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PROVINCE OF ONTARIO
DEPARTMENT OF MINES

Bulletin No. 54

REPORT

ON THE

Mining Accidents in Ontario

in 1925

By
Chief Inspector of Mines: T. F. SUTHERLAND, Toronto
Inspectors: J. G. McMILLAN, Cobalt; D. G. SINCLAIR, Sudbury;
GEO. E. COLE, Timmins; A. R. WEBSTER, Toronto

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To the Honourable Chas. McCrea,
Minister of Mines.

Sir,—I beg to hand you herewith report by the Inspectors of this Department on the fatal accidents in the mines, metallurgical works and quarries of Ontario during the year 1925.

I have the honour to be, Sir,

Your obedient servant,

T. W. Gibson,
Deputy Minister of Mines.

Department of Mines,
Toronto, February, 1926.

MINING ACCIDENTS IN ONTARIO, 1925

Chief Inspector of Mines, T. F. Sutherland, Toronto; Inspectors, G. E. Cole, Timmins; D. G. Sinclair, Sudbury; J. G. McMillan, Cobalt; A. R. Webster, Toronto.

Accidents during 1925

	Fatal	Non-fatal	Total
Mines, underground	28	1,375	1,403
Mines, surface	2	394	396
Metallurgical works	2	240	242
Quarries	3	167	170
Clay, sand, and gravel pits	2	50	52
Total	37	2,226	2,263

During the year 1925 at the mines, metallurgical works, quarries, clay, sand, and gravel pits regulated by the Mining Act of Ontario, there were 2,263 accidents reported to the Department up to January 25, 1926. Thirty-seven of these accidents were fatal, resulting in the death of forty-two men. This is an increase over 1924 of two men killed. In 1924, fourteen men were killed at the quarries, clay, sand, and gravel pits, and in 1925, nine men were killed in these operations.

Workmen's Compensation Rates

The assessment per $100 of pay-roll made by the Workmen's Compensation Board is based on the actual cost of the accidents occurring in each class during the previous year, and consequently shows the accident hazard of each class.

The rates for the years 1922 to 1925, inclusive, were as follows:—

Schedule	1922 Adjusted	1923 Adjusted	1924 Adjusted	1925 Provisional
Silver mining	$2.40	$2.20	$2.40	$2.40
Treatment of ores, with heat, in a silver mining industry	1.20	1.10	1.20	1.20
Treatment of ores, without heat, in a silver mining industry	.60	.50	.60	.60
Gold mining	2.40	2.20	4.00	4.00
Treatment of ores, with heat, in a gold mining industry	1.20	1.10	2.00	2.00
Treatment of ores, without heat, in a gold mining industry	.60	.50	.90	.90
Nickel or nickel-copper mining	2.75	2.50	4.00	4.00
Treatment of ores, with heat, in a nickel or nickel-copper mining industry	1.40	1.25	2 00	2.00
Treatment of ores, without heat, in a nickel or nickel-copper mining industry	.60	.50	.90	.90
Mining N.O.S.	2.25	2.00	2.40	2.40
Treatment of ores or minerals, with heat, in an industry in this group	1.10	1.00	1.20	1.20
Treatment of ores or minerals, without heat, in an industry in this group	.60	.50	.60	.60
Iron smelting, as a business	2.00	1.80	2.00	2.00
Treatment of ores or minerals, with heat, N.O.S., as a business	2.00	1.80	2.50	2.50
Treatment of ores or minerals, without heat, N.O.S., as a business	.60	.50	.60	.60
Refining of nickel, as a business	1.50	1.50	2.50	2.50
Sand, shale, clay, or gravel pits	2.75	2.25	3.50	3.50
Quarries, as a business; stone crushing	5.00	4.00	5.00	5.00

Fatal Accidents

A comparison of fatal accidents for the last five years is given in the following table:—

	1921	1922	1923	1924	1925
Mines, underground	11	15	21	23	30
Mines, surface	1	3	3	1	1
Metallurgical works	4	0	4	2	2
Quarries, clay and sand pits	8	12	2	14	9
Totals	24	30	30	40	42

By months, the fatalities occurred as follows:—

January	2	July	2
February	0	August	5
March	5	September	4
April	8	October	3
May	3	November	4
June	5	December	1
		Total	42

Classifying the fatalities according to the industry gives the following:—

Nickel mines and metallurgical works	5
Silver mines and refineries	7
Gold mines and mills	18
Lead mines	3
Quarries	7
Clay, sand, and gravel pits	2
Total	42

ANALYSIS OF FATALITIES AT MINES, 1921-1925

Cause	1921	1922	1923	1924	1925
	per cent.	per cent.	per cent.	per cent.	per cent.
Falls of ground	33.33	11.11	25.00	25.00	19.35
Shaft accidents	16.66	44.44	16.66	29.16	19.35
Explosives	16.66	11.11	20.83	16.66	25.80
Miscellaneous underground	25.00	16.66	25.00	25.00	29.03
Surface	8.33	16.66	12.50	4.16	6.45

TABLE OF FATAL ACCIDENTS IN MINES, METALLURGICAL WORKS AND QUARRIES, AND GRAVEL, SAND, AND CLAY PITS, 1901 TO 1925

Year	Persons killed at metallurgical works and mines	Persons employed at metallurgical works and producing mines	Persons employed at non-producing mines (estimated)	Total persons employed	Fatal accidents per 1,000 employed
1901	13	4,135	550	4,685	2.77
1902	10	4,426	450	4,876	2.05
1903	7	3,499	400	3,899	1.79
1904	7	3,475	400	3,875	1.80
1905	9	4,415	500	4,915	1.83
1906	11	5,017	750	5,767	1.90
1907	22	6,305	1,140	7,445	2.93
1908	47	7,435	1,750	9,185	5.11
1909	49	8,505	2,000	10,505	4.66
1910	48	10,862	2,000	12,862	3.73
1911	49	12,543	2,000	14,543	3.37
1912	43	13,108	2,000	15,108	2.84
1913	64	14,293	2,000	16,293	3.93
1914	58	14,361	1,500	15,861	3.60
1915	22	13,114	1,500	14,614	1.51
1916	51	14,624	2,000	16,624	3.07
1917	36	16,791	1,000	17,791	2.02
1918	32	14,726	500	15,226	2.10
1919	39	11,926	1,000	12,926	3.00
1920	29	10,486	1,000	11,486	2.61
1921	24	8,436	1,000	9,436	2.54
1922	30	9,500	1,500	11,000	2.72
1923	30	10,500	1,500	12,000	2.50
1924	40	11,000	1,500	12,500	3.20
1925	42	11,500	1,500	13,000	3.23

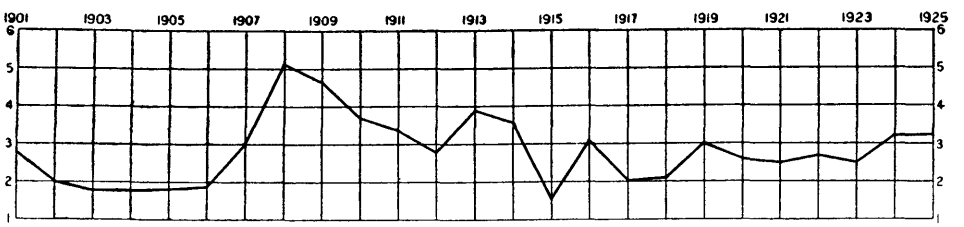


Diagram showing fatalities per thousand men employed between the years 1901 and 1925.

The occupation and nationality of the men killed are set out in the following table:—

Occupation	English-speaking	Finn	Norwegian	Czecho-Slovak	Austrian	Hungarian	Croatian	Italian	Total
Miner	11	2	.....	1	1	1	1	.....	17
Labourer	7	.....	.....	.....	.....	.....	.....	1	8
Shaftman	3	.....	.....	.....	.....	.....	.....	.....	3
Electrician	2	.....	.....	.....	.....	.....	.....	.....	2
Shift boss	2	.....	.....	.....	.....	.....	.....	.....	2
Blaster	1	.....	.....	.....	1	.....	.....	.....	2
Shoveller	1	.....	.....	1	.....	.....	.....	.....	2
Brakeman	1	.....	.....	.....	.....	.....	.....	.....	1
Deckman	.....	.....	1	.....	.....	.....	.....	.....	1
Scaler	1	.....	.....	.....	.....	.....	.....	.....	1
Teamster	1	.....	.....	.....	.....	.....	.....	.....	1
Shovel operator	1	.....	.....	.....	.....	.....	.....	.....	1
Trammer	1	.....	.....	.....	.....	.....	.....	.....	1
Total	32	2	1	2	2	1	1	1	42

The ages of the men killed were as follows:—

Age	14-16	17-20	21-25	26-30	31-35	36-40	41-45	46-50	51-55	56-60	Total
Number killed	1	5	10	10	4	3	5	2	1	1	42

Non-Fatal Accidents

The causes of non-fatal accidents at mines are shown in the following table:—

Cause	Surface	Underground	Total
Rock or ore while working at face or chute	5	283	288
Fall of rock or ore from face, wall, or back		169	169
Tramming	11	157	168
Fall of persons	62	135	197
Flying objects, sledging, etc.	28	93	121
Falling objects	56	92	148
Hand tools	50	46	96
Nails or splinters	30	71	101
Drilling machines		76	76
Crushed between two objects	38	62	100
Strain while lifting	24	47	71
Running into or striking against objects	7	54	61
Machinery	37	7	44
Cage, skip, or bucket	7	22	29
Fall down shaft, winze, raise, or stope		24	24
Explosives		22	22
Unclassified	14	5	19
Burns	12	3	15
Poisoning from cyanide, mercury, etc.	10	1	11
Explosion of carbide		5	5
Electricity	3		3
Silicosis		1	1
Total	394	1,375	1,769

The causes of non-fatal accidents at metallurgical works are set out hereunder:—

Falling objects	45	Burns	8
Fall of persons	37	Running into or striking against objects	8
Hand tools	24	Nails or splinters	4
Burned by slag, matte, or scrap	23	Acid, gas or steam	4
Cranes, ladles, hooks	23	Strain while lifting	3
Flying objects	18	Unclassified	3
Crushed between two objects	15	Poisoned by mercury, nickel, etc	1
Transportation	15	Electricity	1
Machinery	8		
		Total	240

Causes of non-fatal accidents at quarries:—

Handling material	41	Fall of rock	4
Fall of persons	18	Strain while lifting	10
Sledging, flying objects, etc.	13	Unclassified	5
Machinery	10	Nails or splinters	3
Transportation	14	Explosions	4
Hand tools	11	Electricity	2
Falling objects	22	Burns	1
Crushed between two objects	9		
		Total	167

Causes of non-fatal accidents at clay, sand, and gravel pits:—

Transportation	11	Fall of material	5
Strain while lifting	2	Handling material	3
Fall of persons	6	Flying objects	5
Hand tools	7	Unclassified	4
Machinery	1	Nails or splinters	1
Falling objects	4		
Crushed between two objects	1	Total	50

Accidents from Explosives

Cause	Number of accidents	Number injured	
		Fatal	Non-fatal
Struck by rock from blast	4	1	3
Detonator exploded	1		1
Premature explosion	6	4	4
Delayed too long lighting fuse	2	1	1
Drilled into explosive	4	3	2
Sledging, struck explosive	3		3
Returned to delayed blast	3		3
Reloading missed hole	1		1
Explosion while tamping	1		1
Delayed by gas after lighting fuse	1		1
Delayed by illness after lighting fuse	1	1	
Picked into explosive	2		2
Total	29	10	22

Infection

Records show that infection followed in 193 cases out of a total of 2,226 non-fatal accidents in 1925:—

Location	No. of accidents	Accidents followed by infection	Per cent. infection
Mines, underground	1,375	131	9.5
Mines, surface	394	36	9.1
Metallurgical works	240	20	8.3
Quarries, clay, sand, and gravel pits	217	6	2.7
Total	2,226	193	8 67

Non-Fatal Cage and Skip Accidents, 1925

Date	Name of mine	Cause of accident	Men injured
Oct. 17	Keeley Silver Mines, Ltd.	Descending cage struck chairs	1
Nov. 29	Teck-Hughes Gold Mines, Ltd	Descending cage struck a steel	1
Aug. 15	Hollinger Con. Gold Mines, Ltd.	Hoisting steel and one steel caught in shaft	1
Aug. 6	La Rose Mines, Ltd.	Skip tipped while being hoisted and man fell out	1
Mar. 15	La Rose Mines, Ltd.	Skip overturned while being hoisted and man fell into timbers	1
April 25	La Rose Mines, Ltd.	Man riding up in skip with hand outside and arm was caught in timbers	1
Mar. 16	McKinley-Darragh-Savage Mines, Ltd.	Man riding up in skip with cage hung from bottom of skip. Car caught in timbers and man put out his head and was hit by timber	1
May 25	The Mining Corporation of Canada, Ltd.	Man standing in skip when belt broke. Dropped 20 feet and caught in timbers	1
May 20	The Mond Nickel Co., Ltd.	Small piece of timber fell down shaft and hit man riding up in skip	1
April 10	Tough-Oakes Burnside Gold Mines, Ltd.	Chairs on which cage was resting allowed cage to drop and man fell in on head.	1
Dec. 4	Tough-Oakes Burnside Gold Mines, Ltd.	Descending cage hit steel which flew into cage	1

In the following table, the mines are classified according to their record of non-fatal accidents:—

Accidents per 1,000 employees	Mine
Nil	Canada Cement Co., Plant No. 8, Port Colborne.
Nil to 50	Teck-Hughes. Deloro Smelting & Refining Co.
51 to 100	International Nickel Co., smelter. Mond Nickel Co., smelter. Miller Lake O'Brien. Canadian Associated Goldfields. Crown Reserve. O'Brien mine.
101 to 150	Mond Nickel Co. mines. Consolidated West Dome Lake. International Nickel Co., refinery. McKinley-Darragh-Savage. Night Hawk Peninsular. Nipissing. Barry Hollinger. Castle-Trethewey.
151 to 200	Dome Mines. Porcupine Paymaster. Argonaut. Keeley. Sylvanite. Mining Corporation, Cobalt. Hollinger Consolidated. Kirkland Lake Gold.
201 to 250	Kingdon Mining, Smelting & Manufacturing Co. Mining Corporation, Silver Centre. International Nickel Co., mine. Wright-Hargreaves.
251 to 300	McIntyre-Porcupine. Vipond Consolidated.
300 to 350	Tough-Oakes Burnside. La Rose. Lake Shore.

Prosecutions

Before Magistrate Hawkshaw, in the County Police Court at London on February 23, W. H. Thornton was fined $10 and costs for removing material from a gravel pit by undermining. Information was laid against Mr. Thornton, and it was expected that the penalty provided for under Subsection 1, Section 179, would be imposed if he were found guilty. His defence was that the particular gravel pit which was being undermined was on a road allowance in the subdivision of Manor Park, in the county; that he could not keep teamsters out of this pit; and that while he was charging 52½ cents a load, the charge was really for the privilege of crossing his property. The magistrate then made the fine under Subsection 2, Section 179.

Walker Bros., quarry owners, were fined $100 and costs by Magistrate J. H. Campbell, at Thorold, on June 25, 1925. The charge was that blasting caps and electric detonators were kept in the magazine with explosives.

W. E. McCaul, Mount Dennis, was tried before Magistrate Brunton on August 6 and August 20, 1925, for employing a boy under sixteen years of age, operating a sand pit with the banks not at an angle of safety, and negligence. He was convicted on the first two charges and fined $200 and costs. The charge of negligence was dismissed.

William G. Teal, Niagara Falls, was tried before Magistrate Fraser, on September 4, 1925, for operating a sand pit in Stamford township with banks not at an angle of safety. The case was dismissed.

Before Magistrate Atkinson at Haileybury, on September 12, Sylvester Carroll, John Culhane, and Godfrey Billedeau pleaded guilty to the charge of violating Regulation 50a, Section 164, of the Mining Amendment Act, by riding the bucket on or about August 29 at the Red Rock shaft of the Cobalt Contact mine. A fine of $10 and $6 costs was imposed in each case.

Hagersville Quarries, Limited, were tried before Magistrate Massie on September 24, 1925, for violation of Regulation 203, Section 164, of the Mining Amendment Act, in not providing adequate clearance from the ground for 550-volt lines leading to the drills. They were convicted and fined $100 and costs. An appeal was heard by Judge Hopkins, in the fourth division court of the county of Haldimand, on November 27. Judgment was given on December 7, when the appeal was allowed and the conviction quashed on the grounds that lines leading to the drills cannot be considered to be supply lines under Section 203.

At South Porcupine before Magistrate S. Atkinson, on November 5, 1925, W. S. Cowan was fined $100 and costs for being intoxicated at the Consolidated West Dome Lake mine, a violation of the Mining Amendment Act, 1919.

Canada Cement Company, Plant No. 8

The assessment per $100 of pay-roll levied by the Workmen's Compensation Board in 1925 against quarries was $5 as against $4 for gold mines, $4 for nickel mines, and $2.40 for silver mines. This means that more accidents occur in quarrying operations than in other methods of mining. As an example of what can be accomplished when an honest effort is made to prevent accidents, the record of Plant No. 8, Port Colborne, of the Canada Cement Company, is instructive. This plant operates three shifts, employs about 250 men, forty per cent. of whom are of foreign extraction, and on January 12, 1926, had just completed 474 days without a lost-time accident. How this was accomplished was outlined in a paper read by the superintendent, L. M. McDonald, before the Fourteenth Annual Congress of the National Safety Council. The following is part of Mr. McDonald's address, "Three Hundred and Sixty-Five Days without an Accident."

To treat this subject intelligently, a brief résumé of our work since we first became vitally interested in safety work is necessary. I realize that statistics are very uninteresting; and for that reason reference will only be made to same covering yearly operations, and then only to cover the various safety organizations in effect during the respective periods.

During the year 1920, accident prevention work at our plant did not receive any special consideration; we had no active safety organization, and accidents apparently had to happen. At least, it was readily granted by all concerned that it was impossible to prevent them. Our record for the year showed forty-four accidents, including two fatalities, and 924 days of lost time.

The early months of 1921 bid fair to place us in the category of a hazardous plant and occupation; for, with a toll of forty-one accidents for the first five months, our head office entered the scene and politely informed us that we must take measures to cope with the alarming situation and institute some form of safety organization to reduce the number of accidents.

To aid and assist us in this work, we were favoured with a visit from Mr. Jacobsen, and his enthusiasm and confidence in accident prevention work so impressed us that we decided, and with no small degree of skepticism, to make June a "no-accident" month. Committees were formed in all departments and ways and means were discussed to counteract the deplorable record we had established and the low state of morale which existed throughout our plant. Naturally, everything must have a beginning, and although we failed utterly to reach the goal of a "no-accident month," our committees continued to function every week during the year and we closed with a standing of sixty-seven accidents and 948 days lost time.

Some change in our system was evidently necessary, so we disbanded the departmental committees and formed one general committee composed of the foreman and three representatives from each department. We concluded that it was necessary to teach safety, so the subject matter of our meetings dealt entirely with the question of education, and we can candidly say that this form of treating the subject was our first sincere attempt to grapple with the problem from a logical premiss and lay the foundation for our future success. You must creep before you can walk, and with teaching safety by education you must sow the seeds by facts and figures, so that even the skeptics will be converted eventually. Time and patience are big factors in such a programme; obstacles will be encountered and setbacks are bound to occur, but the inborn tendencies of mankind are bound to react to certain influences if you persist in the right direction.

Under our new policy we had our first "no-accident month" in February, 1922, and during that year successfully bridged four months clear of accidents and ended the year with thirteen accidents, including three fatalities and 323 days of lost time.

In order to acquaint as many employees as possible with our education propaganda, the personnel of our general committee was changed every three months, always retaining the departmental foreman as a permanent member. We were pleased with our past success, and here we introduced into our education programme a weekly plant paper, which has been a medium of information and a messenger of safety in our struggle to combat the evils of carelessness, thoughtlessness, and insufficient knowledge and training.

April and June during 1923 were "no-accident months," but a reaction set in during July which was indeed discouraging, but, undaunted, we increased our efforts to combat the tide of misfortunes which appeared to be undoing our best efforts to establish and sell our safety education. About this time the National Safety Council (Cement Section) held their annual meeting in Buffalo, and a paper read by Mr. Purkheiser on "The Foreman and Safety" so impressed me that, after careful deliberation, we decided to reduce our safety committee to include only foremen, and thereby confer on the foremen the authority and responsibility for all future accident prevention work. No man can stand still; he must either go backward or forward, and we believe that men who are led to take responsibility go forward, because they realize they are expected to build up their part of the organization, and for that reason more initiative and energy is expended on the work.

