To Sundry Creditors—						
At the Mines		3,078	12	3		
At Halifax		2,248	16	11		
In England		1,149	6	8		
Unclaimed Dividends		312	11	0		
do Return of Capital		1,256	10	0		
					8,045	16 10
" Reserve—						
Per last account		29,850	0	0		
Maintenance and Renewal Account—						
From 1893	£38,750 0 0					
Sydney Mines, for current year	1,500 0 0					
		40,250	0	0		
					70,100	0 0
Low Point, Barrasois and Lingan Mining Company, balance subject to collection of book debts					4,047	4 8
" Profit and Loss—						
Balance from 1893		684	14	1		
Profit this year, per Account "B"		19,002	12	11		
					19,687	7 0
					£252,959	18 6

Assets.

By Property of the Association, viz.—						
Pits, Railways, Engines, Wharves, Buildings, Machinery, &c.		123,201	9	8		
Other property, including real estate, stores, mining implements, &c., valued per inventory		41,031	17	6		
					164,233	7 2
" Sundry Debtors—						
At Halifax		21,953	18	4		
At the Mines		2,870	1	4		
					24,823	19 8
" Bills Receivable—						
In England		4,033	15	4		
In Halifax		6,398	5	9		
					10,432	1 1
" Government and Indian Securities		38,478	19	3		
Accrued interest thereon		407	8	9		
					38,886	8 0
" Cash—						
At Halifax		1,720	5	6		
do on deposit		9,246	11	6		
At the Mines		1,204	10	4		
At London bankers and office		2,412	15	3		
					14,584	2 7
					£252,959	18 6

B PROFIT AND LOSS ACCOUNT.

Dr.

To Coal stock on hand 1st January, 1894					648	18 11
" Sydney Colliery general working expenses, railroad expenses, shipping charges, royalty, &c					61,994	15 11
" Maintenance and renewal of plant, railroad, wharves, &c.					1,500	0 0
" Management expenses at Sydney Mines					1,739	16 6
" Income tax (average of three years)					472	6 0
" Expenses of management in London—						
Directors' salaries	£900	0	0			
Secretary, clerks, and auditors' salaries	720	0	0			
Office rent, printing, advertising, stationery, telegrams, postages, travelling and petty expenses	630	10	3			
					2,250	10 3
" Legal expenses					286	1 5
" Bad or doubtful debts in Newfoundland					5,000	0 0
" Balance—Profit carried to Account "A"					19,002	12 11
					£92,895	1 11

Cr.

By Proceeds of sale of 236,125 tons of coal and miscellaneous receipts at Sydney Colliery					88,938	18 4
" Rents of cottages and lands					1,211	11 8
" Interest and exchange	2,218	19	4			
Less interest, etc., paid	119	16	4			
					2,099	3 0
" Transfer and other fees					2	5 0
" Profit on real estate sales					220	1 1
" Received on bad debts account					155	6 7
" Stock of coal 31st December, 1894					267	16 3
					£92,895	1 11

The Sinking of the Ladd Shafts.*

BY GEORGE S. RICE, E.M.

At Ladd, which is in Bureau County, Illinois, the coal measures are overlaid by a drift deposit, 160 to 200 feet thick, of clay, sand, and gravel, interspersed with boulders, sometimes of large size. It seems to have been the accumulation at the bottom of an ancient lake, as the material is in more or less regular layers containing shells and pieces of float wood which were found all the way down to the solid rock. The surface of the latter was evidently scoured by the great glacier and is level, if not slightly basin-like in form, as indicated by the prospect drill holes. The surface drains slowly till it reaches the bluffs of the Illinois river, which is distant, as the water flows, about eight miles from the shafts.

The result of this slow drainage above open sandy strata, and a slightly basin-like rock bottom, is to make the drift water-soaked and full of pockets of quicksand.

The coal seam worked at present is the third from the top, geologically, No. 2, and in the Ladd shafts is 460 feet from the surface, but after the 160 feet of drift is pierced, sinking presents no especial difficulties.

The officials of the Whitebreast Fuel Co. were made aware by their prospect holes that water was to be encountered, but did not expect the enormous quantity nor the treacherous ground, consequently, the beginning of the work was marked by several unsuccessful attempts. The ordinary methods of cribbing and spiling were first tried, and then an ordinary timber drop shaft. But, in addition to large quantities of water, much difficulty was experienced on account of the variable nature of the ground, alternating hard and soft strata, the presence of boulders, etc. This made a drop shaft impracticable, since it would settle unevenly and could not be controlled.

Success was finally attained by introducing a heavy steel shoe, which was forced ahead of the lining by jackscrews, additions being made in sections to the lower edge of the lining. In principle this is similar to the method of tunneling in soft ground with the use of an advance shield, and is almost identical with the old Guibal system, first employed for shaft sinking about 1856, with this difference: that in the Ladd shafts, the shoe was rectangular instead of round.

Four shafts were begun, one after another, the fourth having actually reached solid rock, and lacking but little of completion, when the curbing near the bottom gave way, and a strong inrush of sand and water destroyed six months' work.

