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REPORT

OF

BUREAU OF MINES

COLORADO

BY

HARRY A. LEE
COMMISSIONER OF MINES

DENVER, COLORADO
THE SMITH-BROOKS PRINTING COMPANY, STATE PRINTERS
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LETTER OF TRANSMITTAL.

Bureau of Mines, Colorado,
November 15, 1896.

TO HIS EXCELLENCY,

ALBERT W. McINTIRE,

GOVERNOR OF COLORADO:

Sir—I have the honor to transmit herewith the official report of the operations of the Bureau of Mines since its establishment, to November 30, 1896.

Respectfully submitted,

HARRY A. LEE,
Commissioner of Mines.

STATUS OF THE BUREAU.

The tenth general assembly established a department to be known as the "Bureau of Mines of the State of Colorado." The bill providing for the same was approved March 30, 1895, and in pursuance of an emergency clause, went into effect at once.

On May 11 following, the governor appointed the present incumbent Commissioner of Mines, who qualified and entered upon the discharge of the duties of the office on the 21st of the same month. Upon the same date date, Harry Tarbell was appointed clerk, and the board of capitol managers assigned to the Bureau its present quarters, and immediately commenced the furnishing of the same for occupancy.

On June 1, 1895, John H. Talbot, of Boulder county, and Alexander C. Morrison, of El Paso county, were appointed inspectors.

From this time to the September meeting of the state board of equalization, the work of the Bureau was vigorously prosecuted.

The board of equalization, at its meeting above referred to, sought to relieve the financial distress of the state by recommending to the auditor the suspension of appropriations provided by the legislature for the support of certain statutory offices created thereby, among which were included the appropriation provided for the maintenance of this Bureau.

The Bureau of Mines and the office of Commissioner thereof was established, albeit somewhat tardily, by the

last legislature, in pursuance of a constitutional mandate embodied in section 1, article XVI., of our constitution, which reads as follows:

"Article XVI., section 1. There shall be established and maintained the office of Commissioner of Mines, the duties and salaries of which shall be prescribed by law. When said office shall be established, the governor shall, with the advice and consent of the senate, appoint thereto a person known to be competent, whose term of office shall be four years."

Through the suspension by the auditor of the appropriations necessary to the proper conduct of the office, its status was attacked. Legal advice was sought, and as a result it appeared clear to the Commissioner of Mines that the office of Commissioner was created by the constitution, and its establishment and maintenance commanded by the same instrument. If this were true, it was certain that it was beyond the power of the auditor, or of any other officer, by the withholding of its necessary support, or by any other act, to suspend its functions or hinder the discharge of the same.

Acting upon this theory, mandamus proceedings were had by the Commissioner of Mines against the state auditor in the District Court. The decision of the said court was in favor of the Bureau, and in effect, the auditor was thereby commanded to recognize the constitutional character of the office, and to duly audit its accounts.

An appeal from this decision was taken to the Supreme Court, where it was discussed and affirmed in the following language:

"In the case of Harry A. Lee, Mining Commissioner, it appears that the office was created in pursuance of a constitutional mandate; that when the incumbent was appointed he became, by virtue of the constitution, a member of one of the three departments of the government, and as such was entitled to have his salary, and those of his assistants, etc., paid by the state as part of the expenses of such departments, without reference to the date at which the act took effect. * * * In the case of the mining commissioner, the judgment of the District Court is affirmed."

This legal controversy covered nearly three months, and left the Bureau of Mines without any visible means of support from September to January, 1896.

Notwithstanding the personal and official inconvenience which resulted from the suspension of appropriations, the Commissioner made the best of the situation and recognized the advantage of having at this early stage of its existence the status of the Bureau positively and irrevocably determined.

On October 25, 1895, Inspector John H. Talbot resigned, and L. N. White was appointed to fill the vacancy thus created.

ACKNOWLEDGMENTS.

Before entering upon a summary of the work of the Bureau, acknowledgment of the courtesy and public spirit of the Colorado railroads in furnishing transportation for its officers is fitting. The law establishing the Bureau of Mines and prescribing the duties of its officers, makes no provision for transportation charges, and the results attained by the department are largely due to the liberality of the Denver & Rio Grande; Union Pacific, Denver & Gulf; Denver, Leadville & Gunnison; Florence & Cripple Creek; Colorado Midland; Burlington & Missouri; Atchison, Topeka & Santa Fe; Midland Terminal; Silverton railroad; Rio Grande Southern, and Rio Grande Western railroads; the Denver & Rio Grande Express Company, and The Colorado Telephone Company.