We completed the year 1923 with a clear record and won for our plant the first time the honour flag awarded by our company for operating three consecutive months without a lost-time accident.

With this success, a new lease of life and an *esprit de corps* were developed, which convinced us that teaching safety by education through the medium of the foremen was the proper method. At our meetings, which were really round-table talks, we discussed operating, mechanical, good-housekeeping, and general plant conditions. Cleanliness, to my mind, is the most important factor in a safety-first campaign. Put your plant in a first-class condition, both internally and externally, and thereby eliminate from the minds of all employees the idea that careless handling of material is tolerated. Insist that a good-housekeeping policy be adopted and maintained, and who is better qualified to co-operate with this policy than your foreman?

The past year, with a clean plant and all foremen safety-first enthusiasts and preachers, we closed with three accidents, including one fatality and thirty-nine days lost time. We successfully campaigned nine "no-accident months" and certainly proved that results can be obtained if knowledge, enthusiasm, and loyalty are created and fostered.

After three years of steady persistent work in perfecting an organization for our safety work, we decided to aim at a very ambitious goal and attempt a "no-accident year." All the foremen were enthusiastic and expressed confidence that this goal could be reached. We had our last accident on September 25, 1924, and we have passed successfully 365 days, with the honour flag, which we raised at the first of the year, still flying.

Now for a short résumé of the main reasons for our success. We have a clean plant, an asset to any successful drive for safety work. We have a weekly paper, a medium of spreading safety information throughout the rank and file of the organization and at all times keeping the important question of accident prevention ever to the fore. We have our departmental dials recording the number of days since our last accident and operated in every case by the employee individually as his turn arrives. We sign all new employees in our First Aid Department, and therefore introduce them to all rules and regulations covering the work and impress on them the necessity of attending to all cuts and bruises, even the most trivial.

We have our executive and foremen sold to the idea that accidents can and must be prevented and that their responsibility for efficiency and production does not cease at that point, but must include cleanliness, maintenance, installation of guards, and accident prevention education for all employees under their direct control and fullest co-operation in all matters pertaining to general plant safety.

If a foreman possesses the qualities of leadership, foresight, and vision, he will organize his department and turn the work over to men qualified to bring about the performance of those duties: men whose success will be judged solely by their accomplishments. You can, no doubt, achieve a degree of success in accident prevention work by any method you adopt, but the real, sound policy for a permanent organization is to confer the authority on your foreman. Hold him to account for results, and you will be surprised to see how rapidly your safety work becomes a real part of his daily occupation. He will think and act of his own accord, and with every

thought and action comes the great ambition of every man—to safeguard and protect the welfare of his fellow man. When this spirit takes hold it is indeed contagious, and success in any undertaking will eventually crown your efforts.

High Voltage Underground

The transmission of electric power underground for greater distances and the increase in the load underground in the mines of Ontario have reached a point where the costs of installation can be materially reduced by the use of higher voltages. Previous to 1924 the maximum voltage in the province was 550 volts. This has been increased to 2,200 volts, for the first time, at the Hollinger mine on a circuit at the central shaft to a depth of 1,550 feet. Provision has also been made for extending this circuit to the 2,150-foot level.

Shaft Cable.—This circuit is supplied with power from a bank of three 600-k.v.a. transformers—12,000-volt primary and 2,400-volt secondary—at the transformer station at the central shaft. The line from the transformers to the shaft-house is a 2/0 paper-insulated, lead-covered, steel tape armoured cable. The circuit is protected by a set of Westinghouse disconnecting switches, type H, 4,500 volt, 400-ampere capacity, a type B circuit breaker, 15,000 volt, 400 ampere, and a 5,000-volt, indoor type, pothead. This cable is connected at the mouth of the shaft to the cable leading underground, in a cast-iron joint box filled with insulating compound to exclude moisture.

The underground cable is a 2/0 B. & S. stranded, rubber-insulated, lead-covered, steel wire armoured cable. It is suspended in the manway with junctions for distributing load at the 425-, 800-, 1,250-, and 1,550-foot levels. A binding serving is placed on the cable at every twenty-five feet to support it in the shaft. These supports are attached to the concrete wall from the surface to the 425-foot level and from this point to the 1,550-foot level are attached to the shaft timbers. Additional supports are provided at every 100 feet. These consist of four heavy wrought iron clamps on the cable attached to a heavy iron chain which is suspended from the timbers by an "I" bolt. The bolt passes through the timber and is held by an adjustable nut to ensure each chain carrying the proper load.

Distributing Stations.—The cable is run from the shaft at the 425-foot level to a special compartment in the wall, in which is located the iron junction box. The box is two feet square with three outlets for incoming, outgoing, and station load cables. The conductors on the cables through the first two outlets are attached to studs mounted on a one-inch ebony asbestos wood terminal block in a compound-filled compartment. The terminal studs for the station load are enclosed in another compartment of the box.

The incoming and outgoing cables on the 800- and 1,250-foot levels are run to the substations, and on each is a 5,000-volt pothead. Both potheads are enclosed in a removable sheet-metal box.

The cable at the 1,550-foot level is run to a compartment and connected to a bus bar three feet in length, from which a steel tape armoured cable is run 200 feet to the crushing station.

Crushing Station.—The cable from the shaft ends at the crushing plant in a concrete switch cell at a set of 4,500-volt disconnecting switches mounted on insulators near the roof. The disconnecting switches are operated by a switch stick and guarded at the front and lower side.

The line to the motor is controlled by a 15,000-volt, 400-ampere circuit breaker located in the switch cell. The connection between the breaker and motor is a lead-covered armoured cable twelve feet in length, with potheads at each end. The motor terminals are enclosed by a metal guard.

The motor is a 200-h.p., 2,200-volt, 480 r.p.m. with liquid control.

Grounding.—The armour of each section of the cable is grounded by means of copper ground straps and ground wires to the water pipes leading to the surface. Each section, which is approximately 400 feet in length, in the shaft is grounded twice.

Safety Precautions.—Extra precaution has been taken in the installation to reduce the hazard from the high voltage.

1. The cable has a rating of 3,300 volts with a certified test of 8,250 volts for five minutes from the Standard Underground Cable Co.
2. The disconnecting switches have a rating of 4,500 volts.
3. The circuit breakers have a rating of 15,000 volts.
4. All conductors are protected by armour or metal coverings.
5. The potheads have a rating of 5,000 volts.
6. All junction and switch compartments in the rock wall are finished with either brick or concrete and have fireproof doors.

Underground Power Creighton Mine

Electrical energy for mining operations at the Creighton mine of the International Nickel Co. of Canada, Ltd., is supplied from the company's hydro-electric plant at Turbine. The current comes in to the main substation at Creighton mine at 30,000 volts, three-phase, 25 cycle, and is stepped down to 2,300 volts and 550 volts for local distribution.

When laying out the original distribution system for underground, it was decided so to design it that current would be supplied at 550 volts until such time as the demand for power should become great enough to warrant the use of 2,300 volts. All main cables, junction boxes, and circuit breakers in the original lay-out were therefore designed and installed to carry safely the higher voltage.

When it became necessary to change to the higher voltage, substations were cut at the sixteenth and twenty-sixth levels. The stations are duplicates, with the exception that the one at the twenty-sixth level is laid out to take care of two battery-charging, motor generator sets. The stations are 13 by 13 by 13 feet and 13 by 13 by 21 feet, respectively, and have been finished with cement and painted. Suitable cable ducts, drains, and sumps are provided and finished in concrete. Provision has been made for the installation of exhaust fans for ventilation purposes.

Current is transmitted from the main 2,300-volt bus bars in the substation, through disconnecting switches and an oil circuit breaker provided with overload and no-voltage protection, to the overhead lines. Junction is made between the overhead lines and the underground cable through a non-automatic oil circuit breaker installed in the surface switch house.

The underground cable is of three-conductor marine type, and is supported on wooden dividers in the shaft cable compartment. At the sixteenth and twenty-sixth levels, cable is carried directly into the transformer room, and the three conductors pass through a pothead to fuse type disconnecting switches, and thence to the 2,300-volt buses, and then to the primaries of the transformers.

The transformers are protected on the secondary side by a three-pole air-break contractor switch, equipped with an overload relay. The breaker is also equipped with push button control. Outgoing circuits are provided with pot-heads and disconnecting switches. All switching equipment in these substations is pipe mounted.

Current is distributed up and down the shaft to the several levels at 550 volts over marine-type cable of the same standard as that supplied for the 2,300-volt surfaces. The main shaft cable is provided with heavy junction boxes from which current may be taken at any future time for any apparatus using 2,300 volts. Suitable meters are installed at the various points for protection and measuring purposes.

TABLE OF FATAL ACCIDENTS IN OR

No.	Date	Name of mine	Name of owner	Name	Occupation
1	Sept. 5	Red Rock..	Cobalt Contact Mines..	Joseph Bougie.....	Miner.....
				Forrest Finlay. ..	Miner.....
2	Nov. 24	do .. .	do do	John Culhane... .	Miner.....
				Godfrey Billedeau	Miner... .
3	April 18	Dome.... . ..	Dome Mines Company..... .	Robert Sheppard.	Electrician.
4	Mar. 18	Hollinger. .	Hollinger Consolidated Gold Mines, Ltd....	Thos. Fox .	Miner.....
5	April 8	do . ..	do do do .	Cornelius Oliver....	Miner.....
6	April 18	do	do do do .	Rolland Vaillant...	Miner....
7	April 29	do . .	do do do .	Isaac Hjuart.... .	Miner... .
8	June 5	do	do do do .	Octave Frapier.. ..	Miner....
9	June 10	do	do do do	James Roberts. ..	Brakeman.
10	Aug. 15	do	do do do .	Torlesi Braaten . .	Deckman..
11	Sept. 5	do	. do do do ..	Edward Fleming ..	Blaster....
12	Oct. 29	do ..	do do do ..	John Belas	Miner... .
13	Dec. 26	do	do do do ..	A. McDougall.....	Shaftman..
14	June 19	Creighton.	International Nickel Co ...	Nicholas Chymeres	Blaster....
15	Sept. 28	Johnson.. .	Albert Johnson's prospect.....	John McGillivray...	Miner... .
16	Mar. 6	Kerr Lake. .	Kerr Lake Mining Co.....	Frank Nikumma. .	Miner.....
17	May 19	Kingdon.... .	Kingdon Mining, Smelting & Mfg. Co.	William Bludney. .	Miner.....
18	Aug. 10	do	do do do	John Proulx.....	Scaler.....
19	Oct. 15	do	do do do	M. Darcy.... .	Miner.....
20	May 29	Lake Shore...	Lake Shore Gold Mine..... ..	E. Rumig..... .	Miner.....
21	April 27	McIntyre.....	McIntyre Porcupine Mines . .	S. Zimmen.....	Miner.....
22	Nov. 4	do	do do do	Sam Gillis.....	Trammer...
23	Nov. 9	do	do do do ..	M. Rawbic...	Miner.....
24	Mar. 12	Princess..	McKinley-Darragh-Savage Mines....	F. Finnegan.....	Shoveller..
25	Jan. 3	Levack..... .	Mond Nickel Company.	John Dobian.....	Shoveller..
26	Aug. 9	Frood..... .	do do	William Keast.....	Shift-boss..
27	Jan. 21	Teck-Hughes..	Teck-Hughes Gold Mines. ..	E. Littlejohns... .	Shaftman..
28	Aug. 7	Walsh.... .	Tonapah Canadian Mines....	Charles Lord.....	Shaftman..
29	Aug. 15	Vipond..... ..	Vipond Consolidated Mines...	Norman Isnor.....	Shift-boss..

ABOUT ONTARIO MINES, 1925

Nationality	Age	Married or single	Above ground	Below ground	Cause of accident
English-speaking...	27	M	.....	1	Fell with bucket in shaft.
English-speaking...	33	M	.....	1	Fell with bucket in shaft.
English-speaking...	19	S	.. ..	1	Drilled into explosive.
English-speaking...	26	S	.....	1	Drilled into explosive.
English-speaking...	23	S	1	.....	Electrocuted while working at motor.
English-speaking...	42	M	.....	1	Caught in cave-in in stope.
English-speaking...	42	M	.....	1	Fall of rock in stope.
English-speaking...	24	S	. . .	1	Explosion while shovelling at face.
Finn..... . .	37	S	.....	1	Crushed between car and post of chute.
English-speaking...	50	M	....	1	Fall of rock in stope.
English-speaking...	22	S	.....	1	Fell in front of motor.
Norwegian.....	32	S	.....	1	Thrown out of cage when steel caught in timber.
English-speaking..	35	M	.....	1	Taken ill while lighting holes and blasted.
Czecho-Slovak....	28	M	.....	1	Crushed while replacing car on track.
English-speaking..	25	S	... .	1	Hanging in bucket which was being hoisted.
Austrian.... . .	29	S	.....	1	Blast broke through into manway.
English-speaking...	28	S	.....	1	Remained too long lighting fuse in shaft.
Finn...	21	S	.....	1	Fall of rock in stope.
Austrian.... ...	42	M	.....	1	Fell in stope.
English-speaking...	30	M	.....	1	Caught in cave-in in stope.
English-speaking...	35	S	.....	1	Drilled into explosive.
English-speaking...	28	M	.....	1	Fall of rock in stope.
Hungarian.... ...	43	M	.	1	Fall of rock in stope.
English-speaking ..	24	S	1	. .	Trestle broke while tramming and man fell.
Croatian...	29	S	... .	1	Fall of rock in stope.
English-speaking...	23	S	.....	1	Premature explosion.
Czecho-Slovak.....	37	M	.....	1	Crushed between car and platform.
English-speaking...	47	M	... .	1	Crushed in cage when hood caught timber.
English-speaking..	24	S	.....	1	Died while under anaesthetic at doctor's office.
English-speaking..	23	S	.....	1	Blocking fell down shaft.
English-speaking...	53	M	.....	1	Caught in cave-in in stope.

TABLE OF FATAL ACCIDENTS AT

No.	Date	Place	Name of owner	Name	Occupation
30	May 19	Smelter.....	Mond Nickel Co.....	Albert Darby ..	Electrician.
31	Oct. 6	Acid works...	do do	D. Pavan... ...	Labourer..

TABLE OF FATAL ACCIDENTS AT

No.	Date	Name of owner	Name	Occupation
32	Mar. 7	Canada Cement Co., Ltd..... .	Smith T. Bowerman.	Labourer. . . .
33	June 5	Canada Crushed Stone Co.... ...	Leonard F. Wickens	Shovel operator
	June 5	do do	Thomas Moore.... .	Labourer. ....
34	April 8	Hagersville Quarries, Ltd..... . . .	Frank Critelli... .	Labourer.....
	April 8	do do	Giovanni Dionati....	Labourer.. ...
	April 8	do do	Charles Achester..	Labourer... ..
35	July 29	do do . . .	Charles Mepham.	Labourer.. ...
36	Mar. 4	J. K. James.... . . .	Albert E. Mather..	Teamster... ..
37	July 11	W. E. McCaul	Stewart Charlesworth.	Labourer.. ...

METALLURGICAL WORKS, 1925

Nationality	Age	Married or single	Above ground	Below ground	Cause of accident
English-speaking...	29	M	1	. .	Touched live wire while doing repair work.
Italian...	27	S	1	.....	Fell from top of scrubber.

QUARRIES, CLAY, AND GRAVEL PITS, 1925

Nationality	Age	Married or single	Cause of accident
English-speaking...	58	M	Struck by rock from blast.
English-speaking...	37	M	Fall of clay.
English-speaking....	24	S	Fall of clay.
English-speaking....	18	S	Premature explosion.
English-speaking...	18	S	Premature explosion.
English-speaking...	18	S	Premature explosion.
English-speaking....	45	S	Touched live wire leading to drill.
English-speaking....	20	S	Fall of gravel.
English-speaking....	14	S	Fall of sand.

Fatal Accidents, Mines

Cobalt Contact Mine.—Joseph Bougie, Canadian, aged twenty-seven, married; and Forrest Finlay, Canadian, aged thirty-three, married, were killed by falling in the bucket in the Red Rock shaft of the Cobalt Contact Mines about 1.30 a.m., September 5.

The shaft is 110 feet deep. Finlay, who was a machine runner, George Dunn, his helper, and Bougie, who was a mucker, were working on the 110-foot level on the night shift. The men were in the habit of riding the bucket, though forbidden to do so by the orders of the superintendent and the mine captain. The hoistman on the day shift had reported that the bearing of the eccentric on the hoist was heating and knocking. After the midnight lunch, John McDonough, the hoistman, took off the cap of the eccentric and put in a shim so as to tighten up the bearing. The men stood in the hoist-house while he was doing this and walked out when he went to the levers. McDonough threw out the clutch and left the bucket suspended at the collar of the shaft by the brake while he started the engine turning over. He then went to the bearing to examine it to see if the knock had ceased. The first intimation McDonough had that the drum had loosened and the bucket gone to the bottom was noticing the slack cable. The deckman climbed down the ladders to the bottom platform and saw Dunn in the bucket at the bottom. Finlay was lying in the south drift with his head near the bucket and Bougie about ten feet away in the north drift. Bougie died soon after from a fracture of the skull and neck. Finlay whose skull was fractured in two places died in Haileybury hospital about 3 a.m. Dunn, who suspended himself on the cable by one hand, was slightly injured and climbed the ladders unassisted.

According to the evidence of George Dunn, the three men went to the collar of the shaft and stood on the rim of the bucket without giving any signal to the hoistman. Dunn said to Finlay after he stood on the rim of the bucket, "Hadn't we better give him two bells?" Finlay replied, "No, he'll let us down when he gets ready." At that instant the bucket dropped to the bottom. The hoist was the ordinary 6 by 8 Jenckes hoist with cone friction and brake operated by two levers on a quadrant. Finlay was said to be familiar with the operation of such hoists and should have known that, altogether aside from any violation of the regulations, under no circumstances should men climb on a bucket thus suspended without having an understanding with the hoistman.

An inquest was held at Haileybury by Coroner Dr. Jackson on September 7. The verdict of the jury was, "We find that Forrest Finlay met his death by accidental causes which were avoidable."

John Culhane, Canadian, single, aged nineteen, was instantly killed and Godfrey Billedeau, Canadian, single, aged twenty-six, was fatally injured when Billedeau drove into the old bottom of a drill hole in the west crosscut on the 115-foot level of the Cobalt Contact mine about 11.50 a.m., November 24.

This crosscut was being driven by Billedeau on day shift and was mucked out on the night shift by John Coombes. A round was drilled and blasted on Monday and mucked out Monday night by Coombes, who stated that the drill holes had broken to within three inches of the bottom. The face was also seen by Emery Fleury, machine runner, and John McLellan, helper, who, after finishing their round in another drift, helped Coombes to finish mucking out in the crosscut. Both men considered that the round had broken particularly well and that not more than four inches was left in any of the holes. The working place was visited by Fred Allen, the mine foreman, about 7.30 p.m. Monday

night, before it was mucked out, and again about 10 a.m. Tuesday morning, when four or five holes had been drilled in the face by Billedeau. He did not observe any old bottoms which looked dangerous.

At 11.53 a.m. Joseph Vinkle, mucker on the day shift, went into the crosscut and asked Billedeau when he was coming to dinner. The reply was, "When we start this hole." The machine was started on the centre cut hole, and after a few strokes the drill stuck in the hole. Culhane struck the drill steel with a chuck wrench from the right-hand side. When the drill was again started, an explosion occurred which threw Vinkle down at a distance of ten or fifteen feet. Culhane received the full force of the explosion in the arms and the top of the head, dying instantly. Billedeau had his left arm and left leg broken, and a piece of rock penetrated his chest under the left arm. He died from shock about three hours later in the Haileybury hospital.

An examination of the face of the crosscut after the accident showed that an explosion had occurred directly in line with the drill in an old bottom which had been about seven inches deep. The right-hand side of the hole was broken away by the explosion, which loosened about two shovelfuls of rock. The hole in which the explosion occurred may have been a cut-off hole containing powder covered by dirt from the blasting, as there was a mud seam in the face. The drilling could not have been started more than the width of the drill steel from the hole. Apparently the face was not washed down or the stick of forcite, which evidently remained in the bottom of the hole, would have been seen.

