6 ft. timber being used if the sets were stepped down, and 2 ft. 6 ins. by 5 ft. if the timber were set in the incline and steps placed later. This latter method was used by our company near the end of our work, as we found it the quicker method and also easier for keeping line and elevations. The sets of timber were made up of two legs and two caps or sills.

The caps and sills were supplied with spreaders nailed to the 3 in. by 9 in. timber against which the legs set, and so no nails were necessary to set the timber. The ground excavated was just a neat fit, except over the cap, which was one inch slack to allow for setting.

The Germans used a mortised end on their caps and legs, consisting of a ⅓ tongue, but this required a larger cut, and also was more noisy to handle, as they secured them with wedges, although this was not really necessary. We never made a practice of bracing the galleries, but in the dugouts, which were generally 6 ft. 6 ins. by 14 ft. long, we placed a centre support of two 3 in. by 9 in. timbers on edge, with 6 in. by 9 in. posts at centre and each end. Later, we placed a system of spreaders on top and bottom in order to resist the rebound or bump caused by the explosion of shells right overhead. The failure of many galleries and dugouts was due to the legs jumping the spreaders after a blow.

Construction of Galleries

When the ground was satisfactory, sets consisting of 8 ft. I-beams supported on pit props and secured to them by means of cast-iron chairs or hairpin clips (which were best, as they resisted bumping, which the cast-iron chairs did not), were placed at about 18-in. centres and then "lagged" with corrugated iron. This made a very roomy gallery, which we bunked with lumber and wire, three tiers of bunks, two-man wide, accommodating six men every 6 ft. 6 ins. of gallery. Some of these were concreted, and by driving air shafts to the surface about every 40 ft., we got very good ventilation.

When deep shafts were being sunk through quicksand, 4 ft. or 6 ft. steel tubing was used, the flanges being inside. This tubing was supplied in three segments. When the ground was good, these were sunk by digging out below and jacking down by the use of screw-jacks, the successive tiers of steel being bolted on at the top. The lower set was supplied with a flanged cutting edge. When quicksand was encountered, the whole thing was jacked down until solid ground was reached. As I never worked in a deep shaft, I cannot give a very accurate description of the difficulties met with in this work, although line was very hard to keep, due to a slight movement which sometimes existed in the sand, especially near the canal south of Ypres.

After the shaft had been sunk well into the clay or hard sand at the level desired, one segment of the lower tiers could be dropped out, leaving an opening to start the drift, or drive. Line was kept by the use of cross levels on the top, and also checked with a plumb-bob. The difficulties encountered in driving level and using timber sets were mainly due to quicksand just below the sills, and also to broken or shaken ground above the caps leading to a lost roof or cave-in.

Fore-Poling and False Sets

When the roof was allowed to drop, a method known as fore-poling was necessary in order to recover a solid roof. This consisted of driving stakes into the solid face in front, at an elevation above the top of the caps, and catching them on the top of the last set placed. Then the cavity was filled up with spoil in bags and packed until the roof was reached. The gallery would then be continued, the sets being placed under the poles which steadied the roof. If the cavity was not packed tightly, the roof would continue to shell off as fast as the face was removed. At times the ground at the face would not be strong enough to carry the fore-poling, in which case what was known as false sets would be used. They were sets placed inside the last set of the gallery, and sufficiently small to allow about 1½ ins. clearance, top and sides. Long lagging would then be driven through between these sets, angling outwards. After this timber had been driven sufficiently far into the ground ahead, wedges were driven between the inside ends of the lagging and the gallery timber. Thus the ground in front was held in place by the cantilever action of the lagging. The trouble with this method of procedure was that the gallery was very irregular in section, because the sets placed directly in front of the false set would be slightly smaller than the original section.

Pilot Galleries

Very often it was found very hard to drive a large face, although a small one would hold quite well. In ground of this nature a small gallery known as a pilot was used. This method consisted of driving a small gallery about the centre of the main face, and afterwards returning and enlarging it to full size, using the pilot timbers to steady the ground in front. In one case I found it necessary to use a second pilot, and as the gallery in question was being driven through a graveyard, the rum jar was a very necessary friend. A shot of rum every half hour barely sufficed to deaden the stench.

Working conditions seldom allowed one to pick his sight. In one connection made by our company it was found necessary to use false sets and to fore-pole the floor as well as the top and sides, the ground being semi-quicksand. Working in this ground was very unsatisfactory.

Vertical wooden shafts were sometimes used in good ground, the sets being placed at the bottom and hung by strapping to a collar set placed on the ground at the top.

So far I have only mentioned the difficulties met with due to the ground. It must be remembered that all the time the Hun was watching as closely as possible, and the moment he saw a bit of timber or fresh ground or blue clay, he turned all kinds of noisy messengers on to the locality. It was generally necessary to start work at night, and until every man was well below ground no work could be carried on in daylight, and all material would have to be carefully covered with sacking and sand before day broke. After sufficient cover was obtained, the spoil from the day shifts would be piled in the gallery in sandbags, and an extra party of men put on at night to clear it away and dump it, taking care to cover the fresh sand with surface sand before leaving.

Very often a face which seemed to be quite hard and firm would suddenly fall in, due to the shake of a big shell falling near, a condition never met with in civilian mining.

Surveying Under Difficulties

Most of the time our surveying was done with 4-in. prismatic compasses, and as some of the galleries were lined with corrugated iron, and dud shells were likely to be on any side of one, it can be seen that connections were very often made largely by guess. After our second year, however, we managed to get an excuse for a transit and a very good dumpy level, so we were able to make a few decent-looking connections.

The Dominion Iron & Steel Co., Ltd., announces that it has received an order from Rumania for 7,500 tons of specially shaped rails. Work on the order will commence in January.

The Asphalt Association, which has had temporary offices at 56 Church St., Toronto, for the past few months, has obtained permanent quarters in the Tyrrell Bldg., 95 King St. E., Toronto. The temporary telephone numbers are Main 4288 and 4289. The office is in charge of Bruce Aldrich, district engineer for the association.

The following officers were chosen by the Town Planning Association of Southwestern Ontario to serve for the ensuing year:—President, Ald. John Bridge, Windsor; first vice-president, W. A. Childs, Hamilton; second vice-president, S. Baker, city clerk, London; hon. secretary, Gordon Philips, London; hon. treasurer, John Cottam, London; executive committee, F. Maclure Sclanders (Border Cities), J. McAdam (Sarnia), W. B. Burgoyne (St. Catharines), J. M. Shuttleworth (Brantford), and W. H. Breithaupt (Kitchener).