish which was fruit pie, another which was roasted meat, some fish, then roast apples, and other things, all of which had been ordered by pointing. We could stand it no longer, both burst out laughing to see such a funny dinner in such funny order. Next came the time to pay, so I laid down a gold piece, and took whatever change she chose to give me; then came her gratuity, which clearly satisfied her, and we separated, both well pleased. I then continued my journey, travelling night and day to my journey's end. The country in the neighbourhood of Dax was very flat; and the shepherds there walked about on stilts in order to see further. One was resting on the top rail of the railway fence as we passed. Fir tree plantations were plentiful here, and there were many little tins fixed to catch the turpentine as it ran out of the trees. A slash was made down the bark with an axe, and the tin cup fixed below for the turpentine to run into. In this way large quantities are collected.

At Bayonne I picked up an old Irish soldier, who acted as an interpreter, and got all I wanted; one chief requirement being to get a ticket by the diligence that crossed the Pyrenean mountains. We left Bayonne in the evening, and spent the whole night in crossing. We started with four horses, but in the night eight bullocks were hooked on in front, helping to

pull up to the summit level. At the foot of the mountain at St. Sebastian we were in the Spanish territory; had our luggage searched there, and passed on by steamer to Santander, calling at Bilboa on the way. The river there has masonry embankments on each side after the style of the Thames Embankment. At Bilboa there are iron-stones lying about, containing 60 per cent. of iron of first-class quality; the English found this out, and for a time loaded their ships with it on their return voyage to South Wales; they got it for next to nothing, calling it bottom ballast.

Now, there is a considerable trade done in this iron-stone as before mentioned. It is very good in quality, and smelting works are built close by.

While on shore here the laziness of the Spaniard was quite apparent; the men were lounging on logs playing at cards, while the women were hard at work unloading vessels that had come from Norway, laden with salt cod-fish.

After leaving Bilboa we made for Santander, where we engaged an interpreter, who landed us in a small boat, luggage and all. We then went to the Hotel do Comercio, women carrying our luggage on their heads.

I commenced business next morning with the interpreter. There were several English here engaged on the railway, Isabel, 2 (which I afterwards measured up). Producing my authority to the Spanish directors, I went on to Novales where the mines were, took possession of the house, and went to work. The work on some of the unprofitable mines was stopped for the present, and greater strength put on those working at a profit. I then went up the mountains, most days on horseback, generally inspecting, then reported to London, and all seemed soon to look like business.

After a time I took a journey on horseback over a mountain road to Torrelavega, and thence by rail to Santander, to confer with the Spanish directors. They gave me money to pay wages, and all seemed right. In a day or two I returned to Novales, and went to work as before.

Novales is a nice sheltered spot, situated in a valley, and it is a great rarity to see snow there. Oranges and lemons luxuriate, as well as large plantations of sweet chestnut trees. Quince trees grow commonly on the hedge-rows by the road-sides.

In our garden we had oranges and lemons on the same tree by grafting. I sold those in our garden, and the buyer loaded up his mule when he liked; he had three crops in the year; and ripe oranges, green oranges, and blossoms were upon the trees at the same time.

We had also several fig trees, all out in the open, as well as tomatoes, melons, grapes and other fruit.

When the chestnuts are ripe, pigs are sent to pick them up, and they get quite fat. They soon learn how to open out the nuts from the prickly casing; they hold them fast with one foot, then open out the nut with the nose, taking care to work at the end where it grew on the tree, the prickles being softer there.

Most of the cottagers in Novales keep goats for the sake of the milk. After milking in the morning the animals are let loose, and walk away to the rendezvous under a large fig-tree at one end of the village, here they wait till the goat-herd arrives, he is very regular as to time; he gives a certain call which they understand, and they follow him at a slow pace up the mountain, feeding as they go along. At mid-day he returns, the goats still feeding and following. Upon arrival at the village each goat goes home, stays the night, and in the morning, after being milked, goes off to the fig-tree as before. The owner of each goat pays the goat-herd an annual amount, and the sum thus contributed constitutes his living.

There are wolves in these mountains, and sometimes it happens that a young kid strays away, gets lost, and is left behind. As surely as this happens, so surely do the wolves have him at night, and take him to some cave to devour.

I and two or three others once explored one of these natural caves. We provided ourselves with a candle each, stuck a pin through the candle at the half-distance, and started on our exploration. The entrance was very narrow, so narrow that we crawled on our stomachs to enter. Presently we found ourselves in a chamber high enough to allow us to stand upright, with height still above; there we found bones of a goat that had been devoured by wolves. We looked round and saw a very interesting sight. Water had percolated from the surface through the lime-stone rock, and had become saturated to different degrees with lime. The drippings first of all deposited themselves on the floor of the chamber, and became limestone in the form of grapes. As time went on, these drippings formed the base of good stout pillars for about half the height; the drippings then fixed to the ceiling, and hung down till they joined the drippings from the floor, and so on in process of time they became pillars of limestone complete from ceiling to floor. It was a grand sight to see these pillars in their varied forms, some joined, some not yet joined, and some strong, supporting stone pillars, as the dropping of the saturated water continued; the effect of these pillars was very beautiful and graceful.

We continued exploring, and the opening narrowed up, so that we had again to crawl; presently it opened out to a chamber higher and in every way larger than the last.

We were thinking it just possible that a wolf might be about, and were all on the *qui vive*, when one of the party espied two bright-looking eyes.

We paused, and were considering what our next step should be, when one, bolder than the rest, advanced knife in hand. He had not advanced far, when he found that it was not a wolf, but an old he-goat, who, after being lord of his seraglio for some years, beating all pretenders to his position, had at last got beaten by some young aspirant to be king, and he had retired to this cave to die or be eaten—if not too tough. Our candles were then burnt down to the pin, and it was time to return. Thus ended our exploration for that day.

At Novales it once happened that the carpenter observed a fat old cat upon the tiles. He asked my permission to shoot him. "Oh, yes, if you like," I replied, and thought no more about it. Later on he asked me to come and see the feast he had provided.

I think it was Cæsar who said, "I came, I saw, I conquered." Well, I came, I saw, but I ran away, for of all the horrid smells of garlic and cat, I had never experienced anything like it. He pressed me to taste, saying that if I did so, I should never relish rabbit again—it would be too tame eating. But no, I left him to it, with the common saying in Spain of *buen provecho*, which, being interpreted is, "good appetite await you." He afterwards told me it was splendid; gamey, no doubt.

The Spaniards call the English a dull, unexcitable, phlegmatic nation like the Dutch; the latter from their flat, damp, foggy country; ourselves, because we dislike garlic. Garlic, certainly, as far as I am concerned, is detestable. Up country I was obliged to take it or starve; but, oh, the horror afterwards. It was garlic all the rest of the day, especially when on horseback. The Spaniards say we eat such tame food; we seem to like nothing spicy.

My duties called me many times to Santander. The first distance to Torrevega was on horseback over a mountain-road, thence by train. Before the train was publicly run, it was horseback all the way, and required more than a day's journey, in which case a night was spent at one of the small wine shops on the road. I had undertaken this journey more than once, and knew enough Spanish to ask for barley for my horse and something to eat for myself, also to ask for a bed for the night, breakfast in the morning, and then off.

It will be noticed "barley" for the horse; this is because in this country barley is always given to horses, oats never.

The plan is to feed your horse yourself, and see him eat it; you always carry your own halter with you; it is of leather

with leather lead, which when travelling is rolled up neatly at one side of the horse's head, quite in military fashion. Your next duty is to see to yourself. You will get "gabanza" soup (a large kind of pea), then meat, roast or boiled, and perhaps fish (the salt fish from Norway is always to be had), Indian corn bread, and a cup or two of wine or aniseed spirit. Then, not being a smoker and not being able to enter into fluent conversation, I had to sit still till bed time. The company is mixed, some looking very doubtful characters, to these I have appeared as a spy and have in consequence not been looked kindly upon, but there was no help for that.

At this point the wine shop kitchen and general sitting-room may be described. The cooking arrangements are a novelty. A hearth is built of brick, circular or semi-circular in form, covered with tiles at the top, the height being about three feet. The chimney is large, the fire-place is made against the back wall; on the tiles around the fire are clay pots, of such quality as will not crack when heated. These pots are filled with soup, some with baked meat or boiled, according as water is used or grease, and it is wonderful what a dinner the cook can provide from these clay pots. After the cooking for the day has been done, the hot ashes are raked forward, and a flat cake of Indian corn is laid upon the hot tiles, covered with the hot ashes, and so baked. This Indian corn bread is anything but choice food, and the same remark applies to the Norwegian salt cod fish. The only way this can be made at all palatable is when boiled in milk.

The aniseed just mentioned, is made thus: Get a small measure of the spirit, say a wine-glassful. The wine-glass is placed inside a tumbler; water is then poured into the wine-glass, and runs over the top into the tumbler, and so you continue pouring into the wine-glass, as long as it flows over milky: when it passes clear, pour in no more water: throw away what remains in the wine-glass, and that in the tumbler is your "glass of grog."

Now to return to my journey to Santander by train. On one occasion, while waiting for the train at Torrelavega, a woman was on the platform with a litter of young wolves, which she was taking to Santander, in order to obtain the Government reward. They were not yet nine days old, and their eyes were not open. We placed a puppy dog in the basket, but, young as the wolves were, the tiny bristles on their necks rose in a moment, and in many other ways they showed their inherent savage nature.

I have just said that in going from Novales to Santander, the first distance to Torrelavega was on horseback, over a mountain road; and as some mines were not worked to an

immediate profit, they were for the present stopped to reduce the wages account.

One foreman, who was discharged in consequence, took (in his ignorance) an intense hatred to me personally, and even threatened my life. My horsekeeper heard these threats, and advised me to be careful and watchful in passing over this mountain road, and to get home as often as possible by daylight.

The thought occurred to me to act upon their superstition. So one day, at Novales, I brought out my revolver (a novelty in those days), told the horsekeeper to put up a board at a distance away, noticed the foreman was present, and fired at the board five times with once loading; this he thought an unnatural act, examined the board, and was persuaded I had dealings with his Satanic majesty, so he told those present he had better let me alone for fear my friend should kill him. In this way I escaped the danger, and was never molested.

By attention and economy we succeeded in working some of the mines at a profit, and things looked well. We had several bullock-carts at work taking the calamine to the port for shipment, and daily found more mineral. Much of the work is done by girls at 8d. a day. They carry away earth and minerals in baskets upon their heads; for digging for mineral men were employed, but girls, with light hammers, cracked and sorted the stones. The mineral sent out of Spain is largely smelted in South Wales, producing zinc.

Our success was such that the Spanish directors endeavoured to devise a scheme whereby they might get the mines away from the Englishmen; they arranged for one of their number to go to England to obtain a power of attorney to act (as they said) in enlarging the company by the admission of more Spaniards as shareholders. They being Santander merchants of some standing, the English consented, and it was a bad day for them when they did so. Not long after the Spaniard's return things were made somewhat unpleasant for me, but I kept on my strict line of duty as an English representative. Their next move was to put a man in possession, taking the works in their own hands. This resulted in law. In the meantime I telegraphed to London. I was taken before the judge, and produced my documents to shew my authority. The Spaniards shewed their power of attorney, which the judge decided overruled mine.

In this dilemma a lawyer was sent from England; the Spaniards set him at defiance and altogether ignored him; the result being that I was discharged. My riding horse was seized, and I had to hire to get away. I went to Torrelavega, but could get no replies to the letters which I sent to London.

While engaged upon the mines, it was my almost daily duty

to ride along the coast of the Bay of Biscay, and on one of these occasions I saw out at sea a waterspout, it was distinctly of a funnel shape, with the point on the water, and the broad end in the clouds; a gentle breeze blowing towards the shore brought it nearer and nearer, till last of all it hit the rocky coast, burst, and fell with extraordinary violence. My horse refused to advance another step, and I, on his back, had to bear the brunt; the water soon got through all clothing, and came trickling down back, chest and legs, filling the high boots. The next thing was to make for a wine shop, buy a bottle of the cheap spirit of the country, let the water run out of the boots, and give each boot half a bottle of spirit; there was, however, no chance of drying my clothes.

On such days as the wind blew from sea to shore, not a sailing vessel was to be seen; but when blowing in the contrary direction, quite a fleet of vessels would be in sight, the reason being that it was a dangerous coast for a sailing vessel making lee-way. The water is deep up to the rock face, vertical, no anchorage, so once going to leeward, it was only a question of time for the wreck to be complete and the ship founder with a loss of all hands. This danger is known and generally avoided by keeping well out to sea. A steamer has a better chance.

Although I have crossed the Bay of Biscay six times (fortunately always in a calm), I have seen some fearful storms while riding along the coast. The waves have come with such a crash against the rock face, as to send volumes of water over the top of the rock, the wind sending the spray inland like drifting rain. After years of such tumbling about, a somewhat softer part of the rock is worked out into a cavern and vent hole at a distance inland, through which clouds of spray are discharged, which, at a distance, give the appearance of a smoking camp-fire.

I met, one day, in Torrelavega, an English contractor, who was just then in trouble with the Spanish Government, in the final settlement of twenty-two miles of railway he had just finished, from Santander to Las Caldas. I undertook to make the final measurements, as a basis of settlement, and went to work. I dug down to the foundations of bridges as they were actually built, and took out the quantities of brickwork above rail level from the drawings, so there could be no dispute as to the actual quantity; and to prevent dispute as to quantities of earthwork in cuttings, I took levels at each chain length, along the top, on each side, relatively, to rail level; took widths at rail height, took depths at the centre from the section, also lengths of slopes on the ground. Plotted sections, and calculated the quantities from these sections.

The actual length of all culverts were measured by a little dog. To his collar we fixed the ring end of the tape, a man held him at one end while I went round to the other side. When let loose he ran through the culvert to me, dragging the tape after him, and we then measured the exact length. The same especial care was taken throughout, to enable us to prove accuracy before the Government officials, or at the law court; this took a long time, during which I lived at the contractor's house. He had quite a zoological collection, brought up with the aim of seeing how far wild animals could be tamed. First, he had a bear, which he brought up from being quite young; all went well with him for six or eight months. A ring was made to work easily up and down one of the round iron columns supporting the balcony of the first floor; a short chain was fixed to this ring, and a leather collar at the other end to go round the bear's neck. In this way he could go the length of his chain to the back door, or he could climb the column into the balcony floor, just as he wished. He knew us all, and we often gave him sweet things, or buns and cakes, in passing him, and so appeared good friends; but one night an Englishman came home intoxicated, and mistaking the bear for a burglar, he wanted to know what business he had there; not receiving an answer, he pitched into him right and left. The bear for a time seemed to treat him as if it was in play, but when he hit out his very hardest, punching into his nose, the bear got savage, and gave him such a hug as soon sobered him, and he called out as loud as he was able for assistance; we came to his relief, and after a time coaxed the bear off, just as the man was beginning to get black in the face. After this, the bear was never to be trusted; he had to be killed, and his splendid skin was at my bedside.

The next was a young wolf, we could do nothing towards training him, he was never to be trusted, and had no notion of affection. He was shot when four months old.

Next was a young fox; he was chained and had a kennel; he was shy and sly; as he got older he became very cunning indeed, as his plan for catching neighbours' chickens showed. When we threw him a piece of meat, he would take it to his kennel—but not to eat; he would place it just within the reach of his chain, go back to the kennel, lie just inside, showing only his face at the entrance; he would then feign sleep. If any unfortunate fowl came to peck at the meat, he would pounce upon him in a twinkling, eat him, and the meat afterwards. His collar broke one day; he ran off to the woods and never returned.

There were also a young eagle and a young owl, in cages, one above the other, the eagle being at the bottom. One day the bottom of the owl's cage came out, he dropped below, and was



devoured by the eagle. So ended my friend's attempts to tame wild creatures.

Some Spanish highwaymen made up their minds one Saturday to stop the contractor's money cart; every detail was arranged, even a donkey provided with panniers was tied to a tree.

It is said there is honour among thieves, but here was a case of treachery. One of the party divulged the plot to the contractor, who, naturally, sent the cart by another way. Disappointed in this, they resolved to attack the body of sub-contractors, who would presently be returning from the pay-table, with bags of money to pay their work-people. So the Spaniards hid and watched. Presently the English came along in a body, and were attacked, but their money-bags formed formidable weapons, and they were getting the best of it, when one of the Spaniards fired his gun, hitting an Irishman in the stomach, who dropped down dead. The Spaniards bolted, and the sub-contractors went home and reported what had happened. Such, however, is Spanish law, that the body must not be moved till the *Alcaldi*, or magistrate, has been to view it. He did not come that night, and the body was exposed to rain for many hours. Next morning there was an apparent fuss. The civil guard rushed here, there, and everywhere. The *Alcaldi* viewed the body and took certain notes; it was then taken away by the English and buried in the contractor's yard, a piece of ground being railed off as the English burial place. They being Protestants, no Roman Catholic Priest would bury a heretic (as we were called) in their consecrated ground. The deceased being an Irishman was probably a Roman Catholic, but being with the English, and working with them, he would be classed as one of them. The Spaniards were never arrested.

Of the line I measured there are a few more particulars to recount. At Santander there is a long embankment which enclosed a considerable part of the foreshore. This has been filled up almost to the embankment level, and has become valuable building land. Some six or eight miles along the line, the whole of an embankment made for the railway slipped down the hill sideways: this was in consequence of the earth being superimposed upon rock, which rock dipped towards the valley. The water got in a crack on the high side and forced the bank down the hill. So gentle was the movement, that growing trees moved with the bank and did not die. Arrangements were made for the passage of water from the upper to the lower side, and a fresh embankment was made. A little further on there happened a slip in a cutting, which raised the rails so high that traffic was stopped for a time.

I was in the train when we came to this slip. The train was stopped, and we were told it could go no further, so the choice was offered to all passengers, either to be taken back by the train to Santander, or walk along the line to our several destinations. I, amongst several others, chose to walk on. Our company kept diminishing as we arrived at our nearest points, till at last I was alone. It was then night, and while walking along the line a heavy storm of rain came on, so I sheltered under a bridge. It was as dark as pitch. All at once two bright eyes appeared, coming down the cutting by the bridge side, then there was a splash, and a wolf came under the same bridge, only twenty feet away (the width of the railway) from the place where I stood. If ever the hair stands upright from fear, mine did then. My revolver was at home, and my long knife (cuchillo) at home also. Fortunately he did not stop, but cantered away through the bridge, along the line, but in the very direction I had to go. After a time it left off raining, and I made a fresh start, keeping a very sharp look-out, but saw no more of him. He was prowling about alone, which was all the better for me, as a single wolf rarely attacks a man, except he be almost starving. The great fear is when they go in packs in the winter, driven to the valley for food, when from the heavy snow on the mountain tops it fails them there. They are equally fierce at one time in the spring. Eventually I reached Torrelavega in safety, and put up there for the night.

A tragedy in connection with wolves happened while I was in Spain. Staying at a posada or inn, one night, was a travelling draper, who sold his goods at the several villages through which he passed, he travelling with four pack mules. As he had finished business in this town, he decided to go over a mountain road to the next village where he traded, so he started towards evening, as he said he had done many a time before. We all wished him God-speed, and away he went. He never reached the village, but after some time the skeletons of himself and his four mules were discovered, with his packages lying about in great confusion. There was evidence enough to show that he had been attacked by wolves. The skeletons of some that he had shot were there, the flesh eaten by the other wolves. He had evidently made a good stand till numbers overcame him, and he was attacked on every side.