An inquest was held at Haileybury on December 5 by Coroner Dr. Jackson. The jury brought in a verdict that the accident was caused by an accidental explosion, that any blame attached would be on the machine runner and helper, who should have examined the face of the rock before drilling; and recommended that a board be installed for notice of anything unusual.

Dome Mines Company, Limited.—Robert J. Sheppard was electrocuted at the Dome mine at about 11.55 a.m., on April 18, 1925. He was a Canadian, twenty-three years of age, and unmarried. He had been employed as electrician for about two years at the mine, and had been engaged at electrical work for about seven years previous to that.

The chief electrician had instructed him about 9.30 a.m. to reverse the rotation of a 75-h.p., 550-volt motor which drives a crusher. He had evidently forgotten to do this until reminded by a crusher man at about 11.45 a.m. He then left the electric shop alone to do this and was not found until about 12.25 p.m.

To reverse the motor it was only necessary to disconnect and interchange two leads at the motor terminals. The motor was equipped with a set of disconnecting switches and an oil switch on the primary circuit and a liquid control on the secondary circuit The disconnecting switches were never opened except in case of emergency or repairs on the circuit. The motor was operated by first closing the oil switch and then closing the rotor or secondary circuit through the liquid control. The power would be on the motor with the oil switch closed, but the motor would not start until the control was closed.

At the time of the accident the power had either been left on the motor by some other person, or Sheppard had started it to learn the direction of rotation and had opened the secondary circuit and left the oil switch closed. He also neglected to open the disconnecting switches or to hang a danger sign on the oil switch. He had removed the insulation from two terminals and had opened one of the circuits at the motor. He had one terminal in each hand thus completing the circuit for the current through his body. The oil switch had been tripped evidently by the overload to ground, and both hands were badly burned.

An inquest was held at South Porcupine on April 22 by Coroner F. Evans.

Hollinger Mine.—Thomas Fox, English, married, with six children, aged forty-two years, was caught in a cave-in of broken rock in a stope 91 east of 14 crosscut on the 550-foot level of the Hollinger mine at 5.00 p.m. on March 18 and was buried for twelve hours.

He was rescued and taken to the hospital, where no severe lacerations, bruises, or fractured bones were discovered, nor was it believed that there were any internal injuries. The doctor attending reported a partial paralysis of the right arm evidently due to the long pressure. For several days Fox appeared to be recovering, but the shock and poor blood circulation were too severe for him to withstand, in spite of the fact that previous to the accident he was in good physical condition. He died at the hospital at 4 a.m. on March 24.

The deceased had worked at the Hollinger mine since January, 1924, and previous to that had many years of mining experience in Northern Ontario. At the time of the accident he was employed on contract work as a drill-runner and had as a helper an Italian who neither spoke nor understood English in spite of over eighteen months in Canada. Mining in the stope was being carried on the shrinkage system with manways of cribbed timber built up at intervals through the broken rock. During the day shift the machine bar had been set up over one of these manways, and from that position three holes had been drilled into the back of the stope.

When Fox and his helper went to work, they continued to drill from the same set-up and were drilling the third hole when the broken rock settled some ten feet. At the time, the helper was standing on the timber over the manway, while Fox was on the broken rock at the side of the manway. As the rock caved Fox was drawn in and dropped twenty feet.

At the time of the accident the broken rock in the stope was thirty feet deep with the back some eight feet above the top of the rock. On the day of the accident no rock had been drawn from this part of the stope, though on two days previous to the accident there had been some drawn. According to the evidence of the scaler, chute blaster, and timbermen, the level of the rock had dropped in keeping with the quantity of rock drawn. In view of the steady settling of the rock, the stope was considered safe to work in. Together with the miners who worked over the part which caved, during the day shift, two timbermen had shortly before this increased the height of the cribbed manway. During all this time the rock showed no signs of settling further.

It was estimated that the void created would have held about thirty tons of rock. From the evidence of the men detailed to draw the rock from the chutes below the stope, there was no reason to believe that a void did exist. An explanation of the void was offered as follows: The stope was inclined at about 70°, and after blasting a large flat slab of rock may have caught between the cribbing of the manway and the footwall of the stope which at the place was eight to ten feet wide; the broken rock later piled up on this and did not drop as it should when the chutes were being drawn; later when water was draining through the rock from the drill, the slab was loosened and the rock on top caved.

The quantity of rock reported as drawn by the trammers checked within reasonable limits with the measurement of the void.

An inquest was held at Timmins on March 28 by Coroner H. E. Montgomery, when the jury returned a verdict of accidental death attaching blame to no one. A rider was added that the jury believed that there should be records kept of the amount of rock drawn from each chute and that these records should be available at any time to anyone concerned.

Cornelius Oliver, Canadian, aged forty-two years, was killed by a fall of rock in a stope, No. 12 west of 4 crosscut, 200-foot level of the Hollinger mine between 8.30 and 9.30 p.m. on April 8. He is survived by a wife and four children who live in Saskatchewan.

The deceased had been in the employ of the mine since November, 1924. Previous to coming to the Porcupine area, he was said to have had eighteen years' experience in mines in various parts of America. At the time of the accident he was employed as a scaler and block-hole driller.

At 7 p.m. on the night of the accident, Oliver was directed by the shift boss to drill some block-holes in large slabs of rock lying at the west end of the stope after he had finished scaling in the stope. The deceased proceeded to do this drilling and was last seen alive about 8.30 p.m. by two drillers who were working about 100 feet away and to the east. There were no eye-witnesses to the accident, and no unusual sounds were heard by the men working nearby.

When the shift-boss made his next tour of the stope at 9.50 p.m., he found Oliver caught and bent over the plugger-drill. Life was extinct. A mass of rock measuring 3 by 5 by 9 feet and estimated to weigh four tons had fallen from the back and side. As it fell, an outer corner had evidently caught Oliver's back and pushed him against the drill. His back was broken and his chest crushed.

Examination of the place after the accident showed a slip, which no one had previously detected, running at an angle of 45° to the footwall and passing into some banded quartz about two feet from the wall, which dipped at 75° and was faced with a soft "gouge." The mass which fell came out in a wedge with the tapering edge to the banded quartz. The stope at this place was seventeen feet wide and the back (before the accident) seven feet above the broken rock.

Whether the deceased had sounded the back before setting to work is not known, but it is doubtful whether the mass would have sounded "drummy" owing to its size. The scaler on the day shift had passed over this part of the stope and had found nothing wrong. Blasting had been done on the previous night.

An inquest was held at Timmins on April 10, by Coroner H. E. Montgomery when the jury returned a verdict of accidental death, attaching no blame to anyone.

Rolland Vaillant, French-Canadian, aged twenty-four years, single, was injured at 9.20 p.m. on April 18, by an explosion of forcite in No. 11 crosscut south on the 1,850-foot level of the Hollinger mine and died at 11.45 p.m. the same night at St. Mary's hospital, Timmins, of his injuries.

The deceased had been in the employ of the mine since January 10, 1923, working first as a trammer and next as a timber-passer. On April 7, 1925, he began to work as a driller's helper. On the night of the accident he was working with George Couture, a miner whose experience in the Hollinger mine extended over six years. The work in the crosscut was being done on contract, the men blasting the round after the drilling.

A round of nineteen holes was drilled, and the "cut" holes were blasted first. On the return to the face, Couture decided to reblast two of the "cut" holes with the other holes of the round excepting the three back holes. Fourteen holes in all were loaded. Seven-foot length of Clover brand fuse, No. 8 detonators, and forty per cent forcite, were used. All the fuses except that of the right-hand "lifter" were cut to bring about the succession of shots.

Having lighted the fourteen fuses, the two men left the face, Couture going to the central shaft some 750 feet away and Vaillant going to a crosscut some 600 feet away. Each man counted the shots, and within a few minutes after what seemed the last one, the two men met in the crosscut where Vaillant was waiting. Couture remarked that he had counted thirteen shots, while Vaillant said he was sure that he had counted fourteen, two having gone very close together. However, Couture said that as there was plenty of time they would sit down and wait till the smoke cleared away. After waiting for some time they proceeded to get more explosives to finish the blasting of the round.

They returned to the face and Couture noticed on examination that there was some rock protruding on the right side of the crosscut. It appeared as if the side hole just above the right-hand "lifter" had not broken. Couture told Vaillant to get a shovel and clear away the rock from the place to see if it were necessary to reblast the hole. Vaillant got a shovel and started to clear away the rock. Couture in the meantime was preparing to load the three back holes and was standing about three feet back of where Vaillant was working when an explosion took place. Vaillant received the full force of the explosion and was terribly injured about the head, shoulders, and arms. Couture was thrown back by the force of the explosion but escaped with minor injuries.

From evidence of Couture it was certain that the men did not return to the face until at least fifteen minutes after they heard the last report, so that the possibility of a slow fuse was eliminated. It was further certain that the accident was not due to a burnt hole as Couture declared that there were no fumes at the face when they returned to do the second blasting.

Examination of the face after the accident showed that the side hole above the right-hand "lifter" passed through a slip which may have afforded a breaking plane that allowed one of the relieving holes of the "cut" to tear away part of the side hole and expose some explosive. Judging from the extent of the injuries done to the two men, there could not have been remaining all the forcite that was originally placed in the hole. Another explanation may have been that there was some loose forcite lying in the rock where Vaillant proceeded to scrape away with the shovel. A sharp glancing blow from the shovel would be sufficient to explode the forcite and more readily so if a detonator were left.

An inquest was held at Timmins on April 22 by Coroner Hector E. Montgomery. The jury returned a verdict of accidental death, attaching blame to no one, but recommending adherence to the Explosives Regulations. The evidence at the inquest showed that some employees were not familiar with Regulation 16 of the Mining Act which sets forth the time that men shall remain away from a face in case of a supposedly missed hole.

Isaac Maki (probably Isaac Hjuart), Finn, aged thirty-seven years, single, was fatally injured at 9.45 a.m., April 29, in the Hollinger mine when he was crushed between a car and a post of a chute in stope No. 84, east of 12 crosscut on the 1,100-foot level. He died five hours later, the cause of death being a collapse of the lung and heart failure.

The deceased had been employed at the Hollinger mine as a driller's helper for twelve months previous to the accident. Before this he had a year's experience in mines of the Porcupine area and five years in the Sudbury area.

On the morning of the accident, Maki was sent by the driller to have some air hose repaired at the mine workshop. He took two sets of hose out of the stope by a ladderway and evidently when near the level dropped them on the car tracks below. Without picking the hose up, he proceeded along the drift to where some of his countrymen were working with a timber gang.

A few minutes later, a chute-blaster who had been in the stope came down the ladderway and saw the hose lying on the tracks, so he picked them up and placed them against a post in front of and to the side of the ladderway. This chute-blaster then proceeded along the drift in the opposite direction to that taken by Maki and in doing so stepped to one side of the track to allow two loaded cars being pushed out by two trammers to pass. The trammers had only gone a few feet further when their cars were stopped as though by a piece of rock on the track. One of the men stepped ahead to see what was the matter and found that Maki was pinned between the car and a post. He was carrying the hose over his left shoulder and was facing the car. On being released Maki complained of injury to his chest. When the accident happened, there was no cry of alarm or of injury. Maki was taken to the surface and then to the St. Mary's Hospital, Timmins, where it was found that his collar bone and several ribs were fractured, and a lung was punctured

It would appear from the evidence obtained at the inquest that Maki went out of the drift to wait with some of his countrymen while the smoke cleared away from the drift. There had been some blasting done at the chute from which the trammers were drawing ore. As to how long before the accident this blasting had been done, the evidence given varied from five to thirty minutes. Witnesses further disagreed as to how dense the smoke was in the drift and how long it took to clear away, but all agreed that with acetylene lamps an object could be seen at a distance of eight feet away.

The trammers in pushing the cars along the drift did not make a practice of carrying their lamps on the front of the cars. On the other hand it was brought out in the evidence that Maki was carrying a lighted lamp before and after the accident. The cars used were 6 feet 8 inches long, 3 feet 6 inches high, and the track gauge 36 inches.

The clearance between the posts along the drift and the side of the car was only four to six inches, but between any two posts on one side of the drift and also at the ladderway there was ample room for anyone to stand safely while cars were passing. In the drift, cars were trammed by man power only.

Further, it would appear that Maki after remaining away some time while the smoke was clearing, went back towards where he had left the hose but did not notice the cars being pushed towards him; and that while stooping over to pick up the hose then lying on the left side of the drift and against a post, and while placing the hose over his left shoulder, the cars moved along crushing his chest and shoulder between the car and the post.

An inquest was held at Timmins on May 4 by Coroner Hector E. Montgomery and owing to a seeming discrepancy in the evidence, the inquest was postponed until the following day to permit of calling other witnesses. There was some doubt as to who actually did the blasting at the chutes and as to the time when the blasting was done. A rule of the mine required that no blasting should be done by the trammers. The evidence was not clear at first as to whether at the particular time the blasting had been done by the trammers or by the man regularly employed as chute-blaster.

The jury returned a verdict of accidental death attaching no blame to anyone but recommended that lights be carried on the front of moving cars.

Octave Frapier, French-Canadian, aged fifty years, married, with five children, was injured at 10.30 p.m., June 5, in stope 53, east of 10 crosscut, south heading, on the 1,100-foot level of the Hollinger mine by a fall of rock and died at 1.15 a.m. the following morning at St. Mary's Hospital, Timmins.

The deceased had been in the employ of the Hollinger company since August, 1921, working first as a carpenter and since January, 1923, underground both as a driller and driller's helper. At the time of the accident he was employed in the latter capacity.

On the night of the accident, the driller and Frapier had finished their round of holes at the west end of the stope and were taking the drill and hose to a place of protection from blasting. Frapier was some fifty feet away from the drilling place, pulling the hose away, when a slab of quartz, 6 feet by 3 feet by 3 feet fell from the roof and caught him, breaking several ribs and fracturing the spinal column. He was rescued immediately and taken to the surface for medical attention.

Examination of the stope after accident did not show any signs that there were cracks or seams that might have been noticed before the accident. Scalers regularly employed on morning and afternoon shifts gave evidence that they had gone over the roof at the point of the accident and that they had left everything in good condition. In stopes where the quartz predominates in the ore, it is claimed that at times the roof may be scaled clean and inside of a short time the quartz begins slabbing off of its own accord.

Blasting had taken place the night previous at the point where the accident occurred, but neither Frapier nor the driller was responsible for the scaling of that particular part of the stope, therefore, the accident could not be attributed to any negligence on his part. The night scaler declared that he had gone over the place as late as 9.30 on the night of the accident. He was a man experienced in the work of scaling, and that he had done the work at the place of the accident was given in the evidence of the driller with whom Frapier worked.

An inquest was held at Timmins by Coroner Hector E. Montgomery on June 9. A verdict of accidental death was returned with a rider that the jury wished to call the attention of the authorities to the absence of stretchers to properly care for men when accidents happen.

James Harris Roberts, English, aged twenty-two years, was fatally injured at 9.40 a.m. near the entrance to drift 85, on 10 crosscut north, 1,400-foot level, Hollinger mine on June 10 and died within half an hour afterwards.

The deceased had been in the employ of the mine since April 14, 1925, having come from England, where he had worked for several years in mines. His first employment at the Hollinger was as a loader. In May he worked as a driller's helper. On June 9 he had at his own request been given work as a switchman on the 1,400-foot level where ore cars are hauled by trolley motors. Work on this level consisted only of hauling from development faces, two motors being used.

At the time of the accident four empty cars were being pushed into the crosscut from the main haulage way (M4) and Roberts was riding in the car furthest away from the motor, with his lamp hanging over the front of the car. The motorman saw him climb over the front of the car when the train was near the drift. The motorman next saw Roberts' light go out and he immediately stopped the train, although the usual practice was to stop when signalled to do so. Following this, the motorman heard a cry and called to ask what was wrong. Getting no reply he went up to the head of the train and found the switchman pinned at the chest between the front axle of the car and the ground. There was some seven inches of clearance. Assistance was immediately sought and the car lifted. Roberts jumped to his feet but was able to stand only momentarily.

When taken to the surface he was found to have a comminuted fracture of the right clavicle and that a lung had been crushed.

The motorman was the only person in the vicinity at the time of the accident and at the inquest declared that the train was being moved about three miles an hour just before the accident. He saw Roberts get out of the car while the train was in motion but did not see what actually caused the accident.

The shift boss in charge on the level and the motorman both declared that Roberts had been instructed that he was not to get off the cars or get on the cars while they were in motion. The motorman stated that on a number of trips Roberts had not adhered to these instructions and that as he, the motorman, knew exactly where to stop in spotting the cars in the crosscut, Roberts got off the car at a point where he was in a position to throw a block chain under the wheel of the car nearest the switch. In getting off in this manner, the switchman saved himself a walk of thirty feet at the most, each time.

Reviewing the accident, it was found that the switchman had no switches to throw at or near the place of the accident; that there was no occasion for hurry as only a limited amount of rock had to be hauled and the two motors were more than sufficient to do the work; the motorman and switchman were not working on a contract basis; that Roberts had been instructed not to get off or on moving trains.

It would appear that in getting out of a moving car Roberts slipped on the rails near the switch and that he was caught by the axle of the car. It was quite evident to the motorman that the first axle caught the switchman and that the car had not moved more than three feet after the light went out.

An inquest was held at Timmins on June 11 by Coroner Hector E. Montgomery, and the jury recommended that rules as to moving trains be more rigidly enforced and found that the blame for the accident was due to the rules not being carried out.

Torlesi Braaten, Norwegian, single, aged thirty-two, was instantly killed by being crushed on the auxiliary cage at 2,300-foot level in the central shaft of the Hollinger mines at 10 p.m., August 15.

Braaten was employed as a deckman at the 1,850-foot level, and at the time of the accident was engaged with A. Tierney, cage tender, in bringing steel to this level from the 2,300-foot or bottom level. The cage used was the ordinary type of small cage which was provided with doors on one side, the front doors being left off by order of the company because they could not be used when handling cars, and because the men were on contract and came off work a few at a time, the number employed being about sixteen. The back doors, which according to Joseph McAlinden, the shift boss, were on the cage half an hour before the accident, were standing undamaged on the 2,150-foot station after the accident, though the cage tender states that they were on the cage when the accident occurred.

About three dozen steel, the longest being eight feet, were handed to the cage tender by Braaten and F. Santi and D. Gillis, machine runner and helper, and placed by him on the cage. All but the starters, which were laid on the floor, were stood up inside the car guard, leaning against one end of the cage. They were not tied by the cage tender, though there was a rope provided for this purpose at the 2,300-foot level and several chains in the stations on the 2,150- and 1,850-foot levels. The cager rang the signal to be hoisted to the 1,850-foot level and as he turned one of the steel fell and caught in the timbers. All of the steel and the two men were thrown out of the cage, though the hoistman felt the tug on his lever and stopped the cage within about two feet. Braaten

was found with most of the steel in the bottom of the shaft. The cage tender was thrown on to the shaft timbers but climbed back on the cage after it was stopped by the hoistman. He was not seriously injured.

The shift boss came into the station on the 1,850-foot level at the time of the accident, and noticed the jerking of the cable. He went into the hoist room and enquired of the hoistman the position of the cage. He was told that it was about twenty feet above the 2,300-foot level. He then went down in the bucket and finding the cage tender on the cage and the cage very little damaged, he went to the 2,150-foot level and had the cage hoisted slowly to that level where the cage tender was taken off. He then went down to the bottom level where Santi and Gillis were looking at the deckman lying a few feet below the station in the bottom of the shaft compartment.

An inquest was held at Timmins by Coroner H. Montgomery on August 19.

Edward Fleming, aged thirty-five years, Canadian, married, with three children, was instantly killed in stope 85, west of 12, of the 1,400-foot level of the Hollinger mine at 4 a.m. on September 5, by an explosion of dynamite.

The deceased was at the time of the accident employed as a blaster, having worked for the company since March, 1925. With his partner, A. B. Hamilton, they had prepared to blast a number of breast holes in the stope. Fleming proceeded to light ten fuses at one breast while Hamilton lighted nineteen at another, and then together they turned to light another set of eighteen fuses. Hamilton finished his portion and then moved along the stope to light another set of four fuses. He had lighted one when he noticed that Fleming had not joined him as quickly as he should have. He immediately called to Fleming but received no answer. Hurrying back to where Fleming was, Hamilton found him lying on his back, presumably in a fit.

