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Occasionally Practised upon Public Works, by John Newman**

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KNOWLEDGE OCCASIONALLY PRACTISED UPON PUBLIC WORKS ***



SCAMPING TRICKS

AND

ODD KNOWLEDGE

OCCASIONALLY PRACTISED UPON PUBLIC WORKS.

**CHRONICLED FROM THE CONFESSIONS OF SOME OLD
PRACTITIONERS.**

BY
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AUTHOR OF
'EARTHWORK SLIPS AND SUBSIDENCES UPON PUBLIC WORKS';
'NOTES ON CONCRETE AND WORKS IN CONCRETE';
'IRON CYLINDER BRIDGE PIERS';
'QUEER SCENES OF RAILWAY LIFE.'



E. & F. N. SPON, 125, STRAND, LONDON.
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1891.

PREFACE.

The following pages have been written with the view to record a few scamping tricks occasionally practised upon public works, and to name some methods founded on practical experience adopted by sub-contractors and others to cheaply and quickly execute work.

All who have had the direction or charge of an extensive or even comparatively insignificant public enterprise will agree that it is impossible for a resident or contractor's engineer to know the manner in which everything is proceeding on his division, and in some measure he is compelled to rely upon others; nevertheless, it is quite as important to ascertain that the work is carried out according to the specification and drawings as to elaborate a perfect specification and then have to partly leave the execution to the care of the beneficent fairies.

If a finger-post has been correctly pointed in the direction in which a favourable field for scamping tricks may exist, the author's object in writing this book will have been attained.

To the less experienced, the incidents and scrap-knowledge described may be more particularly useful, and on consideration it was thought that the conversational tone adopted would best expose the subject and indicate the ethics of somewhat conscience-proof sub-contractors and workmen, and also the way in which their earnest endeavours to practise the science of scamping may be exercised upon materials and under circumstances not especially referred to herein.

LONDON, 1891.

J. N.

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SCAMPING TRICKS

AND

ODD KNOWLEDGE

OCCASIONALLY PRACTISED UPON PUBLIC WORKS.

CHAPTER I.

INTRODUCTION.

"Take this letter to my old partner as quickly as you can. Wait for an answer, and come back straight."

"All right, sir."

"Now, my wife, when my old partner arrives, leave the room. I want the coast clear as I am going to talk and have a sort of mutual confession of some tricks and dodges we have played and learned during the last forty years or so to get a bit 'extra' on the quiet; and forty years knocking about with your eyes bound to be on full glare ought to teach one a thing or two, and they have. They have! Yes; and I have been in the swim.

"Stir up the fire, if only to keep things all alike and as hot as possible; and put a couple of glasses handy, and some water and...."

"So you've got back. Where is the letter?"

"Have got no letter, sir; but it is all right; your old partner will be round about 7 o'clock and will stay till he is turned out, so he said."

"Oh! I am glad."

"Why, sir, he is knocking now."

"So he is."

"Here I am, old chap, what's the matter?"

"I feel pasty, but am better now you have come. Bring your chair near the fire. Well, I want to talk to you on the quiet very badly. It will do me good, and I am sure it will not be long before the white muslin is spread over me and I'm still in death. You've come to stop?"

"Yes, as long as you like."

"That is good, and I am glad and feel better now you have said it. Before I begin, taste our home-brewed elder. It's all right, for my wife was a cook, but it's a long time ago; and between you and me, my profits don't run to providing her with as large an assortment of materials as she says is necessary to keep her fairly up to art in the cookery department."

"That is very good—the best I have tasted. Well, what is it, old partner? Shake fins."

"It's to talk over old times, and the tricks and dodges we have played, and known others do, to get 'extra' profit on the different works we have been."

"A kind of confession?"

"That's it. Don't laugh. I can't help it now."

"I understand you. Start the fun, and I will follow."

"We can talk pretty to each other, and lucky the young master is not here, for he would think that we are as bad as old Nick himself; still, we have not done many tricks for some time, and could, perhaps, put him up to a thing or two concerning the execution of work."

"Very likely; but we are all tarred with the same brush; it's only a question of quantity and thickness and what colour the paint is."

"I suppose we are bound to work up an excuse somehow or other; and if I moralize a bit tender at first, by way of a diversion, you won't mind, for it is part of the stock in trade of such rare old sharks as us, and I will cut it as short and tasty as I can."

"I was brought up right, like you; and many a time have had my shoulder patted by the good folks and been told not to think of myself too much, and to remember the feelings of others. In my salad days, you know, I used to think whether or not it was coming it rough on chaps, innocent unborn babes that will have to work in the next century, should the world hold out till then, putting in too strong work, and said to myself, Is it acting kindly towards them? No, I said, it is not treating them right to give them so much trouble to make alterations. I won't call them repairs and additions, nor improvements. I soon humbugged myself into thinking it was not being really benevolent to those who will have to work when we are all lying flat, and I hope quiet—but there, of course, such thoughts hardly make one act honestly; however, I have done moralizing now, and perhaps it ill becomes me, and I will have no more of it or it may stop my tongue. Now to business, and I am going to speak pretty freely."

CHAPTER II.

SCREW PILES.

General Consideration—Manipulation for "extra" profit.

"You want to know my experiences with screw piles first."

"Yes."

"They do very well when the water is not deep and the ground loose sand, silty sand, or sandy fine gravel, and nothing else; and I prefer disc piles for sand, provided the water power can be easily obtained."

"The whole area of a screw blade is often taken as bearing support; but I doubt if it should be, for it is not a bared foundation—that is, one you can see and know the character of, as in a cylinder pier, for instance; but some appear to assume it is, and then claim that a lot of metal is saved and the same or more bearing obtained. The screw blade may always be right and it may not be, and no one positively knows; because no one can see whether it is down straight, turned, or broken, but the difference between the actual and the breaking strain comes to the rescue."

"Still, it is no certainty that the screw blade is resting upon the same soil, and even if it does it may not receive the load in a vertical line, and may be strained more upon one side than another. And how about the rusting of the blade, for it is thin, and seldom more than half an inch at the ends and two and a half at the pile shaft, and nearly all surface? In a cylinder pier the hearting is placed on the bared ground, and you know it is there, and it cannot rust, that's certain. I don't see the good of iron rings above a few feet higher than highest flood level, for after the hearting is set, if it be of Portland cement concrete, you can give it a coating of nearly neat Portland cement. However, we are talking about screw piles.

"I have seen screw piles screwed into soft ground for fully fifteen feet, and they seemed quite right, and yet when they were loaded they vanished. I have also known them to be twisted about something like a corkscrew, and to be impossible to get down at all when they have reached a hard layer of gravel, and nearly so when they met with a streak of hard stiff clay. Sometimes they are overscrewed, and made to penetrate somehow or other; and I remember once, when they were loaded for testing and were thought to be right, a washout occurred at one place, owing to a mistake in dredging, and the piles, although they screwed, were found to be twisted about into all sorts of shapes, and at the bottom were turned up a trifle and never went down more than a few feet, and while it was thought we were screwing them down we were screwing part of them aside. They were small solid wrought-iron piles. It is well not to forget that sand varies very much; for it is found nearly everywhere, and may be anything from large hard angular deposit that will bind, to little round mites easily blown away, and it is mixed with pretty well everything; and therefore sand is a thing you must be careful with before you take it to be just the thing for watersunk disc piles or screw piles, and you ought to know all about it. Well, assuming that it is right, and the soil will not become jammed in the screw blade, it is always advisable to try whether the sand grains will roll well together and do not wedge; for you want sand, if it is to be nice for pile sinking, just the reverse of sand for mortar or concrete, for that with round grains is the kind to screw in and not that with sharp angular grains, and if it is slimy, so much the better—just the opposite of that for mortar or concrete.

"The soil must be loose, and if it is silty so much the better. Don't undertake to screw piles into hard and compact sand, gravel, stiff clay, or where there are boulders in the ground or streaks or layers of soil of which you hardly know the character. If you do, good-bye to profit from any screwing, and may be to the screw blades, and your fishes must be got out of 'extras' by omitting a length, smashing a screw blade, or short screwing. Be careful to be paid for all piles you have screwed down directly you have done them, and take no maintenance; for I have known a ship drift, or a gale arise, and sweep away the unbraced piles like sticks, and if you are only paid when you have finished screwing a cluster of them, where are you then, and who's which? Suppose you have nearly fixed a cluster of piles, they will say you ought to have braced them at once, and you will be charged for breakages, and not be paid for having screwed them. You may talk as long as you like, and say, How could I get them all braced when the piles must be screwed separately? You will only be told that is your look-out, and that you knew the terms of the contract and must have considered any risk in the prices. So I bar injury from waves or wind, earthquakes and shakes, collisions from vessels or other floating or moving substances; and believe the last to cover all fishes, from sea-serpents, whales, porpoises, and sprats, to balloons, stray air-balls, wreckage, and mermaids; and it gives you a chance of wriggling out of squalls with an I'm-so-sorry-at-your-loss sort of countenance.

"You have to think over the staging. Fixed staging may be out of the question because of the expense; then you must either screw from the finished end of the pier as you proceed with the work, or from a floating stage, but you may not be able to get sufficient power to screw the piles from any moored floating stage. The shore piles of a pier may screw easily, but when you get out in the sea fixed staging may soon be smashed, and in that case you are compelled to do it from the end of the finished portion of the pier. There is a good deal of uncertainty, as you can judge, and you want to well consider whether and how you can get the power cheaply to screw the piles.

"The idea of the screw pile was that it should easily enter the ground and push aside any obstruction in its descent without much disturbance of the soil, with the ultimate object of obtaining, by reason of the screw blade, a strong resistance to upward and downward strain. Well, it is all right if the whole of the blade bears equally upon the soil and the earth is of the same character; but if it is not, the strain upon the screw blade is unequal, and it will sooner or later crack or break; and except in any earth like fine sand or silt and all of one kind, I should be sorry to say that the whole area of the blade does the work as I said before. And here comes in the value of an allowance of extra strength, for you cannot tell how much it has been weakened by corrosion, nor can you inspect, paint, or do anything to the screws when they are down. If I was engineer of an iron pile structure, I should have a few piles screwed at convenient places independently of the pier, but near to it, and have, say, one or two taken up every few years—say every seven or ten—just to have a look to see how matters seemed to be, and have a piece of the iron analysed, and compare it with the original analysis; and I should take care the piles were all the same quality of metal, so that

the makers should not get up to fun at the foundry.

"The piles have to bear a heavy twisting strain during screwing; and take my advice, always see that the joint flanges are not light, for when piles break in screwing, they usually fail at the flanges. What I have learned shows me it is a great mistake to have the screws of very large diameter, so as to have few of them; let the blades be small rather than large, and they are best for screwing when of moderate size, and are also likely to be sounder metal. There is not the same risk of breaking them in screwing, and you may be able to screw a small blade when a big one would be smashed, and besides it is as well to have the load distributed as much as possible. A screw pile shaft should not be a thin casting because of the strain upon it in screwing, and it should be thicker on this account than a disc pile, but the latter will not do for any soils except those named before. I have known screw piles to penetrate hard and dense sand, gravel, soft sandy ground, limy gravel, loose silt, limy clay ground something like marl, stiff mud, chalk, clay, marl, and all kinds of water-deposited soil, and in almost every earth except firm rock, but it is not advisable to use them for anything much harder than fine sandy gravel, for the blades must then be strained very much and the pile and screw may be injured. It is not using them rightly, or for the purpose for which they were designed, and another system of foundations should be used except under special circumstances.

"Don't attempt to screw piles into ground having boulders in it. It is always difficult to penetrate, as also is spongy mud and stiff tenacious clay. In any ground harder than loose sand, silty and alluvial soil screwing is not easy, and you cannot say what it will cost to obtain the necessary power to screw. As regards that kind of screwing I always feel so benevolent that I like some one else to do it. Do you understand?"

"Yes; when you know a loss looks more likely than profit."

"If you like to put it that way it is not in me to object. I'm too polite. Saying 'yes' and agreeing with every one, gets you a nice character as an agreeable man, whereas you are a big fraud and a high old liar."

"Parliamentary language, please; no matter what you think."

"All right, then. You know what pure sand is?"

"You mean quite clean angular grains, and hard, too, like broken-up quartz rock?"

"Yes. Well, avoid it for screw piles, for then it is very difficult to screw them to any considerable depth. You can't displace the sand enough. It wedges and binds almost like rock."

"You mean it wedges up, and will not move?"

"That's near enough. Well, avoid clean, sharp, angular sand and shingle gravel as much as you can, and take screwing in dirty sand instead. I mean round-grained dirty sand with some clay upon it, or sandy gravel. What is wanted is something to separate the particles of the soil and act like grease so as to make them roll and not compress and become bound. You can't be too careful about this."

"I will put that down in my note-book so as not to forget it."

"To save bother, be sure to ascertain whether the work is in rough ground; and if you are abroad see that about five per cent. is allowed for breakages of all kinds, or the piles may run short.

"I have seen piles screwed into a kind of clay rock seam, the end of the pile was made like a saw, toothed, in fact, and stiffened from the bottom to the underside of the screw blade with ribs shaped to cut the ground as the pile was turned, and I doubt if they could have been screwed without. They seemed to steady the pile; but care must be taken when there is a projecting end and it is tapered to a less diameter than the pile shaft, as generally is the case, that the axis is true, or the pile will not screw vertically.

"Once I had to screw a few wrought-iron unpointed piles with a small screw blade made of angle iron fixed *inside* as well as the large screw blade outside. The outside blade was about 4 feet in diameter, and of half-inch plate, the inside blade projected about 3½ inches, and both blades had the same pitch; but the engineer, after having tried a few, discontinued having an inside screw, and said he thought it even arrested progress, because it interfered with the internal excavation. The experience we had with them was against their use, and they seemed to make the screwing harder, and no one was able to discover any advantage in them, although they did all they knew to flatter the novelty.

"Now a word as to cast or wrought-iron for screw piles. The question of relative corrosion can be decided at some scientific institution, and there will be hot fighting over that between the cast-iron and the wrought-iron partisans. I merely refer to screwing cast or wrought-iron screw piles into the ground. As regards the blade of the screw, it should be as

stiff as possible, and therefore cast-iron is better than wrought-iron, also cheaper; and although a cast-iron screw will break easily, a wrought-iron blade will buckle and bend and give. To me, cast-iron blades seem somewhat easier to screw, if they are good clean castings. I have screwed wrought-iron piles or columns when they have been fixed to cast-iron screws, but in any case when the piles must be long, to have them of cast-iron is my wish. Solid wrought-iron piles can be obtained of a long length, but the price increases, and when they are long and of small diameter, as they must be, they are difficult to screw in a desired direction."

"What do you think of solid piles as against hollow ones?"

"Well, I heard a discussion between two engineers about it, and they agreed that solid piles only do for little or medium heights, and I asked one to write a line or two for my guidance, and this is what he dashed off. Read it."

"No. Read it to me."

"Well, it runs:—'In designing solid piles it should be remembered that the strength of solid round columns to resist torsion, torsional *strength* (he means strength against twisting strain) is as the cubes of their diameters, therefore a solid round bar 4 inches in diameter will bear eight times the torsional strain of a bar 2 inches, the lengths being the same.'"

"How's that?"

"Why, $2 \times 2 \times 2 = 8$, $4 \times 4 \times 4 = 64$, and $64/8 = 8$."

"I understand."

"In the case of hollow columns, the exterior diameter must be cubed, and the cube of the interior diameter deducted from it when the relative values of different-sized columns can be compared. For transmitting motion, and here torsional *stiffness* is referred to, the resistance of shafts of equal stiffness is proportional to the fourth power of their diameters. A 2-inch shaft will transmit 16 times the force which would be transmitted by a 1-inch shaft without being twisted through a greater angle. When the height of the pile is considerable the diameter should be relatively larger, in order that the metal may not be subject to severe torsional strain. So don't forget the piles should be of large and not small diameter, or you may have trouble in screwing them."

"You remember old Bill Marr?"

"Rather, who did the iron pilework on the Shore Railway. I should think I did, for old Spoil'em, we called him, and I were in 'Co.' together more than once."

"Oh! you were, were you?"

"Yes. Well, there is not much to be got that way unless it is soft ground for a good depth and the piles are long and the range of tide considerable, then you may pick an odd plum now and again by a bit of useful forgetfulness. I mean this way:—By using an odd making-up length or two instead of the right length, and getting it fixed on the quiet just as the tide is rising, then you have a nice peaceful few hours in which to get the joint well covered and down before next low water; but it wants some management to keep the coast clear, and you can't do very much at it—still little fish are sweet. One day I was nearly caught at the game of 'extra' profit, and as we had only just begun, of course at the shore end, it would have been awkward for me if I had been found out, and I might have been ordered change of air and scene by the engineer. It happened like this, the piles had been going down very easily, and acting up to the principle of making hay while the sun shines, I had a couple of short lengths put on six of them. We were screwing them in triangles, so one I got to right length, and two did not find the same home, because they could not, not being long enough. I dodged the lengths so that the joints were all right for the bracing above low water. Now the road was clear, so I ordered a new length to be put on all of them before the tide turned, and that each of them was to be down 3 feet or so before the tide began falling to allow them to set, and told them that then they were to proceed as before. Now, I consider the chap that first went in for making up lengths was born right and with an eye to business and nicked profits. We were working two triangles of screw piles I thought lovely, and said, innocent-like, to my ganger, 'Get the joint of each one down say 3 feet below low-water mark so as to protect it, for no joint is so strong as the solid pile, and then you can screw them down till all the tops are level and right for the bracing.' Of course they said nothing, and I am sure never thought anything or wanted to do, too much trouble. It is not my place to teach them, either."

"No, certainly not; there you are right."

"Well, somehow or other, the ground turned hard, or we got into a streak of compact gravel. I did not trouble further about the piles after I had given orders, as the tide had started rising and the joints were well covered. It was rather an up and down shore. I felt certain in

a few hours none of them could be seen except by divers, so I had a bit of business on shore which took me nearly two hours before I got back on the work. My ganger said, 'I am glad you have come back, because they stick; I have tried to get the lot down, but not one has screwed in more than a foot.' That was not exactly what I wanted, and said, 'Why, the long ones went down easily?' 'Yes,' said my ganger, 'but they were at the point of the triangle, and these others are all on one line or nearly so, and have struck hard ground.' I will cut it short, although it got exciting, for it was a race between screwing and, I might say, banging them in, and the tide that was going down; and I was clocking and measuring, and hot and cold, according as the race went, as I thought they would find me out; but I was left pretty well alone, as they cared much more about inspecting the piles than knowing how they were screwed down, besides the engineer was very busy with a lot of groynes and ticklish work improving the harbour channel. However, we just managed; but it made me feverish, and I expect the blades, if they could be seen, are not exactly as when they left the foundry; but there, there is a good deal in pilework that has to be taken on trust, it is not like a foundation you can see and walk upon if so minded. Still, screw piles are all right for some soils, but I like disc piles better for sand, those that sink by water-pressure I mean. I don't think there is the same fear of the disc being broken as there is in the case of the screw, and the sinking is so easy and soft that no parts get strained as in screwing, but the ground must be soft, or there may be a bother.

"After this shave from being bowled out, I always took care to dodge in a short one, now and then, when I knew the ground must be right, and I never got scared again. It was lucky, too, that a good many of the lengths varied, as on most jobs they are all the same, except the making-up lengths, and then down they all have to go unless a whole length can be left out when a seam of hard soil is reached, and that is not often the case, and there is not much chance of a bit of 'extras' that way on the quiet. I have known the game of 'extra' profit carried to breaking off a screw blade purposely, but I draw the line before I come to that."

"Do you? I should not have thought it, as you don't mind cutting off the heads of timber piles, so you have promised to tell me."

"That is a different material and consequently requires different treatment. You understand? Let me also tell you, I once heard a big Westminster engineer say, 'Timber we understand, iron we know a good deal about, and steel also; but we have plenty to find out yet both in the manufacture and use of nearly all metals,' or something like that, he said.

"I acted up to that; and always say to myself, We understand timber, and know how to treat it—and so I don't mind cutting it, as I know what I am about with it, although I represent unskilled more than skilled labour. Metals are different goods, and it wants skilled labour to tackle them nicely."

"There you are right."

"Yes, different goods. So, following the lead of the engineer, I leave the iron piles as delivered, as we have yet something to learn about the metal; and things that I don't know much about I avoid as much as possible, and consequently there are good grounds for getting in some short lengths as occasion offers, just to have as little to do with the material that you don't know much about and that is a bit mysterious in its behaviour. So I lessen the handling of it, and shorten the lengths, and so increase the odds against the chance of it not turning out as one thought it would; and I ought to be thanked for it, I consider. You look a bit puzzled. I tell you, you are getting thick, and want fresh pointing up to sharpen you. Listen to me. Now, suppose you buy a dozen eggs, and you think and know, on the average, at the price two are bad; you take one away and find it's bad, then you have 11 to 1 odds as against 12 to 2 or 6 to 1, and there can't be so much chance of another bad one turning up so quickly. If you don't understand my meaning I can't make you. There may or may not be a different application of explaining the egg business, but mine is what I mean you to take, and I don't intend to bother about any one else. You are younger than I thought you were, or your brain is all of a tangle."

"Wait a minute. All right. I understand now; you lessen the chances of failure and the extent of it when it occurs by having a little less to do with goods that are made of material no one seems to know everything about."

"Now you have it. Shake fins. Glad we have worked on to the right road again, as it looked like a collision just now."

CHAPTER III.

SCREW PILES.

Details.

"Now for some details.

"Solid piles are usually from 4 to 8 inches in diameter, and hollow cast-iron from 10 to 30 inches, and generally 10 to 20 inches. Avoid any cast-iron screw piles that are less than half an inch in thickness. When they are from 1/12th to 1/18th of the diameter is perhaps the best, according as their length is little or great; but of course they have to be of a thickness that will stand the load, and what is the best foundry practice should not be forgotten.

"Now as to the blade of the screw. If of wrought-iron, which seems to me the wrong material for that purpose, it should not be less than half an inch in thickness; if of cast-iron, as usually is the case, the thickness of the blade of the screw at the pile shaft should be about 1.25 to 1.50 that of the column, and at the edge not less than half an inch, and it should taper equally on both sides, and care be taken that the metal is the very best and so cast as to ensure uniformity and strength.

"All sizes of screws from twice to six times the diameter of the pile when hollow I have screwed, but the best are from 2 to 1 to 3 to 1, and when they are more than 4 to 1 it is to be feared they will break before they can be made to penetrate far enough to say nothing about. Solid piles with screws four to seven times the diameter of pile I have also fixed, and 5 to 1 to 6 to 1 is quite large enough; but the kind of ground and the depth to which they must be got down should govern the size and the pitch. The greatest depth, apart from imagination for measurement, to which I have ever screwed a pile is about 25 feet. Without special tackle I have made a 2 feet in diameter screw penetrate hard clay, dense sand, and other hard soil from 8 to as much as 17 feet; but then 10 to 15 feet is deep enough, for there is such a thing as overscrewing. A 3 to 4 feet in diameter screw I have fixed all depths from 10 to 20 feet in ordinary sand, clay, and sandy gravel. A 4 feet to as large as a 5 feet screw, which great size should only be used for soft soils, from 15 to 25 feet, and the most usual depth is about 15 feet, and hardly ever above 20 feet.

"A 9 feet 6 inches screw blade has been used on a 7 feet in diameter cylinder, but that is the largest I have heard of, but then it only projected 2 feet 6 inches beyond the column. Five feet is usually about the largest, and is only used for very soft soils. When more than that size they are unwieldy and very liable to be broken, and if the screws are fixed to a shaft and have to be shipped they are awkward things, and the freight becomes expensive. For hard soil, and that which will not compress nicely, about 2 to 3 feet is large enough for the diameter of the screw, and 3 to 5 feet for soft soils. The pitch of the screw is generally from one-third to one-seventh of the outside diameter of the blade. It varies according to the hardness and softness of the ground and is steeper as it becomes harder. When the pitch is increased the effect of the power applied to screw it is reduced, therefore the steeper or greater the pitch the harder the screwing.

"Piles can be screwed with a small pitch when sufficient power cannot be obtained to make a steep-pitched screw penetrate. Piles with a single turn of the screw, it seems to me, are the best, although the double-threaded screw may be right in soft marshy ground; but the usefulness of a double thread is doubtful, for I believe it breaks up the ground for no good, although some state that the screw threads work in parallel lines, and that a double-threaded screw is steadier; for they say a single-threaded pile is always likely to turn on the outside edge of the blade, and that the double-threaded is not, as it has a lip on both sides.

"Generally the screw has rather more than one entire turn round the pile, and when it is below the ground each side of the blade steadies the other, for the turns range from one to about two. Sometimes the edge of the blade is notched like a saw; but it is a question whether the saw-edge blade will screw into ground that an ordinary blade will not, and until it is proved by experiment it can only be a matter of opinion; but there is one thing to consider, a saw-cut edge blade may to some extent wedge the soil between the teeth; still, I have used them, and they penetrated thin limestone, chalk, and compact gravel seams. Instead of double threads, double points are the thing, and all screw piles should have a point of some kind. For soft ground, a single gimlet, and a double for hard soils, and I have noticed what I call a double gimlet point is best for keeping a pile in the required position, as each point prevents the other departing from a correct line. By points I mean the ends are spread out about 3 to 4 inches on each side of the axis of pile like spiral cutters.

"Unless it is certain the ground is easy and uniform, a pile with a screw having one turn to two turns for bearing purposes, and two, three, or four solid inclined screw-threads projecting about three-quarters of an inch with two end spiral cutters as just named, is my desire, or in addition to the bearing blade a single-turn thread of about 3 to 4 inches projection and the same kind of point; then unless it will screw, none will. They are less

trouble when cast in one piece with the pile; but not for transport or shipping, or foreign work generally, because to be able to detach the screws is an advantage in many ways, such as packing, defects, breakages, carriage, and I think the castings are better when the blade is not cast on the pile. It may also happen that a rocky bed is unexpectedly encountered, then the pile is useless with the screw, but might be fixed firmly in Portland cement without the blade in a hole made in the rock. At the top of the screw blade seat in which a pile has to be fixed there should be a wrought-iron ring about half to three-quarters of an inch in thickness, and not less than 2 inches in width, to relieve any strain on the casting. It may be put on hot, so as to cool sufficiently tight but not strain the casting. A firm and even bearing for the pile on the socket seat is important, and it should fit accurately.

"I have heard of screw piles in which the blade was made of two or more separate segments so as to obtain, it was supposed, equal pressure all round, and to ease screwing, but rather fancy they might be inclined to jam the ground, as they would be not unlike a lot of very large round saw teeth. They may be right, but it has to be proved they will screw where a plain blade will not, provided the latter pile has double cutter-points to steady it.