Here is another anecdote of wolves in this country. There is a class of men who undertake the care of cattle on the mountains in the summer, which they keep with them, for weeks together. On these mountains there is splendid herbage; and if you have a cow, not in profit, or young bullocks to be reared to three years old, these men will take charge of them for you, and live with them upon the mountains for two or three

months, driving them where the herbage is best. Each man has two dogs, each dog about the size of a wolf, they keep guard, especially at night. If a wolf shows himself, or looks suspiciously around the herd, the dogs attack him, and there is a desperate fight before the wolf is killed. Such is the difference between tame and wild nature, that although each dog is as large as a wolf, looks as strong, and has the further protection of a stout collar, with spikes pointing outwards all round, it takes two dogs to kill a wolf. The man also helps with his gun, his long stabbing knife, and his lance in addition. There seems no fear of "packs" of wolves at this time of the year. As a rule, the wolf flies for the throat, and tries to pull out the wind-pipe of his enemy.

Again I have to bring myself to the particulars of the railway. Some of the cuttings showed indications of coal. There was one special cutting that should be described, it was cut out of the solid rock on the high side, and an embankment, or rather a retaining wall of masonry, was built on the low side, to get a width of cross-section sufficient for a single line of railway; the solid rock was cut with the side almost perpendicular; all had to be drilled and blown with powder, at a cost of 5s. per cubic yard; the stone was used for making the retaining wall on the low side. To give an idea how nearly perpendicular the face of the rock cut through was, it must be added that the men drilling were fastened to a rope while at work. About fifty feet lower the river ran along, lashing about among the rocks. Further up on the mountain the gorge is narrower, and the sides of the river are upright and of solid stone. The watercourse is self-formed, and the dangerous nature of this deep gorge is indicated by a story to the effect that a smuggler was once being hotly pursued by the civil guard, who were just ready to fire; seeing which, he took the fearful life or death leap, landing himself safely on the opposite side by using the jumping pole, which they always carry with them, and know so well how to use. As might be supposed, no civil guard followed, and the smuggler escaped free. Since then a foot-bridge has been built across, which goes by the name of "Puente del Salto," or Bridge of the Leap, which would give an air of truth to the tale.

The inhabitants of the province of Biscay (of which Bilboa is the capital) are a splendid race; they are hardy, active, well-made, and live much amongst the mountains.

The Queen (Isabella) could never conquer them, so they were granted certain privileges and concessions above Spaniards, to induce them to become part of Spain. Their wonderful activity amongst the mountains with the jumping pole, made it impossible to conquer them in the difficult coun-



HOLIDAY  
IN  
AT THE

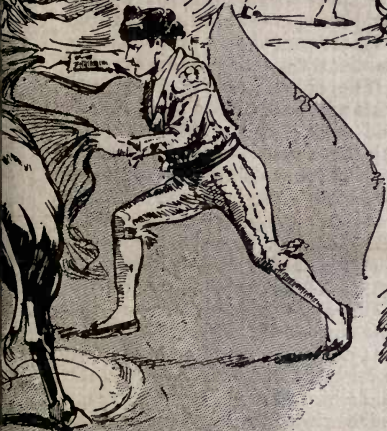
A CRITICAL  
MOMENT

THE TOREADORES TO THE RESCUE

WALKING  
DRID.  
ZA  
TOROS"



THE DEATH



ANTONIO MORENO  
A POPULAR  
MATADOR  
DELIVERING  
HIS TOAST  
TO THE  
PRESIDENT  
OF THE  
FIGHT

(See page 59.)

try they knew so thoroughly. In consequence of these privileges, much smuggling goes on along the borders of Biscay and Spain in tobacco and other excisable goods. The smuggler's outfit is a hairy knapsack strapped on the back, giving the appearance of some animal climbing up the man. His arms are thus free to use the jumping pole, and from his fine, athletic form and wonderful activity, he works pretty straight across country, not being easily caught by the civil guard. Their dress is very handsome; they pride themselves upon the silk sash they wear in place of braces, and the different classes are known by their round caps being red, white or blue, with different coloured tassels hanging from the centre to the shoulder. They wear an ornamental jacket and showy waistcoat, with much braiding and gilt buttons.

Soon after the line was opened to public traffic (it being a single line), an English engineer had charge of a train of trucks, finishing up some of the cuttings, where turnouts and extra pairs of rails were laid for them to work without interfering with the public traffic. The driver had a watch and time-table so as to know the times of the several trains, as between turnout and turnout; thus he would know when his ballast train could pass along on the single line. One day, from the engineer's watch being wrong, he attempted to go on the main single line, when he met the public train full tilt, each going about twenty miles an hour. The crash was awful. It was just at the spot where the retaining wall just described was built. The ballast train suffered most: the tender broke its coupling, turned right over with the concussion, and settled on the top of the engine boiler, with the wheels upwards. Pieces of broken springs were lying all about, along with the splinters of the woodwork. One Spaniard who happened to be riding on a truck in front of the ballast engine, received the whole force of the concussion. His body was shot up into the air for yards and the truck smashed up. There were many narrow escapes, and several deaths. The engineer was not hurt, but the stoker happened to be in the tender when it took the somersault, he went with it, was not hurt, but so confused by the shock that presently, when he came out, covered with coke and water, nobody could persuade him that he had not come out of the boiler. The engine driver was put in prison at Santander, when he became ill from excitement and the filthy, dirty prison. We English obtained a doctor's certificate for his release on parole, and became security for £50; forfeited this and sent him off to England.

About this mountainous district the public road passes many miles along the mountain side. It is made similar to the cutting just described, though less expensively and not so wide,

with no protection on the precipice side beyond guide stones, placed at distances apart. The mules, from long usage, carry you safely along such roads if you let the bridle alone and let them manage themselves. They generally walk on the side nearest the precipice, and while on his back you are near enough to see deep and frightful-looking gorges, so if the mule made a slip or mistake and you went over the side, nothing could save either from death. The reason assigned for the fact that mules walk on the precipice side is, that this allows room for the inner pack to pass free on the rock side; for when they are used as pack mules, they carry two packs, one on each side.

Frenchmen seem far before the Spaniards in energy. The best regulated and best fitted-up cafés in Spain are kept by Frenchmen, and the most extensive calamine mines are owned by Frenchmen. They have made calcining works, to bake out the earth amongst the mineral, and so reduce weight of carriage; they have made their road from the mines to the port of shipment, and many times fifty bullock carts may be seen travelling along in a string. Two bullocks are attached to each cart, and in this country they pull by the horns in the following way: a strong wooden frame or yoke is placed on their necks, at the back of the horns, and their horns are lashed to this by strong leather thongs; a ring is attached to the frame and hangs down between the bullocks; a pole passes between them that is fixed at one end to the cart, and the other end passes through the ring. Holes are bored through this end of the pole, and an iron bolt passed through one of these holes in front of the ring, and from this they pull the cart along. One advantage claimed for the use of this pole is, that if the cart turns over in bad roads, the bullocks are not affected, as the pole simply turns round in the ring. The wheels, too, are primitive, they are almost solid, and are fixed on the axle; the axle turns in bearings on the under side of the cart. The advantage claimed for the fixing of the wheels is, that if one wheel gets in a hole in the road, the other wheel helps it out, acting as a lever. If from any cause a bullock breaks off his horn, he is no longer useful for work, so goes for beef, and is generally tough and lean. Butchers in the country villages are licensed by Government, the selling price is fixed by them, but quality does not seem to enter into the contract, so if tough the best plan is to boil it down to rags and make soup of it.

Before concluding the chapter descriptive of Spain it would perhaps be interesting to say a word or two about a Spanish bull-fight. The fighting bulls have pedigrees as grand as some of our English race-horses. Particular notice is taken of the courage displayed at the several bull-fights, and particulars of

the breed noted. They are bred in large numbers in the country districts, and judges pick the best out of the herd. They travel mostly by road to towns and cities where the bull-fighting takes place. They are kept somewhat hungry at last to make them savage. The circus and seats for the audience are similar to an English circus for horse performances. For an evening's entertainment, from four to six bulls are provided, from a stock noted for their bravery and ferocity. The audience numbers about 5,000, many being ladies of position, who enjoy the sport, and are keen to applaud or disapprove the several acts performed by the picadors, banderilleros and matadors. The picadors, or those on horseback, are provided with a lance to oppose the first violent rushes of the bull. Their position is a somewhat precarious one; the first rush is sometimes violent enough to upset man and horse to the injury of one or both. His place is by the woodwork of the arena, where he waits for the bull's first charge. If the bull gores the horse and he comes toppling over, the banderilleros on foot come to his aid, waving their small red flags before the bull's eyes, and so taking his attention from the fallen man and horse. The bull chases the banderilleros round and round the ring, and it is then they display their wonderful agility in running just in front, the most active will even play with the bull, showing the impressions of his horns on the cloak he carries first on one side of his body then on the other, while both are running round the ring. This performance is varied by the man suddenly turning, and as the bull passes, sticking a dart into his shoulder (the colour denotes the man). This is considered a great achievement, and if done cleverly and dexterously is much applauded.

To show how nimble these banderilleros are, a tale is told of one being nearly pinned against the wooden side of the arena. The bull had lowered his head to make the toss, when the man, seeing no other way of escape, sprang on the bull's head, ran along his back, and jumped down at the tail. The bull's force was so great, that his horns fixed in the woodwork of the arena. Rounds of applause followed this great feat of activity. The more clearly to understand the sport, the following particulars are added. At three o'clock the matadors or espadas marched into the ring at the head of their retinue, keeping step to the music and saluting the judges, the audience greeting them with applause. The bugle blew, and all went to their appointed places in the arena. A large bull was then turned loose into the ring. The first thing he did was to hook a horse as soon as he entered, the rider losing his lance. The bull then tore up planks from the side. One of the matadors then walked fearlessly before the bull, and tossed his blanket right and left to the surprise of the audience. The bull next



tossed one horse, then a second, and he fell to the ground bleeding and disabled. The bugle was then blown again, and all horsemen left the ring. In seven minutes from the beginning, two darts with colours were fixed on the bull's shoulder, closely followed by two more, then two more, the colours showing which banderillero had fixed them. The bull bellowed with this treatment. The bugle then sounded for the espada or matador. He entered the ring on foot, sword in hand, holding also a red flag in front of him; the bull charged this repeatedly. The matador then plunged the sword down between the shoulders, piercing the heart; the bull then dropped down dead. The audience cheer if, after killing the bull, the matador is quick enough to draw back the sword before the bull drops; if he fails in this, he is hissed as a bungler. Twelve minutes have now passed, when the band begins to play, the audience cheer vociferously, and the dead bull is hauled out of the ring by a team of fine mules handsomely harnessed. At 3-15, a second bull enters the ring. The first thing he does is to charge around the ring like a race-horse. He next hooked two horses; the riders dismounted, and were provided with fresh ones. The bull then hooked a third horse in the stomach, so that his entrails came out. The bugle again sounded, and all horsemen left the ring. Again the bugle sounds, and the matador enters the ring, sword in hand. He makes a short speech to the audience, and throws his cap in the air. He then holds a red flag in front of the bull. The bull plunged repeatedly at the flag. During this time the matador sees his opportunity, and thrusts his sword between the shoulder-blades. The bull swerved, and knocked it out of his hand; it is picked up quickly, and a second stab made. The bull swerves again, and the sword flies fifteen feet in the air. He makes a third attempt, and the sword refuses to enter. In a rage it is thrown to the ground. He changes his sword, and in the fourth attempt he succeeds in plunging it in the fore shoulder, reaches the heart, and the bull dies. The mules now enter and drag out the carcass. The bugle sounds and the band plays again. The third bull now enters; he is of a black and brown colour. His first act is to run horses and riders round and round the ring. He then hooks a horse, and carries him on his horns for twenty feet, the rider hanging on to the side railing for dear life. Another horseman now engages the bull, and fights him stubbornly with his lance. The horses are bleeding profusely. The bugle again sounds, and all horsemen leave the ring. The bull then charges the goals and tears up planks with his horns. The judges order him to be driven out of the ring, and so ends the entertainment.

## CHAPTER VI.

HAVING finished the measurements to Las Caldas, I went to Bilboa with the contractor, to see about another contract there; nothing coming out of this, I left Bilboa by steamer to St. Nazaire. Here another adventure happened. It was just at the time when the Emperor Napoleon III. had a bomb-shell explode in front of him as he entered the theatre from his carriage, so the gendarmes were very vigilant, and my level box was scrutinized, and I was asked many questions about it which I was unable to answer; this silence they took for guilt, and so I was marched to the station as a rebel, with gendarmes in front, gendarmes behind, and the other two carrying my level box with great suspicion, and some fear that it might explode. In this way I was conducted through the streets of St. Nazaire till we reached the police station. The magistrate asked many questions, but I still showed a hardened front and made no reply. Things went on from bad to worse, and I was to be imprisoned. In the court there happened to be a man who spoke English: he asked me if I knew the mess I was getting in. "No," I said, "I know nothing of all they have been saying or why they excited themselves so." This he told the magistrate, who said if I was innocent I would go to the box and unlock it. I did so, and showed a simple brass level, and thus the matter ended, and I and my interpreter friend had a jolly good dinner over it and many a hearty laugh. After this treatment I left St. Nazaire and went by train to Havre. Here I put up at an hotel kept by an Englishwoman, and soon made myself comfortable and stayed there a day or two. One evening there arrived by the Havre boat from Southampton, a man and his wife and some children; he ordered dinner, and was just stretching himself out afterwards, when in walked three gendarmes and took him away. I was much astonished at this and asked the landlady for an explanation, which she gave me. It appears the man had done something wrong in England and had escaped to Havre, but by telegraph he was followed; the gendarmes were told he was coming by the boat; he was described well, so when the boat arrived they spotted him, followed him, and after he had had his dinner, took him away. "Oh! this is how espionage goes on in France," I said. "Yes," was the reply, "and I have a description of you," and she showed me the account of my adventures at St. Nazaire, and further said I should be kept in touch till I left France. Accordingly I left Havre, crossed the English

Channel, and came back to England, where I was better understood.

In 1860 I went to Portugal, to build some iron bridges of importance. I left Southampton, and again crossed the Bay of Biscay, still without a storm and still sea-sick. We sighted Cape Finisterre on the Spanish coast, called at Vigo, Oporto, and Lisbon, where we landed and went straight to Durand's Hotel, where the landlord was Swiss, the landlady English, and the children grew up speaking three languages; thus, when the mother spoke to them it was in English, the father in French, and the servants in Portuguese. For some time I made this my headquarters. The thermometer, I observed, registered 84 degrees in the coffee room. I made almost daily journeys to the first bridge to be built at Santarem; the railway was open to public traffic from Lisbon to Santarem.

We first built a row of shops, etc., thirty feet above the summer level of the River Tagus, to be safe, as we thought, against the rise of the river in flood times; we divided the range of buildings into a store, an office, and a place for the English workmen to dine and sleep in, and blacksmiths' and carpenters' shops. This hill was historically interesting, as remains of trenches were distinctly visible, from the time when the French were advancing toward Lisbon to take it. Distinctly, too, are the lines of Torres Vedras, where Wellington made a road to get his cannon at a commanding height (near Poco do Bispo) as a check upon the French advance. The lines of Torres Vedras are about twenty-four miles from Lisbon, the lines stretching in two ranges. On the 8th October, 1810, Wellington was encamped on these lines, Messina for the French in opposition. The first battle began at Villa Franca, close to the Tagus, but there the English gun-boats could reach them. Wellington having held the Torres Vedras lines for a month, fell back on Santarem for the winter. There is a very old aqueduct across the valley near Lisbon that supplied most of the water for the use of the city; and while they were in a state of siege this was cut by the French, and the only water the besieged had was from a well inside the city. Then, again, the river Tagus, opposite Lisbon, was both deep and wide enough to allow Sir Charles Napier to anchor his fleet ready to bombard. The width is from four to five miles opposite Commerce Square.

The Portuguese are celebrated for filigree work in both gold and silver ornaments, and there are two streets called Gold and Silver Streets, where these works of art are sold. There are many evidences of the last earthquake in Lisbon, which was in 1755; it is called the city of the seven hills, and truly the present city has many hills, and some very erratic. To show

this more clearly, in one street, namely, the Rua do Alacrim, there is a steep hill from the harbour to Durand's Hotel, while only in the width of a house the road is level; these houses have doors leading into each street, so that at the Rua do Alacrim side you may be living on the ground floor and at the opposite face you will be on the first floor. From the Rua do Alacrim there are cross streets that have a dip, while another street at right angles to these cross streets and parallel to the Rua do Alacrim the hill rises in an opposite direction; there are the ruins of a church with the roof gone, the spandril walls gone, but the arched groin of each window standing uninjured by the earthquake, in fact, the earthquake has left many unmistakable signs of great disturbances and damage done. Near the upper public gardens, there is a Protestant Church where the service is conducted in English. The climate being mild, and regular flowers luxuriate in the open air, so that the burial ground looks cheerful instead of melancholy. Around the graves are splendid geraniums and other flowers. The foot-path up to the church is straight, broad and well-kept, as are the flowers on each side. The church is a plain building without a steeple, but convenient inside. There is a splendid cactus that grows up the wall at one gable end, and runs along the ridge of the roof for a considerable distance, with flowers growing in various parts, thus materially adding to the beauty of the place. The church was well attended, and there were many English there. Fielding is buried there, and several of the English naval officers who happened to die in or near Lisbon. The lower public gardens are prettily laid out, with a fountain at each end, entrance gates and two lodges, a broad, straight path from end to end along the centre, trees on each side in rows, with spaces between for promenading, and a band playing alternately at each fountain. The entrance admission is twopence.

While at Lisbon I went to Cintra, a most lovely spot. One of the many attractions being the pretty villa residence called Mont Serrat, kept there by Mr. Cook, of St. Paul's Churchyard, London; he pays a visit once a year, the other time it is for the public to see. It is well kept up by resident English gardeners.

Cintra is well described by Lord Byron. To see the Pena Castle as it has been restored by the owner, Dom Fernando, is alone worth a visit, but there are many attractions at Cintra beyond this; there is also a very comfortable hotel. Dom Fernando was husband to the Queen of Portugal, and father of the present King Carlos.

There are very extensive cork plantations in Portugal, and a great deal is imported into England. The cork tree is some-

what similar to an oak tree in its growth. The bark is stripped off the trunk for about one or two inches in thickness, and in lengths of about two or three feet. These are packed in rolls of two or three feet in diameter, and taken to the nearest point of the Tagus river. Rafts of these rolls are made and floated along the river to the port of shipment. A tree having had the bark taken off takes nine years before it is ready for another cutting. Barking does not kill the tree, because it is not taken off to the solid wood. In travelling through a cork plantation one day, I met a lady quietly sitting alone, knitting by the side of her carriage, which had a broken axle. She was English, so I asked particulars. She said that she and her husband were travelling through Spain and Portugal in their own carriage; their horses were tired out and left behind, so they had to go forward with hired bullocks. The roads were very rough, the axle broke and had to be carried to the nearest blacksmith to be mended, meantime she was working while she was waiting and the bullocks quietly feeding until the husband's return.

And the roads are rough enough in the interior. Generally, when wealthy ladies travel in the interior they go in a sedan chair, carried by one mule harnessed in front and one behind, and though the shafts are made of lancewood and spring a good deal, still it is not comfortable travelling. If one mule stumbles the lady gets a bump, and if they go out of step she rolls somewhat.

Well, we must get back to our bridges. Soon after we commenced working at the Asseca bridge, we began the Tagus bridge. In November, 1873, I read a paper before the foremen engineers at the Cannon Street Hotel, and this seems the proper place to give an account of what I said there.

### LATTICE GIRDER BRIDGES.

Some years ago I went to Portugal to build two iron bridges upon the portion of the railway from Santarem to Constancia. The Santarem bridge was at an angle of forty-five degrees from the direction of the river, the other at an angle of twenty-two degrees; each were a little above thirty feet from the summer level of the river. At every 100 feet length piles were driven around the spaces for each cylinder. These piles, when driven firmly, were strengthened and steadied by diagonal bracing, made of six-inch timbers or half baulks, and horizontal walings were fixed top and bottom to ensure the cylinders being sunk perfectly true, vertical, and in their proper position to receive the superstructure.