Hamilton attempted to drag Fleming away from danger and at the same time called for help to another blaster who was waiting for them at a manway some hundred feet away. Together they tried to move Fleming over a pile of rock, but the explosions of the holes nearby put out their lights and they were unable to render further assistance in the smoke. Knowing that further explosions were to take place nearer to them, the two men sought cover. They returned to the place as soon as possible and found Fleming dead. His body did not show many lacerations, but the chest was crushed as though by the concussion.

From the evidence of Hamilton it would appear that the deceased had taken a fit, and the doctor attending after the accident testified that from the evidence he would say that Fleming was in an epileptic fit, although he had no knowledge of the man's previous physical condition.

At the inquest held by Coroner H. E. Montgomery at Timmins on September 8, a blaster who had been working with Fleming getting out firewood during the day stated that the deceased did not appear to be feeling well and that even as they went on shift at 11 p.m. Fleming said he was sorry that he had come to work. However, to the blasters he was working with, Fleming had said nothing as to how he felt and they did not notice anything wrong until just before the accident occurred.

The jury called for the inquest returned the following verdict: "That deceased was either in a fit or overcome by weakness and his partner made every effort to take him out of danger; and that death was accidental." A rider was added recommending that all men on blasting shifts be medically examined as to their fitness for the work.

John Belas, Czecho-Slovak, aged twenty-eight years, married with one child (family in Czecho-Slovakia), was fatally injured when the box of a Hudson car tipped against his head in No. 12 crosscut at the 800-foot level of the Hollinger mine on October 29 at 2.50 a.m. He died at the hospital on October 31.

The deceased had been in the employ of the mine since the 6th of October, 1925, previous to which he had several months' experience in mines of the Sudbury area. Before coming to Canada he had worked for ten years in mines in his homeland.

The accident occurred while Belas with two English-speaking men was trying to replace a car which had been derailed. The deceased had loaded a train of cars with gravel which was to be used for stope-filling, and while the train was being trammed to the dumping place four cars were derailed. The first car, which they tried to right, was resting with one side lower than the other. Belas placed a block near the truck of the car to allow a piece of lagging to be used for a lever. The block at first was not close enough and Belas stooped down to push the block closer to the truck, and while so doing the car-box overbalanced, crushing his head between the edge of the box and the block. His skull was fractured and the scalp badly lacerated.

The car contained a ton and a half load of gravel in which there was considerable moisture. In accounting for the unusual accident, the transportation boss stated that he considered that the wet gravel had shifted to the lower side of the car-box when the loads were derailed, and that the box was overbalanced at the time that Belas placed the block near the truck.

An inquest was held at Timmins on November 3 by Coroner Hector E. Montgomery, when a verdict of accidental death was returned, attaching blame to no one.

Angus McDougall, Canadian, aged twenty-five years, was killed at 9.20 p.m., on December 26, 1925, when he fell a distance of 400 feet to the bottom of No. 19 (Schumacher) shaft of the Hollinger Consolidated Gold Mines, Limited.

The deceased had been in the employ of the company for four months. He was an experienced miner and had followed shaft-sinking work in Porcupine and Kirkland Lake mines for four years previous to the time of the accident.

On the night of the accident only five men of a gang of sixteen reported for work in the shaft and only one deckman reported, where ordinarily there were two. The shift boss and deckman talked over the work being done by one deckman, and it was agreed that it could easily be done in view of the number of men working in the shaft.

In this shaft, rock and material are handled in two buckets operating in two compartments. One bucket is hoisted by an air hoist installed at the 950-foot level and the other by an electric hoist at the surface. The buckets are dumped at the 1,100-foot level. The shaft at the time of the accident was 1,900 feet deep and timber reached within thirty-six feet of the bottom. The crosshead stopped within fifty-five feet of the bottom.

The deckman on duty the night of the accident was called upon to do the signalling for both buckets, as well as dumping the buckets. One man in the shaft signaled to the deckman at the 1,100-foot level, who relayed the signals to the respective hoists. Before detailing the deckman to attend to both buckets, the shift boss instructed him that when one bucket was down and the other up to look after the up one.

Just previous to the time of the accident, the men in the shaft had finished shovelling, the last bucket being on the air hoist. The bucket on the electric hoist was hanging in the shaft below the timber. After clearing the shaft of broken rock, preparations were made to load and blast a ledge six and a half feet deep which still remained at one side of the shaft. A man in the shaft signalled to hoist the loaded bucket and then signalled on the other line to lower the empty bucket. Both signals were responded to as the deckman relayed the signals to the respective hoists. When the empty bucket was lowered two men embarked, one to go up for a blow pipe left some forty feet from the bottom of the shaft, and the other to get some explosives at the 1,100-foot level. While the bucket with the two men riding was being raised, McDougall took hold of a lug on the side near the bottom of the bucket. As it rose he did not let go and another man standing at the bottom of the shaft yelled to him, "Let go of the bucket." When the signal man in the shaft saw that McDougall was hanging on, he immediately rang one bell to stop and, as there was no response, rang again. When the bucket had reached the timber McDougall began to yell to have it stopped. The man at the bottom of the shaft did not know that the signal was not being relayed to the hoistman.

The deckman, when questioned as to why the signal was not relayed, stated that after he relayed the three and one signal he watched the cable rising and considered that the bucket had risen beyond the timbers and from that he decided that the men were coming to the 1,100-foot level. He then went around to dump the loaded bucket in the other compartment and in doing so he had to climb a deck some eight feet high, in all walking a distance of thirty feet. He said that he heard the bell when dumping and came back to the first compartment to find that the bucket and the two men riding had reached the level. They said that McDougall had hung on to the lug of the bucket until he had ascended some 400 feet, when he said he could hold on no longer and dropped.

No information could be obtained as to why McDougall took hold of the lug of the bucket as he did, unless to steady it, and why he did not let go when warned, or why he did not seem alarmed until some forty feet from the bottom, could not be explained. It is questionable whether the deckman waited at the first compartment for the length of time he says he did, as the signal man in the shaft declared that he rang the bell as soon as he saw McDougall hanging to the bucket, and this would have been some twelve feet from the bottom. The signal man was standing on the top of the ledge.

An inquest was held on December 31 at Schumacher by Coroner Frank C. Evans, and the jury returned a verdict of accidental death.

International Nickel Company of Canada, Ltd.—Nicholas Chymeres, a blaster, was instantly killed at about 6 p.m., June 19, by a blast at the Creighton mine of the International Nickel Company of Canada, Limited. He was an Austrian, unmarried, and twenty-nine years of age. He had been employed as trammer at this mine since August, 1924, and as blaster for the last five months.

Chymeres and Alex. Pollis on the day of the accident had loaded six holes to blast out 12-0 box hole on the fifteenth sub-level. This box hole would connect No. 1 drift on 15 sub-level with No. 12 manway. The distance between the two was ten or twelve feet, but Pollis and the shift bosses thought it was about eighteen or twenty feet, and they expected that it would require three rounds of drill holes to complete the distance.

After lighting the fuses, Pollis went to 14 level to guard the entrance to the blast and Chymeres went down 15-2 manway for the same purpose. He warned

two trammers on 15 level not to go to 15 sub-level and then he walked along 15 level past 15-2 manway and was ascending 12 manway and opposite 12-0 box hole when the blast went off.

The blast broke through into the manway, striking him in the head and upper part of the body. A search was started for him when he did not arrive at 14 level to meet his partner as arranged. He was dead when found. Dr. Campbell was called and on examination found that the head and chest were badly crushed and both arms broken in several places.

It is not known why Chymeres was ascending 12 manway, as he had gone down by 15-2, which was the permanent manway and the customary route for travelling. The two manways were about 200 feet apart.

An inquest was held at Creighton on June 23 by Coroner Thomas Stoddart.

Albert Johnson's Prospect.—John McGillivray, Canadian, single, aged twenty-eight, was fatally injured by a blast in a prospect shaft on the property of Albert Johnson at Boston Creek at noon on September 28 and died at Cobalt Mines hospital about six hours later.

An option was taken on the property by David H. Angus of Haileybury, and a contract was let on September 15 to Albert Johnson, Patrick Finn, and John McGillivray to sink a 25-foot shaft. The shaft had reached a depth of between eleven and fourteen feet on September 28. On that forenoon two short holes were drilled with hand steel to serve as easers for two holes which did not break bottom on the previous Saturday. A four-foot hole was then drilled in the bench in the manway end of the shaft. Albert Johnson capped five fuses and these together with eight sticks of 1 1/8-inch forcite were handed to McGillivray by Patrick Finn. McGillivray loaded the five holes by splitting the sticks of powder and tamped them with fine dirt. He took a piece of fuse for a spitter and proceeded to light the fuse. The spitter went out when he had lit four holes, and he took a match to light the fuse in the four-foot hole which was close to the ladder. The first match went out and he attempted to strike another when he was told by Finn to come up and never mind the other. Some doubt existed in the minds of the witnesses, Patrick Finn and Charles McQueen, who were looking on at the collar of the shaft, as to the time that elapsed while McGillivray was lighting the fuses and endeavouring to light matches on his damp clothes, but it evidently was sufficiently long to give them anxiety. At that moment one of the holes went, and McGillivray was knocked down by the explosion. Finn attempted to descend the ladder but was restrained by McQueen. Two other shots followed the first one, and McGillivray was thrown towards the centre of the shaft. When taken out of the shaft, it was found that his left forearm had been blown off at the elbow and that he had received many lacerations.

An inquest was held at Cobalt by Coroner Dr. Jackson, of Haileybury, on September 30 and adjourned until October 5 to obtain further evidence. The jury found that John McGillivray came to his death by a blast with tape fuse contrary to the Mining Act, from the bottom of a shaft over ten feet deep on a property under option to D. H. Angus who had let a contract to Captain Albert Johnson, Patrick Finn, and John McGillivray. "We find negligence on the part of D. H. Angus, Captain Albert Johnson, Patrick Finn, and the deceased, John McGillivray."

Kerr Lake Mine.—William Frank Nikumma, Finn, aged twenty-one years, was almost instantly killed in the Kerr Lake mine about 2.25 p.m. on March 6 by a fall of rock.

The accident occurred in a stope above the adit level on No. 7 vein about 220 feet from the shaft. There was about three feet of muck on the timbers in this stope, and some high grade had recently been picked out of this muck. On the Monday preceding the accident, the place was examined by the mine captain and the two men regularly employed in the mine were set to work to work over the muck and pick out the high grade. The two men, John Nikumma, father of the deceased, and John Wirtanen, worked until Thursday opening out one of the chutes, and then began passing the rock down the chute as they picked out the ore. The place was considered quite safe by John Nikumma, a miner with twenty years' experience in copper and silver mines. On Friday morning the son took his place, as the father was not well. In the afternoon, when about six feet of the lagging had been laid bare south of the chute, a piece of rock six feet long, five feet high above the lagging, and from eight to sixteen inches in thickness, fell over from the west wall against William Nikumma, who was picking over the muck near the opposite wall, and crushed his head between the falling rock and the wall of the stope.

The piece of rock that fell was separated from the remaining part of the wall by a calcite stringer, a fraction of an inch in thickness. When the men sounded the walls of the stope, the sounding was likely done above the rock which fell and no notice apparently was taken of the calcite stringer, which could only be seen from the top. When the muck had been removed from the timbers this piece of rock appears to have been unsupported except near the chute where it rested on the lagging, and all but about two feet at the end most distant from the chute fell at the time of the accident.

An inquest was held at Cobalt on March 9 by Coroner Dr. Kane, and the jury brought in a verdict of accidental death with a recommendation that old stopes should be examined by some one in authority before men are sent to work in them.

Kingdon Mining, Smelting and Manufacturing Company, Limited.—William Bludney, an Austrian, was fatally injured by falling down a stope at the lead mine near Galetta about 9.30 a.m., on May 19. He was about forty-two years of age, married, and had been employed as miner by the company for at least five years.

Bludney and one other man were installing an auxiliary ladderway in stope 501 from the 400- to the 525-foot level. The permanent ladders were completed to within about thirty-five feet of the floor. A temporary ladder was held by ropes at the foot of the permanent ladder for placing the sprags and landing.

The men had climbed down about six feet below the temporary ladder and were standing on an old platform taking measurements when the plank on which Bludney was standing broke, allowing him to fall a distance of twenty-two feet to the bottom of the stope. The stope is about six feet wide and the platform consisted of two or three planks lying across two timbers which were attached to each wall.

When picked up, Bludney was semi-conscious and was attended by Dr. W. B. McNaughton and moved to his boarding house, where he died about 5 p.m. Dr. McNaughton testified that death had been caused by a fracture of the base of the skull. An inquest was held by Dr. A. B. Hyndman, of Carp, on May 21.

John Proulx, French-Canadian, aged thirty years, married, with four children, was buried in a cave-in of rock in a stope at the 700-foot level of the Kingdon mine, Galetta, at 10 a.m., August 10, and his body was rescued at

9.45 p.m. of the same day. Death had evidently followed immediately upon the breaking of his neck when the accident occurred.

The deceased had been in the employ of the company for three months as a trammer and latterly as an assistant to the scaler regularly employed in the stope. At the time of the accident the rock pile in the stope was eighty-five feet above the 700-foot level. During the previous week one of the chutes from which rock had been drawn was reported as being hung up. As the rock was being withdrawn from this portion of the stope and a floor-pillar was being left at the level above, the stope was being scaled as the rock was being taken out.

The work of scaling was in charge of M. Darcy, an experienced miner. On the morning of the accident he with Proulx was working on the walls to the west of the chute which had hung up. They noticed the rock pile subside about eight feet over the chute, and as there was some ground to scale on the wall over the chute they took it that the place was safe following the subsidence. While Proulx was in the act of scaling, a second subsidence took place, pulling him down with the rock and completely burying him.

As there was no chance to remove the rock from over him, an attempt was made to reach him through the cribbing of a manway, but without success. Finally the rock was withdrawn through the chute and the body rescued at the 700-foot level.

An inquest was held at the mine by Dr. A. B. Hyndman, Coroner, on August 13, when a verdict of accidental death was returned by the jury.

M. Darcy was killed by an explosion of dynamite at about 9 a.m., on October 15, 1925, at the Kingdon Mining, Smelting and Manufacturing Company's mine, Galetta. He was a Canadian, thirty-five years of age, unmarried, and had been employed as a miner for about five years.

The explosion took place in a sump seven feet deep on the 525-foot level, about twenty-seven feet from the shaft. One round had been blasted from the bottom of the sump on October 12. The blast consisted of six holes with four to six sticks of dynamite in each hole. The blaster in charge of the work stated that he had counted all the shots.

The muck was taken out by four men on the morning of the 15th. They completed the mucking at about 8.30 a.m. and left Darcy alone preparing to drill another round with a plugger drill.

R. E. Vear, the mine captain, came to the sump at about 9.15 a.m. and found the place in darkness. He stated that he found Darcy's body in a sitting position on a stick of timber with his back leaning against the wall. He stated that the electric light in the drift was not burning, but there were no other indications of a blast.

Dr. McNaughton, of Arnprior, was called and made a partial examination of the body. He stated that the cuts on the face had evidently been made after death and that it was his opinion that the man had died of heart failure. The place was examined by other miners in the afternoon. These men stated that the ladder was broken, the hose cut, and loose stones were lying around the pit.

Darcy's face was covered with dust and was cut on the forehead and chin. The undertaker stated that there were several cuts and bruises on the body and legs. No preparations had been made for blasting, and he had evidently drilled into a missed hole.

An inquest was held on October 23 and 30, 1925, by Dr. Hyndman, of Carp.

Lake Shore.—Englebert Rumig, aged twenty-eight, married, was instantly killed by a fall of rock in 402 stope in the Lake Shore mine about 12.10 p.m. on May 29.

At the time of the accident, deceased was employed as a drill runner in 402 stope on a breast nine or ten feet in width. The drill had been set up on the north side of the stope by the previous shift. Rumig finished the drilling on the north side, and a sample was taken across the face between 10 and 10.30 a.m. by T. E. Keep. Before he left, the column was set up on the south side. J. Trembath, the scaler responsible for this stope, examined the place between 11 and 11.30 a.m. while the men were drilling. The evidence of all the men was that the place appeared safe. Three holes were drilled from the new set-up, and Rumig and his helper were raising the arm for a fourth hole when a piece of rock seven feet long by four feet high and of a maximum thickness of fourteen inches slipped from the hanging wall and crushed Rumig against the arm, breaking his neck. The fall of this piece of rock was due to a slip parallel to the vein, which though it contained gouge had not been detected by any of the workmen.

An inquest was held at Kirkland Lake on May 30 by Coroner Dr. Arnold, and adjourned to June 8, when a verdict of accidental death was returned by the Coroner's jury.

McIntyre.—Steve Zimmen, a Hungarian, aged forty-three years, married, with two children, was instantly killed at 12.20 p.m. by a fall of rock in No. 1,823 stope, 1,875-foot level of the McIntyre mine on April 27.

The deceased had worked for six years at the McIntyre mine previous to 1922, when he took up farming. After this time he worked at intervals in other mines of the area. He obtained employment again at the McIntyre mine on April 24, as a timberman and scaler.

On the day of the accident, Zimmen, with Herbert Cherry, was sent to work in No. 1,823 stope, which is reached from the 1,750-foot level by a ladderway of twenty feet below the level. Zimmen had already worked two days in the stope, but this was Cherry's first shift in the mine.

Mining of this stope was completed from the 1,875-foot level to within fifteen feet of the 1,750-foot level. It was intended to leave a floor at the upper level, withdraw the ore from the stope, and scale the walls as the ore was withdrawn. The two men were sent to scale the back and walls, to place timber to support the floor, and to arrange staging to work on as the ore was withdrawn.

A few days before they went to work in the stope, a round was drilled and blasted in the floor to make an opening for a manway. This blasting had loosened the rock, both in the wall and the back. On the day of the accident Zimmen and Cherry worked east from the ladderway, scaling the back and sides. Some fifteen feet east of the ladderway they tried the roof and it sounded all right. Zimmen worked along the south side and Cherry on the north. They had just returned from lunch and Zimmen set about scaling some smaller pieces on the north wall ahead of where Cherry was working. As he did this a wedge-shaped piece, nine feet long and tapering from a few inches to four feet in thickness, fell from the side and back, the westerly corner pinning Zimmen down and breaking his back. Cherry was not injured. The piece that fell was estimated to weigh four tons.

Examination of the ground after the accident showed that the wall, dipping 87° to the south, was covered with a fine film of calcite gouge and in the back a slip dipped to the east and extended nearly across the stope, here five and a half feet wide.

Cherry, who was an experienced miner, declared that before the accident both he and Zimmen had sounded the ground, of which the slab that fell formed a part. He also stated that before the accident no cracks or seams were in evidence and that he himself had only a few minutes before been under the piece that fell. The size of the piece that fell would probably prevent it from sounding drummy. The junction of the wall and the slip made a condition of weakness that would have been difficult to detect.

An inquest was held at Schumacher by Coroner Frank C. Evans on April 29, when the jury returned a verdict of accidental death, attaching blame to no one.

Mike Rawbic, Croatian, aged twenty-nine years, single, was fatally injured by a fall of ground at 8.30 a.m. in 2,130 stope, 2,000-foot level of the McIntyre mine on November 9 and died at 11 a.m. the same day.

The deceased had been in the employ of the company since September, 1922, and since February, 1923, had been working as a miner. At the time of the accident he was scaling in 2,130 stope, the back of which reached within 16 to 20 feet of the 2,000-foot level. Preparations were being made to leave a floor pillar twelve feet thick. The stope at the point where the accident occurred was seven feet in width. Following some blasting at the place, there was a considerable amount of loose ground in the back. The walls of the stope were covered with gouge and a number of slips showed in the ore.

Before going to work Rawbic was instructed by the shift boss to scale the stope and prepare the back so that it could be timbered. Accompanied by the shift boss he had looked over the place and knew that there was bad ground. With his helper, Rawbic started to scale. They had been at work only a short time when the helper noticed a piece loosening over Rawbic's head. He called to warn him when the piece, weighing about 300 pounds, gave away. Rawbic was not able to move quickly enough and the slab caught him, fracturing his pelvis and spine.

An inquest was held at Schumacher on November 11, by Coroner Frank C. Evans, when a verdict of accidental death was returned.

Sam Gillis, aged twenty-five years, Canadian and single, died at St. Mary's Hospital, Timmins, on January 5, of injuries received while tramming waste to the dump at No. 11 shaft of the McIntyre mine on November 4, 1925.