"Give me a screw blade not more than about 2 feet from the points, and not one with a blade 10 feet or so above the points and say from 5 to 6 feet in the ground, for then, should the screw work at all crooked and the pile be not exactly upright at the commencement of screwing, it is no easy task to get it to stand vertically upon applying the power, because such piles are generally long and slender, and shift about until the blade is screwed. They want careful and constant guidance. Of course, the idea of placing the screw a little way down is that when the ground bears as well at that place as at the point, and there is no scour, it is no use putting the bearing blade lower. That is right; but then it always occurs to me to ask what is the use of anything below the bearing level if the foundation be protected from scour, for a thin pile by itself has little lateral strength.

"Of course, you are bound to make out a pile requires a lot of screwing or you will be considered as making too much profit, but always take care to watch how the first pile screws, and measure the distance every few minutes. What the ground is can then be judged, and you will be able to think out things for 'extra' profit. It causes me a lot of consideration sometimes, but after a struggle I generally manage to think rightly for my pocket, and work it all serene. What a beautiful sharpener of one's brain 'extras' are!

"It is not always an experimental pile is screwed so as to judge of the distance the permanent piles should penetrate, and therefore a guess has to be made from the experience of screw piles under the same conditions of screwing and in the same soil. There is a good deal of chance about it, for although the soil may be of the same general character it often varies in hardness; and that is where the bother is, for it makes the 'extras' to be wrong way about for some time. What I do then is to work the oracle, and try to make out the screw blades will be broken or injured for certain if I am compelled to screw them as ordered, and I work on the proverb that equal support is not to be obtained at a uniform depth when the ground varies, which is true; and I state that the resistance is different and offer to screw on, but say am afraid the blade may be broken, and in that how-kind-I-am-to-consider-your-interests sort of way generally manage to obtain a bit 'extra,' or save something that would have been loss, and get the pile measured at once for a making-up length, and really without damaging any one, for if the ground is harder at one place than at another there is no occasion to go so deep, always provided scour is not to be feared. So I am pleased, and it does not hurt them.

"Now for a hint or two on screwing piles. I shall not refer to the columns above the ground, but to the bearing piles below, i.e., the part that has to be screwed into the ground. However, I will just say that upon the top of some of the columns the usual hinged shoes of bearing-blocks should be placed to receive the ends of the girders, and by that means the pressure on the columns will be on the centre of the pile, and allowance be made for expansion and contraction, and that is important.

"Fixed staging is far the best from which to screw piles, but the chances must be considered of its being swept away by floods in a river, or smashed by the sea, and on any exposed coast there may not be time to construct it during the working season, so as to give a sufficient number of days for screwing operations. When a fixed stage cannot be erected, or the work be done from the end of a finished pier, pontoons or rafts are then a makeshift, but care must be taken that they do not break from the moorings. A couple of pontoons well braced together will do with a space between them to screw the pile, but in a steady or shallow river, perhaps making a timber stage upon the shore and floating it out can be done if a centre pile is fixed on the bed of the river to be certain it is in the right position when grounded. The staging must be equally weighted to make it sink, and arrangements made so that it can be floated away at any time if necessary.

"Piles can also be fixed in a medium depth of water by ordinary gantries, but if they are in the sea the road on the staging should be kept from 12 to 15 feet above high water on an open sea coast or the inclined struts and ties and rail tops as well are very likely to be

destroyed, and it is also advisable to construct the flooring of the stage so that it can be easily taken away in case of storms. The stage piles also require to be well stiffened by struts, transoms, diagonals, and capping sills. I have screwed piles from a floor that has been suspended from staging by chains and ropes to the height wanted, and when lowered it was fixed temporarily and as many guides as possible were made for the piles. Perhaps as good a way as any is to fix, say four guide piles having a space between them a shade larger than the outside dimensions of the screw blade and braced to the rest of the stage, and after the screw is in position and ready for screwing in the ground, place, say a couple of frames, one at top and one as low as possible between the guide piles, about an eighth of an inch more than the outside dimension of the pile shaft, for then the pile is kept in its right position as it is screwed. The guide frames should be at about every 10 or 15 feet of the height above the ground, and at some point between the capstan level and the ground. Should it be a tidal river, fix guide booms if a properly made iron frame cannot be placed, and remember the more a pile is guided the easier it is to screw, and especially so at the start.

"The size and strength of the staging must be regulated according to the power available for screwing the piles, but the length of the lever arms and the capstan bars require a space in which to revolve, from, say, 35 to 60 feet square. No timber stage is immovable, for the wood yields. It is well to have two floors in a stage if it does not cost too much, and there is plenty of tackle and a lot of screwing to do; say, one fixed above high-water level and the other about half tide in order to obtain double power, and sufficient power to screw the piles cannot sometimes be otherwise secured. A word about floating stages. With them it is not easy to make a pile screw vertically unless the ground is uniform, and should a pile meet a boulder it will most probably be forced out of position. According to the power required—which really means the nature of the ground, as the harder the soil the harder the screwing—the form of the pile and the depth to which it has to be screwed, so must be the size and strength of the raft, pontoon, or lighter, and the moorings must hold it tightly. In some places a screw cannot be fixed from a floating stage, for the water may nearly always be too disturbed, and the pontoons may sway too much, for in all cases men, horses, or bullocks must have a steady footing, and screwing machinery also requires a firm base. Unless the moorings are very secure the platform will be unsteady. Its level should be as little above the water as practicable for work, so as to keep the point of resistance and that at which the screwing power is applied as near together as possible, and the lower the pontoon the less it rolls. It does not matter much what craft is used so long as it is broad and steady and not high, as a platform or deck must be made upon it in any case. To do any good with floating stages the power required should be little, and the ground soft and uniform, for sufficient force to screw may not be obtainable from a floating body, and in hard soil it may only be possible to screw piles a little way down and not to a sufficient depth for the load they will have to bear.

"Of course, vertical pile screwing is the easiest, and to try to screw them at a greater angle than 63° , or about $\frac{1}{2}$ to 1, is unadvisable, and may not succeed, and even if they do it is too steep to be nice. 1 in 10 to 1 in 20 for raking piles is enough; for if they have to carry girder ends, the more the batter the greater the strain on the pile, and the same during screwing.

"Sometimes in loose soil it is difficult to start screwing, and then a good plan is to cast some clay or solid earth round the pitch; it steadies the pile and will probably make it bite properly, or a heavy weight placed on the pile may make it catch hold of the ground; if not, a few blows from a ram may do it. As a hollow pile penetrates, the core requires to be removed, so as to help it to descend. If it is not large enough for boys to get inside, scoops and tackle can be used. Water forced down makes sand boil round the screw blade, and when the pile is empty the unbalanced head of water outside relieves the pile and the screw blade from some of the surface friction. If water pressure cannot be used, the water inside the pile should be removed either by pumps or buckets so as to help to loosen the ground.

"Piles do not generally screw to the full pitch, but when a pile descends *more* than the pitch at the last turn, it can be considered the weight of the pile is too great for the ground. The slip usually increases according to the yielding or plastic nature of the soil, and the depth to which the pile is screwed. When water reaches such soils the slip is increased, but not perceptibly in sand and loose grained soils. Suppose the full pitch is 9 inches. The slip may be anything from about 1 inch to as much as 4 inches. By watching the way in which the screw penetrates, and whether it descends about the same distance *each* turn, or regularly decreases, it can be judged whether the bite of the screw is right. Some slip will generally take place, therefore note at first how much it is, and consider whether it will not churn up the ground, for if the screw blade turns on nearly the same lines, the bite will be gradually destroyed, and then it may be very difficult to obtain a fresh hold of the ground, and the pile will most probably not screw vertically, and the screw blade is liable to be injured and may become worn away considerably.

"Piles can be screwed by means of men, horses, oxen, and machines. Man-power can be used anywhere, machines in most places, but horses and oxen only on land when the piles

are screwed on a foreshore or between tides; of course all live power works at the end of the capstan bars. Once I had the option of screwing by horses or oxen, and chose oxen. Another man had horses. I made more profit than he did, and the piles screwed easier than his. I did not let him come near me when screwing; but if you have the choice, use oxen in preference to horses. Of course, I am speaking of those countries where they are used to the yoke."

"Why?"

"Because they do not stop at any time or back like horses, not even when the resistance of the pile becomes too great without more power, but continue to pull, and therefore backward motion of the pile is prevented. The oxen were yoked to two cross-arms attached to the end of the lever.

"There are several machines for screwing piles worked by steam or other power, and when the ground is not easy to penetrate, and a large number of piles have to be screwed, their cost will be saved in the regularity, quickness, and ease in screwing, and in stiff soil by machine power I have known them screwed at the rate of 4 to 6 inches per minute. Of course, it is a special machine, and not easily sold when not further wanted except at a much less price than has been paid for it, and that has to be considered. There are several different methods of screwing piles from a fixed stage; for instance, suppose a pile of sufficient length and with the screw attached is brought to the site by barge or otherwise, the capstan head is then fixed, and the pile swung vertically over the pitch by sling-chains fastened to temporary eye-bolts passing through the bolt-holes in the flanges or otherwise, and is moved either by a jib crane, a derrick upon a raft, or some such hoisting apparatus; it is lowered into its place between the guide-piles or steadied by sling-chains or other means, then the capstan bars are put into the sockets of the capstan head, which should be at equal distances apart, and the pile is ready for screwing after it is known that it is vertical.

"Where circumstances did not allow of room for capstan bars of sufficient length for men to walk round, I have screwed piles by ropes, but it will only do when the soil is easy to penetrate. The way we worked was something like this, we had two endless ropes passing round the ends of short capstan bars and round two double purchase crabs placed upon opposite sides of the pile, about six or eight men worked at each crab, four or five winding, and two or three hauling in the slack, one rope being passed through a sufficiently deep upper slot in the capstan bar end so that it did not slip, also one in the lower slot same end. Both the taut and the slack ends of the lower and upper ropes were attached each to its own crab. A man must be stationed at the end of the capstan bars to put the slack ends of the taut and slack ropes into the slots. One rope gives the capstan half a turn when it is taut, and then it falls out of its slot and is slack, and so with the other rope, but it is not easy to keep the two ends of the rope equally tight, and the power obtained is not great and may not be sufficient. It is a kind of makeshift."

"How do you fix the capstan head to the pile shaft?"

"In many different ways. Sometimes it is keyed on or clamped tightly to the top of the pile length by steel wedges, also placed upon the pile length and fixed by temporary bolts passing through the top flanges of the pile length, and also by fixing a temporary ribbed pile into the capstan head, and by connecting it with the permanent pile by bolts or slots, and so wedging is not wanted and it can be raised and lowered. Another way is, two of the internal sides of the pile at top are cast flat for a foot or so down into which the capstan head fits, and the inside diameter is lessened for an inch or two to prevent the capstan head slipping down, but it generally can't do that, even without the narrowing of the pile for that object.

"As the capstan is subject to great wear and tear and sudden strain, it should be strong, for if it breaks the work is stopped. Wrought-iron capstan heads are used, but cast-iron are perhaps better. Sometimes the capstan sockets are made to fit the ends of rails, if rails instead of timber are used for the capstan bars, but rail bars are rather heavy and are not nice to handle. The capstan socket is generally made to receive from eight to ten or more radial lever arms, and the lengths of the bars are anything from 5 to 40 feet, but the latter is rather too long as it is very difficult to control the strain and the bar usually bends and springs. The best working lengths are from about 8 to 20 feet, if the staging is so large. The best height for the capstan bars above the floor stage is from 3 feet 6 inches to 4 feet 6 inches. The capstan bars have to be lifted and again fixed as the pile penetrates, or a temporary pile of different length has to be fixed in it, unless the capstan head can be slipped up and down on a ribbed pile, hence you may want a platform you can raise or lower easily when required. If you use double-headed rails of the same section top and bottom for the bars, you can have them bent up a little near the capstan head, and when you start, the bent end is lowest, and then the bars can be reversed and so the work proceeds.

"Put the men, horses, or oxen in the most natural position for exerting their full strength or a loss of power will result, and therefore it will cost more to screw the piles.

"Should there be gantry staging on the site, the piles can be pitched from a traverser, or by means of an ordinary crab winch. They can also be screwed from the permanent structure

by means of a projecting stage temporarily fixed to it, and of a length sufficient to reach the next span. The pile is run forward upon rollers and placed in the right position. Then it is screwed on the endless rope system previously described, or by passing the rope round a deep groove in the capstan bar ends, and the rope is held tightly by being placed round a smaller grooved pulley fixed about a hundred feet or so back towards the shore. The men haul the endless rope and so the screwing is done. The worst of screwing by endless ropes this way is that the pile very probably may be pulled over towards the source of power as it comes from *one* direction, therefore, support is required on the side of the pile to prevent this tendency. The circumference of the ropes used varied from 4½ to 6 inches, but I have used a 10 inch rope. Small ropes are generally relatively stronger than large ones. Stretch a rope well before using, as it yields, especially hemp ropes. The distance between the point at which the power is applied, and the ground should be as little as possible. In firm sand, when the power has been more than about 20 to 25 feet above the ground, it is often very difficult to screw piles by ordinary means to more than a small depth, as two places in the pile are wanted from which to apply the screwing force, and both as low down as convenient; but in screwing from a second stage care should be taken that the pile shaft is not bent, for it may then be strained like a girder and not merely as a column, also when much power to screw is required it is not easy to avoid pulling them out of the vertical. Always screw them steadily and prevent jerking. Any obstruction, such as a boulder, tends to displace a pile, and loosens the ground around it. In soft soils it may be possible to pull piles upright by pushing aside an obstruction if the pile is given a turn or two after meeting it and before pulling; but it must be carefully done, or the pile may be smashed, and it is only safe to pull it over in easy soils and when much force is not required."

"How much power is generally wanted for screwing?"

"That is not so easily answered as asked. It varies very much, and, of course, depends upon the kind of soil and the size and pitch of the screw. Ten men may be sufficient and a single stage, but two stages may be necessary should the pile be 50 or 60 feet in length, and then not far from one hundred men. An engineer told me the force generally required for piles of usual sizes under ordinary screwing circumstances varies from about 8 to 10 tons to as much as 50 tons, and usually from about 10 to 25 tons, and, of course, the number of men to screw in proportion.

"Ordinary piles and screws have gone down 21 feet in sand in eight hours, and by steam machinery in clay at the rate of 6 inches per minute, and also, to my loss only about 1 foot in a day—and then it is time to stop altogether, should many piles hold like that. To compare what has been done with what has to be done is misleading unless the conditions are alike, for if they are otherwise the power required, cost, and rate of screwing will all be different. I have screwed a 6-inch pile with a 2-feet one-turn screw into 20 feet of ordinary sand with an applied power of 30 tons as calculated by an engineer from measurements and the force of men applied at the capstan bars. There is the surface friction on the screw blade and the pile shaft in the ground, the cutting of the earth by the edge of the blade and the points, and the loss of power from torsion and that applied compared with the effective force, slip, friction, &c., to consider; and the relative surface of the blades, width, and thickness of the cutting edge and the pitch—for a steep pitch means harder screwing. By using capstan bars and men at them, instead of ropes at the ends of the arms worked by crabs, you will find about one-fifth more power is gained, or rather is not lost. Of course, place the men as near to the end of the capstan bar as convenient for work. My lecture is finished, and I am parched."

CHAPTER IV.

IRON PILES.

Arrangement—Driving—Sinking by Water-jet.

"Tell me what you have learned about iron pile fixing, same as you have promised me you will about timber piles."

"Very well. Here goes, then; first a word as to iron piles generally.

"Although a group of piles when properly strutted, tied, and braced have plenty of stiffness, if you have to deal with them singly they are never stiff, but they can be made steadier when getting them down by having two large pieces of wood with a half hole in them, something like the shape of the old village stocks, and by putting or lowering it at low water until it is

bedded in the ground. It must be weighted though, so as to prevent it floating. It acts like a waling, and is useful when the ground is treacherous, and provided it is level.

"From watching the behaviour of piles when doing repairs and at other times, I think it wants a lot of careful arrangement to be sure the load is acting equally on the whole group, or, as may be intended, on say a few piles, and straight down the centre of each pile, for it makes a lot of difference to the strain on them, and it is not easy to make them all take the load at once as wished. It wants a good deal of attention, and the piles are not unlike a pair of horses that are not matched and don't work together properly—kind of now me, now you business. Before finishing reference to driving and screwing, let me say all the parts should be properly fitted together at the works and numbered so that the putting up on the ground is easier and in order to be certain all the bolt-holes agree; and it is well to have the lengths interchangeable and all the same, except the making-up pieces, and all bolt-holes as well as the flanges should fit in every respect.

"When columns rest on a masonry, brickwork, or concrete base the piles ought to have a ring or base-plate right round them to hold them tightly together. It lessens the pier being shaken, and saves the side pushing of the holding-down bolts. I heard an engineer say the weight of the pier above their ends should be not less than about four times any force that might tend to lift them. The anchor-plates should be well bedded upon a solid mass or the strain upon the pier may go in one direction, and that the one not wanted. Don't be afraid of bracing and strutting piles, the more of it the better. I don't think much of a single turn of a screw blade a few feet below the ground for taking a load, although some good for steadying purposes generally, because the bed may become scoured out below the blade and then the screw is no use. Therefore the depth of possible scour ought to be positively known before relying upon the blade for permanent support. A lot can be said as to the grouping of piles, whether in triangles or in rows. In a triangle, although the load upon the foundations is spread over a larger area, it does not give as much lateral strength as when the piles are placed in one row, and taking everything into consideration I think if I had six piles to put down I should not place one at the top of a triangle, two lower down, and three at the base, but have two parallel rows of three piles; besides it lessens the length of the struts and the bracing, and that is something, but, of course, each case requires to be treated in a special way, and I have noticed when doing repairs that if there are six piles fixed thus, ∴ in a triangle, the wind and other force acts principally upon the bracing between the parallel rows, and the pile at the point does not do much towards keeping the others in the right place; anyhow the bracing there does not seem to hold as tightly as it does between the parallel rows, and I have had to watch groups of them in storms, and when the sea has been high, and that is my opinion."

"Now, as to fixing iron piles."

"When the ends have to be placed in rock, which has sometimes to be done in shore pieces, 'jumping' the holes in more than about 2 feet of water is to be avoided, for if the water is not still the holes become filled with sand and drift, and you must not take the jumper out but keep on continuously making the hole. It is ticklish business, because sometimes the rock grinds the jumper, and then the wings and point wear away. Occasionally they have to be worked inside a cylinder by ropes, rods, and gearing fixed in it, the cylinder being movable and held from the end of the part of the pier that is finished, but where the water is deep the ends must be put in the rock in Portland cement by divers.

"I have driven a good many iron piles with a ram, but you have to be careful, no matter whether the soil is sand, gravel, clay, or silt. I like a copper ring on the head of the iron pile and a good long timber 'dolly,' not less than 4 or 5 feet in length, and then the ram does not burst the top. When the ground is hard the best way is to make a hole by jumpers of about 3 inches less diameter than the pile to be fixed, and in chalk soil it is doubtful whether they will go down right unless that is done; perhaps they won't drive at all, or a lot of them will be broken. I have used a ram weighing from 1 to 1½ ton for an 8 to a 10 inch pile and about a 3-feet fall, and never more than 4 feet, unless you want to deal with some old metal merchant that will give a good price for the scrap, and it does not matter how many get broken, or it is a positive advantage to break a certain quantity out of every lot, so as to have a big price for such difficult driving, and get 'extras' that way."

"I understand, no breakages deducted."

"That's it. I have driven them at the rate of fully 6 inches a minute for a few feet. They often rebound, so I had a boy with a lever, the end of it being clinched to the pile. Directly the ram fell, he gave the pile from quarter to half a turn for the first 4 or 5 feet of driving, and they scarcely rebounded at all; and he earned his wages, for I considered fully one pile extra was got down out of about every ten by the turning movement. The points require to be regulated according to the ground. From 1½ to twice the diameter or width for the length of the point is about right, but if it is made too sharp it may break. Iron piles that have to be driven are seldom more than 12 inches in width, and the thickness of the metal is generally from one-ninth to one-twelfth of the diameter. I heard an engineer say, I think it was Mr.

Cubitt, experiments showed that a T-shaped cast-iron pile about 30 feet in length, should have the top of the T two and a quarter times the length of the upright part, and the thickness a twelfth of the top. Of course, the length of the pile must be considered. I doubt if you can get equally sound metal throughout when the thickness is much more than 2½ inches. From ¾ to 1½ inch is best, and piles I have broken up always seemed more even throughout about those thicknesses; but there, I suppose it is all a question of care in casting and proper machinery.

"One thing, don't drive any piles from a floating stage on the sea if you can help it, it will make you pay for the privilege; besides I have known some places where the sea was always so disturbed it could not be done, even if the moorings were as tight as you dare make them. Driven iron piles are not much seen now, and Portland cement concrete seems the fashion, and no doubt it is better. Still, iron piles can be driven in deep water without much trouble from it, and one might combine the two nicely—the iron to act as a shield to the concrete while depositing it, and give it time to set without disturbance and preserve the face."

"Have you sunk any disc piles?"

"Yes, they are all right for fine sand and silt, but you must be careful the discs are the same in form and dimensions upon all sides, or a pile will almost certainly tilt and sink crookedly. I was busy on the Lancashire coast once, and heard that Mr., now Sir James Brunlees, tried a lot of different kinds of hollow disc piles, and that the best was one with a plain flange base three times the diameter of the pile, and circular, with the bottom nearly closed, it only having a hole in it in the centre of the base 3 inches in diameter. Some ribs and cutters were cast on the bottom of the disc to break the ground up if it was hard. This is what I know about disc piles and have been put up to.

"When piles have to be sunk by water pressure, rotate the pile, and don't let it be still long, so as to lessen or prevent surface friction on the pile shaft and the sand settling round it. Always have circular discs and not too large, not above 3 feet in diameter, for they do not sink nearly so easily as the size of the disc is increased. About 2 feet discs are my choice as they go down much quicker than 2 feet 6 inches or 3 feet.

"Don't try to sink them in sand to a greater depth than 18 to 20 feet, and remember that although they may sink easily for about 12 or 15 feet, afterwards they will want some labour. When you have finished sinking piles with the water-jet, it is best to drive them down an inch or two further by a heavy ram and a very small fall, or heavily weight them as soon as possible after having done with the jet; then the disc has a bearing on firm and undisturbed ground, and if you are afraid of a blow on the pile you can have a heavy weight placed on it to help it into position and the sand to become solid. Obtain considerable pressure of water, and always cause the pile to rotate when sinking. Don't let the pressure get much below 40 lbs. per square inch, and use about 60 lbs. if you can get it. I have worked up to 100 lbs. per square inch but not beyond, and fancy there is then too much pressure, and that more sand is disturbed than is necessary. All that is wanted is to make the sand boil and remove itself from the underside of the pile and disc, but always have a few ribs or cutters on the underside of the disc as they loosen the sand as the pile is rotated—besides, should there be a strip of harder soil, it may be impossible to sink the pile without them. A rather large tube and a moderate pressure are best, and a tube not less than about 2 to 4 inches in diameter according to the size of the pile, and it is better from 3 to 6 inches, of course, if the pressure is high a larger size jet can be used, but if it is less than 2 inches it will only make a small hole, and too much below the disc, and not enough water passes through it. Try to ascertain what pressure of water makes the piles sink the easiest. Sometimes they will go down at the start as much as 3 feet in a minute, and often 2 feet, and from that to 1 foot they should do for about the first 6 or 8 feet in sand, but then the rate quickly decreases. The nozzle should be properly shaped so that the jet is whole. I mean the shape of the pipe at the place where it touches the sand. What is wanted is to get just enough force to cause the sand to separate and boil and to push it away from the disc and no further, or some of the water power is wasted, therefore a good volume of water is as necessary as a high pressure. You understand?"

"Yes."

"The tube should project about 6 inches below the bottom of the disc. A toothed tube can be fixed round it so as to help to disturb the ground and strengthen the pipe. The water supply may perhaps be obtained at a sufficient pressure from the local water-works company, then, probably, a force pump will not be required, but the pressure that can always be relied upon should be known.

"In sand, and when the water power can be easily obtained, I prefer disc piles to screw piles, because there is hardly any chance of breaking or injuring the disc; you always know where the disc is, but cannot positively say where the screw is—it may be sound and may not be; in addition, the disc is stronger than a screw blade, as it can be strengthened by ribs almost as much as one likes, and the disc in sinking is hardly strained at all compared with a screw

pile. They can be sunk quicker, and do not require nearly as much plant to do it, for when you have a force pump, a guide frame—something like an ordinary pile-driving machine 25 or 30 feet in height, with a grooved pulley at top in which the chain or rope runs so that one end can be attached to the pile flange either by jaws or temporary bolts, and the other to a crab winch, which, with the guide frame, is used for lowering and keeping the pile in position, and stay the top of the guide frame by ropes to short piles driven into the ground—and a hose and two levers, with a collar to grasp the pile so as to rotate it, you have about all the *special* plant that is wanted.

"Of course, piles can be sunk by water pressure from a floating stage such as a barge, pontoon, or raft, so long as the pile is kept vertical, but there are the same objections to that method as with other piles. Piles are, however, got down much quicker and easier by the water jet than by screwing or driving, but the ground must be loose granular soil, such as ordinary sand.

"There is not much 'extra' to be got out of iron piles. You can only dodge a bit with a length short now and then when you have the right parties to work with, and the inspector is cross-eyed or a star-gazer, but you may get something 'extra' out of the filling them in. As usual I draw the line somewhere. Everything on earth has a boundary line. This is where I draw it. Listen!

"After as much water as possible—possible is a nice elastic word—is got out of the pile, and it is as clear of deposit as convenient—another nice easy word—and before commencing the filling, I put inside the pile everything I can get hold of that is dry, for just then I have but one way of looking at anything, and that is to consider it Portland cement concrete, unless it costs me more to use it; but when the filling is concrete, I make that as dry as mixing will allow, and sometimes hardly that. The inside of the pile is sure to be wet, and that will help the mixing. I never ram the concrete, but gently cast it in. It is only a sort of anti-rust covering, and is put in for that and to keep water out, and no weight comes upon it—it is not like the hearting of cylinder bridge piers. Ramming the concrete is not far from being a mistake, because the pile should have a chance of contracting without straining, and may be it will crack; and it is just as well to remember that although by ramming tightly you may get more solid filling and better protect the inside from rust, the pile may be strained, and it is a choice of evils, possible rust, or strain."

CHAPTER V.

TIMBER PILES. PILE-DRIVING.