Each pier consisted of two cylinders for the width of a single line of railway, each cylinder was made up of six feet lengths, each length consisting of four quadrants, inner flanges were cast

on the vertical and horizontal parts, bolt holes were cast in these flanges, and the whole bolted together watertight. The outside was smooth, so as to sink the more readily; the bottom length of each cylinder was eight feet in diameter and six feet high, with a cutting edge on the lower end; on this was bolted a cone-plate six feet high, eight feet diameter at the bottom end, and six feet diameter at the top end, all lengths above this were six feet diameter. Having bolted these together so as to have one or two lengths above the water level, the sinking was commenced by scooping out the sand from the inside, and weighting with twenty or thirty tons of rails.

For the first twenty feet of sinking, the sand was worked out by ordinary dredging scoops, a shackle was fixed by the diver in place of one of the bottom bolts that screwed each quadrant together; attached to this shackle was a snatch block, a rope worked through this snatch block, fastened at one end to the scoop, and at the other end to the crab on the top of the cylinder. There were two ropes used to work the scoop, one to pull it across to the snatch block to fill it, the other to pull it to the top to empty it. Upon the first length being sunk nearly to the water level the rails were taken off, other lengths were added, the rails replaced, and the sinking continued as before.

In parts of the river where the sand was of a greater depth than twenty feet, the extra depth of sinking was done by using the compressed air apparatus, which consisted of a circular chamber bolted on the top cylinder; in it were two chambers fitted with doors, these doors were opened and closed to let every skip of sand pass, so that a chamber of compressed air was lost to every skip of sand sent out, in the same manner as a lock of water is lost in the passage of every barge through the lock of a canal. An eight horse-power portable engine was used to work a three-throw air pump, which by piping was connected with the set of cylinders that were being sunk; the air was forced in at such a pressure as to keep the water from rising within the cylinder, so it was dry for the men to work at the bottom, and as they were subjected to the pressure everywhere alike they were not very seriously affected, but could work four to six hours in it. In some cases the cylinders were sunk in this way to a depth in the sand from thirty to forty feet; and in all less depths until they came upon the rock. These cylinders now down to their proper depth formed shells or caissons which were filled with concrete from top to bottom and which when properly set, bore the whole weight of the superstructure. On account of the rapidity and depth of the river during the rainy season, each pier of cylinders was further strengthened by diagonal bracing of strong wrought iron fixed

between them. This done, we erected high staging, for the two-fold purpose of riveting the parts of the superstructure together, and for supporting an overhead traveller, used to lift and fix the several portions in their places, all having been previously fitted together and marked in England. However unequal the depths were that the cylinders were sunk to, all were made to one level, by making up pieces of various heights as shown by levels taken; these were specially cast and sent out from England. On these were fixed caps, circular at the bottom, and four feet square on the top, the horizontal top face being planed true for the rollers supporting the superstructure to run on. In this way expansion and contraction of the girders were allowed for: that is, one end of the girder was bolted down to one pier, and the other end allowed to work on the rollers. Under an almost tropical sun this variation was not more than half an inch in the hundred feet.

Having given a general description of the mode of building one of these bridges, the same will pretty well apply to the other; but it may perhaps interest you if I describe some of the obstacles to progress we met with in building these bridges. As I have said before, we built our shops thirty feet above the summer level of the river; such, however, is the magnitude of area of mountain land all draining into the river as an outlet, that in a week from when the rainy season began, the river rose in vertical height fully twenty feet, and before three weeks up to thirty feet, and travelled at the rate of ten miles an hour. We got caught in our work by a flood, more than ordinarily high it is true, but when the large area of mountain land is considered, and that a considerable quantity of the snow on these mountains melts as well, you can readily understand the bulk of water that comes down. At Oporto a notable phenomenon in rainy seasons presents itself, caused by the narrowness of part of the River Douro and the large bulk of water that has to pass. It is a depth of water rushing along over the surface of the original river at a rate to endanger the shipping lying at anchor; and so suddenly does it sometimes come that there is nothing for it but to slip the cable and let the ship drift.

To go back again to our bridge at Constancia across the river Tagus: our shops were scarcely high enough, the water covered the floors, we were turned out and the new tenants were snakes, rats, mice, tortoises, hares, rabbits and a lot of vermin that had escaped to our upper level from the low lands now covered with water for miles. Barges were sailing about over the low lands to pick up such horses, cattle and sheep, as they could find, and transfer them to the higher land. It is a curious sight to see the horses (when fear overtakes them and they see nothing but one vast sheet of water surrounding them)

form themselves into circular groups with their heads in the centre quietly awaiting their fate without an effort at escape. They form themselves into the same circular group when attacked by a pack of wolves, but then kick and lash out like a battering ram in their defence. I fastened a pile engine strongly as I thought to an olive tree that grew near the works ; the floods covered all, and when the water had subsided both tree and pile engine had gone. At some distance down the river just one or two teeth of a wheel were discovered above the sand, this was the pile engine, which had to be dug out, and a dead bullock and limbs of trees were discovered jammed in amongst the gearing. In Constancia, while the flood was up, we had to shift our quarters from ground floor to first floor and had to cross the street in a boat ; a lot of cylinder plates had, after the flood, to be dug out of the sand that had settled over them. I mention these circumstances to show that obstacles occur while building bridges or other works in these mountainous and tropical countries that do not happen so often in England.

The rock was on the surface on one shore where the bridge was built across the Tagus, but on the opposite shore it took a considerable dip and was covered by a great depth of sand ; consequently we had to build the abutment on that shore upon cylinders sunk in the sand in the manner before described for the piers ; excepting that the cylinders here were four feet diameter and the plan of the abutment a square, the cylinders were eight feet apart each way, the sand was dug out and concrete laid in between them three feet deep ; wrought iron girders rested on the cylinders ; three-inch planking laid on these girders, and the abutment built on the planking to its required height.

We brought a diving dress out from England ; also an English diver. The dress is an ingenious invention and I propose to describe it. The dress is made of india-rubber webbing of very strong texture, it is made in one piece for the whole height of the man, and is put on from the feet and drawn upwards to the head ; next his boots are put on which are made of good strong leather, with buckle and tongue leather fastenings ; on the leather soles heavy lead soles are fixed, about thirty lb. weight, their use being to keep the feet down on the bottom of the river or wherever else he may be walking under water ; next he has two heavy lumps of lead, about eighty lb. weight, one on his chest, the other on his back, the two are joined by cords passing over his shoulders ; they are further secured by cords tied round his body ; next the helmet is screwed on to a flat brass ring secured to the upper portion of the dress and lying on his shoulders ; an india-rubber ring



is between the helmet and flat brass ring, the joints everywhere are, when screwed together, quite watertight. One of the large glass eyes is left out so that the man may have air till all is ready for him to start under water, bands are tied round the wrists to prevent water passing up the sleeves, or air escaping, one end of a long length of flexible india-rubber tubing is screwed on at the back of the helmet, the other end to the air pump. A life line is then fixed round the diver's body, we now screw on the glass eye, start the air pump (generally worked by two men) and all is ready for the man to descend the rope ladder secured to the side of the barge. An attendant is placed at the side of the barge with the elastic tube in one hand and the life-line in the other, his duty is to attend to the orders of the diver, who by a prearranged code of signals makes his wants known by the number of jerks he gives the life line; but that he may not be seriously affected by irregularity of air supply, he has a valve in the front part of the helmet that he can regulate with his own hand. By this system I have had many twelve-inch piles sawn through level with the bottom of the river when they could not be drawn. The diver requires to be very careful amongst piling, and mark well the road he walks, and be sure he knows the same way back that he came, or he may get the air tube twisted and pulled so as to stop the passage of air and so kill himself. His dress and helmet being full of air, he feels nothing of the weight of the lead at his chest and back, or of his boots while under water. Inside the helmet he has on his head a woollen night cap. The diver can work conveniently at from fifty to one hundred feet depth; at the latter depth he cannot remain under water for more than about ten minutes at a time on account of the pressure; at the former depth he can remain under water two hours without inconvenience, and if the water be clear, objects at the latter depth can be seen distinctly.

Having said thus much upon lattice bridges, and the things belonging to the building of them, I have a word to say upon the fine inland rivers that want the thoughtful engineer at work to improve their use by deepening them in the summer months. Take the Tagus as an example and the run up it even as far as Constancia (seventy miles from Lisbon) where the river is 1,500 feet across; and for many miles further up it is a fine broad river, more or less silted up by the floods. Consider too, that by land almost the only means of carriage is upon the backs of mules or horses travelling upon simple road tracks; and the value of the river as a highway will be apparent. As things stand now with the river in summer, the barges are made flat bottomed, and are lightly loaded so as to draw as little water as possible; still they are eternally

sticking fast on the sand-banks; and it is not at all an infrequent sight to see all hands at work with shovels cutting a channel to pass. You can easily imagine then the delay we met with in getting our portable engine up to Constancia. It came from England, but we commenced with it from Lisbon in a barge; got it up in this way twenty miles, then had to build a raft or platform. Sometimes it was afloat on this raft, sometimes had to be pulled across long sand-banks upon its own wheels by bullocks, then again reloaded and started on the water, the lightened raft was towed round along the course of the one channel that the water running towards the sea keeps open. Beyond about twenty miles from Lisbon there is no tide.

Now while I am before men of varied engineering experience and essentially practical minds, I should like to set you thinking of an effective plan to keep open this channel in the summer; you would meet with every encouragement from the government, who are fully alive to the value of this great highway, and how the interior of the country is developed proportionately to the facility of using the inland rivers. There are many rivers in India that require the same treatment, many in Spain that I know of, and no doubt many in other parts of the world.

Then, while thinking of Africa, and of Livingstone, Sir Samuel Baker, Speke and Grant, Du Chaillu, Stanley, and other travellers, and of the energy they have displayed in tracing the rivers and their sources, it shows the value they set upon good navigable rivers as the means to develop a new country, and at once forming a line of communication with the coast at a paying rate to the grower of produce. To abolish slavery was no doubt a great point with them; but they also knew there is almost every climate in so large a continent, that there are large tracts of most productive land, and that it is close to the large European buyers of produce, and if found to possess good navigable rivers will one day become a fine field for emigration.

From levels taken, it is said that the whole desert of Sahara can be flooded from the Mediterranean Sea, to a depth to carry shipping to (what would then be) the productive North African Coast, and to carry produce to their customers all along the south coast of Europe without a change of cargo. And this could be done by cutting a canal about thirty miles long on the Barbary Coast.

As an illustration of the severity of hardships pioneers in Africa have to go through, Sir George Newnes' new work—"Through the Dark Continent," shows Stanley in 1874, before his departure, and 1877, after his emerging from Africa. A world of explanation in itself.

Lake Tanganyika was first discovered in 1858, and found to be over 300 miles long with a mean breadth of twenty miles, by Speke and Grant as mentioned in Speke's work. Dr. Livingstone added knowledge of the lake in 1867. In 1874 Lieutenant Cameron made further discoveries.

In this district the guinea palm grows, india-rubber is abundant, the castor oil plant grows almost wild, ground nuts the same, copper and gold are also found, cotton grows well, coffee grows wild, and ivory comes from this part of Africa, rice also grows luxuriantly.

The town of Congo is 15,000 feet above the sea level. The river Congo is navigable for steamers at 110 miles from its mouth. There are hundreds of canoes that carry about three tons.

Lieutenant Cameron was a young man (about thirty) when he undertook to follow up Livingstone's discoveries on the Congo, which he was engaged upon when he died in 1873.

It took Cameron four years to walk some 3,000 miles across from Zanzibar to Loanda, that is from the Indian Ocean to the Atlantic. 1,200 miles were entirely new to geographers, which before was considered to be a sandy desert, and now found to be a most productive country, inhabited by natives who had never seen a white man before.

In May, 1874, Cameron started from Ujiji across the Manyema country for Nyangwe with the view of descending the Congo from that point to the West Coast. Upon Cameron's arrival at Loanda (not a very prepossessing looking individual) he reported himself to the English Consul (Captain Hopkins) in these terms: "Come to report myself from Zanzibar overland." The Consul's reply was equally noteworthy: "Cameron, by God."

In 1876 Cameron arrived at Liverpool, where he was entertained at a banquet at which the Mayor presided, and in his speech described Cameron as being sent in command of the Livingstone East Coast Expedition in search of Livingstone, and on finding he had died he determined to pursue the discoveries of that eminent man.

He made important astronomical and geological observations, and made a careful survey of his route.

At Bihe, where the Quanza Basin is, there is one of the most magnificent natural systems of water communication in the world, where the Congo and Zambesi could be joined by a canal of thirty miles, and so make water communication across the continent, passing along new mines, new coalfields, and land of great agricultural value.

Tropical Africa has been chiefly treated of in the aforesaid treatise; but the immense size of the continent allows of very

varied climates, as is instanced in England's possessions in Cape Colony and the South, as well as Egypt and Nubia in the North-East.

Once a fortnight it was my duty to fetch money and pay the wages at the Tagus and Asseca Bridges. When on the journey to the Tagus, usually I went by rail as far as Asseca, and was there met by two of our Portuguese labourers in a boat, and performed the remaining distance by water. Towards evening, just about sundown, we made the boat fast, (generally under a large tree overhanging the river) to catch fish for supper. There is a fish in this river that jumps clean out of the water after flies, high enough even to fall into our boat as she lay. In this way we caught enough in quantity to make a capital supper for us all—these we ate; made the boat fast for the night, and slept in her, making a fresh start onwards at daylight. I lay at the stern under an awning, armed with a revolver, and the money for a pillow, the two men sleeping in the bows. As a precaution against treachery, strings were fixed across and across the boat to trip the men up should they come to my end at all, and so give me proper warning. The men however proved honest and I was never molested. Sometimes I made the journey all the way on horseback, but not often, as by water seemed the safer plan of the two. I had between £300 and £400 with me at the time. The thought often crossed my mind of the danger of the journey, as, if the boatmen proved treacherous, they could easily have arranged with others to meet us at the sleeping place, tap me on the head while asleep, take the money, and if my tap were fatal throw the body in the river. There was equal danger by road of being attacked by numbers as it was known I had money with me.

The two boatmen punted up against stream, one on each side of the boat; the punting pole was long enough to reach the bottom and the men's shoulder as they stood up, and walked from end to end of the boat; and as a guard they wear a leather pad on their shoulder with a recess made to fit the end of the pole.

In consequence of so much ague amongst the men, a second foreman and another gang of men were sent out from England to replace the former gang, under agreements as before. After a time this foreman showed himself to be a bad lot; he rebelled and persuaded the men to strike against me. I had rented and fitted up a large house for their accommodation at Constancia; bedsteads were made, and blankets and sheets bought for their comfort; still they struck work after a time, and kept away from work for two days getting drunk, just at a time too when we had a hard drive on to escape the floods. So on the third day

notice was given to each of them that unless they appeared at their duty at once, their agreements would be cancelled. They still refused to come to work and otherwise set me at defiance, so their agreements were cancelled, and their passage back to England refused. It oozed out that they intended to lay violent hands on the money at the next pay-day, so I got a Portuguese officer to let me have a platoon of soldiers in good time in the morning; these were hidden up, I paid the Portuguese workmen. The Englishmen then forced themselves into the office, and insolently demanded their money, the soldiers were sent for, and ordered the Englishmen out; nothing could exceed their surprise at the sight of the soldiers, and they had to acknowledge themselves beaten.

A few days afterwards the foreman went on the works, stood at the office door, barred the way, and refused me admittance, the other Englishmen meanwhile looking on watching events. I pushed past him, telling him not to be a fool, but keep to his position as foreman. He then (being the stronger man) sent me backwards, cutting the back of my head severely against a desk, causing much blood to flow, and I to lose my senses for a time, he then took me out intending to throw me into a pit foundation. I just recovered in time to see the Portuguese coming in a body to defend me, and it would have gone hard with the English, but that the interpreter being present addressed the Portuguese to prevent further bloodshed, and I, while thanking them, persuaded them to spare the Englishmen's lives, and leave them to me to deal with. They cooled down after a time, and the Englishmen were glad to walk away with a whole skin, though very wroth. Their next thought was to waylay me in passing to Constancia after the day's work was over, and knock me on the head. In arranging this they were overheard and I was warned. In this dilemma I applied to a Portuguese friend who lived in Constancia. He had influence enough to swear in some special constables, who were put on guard, and at the proper time it was arranged I was to pass along as though I knew nothing. The English, however, were afraid to attack; they suspected something from seeing more people about than usual. One Englishman who singled himself out against me I put in prison for that night, which caused a great commotion and upset their plans. It would not under the circumstances be advisable for me to sleep in the house where they were, so I slept at my friend's house, and so could not be found that night. It appears they had hired boats to take them to Lisbon after knocking me on the head, and so make their escape to England. Next morning I showed myself again in Constancia, when two of the Englishmen came up and demanded that I should let their mate out of prison. I

asked them to wait a minute when I would see what could be done for them, intending to put them along with their mate. Seeing some suspicious movements amongst the special constables, they suspected me, ran off as hard as they could to their boat, and made off to Lisbon. I sent a special messenger by land to the English Vice-consul to stop their passports, as well as those of the other English who followed. Explaining them as deserters from their duty after incurring the heavy expenses of their passage money, besides other expenses, and the inconvenience and hindrance to the progress of the work.

I and the interpreter and an English clerk followed to Lisbon; saw the Vice-consul, and had professional advice as to what legal redress there was for the assault and hindrance. All particulars were explained to the lawyer, and his first remark was, had I stabbed the foreman, and when told "No," he said, "What you English are made of I can't imagine. Under the circumstances I could have got you free for £3 or £4 if you had killed him. But as things are," he said, "the best punishment is to leave them to their own resources, but don't give them any money." I telegraphed to my employers in London, not to settle with any of the men that might present themselves, until a letter giving all particulars arrived from me.

The Englishman put in prison at Constancia had a rough time of it; he had to walk under escort seventy miles to Lisbon. His experience on the road was quite as much as he wanted. What with prickings up with the bayonet on the way, not a very liberal allowance of food, and the general rough treatment of the guard. He sent for me upon arrival, begging ten thousand pardons if I would only let him have his liberty again. I promised to do so on one condition, and that was that he would be out of the country within twenty-four hours, and that I should have him watched till he left. "Was that the only condition?" "Yes," I said. "Then I will be gone within twenty-four minutes," was his reply, and he did go, working his passage home. This had a good effect upon the others, and they soon all left at their own cost.

There is a very primitive but effective way of reclaiming land on which the river has encroached that is commonly adopted in Portugal; it is as follows:—

A number of old barges are brought up and patched, to be temporarily watertight. These are filled with stones and floated to the mouth of the waterway that is to be stopped up. Strong rings are fixed at each end of each barge. A strong chain is passed through these rings; one end of the chain is firmly secured on one shore. The barges are then floated in a row across the opening, and secured to the opposite shore. Holes are then bored in the barges to sink them. Sediment forms

against the sunken barges; the tide-water goes back to the river. At the next tide, sediment forms over the former sediment, and so on till a sediment is formed covering the barges and becomes the base of an embankment or dam, which is added to by manual labour until a level is reached above high-water mark; then at each tide fresh deposit is added till the land is reclaimed to a fit level for cultivation.