The deceased had been employed at this shaft since January 29, 1925, when he was engaged to tram the waste from the shaft. Until the first of November this work was all done by hand, the motor equipment having only been in use three days when the accident happened.

In the course of tramming, the cars were run out on a trestle, ten feet high and constructed of poles, six to eight inches diameter, the bents being sixteen feet apart and tied with lagging or plank. Within three feet of the last bent of the trestle, a bumping block was fastened to the rails and trestle by means of a chain. The cars used were the Hudson type, weight 700 pounds, with a capacity of 1,700 pounds of rock.

The tramming crew had been instructed not to run the motor out so as to rest on the trestle and at the same time they were not to ride on the cars. The practice in tramming with the motor was that the men rode on the motor until within seventy-five feet of the bumper, the motor stopped after shunting the cars, of which there were four in the train, and each trammer took charge of two cars, holding them back as they moved towards the bumping block. At

the time of the accident Gillis was between his two cars, holding back on the car ahead and leaning against the back car. The other trammer was fifteen feet away with the other two cars.

The cars which Gillis was holding back had taken on considerable speed before he reached them after the motor stopped. and when they reached the bumper they struck with greater force than usual and the trestle was shoved sideways. The cars went over the end of the trestle, taking the deceased with them, throwing him against the edge of the car and causing abdominal injury, which a post-mortem showed to be a ruptured liver.

From the evidence of witnesses to the accident, it was shown that the trestle was capable of holding the weight of the cars and the load. The tramming crew had not adjusted themselves to the motor haulage and had not reached the cars in time to prevent them bringing an unusual strain on the trestle bent. It also appeared that Gillis was vainly endeavouring up to the end to prevent the cars hitting the bumper too hard.

An inquest was held at Schumacher by Coroner Frank C. Evans on January 22, when a verdict of accidental death was returned by the jury.

McKinley-Darragh-Savage.—Francis Finnegan, Irish, aged twenty-three, single, was blasted on the intermediate level above the 185-foot level in the Princess mine, operated by the McKinley-Darragh-Savage Mines, about 11 a.m. on March 12. He lost the sight of both eyes, the right forearm, and received a fracture of the right frontal sinus at the time of the accident. He died as a result of his injuries in the Cobalt Mines Hospital on June 10.

The injured man came out from Ireland and was employed at the mine in April of last year. At the time of the accident, he was working in company with Walter Fenton as a mucker under James Davey, an experienced miner, removing a pile of ore from the above level. All block-holing and blasting was done by Davey. Davey loaded three block-holes with one-half stick of 40 per cent. forcite to each hole and two sand blasts with two sticks and seven sticks of forcite. Five-foot lengths of white jacket fuse were used. Davey had an old detonator on about a foot and a half of shredded fuse which he wished to get rid of. He placed this in one of the block-holes on the south side of the track, which hole exploded prematurely. The others were loaded in the usual way and covered with fine dirt. Eight to twelve inches of fuse was cut off those on the level and the fuses coiled. Davey instructed Fenton, who had experience in blasting, to light the four fuses on the level while he climbed up on the ore pile to light the fuse for the larger block which he was sand-blasting. This was done, and the two men were still standing on the track between the blocks when Davey came down the ore pile. At this instant the third hole lighted exploded, throwing the men down. Finnegan received the blast in the face at a distance of a few feet. He was carried by Davey, assisted by Fenton, along the level a distance of about sixty feet to a place of safety before the other shots went off.

An inquest was held at Cobalt by Coroner Dr. Kane on June 12. The medical testimony was to the effect that the injured man was taken direct to the mines hospital and operated upon, the right arm being amputated above the wrist. He did well for about a week when infection developed in the right orbit and the right frontal sinus, which subsequent operations failed to clear up, and the patient died on June 10, his death being due indirectly to injuries received at the time of the accident. The jury brought in a verdict of death by accident.

Mond Nickel Co.—John Dobian, Jugo-Slavian, age thirty-seven years, married, family residing in his native land, was fatally injured by being crushed between a loaded tram car and a loading platform in 5-1 crosscut, 3rd level, Levack mine, about 5 a.m. on January 3, 1925, and died in St. Joseph's Hospital, Sudbury, about 6.30 p.m. the same day.

Dobian had been employed as a trammer at Levack since March 28, 1924, previous to which he had had no mining experience. At the time of the accident, and for a period of about six weeks previously, Dobian and one, Anton Doles, were tramming from 5-1 crosscut on the third level. The chute or platform they were working at on this occasion is located in the end of this crosscut, which necessitates loading the cars from the end instead of the side, as is usual. Owing to this construction of the platform, it is also impossible for the men to start their trip with their load by getting behind the car and pushing, it being necessary to pull the car out from the platform sufficiently to give the trammers room to take up their usual position behind the car.

On this occasion Doles changed his position as soon as he had clearance, while Dobian remained in front, pulling and swinging the car away from the next platform, which it rubbed against, owing to this car being somewhat bulged. It seemed to be the impression of Doles that it was necessary for one man to be on the front of the car and the other on the rear to swing it in this manner.

After this accident, some tests were made by the safety committee of the mine at this particular place. These showed that while a car started fairly easily from the platform, after moving a distance of about three feet, the grade is against the load and from this point on considerable effort is required to propel the car and that it is much easier to do this by having both trammers pushing. On these tests, cars that were in good shape cleared all the platforms easily, but it was found that a car which had become bulged through usage did rub against this next platform, and it was necessary to swing it somewhat to get it by. All the evidence, with the exception of that of Doles, who was thoroughly convinced to the contrary, pointed out that it was much easier to swing the car, as necessary, by having both men stationed at the rear.

After getting the car past this platform, Dobian apparently made a move to get around behind the car, but slipped just before the car came to the next platform and was pinned between the car and the corner of this platform.

An inquest was held at Levack mine on January 7 by Coroner H. M. Torrington, M.D., at which time the medical testimony of Dr. Cook was not available. This was later taken before R. R. McKessock, Crown Attorney, on February 2. A verdict of accidental death was returned.

William Keast, Canadian, aged forty-seven, married, was fatally injured on the cage in the shaft of the Frood Extension mine about 5 p.m., August 9, and died in St. Joseph's Hospital, Sudbury, about three hours later.

Keast was employed as shift boss, and at the time of the accident he was engaged in moving a pump from the 150-foot to the 1,400-foot level. There is only a pump station in this shaft at the first level. For this reason the nearest cage, which had no doors, was used. With the assistance of Richard Humphrey, the cage tender, and two men, the pump was successfully lowered, and pipe and fittings were then collected from the first, second, and third levels and lowered on the cage to the bottom level. A 3- to 2-inch bushing was required to make connections and Keast, saying, "I know where there is one," went to the cage and rang himself to the 1,150-foot level. The hood of the cage, which

had been up when lowering the pipe, was not lowered. It caught in a rough joint of the guides just below the 1,300-foot level and was doubled up. Keast was evidently thrown down and his legs caught in the timbers at the top of the station. In this position, with his legs dragging between the cage and the cribbing of the shaft, he was hoisted to the next level, where he was found lying on the station floor a couple of feet from the cage.

One of his boots and his hat fell to the bottom level. Humphrey rang for the man cage and went to the surface, where he found out from the hoistman that the other cage was at the sixth level. He and James Steel went to the 1,150 and found the shift boss with both legs terribly crushed and fractured.

An inquest was held at the mine by Coroner Brodie on August 15.

Albert Darby, an electrician, was killed at about 7.15 p.m., May 19, by coming in contact with a 550-volt electric circuit in the smelter of the Mond Nickel Company, at Coniston. He was British, married, and twenty-nine years of age. He had been employed as electrician on maintenance work at the smelter for three years. His previous experience consisted of an apprenticeship in England and employment by the Canadian Westinghouse Company. He had also served as an electrician with the Navy during the war.

At the time of the accident he was making repairs to a square D disconnecting switch while standing on a wooden ladder about four feet above the floor. The walls, floor, and girders of the building were entirely of metal and the switch was mounted on the wall about eight feet above the floor.

The centre terminal at the entrance to the switch had been burned off about two weks previous to the accident and temporary repairs had been made by attaching the line to the blade of the switch. This connection had evidently become loose and Darby was tightening it with a pair of pliers. Some employees saw Darby's ladder slip, and almost immediately he fell to the floor. Some part of his body had evidently come in contact with the ground circuit while his hand was in contact with the circuit he was repairing. This circuit was protected by a disconnecting switch located about 300 feet distant, which he had neglected to open.

A small burn was found on the palm of the right hand, also what appeared to be a slight burn on the chin.

An inquest was held at Coniston, by Dr. Torrington, on May 22.

Dominico Pavan, Italian, age twenty-seven years, single, was fatally injured at Coniston by falling from the top of No. 1 scrubber to the floor of the acid plant, a distance of twenty-seven feet, on the morning of October 6, 1925, and died in the Toronto General Hospital on December 6.

At the time of the accident, Pavan, with other members of the riggers' gang, was engaged in taking down a gin pole which had been erected on the top of the scrubber for the purpose of installing the scrubber shaft.

The original position of the gin pole (a 6-inch by 8-inch by 20-foot timber) was vertical and near the centre of the scrubber and protruding through a pole left in the roof for the purpose of placing the shafting in the scrubber. The top of the pole was held by four guys attached to the roof trusses.

To take the pole down it was necessary to lower it over the side of the scrubber. A set of rope blocks was attached to the base of the pole and Pavan was assisting in moving the base of the pole with a pinch bar, working alongside of the pole on the top of the scrubber.

The riggers had commenced the job at 7 a.m., and by 7.45 a.m., the time of the accident, had moved the base of the pole a distance which was estimated

to give the pole an inclination of 15° off vertical. At this time, Bray, the construction foreman, came into the building and, considering the position in which Pavan was working unsafe, issued orders for him to get around on the other side of the pole. In doing this, Pavan grasped the pole to swing himself around it. In this position he either slipped or the pole kicked out due to the twist he had given it (witnesses who were all on the ground floor were not very exact on this point) and Pavan, losing his balance, fell over the side of the scrubber to the floor, alighting in an empty cement mixing box, sustaining injuries to the spine which in conjunction with later complications due to his paralyzed condition, resulted in his death on December 6.

An inquest was held at Coniston on December 10 before Coroner D. M. Brodie.

Teck-Hughes Gold Mines.—Ernest Littlejohns, Canadian, aged twenty-four, single, had the tip of the index finger of his right hand crushed when working as a shaftman in the central shaft of the Teck-Hughes Gold Mines about 4 p.m., January 21, and died while under an anaesthetic about one hour later.

Littlejohns was an experienced shaftman, having worked in various mines of the district during the past four years, more than half of this time being in the Teck-Hughes. At the time of the accident he was working with Edward Gates and Fred Smith mucking out a round in the bottom of the shaft. In ringing up the full bucket, he attempted to steady it with his right hand on the rim of the bucket. When it was about three feet off the ground he caught hold of the bottom of the bucket to prevent it swinging and had the tip of the index finger caught between the bottom of the full bucket and the top of the empty one, the flesh being stripped off the first joint. He was accompanied to the surface in the bucket by Gates and walked to the company's hospital, where first aid was rendered by Dr. W. R. Luke, who was there at the time. Shortly afterwards Dr. R. H. Armstrong, the company's surgeon, was called from a nearby residence and the injured man was driven to his office, where the finger was examined by him and it was decided to amputate at the first joint.

The injured man was placed on the operating table and chloroform was administered by Dr. Luke, assistant to Dr. Armstrong, who previously had hospital experience in the giving of anaesthetics. Between ten and fifteen minutes after starting the operation, breathing ceased. Artificial respiration was resorted to and after a few motions the man's breathing resumed and apparently became normal. While Dr. Armstrong was preparing to proceed with the operation, breathing again stopped, the interval being estimated at between two and four minutes, though the patient had been given no more anaesthetic. Artificial respiration was again resorted to and continued for one and a half hours without results.

A post-mortem examination of the body was made by Dr. J. F. Edis, of Swastika, and an abnormal condition was found consisting of a persistent thymus gland and an accompanying enlargement of the spleen and of the liver, the spleen being half again as large as in the normal adult. The testimony of Dr. Edis was to the effect that where the thymus gland persists in the adult, it causes an enlargement of other glands, such as the spleen and the liver, and renders the person particularly susceptible to the influence of drugs and unable to tolerate an anaesthetic. He also stated that it was impossible to determine the presence of a persistent thymus gland other than by a post mortem examination, and that surgeons ran the risk, though a rare one, of encountering such patients when giving anaesthetics.

An inquest was held at Kirkland Lake on January 23 by Coroner Dr. Arnold, of Haileybury, and the verdict of the Coroner's jury was that Ernest Littlejohns came to his death accidentally while being given an anaesthetic. After consideration of the evidence of the doctor performing the post-mortem, we are of the opinion that no censure can be reasonably directed towards the attending physician.

Tonapah Canadian Mines.—Charles Edward Lord, Canadian, aged twenty-three, single, was hit on the head by a piece of blocking which fell in the Walsh shaft of the Tonapah Canadian mines about 12.30 a.m., August 7, and died from a fracture of the skull about four hours later.

At the time of the accident, Lord, Hugh McDonald, and Charles White were running two machines in the bottom of the shaft, which was at a depth of thirty feet below the 330-foot level. A piece of blocking, about five inches in diameter and a foot and a half long, which had apparently been loosened by the blasting, fell from a point about midway between the 180- and 330-foot levels and struck Lord on the head. The first intimation that the men had was when Lord fell. White states that he heard something strike in the shaft, but thought it was the bucket coming down. Two wedges fell with the piece of blocking. There were no marks of spikes in the piece of blocking, though Angus McDonald, the contractor, stated that it was their practice to spike the blocking to the timber when wedging it into place.

An inquest was held at the mine by Coroner Dr. Arnold, of Haileybury, on August 9, and the jury brought in a verdict that death was accidental and no blame attachable to anyone.

Vipond Consolidated Mines.—Norman Isnor, Canadian, aged fifty-three, married, was instantly killed when he fell with a run of ore in No. 12 section of the continuation of 403 stope above the 300-foot level in the Vipond mine at 7.30 a.m., August 15.

Isnor was employed as a shift boss and when the accident occurred was giving instructions to the men in the stope. He had instructed the timberman about raising the cribbing of the ore chute and was telling the machine runner where to set up when the stulls gave way on that side near the bottom of the ore chute, which was a disused manway. This allowed about fifteen feet of the ore in this section of the stope to run through the former manway down into 403 stope. Isnor was carried with it, and was found lying on the ore near one wall of 403 stope about midway between the levels. He was dead when found, death being due to a fracture of the skull.

When 403 stope was continued above the 300-foot level, it had first a length of thirty feet. A manway was put in at one end with two rows of stulls and lagging. The ore body lengthened about fifteen feet past the manway, then was vertical for some distance, and then lengthened another twenty feet. Cribbing was used instead of stulls when this manway was turned into an ore pass to get rid of the over break in this end of the stope. When the run of ore occurred the machine runner and his helper were left on the twenty feet of ore in the end of the stope, which did not cave with the other fifteen feet, and remained isolated seventy feet above the level until rescued in the evening.

An inquest was held at Schumacher by Coroner Evans on August 18, and the jury brought in a verdict of accidental death, with a recommendation that safety-first precautions be taken.

Quarries

Canada Cement Co.—Smith T. Bowerman was fatally injured at the quarry of the Canada Cement Company, at Point Anne, on March 7, by a stone thrown by a blast. He was a Canadian, fifty-eight years of age, married, and had been employed for twenty months as labourer in the quarry.

Thirty-six holes had been loaded with 1-inch by 8-inch sticks of 60 per cent. forcite, fuse and caps. Fifteen of these were pops, ten to twenty inches deep, in large boulders, and were loaded with one to one and a half sticks of dynamite. Twenty-one holes were horizontal in a toe of rock at the bottom of the quarry and were covered by about twenty feet of broken rock. These holes were from two to ten feet deep and were loaded with from two to ten sticks each. The charge was distributed over a face of about fifty feet and facing almost directly towards the mill, which was 730 feet distant.

When preparations for shooting had been completed, the foreman ordered every one to get under cover. Bowerman and one other man went to a shack in the quarry and were instructed by the foreman to go to the old crusher building which adjoins the mill. Bowerman was sitting on the landing at the foot of a stairway in the lower part of the building. Almost immediately after the last shot had exploded, a stone weighing about twenty pounds came through the corrugated iron side of the building and struck Bowerman on the head. The accident happened at 2.50 p.m. and Dr. Robertson was immediately summoned and the injured man taken to the hospital at Belleville, where he died at 5 p.m.

An inquest was held at Belleville by Dr. Boyce on March 13.

Canada Crushed Stone Company.—Leonard F. Wickens, a shovel runner, and Thomas Moore, labourer, were killed at about 3 p.m., June 5, by a fall of clay at the quarry of the Canada Crushed Stone Company, at Dundas. Wickens was British, married, thirty-seven years of age, and had been employed at this quarry for a number of years. Moore was twenty-four years of age, British, and unmarried.

The accident happened in a clay pit at the north side of the quarry, where the earth was being removed from the surface. The bank was about twenty feet high and the boom of the steam shovel would carry the dipper to within about eighteen inches of the top. This would cause the bank to become slightly undermined. The nature of the soil was such that the top would be undermined about one foot before falling.

Wickens was in charge of the work in the pit. It had been customary to have all overhanging material removed before allowing men near the face for cleaning or assisting in moving the shovel.

Thomas Moore had two fingers injured on the dipper of the shovel on June 3 and returned to the pit on the fifth for the purpose of learning the details of how his fingers had been injured, to enable him to make a complete report to the safety committee.

Wickens, after loading a train of cars, neglected to swing the dipper to one side and lowered it directly in front of the bank for examination. He then went with Moore and V. Crozier, the fireman, to examine it. The men were standing between the bank and dipper when about three cubic yards of clay fell from the bank. They were all crushed against the side of the dipper. Wickens and Moore were knocked down and completely covered; Crozier was buried to the hips but not injured. It took about fifteen minutes to remove them. Wickens was dead and Moore lived for about one hour.

The evidence of the doctor who was called was that Wickens had died from suffocation and Moore was badly crushed about the chest and died from shock.

An inquest was held at Dundas on June 12 by Dr. A. F. Rykert.

Hagersville Quarries, Limited.—An explosion of dynamite, cause unknown, on April 8, 1925, at 5 30 p.m., at the Hagersville Quarries, Limited, caused the death of three men: Frank Critelli, Hagersville, Canadian, single, aged eighteen; Giovanni Dionati, Hagersville, Canadian, single, aged eighteen; Charles Ackester, Fenelon Falls, Canadian, single, aged eighteen. The first two were killed instantly. Ackester died at two a.m. the next day in the hospital at Hamilton from shock. All the bodies were badly burned.

Critelli was in charge of the loading operations and had been a helper at loading operations the previous year. On two former occasions this spring blasting had been done under the direct supervision of the new superintendent, Mr. Bennett, assisted by Critelli and Dionati. Bennett considered Critelli sufficiently capable to take charge of the work. Loading operations were started at 1 p.m. by the three men. During the afternoon three other men were sent to help them. At the time of the accident twenty holes had been fully loaded, fifteen holes were partially loaded and left for the night, and four or five holes had several 4-inch cartridges, one of which was a primer, near the collar; and work at these holes was in progress when the explosion occurred. Of the three other helpers, one was a considerable distance away and could not throw any light on the accident. The other two gave evidence that the deceased had connected up one or more holes to blow out the mud and water in them. This was done by exploding two 1¼-inch sticks of dynamite in the bottom of the hole by the battery. They claimed the call of "fire" had been given and they were walking away, being distant about fifty feet when the explosion occurred. The battery was in full sight in the pit. They did not see any person at it and Bennett claimed when he got to the scene of the accident a few minutes later the battery wires were not connected. The first explosion was followed by three or four other explosions, as the powder at the collar of the holes caught fire. Witnesses saw this powder burning. The evidence did not show the cause of the explosion, but it did show that the men engaged knew little of the danger involved; two were of foreign extraction and all were too young for such work. Critelli had given his age as twenty-three and he had been working around quarries for five or six years. One of the helpers had warned him he was not careful enough with dynamite and he replied, "Nothing has happened yet."

An inquest was held at Hagersville on April 13 before Coroner Quance, and a verdict of accidental death, cause unknown, was returned, with a rider attached that more experienced men be employed for such work.

