

and depriving it of air. The most extensive catastrophe caused by a fire of this kind took place in 1869, at Avondale, Pa., in which 300 miners lost their lives. Some miners of the neighboring districts sacrificed their lives while endeavoring to rescue their comrades, not a single one of those that were below escaping. Sometimes it is necessary to shut the shaft in order to smother the fire, and if that succeeds, the air pump has to work several days afterwards in order to drain out the foul air. In a very few instances it has been necessary to flood the mine with the water of the river. That was done on one occasion near St. Etienne (France), and it took three months to put the fire out. In a similar instance, it took a year and a half to master the fire in a mine of Pennsylvania. If there be no water at hand, and subterranean holes bring air into the mine, it may burn for years. I was told that there is a mine in Scotland which has been burning for forty years. Near St. Etienne, at a place called *Brûlé*, a mine has been on fire for two centuries past. The same occurred in Wales, in which case the fire underground heated the surface of the ground so thoroughly that the soil, which was marshy and light, became exceedingly fertile, yielded two crops a year, and allowed the cultivation of plants of the tropics. But the fire went out after three years, and that strange hot house in the open air disappeared.

Some details on the life and habits of colliers may not be without interest here. In Belgium there are about 100,000 people working in the coal mines. In England the population of the mining districts is more than half a million; it is somewhat less in France, and much less in the United States. They are generally, at least in Belgium, simple minded, rude, ignorant people, more especially the older ones; for in these latter years the rising generation is a good deal better educated and instructed. Still it is very amusing to hear some of the older men explain their peculiar geological theories. The earth, they will say, is a living being; water is the blood and coal is the marrow of the earth; explosions or inundations are the ways by which it takes revenge on those that cut and wound it. A new seam should not be commenced on a Friday, for it would become lime-stone. If a miner, on his road, meets a black cat, or sets his foot on two bits of straw forming a cross, he will go home and not descend that day, in order to avoid an explosion. Mines have also their special spirits, and some of them are very wicked—at least that is what the miners say. They break the shafts and galleries, steal the coal or change it into blackstone, run away with the lanterns, and play all sorts of bad tricks like truant school-boys. Some miners will pretend to have seen them, and describe them as four, or even ten-footed beings; others allow them no feet at all, and so it would be very hard to class them in natural history.

But these men, though often frightened at nothing, have a superhuman courage when there is real danger. To save a comrade from a perilous position, they will often stake their own lives, and even fight over the honor of going first to meet the danger. Thousands of volumes could be filled with the stories of courage and self-sacrifice which have been witnessed in these dark regions.

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For THE CANADIAN ENGINEER.

### THE SWELLING AND SHRINKAGE OF EXCAVATED MATERIAL.

BY CHARLES BAILLAIRGE, CITY ENGINEER, QUEBEC.

The Harbor Works, Quebec, as we all know, have been fruitful of suits and counter-suits bearing on the question of allowances to contractors by engineers in charge, for what may be termed the swelling or expansion (in French, *foisement*) of excavated material, as compared to the space it occupies *in situ*.

These allowances were never contemplated at the time the works were commenced. The timekeepers or overseers (some of them) had admitted in *enquête* having been paid by the contractors as well as by the Government, without stating what for. Nevertheless, had the contractors been satisfied with the quantities of dredging they had been paid for at the respective prices of 25 to 35 cents per cubic yard, according to depth, it is not likely the query would ever have arisen; but they were not or pretended not to be satisfied either with the total quantities or with the proportional ones, claiming that there was more of the deeper dredging at 35 cents, as against that at a less depth and price.

It is this that caused the Government to appoint an engineer, Mr. Steckel, to overhaul the quantities and ascertain whether in reality the pretensions of the contractors were in any way or to any extent well founded; the curiosity of the Government and suspicions being also aroused by the fact that the payment of the inspectors by the contractors must have been in some way for value received.

Mr. Steckel's inquiries led to the fact that not only were the contractors absolutely without a leg to stand on in their claim for additional dredging, but that they had actually been paid for quantities by 33 per cent. in excess of the actual or *situ* measurement; and it was to cover this over-quantity and eliminate, if possible, any suspicion on the part of the Government that the idea was hit upon of explaining it as due to an allowance or percentage which, it was pretended, was made and should be made to cover the swelling or expansion of the material.

To render this plain, it must be remembered that the contract stipulated scow measurement, and it had to be shown that the additional quantity given by scow measurement, as compared with the *situ* estimate, was explainable by said pretended swelling or increase in bulk of the excavated material.

Now, had the tests made by Mr. Steckel borne out the pretended swelling or expansion, the contractors' pretensions would have held good, that they were only actually paid for net scow quantities; but Mr. Steckel's experiment on some 1,500 yards of material which he caused to be dredged for the purpose from the interior of the wet dock, and therefore absolutely similar in nature to the material taken out by the contractors, instead of showing an expansion of 33 per cent., only gave barely 3 per cent., which being indicative of the fact that some unhallowed practices had been resorted to, either in the way of putting in more scow loads than had actually obtained, or by entering as scow loads fractional portions thereof, or scows unfilled or only partly filled, the Government sued the contractors for reimbursal of money overpaid in that manner. And that something must have been wrong or crooked somewhere must be admitted, from the fact that when the contractors saw from the evidence adduced that the case appeared as if it would go against them, they com-