## CHAPTER VII.

IN 1867 I started the first steam plough in West Kent, taking a set of tackle of the kind working a traction engine on one headland and a self-moving anchor on the opposite headland. The plough was fitted with self-acting apparatus which took up the slack or let out more length according as anchor and engine did or did not work at a parallel width with each other, or in other words the apparatus adapted itself to irregularities in the shape of fields. The traction engine was of twelve horse-power and the tackle worked a four-furrow balance plough or a nine-tined balance cultivator, so arranged that the front set were in the air, the back set in work. The frame on which the implements were fixed (whether ploughs or cultivators) was bent to allow of this. The pair of carrying and steering wheels were in the centre, the ploughman had to change his seat and put the proper set of ploughs or cultivators into work for the return journey; neither implement turned at the headlands at all but simply worked backwards and forwards, commencing at one side of the field, and following on furrow after furrow until the opposite side is reached. The horizontal drum under the boiler of the engine in this system had to be a clip drum to prevent the rope slipping as it only went half round the drum. In this system, too, the rope has to be double the length from engine to anchor, one being the head rope for one journey, the tail rope becoming the head rope for the return journey. The rope is made of the best steel wire and costs ten guineas per hundred yards. I got £1 per acre for ploughing, the farmer finding coals and water; this paid very well. After working in this way for two seasons, the several surrounding landowners advised me to make it into a limited liability company, they offered to take £50 in shares and encourage their tenants to use the tackle; they also promised to order an additional double engine set and so extend operations. We did this, and I was made managing director. For some time we went on amicably together and had plenty of work for both sets of tackle.

Unfortunately, every farmer wants the tackle directly after harvest, this eventually caused a great split amongst the shareholders and a strong party feeling ran so high that I could not satisfy everybody, try as I would. Personalities were indulged in, jealousies shown between the landowners, and the whole thing at last was sold, and I lost such money as I invested.

Being in the hop-growing district I invented a hop presser, or rather two different designs, one to meet the difficulty of a low height from oast house floor to ground floor.



The first plan was where the pocket descended while filling, which wants a height or pit sunk to make the distance between oast house floor and ground floor fourteen feet, namely twice the length of the pocket. There were two successful public trials of this plan, one on the estate of Mr. Coles Child at Bromley, Kent, the other at the Hop Exchange in Southwark, London. So successful were these trials that Messrs. Parks and Son, Messrs. Pattenden and Smith, Messrs. Latter and Co., Messrs. Thomas Waterman and Co., all hop merchants of the Borough, London, and Messrs. Strauss and Co., of the Borough, and Hamburg, Bavaria, gave testimonials.

A large hop grower at Mereworth, Kent, gave a trial order of one machine. We filled two hundred pockets, better, quicker, in more even layers, and cheaper than men did by treading; and all went well when the master was at home; he had to leave one day to find upon his return the machine smashed up and the men treading as before. He saw the strength of the opposition, but of course nobody did it.

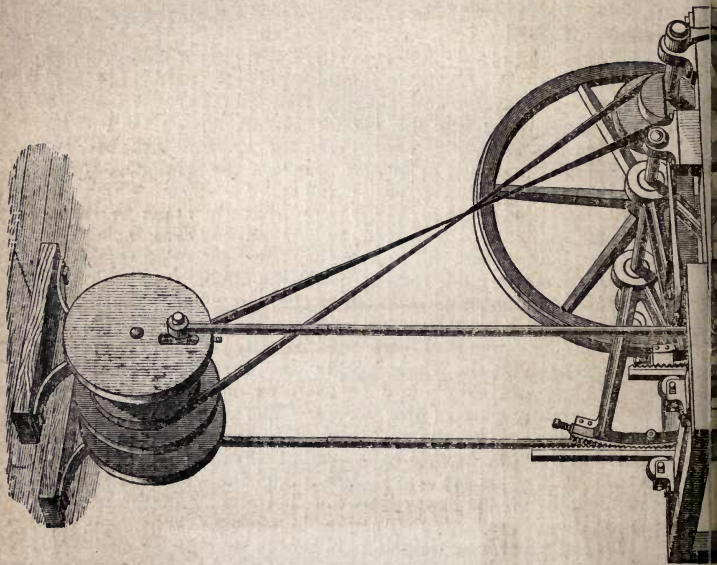
The novelties of this design were, that the upper frame on the oast house floor revolved, as did the treaders inside the pocket. The pocket did not revolve, but descended vertically between two side guide rods as it became filled. The action of the man's treading was imitated by the two treaders inside the pocket, worked by the crank shaft in the frame above; the filling was continuous and the treading also; the pressure was equal throughout the whole pocket and the hops thoroughly well packed and evenly laid so as to produce an even sample taken from any part of the pocket. The pressure is kept the same throughout by chains attached to the underside of the fixed side weights, having balls fixed at certain distances apart, so that as the pocket sinks while filling the weights rise and pull the balls off the floor; thus they become a counterpoise to the weight of the hops that are in the pocket. When full, the pocket of six feet long weighs as nearly as possible  $1\frac{1}{2}$  cwt.

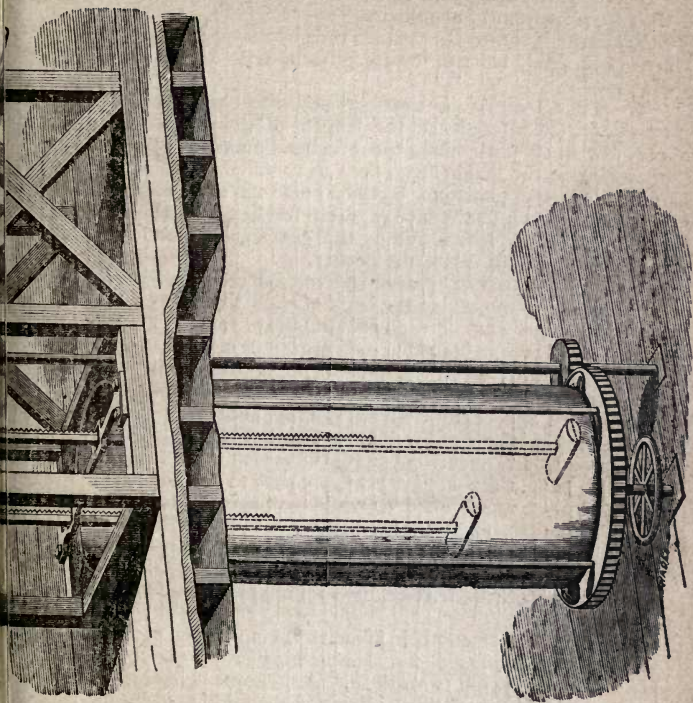
The weights that give pressure upon the hops are so made that any number can be added or taken away without stopping the machine, according as more or less pressure is found necessary according to the state and quality of the hops. The equilibrium being kept up while filling by the chain and balls.

The second design is illustrated on the next page and explained in the page following the illustration. From seven to eight feet is sufficient in height by this plan between the oast house floor and the ground below.

This illustration shows the plan adopted where the height from the oast house floor to the ground is limited, and the height from the floor to the roof also.

By this plan the crank shaft does not rise, nor the pocket descend while filling.





The throw of the crank is altered in a moment by shifting the crank pins where required along the slots in the discs, according as the condition of the hops requires more or less lift to the treaders to get them under.

Motion is given to the discs by a belt or band.

Three speeds are given, to be used as required according to the throw the cranks are set to.

Motion is given to the treader rods by rocking beams, which are connected to the crank pins by rods as shown in the drawing.

To suit all kinds of oast houses, the only parts of the machine to be altered are the length of the connecting rods and the strap that drives the overhead motion. These vary according to the height from floor to roof.

Notched steel plates are screwed on to the face of each rocking beam and on to the face of each treader rod, the notches fitting into each other, and by this gearing the treaders alternately rise and fall inside the pocket.

To keep the rocking beams and treader rods well in gear, a friction roller is placed at the back of each treader rod.

On the upper end of each rocking beam there is a socketed piece, kept down to its place by a spring tempered to resist a certain pressure; when the hops in the pocket get beyond this pressure, the spring gives way and allows the socketed piece to rise until the bottom stroke is fully obtained. Upon the return stroke the socketed piece again becomes free and is pressed into its former place by the spring, when the treader rod will have risen in the pocket equal to the distance the socketed piece was pushed up while making the down-stroke; thus will the treader rods rise from time to time till the pocket is filled, and the hops will be equally pressed throughout by the force of the spring. To make these socketed pieces work freely and with little friction, two rollers are placed at the back of each.

More or less strength is given to the spring by screwing or unscrewing the bolt, and so diminishing or increasing the distance for the spring to work in. A lock nut is used with this bolt to prevent any shifting while the machine is at work.

By this plan the pocket revolves instead of the feet as in the plan where the pocket descends while filling.

An iron ring with another fitting on it, holds the mouth of the pocket open while being filled. This revolves in a circular hole cut in the floor of the oast, and is connected with the lower plate (on which the pocket rests) by four rods, one of which is made to shift to let out the pocket when full and coped.

A screw is fixed under the lower plate, by which the pocket, when full, is first raised a little for coping, it is afterwards lowered sufficiently to let the pocket fall on the floor below.

Different sized feet are provided to be fixed according to the condition and quality of the hops to be trodden. The shifting of the feet is the work of a moment.

Next came a design for a sheep-folding machine of a very simple construction and light weight, where netting is used, This I travelled with to several agricultural shows in 1869, and gained the following prizes :—

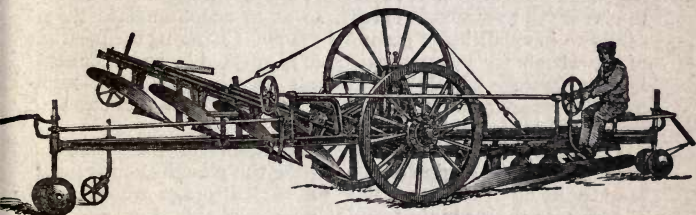
Highly commended by the judges of the Norfolk Agricultural Show held at Attleborough, June 24th and 25th.

A large silver medal at the Royal Agricultural Society of England's Show, at Manchester, in July.

A special prize of £3 at the Lincolnshire Agricultural Show, July 29th, 30th and 31st; and £1 at the Worcester Agricultural Show, in August.

Then a machine for tarring the netting. One hundred yards could be done in a quarter of an hour. For this the judges of the Royal Agricultural Society of England commended me at the show at Oxford, in 1870.

While working Fowlers' Balance Steam Plough tackle in



Kent, I saw several serious practical objections to the plough, so I designed one to remedy these objections. It was put into the hands of a limited company to manufacture, and much of my time was spent at the manufactory. We got one made and exhibited it at the Royal Agricultural Society of England's Show, at Hull, in 1873.

The following is an illustration and description of the plough.

The advantages claimed for the above plough are :—

1st.—Superior steadiness in work from the use of the outside horizontal fixed frame, and from the mode of steering. While as the weight carrying central wheels are not used for steering, but always remains parallel with the frame, and are upon rigid axles, there is no sideway or skidding motion as there is in a steam plough that steers from these wheels when working upon hill sides or upon slippery clay.

2nd.—The facility conferred by the rocking beam movement,

by which the raising or lowering of the plough frames at the headlands is affected by the power of the engines.

3rd.—The neutralisation of all strain upon the outer main frame by the method of attaching the draft ropes, and by the opposite strains upon the central cross shaft.

4th.—As one set of ploughs is not a counterpoise, all tendency of one set to lift the other set out of work is got rid of.

5th.—Transferring the steerage from the centre to the two ends, and the arrangements for holding up the back steerage wheels by attachments to the tail rope, so as to clear the newly-ploughed ground.

6th.—The simplicity of the steerage arrangements and their perfect action.

7th.—The mode of construction of the central wheels.

The following is the general description of the plough :—

It consists of an outer frame, following somewhat the form of the inner frames, on which the skifes, mould boards, and coulter are fixed. This outer frame is carried upon a pair of large wheels, midway of its length, and furnished with angled steerage wheels at each end; these wheels are at liberty to rise or fall to a certain extent, so as to accommodate themselves to inequalities of ground surface. Changing the position of the wheels for steerage purposes is affected by rods, connecting the steerage wheels at both ends together, so the ploughman can steer from either end, according to the direction in which the plough is travelling.

Levers are fixed and attached by chains to each traction rope, so that the engine while shifting the ploughs at the headland, pulls up at the same time the back steerage wheels, and so prevents their running over the newly-ploughed ground.

A rocking beam or wheel carries the two sets of ploughs, and they are hinged upon a cross shaft in the centre, which shaft is supported at either end by upright screw-eyed bolts. These bolts are fixed by lock nuts, and are set to the depth of the work required. At the hinder part of each plough frame is a land wheel, which is set to the same depth; thus every plough on the frame works an equal depth.

For suspending one set of ploughs in the air while the other set is in work, the hinder end of each plough frame is fastened by a rope and union screw (as shown in the drawing) the other end of the rope is secured by a hook on the upper portion of the central rocking wheel. The centre of this rocking wheel is carried upon brackets, fitted on to the main frame.

Hooks are fixed on the lower portion of the rocking wheel, to which the two traction ropes are fastened, namely, the head rope and tail rope to each engine, the head rope being the one that is pulling the implement along, the tail rope being the one

drawn after the implement, to be ready as a head rope for the return journey.

While the plough is travelling along, the strain on the head rope holds up the front set of ploughs, altogether independent of the hind set in work, and so, as there is no counterbalance, an even depth of work is guaranteed.

In starting the plough at the headland, the first thing moved is the rocking wheel for the distance shown by the slot, and while travelling this distance the front set of ploughs are raised clear of the ground, and the hind set are lowered into their work; then directly the end of the slot comes against the cross shaft, the plough moves forward, and the ploughman steers into the new work of the return journey, and as the plough frames are attached to the same cross-shaft in the centre, and are pulled along by it, we have two opposite forces at work upon the same shaft, and so neutralise each other, and as the line of draft is as nearly as possible upon the same level as the plough frame bars, and this point near the ground, the main frame is relieved of all strain due to the work.

## CHAPTER VIII.

IN 1874, I read a paper at the Cannon Street Hotel, before the foremen engineers, upon "Drainage as to Health, and Sewage and its Value as a Fertiliser," which I annex, under the hope it will be of interest to the general reader, and to engineers especially.

Mr. Chairman and Gentlemen,

I wish to call your attention this evening to the above matters, and to lay before you such facts as I have been able to gather together.

First, then, as to drainage, and the necessity of it for health's sake.

Within the last twenty or twenty-five years London has been wonderfully improved by sewage and increased water supply, and as our chemists and other scientific men discover an effectual mode of separating the several sewage ingredients from the water, so shall we have a valuable manure, a pure river, and less typhoid and other fevers. Hitherto this has been the great difficulty, and up to the present time, I believe, no efficient artificial method has been discovered to purify for drinking and culinary purposes, water which has been once infected by town sewage.

By no means mechanical or chemical can such water be more than partially cleansed, by any present known means. It is always liable to putrify again. Such water that appears to the eye to be clear and pure has been known to breed epidemics amongst the people who drink it. Soils, however, and the roots of growing plants have a great and rapid power of abstracting impurities from sewage waters.

From Mr. Campbell, analytical chemist, of Brompton Hospital, we get the following data, relative to the value of town sewage for agricultural purposes, and his reasons why that value remains so low. He says the reduction of the value of sewage for agricultural purposes consists chiefly in the admixture of the water used for household purposes, and the rainfall with it.

In all towns in Great Britain which are supplied by water companies, the consumption is in round numbers from twelve to fifty gallons daily for each individual. The difference chiefly arising from there being neither water closets nor sewers in some towns. In London the water supply is reckoned at about thirty-two gallons per head daily, the total amount supplied by the Metropolitan Companies being 84 million gallons



daily, besides which about eleven million gallons are obtained from deep wells for brewing and other manufacturing purposes, a considerable amount of which passes into the sewers. Then there is a rainfall, which, on an average, amounts to about twenty-five gallons per head daily with nearly two million nine hundred thousand people, so that the total amount of water disposed of in London amounts to one hundred and sixty-seven millions of gallons daily or sixty thousand nine hundred and fifty-five millions of gallons yearly.

There are fifty-three thousand three hundred and ninety-three tons of excremental substance produced in a year, which, being mixed with two hundred and fifty millions of tons of water, presents a difficulty in separation for rendering it valuable as manure for agricultural purposes, and it is computed that the Thames carries to the sea annually about four thousand six hundred and fifty million tons of water.

Supposing such data to be correct, a good idea can be formed of how the river is in want of purification.

Carrying on our thoughts for the moment to tropical countries, we see there the injury to health resulting from imperfect drainage and decaying animal and vegetable matter.

On the South American coast and the New Guinea coast, as well as in India, the most unhealthy parts, and the abiding places of every kind of fever are along the coast where it is flat, low in level, covered at each tide by water, and left bare at every low tide, with the heat of a tropical sun causing quick evaporation, and the swamp so exposed, being in many cases an accumulation of decaying animal and vegetable matter, that has been added to each year since the world began.

Add to this the little the inhabitants can afford to do in thoroughly organised systems of drainage and water supply, while only partially developed, and I think you will agree with me, it is not to be wondered at that they have such fearful periodical outbreaks of yellow fever, intermittent fever, jaundice, ague, and a whole host of such-like diseases, only to be got rid of by change of place, generally to a more elevated interior district, a voyage to sea, or to another country altogether. Generally such countries are a fearful ordeal for a European to go through, especially at first, while acclimatising.

My experience is, however, the great heat of the tropics does not affect general health, if it be a dry heat such as exists on the higher interior parts; it is in the low swampy coast where the great sickness lies, and this sickness would be far greater were it not for those good scavengers, the vultures, and their value will be more apparent still when you consider that in these countries if death takes place in the morning, decomposition sets in by the evening.

Of course, as emigration increases, railways and good roads to the interior are made, and the interior produce is more cheaply conveyed to the coast, greater riches will accumulate, and when also these coast cities can be made healthy by proper systems of sewage and water supply upon a properly organised plan. There are proofs of the truth of this in London, Paris, St. Petersburg, and many other cities naturally low, swampy and unhealthy. Then, again, if we consider that since more perfect machinery has been erected for pumping out the waste water in our reclaimed low lands in England, ague is almost unknown, where before it was in almost every house.

I will next proceed to call your attention to some useful data that I have collected upon drainage generally, and of the value of earth closets in particular, where no properly organised system of sewage exists. From every house is daily produced a valuable manure, of a solid and liquid character, containing organic matter, which, after a short time begins to putrify and give off gases, which, when brought into contact with the human system, and breathed in the lungs, produce diseases of a deadly kind, predisposing the system to diarrhœa, low fevers, cholera, and typhoid. The matter to be disposed of consists of the animal and vegetable refuse, arising from preparing our food, the excrement and urine voided from us, and the soap and other matter contained in the water used for washing purposes. Now, as speaking in general terms, the whole of this matter has come from the land, and as the presence in the land of similar elements to those which it contains, is essential to the growth of our food, it appears an unwise interference with the laws of nature to send to the sea that which belongs to the land, and by so doing, poisoning the pure water provided for our use.

If left to pollute the atmosphere and water, the germs evolved from the decomposition of organic matter are prolific sources of death and disease, but if once rendered imputrescent and delivered to the soil for absorption and assimilation by plants, they are the very elements by which life is sustained. The old-fashioned privy, especially in the country, was simply a receptacle for generating poisonous gas and producing bad odours. The modern substitute consists of an arrangement by which a certain quantity of dry earth (about one-and-a-half pounds for each time of use), is mixed with the refuse before it has time to decompose.

The Revd. H. Moule has invented a closet, now very generally used, by which a proper supply of earth is deposited in the vault each time the closet is used. Disintegration and some combination between the earth and the organic matter

takes place, and the mixture being both inodorous and innoxious, may remain in the vault till full. In the same vault may be thrown all the cinder ashes, vegetable matter, and other solid house refuse, care being taken that it is covered with dry earth.