Charles Mepham was electrocuted at about 10.30 p.m., July 29, 1925, at the quarry of the Hagersville Quarries, Limited. He was British, about forty-five years of age and unmarried, and was employed as drill runner's helper.

The drill runners were operating a well drill which is driven by a 550-volt motor. The transmission line to the drills in the quarry was supported on trestles, and branch feeders were run from this line to each of the drills. These branch lines were single-conductor, double-braided, rubber-covered cables and were lying on the surface of the quarry. The men had completed drilling a hole and opened the switch on the drill and stopped the motor. The drill runner was standing at the front of the drill when he heard his helper utter a sharp cry. He ran back and found Mepham lving on the ground about six feet

from the drill with a hand on one of the conductors. The driller attempted to release him from the live cable, but was unable to do so as he was receiving electric shocks himself. He then ran to the next drill, about one hundred yards distant, for assistance. The switch controlling the transmission line was opened and the man's hand released from the line. It was estimated that he was making contact with the live conductor for about eight minutes.

Those present worked for about fifteen minutes to restore life until the arrival of the doctor. The doctor continued artificial restoration for about fifteen minutes without success.

Heavy rains had fallen previous to the accident, the cables were wet, and the man was lying in a pool of water.

An inquest was held on August 1 by Dr. Quance, at Hagersville.

Gravel Pits

J. K. James.—Albert E. Mather, aged twenty years, single, was fatally injured at 2.30 p.m., March 4, in a gravel pit owned by J. K. James, lot 22, concession I, North Gower township, Carleton county, and died three hours later. The pit is located near the village of Kars.

At the time of the accident there were a number of teams hauling from the pit for the Ottawa Suburban Roads Commission and the County of Carleton. Each had a particular part of the pit from which gravel was taken and the work was in charge of a foreman. Besides this gravel taken, the owner, J. K. James, sold gravel to farmers or others who came for it. When others than the regular teamsters took gravel, the work was not always supervised by the owner.

The deceased was engaged by William Bates, of North Gower, to haul some gravel. He, with several others, had taken gravel from a part of the pit which was not looked after by the foreman. As this part of the pit had been undermined from time to time, the owner had the blaster of the Ottawa Suburban Roads Commission break down some of the overhang. This blasting had not been entirely successful and an overhang extending some four to five feet into the pit was left. The face of the pit at this part was about ten feet deep, of which some two and a half feet at the surface was frozen. In the overhang a loose piece was noticed, which the deceased tried to move with a pick but failed to do so.

With another teamster, Richard Keyes, Mather came to the pit on the afternoon of the accident and, as some of the overhang masses which had been broken down were lying over the loose gravel, he loaded some of these pieces on to the sleigh to pull them away. The sleigh could not be placed close to the face, so Keyes hitched his team to the back end of Mather's sleigh and pulled it into place. The two men started to load the gravel.

Mather had just started when a piece of frozen gravel five feet long, one and a half feet wide, and one foot thick, fell some seven feet and pinned Mather to the ground. His back was broken and he was injured internally.

Coroner Dr. Channonhouse, of Richmond, was notified of the accident, but considered an inquest unnecessary. The Department was not notified of the accident by the owner of the pit and was only advised of it on March 7 by other parties.

At the time of the investigation of the accident, there were none of the men at the pit who were there the day of the accident, and the owner of the pit was away. A witness to the accident, W. Chambers, was located and he stated that when Mather and Keyes were about to draw gravel from the part of the pit where the accident occurred, they were warned by Earl Nixon, a foreman

for the Ottawa Suburban Road Commission, that the place was dangerous and that no work should be done near it. Of course, Nixon had no control over men who were hauling gravel for themselves.

At the time of the investigation a part of the pit was not in good condition.

W. E. McCaul.—Stewart Charlesworth was killed by a slide of earth on July 11, at about 3 p.m., in a sand pit operated by W. E. McCaul on the Weston Road, Mt. Dennis. He was fourteen years of age, a Canadian, and had been employed for about two weeks, principally as driver for a horse on a scraper.

The banks were about 20 feet high, with a layer of sand about 4 feet in thickness over the sand. The face of the pit had a slope of about 11 feet on the horizontal to 20 feet in height.

The boy was standing between the cart and the bank, assisting two other men in loading, when the accident happened. The cart was about seven feet from the bottom of the bank, and about ten tons of clay and sand slid from near the top, crushing his body against the cart. It required about ten minutes to remove the body, which was buried beneath two or three feet of earth.

An inquest was held by Dr. W. H. Butt on July 20 and 27.

Inspection Trip to South Africa

During the summer of 1925 the Ontario Department of Mines sent T. F. Sutherland, Chief Inspector of Mines, to South Africa to study mining conditions on the Rand. Among the subjects Mr. Sutherland was instructed to report upon were accident prevention and silicosis. The following notes on these subjects and South African mining practices are from Mr. Sutherland's observations.

Accident Prevention

The better accident rate in South Africa, compared with Ontario, is, I think, due to four reasons, and I shall deal with them in what I think is their relative order of importance.

1. The licensing of all men who have the safety of others under their care.
2. Educational work done by the Chamber of Mines.
3. Difference in underground working conditions.
4. More Government inspection.

1. *The Licensing System, or Certificates of Competency.*—The mining regulations of South Africa require that the following employees shall have a certificate of competency: mine manager, mine overseer, mine surveyor, mechanical engineer, electrical engineer, assayer, winding engine driver, locomotive engine driver, engine driver, boiler attendant, and blaster. Of these the following may be granted a certificate without examination on the recommendation of any commission of examiners, although the Government Mining Engineer may insist on their being examined on portions of the Mining Act: mine manager, mine overseer, mine surveyor, assayer, mechanical engineer, and electrical engineer. The examining commissioners are appointed by the Government Mining Engineer. The commission of examiners for mine managers and mine overseers is made up of a mine inspector, an inspector of machinery, and three certificated mine managers. This principle is followed in all examining commissions, that

while one or more representatives of the Mines Department are examiners, the majority of the members belong to the applicant's own profession. For blasting certificates, the examiners are: a mine inspector, the holder of a mine manager's certificate, and the holder of a blasting certificate. A provisional blasting certificate, good for six months, may be given by a certified mine manager. The certificate of a mine manager, a mine overseer, a mechanical engineer, an electrical engineer, a mine surveyor, or an assayer may be cancelled or suspended by the Government Mining Engineer for gross negligence or non-compliance with the mining regulations. In practice the matter is referred to the respective commission of examiners and their recommendation followed. An appeal to the Minister is allowed. The certificate of a winding engine driver, a locomotive engine driver, an engine driver, or a boiler attendant may be suspended or cancelled by an inspector of mines for gross negligence in the execution of his duties or physical infirmity which is detrimental to the efficient discharge of his duties. In practice, the inspector recommends the suspension or cancellation of the certificate to the Government Mining Engineer. An appeal to the Government Mining Engineer is allowed. A blasting certificate may be suspended or cancelled by a mine inspector, or a mine manager may suspend such certificate and report the case to the mine inspector. This system of control works out satisfactorily from the standpoint both of the licensee and the Government.

The licensees were favourable to the system for the following reasons:—

(*a*) There was a certain assurance that every man was capable for the work he was doing.
(*b*) There was a division of responsibility.
(*c*) There was a certain protection of your position. This applied from the manager down.

The Government mining officials were in favour of the system because it tended to a low accident rate in the mines. The licensees were, as a rule, capable or they would not have a certificate; if not capable they could be removed.

If a licensee did not observe the Mining Act his certificate could be cancelled or suspended. As this practically meant taking away from him his means of making a livelihood in South Africa, the licensee, as a rule, made himself familiar with and lived up to those portions of the Mining Act that governed his work.

2. *Accident Prevention by the Chamber of Mines.*—The rate of compensation payable to mine workers is set out in the Workmen's Compensation Act. The workmen of the companies registered in the Chamber of Mines, and this includes practically all the operating companies in South Africa, are paid this compensation for injury by the Rand Mutual Assurance Company, which is really a subsidiary of the Transvaal Chamber of Mines. The Rand Mutual Assurance Company has always considered that an important part of its functions, both from a business and humanitarian point of view, was to assist in the avoidance of accidents and also, as far as possible, to minimize the effect of an accident which has occurred. The Prevention of Accidents Committee of the Rand Mutual Assurance Company is composed of representatives of the mining industry, the Mine Inspection Branch of the Government and the Association of Mine Managers. This committee expends $25,000 yearly on:—

(*a*) A monthly magazine called "The Reef."
(*b*) A fortnightly service of bulletins and posters in English, Dutch, and native languages which are posted on all the mines.

(*c*) An authorized digest of the regulations affecting Witwatersrand underground workers, with marginal notes in plain language opposite the legal language of the regulations.

(*d*) Lectures on safety subjects to both whites and natives, illustrated by cinema films and lantern slides.

(*e*) Pamphlets on "First Aid," and cash prizes are provided for the annual district competitions in first aid on the mines of the Rand. Five thousand natives are now trained first-aid men.

(*f*) A bonus prize-scheme for mine officials.

(*g*) Investigation and recognition of devices designed to prevent accidents and disease.

(*h*) Other publications and pamphlets.

In order to minimize as far as possible the effect of an accident after it has occurred, the company provides and pays for the best surgical and medical advice; and special treatments, such as massage, X-ray, etc., are constantly being provided free of charge. Specialists are provided free of charge in all cases where there is any chance of benefit resulting. The Government Inspection Department has repeatedly expressed its appreciation of the good work done along these lines by this organization.

3. *Difference in Underground Working Conditions.*—The winding of large numbers of workmen from great depths, rock bursts, and the great number of natives underground are conditions that increase the hazard over Ontario mines. On the other hand, the one reef, the narrow stopes, and the flat dip are conditions favourable to a low accident rate. What might be called "gravity accidents" should not be as serious a hazard in the Rand mines as in the mines of Ontario, where we have wide stopes on nearly vertical ore bodies. Any advantage that South Africa has as regards ore occurrences is more than offset by the fact that nine-tenths of their labour is Kaffir.

4. *More Government Inspection.* In South Africa, owing to the licensing system, some official or workman is directly responsible for the proper carrying-out of every mining operation. The Mining Act specifies the duties and responsibilities of these officials and workmen. The mine inspectors make inspections to see if these officials and workmen are carrving on their duties as required by law. This is a much better method from an accident prevention standpoint than the Ontario system, where the inspectors check up the work and not the official in charge of the work. Under the Ontario system, poor workmanship and dangerous practices are blamed on the workman. In South Africa, the blame is placed on the foreman in charge of the workmen. In Ontario, if a stope is not properly scaled, the mine foreman says the shift boss is responsible; the shift boss claims the scalers are responsible for that work, and the scalers say they had not time to get around to it and anyway the machine men are supposed to scale before setting up. Against whom can you take action? In South Africa a certain man would be responsible, and he would see that it was done properly; otherwise action would be taken against him and he would be in danger of having his certificate of competency suspended or cancelled. One result of this system is the number of prosecutions. In the Transvaal in 1924 there were eighty-six charges laid before magistrates, 884 charges laid before the inspectors, and 703 cases dealt with by mine managers, who, in certain cases, have power to punish by a fine if the accused pleads guilty rather than be brought before the inspector for trial. Mine managers are debarred from fining natives. This is a total of 1,673 prosecutions in a labour force of 208,000, or roughly, one to every 124 employees. During the same year in Ontario, with a working force of 12,500 men, there were two prosecutions, or one to every 6,250 workmen.

Silicosis

Silicosis or miners' phthisis has been and is yet the most serious problem of South African gold operators. The direct annual charge on the industry at present for this disease is $4,000,000 and the mines have a liability of over $50,000,000 in respect of phthisis men and their dependants. The cause and prevention of this industrial disease have been the subject of much study and investigation and great advances have been made. The report of the Miners' Phthisis Medical Bureau for the year 1923-24 does not report for that year a single case of phthisis in workmen who have begun mining since 1916 and states that the period of employment for all new ante-primary cases was ten years and five months and that the average period of employment for machine men was seven years ten months. Three organizations are working for the control of this disease: the Government, the Miners' Phthisis Medical Bureau, and the Chamber of Mines.

The work of the Government has been through legislation and the enforcement of this legislation by the Mines Inspection Branch. The legislation dealing with this subject is as follows:—

Regulation 158 (10) (*a*) lays down that in every phthisis mine the manager shall provide an adequate and constant supply of clear and odourless water in metal pipes not less than one inch in diameter and at a pressure not less than 30 lbs to the square inch, at every working place which is not sufficiently wet to make the formation of dust impossible. The water pipe must reach within 50 feet of the face and a length of hose shall be provided to bring the water to every part of the working face.

The surfaces of all working places which are not naturally wet are to be kept wet or regularly washed down—158 (10) (*b*). All ore bins are to be provided with atomizers—158 (10) (*f*). Broken rock must not be moved in a dusty condition and work must not start until water has been used to wet down the working place—101 (2) and (3), 101 (1) (*e*). The drilling of any hole by a percussion machine drill (using solid steel) is forbidden unless a water hose is used, and in collaring (i.e., starting the hole) the full bore of hose must be used to supply water—101 (1) (*a*).

In using any axial water feed drill (i e., one in which water passes down the hollow steel of the drill) an adequate supply of water must pass through the drill and in collaring in a development end a separate water hose must be used—101 (1) (*b*).

In hand drilling a swab must be used round the drill and water must be applied—101 (1) (*c*). In raising or boxholing an axial water fed machine must be used—101 (1) (*d*).

No new type of machine drill may be used unless approved by the Government Mining Engineer—101 (1) (*d*).

To allay blasting dust.—A water blast must be used in each development end; this is an apparatus for projecting a mixture of air and water into the atmosphere—60 (2), and the apparatus must be used after blasting and again for 15 minutes before any person enters after a blast has taken place.

Regulation 61 prohibits any person remaining in any part of the mine where dust is perceptible.

In regard to ventilation, it is provided that at least 30 cubic feet of air per minute during the whole of the 24 hours shall be supplied for each person employed underground—58 (2) (*a*).

Every winze shall be provided with a separate air pipe for ventilation—62 (1); and in every development end, after blasting, a quantity of fresh air equal to the volume of the end beyond the last through connection must be supplied before any person may enter—62 (2).

Not more than 0.2 per cent. carbon dioxide or 0.01 per cent. carbon monoxide and no detectable traces of the oxides of nitrogen are allowed to be present in the air—58 (1) (*a*).

The Government has appointed several commissions to investigate the subject and make recommendations, the last of which was the Miners' Phthisis Prevention Committee, which brought in its final report in 1919.

The Miners' Phthisis Board consists of a chairman and not less than three or more than six members appointed by the Crown for a period of three years. In addition to collecting from the mining companies the necessary assessments

to compensate silicotic miners and paying to the miners and their dependants the prescribed benefits, the Board has power to operate training schools in trades or industries, to establish sanatoria for silicotic miners and to establish in industry silicotic miners or their dependants. Working with this Board is a medical bureau, composed of medical men, who conduct the medical examinations. These medical examinations are:—

1. Every man before going underground to work must obtain from the Bureau a card stating that he is free from any tubercular disease and is physically fit to do underground work.

2. Every white underground miner must have a medical examination every six months.

Provision is made for an appeal from the finding of this Bureau to a Medical Board of Appeal, consisting of three medical men appointed by the Crown, who have special knowledge of diseases of the respiratory organs.

For the purposes of the Act a person is deemed to have or to have had silicosis—

(*a*) In the ante-primary stage, when it is found by the Bureau that the earliest detectable specific physical signs of silicosis are or have been present; whether or not capacity for work is or has been impaired by such silicosis;

(*b*) In the primary stage, when it is found by the Bureau that definite and specific physical signs of silicosis are or have been present, and that capacity for work is or has been impaired by that disease, though not seriously and permanently;

(*c*) In the secondary stage, when it is found by the Bureau that definite and specific signs of silicosis are or have been present, and that capacity for work is or has been seriously and permanently impaired by that disease or when it is found by the Bureau that tuberculosis with silicosis is or has been present.

The benefits to miners are:—

(*a*) To a miner who has been certified by the Bureau to have silicosis in the ante-primary stage or to be physically unfit for underground work on account of silicosis, though not in either the primary or secondary stage, an amount calculated in the manner set out in the First Schedule to this Act;

(*b*) To a miner who has been certified by the Bureau to have silicosis in the primary stage or tuberculosis without silicosis an amount calculated in the manner set out in the First Schedule to this Act but with an addition of 50 per cent. thereto and subject to adjustment in respect of any payment made under the preceding paragraph.

(*c*) To a miner who has silicosis in the secondary stage or tuberculosis with silicosis, a monthly allowance calculated in the manner set out in the Third Schedule to this Act.

The benefits to the dependants of a deceased miner are:—

(*a*) If the miner left a widow or any child under sixteen years of age or both a widow and such children, a monthly allowance (subject to the conditions prescribed in the Third Schedule to this Act) to such widow or children or to both such widow and children of double the allowance prescribed in that schedule for a wife or child (as the case may be).

(*b*) If the miner left neither a widow nor child under sixteen years of age, a monthly allowance (subject to the conditions aforesaid) of double the allowance prescribed in the said schedule in respect of a wife, to any dependant mentioned in subsection (4) of section 76 of this Act, if such dependant was wholly dependent upon the miner.

(*c*) If the miner left neither a widow or child under sixteen years of age, nor any dependant who was wholly dependent upon him, as aforesaid, but some dependant who was partly dependent upon him, a monthly allowance (subject to the conditions aforesaid) equal to the amount of the average monthly support given by the miner over such period of his lifetime as the Board may determine to such last mentioned dependant. Such allowance shall not exceed the allowance which would have been payable to the widow of the miner and shall be granted to the dependant subject to subsection (4) of section 76 of this Act.

The schedules are:—

First Schedule

Twelve times that part of the miner's or native labourer's month's earnings which did not exceed £29 3s. 4d.; and

Six times that part of his month's earnings which exceeded £29 3s. 4d., but did not exceed £37 10s.; and

Three times that part of his month's earnings which exceeded £37 10s.

Third Schedule

Rate of monthly allowance—

(*a*) For the miner:—
One half of that part of his month's earnings which did not exceed £20; and
One quarter of that part of his month's earnings which exceeded £20, but did not exceed £28 6s. 8d.; and
One twentieth of that part of his month's earnings which exceeded £28 6s. 8d.

(*b*) For his wife: if she is dependent upon him and if he was married to her before the first day of August, 1919, or the date of the Bureau's certificate entitling him to an award of a monthly allowance (whichever is the later);
One-fifth of the total amount payable in respect of the miner.

(*c*) For each of his legitimate children if dependent upon him (including adopted and step-children as described in section seventy-six of this Act), not exceeding three, until such child attains the age of sixteen years or marries;
One-tenth of the total amount payable in respect of the miner, and for each of such children (in excess of three) one-twentieth of such amount.

The assessment for these benefits is covered in section 41 and is as follows:—

41 (1) From and after the commencement of this Act there shall be levied by the Board from employers in manner hereinafter provided during the first two months and hereinafter every three months such an amount as may in the opinion of the Board be required for the purposes of the Compensation Fund;

(2) The amount to be so levied from each employer shall be assessed as follows:—

(*a*) Thirty per cent. of the amount in proportion to the earnings in a scheduled mine during the previous period of three months of the miners employed by such employer;

(*b*) Fifty per cent. of the amount in proportion to the silicosis rate for each mine;

(*c*) Twenty per cent. of the amount in proportion to the sum for which such employer was assessed for normal income tax in respect of the penultimate accounting period of such employer for that mine taxed under the provisions of the Income Tax (Consolidation) Act No. 41 of 1917, or any amendment thereof, or any Act substituted therefor, or in the case of employers exempt from that tax twenty per cent. of the amount in proportion to the sum for which such employer would have been assessed if liable for such tax.

The complete Act is on file at No. 5 Queen's Park.

The Transvaal Chamber of Mines has done a lot of work for its members studying the dust conditions underground and developing methods to prevent miners' phthisis. Mr. J. Boyd, Assistant Secretary of the Chamber, Department of Labour, issued a pamphlet on December 1, 1924, reviewing the work of the Chamber to that date, and the following information is taken from that pamphlet.

ESTIMATION OF DUST IN MINE AIR AND THE STEPS TAKEN TO PREVENT MINERS' PHTHISIS

The Cause of Silicosis.—The disease known as silicosis or miners' phthisis has as its cause the inhalation over long periods of minute particles of silica.