General Consideration.

"Now, as promised, I will tell you of a little bit of free trade with some timber pilework."

"That's it. I am waiting for it."

"Well, they let me have 400 feet run of pile-driving. Double row of 16 to 12 inch piles, and there were some fine sticks nearly 55 feet long, and that is a long length for a sound pile, and you have to pay for them."

"Before you begin to tell me how you scamped it, give me a hint or two about piling, and say what you have learned from experience."

"All right. First, when a pile is some distance below the bottom waling, which should be fixed as low as possible, a lot must be taken for granted, and it cannot be controlled much. I know this from drawing many piles; hundreds, I may say. After they are down about 5 or 6 feet they begin to do as they like, and take to irregular habits, and you cannot be certain the points are straight unless the ground is the same throughout, and it hardly ever is. In fact, the resistance they meet with varies, and then they accommodate themselves to circumstances; and even when the ground is very soft they turn to the line of least resistance, and if they have to be driven through several feet of soft earth to reach the solid, they may play tricks and bend about in the soft soil in go-as-you-please style, yet seem to be driving nicely; or they may stick between boulders and can't be driven further and appear to be firm as a rock, and so they may be as long as the boulders do not move, but they often do after a time, should the ground become wet, and sometimes when the next pile is being driven.

"Always be careful to see that the shoe has as large a bearing as possible for the end of the

pile, and is long in the point, and more pointed as the soil is harder. Take a 12-inch pile with a 4-inch or so seat in the shoe for the stick. Well, 12 by 12 is 144, and 4 by 4 is 16, and therefore the pile end has a bearing area upon the pile shoe of one-ninth of the area of the pile. No wonder the bottom often becomes ragged and the pile shifts. The shoe should have a good hold of the timber, and be put on true to a hair, so that the point is in the exact centre line of the pile, or look out for squalls. Now high falls and light monkeys are out of fashion, and short falls and heavy monkeys are the thing, not so many piles are injured. Pushing them down is better than breaking them to bits. You should have the monkey so that its centre falls upon the centre line of the pile. The average centre of the pile should be marked on as exact as possible, and the end of the pile be cut to a template, so as to make it fit tightly to the shoe, or it may not drive straightly. I always take a lot of trouble that way and seldom have to draw a ragged one, and believe they used to drive straight. I mean from start to finish about the same number of blows and to the same depth and vertically.

"When hand-driving in soft earth—it's slow business at the best—weight the pile when the monkey is being lifted so as to stop the quivering and press it down and keep it from springing. Provided the work was of importance, and I was the Cæsar of it, before any pile was pitched ready for driving it should be inspected, its dimensions taken, it should be numbered, numbers be burnt in, and every foot from top to bottom should be marked on by a brand; and perhaps the numbers should begin at the bottom and work up, as there is not so much chance to tamper with two figures as with one, &c.

"Pile-driving is fickle work, for sometimes the piles stick because the points can't pierce the earth, and at others because they are held by friction on the surface of the piles. I have known the shoe to be cast, and the pile end look like a bass broom, and to be all in shreds. When piles split a great deal and they must be driven, the best thing to do is to get harder wood, lessen the fall and increase the weight of the monkey; same as in tunnel lining, when stock bricks are crushed, blue bricks have to be put in. The nature of the ground should govern the hardness of the wood for piles. I always pick out darkish even-coloured wood, and sniff for the resin, and the more in it the better for me. You don't catch me driving many white wood piles, for they become dry and break off short, and are not the timber for piles. Once a bother arose about some piles. There was a layer of hard gravel, and by the way the piles were driving I knew they would split, so I gave the word that Memel piles were not hard enough for such gravel; and I worked it humble like, and said to the engineer, 'I think you will agree, sir, you can't expect me to be answerable for smashing them until we get into the soft ground again. It wants rock elm or as strong timber for this soil.' After smashing a few to shreds, they supplied us with rock elm piles, and then we managed. It is true to say in the same soil the harder the pile the better it will drive, and therefore with less trouble and expense. The monkey should have an even widened-out base where it touches the pile head, so as to get the weight as near the head of the pile as possible; it also falls straighter than the long thin rams of nearly the same width throughout. Grease the ways well, and take care they are as straight as a die, and exactly vertical if it is upright pile-driving, and you'll save money. Make the blows quickly in fine-grained soil, so that it has not time to settle round the pile. In clay there is no occasion for such quick-driving, but take care to prevent the piles rebounding. Remember the same system does not do for every soil, for quick driving in hard soil sometimes smashes the piles; perhaps the earth has not had time to become displaced nicely and settle before being jammed again, and then the pile point turns and quivers and soon shreds, and cannot be driven down properly. Anyone that says piles make the ground itself firmer when they are driven into it, and so cause it to support a heavier load, will have to prove it before that can be swallowed. It is the friction on the sides of the piles that principally sustains them and not the bearing of the points. In hard soils drive slowly, for it is like chipping up a stone with a hammer. You must do it gently, or it will break the tool; and as you can't clear out the hole in driving piles, it seems to me time is required instead, so that the pressed out soil may settle away and take a bearing. I tricked a chap once pile-driving from a barge."

"How did you do it?"

"Well, it was bound to be driving from a barge or nothing, and there were three pile-drivers for us, almost as many as we could work, as the driving had to be done by degrees. Some of the work was let to a chap I did not like too much, and the rest to me. They gave me the choice of plant, so I said to the engineer, 'May I have two of the pile-drivers upon my barge, as Faggitts'—that was the other chap's name—'only wants one.' I got the two. Now Faggitts knew about driving piles on land, but had never done any driving from a barge, so I had a bit in hand of him. If you take any pile-driving and it has to be done from a barge, have more than one pile-driver on it if you have the chance; but don't place them close together, make one steady the other, and have as many as you can conveniently work at once; because, in my experience, the more you have the less the swaying, and the piles drive more regularly and the barge is steadier, and you don't have so much bother with the moorings. Of course, if the monkey does not fall flat upon the pile head the pile does not receive the full force of the blow in the right direction, the pile may be driven slightly crooked and it does not get properly treated and won't penetrate so easily, and therefore you lose money. Old Faggitts

found that out in the soft soil we were driving them into. I said nothing to him, but he did to me. I never told him.

"I have read somewhere that it is wearying work going into details, but when you have to do the work yourself, unless you take care of the details you'll find they will make it hot for you; and after all, any one can speak generally, but when they have to explain in detail what they think they mean, and have to do the work themselves, they will soon find out that unless you know the details and attend to them carefully, that you won't make a profit nor anyone else. Anybody can talk tallish after about a fortnight's training, but then they have to pull up or they will fall at the next fence, which I label 'details wanted.' That's by the way, and I may have made it too strong, but it is as well to sound your engineer. No general is successful unless he knows the strength of his enemy and as much more about him as he can, and acts accordingly, and chooses his own time and place for a battle.

"Driving piles in groups, especially if the ground is soft, and not singly, is good. They go down more regularly and fit tighter, and they seem to drive quicker. I have driven cheap fir piles between elm piles that way, and a good many of the soft ones split when we had to drive them singly. Have as few key piles as possible, because they are liable to be jammed before they are down to the right depth, and then, if it is a cofferdam, it is probable a leak will occur under the key pile, because it is the easiest place for the water to soak through, and the other piles being down below it, stop the flow, and it soon finds out the short-driven key pile. When I notice a spot in a cofferdam at which water leaks through the bottom, unless it is an old stream bed, it occurs to me that the piles have not gone down properly, have got bruised, bent, turned up, or broken off, and I have found out that was the case on drawing them when the cofferdam was of no further use. Once I was ordered to drive some three-cornered piles at the turns in a cofferdam on a river front, but said, 'Square or circular shall be driven, but any other shape I will try to get down properly, provided they are carefully fitted and bevelled, but you really can't expect me to be answerable.' They deducted a fixed amount if after the piles were pitched there were more than a certain number visibly damaged or smashed, so you may depend I had a good look at the sticks before they were driven.

"I have driven piles 60 feet in length, kind of giant sticks, but 45 to 50 feet is long enough for good sound piles. Socket pile driving piecework I avoid, for the joints are ticklish business; and if a pile of ordinary length will not do, I throw out a mild hint whether the better system to use would not be Indian brick or concrete wells, or to spread out the foundations so as to get a sufficiently large bearing, or have a fascine platform, and sink it till it is firm, and test its stability properly by a load.

"There is a great deal in starting the driving correctly. I always am very careful at the start, and experiment and watch how the piles drive, and vary the fall a little until the best is known. Few considerable stretches of ground are of the same kind, and to fix a certain fall throughout is not the thing, it generally wants varying. I have easily driven piles in fine sand by having two small pipes, one each back and front, reaching a few inches below the point of the pile, and sending water down them under pressure, and by keeping the pipes on the move so that they can't be gripped. I worked out with the pipes the place where the pile had to be pitched and made a profit that way, because not only did the piles go down much quicker, and a lot of blows were therefore saved, but the piles were easier to start right. I used to call my two pipes the two bobbies, because they steered straight for their station, and these two did the same office for the piles.

"Now a word as to systems of driving; the method must suit the ground. I knew a man that believed in nothing but driving by gunpowder; he must have been going in strong for gunpowder tea, or have been in the militia, for the soil he had to do with was not homogeneous, and had boulders and other hard obstructions in it. It was not like soft sand and clay, consequently many of the piles were broken. The noise also was a nuisance in the dock, and cattle that had to be unshipped from the steamers were so unruly that they had to stop the gunpowder pile-drivers; besides, to do much good with them, a large charge is required, or it costs too much. The power necessary to work the machines is better obtained by other means, and can be without so much noise or shock.

"I have used all sorts and sizes of monkeys, from half a hundredweight to four tons, but heavy rams and short falls are the best, and steam for the power if the contract is considerable and will pay for such plant; otherwise hand, unless the piles are large and have to be driven a long way. A sixteen hundredweight monkey is about heavy enough to work nicely by hand, but it is not sufficiently heavy for a 12-inch pile, except in soft ground. For sheet piles a hand machine is good enough, for it can be moved easily, and six to eight tons weight, being about that of a steam pile-driver, costs something to shift, unless there are rails and tackle handy. Of course the blows are quicker with a steam pile-driver, and in sand that is a great point as the ground has no time to settle round a pile; but should the soil vary and be hard and soft, it is well to slow down the machine at first to lessen the fear of smashing the piles and shaking them till they tremble to destruction. I have worked a lot of different kinds of plant, and driven many piles at once, and the power was obtained from

one engine giving the motion by driving bands, and in another case with drums fixed on the engine shafts, the chains being carried over sheaves to the different pile engines.

"This is my idea of pile-driving:—

"1. Steam driving. 2. Hand driving, if the piles must be driven very slowly, and there are not many to drive. 3. Never use gunpowder pile-drivers, always prefer steam, hydraulic, atmospheric, or some other motive power.

"Gunpowder is more for blowing up than anything else, in my opinion, and I know the pile shoes often shed in driving with it; that is, they loose their hold of the piles and become detached.

"A pile should penetrate regularly, and after the first few blows drive less and less, as then you have a good idea it is all right and uninjured. Uneven penetration is a proof that piles are not all right, and when they sink suddenly there is almost sure to be something wrong, and they are most likely being over-driven, shredded, frayed, shoe-cast, or split up. The rate of descent should be noted. It may be considered they are driving properly if they sink about a foot at a blow for the first one or more, and then 8 or 6 inches, and when they get down to one-eighth, one-fourth, or half-an-inch a blow for some successive blows it is time to stop and consider. I have driven piles with as few as ten blows in sand with the aid of two water pipes at work fore and aft, as mentioned before, and have had to give a pile as many as 300 blows, and when they want as many as that, with all due deference to everyone, the ground is firm enough to build upon for permanent foundations without piles. My experience goes to show that piles are often driven further than they need be, if only for use as a cofferdam, and that back struts and counterforts are better than extra depth in the ground, provided leakage is prevented. 8 to 10 feet down for solid clay, 10 to 12 feet in gravel, and about 15 feet for ordinary soils, and more care taken to ascertain the piles are where they should be, and that they are sound and whole, and not turned aside, bulged, and injured, would be my practice. In boulder ground, in my opinion, piles should not be adopted; for broken, crushed, and twisted fibre bass-broom shreds are not piles; they are out of place and should be used for clearing leaves from garden walks. The longer the piles the softer should be the ground they have to be driven into, or they shake so much, and cost more to drive.

"Unless always well buried and at such a depth that neither the moistness nor condition of the earth vary, I scarcely believe in timber pile foundations at all, except in very peculiar cases, and as a kind of aid to the main support or to help to prevent the toe of a wall from being thrust forward, but for cofferdams, jetties, piers, and such structures, of course they are useful. In hard and most gravelly soil avoid them, and also in sharp sand, if you cannot use the previously-mentioned water-pipe arrangement fore and aft; and although in ordinary clays they drive nicely, and you make a bigger profit than in sand, it puzzles me to discern what is the use of them for permanent foundations, except to help to prevent a wall sliding forward, because when a pile is driven into most clays the clay becomes tempered and softer, and a layer of concrete put in a proper distance down is better and much more certain, and distributes the load more equally. Elastic soil is bad in which to drive piles, for it yields and then rebounds. A pile will sometimes spring back almost as much as it is driven, and in such a case it is well to let the ram or monkey rest on the pile immediately after the blow is given, if you are hand-driving, or have an arrangement so that it is weighted directly each blow is delivered, and perhaps the best way is to hang heavy weights on the pile. In driving in firm sand the ground at the surface becomes considerably displaced, in clay about half as much as in sand.

"Pile-driving is different to masonry, and I always read the specification for pile work, and then judge whether and how a bit 'extra' is to be obtained, and guess as to the knowledge of those I have to deal with, and act accordingly. Sometimes a specification simply says all the piles are to be driven to the same depth or as shown on the drawings. That may be right should the ground have been tested by experimental driving, or the nature of it be known; but if not, I don't take much notice of the specification, because I hate waste, and can't afford the luxury; and it stands to reason that simply because a lot of piles are driven to the same depth they are not equally firm, nor will they support the same load unless the soil is exactly the same, and they drive well and regularly to the same depth and all nearly alike inches by inches, and this seldom occurs. Often 'extra' profit is to be had, as you will soon hear described, for when piles will not drive further than half or a quarter of an inch a blow they satisfy me they are tight enough for the purpose intended if they are at a fair depth and not wedged by boulders; but between ourselves, should a building of any kind have to be erected on piles, and anyone I really cared about had to live in it, I should always weight the piles for as long a time as possible after finishing the driving and reasonably more than the permanent load, watch the effects, and act accordingly, particularly in elastic soil.

"Remember a pile sinks less after it has rested than if it be driven continuously, therefore always take note of the set when the driving is proceeding, and not just at the start, or after an interval, although one does that for one's own benefit, and with a view to 'extras'; and no one wants to drive a pile an inch more than can be helped—at least I don't, nor have I, and it

is certain never shall.

"You want to know when to stop driving. The time has arrived when a pile penetrates very little, and nearly equal for several successive blows of the heaviest ram by which it has been driven at the usual fall.

"A word as to tie and sheet piles before referring to the way I have worked piles for 'extra' profit. It is difficult to make a main pile and a tie act together, one or the other is nearly sure to have to bear more than its proper strain, and the tie rod becomes eaten by rust, bent, and loose in the piles. In taking down old banks and quays you will generally find the main pile and the tie pile are not held tightly by the tie rod, the tie pile is loose or pulled over, perhaps when first strained, and then becomes disengaged when the main pile has set to the strain. The tie rods want to be very carefully and frequently adjusted, if possible, and big washers and cleats on them are required. They hold best in firm sand, not so well in clay, and in large light loose soil, such as ashes, they are not much good. It is an impotent arrangement and it is always uncertain whether they will act together. Don't undertake to tighten up the rods. Fix the piles, and let the engineer see to the tightening up, as you may injure the piles.

"When I have to drive a lot of sheet piles, of course the piles are supplied to me, and I only take the driving. You may be sure the timber is right, and that the edges are sawn square so as to drive tightly together, and that the point is in order. I find it always pays well to temporarily place a baulk at the ground line like a waling, but not fixed to the sheet piling, as it guides the piles, lessens the shaking, and they drive easier and better. It appears to me piles cannot vibrate without force, and that is not where it is wanted, so it is wasted motion. Agitation when drawing piles is all right, but when you are driving you want it in the ground itself, and not in the piles. Once when I had to drive some thin sheet piles, I made a movable guide frame, the side against the sheet piling being planed and greased. It was like one bay of a timber-lattice bridge, and it well paid for itself as it steadied the piles.

"In taking a contract for drawing piles always find out how long the piles have been driven, for if they have been down many years they will be much harder to draw than if they have only been fixed a few months. They can be drawn by lever, hydraulic jack, and chains, and pontoons in a tide way."

CHAPTER VI.

TIMBER PILES.

Manipulation for "Extra" Profit.

"Now, I'll tell you about a bit of 'extra' dodging that rather scared me. First, let me say, no one can ever know how much I hate waste—it can't be measured."

"You and me are alike, a couple of turtle doves on that question."

"We are. Finish up, and we will have another. I remember Lord Palmerston said, dirt was matter out of place, or something like that. Now I think piles are often good timber out of place, so I followed that lesson and said to myself 'What a lot of good timber is going to be buried; and really it is breaking and loosening the ground too much to please me, and that's a mistake, besides placing extra weight on it'; so after dwelling on the subject as much as suited me, I decided it was waste, and that it was poison to me. I had trouble on my mind about it and it made me feel thirsty and does now. Pour another out."

"There you are."

"I'm better now. Well, I wrestled over the waste question some time, and finally made up my mind not to be a party to it, it being against my principles, and, like us all, no man shall make me swerve from them, especially when they agree with my pocket."

"Certainly; shake hands. That is good!"

"Well, there was only one way to do it, so in order that every one might have their way to a certain extent I decided to drive first one pile to the depth as ordered and one to the depth that suited me, and therefore both parties were satisfied and believed they had got what they wanted; for while I left the other man, that is the engineer—excuse the disrespect—to his happy thoughts, I descended to simple practice in a way very comforting to me. Knowing it is not every pile which is driven that drives whole, or is according to drawing, many often

being twisted and knocked to shreds—although I have seen them driven through a layer of old brickwork, and whole, too—and that there is a lot of uncertainty about them in some ground, I dwelt on the matter, and came to the conclusion that according to the drawings every other pile would be driven about 3 to 4 feet too far down, and that all concerned hardly agreed upon the depth to which all of them should be driven, and that I was the chief one to be considered; so I cut off a few feet of the top of nearly every other pile, and varied the length according to whether the pile happened to drive hardly or went down gently."

"Precisely."

"Somehow or other the ground seemed really grateful to me, for more of the piles were cut off than I originally intended. They must have passed the tip—may be the worms did it; anyhow the ground, after a few had been driven, seemed to become harder, and we had more sawing to do than ever. I like sawing. You see your work, and all is above board and nothing hidden and no deception. Suits our principles. Now, you are like me, you don't wish to disturb other people's minds, we are built on the lines of love too much, and tenderness is better than anger any day."

"That's it. I consider you were doing a kindness all round, or as near to it as makes no difference!"

"Well, in order not to disturb any one, it took some thinking over as to the best time to ease off the tops. I mean cut the heads off and put the rings on again, and give the tops a properly seasoned appearance. I used to call it put their hair right. Now, you know docks are not like railway works, for the men are nearly all at one place; here we were in the middle of a large town, but you'll excuse my naming the place, I am too polite to do such a thing without permission. No one was about at dinner time, for all the chaps passed the gates. The place where my work was was shut in nicely, and as there was always a row going on from the traffic close by on road and river, and loading and unloading, it was a really nice little home in which to do a bit of engineering-up-to-date."

"I understand; a convenient spot for scientific experiments in saving labour and the waste of good material."

"That's the lesson. I found dinner time was the best after a week's scouting, and that the road was clear as daylight, for all the spies were away, and there was only one that ever hung about, and he was a young engineer just come to the docks straight from Westminster. He was a nice sort of chap, and a smart one, and had the kind of face a girl looks fond upon from what I have noticed of their tricks. Of course, he did not know much of actual work, being a new pupil, I heard. By the way, what a lot of pupils to be sure some engineers turn out. I almost fancy a few of them must make as much from the schooling branch of the profession as they do from work; but let them, it is nothing to do with me, but this pupil I can say was no fool, though, the same as all new hands, the work was a novelty to him, like a new toy to a child.

"Now, the only thing to interfere with the 'extra' business as described was this pupil, so I decided to fix his attention, if I could, in another direction, and sweetly, so thought it out, and said to myself, 'You have had more difficult things to steer through than this—rather hotter, I fancy.'

"It so happened, just then, they had pulled down an old tavern, and built on the site a showy crib with balcony overlooking the river, and they had a lot of relics on view, and two nicish girls were there. Good figures, you know, and fairly on; so I made myself particularly gracious to Mr. Pupil and pointed out, submissive to his superior knowledge like, a few things on the work. Then the plot was let loose this way. I started a kind expression on my face, and said—

"I'm afraid you find it rather rough, sir, here; there are not the nice feeding places they have in town, in fact, I think there is only one near here, sir, at all fit for you."

"Where is that?"

"It is the Anchor and Hope Hotel, sir. I can hardly direct you to it; but you have plenty of time to go there and get back fully a quarter of an hour before the men's dinner time is over, if you will allow me to show you the place, and they have almost a museum of relics of the river.'

"The relics settled it, and he took on all right, and I knew then things were working smoothly and the wind was getting round to a nice steady breeze from the proper quarter. He was a good-natured chap, and one could see liked inspecting the woman portion of creation better than works, at least, during dinner-time, and I don't blame him; some men are built that way, and can hardly say 'no' to a woman, for if they do they think they have done wrong and been unkind. Poor things! Well, we got to the place, and, fortunately, no one was in the private bar."

"You mean lobby. Don't insult the place."

"I humbly beg pardon."

"In we went, and it was lucky, for the better of the two girls was on parade; they were nieces of the landlord, so had more latitude than paid slaves. I went in first, and Mr. Pupil turned to me and said, 'I will be with you in a minute.' Now, that was just what I wanted, a word or two of priming for Polly. So after shaking hands with her, said:—

"Polly, in a second or two a young swell will be here just new on the works, and will be on the job to the finish, three years, so make yourself pleasant as possible. Three years' presents and fun, to say nothing of odd trips out, are not to be snuffed at; and he is rich they tell me, and should be real good business all round, if you work him right.'

"She laughed; and before I could say any more the door was on the move, and in Mr. Pupil came. I kept my weather eye on him, for I can generally tell, when they run young, whether a chap is smitten sufficient. I saw the place would be a pleasant diversion, just seeing one of the tender gender occasionally, after being all day among men; so to make it appear I was a wolf on business, said, 'Please excuse me, sir, but I have to meet a gentleman at half-past twelve.'

"Certainly. Do not let me detain you.'

"I just turned to Polly, and said, 'Show this gentleman your museum of relics, and the private room looking across the river, as I think it may perhaps suit him for an odd lunch now and then.' Polly twiggled.

"I saw they were started on the road of mutual admiration, and travelling pretty, and that he meant calling again. She also seemed to like the prospect, and knew how to work the game of fascination right, and she did; so the only one in the way of preventing my doing a bit of engineering-up-to-date with the pile-driving was now removed in a nice harmonious way, and to the entire satisfaction of the company's resident engineer—no, hardly that, I mean mine. I consider I did a kind action to all parties, not excepting myself. What a blessing women are, if you use them right. Mr. Pupil had his lunch at the place every day, and Polly and he understood each other, and got on A 1, so I was told. It is soothing work bringing happiness to two young hearts as beat soft.

"*Next day we started cutting off the pile-heads*, while Polly and Mr. Pupil were occasionally very likely pitching their heads together so that I should not have all the fun. Well, we managed to so drive the piles after a day or two as to be able to cut off, generally during dinner time, from 2 to 4 feet, and I should think must have done over 200, when one day, just as we had nearly sawn one through, up turned Mr. Pupil. Polly and her sister were visiting, and never told me they were going, so the Anchor and Hope did not weigh-in much from him that day. My ganger, who was doing the sawing trick with me, looked a bit down, but he is not so educated as me; so I turned to Mr. Pupil and said—as he asked me what I was doing, and what was the matter—'Got the pile down wrong, sir, and shall have to lift it. I think it's broken off, or gone ragged, may be it has struck an old anchor.'

"He just looked very hard at me, nodded, and went away. It was a close shave, and lucky it was not the chief engineer. However, we had a quarter of an hour to work on that pile before the men came back, and we soon ruined it with bars and tackle. Anyhow, we raised it in no time, for we had the best tackle and everything you could wish for. We split the pile right across. It was only down 5 feet, and most of it in mud. We quickly cut it up into cleats; and out of misfortunes, between you and me, I always make as much as I can. So when Mr. Pupil returned I said to him, 'It wants a lot of experience to know when piles are not driving right, but 25 years has not been lost on me, sir, and I will have good work or none.' Perhaps 'none' would have been the correct word; but anyhow I used it coupled, and you can't complain, for if the pile had been cut there would have been none in the place where it was thought there was. We saved a lot of driving, and I said to myself, 'It is lucky this bit of wharf wall is left to me pretty well, because, as nearly most of the piles are a bit short, the wall may settle if they load it much or build on it; still I think it will settle equally, and then it won't matter so much, and they are not going to build on or near it, that I know,' so I saved nearly 1000 feet of driving on the lot; but here comes the shake. I forgot to say the piles were driven, and a platform fixed on the top for the wall in the old style, but it has gone out now, since Portland cement concrete came into fashion. One day the engineer walked over the work with two or three directors, and, after a lot of talk, they decided to build some 3-floor warehouses upon the quay, after some figuring and dwelling on it. That made me think. I heard someone say, 'The piles are 15 feet in the solid ground, and therefore will safely bear the load.' So they would if they had been, but not many hundreds of them were, and many were in 5 feet of little better than mud, and as some had been cut off 4 feet, those piles were only 6 feet in the solid ground. Understand, this wharf piling was only the beginning of a long two or three years profit for me, and I knew the warehouses would be sure to settle, and if they did unequally, over would go the show. I always avoided the quay wall afterwards; it seemed like a sort of spectre to me.

"One day the engineer sent for me to come to the office. Of course I was there sharp. He said:—

"I want you to tell me your idea of the character of the ground upon which the western quay wall is erected?"