The application of earth by Moule's apparatus is merely a matter of convenience. A box and scoop or other contrivance by which a quantity of dry earth can be thrown into a watertight vault is sufficient. The vault must be watertight, so that no dampness from rain or the surrounding earth can enter. A convenient size for the vault is about four feet long, three feet wide, and about three feet deep, paved at the bottom, and the sides lined with a compo. of cement or hydraulic lime. The earth used should be of a loamy or clayey nature, quite dry, and finely sifted; it can be obtained from the garden in dry weather, in the summer, and a store laid up under a covered shed for winter use. The contents of the vault, after lying in the dry for two or three months, may be restored to the garden as manure, or where earth is scarce, may, after drying, be used two or three times over. The earth so disintegrates the paper used, that after a short time it is impossible to distinguish the mixture, either by sight or smell, from ordinary garden soil. The quantity of earth required for an ordinary household of ten persons is about 15 lbs. per day, or about two and a half tons per year. Thus you get rid effectually of a nuisance, and double and treble the produce of your garden. This system is adopted with the most satisfactory results at many schools, workhouses, prisons, and such-like institutions.

In situations where there is a difficulty in getting dry earth and storing it, a modification of the system can be adopted by using ashes in the following manner: so arrange the dust-bin that its contents fall on a sloping shelf, and are delivered into a vault directly under the seat of the privy. The dry ashes from the grates perform to a certain extent the office of the earth by deodorising the excrement and organic matter thrown into the vault, and absorbing the urine, rendering the closet comparatively inodorous and harmless. It is essential that no wet finds its way into the vault, beyond what is due to the use of the closet, and that the contents of the vault be completely screened from the action of the sun and rain. This plan is now successfully in use in many places.

Now to deal with the slops from the bed-rooms and sinks, and the water used in washing and cleansing purposes.

Though there may be little smell arising from the liquid matter at the time it leaves the premises, we all know from the filthy state of sewers and open ditches where it passes, what a deadly odour is emitted as soon as decomposition sets in. The liquid refuse is far more dangerous and insidious in its

effects than solid matter. Many valuable lives have been lost from wells poisoned by the percolation of sewage matter; and deaths have resulted from typhoid and other fevers caused by sewage emanations. In villages or towns where the houses are connected, and are many in number, the only effectual way of dealing with liquid refuse or sewage, is by a properly organised system of sewerage laid down by the sanitary authorities; and as in each case properly qualified advice is to be had, the remarks here made are mostly confined to single houses and individuals.

One thing is quite essential, all communication between the drains on the inside and outside of the house should be stopped or trapped. In all sewers (more especially cess-pools), sulphuretted hydrogen, and other gases are constantly being generated. These gases being expansive, must find vent somewhere, and being lighter than the atmospheric air, travel along the pipes the reverse way to the water, and so find their way into the houses. The ordinary way to prevent this is a trap or curved pipe which has always water in it, higher than the curve in the pipe, this lets water pass forward; but if the pressure of air or gas increases much, some of it will be forced through the water; therefore, as an extra security against the gases entering the house by this means, a ventilating pipe is carried from the highest part of the drain to the roof of the house, taking care to avoid all windows and chimneys.

The common method of drainage for detached houses where no sewers are available is a cesspit dug in the ground, lined with bricks laid without mortar, from which the liquid matter soaks into the ground.

There is no more frequent cause of typhoid fever, than wells thus poisoned by sewage.

It is better both on sanitary and economical grounds that the tanks should be built watertight, lined with cement, and the contents daily pumped up, and used in the garden.

In doing this, as in other systems of irrigation, care must be taken that the sewage does not come in contact with the leaves of plants. A certain portion of the garden should be laid out in trenches, and the sewage made to run in them, the vegetables growing on the ridges.

The size of a tank to hold the sewage of a household of ten persons for a week (allowing one hundred gallons to be used daily for all purposes), would be about six feet diameter, and four feet deep, thus holding 700 gallons, the cost may be reckoned at about four shillings per hundred gallons. But though it may be convenient to make the tank of a size to hold the week's supply, the sewage is better used fresh every day before decomposition sets in. A chain pump is the best for

raising the liquid, because it has no valves to corrode; an ordinary wooden spout or light iron trough will be required to carry the sewage to the trenches.

The amount of vegetables that a garden will produce when constantly supplied with fresh manure is really marvellous. Taking an ordinary household of ten inmates, about seven and a half perches would be sufficient to supply them under this treatment, if under-drained about three feet six inches deep.

The objects sought in purifying sewage by irrigation are: the assimilation of a portion of the ingredients of the sewage by the soil, the absorption of the salts by the growing vegetation, and the oxidising effect obtained by running it over and through the soil.

In surface irrigation all these are more effectually called into play than by any subsoil system, and are greatly assisted by turning or digging the surface soil.

For public institutions where a great number of persons are congregated in a small space, the greatest care is necessary to have the sanitary arrangements as perfect as possible.

No system (in the absence of public sewers) has been found to answer so well as applying the sewage by irrigation: not watering the plants, but by trenches. This plan has been successfully carried out at the Sussex Lunatic Asylum where there are 1,000 inmates, and the daily liquid refuse discharged off the premises is 35,000 gallons. This is used to irrigate eight acres of land on which are grown rye grass and roots.

For twelve years this irrigation has gone on with perfect success, and to the satisfaction of the medical officer of the establishment. With equal success has the same system been carried out at the South Metropolitan District Schools at Sutton where there are 1,600 inmates, and 20,000 gallons of liquid refuse daily, which is laid on three acres of ground that grow rye grass and roots.

At the Devon County Asylum at Exminster, the sewage from 800 persons is spread over some grass fields on which cows are fed.

At Broadmoor Asylum, Colney Hatch, Woking, and other places the same system has been in use many years without any nuisance whatever arising, and with favourable opinions from both medical men and managers of the several institutions.

This system could be extended to villages and towns where the locality and condition of the soil will admit.

There is another practical plan of dealing with the sewage, namely, to collect it in settling tanks, and by filtration or precipitation taking out the grosser matters; and by exposing it to the air by running over weirs, or small walls, and so oxidising and purifying the effluent water as much as possible.

This plan, however, it must be admitted is not perfect, as is sometimes demonstrated at the Tottenham outfall. The idea is still not a bad one, for how beautifully fresh and sweet is water after having passed over cascades or falls, or rippled amongst the boulders on the bed of a running stream; the effect of the movement of such water being to impregnate it with air. And again, this beneficial effect is noticeable in the fresh water distilled from the salt water of the sea, which now is made palatable and refreshing by forcing air into it and keeping the tanks airtight.

The sediment in the sewage tanks is of scarcely any value, as all the salts valuable as manure pass away in solution in the water.

Clay soils when well drained are found to act the best, both as purifiers and as retaining more of the fertilising constituents of the sewage. Italian rye grass from its rapid growth will assimilate the manurial constituents from a larger quantity of sewage than any other crop. Any crop, however, can be grown on any soil by the use of liquid manure. The very poorest soils, even drift sand, will produce crops when so treated; and excellent results have been obtained by the application of sewage to the sands of Aldershot Common, which contain ninety-five per cent. of silica. Average soils when near a town have been known to return £35 to £40 an acre for rye grass, forty tons of mangolds, ten tons of potatoes, £30 worth of cabbages, £70 worth of strawberries, the strawberries being the finest and fetching the highest price at Covent Garden Market.

On the Lodge Farm, Barking, a poor, hungry, gravelly soil, every description of farm and garden produce is now grown, and it yields five-and-a-half quarters per acre of wheat, as against three-and-a-half grown under the former system of farming. A large dairy of cows are fed entirely on sewage-grown grass and roots.

In verification of the data just given upon the advantages of liquid manure irrigation, the following is extracted from the report of Her Majesty's Commissioners appointed to enquire into the pollution of rivers. They remark: "A most important feature of this plan of treating town sewage is that although (wherever irrigation is carefully conducted) a certain amount of unpleasantness is inevitable, yet no injury to health follows the plan. No locality can be named in which typhus fever, enteric fever, dysentery, or any other zymotic disease generally attributed to foul emanations, has been traceable to irrigation with town sewage."

On every ground, therefore, irrigation may be confidently recommended as a safe and trustworthy remedy for the nuisances with which towns have to deal.

It was lately asserted that typhoid fever in Marylebone was attributable to the use of milk from cattle fed on sewage irrigated grass, but it was afterwards discovered that these cows were not fed on such grass at all. It has since been asserted that typhoid fever was always present around the sewage irrigated meadows at Beddington, near Croydon, and at Edinburgh. The report of the Officer of Health for Beddington is, however, that in the surrounding parish of Carshalton and the hamlet of Wallington, not a single case of typhoid fever (that was fatal) occurred in the years 1871 and 1872, two cases only of scarlatina in 1871, one from diphtheria in 1871, and not a single case from either in 1872.

Then the report of the Commissioners to enquire into the matter at Edinburgh is as follows:—

“The Medical Officer of Health to the city, although he looked with prejudice and displeasure on the existence of sewage meadows in its suburbs, had been unable to connect the ill-health of certain localities in Edinburgh with these meadows.”

And Professor Christison, President of the Royal Society of Edinburgh, adds: “Many years ago, my own prejudices were all against these meadows. I have, however, now been compelled to cast them aside. I am satisfied neither typhus, nor enteric fever, nor dysentery, nor cholera is to be encountered in or around them, whether in epidemic or non-epidemic seasons more than in any other agricultural district in the neighbourhood.”

As an additional proof of the earth being a purifier naturally of excrement, we notice cats dig a hole in a garden, deposit the excrement therein, and carefully cover over the same.

And as to the value of the earth as a purifier being known to the ancients, we find in Deuteronomy, (chapter XXIII. v. 13) 1451 years before Christ, the following order given:—

“Thou shalt have a paddle upon thy weapon, and it shall be when thou wilt ease thyself abroad, thou shalt dig therewith, and shalt turn back, and cover that which cometh from thee.”

I beg now to call your attention to some data upon our present subject that has been kindly forwarded by Mr. Mechi, of Tiptree Hall, who, as you all know is an authority in such matters, from having spent many years in their study, and patient investigation both practically and theoretically. He says: “I am much indebted to the sewage system on my farm. For the last six years, my gain upon my farm of 170 acres has been (as landlord and tenant) nearly £700 per annum. Much of this benefit has arisen from steam power, drainage, deep cultivation, and other improvements, but the liquified manure system has greatly contributed to this result.” He further says,

“The Serpentine in Hyde Park would hold one day’s London sewage without rainfall. Two tons of coals with a Cornish engine would be sufficient to empty it.”

One inch depth of water covering the area of an imperial acre weighs 101 tons. Sewage weighs heavier than water according to its saturation. Each individual, it is calculated, contributes in the twenty-four hours one quarter-of-a-pound of solid, and three pounds of liquid excrement. In addition to the human and animal excrement, the rains wash from our granite and other pavements, salts of potash, magnesia, lime, and soda, also sulphuric acid in the form of sulphates—all valuable to vegetation.

The appearance of London sewage water as it issues from the mouths of the sewers into the Thames is very different from what most people imagine, and by no means so repulsive. The great distance it has to flow over a rough surface, the angles it has to turn, and the friction derived from these circumstances, form together the most perfect means of its disintegration, so that on arrival at the mouth or outlet no *visible* trace of its origin is to be detected.

A glass jar taken from the outlet shows a slightly turbid liquid, with a flocculent, slimy, fibrous matter floating in it. It has a putrid smell, but not so bad as might be expected, the chief odour being sulphuretted hydrogen. The chief nuisance of sewage thrown into rivers, is the accumulation of the solid matter that settles on the banks, which in its decomposition gives out noxious exhalations. On the land the soluble manures are conveyed to the soil and subsoil, and become condensed on the surface of each granule of soil ready for the use of the plants.

In grass lands, the excrescences from the growing plants are removed or decomposed by sewage irrigation to the advantage of the growing plants. There is no waiting for a shower.

As a rainfall of one inch is one hundred and one tons per acre, the London sewage would add considerably to the annual supply of moisture.

Everybody can see the effect of a rainfall of even a quarter-of-an-inch on a warm day in the growing season.

In 1864, the length of the city sewers were about forty-eight miles; forty-five of which were large enough for men to enter, and some were sixteen feet in diameter. Those of all London were about 1,500 miles in length as given by Mr. Bagalgette.

In Dr. Letheby’s report on sewage, he says the matters to be dealt with in the public sewers of every town and city are very complex, for they are composed not only of the solid and liquid ejecta of the population, but also of the fluid refuse of every branch of industry. They consist of the filth of kitchens,



laundries, and dye-houses ; the drainage from stables, slaughter-houses, and the public markets, the various liquid impurities of trade and manufactures, and the washings of streets and alleys ; all of which, with the ejecta of the inhabitants, and a large quantity of water, compose the sewage of the towns. Each of these constituents, however, has its influence on the composition of the general mass, and on the putrefaction to which it is liable. Every part of a city, therefore, has its own peculiar quality of sewage, the quality being affected by the density of the population, the habits of the people (as to their diet, cleanliness, and trade pursuits), by the season of the year, and the state of the weather. This makes it difficult to obtain precise information of the nature and composition of sewage. Nevertheless, there are two ways by which a knowledge of the subject may be approached, viz., by the synthetical method of ascertaining the average amount of solid and liquid matter contributed by each inhabitant, and secondly, by the analytical process of examining the sewage at different places, and at different times and seasons. Both of these plans may be open to objection, but they give results which are sufficiently accurate for our present purpose.

The first method of enquiry has been pursued by Mr. Lawes and by Professor Way, and the result of their investigations are, that from two to two-and-a-quarter ounces of dry solid matter are contained in the excrements per day of each member of the population. In the moist state as discharged from the body, they amount to about forty ounces per day. These give a daily total of  $152\frac{1}{2}$  tons of dry matter, or  $2,993\frac{1}{2}$  of moist for the excrement of the whole population of London at the present time (1858 population 2,721,000).

But while on the one hand the ejecta is not entirely discharged into the sewers, so on the other, the numbers take no account of the contributions from trade, or of the washings from streets.

I am not acquainted with any data for the estimation of the first of these, but the second can be obtained approximately from the analytical results of Professor Way. He has found that the rain-water which runs from the streets into the gullies after a heavy shower of rain, contains about  $262\frac{1}{2}$  grains of solid matter per gallon, of which  $113\frac{1}{4}$  are in solution, and  $149\frac{1}{4}$  in suspension.

In the case of the granite roads, where the traffic is very large, the total amount of solid matter is  $813\frac{1}{4}$  grains per gallon, of which  $276\frac{1}{4}$  are dissolved, and 537 suspended ; and in that of the wood pavements, and the same kind of traffic, the amount is thirty-nine grains per gallon, of which thirty-four are dissolved, and five suspended.

It will be manifest from this, that a large quantity of solid matter is carried from the streets into the sewers during heavy rains.

Altogether it may be said that the ejecta of the inhabitants of this metropolis, and the washings of the streets, daily furnish about 233 tons of solid matter to the sewage, and these with the trade refuse are diluted with about eighty-four and three-quarter millions of gallons of water, the calculation being upon the assumption that the water supply is about five cubic feet or 31.15 gallons per head, and the population being 2,721,000 in the year 1858.

The second mode of estimating the composition of sewage is founded on the analytical results of its examination at different times and places.

The sewage that is discharged by day from the city sewers contains about ninety-four grains of solid matter per gallon, of which thirty-eight are suspended and fifty-six dissolved. Of the suspended, seventeen are organic and twenty-one mineral; and of the dissolved, fifteen are organic and forty-one mineral. The night-soil is not so rich in solid elements.

Taking the average of all the results obtained in the examination of the metropolitan sewers, it may be concluded that the sewage which flows into the Thames contains about ninety-and-a-quarter grains of solid matter in the gallon, of which about twenty-nine-and-three-quarters are suspended and sixty-and-a-half dissolved: there being about fifteen grains of organic matter in each of these constituents.

A storm of rain does not diminish the proportion of solid matter, for although it has a tendency to dilute the sewage, yet it washes away so large a quantity of filth from the streets, and disturbs so much of the sediment in the stagnant sewers, that the sewage after a storm generally contains more than the average proportion of solid impurity. Taking eighty-eight grains per gallon as the usual amount in some of the sewers, it will, after a storm, be increased to one hundred and twenty-five grains per gallon, of which sixty-four will be suspended and sixty-one dissolved. So the quantity of filth removed by a heavy rain is enormous.

The mineral constituents of sewer water are chiefly carbonate of lime, and common salt, with small proportions of the alkaline sulphates and phosphates. They are derived from urine and the water supply. The mineral part of the insoluble matter consists almost entirely of the *debris* of the streets, and the grinding or friction from wheels and horse-shoes. These amount to about fifteen grains per gallon, which in the aggregate is as nearly as possible eighty-one tons per day for the whole of the metropolis, or nineteen for the city. By Haywood's

report on gaugings of the city sewers (April 28th, 1857) it appears the total amount of sewage discharged per day in dry weather was 3,255,840 cubic feet; or 20,316,442 gallons; and these contained ninety grains of solid matter per gallon.

Everyone is familiar with the deodorising power of common earth, the graveyards testify to the enormous quantities of organic matter that can be disposed of through its agency, and no one who has witnessed the rapidly deodorising power of clay when sewage or night-soil is distributed upon the land can doubt its efficacy. The Chinese have long taken advantage of this knowledge, for they mix night-soil with about one-third of its weight of fat marl, and knead it into cakes, which are common articles of commerce.

In practice, it is found that a ton of clay will deodorise about three tons of the solid matter of sewage.

Liebeg has said:—"It is true the diligent tillage of the fields, sunshine, and timely rain, are the outward conditions perceptible to all men of good harvests; but these are without effect upon the production, unless certain things, not so easy of perception by the senses, are present in the soil, and these are the elements which serve for nourishment for the production of roots, leaves and seeds, and which are present in the soil, always in very small quantity in proportion to the mass of soil itself."

Under these circumstances a very productive field, in order to remain productive, must have the elements restored, which have been withdrawn in the growth of the crops till the harvest. By the application of guano and bones (to stall or house-made manures) to the land, these elements that were taken out by the growth of the crop are in a great measure restored, and the land is ready to reproduce.

Experiments in Saxony proved that each hundredweight of guano put on the land, produced 150 pounds of wheat, 400 pounds of potatoes, and 280 pounds of clover, more than the same piece of land produced before.

As to the Peruvian and South American guano generally, it is calculated that if used in the same proportion as now, in from twenty to twenty-five years there will not be sufficient to freight a ship. This naturally leads one to consider and thoroughly study the value of sewage, and how far it can be depended upon for the future, or how we are to manage in the time to come, seeing it is indispensable that manures have to be put upon the land, or it will become useless and unproductive.

Liebeg says:—"In order to give town sewage its full value, we should add to it as much superphosphate of lime as is contained in the bones which we do not eat, and which therefore do not

go into our sewers." This mixture he valued at fourpence per ton, whereas sewage phosphates he values at one penny farthing per ton.

Gentlemen, I feel that I have already occupied much of your time, and perhaps exhausted your patience, still the subject of sewage is not by any means worked out, nor are the whole matters relative to it brought before you. Many very able men have written upon the subject, and have given most valuable data to show the difficulties that still present themselves in obtaining a thorough purification of the rivers.

We have to look to our chemists and engineers to solve the problem. Perhaps by chemical agency, perhaps by some mechanical arrangement, or perhaps by a combination of the two.

And if it be true that our stock of guano is seriously diminishing each year, and that the limit of its holding out is from twenty to twenty-five years, the necessity for studying the subject of sewage, with the object of utilising it on the land will be more urgent than it has hitherto been.

With these remarks I beg to conclude, thanking all for your patient attention.

## CHAPTER IX.

**I**N 1875, I exhibited an elastic horse-shoe at the Royal Agricultural Society of England's Show at Taunton, Somersetshire.

I also exhibited it at the Agricultural Show at Preston, in Lancashire, in the same year, and got a silver medal awarded.

At Taunton, His Royal Highness, Prince Christian, was brought by Mr. Jacob Wilson, steward of general arrangements, specially to see it, as one of the chief novelties of the show, and his Royal Highness ordered a sample to be put into his carriage.