The liberality of C. A. Palmer, general manager of The Mollie Gibson Consolidated Mining and Milling Company; the Denver & Rio Grande; Union Pacific, Denver & Gulf; Colorado Midland railroads and The Denver & Rio Grande Express Company at the time of the disaster at the Americus-Sleepy Hollow mines at Black Hawk is deserving of especial mention.

Mr. Palmer wired, offering the use of one of his large Palmer sinkers, which had never been used, weighing, with connections, about 20,000 pounds. To a request for transportation rates for shipment of pump from Aspen to Black Hawk and return, both railroads and

express company quickly and generously responded: "We will transport the Palmer pump and as many more as you may require for the Black Hawk sufferers, free of cost. Advise us what you want and we will rush it through."

A number of samples of ore from this and adjoining states have been forwarded the Bureau, requesting their determination and classification. When the requests were within reasonable limits, they have been forwarded to Dr. Wm. P. Headden, of the state agricultural college, at Fort Collins, who kindly complied with all requests made and thereby placed the Bureau under many obligations, acknowledgment of which is hereby made.

Acknowledgment is hereby made of the many courtesies extended the Bureau by Wm. E. Mead, a consulting mining engineer stationed at Ward, Boulder county, and Mr. T. W. Wilson, a mining engineer stationed at Columbine, Routt county, in the furnishing of valuable data and upon request acting in the capacity of special inspectors to investigate accidents, donating their services for the same.

To the Hon. Henry M. Teller, Hon. John C. Bell and Hon. John F. Shafroth, acknowledgment is also made for courtesies extended in furnishing the library of the Bureau with valuable publications.

The following newspapers and periodicals have kindly donated their publications to the Bureau, and are now on file, which courtesy is hereby acknowledged:

The Ophir Mail, the Loveland Reporter, the Loveland Register, the Pueblo Sunday Opinion, the Ouray Herald, the Boulder News, the Fort Collins Express, the Fort Collins Courier, the Saw Pit Hummer, the Gunnison Tribune, the Rocky Mountain Herald, Denver; the Leadville Herald-Democrat, the Enginering and Mining Journal, New York; the Mining Investor, Colorado Springs; the United States Investor, Boston; the Inter-Mountain Mining Review, Salt Lake City; the Mining Journal, London; the Denver Republican, the Rocky Mountain News, the Denver Times, and the Denver Evening Post.

The following is a list of books now in the library:

One Record of Mines, No. 1.
One Record of Mines, No. 2.
One General Record, No. 1.
One Record of Specimens, No. 1.
One Record of Accidents.
One Index to Mines Record.
One Index to General Record.
One A System of Mineralogy, Dana.
One Manual of Mineralogy and Petrography. Dana.
One Geology of Colorado and Western Ore Deposits. Lakes.
One Webster's Unabridged Dictionary.
One Second Report California Mining Bureau.
One Third Report California Mining Bureau.
One Fifth Report California Mining Bureau.
Two Sixth Reports California Mining Bureau, two volumes.
One Seventh Report California Mining Bureau.
One Eighth Report California Mining Bureau.
One Ninth Report California Mining Bureau.
One Tenth Report California Mining Bureau.
One Eleventh Report California Mining Bureau.
One Twelfth Report California Mining Bureau.
One Cyanide Process, California Mining Bureau.
One Gas and Petroleum, California Mining Bureau.
One Mine Timbering, California Mining Bureau.
One California Fossils, California Mining Bureau.
One Human Remains, California Mining Bureau.
One Mine Drainage, Pumps, etc., California Mining Bureau.
One Geology and Mineral Resources, California Mining Bureau.
Three volumes U. S. Geological Survey. Hayden.
Ten volumes U. S. Geological Survey. Powell.
Six volumes U. S. Geological Survey. Walcott.
Six volumes Colorado Court of Appeals Reports.

Five volumes Colorado Reports.

Mills' Annotated Statutes, Colorado.

Colorado Session Laws, 1879, 1881, 1883, 1885, 1887, 1889, 1891, 1893, 1894, 1895.