"Don't you think I was lucky, old pal? Here was my deliverance. It was not exactly a path of roses—there are not many knocking about now—because if I said it was soft ground he could reply, 'You had a very high price for such driving.' If I said it was firm, I felt sure, should they build a warehouse on it such as I heard them talk about, it would sink or topple over, so I had to be careful how the ship was sailed. I answered the engineer like this: 'If you'll excuse me talking to you freely, sir, I will speak my mind; but I most feel abashed with such as you, for you know a thousand times better than me.' He then said to me:—

"Be at your ease. I wish to hear exactly what you would do in the matter if you were in my position. I have made up my mind; in fact, I have already committed my views to writing.'

"Thank you, sir. Well, sir, I think it is a risky place, although the piles were many of them dreadfully hard to drive, and wanted a lot of care and all had it, I think, judging from the variation in the depth to which they went down under the same number of blows, that the ground is a bit mixed, and therefore I should choose another site, as there is plenty of room.'

"Your opinion somewhat coincides with mine. Your idea, I may say, is one which the configuration of the ground leads me to think is the case without doubt. It is therefore probable that in a few days I may have a considerable length of the quay loaded with rails, nearly 2000 tons will arrive for the main and branch lines before the end of the week, as I intend to load part of the quay with about 8 tons per square foot in order to test it. In any case, much as I am urged to commence the warehouses at once, I shall not do so until the quay has withstood the test during at least a month.'

"That is a heavy test, sir.'

"You can go now!' He bowed, and smiled his thanks, and I withdrew. Of course, I said nothing to anyone. It don't do to annoy the gov'nor. Well, in a few days the rails came, about 2500 tons of them. The engineer sent for me again and said, 'I wish you to see the rails stacked on part of the quay in accordance with instructions you will receive.'

"I could only say, 'Very well, sir,' and withdraw. I felt I was had again, and went straight away and had a pull of rum. There was no help for it now. I was in the fix and had to get out of it somehow, and what made it doubly worse was being ordered to superintend my own ruin. Listen, for you will when I tell you I might have been tried for having killed or injured 400 men and one director! It was a near squeak for the lot, and as it was—No! I'll tell you in a few minutes what happened.

"Well, we stacked the rails over the place according to the engineer's directions, after Mr. Pupil had taken the levels—he also took them every day, to see how things were going. I made no remarks, for fear I might say something that would lead to further enquiries, and took the cue from a chap I once knew, the biggest rogue out he was; he could please them pretty, and never had any fixed opinions about anything, like some of our politicians, or could twist them about to suit the times; and he set his sails according to circumstances, so as to be pleasant to everyone, and was liked and respected by a lot that knew no better and could not see through him, but he had not a bit of honesty in him. Fact was, knowing I had got all I could out of short driving and cutting off these piles, I played a mild game of respectful bluff, more particularly as Mr. Pupil told me the ground had only gone down a mere decimal of an inch.

"One day the engineer walked over by himself and said to me, 'Come to the quay wall.'

"We got there, and I felt I had soft sawder enough in me for anything. He led off by saying, 'Although this is a severe test it is not altogether satisfactory to me. The rails shall remain in their present position for at least another month. I have known, as in cylinder sinking, subsidence to occur very suddenly and unexpectedly. I do not like the system of foundations upon piles, but have been overruled here.'

"Now what he said pleased me much, because I thought to myself if the wall does break up it will not be exactly a heart-breaking trial to him. Well, all went on as usual for a fortnight, and I heard nothing further till one Friday about 5 o'clock. It was near low water, and Mr. Pupil came to me and said the engineer wanted to see me. I went towards the office, but on the way met him and the engineer and three or four other swells, two of them that came before. I touched my hat, and walked behind. I heard the engineer say, 'Mr. Selectus, although the position is very good, I am not satisfied with regard to the foundations, more especially as I believe the ground to be varied in character; and on an old plan, dated 1720, I note a stream marked here; in fact, Mr. Pupil has searched and found a water-course existed almost from the earliest known times.'

"If he did not say exactly that, it was just like it, anyhow he spoke up pretty straight. One of the directors (I heard they were all such afterwards) said, addressing the engineer, 'I have an idea. The men will cease work, I think, very soon?' 'They will,' said the engineer. 'Have you any objection to their marching and marking time, as it were, upon the rails, as a final test, as I remember we so tested a suspension bridge I had erected at my place?'

"The engineer assented, and remarked that although the weight of 500 men was not much compared to the weight of the rails, the vibration they would create might cause a sudden subsidence. However, he slightly bowed to the director, and said, 'I leave the experiment entirely to you, although I may say it is not unattended with risk; for the test load now imposed is a very severe one for such unstable soil, and the effects of vibratory motion are usually most deleterious.'

"However, the director, after some talking, had his way, so the men were fetched. We had about 700 at work then, the company's own men. I will cut it short. Well, the director told the foreman, as the engineer asked him to do so, what he wished to be done, and the men marched up and down I should think six or seven times. It did not take long, and they soon got into step, for we had a lot of militia chaps at work; and then the director, who seemed to be enjoying himself, said, 'Now we will try three trips, double quick,' so the men went by once all on the smile, and we were as near laughing as smiling allows, when!—

"It chokes me to think of it. Fill up the glass, so that I may keep my pipes open. Thank you, I was near being blocked up. Well, about half of the men were behind the rails, and we were all, except the director-in-command I'll call him, looking on and stationed on a mound close by. I shouted out—seemed a sort of sudden impulse—

"'Look out! the ground is settling. Run for your lives.' About half of the men heard me, and got away, but the front lot went on. I should think 200 of them. Bless you, the ground began to yaw and sink with the rails very quickly, and the wall pressed forward and toppled over in one place for about a 30-foot length with men upon the top of it, and the director as well, and fell very slowly, and quite majestically, right into the river, and there was a splash and crash. I said before it was nearly low water, and I should think there was about 5 feet on the sill and 2 feet of mud. After all, somehow or other, only about thirty men and the director were cast, and they were all taken out right, for there was plenty of assistance. Still one man had his arm broken, which was a good thing for him as it turned out, for the director made him one of his lodge-keepers; but as he was a smart-looking chap, and had been brought up right, and could not work much after, it was an even bargain."

"How about the director?"

"Ah! that's the only fun we had; for I tell you, when I saw the men and the wall go over it made me take root, and my boots were nearly pressed into the ground, and they said I went awfully white in the face. It did give me a shock; but it was lucky the break-up was so slow, for those that could not get off had time to jump and get clear of the rails, but I tell you it was a shave. As it turned out, the director had the worst ducking of the lot that fell in. He went sprawling into the mud; but he could swim, and when we saw him I nearly burst out laughing, only my feelings had been so shaken, for he was smothered in slime from head to foot, and looked like a real savage. All his hair, face, and beard were thick with mud, to say nothing of his tailoring; and I tell you he put me in mind of a baboon just then, and I don't think he will attempt any more testing.

"Of course, the warehouses were not erected upon the quay, and the engineer was not sorry at the way things had turned out. Anyhow, he let me do the clearing away the rails and the rebuilding; and I drove in the piles just the same length as the others, and nothing was said to me or suspected. It worked all right; but suppose a lot of the men had been killed, and the director as well! I tell you it was a near shave, and all before my eyes. It would just have killed me; for I should have known about another 3 feet down of those piles would have made them stand all serene. As it was, my wife said I was that disturbed in my sleep, and kicked so, that she hardly got a wink of rest, and had to double herself up in bed for fear of having her legs broken; however, it wore off in time, although once I sent myself and my old woman clean off the bedstead, and I saw by the light of the moon we were sitting on the floor, and the clothes were all of a heap close by. It made a nice picture of domestic bliss. My wife gave it me hot, and she said she would stand it no longer. I said, 'Don't grumble, you have not got to stand. You are sitting down now, and you ought to know it.' She said she heard me mumble several times in my sleep 'Cut 3 feet off her, Bill!' That was my ganger's name, and, of course, my brain was alluding to cutting off the piles; she thought it was her—no fear. Still, she always makes out I was not so good as I once was, and she felt sure Old Nick and me had night conversations. I laugh over the whole thing now. I hardly did then."

CHAPTER VII.

MASONRY BRIDGES.

"Now I'll tell you how we got on with some masonry bridges. Being more of a scholar than most of them—thanks to the parish school—and being able to read, write, and sum a bit, I knew a trifle extra to the other chaps, and was made a ganger when very young. Somehow or other, I drifted into being crafty, and just then made friends with a man that was up to every game, and remembered old George Stephenson. He could tell and teach you something, and did me; but even I have known the time when we hardly ever had a drawing to work to, except the section, and have walked many miles behind an engineer, and heard him say to my partner—who was a mason, and a real good one—'Joe, put a bridge there, the same span and width between the inside of the parapets as the others.' 'All right, sir!'

"You know that was the time of the rush for railways, and few understood the business. Too many do now, I think, and the old country is too full of mouths generally. Then there was scarcely time to think, much more for many drawings; they were made after.

"We used to take a bridge at a time, at so much the cubic yard, and we did put it in thick, abutments, counterforts, wingwalls, and parapets, and all the work was as straight as could be made; and I have known my partner, Joe, nearly drawn into tears when he was forced by circumstances over which he had no control to own an arch to a bridge was not exactly a straight line. Spirals and winders made him that waspish as I took good care to make myself particularly wanted somewhere else than at the bridge at which he was busy when he had to do them.

"Some of the bridges we built have enough masonry in them to nearly build a church or a small breakwater, and lucky they have, as it gave one the chance of a bit of profit; and the depth of the foundations was hardly so deep as shown in the drawings made after we had built a bridge. Somehow or other our imagination used to scare away reality, and we generally were paid for a foot or more extra depth all round.

"Joe said that was the way he got his professional fees for building a bridge without a drawing, and the only way he could and, moreover, did; but he always put the masonry in solid, that is to say, when he considered it should be, although hardly, perhaps, to the specification throughout, but the face looked lovely; and if the inside work was rather rough and tumble and really "random," he knew what a good bond was, and would have it, and was really clever at selecting the right rock in the cuttings for masonry; but there, no one can expect the filling-in work to be done the same way as the facework.

"Of course, it was not exactly honest to be paid for more work than we had done; but it is only fair to say we were generous with our *extra* profits, and always treated the inspector and our men right. We were bound to educate them and enlighten their minds. I own it was not right, and, after all, it would want an 'old parliamentary hand' to tell the difference in dishonesty between over-measurement founded on lies and stealing. However, one is supposed to be the result of cleverness, the other, crime.

"I forgot to tell you we took a cue from a director who occasionally walked over the line, and who always showed about half-an-inch of his cheque-book sticking up out of his pocket. We were told he wore his cheque-book like the mashers do their pocket-handkerchiefs; but that he was not worth much, and was on the war path for 'plunder,' and so were we, and took his tip. I said to myself, as he has brought a new fashion into play in these parts, let us take the hint.

"So we will,' said my partner.

"How long is the specification for masonry?"

"I am sure I don't know. What *are* you talking about? I never read such things. All I want to know is for what purpose the bridge is to be erected, and whether it is to be coursed work, ashlar, or the same as the others, and up it goes according to my specification. I'm above other people's specifications, thank you. What's the use of my education if I am not? Do you think the alphabet must be again taught me?"

"I beg pardon, partner, you are right; but appearances go a long way, and shamming is fashionable.'

"Oh, well, have your way; we all look better when we are properly clothed; and I once heard an engineer say he never felt right when on any works without a plan in his hand, and we know a music-hall singer is generally not at home without a hat; besides, it will please them to see we have the specification always on the premises.'

"That is what I think.'

"Well, I made two copies of it, one for Joe, my partner then, and one for me, and wrote in large letters on the top, 'Specification—masonry —bridges and culverts.' Then we both showed the top out of our pockets, with that writing on it, in the same way the director did his cheque-book. It worked beautifully; for a few days after a big engineer came down, and we heard he had said he thought we were the smartest masons on the work, and he was pleased to see we appeared careful to comply with the specification, for he noticed we each had a copy in our pockets.

"The fun was, my partner had never read it at all; I only when copying.

"The game worked really lovely; we were looked upon as downright straight ones, and the inspector—who wanted some dodging, I can tell you, as well as a tip, now and again—was taken away and posted at the other end of the work, and then we made hay while the sun shone, and no mistake. We used to make the bridges rise out of the ground; we gave some drink to our chaps; and then, as soon as the wagons with the rock arrived from the cutting, in it went. The difficulty was to keep the face going fast enough for the filling-in work. It was a game. First a wagon-load of rock, and then—well, I suppose I must say—the mortar, but it is squeezing the truth very hard indeed. There was Joe, my partner, superintending in his own style, the raking and mortar business, and I was busy at the facework looking after our best mason.

"Give my partner his due, he was always careful about bond and throughs, and he was fond of mixing up the flat stones a bit, for he said it prevented their sliding on the beds, and always maintained that the weight above kept all tight enough and more than the mortar, so long as the stones were flat and large. I said, it's lucky it did.

"One day he frightened me. We were short of stone, owing to a mistake in the cutting, and so the facework was up a good height. At last Joe caught sight of the engine and wagons coming round the hill, and said to me—

"'Hold hard, here they come, thirteen wagons; they will fill you up both sides.'

"'I agree with you; they will, and more.'

"It was then past one o'clock, and Joe called out to me—

"'Before we leave I mean to be level with you, but you must help.'

"'Joe, it can't be done.'

"'Away with your cant's; it *shall* be done.'

"Well, it was tempting us too much, such a lot of rock to work on all at once; if we had only had a little more than sufficient for one day's work at a time, we could not have done what we did. By Jove, he did go it. Down came the rock—I know you will kindly excuse me from calling it building stone.

"'Easy does it, Joe, or you will burst the show.'

"'Not I,' he shouted.

"Now listen to me, for this *is* truth. Never since the foundation of this world did bridges grow at this rate. It beats mustard-and-cress raising and high farming into fits.

"Smash them in, lads, bar them down; give them a dose of gravel liquor. Now then, for some real cream mortar.'"

"These, and such-like, were his war-cries."

"'Bless me, if the mortar is not as thin-placed as the powder on a girl's face, Joe.'"

"'It's pretty.'

"'Now, lads, five minutes for beer.'

"All was soon comparatively silent.

"'Joe, you must draw it milder, for the row going on is more like an earthquake let loose than anything else I can think of, and it may spoil the game, for it is bound to draw a crowd.'

"'All right, partner, I never thought of that. Talk about Jack and the beanstalk, this beats it to squash. It's lucky the rock works in flat, and is not hollow. Of course, all the stones are on their natural beds, according to the specification—understand that. Don't let us have any mistake as to the catechism; if they are not, they will grow used to their new ones and shake down to rest.'

"I've never built a bridge that fell or gave much, perhaps a wingwall has bulged, but then it is the want of proper drainage and backing and nothing to do with the masonry. *We* only

attend to the masonry according to the specification. Chorus—According to the specification. But they all do it, as the song says.

"It's my firm conviction that the man that invented wall-plates ought to have a marble monument in his native town, for they are beautiful distributors of weight, and when the stones are small, they are salvation for such masonry as we made rise."

"I agree with you, they cover a multitude of sins, and are powerful agents in the cause of unity and good behaviour."

"That is right."

"Have a sip?"

"Yes."

"I nearly got bowled out once at the masonry game. This is between ourselves."

"Of course, we understand each other; shake hands."

"They nearly caught me."

"How?"

"We were walking over the work—when I say we, I mean a party of directors, a couple of engineers, and the resident engineer. An unlucky thing happened. Someone said, 'I should think a good view of the surrounding country is to be obtained from the top of this bridge.' Now, you know, in those days, some engineers liked offsets at the back of a wall very close together, say about every two feet, as they thought the backing remained on them, and helped to prevent the wall overturning; but it seldom does, the backing is usually drawn away from such off-sets. However, unfortunately, most of these directors had only recently returned from Switzerland, and had been up the Mortarhorn, I think they said—or thought they had, or read about it in a guide book. Anyhow, they started climbing up the back of one of the abutments. They ought to have known our work is not quite so solid as nature, nor as the Romans made in the old slow days when they were not fighting; but it is all right for the purpose intended, at least, for what we intend it, and that is enough. The abutment of the bridge I am referring to was 50 feet in length, and what must they all do but start at once at the climbing business, like a lot of schoolboys eager to get there first, and I had only time to think a moment, and to shout,

"'Be careful, gentlemen, please, the mortar has not had time to set yet, it's green.'

"Lucky, I said 'yet'; but between you and me, I should be an old one, and no mistake, if I had to wait till it set right.

"They got upon the first offset all serene; but when they footed it on the third, down they came, and humpty-dumpty was not in it with the show. It was a flat procession and a general lay-out, and such a rubbing of mid-backs occurred as few have seen before. They fell soft, though, as we had partly finished backing up the bridge. I was nearly had; but I had a bit in hand with which to squeeze home at the finish, and get in the first words. They were:—

"'Gentlemen, I had no time to warn you, but the mortar has not had time to set all round, it is green; and where it has set, it is that powerful it often shifts the stones first, and then clenches them tight, and there is no parting them at all; they become gripped together just as by nature in the quarry. It is wonderful material, and the best lime known, or that I have had to do with during thirty years of hard working experience.'"

"Of course, the directors could say nothing; they were bankers and solicitors, or such-like, nor could the engineers. It did not do to make out the masonry had not been properly executed. I thought I had got off beautifully, and the whole party were just going to start when out of the blessed wall, there and then, flew two pheasants!"

"Well, I never!"

"You wait. Yes; and before we could speak, out came a fox. I own I was nearly beaten, but one of the directors, turning to us, said, 'You appear to have a veritable Noah's ark here, and we know a pheasant is a gallinaceous bird.'

"We all laughed. He then went on to say, 'Perhaps if we wait long enough the procession will continue. This may be the ancestral home of the dodo or the mastodon. Who can say it is not?' They again laughed.

"Now, you know, there is no denying, neither a pheasant nor a fox can squeeze themselves through an ordinary-sized mortar joint. While laughing I got my mind right, and said, 'Gentlemen, I feel sure the poachers have been on the prowl here, and have disturbed the work.'

"'Yes,' said the director. The others seemed afraid to speak. There is always a cock in every farmyard, and he was in this. 'A four-legged poacher—the fox; and I am afraid, if we do not exercise due care, the board will be charged with larceny.'

"Then we all thought we ought to laugh, and did. 'Gentlemen,' I said, 'I'm sure the bridge has been tampered with, and no doubt if we keep watch we shall find the rascals.'

"Excuse me now saying 'rascals' to you, but, old chum, of course between ourselves, that is you and me, we have never done any poaching."

"Not we, certainly: at least we forget doing it if we did. A good memory is not always a blessing, or to be owned to, although it's useful."

"Shake. That's right. As we understand each other, I will now tell you how things ended. I went on to say to the gentlemen, 'I will root out this matter; and may I ask you to say nothing to anyone. My partner and myself will get to the bottom of it. Trust your old servants, gentlemen.' Then I raised my hat. That fetched them; for one turned, and said to me:—

"'I cannot send my keepers to-night, but to-morrow they shall meet you here at six. Please watch to-night.'

"He then handed to me a five-pound note. Blessed if he did not own the land for miles round and I did not know it. I beamed all over, and said I would, and looked as humble as only an old sinner can; and I was just going to forget to tell you I put that 'fiver' carefully away, to keep it from the poachers."

"I could believe that of you; I could, old chap, without your saying it."

"Well, now talk about 'all's well that ends well;' this was better than that—simply crumbs of comfort, except the awkwardness of the situation before the finish.

"I suppose you want to know all about the cause of the tumbling show."

"Yes; I am waiting to know."

"Very well, I will tell you. I had become greedy, and as there was not much more work for me on that railway, I used to make it a rule, wherever I was, and before leaving, to have a final haul in by way of a loving remembrance of a past country in which I had spent some part of my life in opening up to civilization, and the immeasurable benefits of rapid and cheap locomotion. Is that good enough?"

"Rather; it likes me much."

"Now this bridge was a beauty to draw on, so we just left a few voids here and there. Tipping the backing must have broken a bit of the wall unknown to me, or something must have given way in the night; and I suppose the birds walked in, and the fox after them, and then the abutment settled and the backing pushed it closer together. Now the birds got to a place where the fox could not reach, and there very likely they would have been, three caged-up skeletons; but the Swiss mountain climbing spoilt that fun, and pulled down the wall sufficiently to raise the curtain on the show.

"It so happened that all the engineers and residents had to go away on some land case—I like *other* people to go to law; and so we had three clear days to put things in order; and we did, you bet, and began almost before the break of day. I had an untarnished reputation at stake, and was on my metal. My partner and myself just about both smiled over the fun real mutual admiration."

"The engineers did not say much for we had been paid, and they knew they would get nothing out of us, and therefore proceeded on the principle that it is no use stirring dirty water, and I say, and maintain, that on the whole—not *in* the hole, mind you—never was more solid and firmer masonry put together than our work, although we took care to do as we liked, and relieved the foundations of some strain now and again, and improved the specification.

"I forget whether I watched for poachers that night, but I might have done for a few minutes, so as to make it all right; but as my memory is not clear on the point, I had better say I fancy I did not, but I met the keepers next night; and did a three hours watch and told them a lot, and got well rewarded. Pay me and I'll patter pretty; but no pay, no patter, is my motto. The only thing that grieved me was losing those pheasants and the fox's brush and head. That was hard luck, but there! life is full of disappointments which are hard to bear."

CHAPTER VIII.

TUNNELS.

"Have I told you of my scare in a tunnel I got some 'extra' profit out of by real scamping?"

"Not that I remember."

"Well, that was a whitener, for I was almost trapped, nearly caught, and paid out. Retributed, I think it is called, but there, I am not sufficiently educated, although you and me have had a good deal more schooling than any others on this work, which perhaps is not too much of a recommendation. Anyhow, you agree, don't you?"

"Of course I do!"

"Well, let us drink. Now we are oiled, the machinery will start again easy and soft, and continue going for some time, but don't you consider we know enough to suit us. I have watched various guv'nors I have had, and they seem to be thinking and puzzling their brains even when they are eating, and I don't think their digestion is improved by it. A peaceful mind needs no pills. It is medicine for the upper works, and exercise and good food is the right physic for the body unless you are half a corpse when born. Now, when we eat, we have a look at the goods first, and all we trouble about is to divide the vegetables, meat, and bread, and beer, so that they last the show out in their proper quantity to the finish."

"That's it, but what has that to do with the scare at the tunnel and the scamping?"

"You wait. Really you should know impatience is not polite; and to be a good listener, and look as if every word that was said to you was virgin information and pure wisdom, is the best game to play."

"That is enough, get to the tunnel scare and scamping."

"Well, why I named about my food was, my old woman was queer just then, a lying up on the cherub business, and the party that she had to look after things was no cook, few are, and I believe she was paid by some of those pill proprietors to make people ill and then pill them. Anyhow I got queer and dreadfully out of sorts, and just at the time I was a regular nigger, and had taken a length of tunnel lining, and in such ground, horrid dark yellow clay, and it smelt awfully bad. We called the tunnel the pest-hole. What with the food being wrong, and the hateful place, I did the worst bit of scamping I ever was guilty of."

"Fortunately, the engineer knew what he was about, and our profiles were nearly round, that is, the section of the tunnel was nearly circular; if they had not been, that tunnel would have been filled up by this time, and perhaps been the grave of hundreds, and it nearly was. There were eight rings in the lining, and therefore some bulk to play with. I got frightfully pesky about the job, and meant getting out of it as quickly as possible, and did. I am not the one to play about and squat, action is my motto; and I am busy if there is anything to be got, and keen on the scent."

"You are right there. You generally find a fox, and get his brush, too."

"I was roused. The brickwork was in Portland cement, and believe me, I never would have done what I did if it had been lime mortar. Must draw the line somewhere, and the easiest conscience has a limit to being trifled with. You know, tunnel work gives one chances that are not to be had in the open, and the temptation is strong. I dropped word on the quiet, 'Be careful to-night with the first two rings and then'—well, they twigged, and I had no occasion to say much. Afterwards, the material that was given them went in anyhow. But bless me, we had Portland cement, it was supplied by the company, you understand. It held almost anything together, firm as a rock. I said to my ganger, whatever material you are given, so long as it is clean, will do, and it will be just like conglomerate. The inspector was inclined to be my way of thinking, and, by a manual operation on my part, he fully agreed with me, and said he had always been of the same opinion, only other people failed to comprehend his meaning. It has been said the pen is mightier than the sword, and so it may be; but ten hours writing, and a ten hours speech full of argument, have not the same force with some inspectors as a few sovereigns judiciously placed to aid them in arriving at a proper view of a subject."

"You are right; bribes and lies are twin brothers."

"Well, it was just a scamper all round. Yes, scamper and scamping. I had some good brickies then—militia chaps, smart, and they could stay. They made the rings grow; I forget how much we got in that night, but a good length, for the bricks ran short at one end of the tunnel, and we were close up to the face at the other end. No one that I did not want to see was about. After measuring, I found we were short at least twenty yards of bricks, and only

about two thousand or so left, so I said, 'Lads, if you finish the ring by five o'clock, you shall have a quid amongst you; but do it, and keep the beautiful clean face on for all you are worth.'

"I looked a bit crafty at them, and they twigged the tune to play. I took old Bond—he was my ganger—with me, and said to him, 'How are we going to do the lining?' We can't fetch bricks from the other end, and I draw the line at timber to do duty as bricks. I waited, and the 'extra' profit string of my brain worked right, and I pointed and said, 'There is a heap of broken bricks and no one knows what; well, twenty yards of that won't be noticed if you take it equally all round; put that in, and dose it with cement, and rake it well on the top of the rings, and don't forget to finish the top nicely and clean to a hair if you have not time to fill in all of it. Keep the best stuff for near the finish, and enough bricks to make a solid strip or two, and I am otherwise engaged or tired-out till four. Wake me then; I'm off for a peaceful snooze.' Well, they got it all in, and nothing was known till—I won't name it yet, it must wait."

"I suppose the bricks you took from the brick-yard were tallied, and deliveries checked with the work done in the lining?"

"Yes; but there is tallying of all sorts, and, of course, the right amount of bricks were taken from the yard early next morning, but where they went is best known to the yard foreman, the inspector of brickwork, and the dealer; but as my partnership with them is now at an end, of course my memory fails me, and I am sorry I can't give you any more information in that direction. It grieves me to keep back anything from you, and is so unlike me."

"I don't want to hurt your feelings. All right, I understand."

"Talk about varieties of concrete, why we had sardine and meat tins, all sorts and sizes and weights and ages, tiles, ashes, bones, glass, broken crockery, oyster shells, and a lot of black-beetles and such-like shining members of creation. They all did their duty to the best of their ability. What else there was I would rather not try to remember, but it was *not* bricks."

"Don't trouble, I can understand. We are all pushed a bit for the right goods sometimes, and have to make shift; but it is hard, very hard, to have to do it."