All the local papers gave very flattering accounts afterwards, and the following is a general description of it, which I read in December of the same year, at the Cannon Street Hotel, at the monthly meeting of the Foremen Engineers and Draughtsmen's Association:—

The invention consists in rendering the shoe elastic, by the introduction of india-rubber between the two plates of iron that form the shoe, differing from other attempts at elasticity between the hoof and the shoe; the defect of such plans being as I consider that the shoe becomes loose directly the leather or india-rubber is compressed by the weight of the horse, whereas by placing the india-rubber between the two iron plates, and confining it as in a box in one, it cannot spread sideways; thus the elasticity continues as long as elasticity remains in the india-rubber, and thus the concussion is taken off that would remain in ordinary iron shoes while the horses trot on hard roads, thereby making them last longer while at such work.

Another advantage claimed is the facility of roughing horses during frosty weather.

Another advantage is that the nails are not disturbed in the hoof until from its growth a removal is necessary.

Another claim is simplicity and efficiency in the mode of affixing the two plates together, the fastenings being secure, and yet free to work at each step of the horse. The effect of the elasticity in practice is less liability to hard and callous swellings at the joints, freer action of the horse, and a great protection from any tenderness of the feet from any cause.

I next proceed to explain the several parts of the shoe we have before us. Other designs we have, but perhaps it will be taking up too much time to explain fully all their details; and that they differ only for the most part in the modes of attach-

ing the two plates together. You will perceive the part that is nailed to the hoof is made in a channel form to receive the india-rubber and prevent its flattening or spreading sideways by the horse's weight; the channel form likewise gives strength and lightness of weight.

This part of the shoe is nailed to the hoof in the ordinary way, the india-rubber is then placed in the channel, and the lower plate that goes on the ground is fixed in position and riveted at the toe; the shoe is then complete.

The part that is nailed to the hoof is stamped out of wrought iron or Siemen's steel between steel dies; and the lower plate that goes upon the ground is stamped out of steel. We have, as far as we have gone, made shoes from four inches to six-and-a-half inches at the quarter, and of proportionate lengths; and to save trouble in measuring, when new plates are required, each size is numbered throughout. In the part nailed to the hoof we have more than double the quantity of nail holes than are required at each shoeing (namely, fourteen). The uses of this great quantity of holes are that if at one fixing the nails are put in alternate holes, at the next remove they can be put in the intermediate ones in a fresh part of the hoof, and at the next shoeing (namely, the third time) the hoof will have sufficiently grown to leave new horn to nail to; also, if there should be a faulty part in the hoof (chipped or a sandcrack), nails can be fixed in each hole on either side of such faulty part, and so give it the opportunity to grow out. Again, it enables you to have as many or as few nails on both the inside and outside as is thought necessary.

For fixing this part of the shoe, as well as for riveting or changing the lower plates, a set of cheap and useful tools has been contrived, the cost of which is from one shilling to one shilling and sixpence the set, so that in case of a sudden frost the coachman can change the plates in a few minutes.

Next we come to the explanation of the lower plate (this is the plate that goes upon the ground), which bears the whole wear, encloses the india-rubber, and protects it.

Now that steel is cheap, tough, and durable, this plate is made of it, stamped out between steel dies in place of malleable iron case-hardened in the wearing face.

By the samples sent round, you will perceive the elastic action of the heel is obtained by the lugs or clips working in a recess at each heel of the part that is nailed to the hoof, the elastic action at the toe is obtained by a long hole made in the front lug, which works upon the pin, that passes through round holes in the channel plate and through the long hole (as well) in the lower plate: this pin is riveted in front of the channel plate.

Thus we get free action for the lower plate to work at each tread of the horse, and at the same time perfect security against the lower plate coming off when the pin is riveted in front.

It will also be seen that there is no liability of this pin working loose when once riveted, seeing it has nothing to do beyond preventing the lower plate dropping off when the horse's foot is off the ground.

All pressure is taken away directly the weight of the horse comes upon the shoe.

We have several patterns of these lower plates, some with roughs or spikes upon them for use in frosty weather, some with cross roughings for use on wooden pavement or asphalt, some smooth for gritty country roads where there is no fear of slipping, and some with caulking for omnibus, cab, and van horses. Also one great point we make relative to this plate and the mode of fixing it is, that the horse can be roughed in a few minutes by simply cutting off the burr of the rivet in front, driving it back, change the smooth for the rough plate, and rivet it on with a fresh pin, all without disturbing a single nail in the hoof, until it will have grown sufficiently to make a removal necessary.

To make the roughing complete a plan has been designed, and will shortly be carried out, for putting shoes on this plan upon the hind feet.

One more point we consider advantageous is, that although the first cost is more than the ordinary shoe, still as the upper part does not wear, nor the india-rubber, the only part renewable is the lower plate, which is the cheapest part of the whole shoe; and from this being now of steel will last much longer than an iron shoe of the ordinary kind.

Another point for our consideration is, that though the first cost is more than the ordinary shoe, size for size, still as the only wearing part is the lower plate, costing from sixpence to eightpence you get the following comparison. One shilling and sixpence first cost of the elastic shoe as against one shilling the solid wrought iron shoe. At the second shoeing you get sixpence to eightpence for the elastic shoe against one shilling the iron one, showing from fourpence to sixpence saving in the elastic shoe. At the third shoeing you have again the sixpence to eightpence against the one shilling, showing the same saving; add this to the former fourpence to sixpence and the upper part of the shoe and india-rubber is paid for; then at every succeeding shoeing you stand at a saving of from fourpence to sixpence upon each shoe.

Then, again, as to elasticity. Nature gives in the horse's foot cushions or protectors against jars and concussions, sufficient for all places he travels when in a wild state. I, by my

artificial elastic cushion, help the horse when he is at work for man upon hard unyielding roads.

I next proceed to relate a few particulars of the horse's foot, that I have gathered together, and which have guided me in maturing my shoe.

The average duration of shoes upon horses actively engaged upon road work (especially trotting horses) is from three weeks to a month, by which time also the foot will have grown sufficiently to necessitate a removal. To remove shoes more frequently is destructive to the feet from nail holes. Hence, one great value in my plan. From five to six nails are generally sufficient to fix one nag horse shoe, and eight or nine for a cart horse. In my shoe, as you will perceive, there are fourteen holes, out of which number you can have your choice, according to the requirements of the particular horse being shod. Much depends on the accurate fitting of the shoe before nailing, and burning the hoof of the horse is objectionable, the natural thickness of the crust of the hoof has to be studied, as well as proper clenching to secure a tightly-fastened shoe, one that will not come off under any circumstances while in wear.

An ordinary set of nag horse-shoes of the design and size handed round will weigh four pounds, or one pound each shoe, while those of great heavy draught horses will weigh four pounds each of about six-and-a-half inches width at the quarter.

Ordinary care is required in putting on the hind shoes, but far greater skill is required to shoe the fore feet. The horse places the hind feet differently upon the ground to what he does the fore feet; they have not the same weight to carry, nor the same wear as the fore shoes, the hind limbs are the propelling power, while the fore-quarters are the weight carriers, in addition to the part they play in propulsion.

The flatter the feet the more carefully the shoe requires to be fitted, also greater care is necessary in seating the shoe, the web of the shoe also requires to be broader, for the better defence of the sole of the foot.

It appears highly important the rate of the natural growth or reproduction of the hoof should be known. The laminations of the sole of the foot should be pretty well left to fall off of themselves, whereas the bottom of the crust (which forms the seating of the shoe) about half-an-inch in thickness, has to be cut down by the farrier at each time of shoeing, and care has to be taken that this paring is not more than the natural growth of the hoof, which growth varies in different horses.

Rasping the crust or wall of the hoof is condemned on account of the injury done thereby to its natural formation. By observing these rules, horses would seldom become lame.



The frog should not be pared, nor the heels cleaned out, the frog being the natural protector or cushion to the foot generally, and to the navicular joint in particular.

Here, I take it, I follow up nature by adding my artificial india-rubber cushion, which makes the horse still less sensitive to the jar or hammer upon the hard roads, especially while trotting or while upon any of the quicker paces.

It has often occurred to me that nailing the iron shoe to a hoof that has vitality in it, is an objectionable plan, as often by pricking a very valuable horse is injured.

Some day, perhaps, a cement will be discovered that will fasten the iron and horn together by the application of heat, and taking off the shoe by the same heated application.

It is a subject well worth the diligent thought of young, enterprising, clever men, independent of the great gain such a patent would be to him who hits upon the right idea. Free access is to be had at the Patent Office Reading Room, Chancery Lane, and they have there capital standard works upon every known cement.

Having thus far described my shoe and stated what has guided me in the consideration of an elastic shoe, there only remains for me to thank you, Mr. President and gentlemen, for the patient hearing you have given me, and while hoping I have made the subject clear, I have the satisfaction of telling you we have tried the plan practically and as far as we have gone have succeeded.

At the present time (1897) aluminium, from its lightness and toughness, is fast coming to the front as a metal for ships; before long horse-shoes may be made of this metal instead of iron or steel for the same reasons.

## CHAPTER X.

IN 1878 I went to Stourbridge to put a fire clay works in working order on behalf of the owners. I worked very hard at permanent improvements for five years, it then passed into other hands as a going concern.

In 1885 I was an exhibitor of my new nose band for horses at The Inventions Exhibition at South Kensington.

Here follow illustrations and description with testimonials.



This illustration of the horse's head of the nasal bone "Carrago" is fixed, dotted lines.



shows the skeleton and the formation upon which the as shown by the

### THE NEW PATENT "CARRAGO" STEEL NOSE BAND.

The "Carragos" are made of best steel, covered with black or brown leather to match the harness, or they can be painted either colour.

Fix them two inches below where the nasal bone separates from the skull (as shown by dotted lines in the illustration), then buckle up the back strap sufficiently tight to keep all in position when in use.

It is intended to dispense with the bit.

It has been tested with the saddle and in harness along the road as well as upon the various high-couraged horses at horse shows, with most satisfactory results. All horses tried have been strangers to it; they have started off well, and continued under subjection to the will of the rider or driver, the more

readily so when worked with a light hand ; they soon find the comfort of having no bit in their mouth and take kindly to it. Its weight is very little, and it becomes severe only when the horse is necessarily under sharp correction, and so sensitive is the horse to the guiding power that ordinarily a light pull will turn him anywhere, even within his own length.

By its use horses can feed or drink by the wayside without loss of control.

Its tendency is to keep the horse from rearing, but if he attempts this or carries his head high in the air while going, its full power is retained at any angle by using a martingale as with an ordinary snaffle bit.

As we depend entirely upon leverage upon the nasal bone for our power, care should be taken that the "Carrago" is not placed higher than the two inches down the nasal bone as before directed. Equal care is necessary to tighten up the back strap to keep all in position.

To nervous people making a first trial, a double-headed bridle can be used: one to hold the "Carrago," the other to have a ring bit in the mouth, reins to each. Let the reins to the bit be loose and use those on the "Carrago." Confidence may be felt as the bit is there, but soon it will be taken off as superfluous.

To make a similar first trial in harness, pass the "Carrago" over the nose from the front, let the underside of it rest on the bit in the mouth, tighten up the back strap and put a pair of reins to each. Work with the "Carrago" reins, leaving the reins to the bit loose. When the bit is shown not to be wanted, take it off and fasten the "Carrago" to the headstall and tighten up the back strap.

### TESTIMONIALS.

Albert Works, The Green, Darlaston,

*February 23rd, 1884.*

Dear Sir,—We have driven two of our horses with your patent nose band, and both go very quietly and turn any way we require. Although they have been always used to a bit, they started quietly, and went as well as our other horse you drove with it when here.

Yours truly,

JOHN GARRINGTON & SONS,

Cofton Hackett, Rednall, Bromsgrove.

*February 23rd, 1884.*

I have given your nose band a good trial, and there is no mistake about it answering. I tried it on my mare (a thoroughbred) on Tuesday, when she was fresh. I missed my day's

hunting last week, so she had done nothing for ten days beyond the groom's quiet exercise.

I rode into Birmingham (eight miles) without any bit in her mouth, though the groom was most anxious I should have a double bridle and bit. I cantered and galloped on the turf at the roadside, rode up and down New Street, High Street and all the busiest parts of the town, and I am quite satisfied it is all right and safe for the rider, and there can be no doubt about its being a great advantage and comfort to the horse.

I am, yours sincerely,

W. G. ASHFORD.

Grenville, Droxford, Bishops Waltham.

*March 16th, 1884.*

Send me another nose band by parcel post. I tried one with success this morning on "King Stephen." If I find it answers with others, shall want several more.

Yours faithfully,

A. GORDON SCHNEIDER.

P.S.—I am just going to try it on "The Widgeon."

Riverside Brewery, Barnes.

*March 17th, 1884.*

I have delayed writing till now in order to thoroughly test the efficacy of your nose band. I have tried it on three different horses, one a puller, another a light-mouthed horse, and the third one with a nasty habit of throwing his head about, and it has answered satisfactorily in each instance.

Yours truly,

G. GOUCH TODD.

P.S.—I shall certainly recommend it to my friends.

Earley, Reading.

*March 19th, 1884.*

The nose band I had from the Sportsman's Exhibition is really a wonderful thing, and I can drive my trapper, who is one of the hardest pullers in England, with finger and thumb. I have lent the nose band to a gentleman who has a notorious hard puller, so please send me another, as I feel sure it will not be returned. Also send one to my friend, Mr. John White, Taunton, Somerset, who is a large hunting dealer and job master, having generally about one hundred horses by him.

Yours very truly,

GEORGE REEVES.

30, Christ Church Road, Streatham.

*March 26th, 1884.*

I received the nose band on Monday night. I tried it on one of our horses that pulls a good deal and I find that I can hold her quite as well as I could with a double bit. I am very well satisfied in every way.

Yours truly,

ARCHIBALD H. BROWN.

Grenville Hall, Droxford, Bishops Waltham, Hants.

*March 28th, 1884.*

I enclose the nose band Captain Schneider had from you, so that you can pad it with india-rubber like the one you have sent me.

I have been riding all the morning with the one already done and find it answers much better.

Your nose band answers admirably with such horses as we have tried. It will do for hunting.

"King Stephen" that I have been riding this morning is a bad-tempered brute and rears with a bit. He is, however, under perfect control with your nose band, and does not offer to rear.

I will give the invention a good and thorough trial, and if "King Stephen" runs at Croydon he shall wear it.

I remain, yours faithfully,

WM. HIGGENS.

Late 90th Light Infantry (Scottish Rifles).

The Brewery, Ivinghoe, Bucks.

*April 1st, 1884.*

The nose band I bought of you at the Agricultural Hall answers well. A four-year-old thorough-bred I am riding goes better in it than with a bit. This is also the opinion of my man.

The way the horse answers the rein is really most remarkable, and has made not a few people stare.

Yours faithfully,

H. M. ROBERTS.

Stafford Lodge, Southend, Bedford.

*April 12th, 1884.*

The nose band gives every satisfaction, we have been driving an entire pony in it for a month and we prefer it to the bit.

Yours faithfully,

F. GILBERT BOWICK.

20, North Bank, Regents Park, N.W.

*June 11th, 1884.*

You may perhaps remember we had some conversation regarding your nose band at the Horse Show at the Agricultural Hall, Islington, on Friday last.

This morning I tried it for a short distance on five different horses; it answered capitally. I then tried it on a spirited horse for five miles along with a bit. It answered so well, I removed the bit, and tried it alone for another five miles. The result was a perfect success, both as to guiding and stopping.

I am, sir, yours truly,

W. A. CARTER, Major-General.

Portswood, near Southampton,

*July 10th, 1884.*

I have sold several of your nose bands already, and they answer very well. I am using them for two of my own horses, and I find they go better than with bits. I drove these horses twenty miles the first day I tried them. I took the bits out of their mouths before I started, and no horses could go better.

I remain, yours faithfully,

CHARLES KYTE.

From Professor Axe, of the Royal Veterinary College,  
Camden Town, N.W.,

*2nd October, 1884.*

Dear Sir,—With reference to the nose band you forwarded me a few days ago, I beg to inform you that I have tested it. The horse on which I tried it appeared to be well under control by the employment of a very moderate amount of force.

I am, yours faithfully,

J. WORTLY AXE.

The Hall Curragh Camp, Ireland,

*January 27th, 1885.*

Dear Sir,—Col. Vivian has just been telling me of the wonderful effect of your nose band. Please send me one here as I like trying everything of the sort.

Yours faithfully,

GARRETT MOORE.

People who have been accustomed all their lives to a bit in a horse's mouth as the only means of control, seem afraid to trust to no bit at all. This is a powerful prejudice to overcome, and yet by studying the formation of a horse's skull, the separated nasal bone seems made on purpose for the nose band,

which of course has the greater leverage or power the lower it is fixed below the point of separation of the skull and nasal bone. We have fixed the point at two inches below the point of separation, having found there is leverage enough to control at that distance.

To indulge this prejudice in favour of a bit, a thought has occurred to me which I have practically tried, and it is this: The root of a horse's tongue is especially sensitive, having numerous blood veins on the underside, so I have made a bit with a double port, and have bent this port *backwards*, and thus bring the *first* pressure upon the tongue root, and only a *secondary* pressure upon the sides of the mouth.

It is well known that if your horse runs away, it is not long before the sides of its mouth become callous from hard pulling at the curb bit, and your pulling is powerless to stop him. Now by the plan here suggested you pull first upon the sensitive tongue root and press the blood veins underneath, and then as quite a secondary matter you pull against the sides of the mouth, and so prevent its getting dead or callous to feeling. Then the *double* port is to make it impossible for the horse to work the tongue over the upper port. Care also must be taken that the bit is not too low in the mouth, as I have known the horse do this from this cause, and your power to control is gone at once. Another consideration is, the bit must not turn in the mouth under any circumstances, we have provided against this in our plan. And we have stopped some desperate pullers; and have worked them without pulling after they have had their first fight, and given in. The feeling that the bit is there is enough for them ever after. They never try against you a second time.

## CHAPTER XI.

### NORWAY.

IN July, 1890, I went my last journey abroad, which was to Norway. Starting by that well-managed line of steamers from Hull—the Wilson Line.

We called at Christiansand on the way; unloaded some cargo there, then on to Christiania, which we reached in forty-two hours from Hull.

My usual luck happened on the passage out, sea-sickness, of course.

I had an address to go to in Christiania, but had not Norse enough to ask the way.

The Customs House officer on board, however, supplied the deficiency, he knew enough English to understand me, and he directed the cabman to drive me. Away we went, and arrived all right at the address; there fresh difficulties occurred. The next problem was to ask the cabman what was to pay; I could not say so much, so got out of the cab, left my luggage behind, and walked up to the front door, but was much disappointed to find a German name on the ground floor front door; here was a fix! While in this dilemma, I happened to look up and around, and saw the name I wanted on a brass plate leading to the first floor. This was the first idea I had that in Norway the different families live in flats like in Edinburgh. I rang the bell, a Norwegian servant answered; not being able to say anything to her, I rushed past her upstairs, looking, as I am sure she thought me to be, an escaped lunatic. Upstairs I found my son's wife, who is a Norwegian but speaks English very well; we returned, paid the cabman, had my luggage brought up, and I made myself comfortable and at home, clothed and in my right mind: my son returned from a yachting excursion that night.

In the evening, we went to Tivoli Gardens, where there was a great diversity of entertainment and amusements, such as comic songs sung on an impromptu stage in the grounds, the audience sitting in the open air, around small marble-topped tables, where we had refreshments, listened to music and songs, also saw a Japanese company go through wonderful performances upon horizontal and vertical poles; others performed on the trapeze at a great and dangerous-looking height, eventually falling into a net spread out below—all sensational and dangerous. There was a theatre also, where plays were being performed, this was all Greek to me, many times the



audience laughed heartily at points and witty puns, which, of course, were lost upon me altogether.

My host knew English and Norse equally well, his wife, too, knew English quite well, enough for me to hold long conversations, and from her natural intelligence, agreeable manner, and perfect knowledge of Christiania, her company became equally enjoyable with her husband.