Twenty-third and twenty-fourth volumes Denver City Directory.

Twenty-first and twenty-second volumes Colorado State Directory.

History of Colorado. Hall. Volumes 1, 2, 3, 4.

INSPECTION.

Acknowledgment is here made of the uniform courtesy extended the inspectors, in the discharge of their duties, by the mine owners throughout the state.

It has been the policy of the Bureau to do as far as possible what was necessary and avoid meddling or any useless display of authority. As a rule, suggestions were courted rather than evaded, and the recommendations made were cheerfully complied with. In many cases these recommendations required considerable outlay, and in but one case was it necessary to invoke the power of the court. A permanent injunction was granted immeditely upon hearing, the same to remain in full force and effect until the orders of the Bureau of Mines had been complied with. The orders were immediately complied with and the injunction dissolved. The effect was good, and caused others who doubted the authority of the Bureau to promptly comply with recommendations made.

A large number of recommendations have been made by the Bureau which do not appear on record beyond numerical annotation. This course has been pursued at the earnest solicitation of those in charge, who admitted the justice of the recommendations and assented their willingness to comply with same as soon as ways and means for the unexpected outlay could be arranged for, as an additional reason stating that their mining operations were in embryo and that if the Bureau of Mines would keep its recommendations from the public, they could arrange in their own way to have same complied with, but, if given to the press, the chances

were they would be closed down indefinitely. The inspectors were, therefore, instructed to use their best judgment in such cases, and when satisfied, the recommendations would be respected, to permit the operators to supply an excuse for closing down the property and keep their work secret. It may be further stated in this connection that under the above arrangement there were at one time twenty-seven properties temporarily closed in the Cripple Creek district alone, all of which have since complied with recommendations and continued operation. The Commissioner of Mines assumed that one of the primary objects of the Bureau was to promote legitimate mining in all ways possible, and in no manner deter it, providing the safety of employés and other requirements were not lost sight of.

The Bureau has encountered more antagonism from the miner and lessee, when working for themselves, than from any other quarter. They fully appreciate the risks incurred and resent official interference with their alleged personal rights. This is especially true when applied to that class of lessees who obtain a lease on a "block of ground" in an old mine, the block of ground having been practically abandoned by the owners through their inability to make same return a profit. For a lessee to take this ground, not only make it pay but, in addition, pay the lessor a royalty, produces a condition of affairs that does not augur well for safety, viz.: The lessee must do more work per shift, work more hours or neglect the outlay in material and labor necessary to provide safety.

During the life of the Bureau, a number of complaints have been filed by miners, alleging unsafe conditions and practices upon certain mines. Investigation has shown many to be just and worthy of attention, but the majority have shown a spleen of discharged employés, who have endeavored to use the Bureau to rectify their supposed wrongs.

Another class of complaints have been received from property owners "through fear that their lessees were not strictly complying with the terms of their lease in regard to timbers, etc." Investigation has shown in

some cases these fears well grounded, but in the majority it was found that the lessees were producing fine ore and the ulterior purpose of the complaint was the hope that the Bureau would close the property and thereby terminate the lease.

Systematic mine inspection has been greatly retarded by the occurrence of accidents. At no time since the establishment of the Bureau have its officers been able to take up a camp, district or county and work it systematically, on account of casualties. The officers are so few in number, the territory to be covered so large, that it is safe to assert more time has been consumed in travel to investigate accidents than has been consumed in systematic field work.

To comply with the provisions of the statute establishing the bureau, the following blanks were prepared, together with corresponding books for permanent records, to which reference is hereby made:

ACCIDENT BLANKS.

.....Colo., ..., 189..

HARRY A. LEE,
Commissioner of Mines,
Denver, Colo.

Sir—I hereby report accident at the..... mine, ...mining district, ...county, Colorado, to.....(full name of injured person).... Nationality..... Age..... Married or single..... Insured or not..... Number of years' experience in mining..... Date, cause of accident and nature of injuries.....

REPORT.

Name of mine.....
Date of original location.....
Location .....
Mining district .....
County of....., state of Colorado.
Title.....containing.....acres.
Principal office located at.....
Name and address of officers.....