"Well, I found out that the bricks were not quite so many as I thought, and for a 5 feet length, about 15 feet from shaft No. 7, they had to do with one ring of brickwork, and the rest, my patent midnight conglomerate. That frightened me, and had I known it at the time, I would have stopped the show; of course I would, you know me. I always draw the line somewhere."

"Right you are; although 'somewhere' is an easy-stretching sort of place, and there is not much of a fixed abode about it; but it can generally be found on a foggy night."

"It's my belief they did not put in enough cement mortar, and carry out my orders, which indeed was very wrong of them."

"What do you mean, your orders were wrong?"

"Oh dear no, of course not, not likely—*their* orders were wrong, not mine. You don't follow me rightly. You understand now? Dwell on it, and I'll wait."

"Oh yes, it was stupid of me. There, I am not so young as I was, nor so quick."

"Now we are coming to the scare. Pass my glass, it makes me feel weak, it does."

"That conglomerate length stood all right, more by luck than anything else, till one night, although all the rest was sound work and done properly, for it was well looked after, and there was no chance of a slide towards extra profit; besides, the ground would not have stood unbarred long, and, of course, short lengths had to be the order, and were bound to be carried out, for the clay soon got dropsy and swelled."

"Well, my gov'nor took a contract for a line about 20 miles away from the tunnel. I had some work on it, and had to go to London, it was abroad, for I was called up by him, It was a slow train, and followed an express goods. There was a signal box at each end of the tunnel, and a fair traffic, and fast trains passed. Something got wrong with a wagon of the express goods train—I never knew exactly what it was but anyhow, nothing very serious, for the permanent way was all right and so were the wheels and axles. We were stopped by hand-signal in the tunnel, and there may have been something wrong with the signals, but that does not matter for what I am going to tell you."

"Were you scared to think the train after you would telescope you?"

"No, for there was none for an hour and a half."

"Well, the carriage I was in pulled up just under the place where that patent midnight

conglomerate length was put in, and I looked up and saw the old spot had bulged, and was yawning, and looked to me as wide and moving as the Straits of Dover in a S.W. gale, and a lot worse, and it seemed to be getting wider every minute, and I saw something drop. I was alone in the compartment, and it was fortunate I was for many reasons or I know they would have found me out. I knew the place. How could I forget it? It was just by the shaft. The passengers were talking to the guards, or were otherwise engaged. Presently I heard the down mail coming at a rare speed. I said to myself, 'There is not much the matter, or they would not let her go through.' She was the last passenger train down that night, and lucky she was, you will soon say. Oh! dear me, when I heard her I felt cold and hot, and my heart got to my teeth, and I believe if I had not kept my mouth shut it would have jumped out, that's true. What scared me most was not about the mail train, I knew she would be right, and would be past the spot before the ground had time to tumble in. She was going too quick, but our train, *and me*, right under the place, and bound to be there *after* the mail had shaken it to bits! That's what made me feverish.

"I said to myself, 'You are paid out in your own coin, you are.' Before I had time to think more the mail went by all serene, and I hardly dare move, but slid up on the seat just in time to see her tail lights vanish. I then looked up, and if it had been my scaffold it could not have been worse. Oh! fill my glass up, nearly neat, while I wipe my forehead. Thank you. Yes, I looked up, and saw the crack had widened and was becoming wider, and chips were falling now and again as large as hailstones! I knew it was bound to come down. I looked to my watch, another full hour had to pass before the next train was due behind us. I was just going to get out, when I heard the guard coming along on the footboard, and he said, 'Another five minutes and we are off, gentlemen.' He did not see the falling pieces, as the carriage hid them, but I did, and the engine blowing off steam prevented him hearing them. Soon he reached my carriage, and said, 'You are the only gentleman in this carriage.' He would not say anything more. I heard him repeat the same words almost as he moved along the train, 'Five minutes and we are off, gentlemen.'

"I said to myself, 'Five minutes more and I am buried and off for ever somewhere,' for I was certain in five-and-a-half the lining would burst and down everything would come and crush us to powder. I did not care to think what else or how much. I cannot describe how I felt, but drink squalls are nothing to it. I kept my watch out of my pocket, and gazed at it till I hated it. One minute passed—two—three—and then I watched the second-hand go round. What I suffered cannot be told. I looked out of the window. I heard a whistle. It did not sound like our engine, it seemed too shrill. I had no fear of a train being behind us as I knew our road was blocked. Was it a down special excursion, or a down special goods, I said, tremblingly, to myself, for I knew all the down ordinaries had gone for the night. 'If it is,' I said to myself, 'you are settled and corpsed, and have made your own grave, and it will be a rough one.' I won't say what I did then, but know it would suit a clergyman.

"Thank goodness I was wrong, the whistle was from *our* engine, but it had been low and now was shrill. I was so feverish that I forgot the steam was blowing off. At last we started, and I looked at my watch. It was five minutes ten seconds from when the guard spoke. I knew I was safe, but thought I would look back. I was just able to see in the glimmering, as the fire-box was open, and by the tail lamps the last carriage had well cleared the shaft when there was a horrid hollow sound like waves breaking in a long cavern, and I saw something come down like a veil across the metals. The tunnel was in, fallen in with a slow smash, and not a minute after we started!

"I don't know how long it took the train to get to the signal-box at the entrance, but we pulled up there, and the first thing I remembered was the guard saying to me, 'No one is hurt, you need not be frightened, but we have to thank God for it. Terrible shave. The tunnel has fallen in, and just where your carriage stood!'

"I said, 'Oh!' and sank back upon the seat. The guard again came to me and popped his head in and said 'You are the only passenger that knows what is up. Keep it quiet, if you please. Shouting will do no good, and I shall be much obliged to you. It's no fault of mine or the Company's. Are you ill, sir?'

"No, but I saw the tunnel fall in."

"Traffic is stopped, sir, at both ends. The wires are right as we had reply from the other end of the tunnel. I thought you must have seen it fall in, because you looked very white, and were clasping the window frame with both hands and shaking so. I was afraid you had been almost scared with fright.'

"No, I am not ill, but I saw it fall."

"Well, sir, it is no fault of mine or the Company's, although I am sorry it has frightened you a little.' He then went away and we started again."

"When he said, 'It is no fault of mine,' bless you, it near cut my vitals out, it did; for I knew it was my fault and no other person's, and that it was only by the act of Providence the mail

was not smashed to bits, and us too. I made a vow there and then never to have anything more to do with tunnels, and whenever I go through one I always feel wrong and twitchy, and shut my eyes till the rattle tones down and I know we are in the open."

"How much fell in?"

"About 20 yards altogether in length. Traffic had to go round for a month, but the rest of the work was all-right, and so it really was, and I ought to know. No one found out that nearly the whole of the fallen length had been scamped, for everything was broken and mixed up, and, as luck would have it, a spring burst out there and the flow had to be led away to one entrance, and the falling-in was always put down to that, and that only; still I know the ground was a bit cracked, and underground waters have mighty force, and are best guided and not tried to be stopped, for they will come out somewhere.

"I met my guv'nor next day, and he quietly said to me, 'I have let the tunnel work on your length to an old foreman,' and then he looked clean through me. I know he thought a lot, and I'm afraid I can't play the game of bluff as good as some can, and so work 'extra' profit out of ruins. What do you think of that scare?"

"I don't want to think about it. Glad I had nothing to do with it. Dreadful! No wonder you have a wrinkle or two. What shocking hardships we all have to pass through in getting 'extra' profit, and so undeserved!"

CHAPTER IX.

CYLINDER BRIDGE PIERS.

"Deep river bridge foundations are not to be easily worked for 'extra' profit as they are generally too carefully looked after; still, even there, you get a chance occasionally, if you know how to work things. I was always on the scent for 'extras,' and once got a bit out of a cylinder bridge, more by luck than anything else."

"How did you do it?"

"Listen, and then you'll know."

"The bed of the river was soft for a depth of nearly 50 feet, then firm watertight ground, and into that we had to go about 15 feet. Our cylinders were 15 feet in diameter, of cast-iron, and in one piece 6 feet in height I will just name that there is more chance of a bit 'extra' profit when the rings are little in height than if they are in pieces and have vertical joints and are about 9 feet long as usual. A 15 feet ring, 6 feet in length in one piece was not often seen then, but they are now cast much heavier; still, they may be made too large to handle nicely without special tackle, and foundry cleverness should be considered less than ease in fixing on the site."

"Why are short lengths best for 'extra' profit?"

"Because you may have a chance of leaving out a ring if the coast is clear, and nice people around you."

"I see."

"Well, the Company's foreman had to lay up for three days, for he had ricked himself, and I had an old pal with me, and two of my nephews working the crane, and other relations about. All had been properly schooled, and knew crumbs of comfort were to be got out of a bit 'extra,' so I embraced the opportunity as we were such a charming family party, quite a happy farmyard.

"The rings went down rather easily as the bed of the river was soft; in fact, they sunk into the mud for the first 6 to 10 feet by their own weight. So I gave the office, and we just dropped a 6 feet ring over the side into the mud, for I knew it would sink all right, and that by the time the Company's foreman returned to work we should have pumped out the water from the cylinder and got enough concrete in to seal the bottom; of course, after the resident engineer had gone down to see the foundation was right, and I felt sure it would be, and that he would only look at the foundation, and not bother about the height of the cylinder or the number of rings; and if he did, we could dodge him a bit, as there would be four or five of us, and stages were fixed on the horizontal ring-flanges, and no numbers were cast on the rings, as they all were made to fit together. He went down, just as I thought, to

see the foundation only, although he measured about a bit, and enjoyed himself. We worked the tape right—it takes two with a tape. By-the-bye, I hate measuring-rods, they are not good business for 'extras.' They are so unobliging. A tape you can pull a bit, and tuck under, according as you want a thing to appear to be of a different length to what it is. One of my gangers made a false end for a tape. He used to turn the end of the true tape under for a few inches and slip on his false end, or he added a false length if he wanted. He took good care to hold the end, and he could slip it on and off like a flash of lightning, and good enough for a conjurer. He could lengthen or shorten a tape a few inches at will; all he wanted was to hold the ring at the end. His false end was a bit of a real tape with his attachment, and I have seen him trick them really pretty.

"Considering we had about sixteen rings altogether, top to bottom; there was a good length on which to dodge, but our game would have been too risky I fancy with eight or ten rings, and in a strong light, because one could count the flanges pretty easily; but it is not many that suspect a ring may be omitted.

"We were some 8 feet in the hard soil, and I considered that enough, for the ground did not help much to keep the cylinders in place for 50 feet of the height above it, but they were well braced above high water and at top. When I consider a thing enough, you don't catch me let them have much more if I can help it. I hate waste.

"The foundations were declared to be all right, and so they were, and we at once began the hearting, and sealed up the bottom after cleaning up, and we put in good Portland cement concrete, for all the materials were supplied to us.

"Of course, the Company's foreman, when he came back, could not tell, nor could anyone else, that we had been having a happy time; but give him his due, he did all he knew to find the rings were in. You know the ring we got rid of for 'extras' we took care should be sunk in the middle, between the two columns, and well away from each one. The bridge was wide,—about four lines of rails on top—so we slung the ring out very quickly, after the men had gone for the day, just about midway between the cylinders, and down it went pretty quickly, and it was bound to be in the mud fully 8 feet by the morning, and sure to sink a bit more, for I had it dropped sharp, and I thought it would be certain to break up where it fell. We worked it so nicely, and all was as lovely and serene and merry as a marriage, and real crumbs of comfort, and I thought no more about it.

"We sank the ring purposely midway between the other two cylinders, so that if the bridge had to be widened it would not be found. But we were had for once, and no mistake this time, and all our own fault, and just where we thought we had been clever, for one day the engineer came down and sniffed about. I wish he had stopped at home instead of coming bothering; however, he did not, but came. The result was the resident engineer handed to me a tracing with a new cylinder marked on in the middle of a line drawn through the centre of the two cylinders, and just where I had sunk the 6 feet length I thought I had got a bit 'extra' out of so sweet, and I might have just as well sunk it outside. Well, I took two pills that night to brace me up and set my machinery in perfect trim; and no one can know what I suffered, for I meant getting out of the fix somehow or other, but could not see my road much ahead.

"You know I was certain we were bound to find that 'extra' ring. If we could have broken it up, or have been sure it was broken, there might have been no harm; but we did not know exactly where it was, and if we did we could not raise it. I felt certain we should come to it, and tried the crane to see if we could fix the spot, but we had to chance it. It was no use humbugging ourselves into thinking we knew where it was, when no one could possibly know. As I said before, I was positive we should meet it in sinking the cylinder, and as the ground was soft for some distance that it would tilt the centre rings—and then the game I had played would be found out, for cast-iron is hardly as soft as mud.

"I felt my reputation was at stake—in fact, all my noble past—and all for a 15 feet cast-iron cylinder, 6 feet in height, and 1¼ inch in thickness! I thought of blowing up the surface before the men were at work, and doing a bit of subaqueous mining; but it was too risky and desperate, so I saved myself for the final round, that is, I waited with my teeth set till I met that sunken 'extra' ring, and meant getting clear and settling it in one round, you bet, for I considered the situation very degrading, not to say insulting.

"We quickly erected the staging, and I tried all I knew to get the foreman away and the resident engineer. Still I dare not play the same tune too much, or they would suspect, but they were too 'fly' to be drawn off. I arranged with my nephews at the crane to give me the office, if I was not on the spot, by sharply twice turning on the blow-off cock.

"I happened to be on the top of a column on the next land-pier with the resident engineer who had called me, and the foreman was there also, when I heard the two puffs. I pretended to take no notice, nor did he or the foreman, and I managed to govern myself and keep myself quiet, just like the old nobility do, and think a lot.

"Before I left the resident engineer I found he was going at once to some meeting, and I just wished he would take the foreman with him, if only out of the love I had for him and give him a holiday; however, I got to know on the quiet he had to superintend some unloading at a wharf half a mile or more away, so the road was pretty clear. Directly I got to the cylinder I knew what was up, for it had tilted.

"We could not pump out the water, and divers could not go down unless the bottom was sealed, because of the almost liquid mud at the depth we had reached, but in another 8 or 10 feet it could have been done. I thought for an instant and then gave the word. 'Weight her down, lads, get some more kentledge and then we will pull her straight. It's only a piece of a wreck, or a bit of timber or stone.'

"I forget whether I told you that it was only my family party that knew of the 'extra' ring being sunk, the rest of my men did not. My game was to wreck the cylinder if I could, and tilt it over so that it would fall, and then fetch the foreman when I knew it would go. If I could manage that I felt I was right. Anyhow I was bound to smash up the bottom ring, at least, I thought so then. Cutting out the obstruction I was thankful could not be done, nor drawing it in, nor splitting it up inside the cylinder. That was certain. I did not much care to tackle lifting the rings. I wanted to smash them. Compressed air I did not want to hear of, for that would have bowled me clean out, and shown the whole game. I wanted to try to thrust the cylinder through the obstruction, although, of course, I was not supposed to know what it was, as that usually fails and ends in smash more or less, and I was certain it would in this case, for it was cast-iron against cast-iron on an earth bed. Attempting to thrust a cylinder ring through anything and everything is always a dangerous operation, and one to be avoided.

"Now they knew exactly how many cylinder rings had been delivered by the manufacturers, and if they had found the one we played 'extras' with, they could soon see it was the same size and make, and could easily tell how many were on the work and in the piers. I beg pardon, I should have said, *supposed* to have been in, and it was 1000 to 1 all would not be well.

"It occurred in the summer, and the foreman came and sent a telegram to the resident engineer, and before he arrived we had weighted the side that was up and endeavoured to get it straight by hauling, but it was no good; at least I think I tried to get it vertical, but I may also have tried to smash it. I expected, and was afraid, they would lift it by pontoons the next tide.

"Well, the resident engineer came. He tried a few figures over, and said to the foreman, 'If we do not mind, it will cost more trying to right it than it will to lift the lot.'

"Anyhow we got more power and more weights. He had the soil loosened on the upper side of the ring; but, of course, as it was iron at the bottom, it did not do much good; and we tried pretty well every dodge in turn that is known, but I need hardly say with very little effect.

"The resident engineer said, 'Compressed air will be too expensive for this one cylinder, but I think we can sufficiently clear the interior by a force pump and dredger for a diver to go down.' Now the chief engineer was abroad for a fortnight, so we left it alone that night; but I tried all I knew, bar hammering, for that I dare not do, to smash the rings and they would not break, the soil was too soft and even. I was certain I could pull them over, but then they would most likely lift the rings and might find out the cause of the bother.

"However, I let everything rest, and trusted to luck. The resident engineer decided to have the cylinder raised, as we had two large pontoons handy, so the top rings were removed to as low a depth above water as possible, and chains were fixed round the rings and also to bolts in the flanges, and in two tides all the rings were pulled up."

"So you got out of the trouble all right?"

"You wait, don't be too sure. The resident engineer and the foreman were pacing up and down just as we were lifting the cutting ring, and we did that by the crane. They were at the other end of the staging though. The cutting edge was within a few inches of the water-level when I saw that a bit of the ring I had sunk for 'extras' was actually jammed into and hanging to the cutting ring."

"Oh! save my nerves, that was bad."

"Well, I had the crane stopped in a second, for my nephew was watching like a vulture, and I and my ganger had provided ourselves with a bar each, and were standing on the flanges. The cutting ring was only 3 feet 6 inches in height, and after two smashing taps it dropped, neither the foreman nor the resident engineer saw the fun closely; but as the resident asked us what we had been barring at, I said 'A small bit of a wreck got wedged on, sir, and would have stuck between the pontoons, and I am very sorry we could not land it to show you.'"

"That's good enough old pal. Pass on, please."

"I thought you would laugh. Well, the pontoon had been brought to the side of the staging as a precaution in case the chains might break or an accident occur, so as to be away from the line of the bridge, and so it did not matter where we dropped the cylinder ring I had 'extra' out of, but it was an ugly fish to hook I can tell you, and is about the only one I ever wished to get away, or did not want to see.

"Of course the cylinder went down all right afterwards, and the cause of the tilting was considered to be the remains of a wreck; but it strikes me, should they have to drive piles or sink cylinders anywhere near that pier, they may meet with some obstruction, and perhaps think they have struck rock; anyhow they will find out they have not 'struck oil,' and may send forth the news that a recent discovery has shown the early Britons built ironclads, and it was certain they sank, but there was not sufficient evidence to show whether the warships floated for many days."

CHAPTER X.

DRAIN PIPES. BLASTING, AND POWDER-CARRIAGE.

"The experience you had with cylinder bridge piers reminds me of a near shave for a bowl out I had. They let me a quarter of a mile of work, and I had to put in an 18-inch pipe at the deepest part of an embankment, just to take any surface-water that might accumulate now and again. Of course, an 18-inch pipe will take a lot of water, and I think we agree it is hardly right and proper to throw away good material or provide against events which, an earthquake always excepted, cannot occur in the opinion of the most experienced. You can't accuse me of being wasteful, it's not in me; for I've heard my mother say she never knew me upset anything I could eat or drink, and that I always licked my plate and never lost a crumb. You know it is a quality born in you, and I don't wish to take any credit myself, not me; I'm constructed different. Nor do I wish to say you are not so careful as me, and perhaps more; only, of course, you may put in a lot of strong work when I am not looking, and I think you'll have to do to get level with me. It never was in my heart to see anything wasted. It is against my principles. I hate it, I do.

"I said to myself, 'You shall not waste any material.' So what I did was to put five lengths of 18-inch pipe at each end of the slope, and 9-inch in the middle. The tip was almost on the spot, so I put in the 18-inch and the other pipes, and left a couple of lengths bare each end. The embankment was over 40 feet in height, the slopes were one and a-half to one, and the drain was about 50 yards in length, so it was not bad business.

"I never forget what the engineers tell me, and when I hear a discussion among them I always make a note of it, and wait till I have an opportunity of making a bit 'extra' profit by it. What is the use to the likes of us of a bit of education if we can't turn it into gold? Not much; almost sheer waste, and I hate waste—abominate it. Well, one day the resident engineer was talking to another swell about how a splayed nozzle to a pipe caused an increased discharge.

"So, ever ready to learn, as you and me always are, I said to myself, fond-like and quiet, 'Try it; put it into practice.' And I did, as I told you just now, by the insertion in true scientific manner of smaller pipes in the middle. I wrestled with the subject, and said to myself, 'Now, look here, if I put in all 18-inch pipes that drain can't have a splayed nozzle, that's sure; in fact, it is fact.' So I said, continuing the discussion with myself, 'Don't be beaten. Let science lead you.' And I did."

"Fill up your glass, lad. Grasp. I'm hearty to you."

"Now, it was in the summer, and we are coming to my scare. I said to my men, 'Come an hour earlier to-morrow morning, for I have got a little extra work, and some of you call at my place on your road.'

"They came, and I had the 9-inch pipes handy, and away we went, about fifty of us, with a pipe or two each. It did not take long laying the pipes, nor covering up the lot. In any case you could hardly see through such a length, but as a precaution, I had the pipes put in a shade zigzag after the first six or seven lengths, so everything seemed all serene, at least, I thought so; but it was not, for I had the nearest shave for a bowl out that I ever had, and all on account of a bow-wow."

"How did it happen?"

"Well, the resident engineer came over with his pet dog, and I took to patting him, and felt really happy at the little bit of 'extra' I was to get out of these pipes, when the blessed dog began sniffing about one end and jumping up. The resident engineer got a bit excited.

"'Rat, is it, Dasher?' he said to his dog.

"The dog barked his reply to his master. The resident then said to me, 'Stop here with Dasher until I call him at the other end, as I intend him to go through the drain.'

"Before I could say a word, he was up and down the slopes, and at the other end of the pipe. I sat, or fell down, I don't know which, I did feel bad. I heard him call 'Dasher, Dasher.' The blessed dog rushed in, and then came back. His size was right for the 18-inch pipes but he was near too big in the barrel for a 9-inch pipe.

"To think that after working the show so smoothly and lovely to the satisfaction of all mankind as knew of it, and then to be bowled out by a 'phobia-breeding animal as hardly knows how to scratch his back, was too much. So I braced myself up, and said to myself, 'Mister Dasher you have not done me yet, not you, hardly. It will take a man to do it.'

"I patted him, and smiled pretty at him, and gave him a bit of biscuit, and grasped him round the middle just to see if he could get through the 9-inch lengths. I felt seven years younger when I found he could just manage it, but he would have to do it more like swimming than walking.

"Now I knew the pipes were all sound and whole, for I never put in broken goods, however small they may be.

"The engineer kept calling 'Dasher, Dasher,' so I said to him, through the pipe, 'Wait a minute, sir; Dasher, I fancy is not so used to tunnels as you and me. What do you say to try the other way in, sir, we all have our fancies?'

"I knew it was no use attempting to work him off, as he meant what he said, and would be sure to get suspicious—as he was no flat, I can tell you.

"Well, after a lot of urging, in went the blessed dog, and Stanley's journey in Darkest Africa was outdone then, I'm sure, and Dasher's rear-guard was in trouble.

"We waited, and called, and whistled, but could hear nothing. We must have waited half an hour I should say, at least it seemed to me as long, and the resident engineer shouted to me two or three times, 'If Dasher does not appear in a few minutes, your men must dig him out.'

"Lawks me, it makes me ill to think of the squalls there would have been if I had had to do that. I wished just then that no dogs had ever been made nor nothing on four legs except horses, cattle, sheep, and pigs; but I turned sympathetic like and went to the top of the embankment, and said, 'Perhaps there may be vermin up there; and I know Dasher is a game one, and won't back.'

"This pleased the resident engineer. Believe me, I would have given at that moment a sovereign to anyone who could have produced that dog.

"Old pal, you need not put your hand out, I said, 'at that moment.' Don't excite yourself. I know you are always thirsty, but you have got the gold hunger bad as well. Just keep quiet, and put your hand in your pocket."

"I beg your pardon, I was forgetting myself."

"All right. Now I'll go on again. Well, I thought the dog had got jammed in, and knew what tight lacing was, and so he did. At last we thought we heard him, and he came out looking more like a turnspit than a well-bred fox terrier.

"Some blood was on him. He had had a squeeze and no mistake, and was about done, but no bones were broken.

"I said slow and solemn like, 'Sir, he has tackled them.'

"'What do you think it was?'

"I said, 'You mean they, sir. He has had more than one against him.'

"I then took up Dasher and carried him to a tub of water and washed him. I did feel very sorry for the dog. I said, 'He has had a regular battle of Waterloo, but it is his high-breeding and proper training that has pulled him through the fight He has finished the lot, sir, you bet.'

"The resident engineer looked pleased, and I am sure I was. Dasher soon recovered and we walked away. Don't forget, what the eye does not see the heart does not grieve for, that is to say, I escaped all right; and those pipes were considered to be 18 inches in diameter, and you know it is not right and proper nor becoming to differ with one's superiors too much, it

almost amounts to foolishness I consider in such cases. I always keep my brain in curb till I get a lean measurement, and then I speak, but it don't do to differ with your governor too much. The wheedling lay is the best game to play, and I have an aversion to a quarrel with anyone when you can get more by oil and smiles.

"Take my advice, and before you try splayed nozzles, know whether your guv'nors or the engineers have dogs, and, if so, the size of their barrels and whether they have done growing and laying on bulk, because, to be safe, you must work the pipes to fit the bow-wows. Remember I had a near squeak, and so did the dog. I always keep in with them now, and Dasher gets a biscuit from me whenever I see him, but he nearly cost me all I had. It is indeed a real pleasure to have the opportunity of rewarding virtue in men or dogs."

"That's right. Fill them up."

"The thought of that day rather makes me nervous and dry."

"That pipe and dog business was not exactly a holiday, but I had a worse nerve-shaker than that, for it is a wonder you see me now when I come to think of it. But there, Providence shields us all, good and bad, just to give the bad ones a chance to alter, and to test whether the good ones are really good. Still, I never meant anything wrong, of course not—no one ever does. It is always the surrounding circumstances that make things bad; and so we all humbug ourselves into thinking we are very right and proper and good, and we have our private opinion about other people."

"Stop that. Speak for yourself, and never mind about other people."

"All right. Don't get testy."

"Well, they let me take a cutting in hard marl down at Throatfield Junction. It wanted a lot of blasting, for it was deceptive material. The powder used to go very quick and not split or move the ground much either. I would fifty times rather had a real rock cutting than this hardened lime and clay soil that won't cleave, and when the blast is fixed it only about blows up the tamping and makes a noise for nothing, but blasting marl rock is often vexatious work. One day, by a mistake, the firm I had the powder from did not send the weekly quantity by road as they ought to have done. I always paid for it prompt. They knew me, as I was an old customer. It was nothing to do with the cash, but a mistake in their office, so the only thing to be done was to fetch it; and as seventy pounds' weight of powder is no joke, and I did not want to lose a relation just then, I got it myself by train, and it nearly cost me my life. I took a large box, just like a cheese box, planed inside and as smooth as glass. We used the large-grained glazed powder. I thought to myself, 'I'll take it in the front van, and ride with it, and then I know all will be safe.'

