

## CHAPTER VI. SIMON FORD'S EXPERIMENT

THE old clock in the cottage struck one as James Starr and his two companions went out. A dim light penetrated through the ventilating shaft into the glade. Harry's lamp was not necessary here, but it would very soon be of use, for the old overman was about to conduct the engineer to the very end of the Dochart pit.

After following the principal gallery for a distance of two miles, the three explorers--for, as will be seen, this was a regular exploration--arrived at the entrance of a narrow tunnel. It was like a nave, the roof of which rested on woodwork, covered with white moss. It followed very nearly the line traced by the course of the river Forth, fifteen hundred feet above.

"So we are going to the end of the last vein?" said James Starr.

"Ay! You know the mine well still."

"Well, Simon," returned the engineer, "it will be difficult to go further than that, if I don't mistake."

"Yes, indeed, Mr. Starr. That was where our picks tore out the last bit of coal in the seam. I remember it as if it were yesterday. I myself

gave that last blow, and it re-echoed in my heart more dismally than on the rock. Only sandstone and schist were round us after that, and when the truck rolled towards the shaft, I followed, with my heart as full as though it were a funeral. It seemed to me that the soul of the mine was going with it."

The gravity with which the old man uttered these words impressed the engineer, who was not far from sharing his sentiments. They were those of the sailor who leaves his disabled vessel--of the proprietor who sees the house of his ancestors pulled down. He pressed Ford's hand; but now the latter seized that of the engineer, and, wringing it:

"That day we were all of us mistaken," he exclaimed. "No! The old mine was not dead. It was not a corpse that the miners abandoned; and I dare to assert, Mr. Starr, that its heart beats still."

"Speak, Ford! Have you discovered a new vein?" cried the engineer, unable to contain himself. "I know you have! Your letter could mean nothing else."

"Mr. Starr," said Simon Ford, "I did not wish to tell any man but yourself."

"And you did quite right, Ford. But tell me how, by what signs, are you sure?"

"Listen, sir!" resumed Simon. "It is not a seam that I have found."

"What is it, then?"

"Only positive proof that such a seam exists."

"And the proof?"

"Could fire-damp issue from the bowels of the earth if coal was not there to produce it?"

"No, certainly not!" replied the engineer. "No coal, no fire-damp. No effects without a cause."

"Just as no smoke without fire."

"And have you recognized the presence of light carburetted hydrogen?"

"An old miner could not be deceived," answered Ford. "I have met with our old enemy, the fire-damp!"

"But suppose it was another gas," said Starr. "Firedamp is almost without smell, and colorless. It only really betrays its presence by an explosion."

"Mr. Starr," said Simon Ford, "will you let me tell you what I have done? Harry had once or twice observed something remarkable in his excursions to the west end of the mine. Fire, which suddenly went out, sometimes appeared along the face of the rock or on the embankment of the further galleries. How those flames were lighted, I could not and cannot say. But they were evidently owing to the presence of fire-damp, and to me fire-damp means a vein of coal."

"Did not these fires cause any explosion?" asked the engineer quickly.

"Yes, little partial explosions," replied Ford, "such as I used to cause myself when I wished to ascertain the presence of fire-damp. Do you remember how formerly it was the custom to try to prevent explosions before our good genius, Humphry Davy, invented his safety-lamp?"

"Yes," replied James Starr. "You mean what the 'monk,' as the men called him, used to do. But I have never seen him in the exercise of his duty."

"Indeed, Mr. Starr, you are too young, in spite of your five-and-fifty years, to have seen that. But I, ten years older, often saw the last 'monk' working in the mine. He was called so because he wore a long robe like a monk. His proper name was the 'fireman.' At that time there was no other means of destroying the bad gas but by dispersing it in little explosions, before its buoyancy had collected it in too great quantities in the heights of the galleries. The monk, as we called him, with his face masked, his head muffled up, all his body tightly wrapped in a

thick felt cloak, crawled along the ground. He could breathe down there, when the air was pure; and with his right hand he waved above his head a blazing torch. When the firedamp had accumulated in the air, so as to form a detonating mixture, the explosion occurred without being fatal, and, by often renewing this operation, catastrophes were prevented. Sometimes the 'monk' was injured or killed in his work, then another took his place. This was done in all mines until the Davy lamp was universally adopted. But I knew the plan, and by its means I discovered the presence of firedamp and consequently that of a new seam of coal in the Dochart pit."

All that the old overman had related of the so-called "monk" or "fireman" was perfectly true. The air in the galleries of mines was formerly always purified in the way described.

Fire-damp, marsh-gas, or carburetted hydrogen, is colorless, almost scentless; it burns with a blue flame, and makes respiration impossible. The miner could not live in a place filled with this injurious gas, any more than one could live in a gasometer full of common gas. Moreover, fire-damp, as well as the latter, a mixture of inflammable gases, forms a detonating mixture as soon as the air unites with it in a proportion of eight, and perhaps even five to the hundred. When this mixture is lighted by any cause, there is an explosion, almost always followed by a frightful catastrophe.

As they walked on, Simon Ford told the engineer all that he had done

to attain his object; how he was sure that the escape of fire-damp took place at the very end of the farthest gallery in its western part, because he had provoked small and partial explosions, or rather little flames, enough to show the nature of the gas, which escaped in a small jet, but with a continuous flow.