Altitude of main workings.....
Character of country rock.....
Character of vein.....
Character of walls or enclosing rocks.....
Character of ore.....
Ore occurrence.....
Development, ventilation, sanitary condition, exits.....
Method of ore extraction.....
Method of timbering.....
Condition timbers .....
Power used.....Fuel used.....
Boilers .....
Water used in boilers.....
Pressure carried.....
Hoisting plant.....
Pumping plant.....
Cost of fuel.....Average cost per month.....
Cost of timber.....Average cost per month.....
Cost transporting supplies to mine.....
Average assay value ore per ton.....
Cost per ton for transporting to market.....
Average cost treatment per ton....Method treatment...
Gross tonnage.....Average tonnage per month.....
Gross investment.....Gross receipts.....
Average cost sinking per foot.....
Average cost drifting per foot.....
Explosives, where stored.....
Safety devices.....
Fire protection.....
System of signals.....
Average number of men employed.....
Are employés insured?.....
Wages paid miners....hour shift.....
Wages paid trammers....hour shift...
Wages paid cagers....hour shift.....
Wages paid nippers.... hour shift....
Wages paid timbermen....hour shift..
Wages paid topmen....hour shift.....
Wages paid firemen....hour shift.....
Wages paid shift boss....hour shift...

Wages paid foreman....hour shift....
Wages paid superintendent....hour shift....
Wages paid asayers....hour shift.....
Wages paid ore assorters....hour shift....
Wages paid laborers....hour shift....
Wages paid engineers....hour shift....
Wages paid pumpmen....hour shift...
Wages paid electrician....hour shift...
Wages paid blacksmiths....hour shift....

.....

From June 1, 1895, to December 1, 1896, the Bureau has made the following

RECOMMENDATIONS.

Recommending upraises for better ventilation.....	59
Sanitary condition	5
Double exits.....	81
Putting in ladders and plats.....	185
Trap-door to ladder-way and shaft.....	20
Dividing shaft in two compartments.....	46
New cables	8
Repairing cables	11
Repairing bucket-way.....	4
Stopping use of bucket for hoisting and lowering men until new machinery was put in	15
Overloading cages, buckets or skips (with men).....	111
Repair hoist	3
Guard rails at shaft	49
Timbers	264
Repair and re-timber shaft.....	23
Repair and re-timber tunnel.....	5
Stulls in drifts and stopes.....	24
Secure ground in tunnel.....	10
Do not work men below "stated" levels.....	2
Discontinue use of shaft.....	1
Place bulkhead	2
Indicator on engine.....	5

Regulating the storing and handling of explosives....	316	
Take down loose slabs, hanging wall and rock.....	13	
Fire protection	218	
Total		1,480

THE MINERAL COLLECTION.

The appropriations made by the tenth general assembly were lamentably out of proportion to the demands made upon the Bureau by the law establishing it. So great was the discrepancy that a strict compliance with the law has been a practical impossibility. With this fact at all times painfully present, the Bureau has been conducted with a view of getting the best results from the meagre resources provided for it.

Section 1 of the bill establishing this department provides:

"Section 1. There shall be and is hereby established in this state a department to be known as the 'Bureau of Mines of the state of Colorado,' the principal office of which shall be maintained at the state capitol, in the city of Denver, at which place there shall be collected by the Commissioner of Mines, and preserved for study and reference, specimens of all the geological and mineralogical substances, including mineral waters, found in this state, especially those possessing economic or commercial value, which specimens shall be marked, arranged, classified and described, and a record thereof preserved, showing the character thereof and the place from whence obtained. The Commissioner of Mines shall also, as he has opportunity and means, collect and in like manner preserve at said office, minerals, rocks and fossils of other states, territories and counties, and collections so made shall within reasonable hours be opened to public inspection, examination and study."

It is evident from the above section that the framers of the law considered a permanent exhibit one of the first duties of the department. The advantage obtained or benefits derived from a permanent exhibit are hard to estimate. Directly it yields no revenue, but on the other hand, requires an outlay to maintain. It is advertising. A material display which can be seen, examined and studied, supported by a state and backed by a depart-

ment under state control, the exhibit stands as prima facie evidence of the existence of such products as are presented and coming from the districts so marked and recorded.

Starting from nothing, the growth of the collection was at first seemingly slow. Cases of special design were furnished by the state board of capitol managers. As specimens arrived they were properly labeled and arranged until the cases on hand were filled. Another order was placed by the state board of capitol managers, making a total of 200 lineal feet of cases and tables, at a total cost of $500. They also were soon filled.