In the mining operations of the Witwatersrand where the rock is a hard quartzite—a rock containing up to over 90 per cent. of silica—the processes of drilling, breaking and handling the rock would cause dust to be formed and the air of the mine to become charged with this dust in varying quantities unless care was taken to stop the formation of the dust at its source.

The silica dust which is inhaled into the lung and is the cause of silicosis, is of infinitely small size, as is shown by the researches of McCrae and Watkins-Pitchford. These investigators found that the largest particles of dust found in the lungs of persons who had died from miners' phthisis were only twelve microns in size (1 micron = 1/25,000 inch).

Previous to the work carried out by the Miners' Phthisis Prevention Committee in 1913-4, little was known as to the quantities of dust to be found in the air of mines.

The Miners' Phthisis Commission of South Africa in 1902-3 made some determinations of dust in underground workings.

In 1907 similar determinations were made by the Mining Regulations Commission, and in 1910 experiments on the East Rand Proprietary Mines showed as much as 1,500 mgrms. of dust in the air of a drive.

In 1911-12, experimental work was carried out by the Consolidated Goldfields of South Africa and the sugar tube method was used for the first time.

During 1913-14, the Miners' Phthisis Prevention Committee carried out the first complete dust survey of the Witwatersrand mines when some 443 dust samples were taken, showing a general average for all the mines of 5.4 milligrams per cubic metre of air.

The knowledge gained by this investigation appeared of such importance that the Chamber of Mines decided to continue and extend the work and established its own Dust Sampling Department in 1914.

In the sugar tube method a known quantity of the air to be sampled is aspirated through a column of cane sugar, the sugar dissolved and the residue weighed.

In the konimeter method a known quantity of the air is projected at high velocity on to a glass plate and the particles counted with the aid of a microscope with dark ground illumination.

Methods Employed to Prevent or Reduce the Dust.—The chief objects of the campaign against miners' phthisis have been to prevent the formation of dust at its source; to prevent its dissemination into the air and to prevent its being inhaled. The methods in use are two—water and ventilation.

Water.—As the results of experiments the Miners' Phthisis Prevention Committee reported that the judicious use of abundance of water was the most satisfactory method of preventing the formation of dust and, if found, of allaying it.

In the mines today water is used in all operations where dust is likely to be found, and water, if used effectively, will prevent the formation of large quantities of dust, and if used in an atomizer or spray assists in removing dust from the air.

Ventilation.—But the accidental formation of dust cannot be prevented by this means and ventilation is also necessary. In fact, in view of the fine state of division of the dust, it is necessary now to regard and treat it as a noxious gas, and endeavour to remove it from the air of the mine by ventilation. As the extent and depth of the workings increase, the problem of efficient ventilation becomes more difficult and natural ventilation is not usually sufficient. Many mines have therefore special shafts solely for the purpose of ventilation and, in mines requiring it, the ventilation has been improved by the installation of fans, the rearrangement of the mine into ventilation districts and the splitting of the air currents. In laying out the newer mines it has been possible to benefit from the experience gained in the older mines and to provide better facilities for the ventilation of the workings.

Dust Sampling Department.—As mentioned before in 1914 the Chamber of Mines established a Dust Sampling Department.

A Supervising Committee was appointed consisting of representatives of the Consulting Mining Engineers, the Mine Managers, the Chamber's Technical Advisers, and the South African Institute of Medical Research, a qualified staff of dust inspectors and chemists were appointed.

The instructions given to the department were to conduct research work into the dust problems, to sample systematically the air of the mines, to report immediately on places where conditions were bad, to suggest means of improving the dust conditions and to devise methods of removing dust from the mine air.

In the systematic sampling of the mine air, the mines were divided into sections—a section corresponding more or less with the area under a mine captain, and periodical visits were paid to each section and samples taken. At first, with a small staff of three, it required five months to complete the survey of the Reef, but the Chamber, encouraged by the progress made in eliminating dust, in 1916 increased the staff, and, at the same time, an official was detailed to do dust sampling on each mine.

It was arranged that the analysis of the samples should be carried out in the Chamber's laboratory and, since 1916, 264,615 such samples have been analysed; while 58,602 samples have been taken by the Chamber's own staff in connection with routine work.

From 1914 to date forty-eight complete dust surveys of the mines have been carried out and valuable information re dust conditions obtained. With the large number of samples taken, it is possible to obtain some idea of the improvement which has taken place in the dust conditions of the mines, but it should be mentioned that the figures given do not purport to represent the true average amount of dust in mine air, but are only the arithmetical average of the samples. Nevertheless since, approximately, the same number of samples are taken in each survey and in about the same proportion in the different classes of work, the whole gives a good idea of the dust conditions of the mines.

ANNUAL AVERAGES, 1915-1923

Year	1915	1916	1917	1918	1919	1920	1921	1922	1923
General average	4 9	3 9	3 8	2 9	2.4	2 6	1.6	1.6	1 3
Development	6 9	5 8	5.4	4 4	3 5	2 9	2 3	2.4	1 9
Stopes	3 4	2 8	2 9	2.1	1 9	1 6	1.2	1.2	0.9
Ore bins	4 4	4 0	4 2	3 7	2 9	2.7	2.1	2 2	1.8
Total samples	1,758	5,263	6,188	7,431	7,491	7,034	6,695	4,545	4,785
Percentage below 5 mgrms	73	77	80	87	90	92	96	96	97

These figures reflect the improvement in general dust conditions since 1915. About 25 per cent. of the samples are taken in development ends, i.e., drives, raises and winzes—places which are difficult to keep free from dust—and it will be noticed that the average amount of dust therein has fallen from 6.9 mgrms. in 1915 to 1.9 mgrms. in 1923.

About 50 per cent. of the samples are taken in stopes—where the majority of the underground employees are at work—and here, while the dust conditions have always been comparatively good, the average has fallen from 3.4 mgrms. in 1925 to 0.9 mgrms. in 1923.

If we assume that 5 mgrms. per cubic metre of air is the allowable limit of dust, then it should be noticed that in 1915 only 73 per cent. of the samples were below this figure, while in 1923 the percentage had risen to 97, and only 3 per cent. of the samples were above this limit.

The percentage of samples containing only a "trace" of dust, i.e., an unweighable quantity, has increased from 4 per cent. in 1917 to 17 per cent. in 1923.

Since 1916 each mine has had its own dust inspector who has taken samples; which have all been analysed in the Chamber's laboratory.

Samples by the Konimeter method have been taken systematically in conjunction with the Gravimetric method by the Chamber's dust inspectors for some years past and until 1923 the spots were counted by light ground illumination.

During 1923 improvements were made in the method of counting, i.e., by standardizing illumination and alteration of condenser and, in addition, a commencement was made with counting routine spots by light ground illumination; as a result no proper comparison can be made with the results of previous years.

The principal method of illuminating a mine is by acetylene lamps which always produce soot and it is found that with dark ground illumination the soot is liable to be counted as silica, thus increasing the number of particles.

Research Work.—Since the commencement of the department in 1914, a considerable amount of research work has been carried out each year, and valuable information obtained.

The use of the Konimeter has been extensively studied and improvements and modifications made tending to make the instrument more efficient.

Studies were made of the amount of dust produced by the various types of drills during a shift, with a view to seeing which drill produced the least amount of dust.

Extensive tests of drills were commenced in 1918 and valuable information obtained.

Investigations into the high samples obtained from certain types of drills have been continued and in March-April, 1923, a special test of the long and short piston Leyner drill was carried out on fifteen representative mines. In this test over 9,000 Konimeter samples and 4,900 Gravimetric samples were taken; the results obtained showed that the long piston type of drill made less dust that the short piston type.

The "special test tunnel" has been equipped at the Village Deep mine for experimental purposes, on such questions as:—

(1) The volume of air necessary to be delivered at working places to dilute dust and maintain comfortable conditions from the cooling standpoint.
(2) An inquiry into the phthisis-producing dust raised under various conditions of working.
(3) Methods of air cleaning.
(4) Methods of local cooling.
(5) Methods of blowing out holes.

During 1924 the staff of the department carried out a special investigation into the amount of dust in intake air for the Joint Committee of the Mines Department and the Chamber on Ventilation. This work has extended over six months: 361 places were sampled and 5,331 Konimeter samples collected, and the work is still being continued.

In addition, the staff has carried out many tests on methods of improving ventilation, on schemes for purifying mine air, on tests of new types of drills and on general questions of dust prevention.

In the laboratory, in addition to the estimation of dust, the staff conducts the analysis of dust in mine water, it was found by the department in 1916 that if dirty water is used in sprays or atomizers instead of dust being removed from the air, dust is being added in the atomized mine water and, since that date, periodical samples of mine water used for dust allaying have been taken and analysed. Samples of mine air are also analysed for carbon dioxide.

Analyses of the mineral constituents of dust and of rocks are made from time to time.

The mine dust inspectors make full use of the experienced staff of the department and regularly come into the laboratory to discuss difficulties met with in the course of their work.

With a view to improving the mine dust inspectors' knowledge of the problems of ventilation, arrangements were made with the Witwatersrand University for a course of lectures on ventilation—these lectures were held in 1923 and were attended by all the dust inspectors, the majority of whom were successful in the examinations held at the end of the course and were given certificates by the University.

In addition, monthly meetings of dust inspectors are held in the Chamber of Mines, when papers are read on problems of ventilation and dust sampling, and discussions take place—the average attendance at these meetings is over forty, and most instructive and valuable debates take place.

In considering the improvement in the dust averages from 1915 to date, it is obvious that the establishment of a Dust Sampling Department has been amply justified. The improvement has greatly exceeded expectations, but it must be remembered that constant and continuous effort is necessary to keep dust down to its present low limits and any slackening of effort will be immediately reflected in an increase in the amount of dust in mine air.

The "surprise" visits paid by the Chamber's dust inspectors and the knowledge that very high dust results would immediately be reported to the manager of the mine, to the Government Inspector of Mines and to the Chairman of the Mining Company, have an excellent effect in encouraging the taking of every possible precaution by the underground officials and the miners for the prevention of dust.

In conclusion, it may be said that the technical work in connection with the prevention of miners' phthisis is now along the lines of improved ventilation and the development of a dustless rock drill.

Notes on South African Mining Practices

1. The circular shaft seems to be gaining in favour over the other types. It is now recognized that the very fine silica dust in the mine workings must be considered as an injurious gas and be removed by ventilation. The circular shaft gives a greater area and offers less obstruction to the air current than any other type of shaft. Increased ventilation is also needed on account of the increased temperatures at depth. The cost of timber in South Africa is high, and this is another factor in favour of the circular shaft. Low upkeep and speed in sinking are other favourable factors. The younger engineers consider the circular shaft the cheapest and quickest to sink, the lowest in upkeep, and the most efficient for ventilation.

2. Wooden guides are bolted to specially designed brackets which are bolted to the dividers. The best type I saw was at the Randfontein, and a blue print of this is on file at my office (No. 5 Queen's Park, Toronto).

3. Rubber rollers are giving good satisfaction, but they must be perfectly adjusted when installed and well looked after. They give a better grip and are especially satisfactory where whipping occurs. A favourite type is the rubber centre with aluminum flanges, weight about thirty pounds. Rubber rollers prevent the change to Martinsite where the wires of cable rub on iron roller.

4. Flattened strand ropes are gaining in favour, especially where the triangular core is made of six wires laid up in triangular form. A favourite rope now is one made by the Jupiter Rope Works, of Johannesburg. The core is

made of three pairs of twisted wires wound on one another and has the appearance of being braided. This is then passed through rolls at great pressure, the bottom roll being V-shaped, giving the core a triangular shape. The outer wires are then laid up and the strand passes through another set of rolls, the lower roll being V-shaped, continuing the triangular shape. The triangular shaped strands are then laid up in a rope. Probably 70 per cent. of the ropes installed during the past year are of this type. The manufacturers of this rope claim a rope of smaller diameter can be used with this type of construction, but it must be remembered that a smaller rope than the groove of the drum must not be used. There is a difference of opinion regarding grooved drums. Some engineers prefer the smooth drum, some the very shallow groovings and some the smooth drum lagged with wood. One advantage claimed for the flattened strand rope is that it does not crush as badly as the others where there are two or more layers on the drum.

5. At the New Modder is a 5,000 h.p. Ward-Leonard winder carrying 2,830 feet of two-inch flattened strand rope on a cylindro-conical drum. The small diameter is fifteen feet and carries 6.7 turns, then rising through five turns to the large diameter, twenty-four feet, which carries 21.2 turns. Auxiliary reels are placed inside both brake treads to carry the spare rope for cutting, capping, etc., as number of turns must be constant. Each auxiliary reel carries 250 feet of rope.

6. Socketing of cables is absolutely taboo on the Rand. If not skilfully done it is dangerous, and poor workmanship cannot be detected. If the carrying vehicle is landed, an injurious bending action results. Splicing is used to a considerable extent, but non-spin and locked coil ropes cannot be spliced. The Welsh practice of using a capple is now very much favoured and has been satisfactory. The Reliance capple seems to be the favourite.

7. Tail ropes have not survived modern practice on the Rand. They are only used in the old installations where the winding engines are not powerful enough for the present work. Their life is short; they require constant care; they may do enormous damage to the shaft if breakage occurs; advantage cannot be taken of a light rope for deep winding, and with tail ropes skips and cages are not interchangeable. The unbalanced load in deep winding is overcome by conical drums.

8. The guide ropes in circular shafts are fastened to the headgear by clamps and are weighted at the bottom. For a depth of 3,000 feet, eight one-ton weights are used on a guide rope of 1¾-inch diameter. Ten tons is used on the rubbing rope of 2-inch diameter. In order to avoid a synchronous motion being set up by the cage, half the guide ropes are only weighted with seven tons. I have a blue-print showing how these different weights are distributed at the New Modder 18-foot circular shaft. The life of a guide rope should be about twenty years. At the Crown Mines, 1½-inch diameter guide ropes are used of half-locked coil construction, the outer wires being 3/8-inch.

9. At the City Deep the sheaves are 16-foot diameter, removable tread, made of mild steel plate.

10. At the Randfontein mine a common carrier is used in the shaft for the cage and skip. A travelling carrier comes in from the back of the shaft, the skip is lowered on this and shoved back. The cage is then hoisted up from the

front of the shaft and dropped into the carriage. This avoids removing the guides and the change is made in a few minutes.

The next best transfer arrangement is at the Crown Mines, but this necessitates the removal of the guides. At the Crown Mines, gun metal slippers are used. These have to be renewed every three months on the cages and every thirty-six hours on the skips. Sharp's swivel skipper and Job's spring-controlled shoe for skips are not in use now.

11. At the Randfontein Mine is a Fullerton, Barclay and Hodgart hoist and the first coil is partly let into the flange to avoid the sudden kick over at the beginning of the second coil. Another method is to tail out a rope and fill in. Brass is also used to fill in. The type of hoist most favoured for underground shafts is the geared three-phase electric. The modern tendency is big loads at slow speeds. Friction clutches are not used, the multiple tooth jaw clutch is the standard. Dials are all plain, black with white markings. Standard practice is one inch travel per revolution of drum. The right hand drum is always the top rope and the dial travels clockwise for lowering. On steam hoists the Whitmore Overwind is the favourite. Electric hoists are equipped with a trip operated by the depth indicator, and the emergency application of brakes is controlled against sudden application either by oil cataract or dash board. The Humble hook is in general use. The hoistman's log book is now made in duplicate and a copy is sent to the engineer.

12. Safety catches are not much in favour and are very little used. The best is the Undutsch, which is considered fairly satisfactory for loads up to five tons. Dependence is placed on the inspection of cables and hoists, and cables as a rule are now examined by three different men.

13. High Pressure Turbo-centrifugal Compressors are in use by the Victoria Falls and Transvaal Power Company and at several of the mines. Belliss high speed reciprocating machines are used for small sets on the mines. At the Randfontein is a 30,000 cubic foot Fraser and Chalmers machine. The average pressure of air at drill is from 65 pounds to 80 pounds. There is not any trouble from water in the air at deep levels. The ordinary water trip is all that is used.

14. Forced ventilation is now necessary to sweep out the fine dust and to relieve the high temperature underground. The rock temperature at the Village Deep mine at 7,000 feet vertical is about 95°. The world's largest fan was recently installed at the circular shaft of the Government Areas. The fan is built by Walker Brothers, of Wigan, is thirty feet in diameter by 10 feet wide, and is designed to supply 900,000 cubic feet of air per minute at 125 r.p.m. on a 7-inch water gauge. At the Crown Mines an underground power room was cooled and ventilated by aeroplane blades, motor driven.

15. The Sulzer has been the standard for years in high lift pumps, about 80 per cent. of the installations on the Rand being of this manufacture. They have an installation at the Simmer and Jack handling about 2,000,000 gallons per 24 hours in a single lift of 3,250 feet and claim to be able to do 4,000 feet in a single lift. The success of the installations depends on clear water and the mines have installed elaborate settling chambers. At the Randfontein, where a Sulzer installation is pumping 4,500,000 gallons a day against a 2,500-foot head, the settling tunnels and clarification launders have reduced the solids to .047. The engineer in charge of the installation claims the cost of maintenance is negligible.

16. At the end of 1924, of Donovan furnaces there were 29 sharpening, 24 tempering, and 4 shanking furnaces in operation, and 7 sharpening, 12 tempering, and 1 shanking on order. The principal complaint I heard against the furnace were the amount of labour necessary to work the steel through the muffles and breakage of muffles. Most of the mines admit that it has improved the steel and that it is a big improvement on any other method in the past.

Another tempering furnace is in use at the West Springs. This is a salt bath tempering furnace made by the Allegeneine Elecktricitats Gesellschaft. Capacity is 1,000 steel per hour. The salts used are $BaCl_2$ and KCl. Seven-eighths inch drill steel is ordinarily used. The analyses are:—

	Swedish	English
Carbon	0.89	0 73-0 78
Manganese	.31	.3b- .35
Phosphorus	.019	02 max.
Silica	12	15-0.2
Chromium	061	nil.
Sulphur	015	02 max.

Lug shanked steel are used for Leyner type machines.

17. The Crown Mines have about thirty sharpeners underground. Paraffin is the fuel used; 450 1¼-inch steel, or 600 7/8-inch steel, are sharpened for eight gallons of paraffin. Underground sharpening will become universal if a satisfactory type of electric furnace is designed. The advantage of course is no hoisting and the disadvantage is the gas. Transportation is the deciding factor.

18. Powder is stored underground in units of one hundred pounds. The best type of box I saw was built of reinforced concrete with dog-kennel roof. These boxes are fireproof, dry, cannot be used as a seat, and withstand considerable hard usage.

19. For underground sanitation, buckets with cover are used. The lavatories are on main air currents, separated from travel way by brick wall; floors are cement. The buckets are taken to surface, emptied, hosed out, and dipped in creosote before returning underground.

20. *Electric Butt Welder.*—There were seventeen in use at the beginning of 1925. This machine is made by the Allegeneine Elecktricitats Gesellschaft. It consists of:—

(1) A special transformer for transforming the voltage from 500 to about 3 volts.
(2) A switch for controlling the amount of current required for welding different size jobs.
(3) An operating switch worked with a pedal.
(4) Two pairs of quick-setting clamps for holding the parts to be welded. One pair of clamps is operated by a feed arrangement, so as to allow the two parts of the job to be separated or drawn together with a fair amount of pressure and speed.

The local agents of the Allegeneine Elecktricitats Gesellschaft claim that the machine can weld all ordinary metals except platinum up to four square inches sectional area.

One mine, which has had an installation for some time, has successfully welded without difficulty wrought iron and mild steel, mild steel and tool steel, mild steel and high speed tool steel.

When the first butt welder was installed, one mine started in on their scrap heap to weld everything in sight. For some time they reduced their monthly consumption of new steel from 20 tons to 5 tons. They then found that they were going too far with their welding, and at the present time they are putting in about 10 tons of new steel per month, so at that they are saving about 50

per cent. of their former consumption. Whether they will be able to maintain their underground complement indefinitely on this basis remains to be seen.