"Now, there never was much luggage by this local train, although a lot of passengers, and hardly ever above a case or two in the front van. I knew the guards, and all would have gone pretty, but the usual front one had got a day off to bury a relation, and that nearly buried me and a lot more. After the front guard knew from the other who I was, he let me ride in his van when I showed my ticket. We had about 30 miles to travel, and stopped at nearly every station, about six of them altogether. It was nearly a two hours' journey. I got a chap to pack the powder safely for me, and all I had to do was to keep it from flame and heat and being knocked about. Of course the guard did not know what was in my box, and did not seem to care—he had other things to attend to that were, or seemed to be, more important. I sat on the box, and began a yarn about railway travelling, and was making the necessary impression upon him, just to show I knew a few swells and things. There may have been a trifle more imagination than fact about my talk, but not too much, just enough to season it. We were getting on very pleasantly, and nothing ugly occurred till we got two stations from home, then there was a crowd on the platform. Been a football match. The result was that three swells got into the guard's van. The old guard always locked the door, this new one did not. No room in the first, or anywhere else. Now I should not have cared a rap, as these three swells were as sober as judges, but one turned to the guard and said, 'You will not object to our smoking, I suppose?' Asking a question that way always seems to me more than half a command. The guard took it that way, I think, for he said, 'No, gentlemen, as the carriages are full; but if you can keep it as quiet as you can at the stations I shall thank you kindly, as there is a superintendent here as has pickled pork and coffee for tea, that considers smoking worse than poison, and it is against the rules.'

"Well, you can imagine I was just about fit to sink, as I knew there was enough pent-up force in that box to elevate me higher than I wanted to go by that sort of machinery. Two of the swells were free and easy kind, the other rather a lady's man, sort of feminine man—the latter began the game, and said, 'Charlie, have you a Vesuvian?'

"I dared not say a word, but I thought, 'My noble swell, I have not, but I have a Vesuvius here—in fact, I'm sitting on it—and if you are not careful the real one will have to take a back seat, and ashes will be large goods to what we shall be like.' Well, they all started smoking, and threw the fusees out of the window. After all, I thought to myself, there's

nothing much to fear now, although it would be considerably more pleasant if you were in some other train somewhere. When I got in I put my box just a little way from the side, so that it should not jar, and there they had me. Soon we got near to the last station we had to stop before mine, and these swells all took their cigars out of their mouths, and as there was no place upon which to put them except on my box, *they put them there!* Pass me the bottle. Oh dear, oh dear, the thought of it! and they said to me, so nicely, 'You won't mind, I know.' Before I could think almost there were three cigars alight and red, been well puffed, and within 2 inches of 70 lbs. of the best glazed blasting powder, and me sitting on it as a sort of stoker!

"I dared not say anything; but worse was to come, for they kept taking a whiff and putting the cigars down again!

"After the train started the van jerked a bit over the crossing or a badly-packed sleeper, and just as one of the swells was going to pick up his cigar, it slipped, fell upon the top of my box of powder and then upon the floor, and the sparks did fly!"

"No wonder you felt bad. I feel for you now, I do. It makes me dry."

"Stop! Worse is to come—worse. Pass the bottle. Wait a minute; I can say no more until I have loosened my collar."

"Well, true as I am here, if there was not a fizz, a few grains had got loose. My box had a hole in it; a knot in the wood had shaken out! I knew the fizz was not like that of sporting powder, but my powder—and to think there might have been a train self-laid right up to the bottom of the box! Providence again."

"Shake."

"I'm hearty to you. It must have been an angel that broke the train of powder, for on looking carefully about I saw a dozen or more grains. Luckily for me, the guard had his head out of the window all the time, as the whistle had been sounding. The swells only laughed at the fizzle. I did not; I knew what a fearfully narrow squeak I had had. I expect they thought it was a match end. However, I have had a life of narrow squeaks, and so I got over it pretty soon, and said, 'The next station is mine, gentlemen!' I moved my box a trifle, and noticed there was a bit of paper on one side sticking out. I saw one of the swells also noticed it, and seemed thoughtful. He soon made me understand that he knew the paper. It was specially prepared, and a peculiar colour. His father was the owner of the powder mills, and lived about five miles from my cutting. If I was not previously blown up, I knew it was in his power to have me fined fearfully heavy, if not imprisoned. He stared at me, and as we were going down a long 1 in 50 gradient and corkscrew line the guard looked out for squalls and two of the swells on the other side. He then whispered in my ear, 'Is your name Dark?'

"I could not speak, it took me back so; but I managed to nod. He said, 'Why did you not telegraph? I would have had it delivered specially'; and he pointed to my box. He gave me a half-dollar, and put out his cigar. I quickly and carefully filled up the hole and picked up the stray grains, and no one knew anything, except him and me. He then said, 'Take my advice, don't try that game again; for if you manage to struggle through such a journey without becoming a million or two atoms you will probably be hanged'; and he motioned with hand to his throat. 'This time I shall say nothing.'

"I thanked him. I never felt so small and weak in my life. Well, I arrived at my station, and got my box out and sat upon it for some time till the reaction on my nervous system had worked; but I would have given just then some one else's gold-mines for a strong lap-up of something neat. Mind you, about five minutes before we stopped the up mail passed us, and we were both going full forty miles an hour. Suppose the box had fizzled out just then, it would have wrecked both trains, killed a few hundreds, blown a big hole in the line, spoilt the dividends for some time, shocked the world, made widows and orphans of half the country round pretty nigh, have ruined a few speculators who were on the 'bull' lay in the main line shares, and have smashed into chips more than half the 'bucket-shop' outside benevolent (?) institutions for the distribution of wealth as were operating for a rise."

"It seems to me you lost a grand opportunity of being a big pot for once, and showing them who's which—but there! you always had a kind heart, and I remember you have often said a too sudden rise in the world never did any one much lasting good."

"You are right; but perhaps it is as well for me. I am so modest, and ambition knows me not."

Note.—On all public works it is advisable to know by what means any blasting agents are brought to the works. Daily use not infrequently causes the men to be very reckless, and stringent regulations in conformity with the various Acts and general experience should be made, and every care taken to have them faithfully observed.

CHAPTER XI.

CONCRETE. PUDDLE.

"Have you managed to squeeze any 'extra' profit on the quiet out of concrete?"

"Yes, twenty or thirty years ago, but there is not much to be got now. Since a few engineers took to writing upon the subject they have reminded or informed others pretty well what to look after, but there were not many thirty years back that knew how it ought to be made; and you see, although one receives the materials, the concrete has to be made with them, manufactured, as it were, on the work, and you can spoil the best Portland cement that is, was, or ever will be made in the proportioning, mixing, and blending it with bad sand and gravel, or dirty broken rock.

"They handed me the Portland cement, and all the specification said was, 'All concrete shall consist of 1 of Portland cement to 6 of clean gravel, and shall be mixed and deposited in a workmanlike manner [which we consider means as the workmen like] to the entire satisfaction of the Company's engineer.'

"This was drawn up by a civil and mechanical engineer, which is a big-drum kind of title, and I should think covered corkscrews and manufacturing machinery, and everything else under the sun that can be handled at any time, including a 6-inch drain, the Forth Bridge, and the Channel Tunnel thrown in. It's too much, it seems to me, for one man to completely understand; and I once heard a celebrated engineer say that, with a few brilliant exceptions, such a man knew thoroughly neither civil nor mechanical engineering—life was too short. I don't presume to say anything, but his specifications of our kind of work might have been more exact; still they were sources of joy and comfort to us.

"Machine mixing was hardly known at the time I am particularly referring to, and the Portland cement was of all qualities, good, bad, and indifferent, and some as I really can't say had any quality in it at all, and was utterly unlike what you get now. It was then sometimes bought on the same principle as going to the first shop handy, and saying, 'Small bag of cement. How much?' There was no name on the bag, for no one wished to own he had made the cement, and it was indeed of illegitimate origin, and had no parents.

"The cement came, and we did pretty well as we liked, for the inspector knew nothing about it; in fact, we were all in the same boat. But what a lucky thing it is that there is such a thing as a margin of safety!"

"You mean the difference between the strain a thing has to bear in ordinary use and what will break it?"

"Yes, that is it. One day an engineer said to me, 'There is a large factor of safety in this case, which is fortunate.' I thought he was talking about a flour factor near the works that also sold fire-escapes and fire-extinguishers, so I said, 'He weighs nearly eighteen stone, and I should call him big rather than large, for he is like the prices at which he sells flour, and charges a penny a quartern too much; but he is greatly respected in the neighbourhood by those who don't know what fair prices are, for he is so oily and civil, as just suits a lot.' Between you and me, he swindled them, and beat us for 'extra' profit.

"The engineer looked as if he could not at first make out what I was talking about, and, as it turned out, I did not know what *he* was. He seemed to enjoy himself, and let me finish my sermon. He then explained to me what we call 'margins' of safety, and what they call 'factors' of safety are the same goods."

"You have learnt something now."

"I have, another name; no doubt their word is the right one, but they ought to consider the likes of us are not poets, or fed on stewed grammar, and should remember we were boss-gangers once, and have blossomed into sub-contractors.

"Let that pass. You should have seen the cement. It was lucky we never had to sift it as we do now, or we should never have got any through a forty-to-the-inch mesh. It was just like fine sand, and nearly the colour of it, too, instead of grey. I have had a fair experience with Portland cement now, for we had testing-rooms, machines and troughs, fresh and sea water, slabs, and a host of other detective apparatus at the last dock works I was on. However, the cement we had and I was just referring to, was pretty nearly all residue, and of course it did not stick the gravel together except in streaks that had good luck rather than anything else. And the gravel! Well, it is an elastic truth to call it gravel, for it was dirty; and I conscientiously feel I am close to thinking I am not speaking in accordance with the principles of strict veracity if I call it gravel.

"And the mixing! Well, there was not much of it, just a turning over or two, and we deluged

the stuff with water so as to make it easy to handle, and we hurled it into the foundations as we pleased and at all sorts of heights, just as might happen to be convenient. I did not trouble myself about it then, but I do now, for I had a month or two in and about the testing places when there was no other job for me that suited, and I firmly believe almost all the failures of Portland cement concrete occur because the men that used it do not understand it, or the specification is not carried out, or is wrong somewhere. The best goods in the world want proper treatment, and, after all, the abuse of a thing is no argument against its use. Some quarry owners and stone merchants don't like cement concrete; it is poison to them, because it hurts their trade. It is my opinion, founded on what I have seen and know, that Portland cement concrete is grand stuff when properly made; but you can't make the 'extra' profit on it you could, unless you can forget to rightly proportion the material. I mean leave out anything on the quiet you find is more profitable when it is absent; and now mixing machines are always used on works of importance where concrete is made in any considerable quantity, that is the only way you get a chance of a bit 'extra,' at least so runs my experience.

"Bless me! when I come to think of it, it is really wonderful that some of the concrete I have cast in has set at all, and don't believe it can all have set; for, first, the cement was wrong, then the gravel was not gravel, the sand was like road siftings, no trouble was taken to proportion the materials properly, and no mixing was done rightly, only an apology for it. The water was dirty, and used anyhow, and if a lump got a bit stiff it was rolled over, broken up in the trench and watered down below. Some went in like the soup that has balls in it, and we threw the concrete (?) down just anyhow. The inspector, as I said before, knew nothing much about it, although he was a beautiful kidder and could patter sweet and pretty just as if he were courting, and the engineer was away, so the road was clear for a bit 'extra,' and we took it."

"Now, how the dickens could any concrete be right with such treatment? It is cruelty to expect it."

"I left those works, and the engineer got corpsed, so he is past blaming; but, fortunately, the middle wall of the dock that got strained the most—the one in which was some of the concrete (?) I have been telling you about—had to be removed for improvements, and when they pulled it down I heard the concrete was in layers like thick streaky bacon, a layer of gravel with hardly a bit of cement in it, then a few lumps of solid on the top and hard as all would have been if the cement, gravel, sand, proportioning, mixing, and the putting into place had been done properly; then another layer of open stuff that had stuck together a bit, and then a lot of soft oozy rubbish, like decayed cheese, bad, coarse cement, you know, that would not or could not hold together and had done the 'fly' trick, you know, had cracked about, the coarsest part of the cement. The streaks were there because we watered the cement so much that it was not concrete but weak grout, and bad too; and it could not drain down because one of the thin, hardish streaks, already set, stopped it, and it was bound to make friends with the gravel and dirt somehow, although trying to shun such company by running away and so get off duty. It was the same all the way through, and there were a lot of holes in it caused by the nearly set lumps coming together and slightly sticking, and therefore preventing the other material from filling the voids. *Hardly a cubic yard of the whole mass was the same.*

"That is what I call a real bit of scamping; but, honestly, I did not think I was putting it in so bad as that, but I then knew hardly anything about the material. I shall never do it again, for I know I shall not get the chance, besides we all must draw the line somewhere; but there, a lot is now known about concrete that was only in the brains of a very few then.

"As the cement is now supplied to you, I often put it in a bit thick, that is when I have to find the gravel and sand. It would be the other way about under different circumstances; but at the present time, with Carey's concrete mixer—which, luckily for plunder for us, is the only machine that measures and mixes the materials mechanically, and turns out from 10 to 70 cubic yards of concrete per hour—you do not get much chance of 'extras' and none with it; and concrete mixing is now nearly done as carefully as mixing medicine, and I don't regard concrete as fondly as I used to, for no 'extras' worth thinking of are to be made out of it. My old love, consequently, is cooling off, becoming warm and perhaps distant respect, not much else; but good Portland cement concrete is the best material, bar granite, I know of, if properly used, as it is then all the same strength—that is when the Portland cement is right, the proportions, mixing, and depositing even and proper, and the gravel and sand really clean sharp gravel and sand. You see, in that case, it is uniform throughout, and, after all, what is the good of the hardest stone or brick when you have a weak mortar to join them together which cannot nearly stand the same strain in any direction as the stone or brick?"

"You are right, it is simply waste. Like deluging good spirits with pure water, and spoiling them both. Lucky you had finally left those dock works before they pulled the middle wall down, or you might have had a bad quarter of an hour in a very sultry atmosphere."

"After that we will have a toothful neat."

"That's warming and is real comfort."

"I have never had much to do with concrete, but I remember seeing a lot go in on some dock works where I had some puddle to make for the cofferdam, and I got something 'extra' out of that."

"How did you do it?"

"Well, you know, working such stuff all day and nothing else makes anyone rather sick of it, it is like breaking stones for metalling, I should think, and the weariness of it makes the big stones have a tendency to hide and cause the face to look small and even. I had a dozen men besides casuals, and all old hands at the game of 'extras.' We had to, or were supposed to, work up a certain right proportion of sand with the clay so as to prevent the puddle cracking and keep it sufficiently moist. I own we sometimes let the clay have a taste of peace; in fact, between you and me, we were going express speed, and 'extras' was the name of our engine.

"One day the resident engineer came, and somehow got up close to us rather unawares, and took us by surprise. Of course, the material ought to have been worked the same throughout, and we nearly did it, but nearly is not quite. He seemed to sniff out that all was not just as right as it might be, and said:—

"Don't forget to work it up thoroughly. You have a good price, and it is important the clay should be uniformly mixed with a little sand."

"Certainly, sir."

"I generally agree with my boss, it pays best. So I at once called out sharp to my chaps, as if all I loved in this world was at stake, 'Don't fear mixing it, lads. Get it well mixed.'

"One of them, he was a new chap to me, and belonged to the militia I found out, turned round, and said:—

"All right, boss; I always make the broad-arrow kitchens in the camp, and the flues and the openings for the Flanders kettles, so I know how it ought to be done; but if you think I'm a white-faced doughy [i.e. a baker's man] I am not, and you had better fetch a batch of doughies and start them at work feet and hands. It will make them sweat. That puddle, I tell you, is as well mixed as the doughies do the different kinds of flour, and call all the bake the best and purest bread, and make it smell sweet with hay water."

"I suppose you silenced him quickly?"

"No, I pretended to take no notice, for I knew I had spoken too sharp, but the resident engineer smiled downwards and passed on.

"We had a heap of clay on one side and the same of sand on the other, and the inspector saw we had from time to time a small mound of clay and one of sand put separate and measured ready for mixing. We had a few piles of clay and sand at first measured exactly, and then we got used to it, and did it by sight only. We were close to the river, or rather estuary, and used to fill a barrow now and again with the sand and shoot it over the entrance jetty. A little was taken from each heap. The engineer knew his book, and would not have it worked from one or two big heaps, and the sand brought to it, but he would have separate mounds of about 20 cubic yards at a time. There were nearly 5000 cubic yards of puddle to work up, and as the clay came from the trenches so we worked it up. A kind of filling and discharging, and everything on the move.

"I made a nice thing 'extra' that way, but nearly got bowled out, for one day there was an extraordinary low tide, a low tide was expected, but a land wind was blowing great guns, and it was the lowest tide known for fifty years or so. Now, when you start the game of 'extra' profit you will agree with me, it is necessary to have someone you can rely upon, or else things may not go exactly as you expect. They may work wrong, and then you have to look out for squalls when they lay you bare and find out all. Here, I had been getting a rise out of my bosses, and blessed if old Ginger's snip, his boy, whom I paid a bit extra to do the harrowing well out, did not get a rise out of me. It caused a near shave, too.

"Well, the tide ran down till it laid dry a little sandbank, that is, some of the stuff that should have been at home in the puddle, had travelled by the wrong road by the entrance jetty. I did give Ginger's snip a talking-to, I tell you, after; but it was a near shave, as you will soon know. I saw the bank, so I sent him down the jetty with two chaps that knew what was up and got duly rewarded by me. They knew me. I never forget friends—too good, I am. Not even to borrow from them, if occasion requires, so that they should remember me in their dreams. I said to them: 'Stir up the sand, lads, for I think I saw a leg in it, and a bit of a dress; it may be there has been another midnight horror. It's really shocking!' And that was true, for I thought the sand was shocking, and that murder will out, as the saying goes. It was a shave, for just as the tide began to turn, up came the resident engineer, and there could not have been more than an inch or two over the sand, but it soon rises, as you know,

and almost walks up. I had not time to call the men, and there they were, stirring away. It was lucky I thought of the leg and the woman's dress. So I shouted, 'Come up, lads, it's nothing.'

"Then the resident engineer started asking me questions; and I was afraid he might ask the men something, so I kept him as long as I could, and spun a yarn, and pointed out the spot where a body was found some time ago, and talked away like a paid spouter, for every minute that passed was good business, for the water was rising quickly, and I knew the tide would soon just about put it right. After a little while the resident engineer went away, and I was rubbing my waistcoat thinking I had been in another near squeak, but won on the post by a short head owing to jockeyship, when I saw him down below with a large black retriever, and the blessed dog was half out of the water. I kept as far away as I could, but I saw he had taken off his boots and turned up his trousers, and was walking about on the heap probing with his stick. He did not stop long, as he knew the tide was rising, and then he came to me afterwards and said that a sandbank had been deposited at least 30 feet in length.

"Very likely, sir; but did you find the leg, or body, or dress of a woman?' 'No. But I found a lot of sand that would have been better in the puddle.' And he looked straight at me.

"Well, I had to put on my best sweet, innocent child face, and I hazarded the mild remark, 'It's the eddies that have done it. I have known them bring stuff for miles, sir.' It was no use saying from the other side or nearer, because there was no sand like we had to mix with the clay for the puddle for many miles, nor could I declare that a barge had got upset. He did not say anything more, but called his dog and went to the office. Let me impress upon you that the last 1500 or so yards of puddle had more sand in them than the first 3500. Tides I like, and they are healthy and useful; but it is the deuce to pay if you think you can go against them, as King Canute showed his courtiers, when he did the chair trick upon the sea-shore. Do you know I go so far as to think that if a floating caisson were taken about and sunk so as to lay bare the bed of the Thames in certain places, things would be found by a little digging that neither you nor me dream of, and perhaps might not like to see, for even sandbanks at certain times and places are not pleasant to gaze upon. Eh?"

CHAPTER XII.

BRICKWORK. TIDAL WARNINGS. PIPE JOINTS. DREDGING.

"You remember my old partner on the last dock works we were on?"

"Rather. He had been properly educated, and knew the time of day, and there are few things he ever had to do with he did not get a bit 'extra' out of. On that you can bet the family plate."

"Right you are. Old partner, do you know I have a weakness. I liked the old times when there was plenty of work to be had, and few that knew how to do it. Then the likes of you and me were regarded at their proper value, and estimated as worth something extra. Now there are about a million too many of us, and not half the work to be done. Old England is not like a big place that wants opening up, and it is a rare high old breeding country, and a lot of folks seem to wish it to be nothing else.

"My then partner took, labour only, a lot of brickwork in cement. It was a dock wall, and it averaged not far from 20 feet in thickness. It was a wall, and not a mere facing like little bridges. It gave a man a chance of something to work on. When a chap takes a contract, labour only, not having to find the materials, it is no use turning your attention to saving them; the only game to play is to use the mortar nearly liquid, so that it runs about of itself almost, and put some random work in between the face work and the back, and trust to mortar-rakes and grout, and oiling the human wheels as much as required. I don't like the word bribe the inspectors. For two chaps like us, that will have what we consider good work, it is not bribery, it is downright pure philanthropy that prompts us to give a sovereign away now and then in the proper and most deserving direction, which I generally find to be the inspector. I never give gold away without knowing it will come back well married, and may bring a family, and they are welcome to my best spread. That's just where our education enables us to grasp things right. What a shame it is for people to find fault with the School Board rate, when it is only about four times more than its promised highest figure, and the school buildings are such models of art and strength; and how thankful we ought to be to the teachers for their kind attendance, given for almost nothing! How pleased our old

schoolmaster would be when he knew we took every advantage to make a profit somehow or other from what he taught us."

"I guess he would be, the joy might kill him; but how did you apply your schooling to the brickwork?"

"Wait, patience please! As I said before, or nearly did, there was not much face work compared with bulk in the wall. I had a lot of militia chaps, and well paid and lushed them. They were something like brickies. Bless me, the wall used to rise up; and I was half afraid if those at the office worked out the check time, and compared it with our cubic measurement, they would think I was paying all my chaps more than any other member of creation ever did, or making too big a profit to suit them, and don't you mistake. But there! the Company did the work themselves, or let it in bits, and of course the check-time game was not played anything like so strong as if we had been working for a boss contractor.

"Well, we were doing trench work, and had shoots for the materials to travel from the surface down to the wall, and the trench was about 50 feet in depth from the top to the foundation. We had one shoot for bricks and another for mortar in between each frame, and that would have been plenty if all the work had been laid to a bond, but when only about 4 feet in the front and 2 feet at the back was, and the rest raked in level, except a course or two now and again, we used to want a couple of shoots for each. I had the face of the wall made really pretty, just like a doll's house, and pointed up lovely; but let me give a bit of credit to the Company, for they gave us the best materials with which I ever had to do."

"You mean the bricks and mortar were such that it would have been a downright waste of good muscle to put the bond the same throughout, simply pampering up the materials and turning them sickly, like some people do children, so as to appear so fond of them before other people!"

"Precisely; so after my partner got the face in right, the stuff went down and in. All we had to be careful about was not to smash the bricks. We soon managed that, and we had few broken ones, for they were good, hard, and dark. Well, in they went, and when we began to work the show, some of the scenery was hard to get right. Of course the inspector began to find fault, that was what he was paid for, and was about the only way he could work round for his 'extras.' After oiling him a little, and pleasing him in the old-fashioned way, we managed gradually to overcome the natural dulness of his mind, and we became a happy crew—a lot of brickies with a single thought, and hearts that beat as one.

"Well, in the stuff went; and after working out the averages according to the rules of the exact sciences, me and my partner arrived at the conclusion accordingly that about one-half or a trifle more bricks were put in by hand, and the rest were like machine-made bread, unsoiled by hand, and therefore must have been good and pure, as those alone know who work on the same lines. My partner, in his younger days, before he took to brickwork, had been to sea, and all the men used to call him 'Captain.' When he wanted to give the chaps in the office the straight griffin, he used to say, 'Nelson's my guide.' That meant give them 'biff,' in other words, finish off the enemy as quick as you know how."

"You mean get the bricks in as fast as you can *only get them in quick.*"

"Yes, that's it. If good old Nelson sent his shots in as fast as these bricks were squatted, all I can say is the guns did not get much time to cool. Let me give my partner all praise, for although he had a nice spot to work on—as of course the timber in the trenches hid a lot of the work, and made a nice gloom—as a precaution he kept the ladder away from the top of the trenches, so that anyone had to walk along the top strut and then get down, consequently there was not much chance of being caught; and after the bottom courses were in and the face and back right, it was easy work, because there was always time to get the road right and all went as peacefully as could be wished. But the old Captain, on the same dock, nearly overdid it one day, and all to save him scarcely one hundred pence, but he got so eager that money to him was food, and it is my opinion if he had been born rich he would have made a fine miser; but apart from that, he knew how to make a contract and what work was, and the training on board ship he had in his young days set him right, and he was always on the work looking out for a bit 'extra,' or on scout. But once he nearly overreached himself."

"How did he do that?"

"I will tell you, if you keep quiet."

"Right away."

"It happened like this, and might have wrecked the whole place, and was the consequence of working against orders. At one part of the works there was an old slope at the end of the dock which was no use without a new entrance. Where the trenches had been dug out for a wall a piece of earth was left in at the dock end, and was stepped down like a retaining wall, although only earth. Well, the orders were to keep it 4 feet above a certain level, which

made it not so nice for unloading from barges as 2 feet or so. As that end of the dock was only sloped off, and left to itself, for no one ever seemed to go there, and it was a good height, and up and down a bit at top, been stuff run to spoil, my partner, the old Captain thought he might as well take another 2 feet off for about 10 feet or so, and ease the unloading the bricks, cement, and sand, and made certain it would not be noticed. Now of course it did not take long to pare a slice from that short length sufficient to help the unloading, and I should have said this was done soon after we began the brickwork. I remember the day well enough, for if I had not have happened to have been having my dinner by myself on the cofferdam, I believe we might have been flooded out and wrecked.