The first shaft was started June 1, 1888, by experienced sinkers. The customary method of sinking through drift was employed, that is, excavation was followed closely by timbering with 2 in. by 12 inch planks laid flat. The water was handled first with barrels. At a depth of 50 feet water and sand burst up from the bottom, and the cribbing became so swung and twisted that the shaft had to be abandoned.

The second shaft was started in the latter part of June, 10 feet west from the first, which was to be used as a sort of sump until the second shaft had gone below it. When the second shaft did get below the first, great trouble was again experienced from water and sand. Spiling was tried, driven in advance of the timbering around the edges, but the rushes of sand and water threw them out. Meantime a pump was put in; but at a depth of about 70 feet the rushes were so strong it was found that ordinary methods would not do. A heavy wooden shoe was proposed, to be sunk from this point, building the curbing on top of it, in other words, making a drop-shaft through the very soft ground from the point where the ordinary method had stopped. The ground back of the gap where the successive rounds of timbers were added on, as the drop-shaft sank, was to be kept back by a stationary shield of plank outside the curbing. The shoe was made and started; it could not be made to sink evenly, and almost at once became distorted and stuck, and the rushes became so bad that the stationary curbing above was pulled apart and the shaft was so racked that it was abandoned.

Mr. Phillips now designed the steel plate sinking shoe and the plan of suspending the curbing on which he received Patents No. 424,819 and No. 424,820. The first experimental shoe may be briefly described as a steel plate box, open top and bottom, the upper part inclosing the bottom of the curbing, the lower part divided by plate braces into six compartments. The shoe to be hung when it was so needed, by chains to lines of iron rods running from trusses across the shaft at the surface. These rods were in the corners of the shaft and also helped support the curbing by means of cross timbers every 10 feet, through which they ran. The timbers were set into the curbing, and later when the curbing rested on the solid rock were to be cut out. While the shoe was building, the shaft in which it was to be placed, No. 3, was started about August 1, 1888. The cribbing was again of 2 inch by 12 inch planks laid flat, with two temporary lines of buntons of 6 inch by 8 inch timbers with 10 inch intervals. The outside dimensions of the shaft were 12 by 16 feet. It was planned when the shaft reached the solid rock to timber up with an inner cribbing 8 inches thick, puddling between the two cribs, leaving a shaft way 6 feet 3 inches by 10 feet 6 inches, divided by a partition 6 inches thick. The shaft was carried down 50 feet by ordinary methods before the shoe was ready.

The latter was taken down piece by piece, put in place and bolted together, which proved a hard job in the mud and water, but which was successfully accomplished. The shoe and the method of hanging the curbing proved a decided success, and sinking steadily proceeded to a depth of 125 feet. At this point, however, such a burst of sand and water came up from the bottom that it drove the men from their work. While the shoe had worked well, it had proved to be too light for the conditions and the compartments too large; so it was decided to let the shaft stand for the time being and put down another shaft, which might lessen the water and thus permit the work on this to be resumed.

Accordingly an improved and heavier shoe, with 15 compartments, instead of 6, was built, and on January 8, 1889, the fourth shaft was started, located about 50 feet east of the first. This shaft made good progress considering the severe winter weather, till a depth of 138 feet was reached, which was on March 8th, just two months from the start. But here there was a tremendous burst of water and sand, the water amounting to over 640 gallons per minute, which soon drowned out a large Deane pump with a 6 inch discharge, and a Blake with a 4 inch discharge. Before another pump could be brought into action, the water was 80 feet up the shaft.

Then followed long delays, while certain pistonless pumps were tried and found wanting. Very little sinking was done till May 9th, when it progressed slowly, meeting great difficulties. Boulders were encountered, which got under the edge of the shoe and had to be blasted, and bad rushes of sand and water. The sand added immensely to the difficulties of pumping. At times a man had to be kept constantly at work cleaning the suction strainers so they would draw. It also cut the valves and linings of the pumps, so that the pumps had to be changed and completely repaired at least once a week. The removal of the enormous bodies of sand and water from around the shaft was felt clear to the surface, which sank a foot or more in places over a large area, sometimes on one side, sometimes on another. This caused the shaft to swing and threw great strains on the supporting trusses and on the curbing. This was further aggravated by the uneven pulls of the shoe, due to its being hard perhaps only under one corner or side. These strains sometimes forced the cribbing planks from the level, and it would be necessary to level up again so that the shoe might descend vertically and the next courses would be tapered, that is, the planks would be adzed so as to be thinner at one end than at the other. This necessarily weakened the plank, and together with the strains from the general distortion of the curbing, was undoubtedly the cause of its giving away later. However, the shaft progressed to a depth of 158 feet, which was reached May 20th, and brought the crib within 4 feet of the rock. At this juncture the pumps on hand completely played out, and another delay ensued till June 26th, four days after which the rock was reached.

The shoe was then secured, the compartments were cut out, and the timbering carried down to the rock. The rock at this point proved to be 3 feet thick, and this

*School of Mines Quarterly.