An hour after leaving the cottage, James Starr and his two companions had gone a distance of four miles. The engineer, urged by anxiety and hope, walked on without noticing the length of the way. He pondered over all that the old miner had told him, and mentally weighed all the arguments which the latter had given in support of his belief. He agreed with him in thinking that the continued emission of carburetted hydrogen certainly showed the existence of a new coal-seam. If it had been merely a sort of pocket, full of gas, as it is sometimes found amongst the rock, it would soon have been empty, and the phenomenon have ceased. But far from that. According to Simon Ford, the fire-damp escaped incessantly, and from that fact the existence of an important vein might be considered certain. Consequently, the riches of the Dochart pit were not entirely exhausted. The chief question now was, whether this was merely a vein which would yield comparatively little, or a bed occupying a large extent.

Harry, who preceded his father and the engineer, stopped.

"Here we are!" exclaimed the old miner. "At last, thank Heaven! you

are here, Mr. Starr, and we shall soon know." The old overman's voice trembled slightly.

"Be calm, my man!" said the engineer. "I am as excited as you are, but we must not lose time."

The gallery at this end of the pit widened into a sort of dark cave. No shaft had been pierced in this part, and the gallery, bored into the bowels of the earth, had no direct communication with the surface of the earth.

James Starr, with intense interest, examined the place in which they were standing. On the walls of the cavern the marks of the pick could still be seen, and even holes in which the rock had been blasted, near the termination of the working. The schist was excessively hard, and it had not been necessary to bank up the end of the tunnel where the works had come to an end. There the vein had failed, between the schist and the tertiary sandstone. From this very place had been extracted the last piece of coal from the Dochart pit.

"We must attack the dyke," said Ford, raising his pick; "for at the other side of the break, at more or less depth, we shall assuredly find the vein, the existence of which I assert."

"And was it on the surface of these rocks that you found out the fire-damp?" asked James Starr.

"Just there, sir," returned Ford, "and I was able to light it only by bringing my lamp near to the cracks in the rock. Harry has done it as well as I."

"At what height?" asked Starr.

"Ten feet from the ground," replied Harry.

James Starr had seated himself on a rock. After critically inhaling the air of the cavern, he gazed at the two miners, almost as if doubting their words, decided as they were. In fact, carburetted hydrogen is not completely scentless, and the engineer, whose sense of smell was very keen, was astonished that it had not revealed the presence of the explosive gas. At any rate, if the gas had mingled at all with the surrounding air, it could only be in a very small stream. There was no danger of an explosion, and they might without fear open the safety lamp to try the experiment, just as the old miner had done before.

What troubled James Starr was, not lest too much gas mingled with the air, but lest there should be little or none.

"Could they have been mistaken?" he murmured. "No: these men know what they are about. And yet--"

He waited, not without some anxiety, until Simon Ford's phenomenon



should have taken place. But just then it seemed that Harry, like himself, had remarked the absence of the characteristic odor of fire-damp; for he exclaimed in an altered voice, "Father, I should say the gas was no longer escaping through the cracks!"

"No longer!" cried the old miner--and, pressing his lips tight together, he snuffed the air several times.

Then, all at once, with a sudden movement, "Hand me your lamp, Harry," he said.

Ford took the lamp with a trembling hand. He drew off the wire gauze case which surrounded the wick, and the flame burned in the open air.

As they had expected, there was no explosion, but, what was more serious, there was not even the slight crackling which indicates the presence of a small quantity of firedamp. Simon took the stick which Harry was holding, fixed his lamp to the end of it, and raised it high above his head, up to where the gas, by reason of its buoyancy, would naturally accumulate. The flame of the lamp, burning straight and clear, revealed no trace of the carburetted hydrogen.

"Close to the wall," said the engineer.

"Yes," responded Ford, carrying the lamp to that part of the wall at which he and his son had, the evening before, proved the escape of gas.

The old miner's arm trembled whilst he tried to hoist the lamp up. "Take my place, Harry," said he.

Harry took the stick, and successively presented the lamp to the different fissures in the rock; but he shook his head, for of that slight crackling peculiar to escaping fire-damp he heard nothing. There was no flame. Evidently not a particle of gas was escaping through the rock.

"Nothing!" cried Ford, clenching his fist with a gesture rather of anger than disappointment.

A cry escaped Harry.

"What's the matter?" asked Starr quickly.

"Someone has stopped up the cracks in the schist!"

"Is that true?" exclaimed the old miner.

"Look, father!" Harry was not mistaken. The obstruction of the fissures was clearly visible by the light of the lamp. It had been recently done with lime, leaving on the rock a long whitish mark, badly concealed with coal dust.

"It's he!" exclaimed Harry. "It can only be he!"

"He?" repeated James Starr in amazement.

"Yes!" returned the young man, "that mysterious being who haunts our domain, for whom I have watched a hundred times without being able to get at him--the author, we may now be certain, of that letter which was intended to hinder you from coming to see my father, Mr. Starr, and who finally threw that stone at us in the gallery of the Yarrow shaft! Ah! there's no doubt about it; there is a man's hand in all that!"

Harry spoke with such energy that conviction came instantly and fully to the engineer's mind. As to the old overman, he was already convinced. Besides, there they were in the presence of an undeniable fact--the stopping-up of cracks through which gas had escaped freely the night before.

"Take your pick, Harry," cried Ford; "mount on my shoulders, my lad! I am still strong enough to bear you!" The young man understood in an instant. His father propped himself up against the rock. Harry got upon his shoulders, so that with his pick he could reach the line of the fissure. Then with quick sharp blows he attacked it. Almost directly afterwards a slight sound was heard, like champagne escaping from a bottle--a sound commonly expressed by the word "puff."

Harry again seized his lamp, and held it to the opening. There was a slight report; and a little red flame, rather blue at its outline, flickered over the rock like a Will-o'-the-Wisp.

Harry leaped to the ground, and the old overman, unable to contain his joy, grasped the engineer's hands, exclaiming, "Hurrah! hurrah! hurrah! Mr. Starr. The fire-damp burns! the vein is there!"