"The wind was blowing strong and had been for several days from the same quarter, and it brought the water up till it was heaped. Before the wind began to blow it had been very wet, and it was also the time high tides were expected, so everything worked in the direction for a real high one. I began my dinner before the usual time, feeling a bit hollow, and had done by a quarter of an hour after the whistle had blown. I was just lighting my pipe when I happened to look upon the water. It wanted about an hour or more to high water, I watched the tide flowing up, and, all of a sudden, it struck me it would be a topper; but as the cofferdam was a long way above high water, so as to stop any waves breaking over, for the estuary was nearly one mile in width, and as this dam was a really well strutted one, it did not trouble me. I dare say I smoked for nearly ten minutes, and was thinking it was a nice job, and that 'extras' would have a good look in, when, just as things that frighten you do occur to you very quickly, it struck me—How about the Captain and his two feet off, pared off, up at the trench end bank? Well, I did not stop, but went at once to the place, although a good half mile away, and was soon there. I saw it must be a near squeak, and I knew there was no chance of the entrance gates being shut because a lot of craft was waiting to go into the dock, besides it would give the office that something was wrong, and I knew the chances were a thousand to one no one would come near as it was right away one end of the works, and nothing doing there except for us when we were unloading. Most of the chaps had never been that end of the works at all. Now this was all very pretty looked at from getting a bit of 'extra,' but it was hardly the same when that game was played by the tide putting in a bit 'extra' and rising nearly 2 feet more than ever recorded before. I looked at my watch and knew the tide had about an hour yet to run up. I got out my rule and measured, and then I was sure it would not be far off two feet over the dip the old Captain had cut to save an odd penny or two. I was just turning round to go to fetch him—for I knew where he was, and of course we always let one another know, although we don't name it—when I saw him coming pretty sharp with his ganger and a few trusty chaps. I beckoned to him. He was alongside very quickly, and I said, 'The tide will be over.'

"He answered: 'I thought it might, as the bottom of the tenth step down on the landing place was just the same level as the top of the dip. I knew it by the water.'

"I said, 'There may be a chance about it, but I don't think so, for this tide is running up so strongly that I know, from experience of the estuary, that it will beat the highest tide ever recorded.'

"While I was speaking he measured, and took out his watch and timed five minutes. He measured again, and then off went his coat like greased lightning, and we all followed suit as if we were a lot of figures pulled by strings, and he shouted, 'We have not a moment to lose. It will rise 1 foot 6 inches above where we are.'

"He then clenched his teeth. 'Planks, stakes, bags, tarpaulins, bring anything you can get, and come back at once or we are drowned out, wrecked, and lost, all ends up.'

"We soon got some stakes in, and some planks, and we set to work, all six of us, raising the dip in the bank the old captain had made. He turned white as a sheet, and said, 'She is on us, simply romping in. Half a dollar each if you can stop her.'

"We all worked like black devils flying from torture, for we only had half an inch start of the tide. It was a sort of life and death race, and death for choice.

"'She is still rising, Captain.'

"He then cried out: 'By thunder! She's over the far end at the plank dip. Once really over, and all will go.'

"He stood still for a moment and then dashed to the place and laid down on his side full length, and shouted: 'Give me a short plank, and my coat.' He would not get up although we asked him. He had got the frights, so we let him be. He placed the plank in front of him, and his coat over it, and there we were filling in stuff at the back of him as fast as we could, and putting in stakes for the planks. The tide was still rising, He turned his head, and said: 'Are you ready?'

"'Yes.'

"He then rose, and a pretty mess he was in.

"By thunder! that was a close shave. If we had only had another tarpaulin or two we should have been right sooner. There was some sand there, I remember we upset a wagon-load."

"He looked scared, but soon brightened up and said: 'We are right now though. The tide has stopped, but keep at it, lads, we must bury everything and get a good 2 feet higher, for if once the water runs over, the tail-race of the largest mill stream in creation will be a fool to it, and it would only be a question of minutes before the whole earth-bank would burst and let in ten acres or more of dock water, and the sea, and perhaps break up a lot of craft and wreck the whole place. Lads, I well remember seeing a catch-water earth-bank give way, and it is soon over when the water runs down the back slope, and there is not much chance of stopping a breach.'

"The men went away, and the captain said to me: 'My word, I shall not forget this.' He then sat down and wiped his forehead and said on the quiet to me: 'There is one blessing, no one on the work knows about it but us, and, if we are careful, no one will.'

"You had better get home at once and have a rub down and change and sixpenn'orth or more, hot. I know what to do, and will see all is put right.' He took the hint and skipped, but came back in half an hour, and then we had a talk."

"I tell you what it is, one can play a lot of tricks on land, and get 'extras' many roads, but water won't stand it. It is too honest, and turns upon you and soon finds you out. I never did like water much, you can't beat it, that's why I left the sea. It's an unsociable element, and is most always in the way except when you're boating, washing, fishing, or mixing something. You can't educate it so as to look at work from an 'extras' point of view, for it cares for no one.

"Take my advice and always give it a margin and allow in temporary structures a good 3 feet above the highest recorded water line, unless you want the work wrecked, and then add a height necessary to keep out the waves."

"You are right, for I remember getting a bit 'extra' out of some pipe joints. Instead of making all the joints according to the specification, we made a good many with brown paper and covered them up quickly. The pipes were laid at a depth of some 20 feet, and it took a considerable time before they began to leak. At last there was a burst up, but it was so powerful that all the jointing was washed out, so they never knew who was to blame. The place where that happened is fully a couple of hundred miles away, and will never see me in it again as I did not like the people, so I said to myself, all right, I will leave something behind that will tickle you up, and cost the lot of you some beans to put right, and I did, and so got even with them all. It was one of those lovely small towns where everyone knew everybody's business much better than their own."

"Do you remember Carotty Jack?"

"Yes, rather. You mean him who was up to snuff in spoon-bag dredging. 'Old tenpenny labor' only was his 'chaff' name."

"He was the sharpest card, so I was told, on the river for getting 'extras' out of dredging. He was measured by the barge, and paid accordingly. I confess I don't quite know how he worked it, but he did for years, and never got found out. You see, what is ten or twenty yards of dredging, nothing either way? It is never noticed, and you can't measure under the water as you can on land. It can't be done, except in new cuts, when new cross-sections have been taken over the ground. The beds of most rivers being always more or less on the move, water then becomes a nice servant to work a bit of 'extras' out of, and that is about the only way I am aware of where it comes in useful in that direction.

"How Carotty did it, as I said before, I don't quite know, although I saw the thing, but he used to work it somehow or other by movable boards fixed on a pivot. He had three or four of them, and could fit them together just about as quick as the roulette tables are fastened by racecourse thieves and stowed away. They had two flaps at the sides covered with stiff tarpaulin, and the ends were closed by planks loosely fastened by a catch to the pivot. They were well made and fitted splendidly, just like hinged box-lids, and the whole thing was similar to a box with the bottom out and the sides hinged and ends to slide up and down. I believe Carotty would have made furniture A 1, if he had turned his attention to it.

"He had an old ship's boat of his own. The apparatus was stowed away in it, and I might further say it resembled a shallow box upside down, with the lid off, working on a saddle, and the flaps at the sides moved as the box got pushed down on either side; but they kept the stuff from getting under it almost always; for when they measured the barge-load for depth, if they put the measuring-rod down on one side and touched the board, it went up a foot or so on the other, and no one suspected anything. The barges were all narrow ones, as usual with spoon-bag dredging. The measurer used to walk round the barge and be busy trying the stuff here and there, to see if there was no gammon. The mud was thick, and went up and down very slowly. Carotty always had two or three of these boxes fixed on the

saddle, and just the right distance to be out of reach, and he did not fix them on the same line. He kept the frames two or three feet apart, so that if by any chance two men started probing on the same line he would soon shift them a little, and say it was an odd brick, or a tin, or a bottle, and then everything went down easily upon both sides, and for one place where they were extra sharp, he made the machinery in very short lengths, and zigzag fashion. He told me he got pretty nearly from six to ten yards extra out of every barge, according as the stuff and the size of the barge was kind towards 'extras.' Of course, from the solid dredging he had the best haul. Carotty was a cool card at the game of 'extras,' and had a face on him like a nun, and could look that innocent and lamb-like as only humbugs can. He used to laugh over it.

"He told me that he had known the time when no 'extra' machinery such as his was needed, for plenty of water, some boxes, a false bottom, and a few planks, were all the things that were wanted. Then they had to be given up, and he said he was really compelled to make himself a present of the first small pump he could privately annex, and soon found the chance on one of the works where he had a little contract.

"He got some old bags, mended them, and soaked them in some solution that made them tight, and he used to fill them with water and weight them with a stone or two. He had a rope with a draw-knot attached to short lengths of line so that he could let the bags loose or fasten them against a hook when he discharged the barge out at sea or elsewhere. Generally he used to unscrew the stopper of each bag at the side of the barge, and when on the return journey let out the water and then haul up. Although it cost him some labour, he said he used to get one way or other a bit of gold 'extra' by that means every barge load, or, rather, what was thought to be; and sometimes he did not let the water out of the bags at all if the people he had to deal with were easy, but now times were very hard on him, as he had to work at night to keep the machinery right, and he thought it very cruel of them, as it gave him a very short eight hours' recreation, as was the cry now for the third part of a day.

"He was clever, and I believe he could have made an iron-clad out of old fire-irons and coal scuttles if they had given him enough goods, plenty of time, and paid him sufficiently, and you may bet the ship would have answered its rudder all serene.

"He told me he actually got twopence a yard more on one occasion by using the boxes right for a week, on the ground of extra hard dredging, for, of course, all the stones and heaviest dredgings fall to the bottom. He put in his machinery pretty close together, and heaped up the stuff in the middle, and did the injured innocence business properly, and after they had done a lot of probing about, during which he told me the machinery worked lovely, they gave him another twopence a cubic yard. Measurement by the ton would have spoilt that game, though; but then it was not canal dredging he was doing, but in the open. Give Carotty his due, I was told there was not a man on the river who could dredge to a section as he could, and he did the work quickly and well, but he always managed to get paid for more than he did, and he told me he never meant to do otherwise. He said he considered he was cheap goods at the price, and wholesome; but he complained tremendously of the dredgers and excavators introduced lately, for they spoilt him, and there was but little chance of 'extras' now worth the trouble or the risk. In consequence, he had given up doing dredging."

CHAPTER XIII.

PERMANENT WAY.

"Will you listen to me for a few minutes?"

"Yes. I notice you have something pent up in your head."

"Well, this was rather an amusing bit I am going to tell you, but was a near shave for real squalls, as you will agree when you hear about it.

"I got the gov'nor to let me do a bit of linking in at so much per chain. Of course, he supplied the rails—they were flange rails—sleepers and fastenings, and they were all right. I linked in the road. We had a mixed up permanent way, nine by four and a half half-rounds, and ten by five rectangular sleepers. Check pattern, an odd and even road. Between you and me, I think mixing them up betwixt the joint sleepers is a mistake. It makes the road stiff one place and loose at another, and a train cannot run steadily, and I would rather have all rectangulars, and put them wider apart, and give the rail flange a bit of bearing, for half-rounds are mere sticks, although they are lighter to handle, and in that respect nicer. You see they have only about three-fifths of the bulk of rectangulars, and when they are adzed less than that, and

not more than half the bearing for the rail flange. If I had to do the maintenance, no half-rounds for me, still they do for light traffic and for cheap agricultural lines."

"I agree, they are temporary goods."

"Well, it was funny, but here we had too much and too little of a good thing, and were as near in hot squalls as could be. I expect they made a mistake in loading them; anyhow, young Jack, my ganger, found he had no half-rounds, but a lot of rectangulars. He is a bit impetuous, and would not wait, it's not in him, so he put in all rectangulars that day, and, of course, with the result that they had not enough rectangulars left for the other road all through, so about six or seven chains were nearly all half-rounds, and he actually placed one rectangular one side of a rail joint, and a half-round on its back, flat end upwards, on the other, and so a lot of the half-rounds did duty for rectangulars.

"It was a bit of a scurry, and as soon as the road was in the spikers, ballasters and packers were on us, and no time for thinking. Well, neither me nor Jack gained much by the fun, except our men would have been stopped, and they were not, and things would have been put out a bit for the day. My guv'nor did not know, or would have made us pull it all up and put it in right. Now, they knew the number of sleepers, &c., that had been served out, and had sufficient confidence in me to be sure I never scamped the materials, except a bit of ballast here and there, and that is soon made up.

"Of course, there was no mistake six or seven chains of road were weak, and I told Jack to put in a little extra good ballast and pack the sleepers well there, and what he did extra at that place was to come out of the part where all the rectangulars were, for I never throw away or lose anything on purpose."

"Quite right, we agree. Shake, for I'm hearty to you."

"He understood how I wanted the wind to blow, and it would have gone on all serene, but you know, just when you think you are out of a scrape, you sometimes find you are in it, or as near to it as wants 'an old parliamentary hand' to explain and fog away. I was down at the junction, when I saw the engineer, and some swells with him. The resident engineer was away that day. After a bit of jaw among them, they beckoned to me, and said they wanted to go to the end of the line, the very place where some of the sleepers were lying turned on their round faces. There was a bit of luck. I felt dead wrong. However, they had to walk about a couple of miles, and then wait till the engine had returned with the empties; so I said to the engineer, 'Please excuse me, sir, but I will arrange that the engine is at the ballast hole at four o'clock, as you wish, and I will be back to attend upon you as quickly as I can.'

"I scampered up the slope of the cutting and out with an envelope. I always keep one or two about me handy. I tore out a leaf of my note-book, and called young Snipper, the brake boy, and said to him, 'Jump on old Leather's nag. Take this to young Jack, and I'll make it all right for you when I see you next time; but go quickly, and give this letter to no one else but young Jack. If he is away for more than a few minutes bring the letter back to me. No—wait till he comes up, and send someone to fetch him to you. You understand.' 'Yes, sir, I know what you mean.' 'Now do a bit of the Johnny Gilpin business.' Off he went, and was busy.

"This is what I wrote to young Jack, my ganger:—'Bosses has come, and will be up to you in about an hour. X... them. Cover up the ends of the half-rounds, and sprinkle them pretty with fine ballast if you can do it in an hour. Then shunt the empties or the full wagons over where the half-rounds are, and look innocent, as if you had never moved above a foot all day, and be busy, or I'll pull your throat out, much as I love you. Smooth it right, and leave rest to me. Pull all your gumption out ready. Keep this, and hand it back to me. Show no one, or I'll have you hung. If I find all right, there are two pints, and something else.' That's what I call a business letter. No double meaning about it.

"Young Snipper got there in double quick time, and young Jack was there as well. I saw he had carried out my letter of instructions. Still, I knew the engineer would be likely to twig, as he was near to being hawk-eyed. Now, I felt sure they would be hanging about for an hour, perhaps two, as most of them had never been up there before, and they thought of carrying the line on further to somewhere or other, but they did not on account of the expense, for several tunnels, viaducts, high retaining walls, and other heavy work would be required. Here was the very place for a rack railway on some system like Abt's, it seemed to me. I saw one at work in Germany, and know they are safely used in Austria, Switzerland, Italy, and in North and South America. As you know, you cannot nicely work a railway by adhesion only much above a gradient of one in fifty with sharp curves upon it, or one in forty on a straight line, consequently the rack is the thing to use then, I fancy, for on the Abt rack railway the pinions on the engine can be easily put in and out of gear on the rack, and the journey be continued by simple adhesion, as by an ordinary locomotive, and the rack system works all right round moderate curves.

"I should think, in hilly parts of the country there are many places where 4 feet 8½ inch

gauge railways could be laid out almost on the surface of the ground, and at such gradients as about one in fourteen, and there should be no difficulty in working them safely, because similar lines have been worked for many years. There must be many little feeder lines that end nowhere almost now, that could be so continued over the hills to a main line, and thus join two large traffic trunk lines, and raise the feeder from obscurity to some importance, and from the state of a mere agricultural 5l. to 10l. per mile per week line of railway to one earning more than double. However, that's by the way. Now, my best game was to draw the swells away as quickly as I could, and yet not show them my hand. I started badly, though, for I said, 'Gentlemen, I think a shower is coming up over the hills, and if you command me, I will tell the engine driver to run you down quickly by himself, and come back for these empties. It won't delay the work in any way, gentlemen all.' They said, 'Never mind; if there was a shower they could stand upon the sleepers by the wagons and get sufficient shelter.'

"That meant on the sleepers I was trying to hide. Just fancy, the very half-rounds that troubled me. I felt I could sink through the earth, as I saw the engineer's eyes were doing full time as lighthouse revolving lights. I thought, he will have me chucked from this job, sure as half-rounds are not rectangulars, for he would not have bad work.

"Now the wagons did not quite reach all over the half round road, the swells took to walking between the roads. Why, I never knew, but they did. I felt certain, if any of them took to walking upon the half-rounds, they would find it all out. I got to young Jack, and on the quiet he returned to me my letter to him, which I burnt afterwards. By luck, one of the directors—that's what they were—drew the attention of the engineer to something on the station road close by; and all except two of them passed on, but two directors kept behind with me, and one started walking on the half-rounds, and on those too that were on their tops, as should have been uppermost, and one nearly got upset before he travelled five yards. So I went for him there and then, and said, 'Please, sir, the road is not packed yet, and has only just been put in to take these few empties. It will be as firm as a rock in two days, sir.' I left the rest to him. He looked at me and said, 'I hope it will be, or passengers will think they are travelling over the Rocky Mountains.'

"I smiled, and looked as pleasant and truthful as I knew how, but thought, hope with you, as with me, is grand goods, but fact is better business. They were a smart lot, and no one was going to move them on till they had seen just about all they felt inclined to, but I had a bit of luck then, and ever after have liked birds."

"What was it?"

"Well, a cocktail rose almost at our feet. The line passed between two coppices. From that moment I was safe, as both the directors talked of nothing but shooting. I kept the game alive for all I knew and more than I did, that's certain, and before I had done had made out it was the finest part of the whole country for game, although they ran a bit wild, and wanted stopping. It is convenient to always ease down a strong sentence, then you can alter its meaning a bit when what you have said don't agree with what you are saying; so I warned them the birds wanted stopping. They all got talking and pointing about till they had no time to spare to get back so as to catch the train at the junction. I tell you it was a near squeak, and shook my constitution more than a trifle, and no fault of mine, but it ended all serene."

"Your escape reminds me of one I had. It was a long while ago, must be about forty years back, when railways in many parts were a sort of novelty, and the natives used to turn out, swells and all, to see what was going on, and made a line a free show. One day about seven or eight swells came bearing down on me. One I knew had put a lot of money in the line, although he was not a director, and I have no doubt got it well back in a few years by the good the railway did his estate, for houses began to spring up all round soon after we had finished. I remember, and you will, that old Jack Slurry used to say married folks were nothing to a new railway for increasing the population in certain parts. It brings people together as never could come before, and so up goes the number of mouths, and no sooner do houses rise than shops follow, then churches and chapels and clubs and halls and so on like a procession, till the old folks almost wonder where they are. I'm talking a bit astray of my subject, and will now to it again.

"These swells came straight to me and asked me to show them through a few of the cuttings, and I did. I met my ganger in one, and managed to get in front of them and ask on the quiet who they were. He said, 'Them is nob's. They be hanteaquariums. They are searching for as old goods as can be found!' I knew what he meant, so I broke a small boulder or two and showed them the impressions of shells, and I called to my young Snipper and he got them a specimen each, and they were pleased. One gave me a quid when they left. They were real gentlemen, at least one was; and it is only charitable to suppose the others were in company, and this one was banker!"

"I agree with you."

"After looking at a few of the cuttings, and my putting in some pleasant words which seemed to be food to them, one of them opened a gate and they commenced to walk back along the

fields and through the wood, near to where a culvert is, and close to a bit of marsh. They did not seem to mind the dirt or brushwood, and they asked me to come with them, and point out and say anything I thought they would like to hear, and I did. Perhaps they would have liked to have known what the prices were I was paid, but I had not the heart to distract their minds from their own true-love study to such a plain thing as £ s. d. I ought to have told you our engineer we used to call 'Old Fangbolts.' They were his hobby, and it is my opinion that if he has as long fangs to his teeth as the bolts he would have put down, when they get decayed he will know what pain is, and wish they were short spikes. He had his way, of course, although there was a great waste of metal. Now fangbolts are good things for getting a through grip of the sleepers when the fangs are screwed on tight, but still they don't keep the rails from spreading much more, if any, and I rather think less, than flat-faced spikes of fair length. At least, that is my experience."

"And so it is mine."

"Between you and me the chap that first had the stern end of a bolt put uppermost in the rail, so that he could be sure the nut was on, knew what he was about, because fangs are nasty goods to screw on, and, bless you, tricks are sometimes played that way. I have known them just turned round once and then wedged by a piece of ballast, and they appeared to be tight; and when a bit of the road had to be taken up and the fang had got loose it was on the premises—perhaps, it is truer to say, just outside and at the door—and then you could always say the threads were wrong and blame the maker, or wriggle out and wrestle with the subject in the direction that looked the most serene."

"You mean work your lay according to circumstances."

"Precisely. Besides I have had two fang bolts with triangular fangs to fix in the flange of a rail almost in line, one each side of the web, and they could not be both screwed tightly, for the points of the fangs under the sleeper met when you turned them. This time, of course, none of these nobbs knew what a fangbolt was, and if I had told them I dare say at first they might have believed it was a Roman tooth, or a piece of chain armour, or part of an early Briton's war paint. Well, we were walking through a wood—it belonged to one of them—and clearing our way, for the brushwood was rather thick, when we came to a small mound, and I own I did not know what it was. One of the swells smiled, and said, 'How very interesting. This is a tumulus.' I said, 'Excuse me, gentlemen, but I am always glad to learn anything, and you don't mean to say some earth has tumours and, swells a bit, because if you will tell me how to work it it would save me and others money and a lot of work forming embankments, if it does not cost too much to start the swelling.'

"They smiled, and one said 'A tu-mu-lus was not a tumour, but an artificial mound raised over those who were buried in ancient times.' I touched my hat and said 'I thought there was something wrong, gentlemen;' and told them I knew there were a good many women round these parts that had wens and they swell up as big as marrows, but I did not know the ground had tumours, and was eager to learn it had, as I thought I saw a useful application of them, and they might be a new form of wonder produced by inoculation. One of them then said, 'No doubt the women have their whims and playful humours, but he trusted they were free from wens or other tumours.' Then they all laughed, and one of them hazarded a remark and said, 'This is the ... formation.' It sounded to me like upper railroadian formation. I forgot myself, and turned round sharp to him and said, 'It is nothing of the kind, gentlemen. There is no such thing as a upper railroadian formation.' They did stare. I went straight on, and said straight out, 'There is no formation here at all, besides upper railroadian formation is utterly unknown on railways. The formation is at the bottom of the cuttings or the tops of the banks and nowhere else.'

"They stared just as if I was going to shoot them, and one of them laughed and said, 'I am afraid there is a slight misunderstanding somewhere.' Then the others smiled. I thought it was time to stop my tongue. The same one turned to me and said, 'My friend was alluding to the geological character of the locality. It undoubtedly is Upper Si-lu-rian.' So I touched my hat, and said, 'I hoped they would excuse me, and would they kindly remember I was a bit rough.' They all said, 'Oh! certainly!' and they seemed to like the business that had just passed, and were enjoying themselves, I could see that.

"Well, all this passed when we pulled up at the mound, which was about fifty feet away from the line, and in the thick of the brushwood. One of them began poking about with a stick, and bless me, I saw about half-a-dozen fangs here and there. I thought to myself it is lucky Old Fangbolts is not here. He would have shot me, and killed himself right off, or gone loose. I twigged what the mound was made of. It was only a small one, but the gentleman was at first mistaken, and no wonder, because there are a lot of real ancient mounds round and about the wood. However, this mound was a mixture of fangs that should have been screwed on the bolts and were not, that's certain, and earth and turf, and had been artfully covered up, for it was quite green except one little streak. I expect some vermin had tried it, and found it no good, and scratched away a bit, and bared it. Anyhow, it might have been awkward for me, for one of the party picked up a rusty old fang, and turned to the other

nobs, and said, 'I don't think that is very ancient; at least, if it be so, it is a Birmingham-made ancient relic, and has been deposited upon the wrong battlefield.'

"I believe that was only a sly hint to me that he meant the battlefield to be the permanent way; but, of course, I took no notice. He threw down the fang, and then we all walked on. No patter is sometimes the best game to play, and look as if you were learning a lot. However, on being asked about the mound, I said, 'It's only an old earth mound that has grown over green. It may have been there fifty years, not more, perhaps less.'

"Really, it was full of fangs that ought to have been screwed on the bolts, a heap of them, too. So I gave the office in the right quarter, and two of us went next morning very early, and soon dug a hole, and buried the mound, and carefully cast the excavation as close by as possible, and covered it up with a nice green top, so as to look quite natural and pretty, and when we had done we considered we had improved the scenery. It was a near squeak though, and it was lucky no engineer was with them, or I should have been had.

"It is my opinion, from what I have noticed, that the engine does a good deal to keep down the rails, and as long as the rails and sleepers are right, and the ballast good, and the sleepers well packed, the fastenings have more to prevent the rails spreading, and the road bursting than keeping the rails down, although, of course, that is necessary and should be done as well."

"I think you are quite right there."

"Old Fangbolts was all for the through grip, and did not seem to care much about preventing spreading. Well, engineers work in all grooves. Some have one way of thinking, some another, and all perhaps are partly right, and if they would but balance accounts, instead of harping on one string, it would be a smoother world."

"There we agree."

"Did you ever get a bit 'extra' out of rock ballast?"

"No; never had a chance."

"I did this way. Of course, rock ballast is not equal to shingle and clean gravel, but there is more chance of 'extra' profit, for you can pitch it in big, if you have a nice cover of small ballast, so as to make it look pretty at the finish, and like a garden path, and as occasion offers you can pare off the cress between the ballast wall and the top of the slope in embankments and the foot of the slope in cuttings, a couple of inches or so and sometimes get paid the specified depth that way, although the real depth of ballast throughout is not within 2 or 3 inches of it on the average. When the guv'nors are walking over the line keep them on the outside rail on curves as much as you can, as the cant makes the ballast wall look big. You have to be careful with the packing under the rail, because, if you don't mind, it may happen the centre of the sleeper is on a bit of rock, and then the sleeper may split when doing the see-saw trick as the trains pass and sway about.

"Just so. You must be careful not to pack them upon a middle pivot."

"I had two chaps who would almost have done for masons. They used to pack the sleepers with a few lumps where the rails rested on them, just to get the rail top nice and the rest was filled up anyhow, like nature on the sea shore; and we can't do wrong in taking a hint there, you know, for the cue is right, particularly when it runs towards 'extra' profit. Still, I don't like to chance breaking a sleeper's back, so I let them lie easy between the rails, or rather under the parts of the sleepers where no rails rest."