After having been in Christiania some time, and beginning to know my way about pretty well, I went out a good deal alone, about the streets, and through the grounds of King Oscar's Palace; the grounds were at all times open to the public; there were several ornamental lakes, with different kinds of water-fowl about, and fountains playing, also seats placed at the sides of the several footpaths to rest upon, making it altogether a most enjoyable spot.

The Palace has finely proportioned rooms, but the erection, architecturally considered, is a plain building; commandingly situated however in a direct line with the chief street of the City—Carl Johan's Gade.

I arrived the day after King Oscar and the Emperor of Germany had been in procession through Christiania. One grand triumphal arch was erected across Carl Johan's Gade, flags were flying, Venetian masts on each footpath, festooned together by pretty decorations, looking altogether gay and holiday-like; a platform was erected for King and Emperor to appear and address the people; all were good tempered, gave the Emperor a hearty welcome, and it was altogether a regular gala day.

The King and Emperor afterwards publicly opened a new road five miles in length, of one continual ascent of about one in twenty or twenty-five to an hotel called Holmenkollen.

The road passes through a very interesting country, romantic in nature, and through large forests of the fir-trees of commerce.

The word "forest" is used because all the fir-trees grown in Norway are self-sown not planted. There are many notable things by the way. One is a bridge *under* which you go; the road goes skirting the hill side, winding and ascending out of sight of the bridge altogether, when presently you come back again to this bridge, but this time *over* it.

At another part of the road the solid granite rock is cut away on the high side, and a retaining wall built on the low side, to get the necessary width of cross section for the road. So steep is the descent of the hill-side to the river below, that it is not advisable for a nervous person to look down from the roadside to the river below rattling along among the boulders at perhaps 100 feet below. Many of the fir-trees grow-

ing on this slope, perhaps thirty or forty feet high, just show their tops level with the road and not far off either.

The only guard against going over the edge are stones placed at regular distances apart.

On the rock face that has been cut away to form part of the road, are cut into the solid stone the names of King and Emperor, gold leafed in each cut, with the date when they opened the road to the public.

At the end of this road is the Hotel where King and Emperor took refreshments, and examined the paintings or frescos on the walls of dining and other rooms; they then went outside on the upper balcony, and saw the general view of Christiania and the several fjords; some surround islands (covered for the most part with fir-trees), some ending in a *cul de sac*; but the main one broadest and deepest leads out to sea.

The water is so clear in the fjords that objects of an inch or two in diameter can be seen at a depth of 150 feet.

Some idea can be formed of the view from the Hotel, considering you are about 1,000 feet high. Afterwards I and my friends went to the Hotel in a carriage and pair of horses (a most comfortable way of going). We had a first-rate dinner and spent much of the day there. We also went further up the hill to a museum of curiosities which was most interesting; then there are the magnificent lakes, waterfalls and other natural wonders of Norway too numerous to describe: they must be seen to be fully understood; description is necessarily tame by comparison with the grand reality.

Another day we went to the waterworks reservoir, where there is a charming view of Christiania and the fjords; the grounds are well laid out, and just now (July) the flowers are splendidly in blossom.

At a lower level, still in this quarter of the city, is a very nicely kept public garden, with ornamental walks, water, and water-fowl. In fact, the neighbourhood around Christiania and within easy distance by steamboat abounds in public gardens, where concerts are for the most part held and refreshments obtained.

One especially pretty place is Oscarshall, open to the public, approached by steamboat and road, and is the property of King Oscar.

In the building much is to be seen and admired, and in one room is the barrow and shovel that the first sod was turned with, at the commencement of the first railway out of Christiania.

The Viking ship that went to Chicago was modelled from the Viking ship found near Sandefjord, hereafter described, The *Fram*, recently in the Arctic Sea, commanded by Dr.

Nansen, who was in Christiania at the time I was there superintending the building of her. Capt. Nansen is just the man for such an arduous undertaking as he has been engaged in. He is a little over thirty years of age, a fine, tall, athletic-looking man, with a look of determination and energy, able to bear any amount of fatigue and endurance; with not an ounce of superfluous fat upon his whole body.

Dr. Nansen having again appeared amongst us, and given a most interesting account of his adventures in the *Daily Chronicle* of November 2nd, 3rd, and 4th, 1896.

The following extract will prove interesting here.

“A sea-way between the North of Behring’s Straits and the Coast of Greenland, with a current constantly running across the polar region to the North of Siberia and Behring’s Straits, and into the sea between Spitzbergen and Greenland. The *Fram* is the first ship that has passed the polar circle. She was built by a Norwegian Government grant. The *Fram* started on the 24th June, 1893. On the 21st July she stood out to sea from Vardö, the last Norwegian port. On the 3rd of August she bid farewell to mankind; on the 6th of August, stopped by ice; on the 20th of August, landed on one of Kjellman’s islands, shot two bears and some reindeer; September 20th, in  $77^{\circ} 44'$  North latitude; September 22nd, made fast to an iceberg in  $78^{\circ} 50'$  N., and  $133^{\circ} 39'$  E. longitude; September 29th, in  $79^{\circ}$  N. Electric light worked by windmill on board. Near the Siberian Coast at  $79^{\circ}$  N., depth of water 1,600 fathoms (9,600 feet); June 18th,  $81^{\circ} 52'$  N.; October 21st,  $82^{\circ}$  N., and  $114^{\circ} 9'$  E. longitude; Christmas Day, 1894,  $83^{\circ} 24'$  N.; the most northerly ever reached. Ice here thirty feet thick: March 14th, Nansen and Johannsen left the *Fram*, leaving Sverdrup in charge. They took provisions for themselves and dogs, namely: for themselves for one hundred days, for dogs for one month; they took three sledges, two kayaks, and twenty-eight dogs, latitude  $84^{\circ} 14'$  N.

“On the 22nd March, they reached  $85^{\circ} 10'$  N.; on the 25th of March,  $85^{\circ} 19'$  N.; 29th March,  $85^{\circ} 30'$  N.; April 1st, barometer  $36^{\circ}$  below zero; April 3rd,  $85^{\circ} 59'$  N.; April 4th,  $86^{\circ} 3'$  N.; April 7th,  $86^{\circ} 14'$  N.  $95^{\circ}$  East longitude; they could get no higher. This makes 240 geographical miles, or 276 statute miles from the North Pole. In returning, they crossed fox tracks at  $85^{\circ}$  N. They travelled towards the North Pole after leaving the *Fram* about 110 miles, and were afterwards found by Capt. Jackson, and sent home to Norway by the *Windward*. The *Fram* reached Norway soon after.”

The following is extracted from Dr. Nansen’s narrative:—

“As early as October the ice pressure began to be tremendous, and continued through the autumn and winter.

"We discovered it was principally due to the tidal current, and that the ice periodically parted and packed together again, twice in the twenty-four hours.

"The pressure was, therefore, the greatest at the spring tides, when it would often lift the vessel several feet, only to let it drop again into its former position as soon as the ice again opened. In the case of any other vessel this pressure would have been fatal; but the *Fram* surpassed our boldest expectations, and was superior to all pressure.

"The ice packed itself up and crashed against her sides with a noise like the crack of doom; but in vain. The noise rose to such a pitch, that we could not hear each other speak as we sat in the cabin.

"During many weeks the quicksilver was frozen. The lowest temperature was 63° below zero.

"On January 4th and 5th, 1895, the *Fram* was subjected to the greatest pressure we experienced during the whole voyage. The ice piled up above the gunwale, threatening if not to crush, at least to bury her. All thought she must be lost, and made ready to leave her; when she suddenly broke loose, and slowly lifted out of her icy berth, and out of danger. Not a timber gave way, nor a plank started.

"The *Fram* being now fixed in drift ice, our course was erratic, according to the wind, and in June 18th we reached in this way 81° 52" N. latitude. We then drifted in a more southerly direction: we then drifted in a more northerly direction, until we reached 83° 24" the most northerly latitude any ship had ever reached. In January, 1895, the *Fram* seemed to travel or drift in a south-westerly direction, so Dr. Nansen and his companion, Lieut. Johannsen determined to leave the ship and travel by sledges, kayaks, and dogs across the ice northwards.

"So two kayaks were made, twelve feet in length, besides three sledges; the kayaks each would carry a man with provisions for four months as well as a team of dogs. The framework of these was of bamboo, covered with canvas to be watertight. When complete each weighed 40 lbs.

"One day we had an adventure: we were just about to cross a channel in the ice in our kayaks. This was generally done by tying the two together, and placing the dogs on the deck. I had just placed my kayak to the edge of the floe when Johannsen drew his alongside. All at once I heard a noise behind me, and turning, saw Johannsen on his back with a bear over him, he holding the bear by the throat. I caught at my gun, when Johannsen quietly remarked, 'You must hurry up if you don't want to be too late.' I shot the bear behind the ear, and he fell dead between us. And so we had a good supply of fresh bear meat.

“The provisions were dried meat, dried fish, steam-cooked oatmeal, biscuits, and butter. We had then reached  $84^{\circ} 4' N.$ , and had twenty-eight dogs.

“From the perspiration of our bodies, and the temperature outside, our woollen clothing became covered with a thick layer of ice, which took fully an hour to thaw every night in our sleeping bag. In the morning upon going out in the open our clothing was covered with ice again. In this way  $86^{\circ} 3' N.$  was reached when there was no possible road further north. We then commenced the return journey southward as already described.”

Upon leaving the *Fram*, Dr. Nansen left Sverdrup in full charge, with instructions how to meet emergencies on his passage back to Norway.

Both Dr. Nansen and his companion describe their feelings upon having their first warm bath when with Jackson, and the comfort felt in a clean change of clothing, to be shaved, have their hair cut, and to sit down to a comfortable dinner with cigars and port wine. “All (from Jackson downwards) were most considerate and kind, their aim seeming to be to soften our recollection of last winter’s loneliness, hardship, and dreariness.”

After passing about six weeks in Jackson’s comfortable quarter, his ship—the *Windward*—arrived with fresh stores. These were unshipped, and on August 7th, Nansen and Johannsen started on their way back to Norway with Captain Brown, an old whaler in charge, and on August 13th reached Vardö, where the *Fram* left on her voyage towards the North Pole.

On the 20th of August Captain Sverdrup arrived safely with the *Fram* at Tromsö, by way of Spitzbergen, on the west side, both Vardö and Tromsö being on the north coast of Norway.

Neither Nansen nor Johannsen had a day’s illness while on their adventurous sledge journey.

And with trifling exceptions all were well on board the *Fram* during the whole voyage.

Dr. Nansen and Lieut. Johannsen having reached  $86^{\circ} 3' N.$  (the highest latitude ever reached) found their difficulties increasing, and so climbed one of the highest hummocks of ice that lie jumbled up together, stopping all road for sledges or men.

Dr. Nansen brought his telescope to bear looking northward, and, as far as he could see, all was one mass of pointed icebergs. So he returned (in his wisdom) southward, where seals, bears, walruses, and other food was to be found.

Such a mass of immense hummocks of many tons weight each, all jumbled up together, showed that fearful storms raged in these parts. Animals could not live there; there was nothing to eat beyond the provisions they brought with them, and many of the sledge dogs had already died.

Both Nansen and Johannsen suffered many hardships in their southward journey till rescued by Captain Jackson. They spent one winter in a hut they built on the ice, ten feet long, six feet broad, and just high enough to stand upright at the ridge. They found a piece of drift timber that became the ridge pole, the side walls were of stone, earth and moss. Walrus hides and blubber formed the means of heat for cooking, and warm clothing; the flesh they ate. And in the same way bears they shot helped them with food and clothing. Their bed was bear-skins: for warmth, both slept in one sleeping bag of bear-skin. During the time they lived in the hut they neither had the chance to wash nor change their clothes; they became so saturated with coat upon coat of seal and walrus blubber that when they reached Jackson their clothes stood upright when changed.

On July 11th, 1897, Herr Andree, a Swedish engineer, accompanied by two comrades (Messrs. Strindberg and Frankel), left Virgo Haven, Danes Island, Spitzbergen, with four months' provisions in his monster balloon, with the idea of reaching the north pole—620 geographical miles. He was a man of considerable experience in Arctic America and Spitzbergen before he had set out on his adventurous balloon journey.

Every article was marked "Andree's Polar Expedition." A large collection of scientific instruments were taken, with plenty of tinned provisions. But the fearful storms to be encountered so far north with such an unwieldy machine as a balloon nearly 100 feet high to manage, makes one fear they have come to an untimely end.

One Dr. Eckholm was invited to join the party, but he declined, his opinion being that the balloon was too leaky for such a protracted journey, and to keep clear of the ice mountains it might be necessary to throw all provisions overboard, as well as everything in the shape of ballast. Starvation would then stare them in the face, with no chance of a renewed store of gas.

To give an idea of the force of storms in high latitudes, Pearson's September number of 1898, tells us what happens at times at the Observatory at Ben Nevis, the highest Observatory in the British Isles.

Nine months' provisions for three persons have to be stocked, namely—two observers and one cook.

Only two months in the year can the bridle-path be traced (June and July) when soups, meats, fish, milk, fruit and even vegetables in tins are, with potatoes and flour, the food supply.

For drink, they have rain water in summer, and melted snow in winter.

Observations are taken night and day at every hour, where it is not uncommon to find the wind blowing one hundred miles an hour, accompanied by thunder-storms thus described :

“The storm-cloud was seen approaching with lightning darting from it, with a crackling report from all metallic objects about the Observatory—stone pipes, kettles, etc. After wrecking the telegraph instrument, it set fire to a part of the Observatory, and knocked down the observer.”

Nansen also tells of the severity of the storms at times while he was in his hut on the ice at  $81^{\circ} 13''$  N.

If such severity is shewn at Ben Nevis, what may be expected in the region of the North Pole, where immense mountains of ice are knocked about in all confusion, the wind going at one hundred miles an hour and playing upon a balloon one hundred feet high without anchorage or shelter or guidance of any kind.

When the Tay Bridge was blown down, it was found that the wind was blowing against it at one hundred miles an hour, and when the train came along it acted as a blind or screen, and the wind-force pushed the girders off the piers, and sent one end into the river below, the train followed and drowned all passengers.

The chances are that Dr. Eckholm was right, the difficulty was to keep clear of the hummocks of ice, and that either they were knocked about and killed, or starved from having had to throw away their food to lighten the balloon. Perhaps the better plan would have been to have passed to a much greater height than they did; that is supposing they could breathe at such height. Green, the balloonist, once went five miles high and felt this difficulty. Then, Nansen tells how he went backwards and forwards, making little headway when drifting in the solid ice for weeks.

Coming back to Christiania. The Museum is a most interesting collection.

The Viking ship found near Sandefjord is historically most interesting, and it was discovered in 1880.

Equally so is another ship of the Viking period, which was discovered in 1867, in the parish of Tune, between the Christiania fjord, and the Swedish frontier hard by the Glommen.

The following is an interesting extract on the subject:—

“From passages in ancient manuscripts the custom of burying men of note with one of their war ships, has long been known to prevail among the Northmen throughout the later centuries of paganism in Scandinavia (9th, 10th, and 11th centuries after Christ). Nor can such interments appear surprising when practised by a pagan people, such as the Scandinavians of that epoch, for whom a seafaring life had great attraction.

"This mode of burial has proved of singular importance to modern archæological research, since on excavating some of the grave mounds, ships from that remote period have been brought to light in a more or less state of preservation. We are enabled thus to form a more precise idea of the naval architecture of the time, and the adventurous life of its Viking voyagers. Their boats varied from forty to sixty feet keel. In most cases where the vessel had been hauled ashore, she was placed on an even keel, and the remains of the dead deposited along with such articles as (according to the usage of the time), were to accompany the departed for his use in the other world; after which a mound of earth was thrown over the grave. Those that were buried in blue clay have been found in the best state of preservation. The ships were built entirely of oak, clinker built, the seams caulked with oakum made of cow's hair worked into three-stranded cord. The Sandefjord ship measures sixty-six feet keel, sixteen feet nine inches amidships, and the depth at the same point from top of bulwark to bottom of keel four feet.

"This ship (as indeed the largest of the Viking period), had both oars and sail with one mast only. The oars of this ship were about nineteen feet long, and had sixteen of a side, making thirty-two men at work at one time. The crew in all were about forty men. There was no deck, loose boards only. To provide some sort of protection, a tent cloth was stretched above the after part of the vessel.

"The rudder is hung by a rope a little forward of the stern post, on the right hand side.

"She is supposed to have been built from eight hundred to one thousand years after Christ.

"There is every reason to believe that similar vessels in size and construction have crossed the North Sea to ravage the British Islands and the adjacent coasts of France."

The paintings and sculpture in the National Gallery are of a very high order.

The splendid stone mansions newly built were all formerly of wood.

The well-kept, clean wide streets everywhere.

And that street of all streets, straight, wide, and noble, reaching from the King's Palace to the water side (Carl Johan's Gade).

A word, too, ought to be said of the grand shops in this street, and the large plate-glass windows, noble entrances and lofty apartments or show-rooms.

Also the fine avenues of trees on one side of the street, reminding one of the alamedas of Spain in every town of note, purposely for the people to parade or lounge under their shade



as well as enjoy the luxury of taking your coffee under the same shade.

Imagine the joy of a first-class dinner at an adjoining restaurant, and afterwards sipping your coffee or cognac, and smoking, watching the passing people as you lounge at your ease in the cool shade.

Tramways pass along this street branching off to many parts; the principal railway terminus is near the landing wharf; fruit and fish markets; and cabs to take you anywhere.

Altogether, from what could be seen of Christiania and its neighbourhood in two months in the summer; it is my opinion no intelligent Englishman, European or American should miss the sight.

I soon got to know Christiania pretty well and used to go about a good deal alone; and got on capitally so long as no one spoke to me; as soon as they did I had to do something eccentric.

One day while resting on a seat at Carl Johan's Gade, a boy asked me what was o'clock: at least I guessed so because he said "clocken."

Although I knew what he wanted, and there was a public clock opposite, I had not words to tell him. He asked me again, no doubt thinking I was deaf, so there was nothing for it but to get up and walk away; the boy looking on with perfect wonder.

Again strolling along another day I came to the barracks, and went marching on unconcernedly, when the sentry said something which I did not understand. He asked it again with no better effect; last of all he put his gun across my chest, saying something more. Feeling the time had come when something must be done, although for the moment I could not tell what, I just turned round and walked back again, the soldier no doubt thinking me some extraordinary curiosity. I know I felt so; but what else was to be done in a strange land, and with no knowledge of the language.

As a contrast to this, I one day met a most enthusiastic Norwegian elk hunter who spoke English, and his description of it so interested me that it seems worthy of a place in these Reminiscences.

On the 15th of September elk-hunting begins.

He had his holiday of a month from business in the summer. He would start to the forests, taking dog, sleeping bag, knapsack, and as little impedimenta as possible besides. The dog is a small one, about the size of a terrier, he has good scent, and so traces the elk.

The sleeping bag is of mackintosh manufacture, lined with hair inside. When used for the night it is stepped into with

both feet, and drawn up outside the body, and fastened by a drawn string like a bag, over the head, and the arms inside, leaving just sufficient opening at the top for air. With this covering around you, you sleep on the ground anywhere, let there be snow or not.

The knapsack and all else has to be carried along, because you never know where you may be at night; the gun and knife must always be kept dry and bright.



NORWEGIAN ELK-HOUND.

Now for the start: you put the dog on to his work; presently he comes across the scent, and off he goes, you following at as quick a pace as you can. You lose sight of the dog, but listen attentively; presently you hear him bark, and make for the direction. The elk is at bay, the dog giving tongue. You now begin to stalk him, guided by the barking, and keeping so that the wind does not blow

from you to him, or he will scent you and be off again.

