

The Third Schedule prescribes that each cartridge, in addition to any marking required in the First or Second Schedule to the Order, shall also be marked with the outline of a crown with the letter P in the centre. In the case of compressed cartridges, which are not contained in a wrapper of paper or metal, the outline of the crown must be indented on the end of the pellet.

The Fourth Schedule prescribes the composition of fuze, and the Fifth Schedule prescribes the composition of gunpowder, squib, and Brock squib.

(c.) CRUSHING OF COAL PILLARS AND SUBAQUEOUS MINING.

[Section 40 (39).]

At the Taupiri Extended Colliery serious crushing of coal pillars has occurred during the past two years, due to coal pillars of inadequate strength being left to support the cover.

The Taupiri Extended Colliery workings are large, extending underground from the two shafts northward and westward for one mile and a quarter. Mining operations are carried out on the bord-and-pillar system, the bords being 14 ft. wide, of variable height (generally exceeding 10 ft.), a coal roof being left as a support to the jointed fireclay cover, which is for the most part a dead-weight with but little supporting strength. The haulage-roads are 12 ft. wide. The pillars were 8 yards wide and about 22 yards in length, with stentons 5 ft. wide and 6 ft. high.

Two thick workable brown-coal seams exist of variable thickness. The workings referred to in this report are in the bottom seam.

Owing to the mining operations being under the River Waikato or under privately owned land, the surface of which it is required to protect against subsidence, no coal pillars have been extracted. As the workings advanced in the solid coal to the northward, owing to the strata dipping in that direction, the thickness and weight of the cover increased until its weight became more than the coal pillars could support without fracture, the result being crushed pillars, falls of roof, heating of the coal, and in two cases fracture to the surface, the thickness of cover necessary to bring about these results being from 360 ft. upwards.

During 1917 or early in 1918 the first of these occurrences took place in the north-west section of No. 6 dip. In consequence of their fears the miners stopped work for four days. To arrest the heating of the coal which occurred the area (about 10 acres) was flooded by the management, and it remains so.

During 1919 a similar occurrence took place in the most northerly workings of No. 5 level (tail-roped district). About 2 acres of workings were affected. The section was also flooded and closed by brick stoppings. In this case cracks appeared on the surface around an area of about 5 acres, the nearest crack to the river being 9 chains. The settlement of the surface, if any, was unappreciable.

During August, 1919, another area, of about $1\frac{1}{2}$ acres, became affected—viz., No. 6 level north. These workings are situated under the River Waikato, at a depth of about 400 ft. below its bed, and, being to the rise of the haulage-road, could not be flooded, which caused anxiety among the miners, who ceased work in consequence, and at their request the Minister of Mines instructed me to investigate and report.

The safety of subaqueous mining operations is chiefly dependent upon the thickness and character of the cover, especially as regards faulting. In this case these were reasonably satisfactory, being proved by boreholes situated 6 chains westward and 23 chains eastward respectively of the affected area. The strata in these boreholes shows the cover of the seam being worked to consist of alluvium, chiefly sand and shingle, with two thin seams of clay, to a depth of about 190 ft., underlain by coal-measures consisting of claystone and coal-seams for a thickness varying between 167 ft. and 256 ft. The affected area being to the rise, and flooding being impracticable, the management isolated it by brick stoppings to produce blackdamp and thus arrest oxidation and consequent heating of the coal. Without any delay strong reinforced-concrete dams, 6 ft. in thickness, were built at the outby side of each stopping, such dams being well recessed into sides, floor, and roof, the roof-joint being finally grouted under hydraulic pressure. These dams are of ample strength to withstand the greatest hydraulic pressure possible. The coal abutments, however, although the best available consistent with maintaining the No. 6 haulage-road to the extensive unworked coalfield to the northward, are not of such strength as the dams, the coal abutments being frequently weathered and friable, and coal of insufficient depth. The precautionary measures taken by the mine-owners in No. 6 rise district against fire and irruption of river-water are, I believe, the best that could be adopted under the conditions, and I have no fear of any sudden irruption of water without warning. Possibly the crushing of pillars and falls may slowly extend from either side across the haulage-road, thereby rendering the same unworkable. In such event this road and the whole of the workings to the northward may be isolated by the construction of two concrete dams built in the solid coal near No. 5 flat-sheet. For the purpose of preventing further crushing coal pillars of larger dimensions are now being left.

The fourth occurrence of crushed pillars was observed by the Maoris resident on the west side of the river on or about the 14th March, 1920. A series of small cracks, without surface subsidence, appeared on the Rangiriri Road north of its junction with the Waikokowai Road. These cracks enclosed in somewhat circular form an area of about 5 acres immediately above the workings of No. 5 west section, north-west district, the cracks on the eastward being parallel to the river-bank for about 6 chains, and a distance of 44 ft. to 60 ft. therefrom. The cover above the workings is about 420 ft. in thickness, of which 190 ft. of the lower portion is claystone and coal-seams. The workings under the fractured and crushed area have been stopped for some time, and are flooded, but the sound of crushing has recently been heard near the edge of the flooded area.

The fifth and perhaps most serious occurrence was observed and reported by the mine-deputies in No. 4 dip, west side, on the 19th March. Considerable crushing of coal pillars, falls of roof, also heating of coal, destruction of brick stoppings, and creeping of the floor, occurred. As a result the manager stopped the workings and removed about thirty-four men employed therein preparatory to flooding the section.

I inspected the accessible portion of this area on the 22nd March, four days after it was first reported, also as near thereto as accessible on the 9th April. I found crushing much in evidence