When steel is to be welded, the operations are approximately as follows:—

If the fracture is ragged, or if the steel has not broken approximately square, the end is heated and cut off square, and with the same heat, dollied in a sharpener machine so that the hole is slightly countersunk. This procedure is adopted in order to save excessive grinding. All steels, before welding, are dressed on an emery wheel, the ends being ground approximately square, and the outside cleaned back about 6 inches in order to give a good electrical contact. After matching the ends the two pieces are firmly clamped in the machine and brought into contact with the feed arrangement. The current is then switched on by the pedal switch. The resistance offered by the imperfect contact at the butt sets up local heating, which gradually extends back from the joint. When the heat has travelled back about ½ inch on each side of the butt, the feeding device is moved back about one millimeter, when a vigorous arcing effect is set up and is maintained until the two pieces of the butt are electrically parallel. The current is then switched off, and simultaneously the two pieces of the job are forcibly fed together by a quick positive movement given to the feed arrangement by the operator. A jet of compressed air is kept blowing down the steel throughout the welding period.

A time study of this operation shows that the preliminary heat takes approximately 13 seconds, the arcing 4 seconds, and adjusting and removing the steel 43 seconds, total time per weld 60 seconds. The makers claim that nine welds can be made with one and a quarter inch hollow round steel, for one kilowatt hour, and this seems to check with results obtained on the Reef.

During the preliminary heating, the current on the 500-volt side fluctuates considerably, but does not exceed 150 amperes, and during the arcing period the current is too small to register on the ammeter.

On one mine, where they have gone into the question of costs per weld thoroughly, they state that the welds by their old methods cost them 12s. 6d., and with the electric butt welder 2s. 5d.

21. The largest of the mining groups on the Rand buys 336,000 cubic feet of air per minute and has evolved a meter known as the F.M.L. Graphic Recorder, Patent Number 1154/23, Union of South Africa. The principle upon which this meter operates is that of the gate or weighted door in combination with a differential orifice. A description of this meter, by its inventor, is on file at No. 5 Queen's Park.

22. *Timber.*—Mine timber is being treated for two reasons: to increase the life of the timber and to decrease the fire hazard. The timber is immersed for two hours in a bath of 5 per cent. $ZnSO_4$ and 5 per cent. Na_2SO_4 at a temperature of 80°C, followed by immersion for one hour in a cold solution. The penetration extends for a depth of three-quarters of an inch and half a pound of $ZnSO_4$ is absorbed per cubic foot. The life of the timber is doubled.

23. *Drills.*—On the Rand there were 7,416 drills in commission during 1924, of the following makes:—

Ingersoll-Rand	4,247	Cochise	13
Holman	2,064	Atlas	213
Climax	539	C.P.	116
Denver	45	Sullivan	179

The favourites were: D.C.R.W. 23 with 1,567, Leyner 18A with 1,122, B.C.R.W. 430 with 964, and Holman C.H. 2 with 866.

24. In raising and lowering men the hoistman gives a release signal, three bells, before the cager opens the cage doors and allows the men out.

Exhibits on File

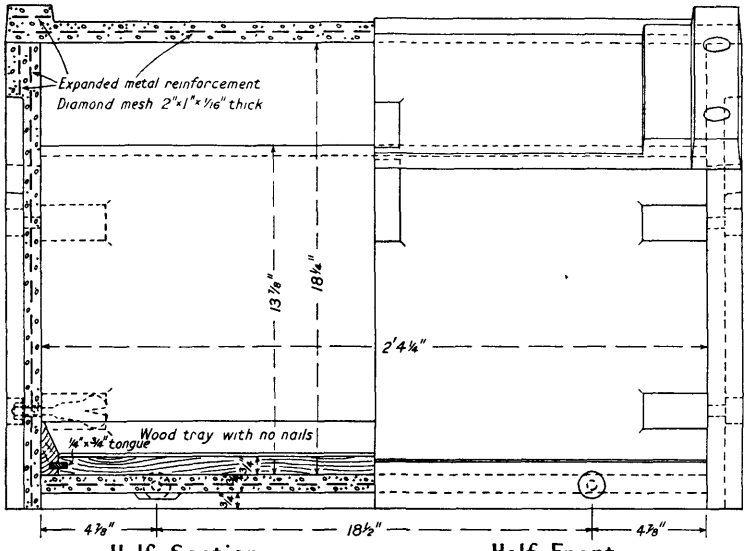
The following tracings, blueprints and photographs are on file at No. 5 Queen's Park for the use of any person who wishes to consult them.

1. Blueprint showing methods of weighting rope guides in circular shaft.
2. Photograph of Sulzer installation, 8,000,000 gallons per 24 hours, 2,600-foot head.
3. Blueprint, Double Deck Man Cage.
4. " Fastening for Skip Locking Lever.
5. " Five-ton Skip.
6. " Skip Changing Cradle, Randfontein Mine.
7. " Cast Iron Bracket for Shaft Runners.
8. " and Photographs of Reinforced Concrete Explosive Boxes.
9. " Skip and Cage Changing Gear, Randfontein Mine.
10. " Chamber for 36-inch Conveyer to Underground Loading Bin.
11. " Underground Loading Station and Ore Bins.
12. " Steelwork for Circular Shafts.
13. " Changing Gear.
14. " Changing Gear.
15. " Cross Section, Circular Shaft.
16. " Headgear, Circular Shaft.
17. " Five-ton Skip with Spring Controlled Shoes.
18. " Sharp's Swivel Guide Runner.
19. Tracing, Skip and Cage Changing Device.
20. " Skip and Cage Changing Device.
21. Blueprint, Measuring Box and Spillage Plate.
22. " Loading Bin.
23. " Guide Rails, Fish Plates and Bracket Fish Plates.
24. " Shaft Equipment.
25. Drawing, Permitted Copper Blow Pipe.
26. " Detonator Director.
27. " Thomas Safety Belt Fastener.
28. " Anderson's Circular Saw Guard.
29. " Phillips' Patent Saw Guard.

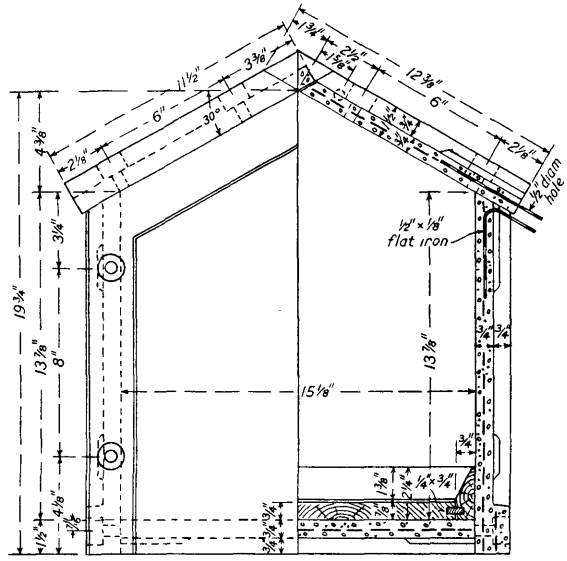
The following pamphlets and publications are also on file at No. 5 Queen's Park.

1. F. M. L. Graphic Recorder.
2. "A New Form of Air Meter and the Measurement of Compressed Air."
3. "Supply of Electricity and Compressed Air by the Victoria Falls and Transvaal Power Co., Ltd."
4. "The Smart Device for Recording Shaft Signals"—with Graph.
5. "The 30-foot Walker Fan at Circular Shaft, Government Gold Areas."
6. "Centrifugal Pumping Plant at Durban, Roodepoort Deep, Ltd."
7. "Pumping Layout at Randfontein Central."
8. "Notes on Deep Level Winding," by J. A. Vaughan.
9. A.C.E.C. Electric Winders.
10. "Explosions and Air Compressors," by J. A. Vaughan.
11. "Systematic Packing Underground at the Ferreia Deep."
12. "Tipping and Guarding of Vertical Skips," by Sharp.
13. "Square Shafts vs. Circular Shafts."
14. "Neutralizing of Acid Mine Water and Settlement and Treatment of Sludge."
15. "Notes on the Settlement of Mine Water."
16. "Improvements in Drilling Efficiency with Jackhammers."
17. "Electric Winders at Randfontein Central."
18. "Power Supply to the Witwatersrand."
19. "Safety in Winding Operations," by J. A. Vaughan.
20. "Ventilation of Development Ends."
21. "The Banket of South African Gold Fields."
22. "Minerals of Southern Africa."
23. Report of the Prevention of Accidents Committee.
24. Report of the Safety First Movement.
25. Report of the Mining Industry Board.
26. Report of the Economics and Wage Commission.
27. Report of the Mining Regulations Commission.

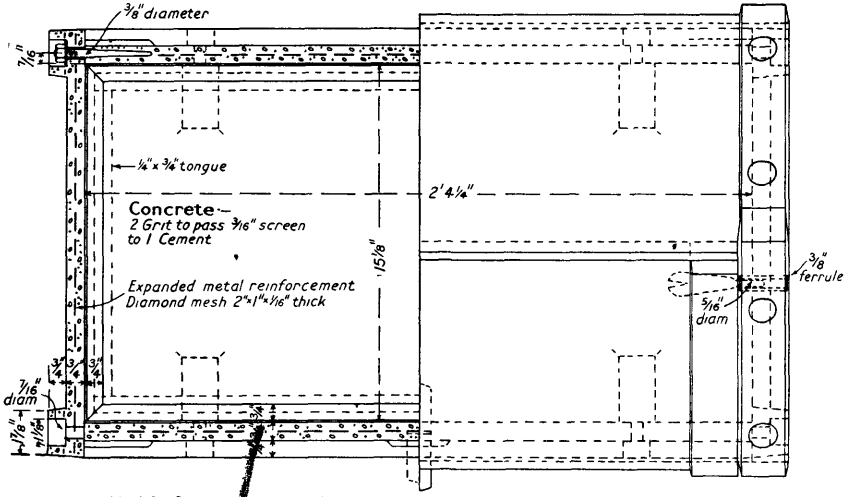
28. Report of the Low Grade Mines Commission.
29. Report of the Miners' Phthisis Prevention Committee.
30. Annual Report of the Department of Mines, 1923.
31. Report of Joint Committee on Rock Bursts.
32. Report of the Department of Mines, 1924.
33. Report of the Chamber of Mines, 1924.
34. South African Mining Act.
35. South African Miners' Phthisis Act.
36. Workmen's Compensation Act.
37. South African Tax Act.
38. South African Year Book, 1924.
39. Safety Bulletin, etc., of the Rand Mutual Assurance Co.
40. "Estimation of Dust in Mine Air and the Steps Taken to Prevent Miners' Phthisis."



SIDE ELEVATION



END ELEVATION

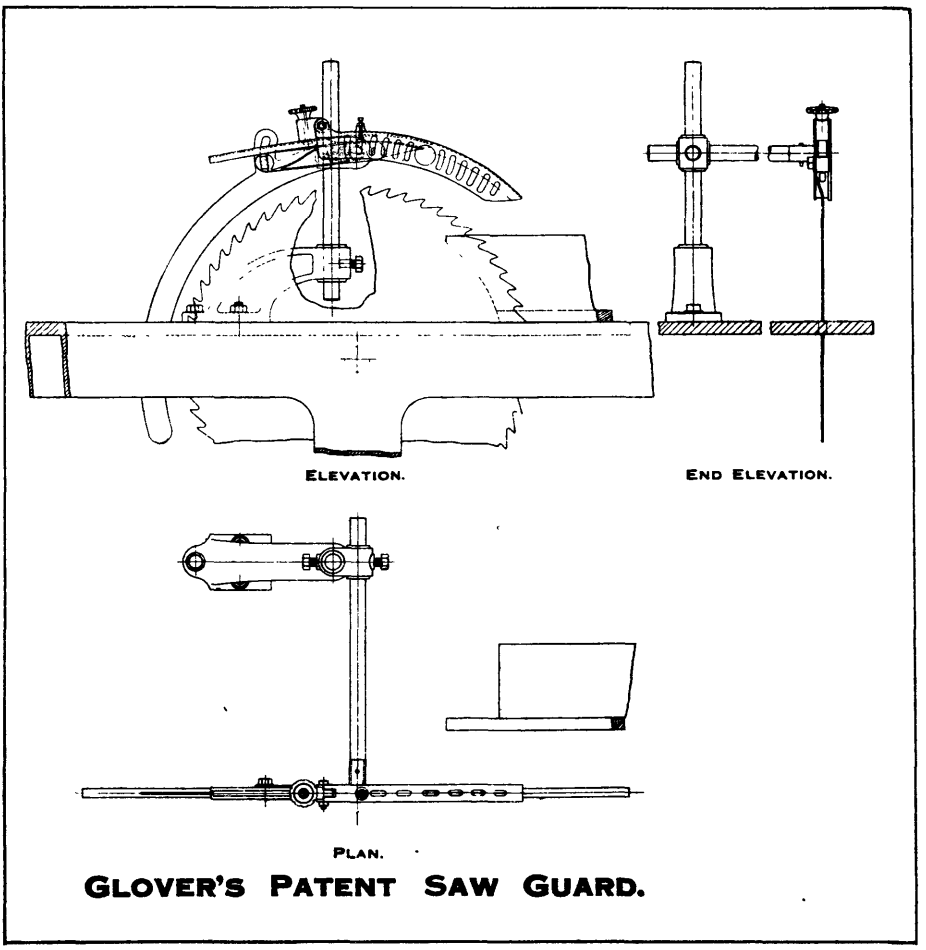


PLAN

Scale $\frac{1}{8}$ inch = 1 inch

1 0 2 4 6 8 10 12

Underground explosives box used by the Randfontein Estates G. M. Co., Ltd.



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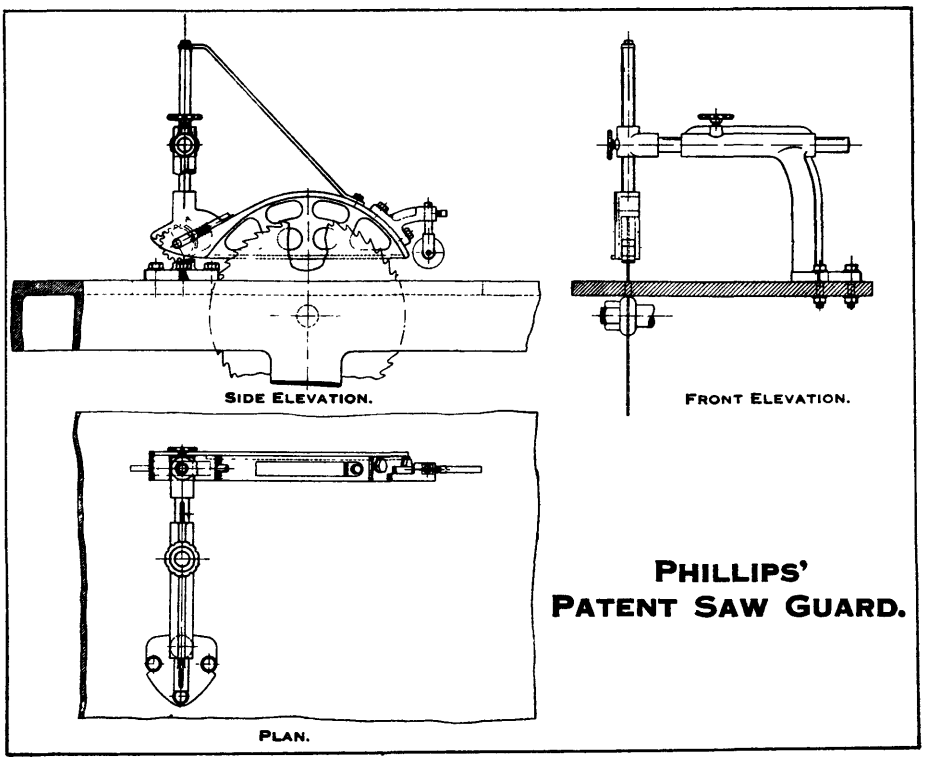

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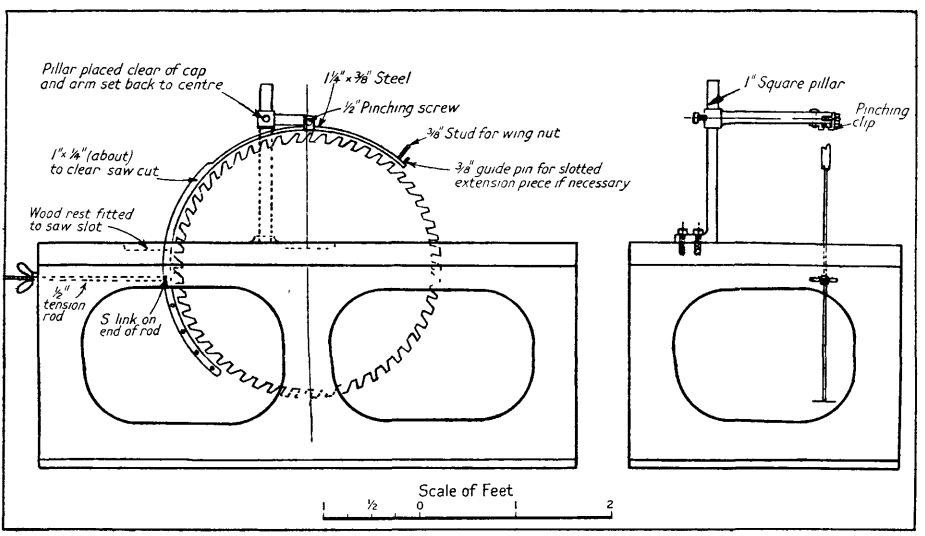
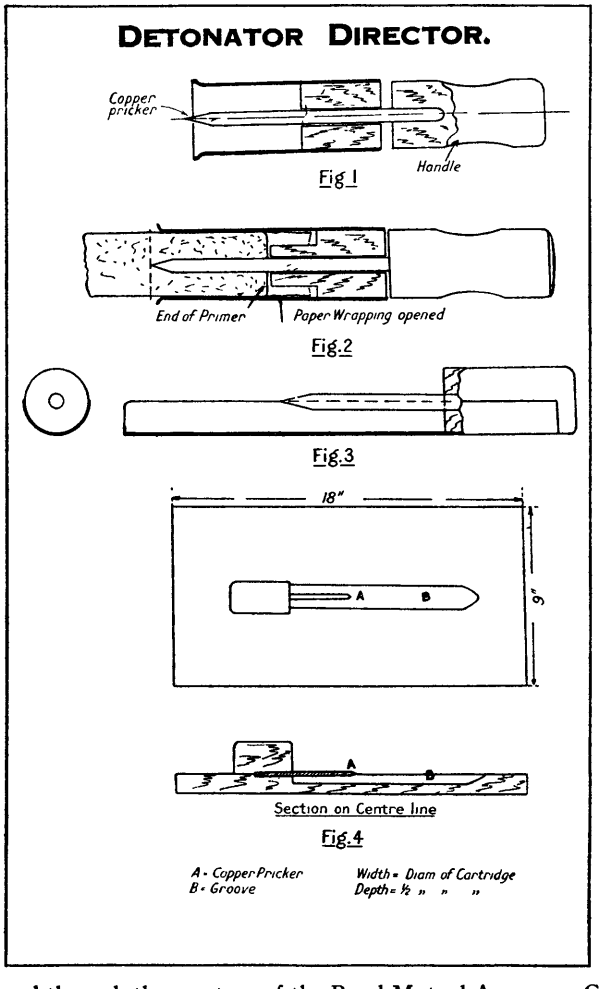


Anderson's adjustable saw guard. Reproduced through the courtesy of the Rand Mutual Assurance Company.



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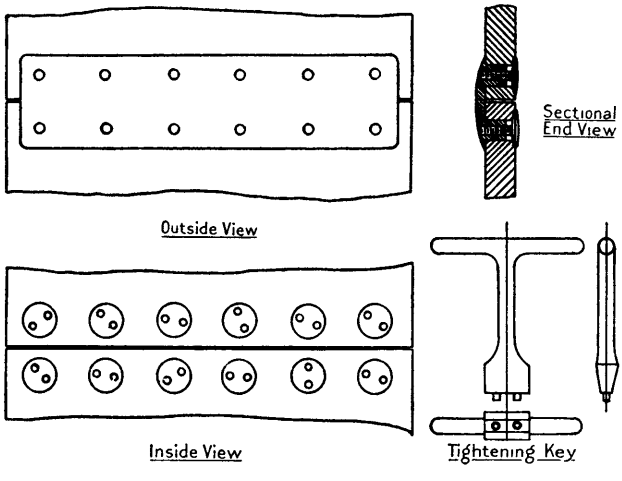

Thomas safety belt fastener. Reproduced through the courtesy of the Rand Mutual Assurance Company.