After great labour, much climbing, patience and careful stalking, you get within shot, take steady aim, and hit him; then out with the knife and finish the business. Now you have a prize. If a male, and of full size, his weight will be two hundred pounds. You carefully cut off the head for stuffing (when prepared and mounted, the value of these heads in Christiania varies from £3 to as high as £20, according to quality). You then skin him, and cut him up into joints, and the value of your prize in a general way will be from £7 to £10.

You now cast round for help to carry all away. This done you go to work for another elk, and thus spend your holiday with that thorough enjoyment that an enthusiastic sporting man can do.

Higher up in the mountains the reindeer is hunted in a like manner. Their stuffed heads are valued at from £2 to £14.

Following the description of elk-hunting comes an interesting account of reindeer hunting in Norway, given by two English gentlemen who have enjoyed the sport there: hence its value from being the result of their own practical experience.

The journey to the hunting ground was by rail for some distance from Christiania, thence by carriole for about seventy miles; then on foot to an elevation of something like six thousand feet above sea level, which is the land of the wild reindeer, they are seldom if ever found below the snow level.

The headquarters were an old wooden hut. The first start

was made with a dog led by chain and collar, whose chief duty was to follow up the trail of any wounded stag; also rifles (a good express being the most suitable), telescopes, compass, good knives, and as little personal luggage as possible. Watching acutely for reindeer slots or tracks; some are presently seen, and you judge from their freshness how long since the deer passed along; following the slot with great care and quiet, always on the alert, and keeping (as far as one can judge) so that the wind is from the game to you.

By the use of the telescope the herd is presently sighted. The great aim now is to get within shot, careful alike not to tread on any loose stone to set it rolling, or to make the least noise whatever; for you have a most wary animal to deal with, equally sensitive to sight, hearing and scent; off in a moment at the least sign of an enemy. The larger stags at this time of the year (autumn) are generally to be found separate from the main herd and in threes.

You have to guard against one, always on the look-out down-wind, and never feeding; another feeding up-wind occasionally, but well on the look-out between whiles; while the third feeds in security or lies down to rest; these positions they each take in turns.

Thus does the difficulty of successful stalking become apparent, and in this the chief charm and excitement of the sport lies.

For hours you have sometimes to hide up, as still as death; on the alert for the least change of the wind that would affect your position, and form the necessity for a sudden change of place. All this in a country rough and rocky, to say nothing of precipices, glaciers, and thick fogs that rise in a moment and prevent your seeing a yard before you.

Across such ground, the reindeer can with facility and without hesitation pass at a gallop without accident, such is their accuracy of eye in the leaps they take from rock to rock.

Well suppose these difficulties overcome, and you get a shot and are successful, bringing down your stag. Then your knife goes to work first to stab if there be still any life left; then commence to skin (taking special care of the head and horns), cut up the meat into joints, and carry it away, or bury it for the night if far away from headquarters, taking observations, so as to know the spot again. A very useful small compass can be bought for this purpose, and carried on the watch chain.

There is to a beginner a difficulty in judging distance.

On account of the clearness of the atmosphere you are apt to think the stag at least fifty yards nearer than he really is. Another difficulty to a beginner is the excitement of a first shot,

playing havoc with nerves, and giving what is called "stag fever."

In cutting up your meat, you must remember you have nothing but a knife and a stone to hit the knife with; no hatchets or saws for the purpose while out reindeer stalking.

Now a word or two as to the animal itself. The male has horns with branches to indicate age. The horns are covered with a velvety substance at a certain time of the year, and the horns are shed each year.

There is a horn pointing forward between the antlers, which is used to plough up snow to get at their food. The nose is like, and about the size of a six-months-old calf. The head is graceful in shape and the body equally so. A white moss in winter (known as reindeer moss) and a mountain flower in summer form their food; no other herbage is to be seen at the altitude in which the reindeer lives and flourishes and gets fat. Cut a steak off the haunch after a long, heavy day's stalking, and you'll say you never eat anything better nor with a better relish, that is if you are anything of a cook at all, and have health to enjoy the pure mountain air.

Bears are to be found wild also, and wolves trouble the Laplanders a good deal in slaughtering their tame reindeer.

The horses in Norway are for the most part a light, active, intelligent horse of about fourteen hands high and valued at about twenty pounds, they are very sure-footed amongst the mountains, as much so as a mule. A very common colour is a cream colour, with sometimes black mane and tail.

In harness they have only short traces from the collar to the back band; the shafts become the other part of the traces, they being well secured at the back band.

In Christiania the law is if you leave your horse unattended, he must be fastened by a light chain around one fore leg, the other end of the chain is secured to the shaft.

It seems quite the custom for ladies to go marketing, buying fruit, fish or meat, according to the requirements of the family; the tradesmen are obliging and send the goods home.

The cod fish best liked, is one, two or three pounds weight; those weighing ten to twelve pounds are thought common, and can be bought for about one shilling the whole fish.

Salmon was not less than one shilling per pound, but so splendidly fresh.

Another peculiarity is the small size chickens are killed; the size they think most choice we should not think fit to kill.

There seem to be more cows than sheep about. The barns in which they live in winter are very long, wide and high, large enough to hold fifty cows. The cows are at ground height, the floor above holds the hay that is carted in summer, up a raised

approach outside, reaching to the floor level, the waggons are small, generally drawn by one horse, the hay is stacked to the roof inside on this floor, the roof covers the hay and keeps it dry.

In summer, after cutting the hay, it is hung on to long lengths of wire or horizontal poles fixed to vertical poles in the ground; and in this way dries by the wind passing through it till it is ready to cart into the barn for winter use.

The cows' floor boards are a certain distance apart for manure and water to pass through; there is height enough below for a cart to pass when clearing away into the fields. They thus have the benefit of covered sheds.

In July the days are long in this country. Daylight till past eleven at night.

My only regret was my inability to go to the North Cape to see the midnight sun at this time of the year.

Costumes of the peasants are very pretty.

It appears when hunting bears in Norway the plan is as follows:—

When seen, or rather when he sees you, he rises on his haunches ready for the attack, you then let loose your dog; he runs round and round the bear, trying to get a bite at him, barking all the time; this gives you the opportunity of a shot, but you must shoot true or you lose a second chance, for if unwounded he is off for miles away.

English sportsmen will be surprised to hear that foxes are shot and poisoned as vermin in Norway. Norway is not a fox-hunting country, it is not suited in any way for such sport. Foxes here do not turn white in winter like Arctic foxes, but hares do, these are also shot.

The only winged game that turns white in winter are ryper and ptarmigan.

Of late more attention has been given to the South Pole. In August, 1898, M. Borchgrevinck started in the ship *Southern Cross* (which was furnished by Sir George Newnes, and built by Mr. Colin Archer), left London for the Antarctic circle. M. Borchgrevinck is a Swede. His first idea of exploring this region was when with a whaling expedition which touched at Cape Adair in South Victorialand. His plan is to renew the supply of coal at Hobart Town, Tasmania, and proceed southwards, and on reaching land they will form a camp, make short overland expeditions, and get acclimatised in readiness for a possible advance by stages to the geographical pole, distant some 1,200 miles. This is to be undertaken (if at all) not earlier than the spring of the next year. The ship will winter at Hobart, and return in the spring with fresh provisions. The captain of the *Southern Cross* is Jansen—a Norwegian—who has had a long experience in the Polar Seas as a whaler. She

has a crew of thirty men. Lieut. Colbeck, R.N.R., is the first magnetic observer, he, for some time past, has studied at Kew; he is assisted by Mr. Louis Bernacchie, of the Melbourne Observatory. Dr. Klovstad, of Christiania, is the medical officer, and Mr. Hansen, of the British Museum, and Mr. Hugh Evans, will serve as zoologists and collectors.

On the 6th of April, 1900, the *Southern Cross* is reported as having returned to one of the southernmost ports of New Zealand with the following report:—"That after leaving the Thames on August 22nd, 1898, and sailed southwards from Hobart for Cape Adair, on December 19th, after sighting Bellamy Islands she was caught in an ice pack for six weeks. On February the 15th high land was sighted, and three days afterwards a landing was effected. They then set to work to build a house, which was completed by February 28th, when M. Borchgrevinck and his staff landed to spend the winter; the vessel then sailed back to New Zealand for provisions."

Much has yet to be discovered, but this is the report up to date of the proceedings of this expedition.

As far as is at present known of the Antarctic regions, the nearest a ship has been to the South Pole is  $71^{\circ} 36''$  of south latitude. The usual limit of ice in the summer is about  $67^{\circ}$  south latitude.

Icebergs are as frequent as in the Arctic regions, and of a similar size and shape. Fearful storms arise, so that the ship rises and falls with the gigantic heave of the South Pacific Ocean: along with the mass of icebergs and sea ice, storms, rain, sleet, and snow, are the normal conditions throughout the year.

The ship, working southwards, has to battle with the immense icebergs, and large masses of loose ice, and the bumping of the ice against the ship in a storm seriously endangers the ship, and makes such a noise as to make it impossible to hear one speak.

As time went on and the ship worked southward, the ice packed into a more solid body, and fixed the ship at  $71^{\circ} 22''$  south latitude. This happened at about 300 miles across the polar circle and about 1,100 miles from the geographical pole. In this fixed position the ship drifted for thirteen months, and passed over about 2,000 miles.

After passing Graham Land in the Antarctic circle, and Alexander Islands more southward, the ship drifted from five to fifty miles a day in a zig-zag direction, generally westward. Penguins, sea leopards, and seals were found. The midnight sun appears in the summer; when in May the sun sets and remains below the horizon for seventy-one days, the temperature falling till it reaches  $45^{\circ}$  below zero.

In March and April penguins were caught, seals hunted, and some petrels were shot for specimens. On May 16th the sun set and remained below the horizon for 1,700 hours.

The ice around the ship was from 20 to 25 feet thick. Through this, borings were made to take soundings from time to time while drifting. The soundings showed sea of different depths, where land was supposed to be by former explorers: the greatest depth being 1,000 feet.

When the time became favourable, every man on board set to work with saws, axes, dynamite, and other means to cut a passage out of the ice. This took sixteen men five weeks to accomplish, working night and day in relays of eight hours, when they had cut a channel for the ship 2,400 feet long, out of which she passed into open water, and made the passage to Cape Horn for repairs.

When an apprentice, the thought occurred often to what extent can we bear hardship and live.

This thought was more pressing when walking along the high East India Dock Wall before six in the morning on my way to work, with the wind blowing a full gale in my face, with snow and sleet drifting at the time. Many times have I felt sick with the intensity of the cold.

And yet, here I am, after passing through the chances and changes of foreign travel, considerably over seventy years of age, with both eyes in my head, no arm, leg, or rib broken, not a shot-hole or stab in any part of the body, not even lame, and in fairly good health.

For all escapes enumerated, the guardianship of Providence is apparent, and I thank God for all mercies.

This, then, brings me to the end of the Reminiscences, but I hope not to the end of the patience of the reader: my desire being to keep the spirit alive up to

THE END.





Extract from *Louth and North Lincolnshire News*,  
(Written by Rev. E. H. Jackson, Louth.)

---

## BOOKS TO READ

---

### WINDER'S REMINISCENCES.

This is a really interesting book, describing the work and adventures of an engineer in various parts of the world. The composition is devoid of literary pretension, but it is pleasant to read for clearness of expression and the evident truthfulness of the writer. The author gives us a view of what thousands of ingenious Britons have been doing in our century to advance the material progress of the world, in the construction of railways, and other public works. If he had written a dozen such chapters as those on his sojourn in Brazil and Spain we should have read them from beginning to end. It is a picture, honest as photography, of the energy and queer experiences of our countrymen as pioneers of civilization in foreign lands. There is solid instruction as well as pleasing narrative in this work. Notably, the chapter on that huge problem of our day, the sewage of the great centres of the population. Anyone who can read can follow the argument of the author, and yet it was produced specially for engineers who met in London for the special objects of their profession; it proves that the author could not become obscure or tedious even when dealing with strictly professional topics. Beside the running story of adventure and the informing discussion of the relation of sewage to health and wealth, there are descriptions with illustrations of inventions by the author, who is a silver medalist, for his elastic horse shoe, and whose driving nose-band for horses ought, it would seem, to have taken the bit out of use altogether if the prejudice in favour of bits were not so unreasoning. His hop-pressing machine, improved steam plough, and other inventions are all interesting to the general as well as to the agricultural reader and engineer. The contents of the book are too varied to be included in any short sketch of them, being an agreeable mixture of personal anecdote, description of foreign scenes and ways, and mechanical appliances, of which some, at least, would, we think, be more extensively used if they were better known. Of the chapter on Norway, we say nothing, except that it is the last of a book that leaves one wishing it had been longer. By permission, these Reminiscences are dedicated to Lord Heneage, and a considerable number of influential persons who have read them have signified interest and approval. The author disarms criticism of small defects by pleading his inexperience as a writer, but he has told his story well enough to make us glad that he did not allow his inexperience as a writer to deter him from giving his experiences as an engineer and a traveller in his own and in other lands.

---

## ADDITIONAL PRESS EXTRACTS.

---

Extract from the *Lincolnshire Echo*.

A new edition is just published of "Winder's Reminiscences," a volume relating the experiences of an Engineer, at home and abroad.

The book is really an autobiography, and what Mr. Winder has to say will be of particular interest to Engineers, though his story penetrates into many other spheres than his own profession.

His description of Brazil and its people is good, and with other countries he has visited and describes form an interesting brochure.

## PRESS EXTRACTS.—Continued.

Mr. Winder claims no special literary merit for his work, but its chief value lies in its clear and unconventional narratives of fact concerning the various lands in which he has spent the fifty years of his work.

---

Extract from the *Lincolnshire Chronicle*.

**REMINISCENCES.** This is the title of a booklet by Mr. Richard Winder, senr., of Benniworth, via Lincoln, and tells in plain and unvarnished language the experiences of the author, as an engineer in all parts of the world. The little work makes no pretence whatever to literary style: it is the life story of a plain, practical man, plainly and practically written. It is a convincingly sincere narrative, and its simplicity of diction makes it very graphic and realistic.

The reader is first taken to Ireland, and introduced to a "wake" and a wedding: then he is told of the construction of the early railways in England, after which he is transported to Brazil, Spain, Portugal, and other parts of the world: the industries, modes of life, and customs of the natives being set forth.

In addition to the story of adventure, there are descriptions with illustrations of inventions by the author, who is a silver medalist, for his elastic horse-shoe, and whose driving nose-band for horses has much to recommend it. His hop-pressing machine, improved steam plough, and other inventions are all interesting to the general as well as the agricultural reader and engineer.

---

## Testimonials.

The Rectory,

Donington-on-Bain, via Lincoln.

Dear Mr. Winder,—

I have read your book carefully and with much pleasure. The chapter 8 on sewage and its value as a fertiliser interested and pleased me very much indeed. My gardener uses liquid manure very abundantly, and to our great satisfaction and I may say "profit."

For example, I have two rows of celery that I think cannot be equalled by anyone in the parish. Indeed, everything in the garden has done uncommonly well.

My peas and strawberries treated with liquid manure have been remarkably good, fruitful, and abundant.

Believe me,

Yours truly,

JAMES W. ASHE.

To Mr. Winder, Senr.,

P.S.—I have just cut a vegetable marrow which has been nourished with liquid manure weighing 18 lbs.

---

Mayor's Parlour,

Town Hall, Louth.

Reminiscences of an Engineer at Home and Abroad by Richard Winder. I have derived great pleasure from the perusal of this work.

HENRY D. SIMPSON,

Mayor of Louth.

## TESTIMONIALS.—Continued.

Benniworth,  
Lincoln.

To Mr. R. Winder, Senr.

Dear Sir,—

It is with very great pleasure I read your Reminiscences, wherein you give descriptions of what you actually saw in countries abounding in interest, yet but little known to us. The first six chapters, as well as the eleventh, treat of these countries, and from the several anecdotes and incidents given, are sure to interest the general reader. Chapters 7, 9 and 10 were especially interesting to me, describing as they do, machines and mechanical arrangements, ingenious in character, such as a mechanic delights in. I read also with great interest chapter 8, upon sewage, a subject all-important at the present day.

I quite agree with you that Africa will be one day the coming country. I note you lightly touch upon the subject at page 57. The equator passing through it, and the vast extent of the Continent, naturally give many varied climates. The fine bold rivers running into the interior, form the best highway for the carriage of produce of all new settlements to the coasts. The splendid maiden soil and minerals are all waiting to be worked. And now, from levels taken, it seems possible to flood the whole Desert of Sahara from the Mediterranean Sea, and so let ships pass over this unproductive stretch of sand to (what would then be) the productive North Coast of Africa, thus forming direct communication to the customers of Southern Europe without change of cargo. This I hope to see one day done.

I am, dear Sir,

Yours faithfully,

J. P. PARISH.

---

---

Langton Rectory,  
Horncastle,

Dear Mr. Winder,—

I have read your Reminiscences with great interest; although the volume is small and unpretending, I may indeed call it a "multum in parvo." Seldom can it have happened for one life to go through experiences so varied, and in regions so widely apart; literally, in almost the four quarters of the globe. My own rambles in Europe, Asia and Africa, enable me to enter with pleasure into your more extensive travels, while a keen love of adventures (of which I have had several) makes me relish your graphic accounts of wild life in Brazil, and my ardent affection for mountain scenery enables me to appreciate your descriptions of life and scenes in Norway.

Apart from your engineering achievements in South America, Spain, Portugal and elsewhere, your success in grappling with local and mechanical difficulties; your valuable paper on sanitation read in London; and your useful mechanical inventions. Page after page contains vivid and varied pictures which every one should be able to enjoy.

Your volume does not, of course, pretend to a literary classic, but what it contains has the ring of sterling metal, and is well, if plainly told.

I hope it may meet with the success which it so thoroughly deserves.

Believe me,

Yours very truly,

J. CONWAY WALTER.

---

---

Benniworth Rectory,  
Lincoln.

Dear Mr. Winder,—

The book of sketches lately published by you cannot but prove acceptable to those like myself, have been brought much into contact with the engineering profession.

But apart from any special interest of this kind, your little book containing as it does, descriptions of many lands and many customs, will be found useful and instructive to all.

Yours faithfully,

GEORGE S. LEE.



---

LIST OF PATRONS TO THE FIRST EDITION.

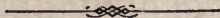
---

His Grace the Archbishop of Canterbury.

- |                             |                            |
|-----------------------------|----------------------------|
| The Bishop of Lincoln.      | The Dean of Durham.        |
| „ Dean of Lincoln.          | Canon Farrar of Durham.    |
| „ Sub-Dean of Lincoln.      | The Bishop of Winchester.  |
| Archdeacon Bond of Lincoln. | „ Bishop of Truro.         |
| The Bishop of Chester.      | „ Dean of Exeter.          |
| „ Bishop of Ely.            | „ Archdeacon of Maidstone. |
| „ Bishop of Carlisle.       | „ Archdeacon of Coventry.  |
| „ Bishop of Peterborough.   | „ Bishop of Worcester.     |
| „ Bishop of Durham.         | „ Bishop of Liverpool.     |
- The Rt. Honble. Lord Heneage, P.C.  
The Clergy of Lincolnshire (to the extent of 16 copies).  
Private Subscribers (300 copies).  
The Mayors of Lincoln and Louth (5 copies).



# Order Form.



To Mr. R. WINDER, SEN.,

BENNIWORTH, LINCOLN.

Dear Sir,—

Please supply me with \_\_\_\_\_ cop \_\_\_\_\_  
of your work "THE REMINISCENCES OF AN ENGINEER  
AT HOME AND ABROAD," at 2s. 6d. each, Post Free.

Yours truly,

Address \_\_\_\_\_

\_\_\_\_\_

UNIVERSITY OF CALIFORNIA LIBRARY

Los Angeles

This book is DUE on the last date stamped below.

University of California, Los Angeles



L 005 793 083 6

UC SOUTHERN REGIONAL LIBRARY FACILITY



AA 000 085 606 2