"I understand. You pack the sleepers only where they are under the rail-flange."

"Yes. One day the engineer said to the inspector who was a kind-hearted man and bred right, 'Mind the sleepers are evenly packed and not with large pieces of rock.' He called me up and repeated it extra treble to me. 'Very well, sir; but some of the rock will soon weather, and don't you think it better to keep it a bit large rather than small? The quarry runs very uneven. Some of the rock is as hard as nails, sir, and some soft, and it is not exactly the best ballast to handle or in the world; and if you will excuse me, don't you think, sir, on these soft banks another 3 inches under the sleeper would be advisable?'

"He did not seem to want to agree, but after a week, an order came from my guv'nor for 3 inches extra depth upon all banks. That was a good stroke, as it enabled me to do with larger stuff, and lessened the breaking it up. He was right in what he did, and so was I. I like rock ballast for 'extras,' although the walling is a nuisance. There is more chance for expansion of profits than in gravel ballast, and that is a great recommendation to us, anyhow, and is good enough apart from what things really are. I gave the tip on the quiet in the quarry to send half the rock down a trifle bigger, and it did not want so much getting or handling in the quarry, so they liked the new order, and it saved some breaking. Consequently I prefer rock ballast that weathers quickly sometimes, although, of course, an

engineer should avoid it for ballast if he can, and the money allows."

CHAPTER XIV.

"EXTRA" MEASUREMENTS. TOAD-STOOL CONTRACTORS, TESTIMONIALS.

"Have you managed to get a bit 'extra' out of measurements?"

"Yes, occasionally, but that game is about played out. In the good old times they used to let us all kinds of work, for we did business in company more then than we do now, and what one did not know the other did, and so we could do pretty nearly everything except metal work, so long as they supplied us with the materials.

"I have already named about the 'extra' depth of foundations in bridges, and pipes that were not so large as thought. I have also got a bit 'extra' from side ditching when they had taken no cross sections of the ground by leaving a few buoys or mounds at the highest parts. I have also had a trifle out of the cuttings by rounding off the slopes a few inches when they were long but working right to the slope peg at top and nicking in an inch or two at the foot of the slope; but the game is hardly worth the candle, as they have almost given up soiling the slopes. Then there was a chance both ways. You got more measurement than the actual excavation, and also a bit 'extra' for soiling that was not put in, but it does not run into enough money to make it pay safely, and as the slopes and formation are so much on show the fun is hardly worth the risk. There is more to be had, so far as earthworks are concerned, in road approaches than railway cuttings, and in docks than either."

"I think you are right there."

"You see the earthwork is not so much in patches in dockwork, but all together, and there is often as much in an acre or so of dock as in a whole railway four or five miles in length, and inches in dockwork are worth remembering. Besides they are not noticed so much, and the excavation is soon covered up; and if it is in clay, and found out, you can always say to the bosses—'I never saw such clay to swell in patches.' Be sure to say 'in patches' for then you have an excuse handy if the clay 'swells' nowhere else except at the place you have not excavated to the right depth. You can generally get the surface not exactly level throughout, and you have a large space to work on then, and every inch means sovereigns. Really I think it does no one any harm, and does good to me if the bottom is a trifle elevated. It comes rather easy to most of us to make ourselves think a thing is good and nice when it would cost us something to think otherwise."

"Yes. Money and our wishes usually work on the same main line."

"I once got done out of a bit 'extra' measurement by an engineer really lovely."

"Did you. How was that?"

"I don't mind telling you, but there will be squalls if you blab. It happened like this. It was a line that had been commenced and most of the easy work done. It was in the days when every jerry-builder and parish sewer contractor, and big linen-draper too, thought he was a railway and dock contractor. You know they borrowed a bit from a local bank, and would take any contract from a bridge of balloons to the moon to a tunnel through the earth to Australia. Channel Tunnels, Forth Bridges, and Panama Canals would have been toys to them, and they could have made them on their heads. They sprung up just like toad-stools—can't call them mushrooms, it would be a libel on the plants—and every one of them thought they were quite as good as Brassey, and could have given him points. They had cheek, that was all, just like quack doctors. Well, what with, so they told me, big local loan-mongers to work the oracle and swim with them, and general recommendations—which I never take much notice of unless I know what a man has seen or done—saying they were full of the sublimest honesty and wisdom as ever had been known, and were that clever as few indeed could hope to be, the game was worked trumps for a time. Tests, not general testimonials, is my motto. What you have done or seen done, not what people are kind enough to say they think you can do, and which they don't know you can do. The man that asks a chap that he is friendly with to write a recommendation has his sentimental feelings worked on, and then truth takes a back seat, and of course you are bound to say your friend is the best man that could be made for the place, just that and nothing else. It costs a chap nothing to write it, and it is only very few that care to refuse, because it does not do to tell a man whom you wish to be friendly with that you don't think much of him, and that he is quite sufficiently a

shirker and polite humbug to suit a good many, or that your own private opinion is he is not far off being twin-brother to a mouse-coloured beast of burden that brays. It is not good form, so we all, from kindness I suppose, write pretty of one another except when we are owed money and can't get it, then adjectives are often necessary, and as strong as you can find, with a few put in as are only known to chaps like you and me, and are not taught in schools, although they learn a lot there as they should not. Do you know when I read general testimonials I always think what a lot of saints and Solomons there are wanting situations, and it must be only the sinners and fools as are in harness. What you want to know from a reliable source is, how did a chap get on upon any particular bit of work he had to do, and have it specified what it was, and in what position he was, and whether all was and is right. Therefore, if I asked for a testimonial I want one specially written for the occasion and with reference to the kind of work that is in hand, and not as if I was going to let a man walk out with my daughter. I name this because, between you and me, I've found when a man is praised up as a sort of saint, and nothing said as to what he has done in work that he is near to being either a humbug or an ass. That was just the case here, for it was to one of these toad-stool contractors that the directors let the first contract, and engineers who do not advise their directors to have nothing to do with such public works contractors (!) I think deserve all the trouble they get into. Surely it is better to have a contractor who knows what work is and should be, even if he has but a small capital, than one who knows next to nothing about construction, and is financed by some loan-monger, or is at the mercy of some wire-puller?"

"I say, you are hot on the question."

"Well, I consider it about poisons some works that would otherwise have been made all right, and would have paid well too at the original capital. Besides it ought to be known a man must be specially educated to properly execute large public works, and should be bred an engineer, for one that can make shanties, dust-bins and privies, may blossom into a jerry runner-up of two-story stucco villas that have the faces and insides covered with lime and mud and half-penny paper, but it wants a contractor that is just about an engineer to know how to properly carry out railways, docks, bridges, canals, harbours, and all sea works and similar undertakings, and not a bell-pull mender and drain maker, because then he hardly knows anything himself of what has to be done and he is at the mercy of others. He tenders at figures below what he ought, and then the work cannot be properly executed, or the easy portion is done somehow or other and then the man goes smash. It is just the difference between our sterling building firms and the jerry-shanty-raisers who ought not to be called builders. Well, this one started with a rattle and scraped about, and then went to splinters. That's why I have named it, and because on this railway there was a road diversion. About a quarter of it was excavated and it was in an awful mess. It was in gravelly sand, and taken out in dabs, and in and out, all widths and depths.

"I thought I saw a chance of a bit 'extra' and said nothing. One day I got rather fierce for 'extras,' and I sniffed out some small heaps at intervals up the approach. They were about a yard in height and four or five yards round. I felt sure they had not been put on the cross sections, which I got to know had been taken in some places as close as 15 feet apart, so I thought, 'Before I get the wagon roads in and move another heap, I will see the young guv'nor.'

"Well, I had to go to the office, and he knew of the heaps and said 'I will allow you 30 yards for those. I had not forgotten them.' Now that was what they were to a spadeful, so I thought it was good business as I knew they were not shown on the sections. He said 'In case anything should happen to you or me I will write what I mean and have it attached to the agreement.' I thought that was kind of him. Now, we had worked for about a week, and I was keen on plunder. He then dictated a few lines to the timekeeper, saying that it was agreed 30 cubic yards of earth were in the heaps and they were to be paid for as an allowance in addition to the 9239 cubic yards, the total measurement of the excavation I had to do under the contract. Of course it was worded right, but I give you the meaning. This I signed, and it was witnessed by the time-keeper and the young guv'nor. I made just about the same as he did of the total measurement, but was so eager after the 30 cubic yards in the heaps that I signed the paper off hand, but of course I knew then what was written, but thought no more about it. I left the office and had six of neat right off on the strength of those heaps. I will cut it short now.

"Well, I finished the job quickly, and one day, just before I had done, I thought to myself, 'There have not been any "extras" on this approach road, for what with slope and fence pegs being set out there has actually been no chance of a bit "extra."' After thinking I said to myself, 'It is an awkward place to measure. I will make my measurements so that they work out five hundred yards more, add a little all over, I can but give way in the end, have a nice, warm, genteel wrangle that will shake up the cockles of my heart, and I may get half or something extra if I do the oily persuasive trick, and look wronged in my countenance.' So up I went to the office and said, 'I shall about finish to-morrow, sir, and I think you will say I have done the job well and quickly, and deserve another. It has been a tight fit, and has only

just kept me going.'

"Usual patter followed that is required on such occasions, and is kept in stock for them. I was beginning to feel real happy, and thinking I had got twenty pounds at least, and no mistake for talking pretty. So I said, 'As I am here, sir, do you mind telling me what you make the measurement?'"

"Certainly. 9239 cubic yards, and 30 yards allowed for heaps. Total, 9269 cubic yards.'

"That did not suit me, so I started on the injured innocence lay, and said meekly and persuasive like, 'You have left out something, I think, sir.'

"No; I have not.'

"Well, sir, I make 500 yards more than you; and if I don't get it it will be very bad for me, for I shall not be able to pay my men.' That did not seem to flurry him. He opened the safe, and read from the paper I had signed some months ago. Blessed if it ever occurred to me to think that I had signed for the total quantities, but I had, for I was then so taken up with the 30 yards. Like you, I am old enough to know that no contract is indisputable, and that many things in law have to be tried before they are law when a question arises, and that there is not much finality about the show; but here I was caught, and had made my own net, and no mistake; so, after putting in all I knew and saying to him, 'I did not take that bit of paper to mean the same as he did,' I considered it best to shake down easy as I saw I was grassed, so I took his measurement; but I wished blue ruin to the heaps, and may where they were tipped be well worried by worms and vermin. Look out! I shall break something."

"Don't slap the table with your clenched fist like that, or we shall have to pay for damages, and have nothing left for drinks."

"Right you are; but it does make me wild to think of it."

"You were had at your own game there!"

"Yes; but after all said and done, except the ground is level throughout, I heard two engineers say earthwork measurements are generally a matter of fair averaging; and if tables are used, some like this table and others that, so all are happy; but they agreed cross-sections are the best, and unless a plaster cast is made of the surface of some ground, no one could say what the measurement really was to a few yards, and that it does not much matter as the price per cubic yard is so little compared with most prices of work, such as masonry, brickwork, concrete, &c."

"You have finished, I fancy?"

"Yes."

"Now I'll tell you how I once got a bit 'extra' from measurements in rather an odd way. The work was done without a contractor, it was principally let in pieces to sub-contractors, and the rest day-work; but I heard they did not gain much, if anything, by it. Came to nearly the same thing, and all the bother and risk themselves, and about the same good work."

"Well, the funny way I made some extra profit, of course, as usual, very much against my will, was this. I happened to be in the engineer's office, and heard the resident say to his assistant, 'Mr. —, please make a list of timber required for the quay sheds, and take out the quantities.' Now it is only fair to say the assistant knew his book and was up to snuff, but we are all caught tripping sometimes, and whether it was his anxiety to ascertain the exact quantities, I don't know, but he got mixed, and blessed if the timber was not ordered net lengths, and nothing allowed for mortises and making joints. Just as we were going to start on the sheds they took us away, and before the foundations were excavated for the walls. It was fortunate they did, as it happened, for it afterwards occurred to the assistant that he had forgotten to allow for mortises and joints. So the sheds had to be made about a foot less width than they should have been, and we got paid for the foot or so at each end that was left out; and the inspector got the tip, I suppose, for nothing was said, and it was not noticed, for they were wide store sheds, with a line of rails through the centre, and it really did not matter at all. So you see I was forced to take a bit 'extra,' but that is the only time in the whole of my life. Of course it worried me much."

"No doubt it caused another wrinkle to set on your forehead."

"Very likely; but an old partner of mine told me he once was paid for the corners of a lot of level-crossing lodges twice over by taking the outside wall measurements all round instead of two outside and two inside, but only once, when things had to be done at a great rush; it was a case of hurry up all round, for all the final measurements of the whole line had to be done in a fortnight."

CHAPTER XV.

MEN AND WAGES. 'SUB' FROM THE WOOD. A SUB-CONTRACTOR'S SCOUT AND FREE TRAVELLER.

"It is nearly midnight. I am game for another hour, are you?"

"Yes. I like talking on the quiet, it draws you together, you know; you feel for a time as if we all belonged to one family, although we do not, and don't want; that's a fact."

"Precisely, old pal. Let us grip and sip."

"Did any of your men ever play rough on you?"

"Not often; but I remember one. He was a good working hand, and I did not mean to lose him. Ted Skip was his name. This is how it occurred. One Saturday night I was in the village, and saw at the corner of a lane a man standing up in a cart spouting away fit to give him heart disease, or break a blood-vessel, and getting hot so quick, that I am sure he was going to beat record time. I believe he was fed on dictionaries and stewed Socialist pamphlets that did not agree with him. He was pouring it out. He said in effect that pretty nearly everybody was a thief except himself and his comrades, and that nearly all things were poison as they were, and unless we all did as he said we were fools and felons, and worse. Then he went on to say, beer was poison, tobacco was poison, and the way things were now, and all went on, was worse than poison. Then he talked about us, called us railway slave drivers and slaves, and I am sure there was no one or nothing that existed that was not poison to him except himself and what he possessed, and the fools that paid him. I got wild after a bit, hearing him lying away as fast as he could speak, and I shouted, 'You are all poison, you old bit of arsenic, for what is not ass about you is from old Nick.' He was then shouting out 'Your constitution is wrong. All the bills are of no use.' That was too much for me, so I pushed my way in and showed him my fist, and said, 'I'll soon show you whether all the Bills are of no use and whether my constitution is wrong. My name is Bill Dark, and there are numbers of people here that know I have never been sick or sorry since I was born, and I have taken beer and smoked tobacco from the time I was fifteen. In moderation, I believe in this country it does good to most of us, and pretty well all except those that are built up peculiar, and if you want to see if I'm of no use, come on; only get a sack first, so that the pieces of you that remain, and are large enough to be found, can be taken away and burnt to-night instead of later on. You understand what I mean.'

"Our chaps cheered me like mad, and I suppose old Arsenic thought his show was being wasted, for he threw up his arms and drove off, and we yelled him out of the village. Well, now you'll hear what came of it. Teddy Skip was there, and heard me say that beer and tobacco in moderation in this country I believe did good to most of us. A week or so passed, and I forgot all about old Arsenic when Teddy Skip came to me, and said, 'Guv'nor, after hearing you down in the village, and feeling a bit cold now and then, I thought I would try a pipe. I find it suits me, and is quite a friend, but it costs me nearly twopence a day, at least that is what I reckon it does. I have been with you a long time, and hope you won't mind another twopence a day just to buy the tobacco as you recommended to be used in moderation.'

"He had me there, so I made no bones about it, and said, 'Very well then, another twopence from Monday;' but I gave him a parting shot in this way, 'I know you are courting Mary Plush, and may be joined soon, but don't you come to me for a rise after each lot of twins is born, and say you have done a kindness to me and the public generally; because the wife and ten children lay is played out for increase of wages, and folks do with them that show as much moderation in size of families as remember I said should be used with beer and tobacco.' He began to move, and said smiling, as he cleared out, 'All right, guv'nor, thank you, I understand.'"

"That was pretty for you; but did I ever tell you how I got well insulted by one of my chaps?"

"No. Out with it."

"It was in my early days, about the first work I had on the piece. It was clearing and forming through a wood, and there were more rabbits there than trees. The contract was just started, and you know what the chaps are then, they want 'sub' nearly to their full time. Well, I was not flush, in fact they nearly drained me out, so the rabbits were too much for me, besides they were wasted in my sight where they were, simply gold running loose; so I bagged a fair lot, in fact as many as I could catch. Now, my men finding I was subbing them nicely seemed to think I was the man they had been looking to serve since they took to work, so I considered I ought to stop their game with another variety of sport. It does not do to let wrong ideas rest quiet in any man. It is not kind. It was Thursday, and on Saturday I should have a fairish draw for myself on account of work done; but as things were, I was nearly run

out. About six wanted 'sub,' so I threw a rabbit to each of them, and said, 'That is tenpence, and it ought to be a shilling, for they are as big as hares and more feeding, and they are not half the trouble to cook.' They grumbled, so I growled out, 'Except on Saturdays, it is that this week and next most likely, or nothing, so choose your time.' One stayed behind, and said, 'Boss, just you look here: eightpence is enough for that, and too much, because I know it is poached, for I saw you doing a lift among the "furrers," and when I receive stolen goods I am paid for holding them, and chancing the consequences, and I don't pay for taking care of them. Do you understand? It is the last I take, and don't you mistake.'

"This 'riled' me, so I said, 'Off you go, or I'll flatten you out.' I was had there. Of course, he was at the same game as I had been, and rabbits to him were not exactly a novelty. Well, I carried on the fun there to such a tune that at last it became too hot. A dealer used to fetch them. He had an old cart. It looked like a baker's, and had some name on it, and there was a bit of green baize, and a basket or two, and a few loaves to keep up the illusion. We worked it till it turned on us, and the business had to be stopped."

"I never have done much at that. Not enough money for the risk to please me."

"Believe me, I have given up the game twenty years or more. I soon found in taking work by the piece I was bound to have a bit of capital, and, as a rule, what I want I get if it is to be had by anyone, and I generally find it is. I overdid it though, that's the worst of money, the more you get the more you want, and it's the biggest slave-driver out and spares no one. Well, complaints about poaching went up to head-quarters and I was called before the gov'nor. He said to me very sharp, 'I shall measure up your work unless from this day I hear no more of your poaching.'

"Of course I bluffed it a bit, but it was no good. However, knowing he always liked fun, he listened to me and I went off fond as a lamb. After promising I would keep watch on the men, which he did not let me finish saying before he had advised me to have assistance, he meant someone to watch me, I went straight for some joking, just to get the venom out of the subject. There is nothing like flattery to start a talk easy, so I said, 'You, sir, know a host of things more than me, and no doubt can explain how it was my father told me when I was a boy that all the family had a natural power of attracting animals. He said it was born in us. One day, sir, he drew me close to him and whispered, after feeling my head, 'You have the family gift very powerful.' You'll excuse me, sir, but I just name this because game always follows me about, and when these rabbits come on the work there is no mistake they are trespassing, and so I punish them by taking them into custody according to the law. When I walk up and down the line they seem to be that joyful, sir, as is real touching. They will come, and the bigger they are the more they seem to like me (between ourselves, that is you and me, to-night talking quiet, small 'uns don't suit me). I have not got the heart to frighten them away, and so they come to me, and sooner than let them go back to their savage life I take them up and become like a parent to them. You cut me so hard in price for the work, sir, I cannot afford to keep them long, so they have to partly keep me."

"Did your gov'nor stand that?"

"Yes. He was a good listener and always gave a man enough rope to hang himself."

"I should have punched your head if I had been him."

"Very likely you would have tried to, but he did not, so I went on to say, 'Well, sir, it is my undoubted belief the big rabbits down here can tell the difference between some letters and others, in the same way, I suppose, as they know the difference between some shot through their ears and a cabbage leaf in their mouth, or a horse and a fox; for they always run away from every cart but mine. I was just thinking I had said enough when the gov'nor had his turn and said:—

"'After what you have told me, attach a dozen white boards to the fencing, and have these words painted upon them in six-inch black letters—"Rabbits are vermin," and have your name put underneath. As you say some of them can read, that will cause them to cease following you. I am determined that this poaching shall be stopped once and for all.'

"'Excuse me, sir, but suppose they still will come to me after the notices are up, and I can't keep them away?'

"He answered, 'In such an event fix notice boards painted thus: "Any rabbit found trespassing upon this railway will be prosecuted with the utmost rigour of the law, and any rabbit found destroying the fences or hedges, or committing any damage of whatsoever kind will be shot.' Have your name put on it as before.'

"After that I thought it was time to go, and as I went out I could hear laughter. He had me, you know, so I was compelled to take to butcher's meat again throughout, and only a spare rabbit now and then went home to see his relations by aid of my mouth."

"What a row there is outside?"

"It's my dog barking. He must have heard you talk of rabbits. He is clever. I trained him so that I always knew when any engineers or inspectors were on the prowl. I call him 'Spot,' because he can 'spot' them so well. I made him do the spy business right round our end of the docks I was then on, and also on railway work."

"What did he do?"

"He used to do a tramp up and down quite naturally, about quarter of a mile in front of the tip and a quarter of a mile back of the gullet, or anywhere I had work, and not even the men knew he was on scout. He is the best watchman I have known; and so long as things were right and no bosses about he never came close to me unless I called him, but if anyone was prowling about he soon was close to me, and three pats communicated to him that I twigged, and he went on the scent again. He seemed to sniff out the faces of all my guv'nors in an instant, and looked anxious till I patted him three times, and then he turned up his eyes to meet mine, and a lovely beam of satisfaction came over him and he was as happy as he could be, and then he vanished. He was a sly dog, and useful too. He slept at the bottom of my bed in a basket. My wife did not like him on the bed; said dogs were dogs, and carried too many relations on their persons, so I hung a big basket to the tail end of our sleeping apparatus, and there he snoozed. Now, wherever I was, he was, or near to; he did not seem happy except he knew where I was. I always took him wherever I went, and on free pass. It's not very often I am travelling far, except when the works are finished; still, I easily trained him to be a good free traveller after a few trials, so that I never took a ticket for him. Not me. I always think it is hard, provided you have no luggage for the van, and have your dog well under control, that you cannot take him with you free, like you do a stick, an umbrella, or your pipe. A dog does not occupy a seat nor make a noise the same as a baby; but there, I don't mean to argue the question, and, personally, have no occasion, because I have not paid anything for my dog's travelling for years. The problem is solved as far as I am concerned, and the rest of creation will have to look out for themselves."

"How do you do it?"

"You mean, how does my dog, Spot, do it? In this way. I take my ticket, and before putting it into my pocket hold it in my hand for a moment. I then go on my right platform. Spot, that is my dog, then knows he is to get on that platform. He usually waits till a good many people want to pass, then he slips in beautifully quiet, sometimes by the side of a lady, or under cover of a group of passengers, and I have never known him noticed at the doors, as the ticket collectors are busy ticket snipping. I don't interfere with Spot's platform arrangements, for properly educated and well-brought-up dogs would object; but there is no doubt at some of the terminal stations the game could not be worked unless all the platforms are open. Suppose he was noticed on a platform, and they tried to find him, he was so good at hiding that they always thought he had gone; besides, they had plenty to do, and more serious business to look after. Once I saw they were searching for him, but they did not find him. He was not on the platform at all, but under a truck in the siding and enjoying the fun. He rested there, or at a convenient place till he heard the train coming, or saw I was about to get in. He timed his movements very cleverly, and has taken me by surprise sometimes, but he was sure to be under the seat, and hiding as quietly as a mouse, and taking no notice of me; not he.

"When I arrived at my station, if it was a big one, there was no trouble, I got out and Spot sneaked out without taking any notice of me, nor did I of him then. He used to make straight for the wall, and you bet he got out of the station quick, or was turned out. I have seen him driven out, as the porters took him for a stray dog. Once they threw a stool at him, it just caught his tail, and made him squall a trifle; but although it was a hard trial for me, I suppressed my feelings, as I had no ticket for him. I have known him sit down after following me out of the carriage, close up to the wall one end of a platform, and wait till the ticket-collector was busy sorting the tickets, and then Spot would walk out like a nobleman. I waited for him at a respectful and safe distance from the station, and then we had an affectionate meeting, and he had a biscuit and I had a drink, and we were a happy two. Spot is a real good dog, and as honest as the day, for I trained him in the right direction from the time he was a pup. He is a cool one; but there, it is a gift of nature like a swell singer's voice."

"Precisely."

"Now, listen; for once I was nearly had, even with Spot. There were about ten people in the compartment of a long carriage, and I sat next to a fly-looking chap, and only got in just in time, with my dog handy. Off the train went, and I was trying to consider what I ought to think about during the journey, when we all started, for Spot barked really fierce; and I said, 'Quiet.' Blessed if there was not another bark, and from another member of the dog creation. I knew it was not Spot, so I looked under the seat, and saw two bags, and Spot looking very warm and ready on one of them, with his head a little on one side. I knew it was live game, and I saw the other bag move. I thought the railway company had got the office and caught me, and that it was a 'put up job,' but I was wrong. It was all right. The chap next to me

whispered in my ear that he was a rat-catcher, and had live rats in one bag, and his dog in the other, and they were travelling as passengers' luggage. I winked, and he did. Then it occurred to me, I was too friendly with him. However, of course his dog was trained to keep quiet, but mine was not in the presence of rats, so I had to look under again, and put out my stick, and say. 'Quiet, bosses.' Spot knew what that meant, and was quiet.

"Now, the other passengers steadied down very quickly, for of course they did not know we had not paid for the dogs. It was a fast local train and only stopped at the terminus, so there was no chance of their getting out before me at the station. I took care of that. It might have been awkward otherwise. The beauty of it was, this rat-catcher, I could see was not altogether satisfied when he came to dwell on it, for I fancy he thought I was a spy, and that he was caught; and I was not quite convinced he was not a detective. Still, a bold game generally pays the best; anyhow, I pretended I was dozing. It was evening, and when the train had barely stopped, after saying. 'Good-night all,' I got out first, and did not wait to see how the rat-catcher fared. I had Spot to look after, and was afraid the guard might have heard the barking; but he did not, for if he had we should both have been had lovely, all through a bag of rats. What my dog suffered from having to leave the game alone, it grieves me to think. All I know is, he was really bad for days after; but I should say the rats were tuning up to sing, 'We are all surrounded.'"

"I'm off now. Good-bye, old chap. Cheer up."

"Thank you for coming to see me, and having a good chat. It's lucky no one has heard us though, still, we have not confessed all. Have we?"

"Not exactly. Good-bye."

"Mind how you go, and I hope to see you to-morrow."

"All right; I'm safe enough, for I have been in too many squalls not to be careful. I won't say artful."

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