Up to this time no attention had been given to arrangement beyond that of presenting a pleasing effect to the eye. Visitors became more and more numerous, and while many came through idle curiosity, the inquiries and demands of a large proportion indicated that, to be of any practical benefit, the ores must be localized by re-arrangement. This was undertaken, and ores from counties represented were, as far as possible, placed together. When effected the result seemed to be highly satisfactory to that class of visitors who, prior to visiting a particular section of the state, with a view of investing, first came and studied the ores and country rocks from that section. The large number of visitors of this class suggested the idea of still further individualizing districts of the state by having a wall-case for each county, and the placing of the mineral products of that county in its own case. Neither the state board of capitol managers nor the Bureau were in financial condition to supply these cases, so the desire of the Bureau was placed before the boards of county commissioners or boards of trade of the respective districts.

The board of trade and mining exchange of Victor were the first to place an order for a specially designed case and a panoramic picture of the city and its surroundings.

The board of commissioners of El Paso county made an appropriation for a case, and the money collected at Cripple Creek was utilized in the purchase of a pan-

oramic picture of Cripple Creek and surroundings. These views were taken by Howard G. Pierson & Co., Denver, the Victor picture being finished in oil and the Cripple Creek picture in water color. The Cripple Creek picture is interesting from the fact that the negative was obtained two days before, and shows the camp as it was prior to the fires which practically wiped the city out of existence.

Orders for similar cases were placed by the boards of county commissioners in the counties of Gunnison, Larimer, Hinsdale, Gilpin and Clear Creek. These cases are all in place and filled with the economic minerals of their respective districts. Several other counties have the matter under consideration and will no doubt take favorable action. The ultimate result will be a case from each mineral-producing county of the state and the same filled with mineral products distinctly its own. The flat cases will be filled with specimens having scientific value, and the whole will be such that the provisions of section 17 can be complied with in a manner creditable to the state. This section provides:

"Sec. 17. It shall be the duty of the Commissioner of Mines to make, or cause to be made, exhibits of the mineral resources and products of the state, at such industrial exhibitions held in this or other states as the governor of this state may direct, and for which due appropriations shall have been made."

Colorado has in the past responded to numerous calls for mineral displays, and is daily contributing to the hordes of specimen hunters for private or scientific collections. Perhaps none appreciate the number in the field in search of mineral curios better than the mine owner. Requests and appeals are constant. Notwithstanding this condition, the Bureau of Mines collection has made headway.

The mineral collection of the department is a fair display of the economic ores of the state. No time has been given exclusively to the collection of ores, but the same have been gathered when at mines and in districts performing other official duties; the duty of collecting being at all times made secondary to other duties. When

the time and mode of gathering the specimens now in place is considered, the result is creditable and largely due to the courtesy and generosity of the mine managers and miners throughout the state, and to the generous support of The Denver & Rio Grande Express Company, which has transported and delivered all donations to the Bureau of Mines free of cost.

The collection as it now stands contains 1,652 specimens, the same being the economic ores of the various sections visited. The above specimens have been duly "marked, arranged, classified and recorded" as provided by section 1. In addition to the above, 2,338 specimens are in place, duly marked, arranged and classified, but not recorded. It is intended to replace these specimens with better ones later on.

The success in obtaining specimens of scientific value has not been as great as wished for, but better than expected. Quite a number have been donated by friends of the Bureau from their private collections, and the remainder collected by happening to be at the right place at the right time.

Colorado is noted for the variety and perfection of its crystallized minerals. This fact has been known and appreciated by scientific men throughout the world for many years. As a result nearly all dealers and educational institutions throughout the east and many foreign countries have emissaries constantly in the field and ever alert for mineral in perfection. Our own institutions and curio dealers are also watching for something fine in this line. It is safe to assert that a large number of men in Colorado gain almost their entire livelihood through the bartering, begging, exchanging, buying and selling of crystalline minerals.

Upon application to the Denver chamber of commerce, which had several boxes of specimens returned from the World's fair exhibit, the same were transferred to the Bureau of Mines. Upon unpacking, this collection proved a great disappointment, only a few specimens being saved from the whole, which were duly recorded and credited to the chamber of commerce.

The collection placed with the real estate exchange by the board of World's fair managers was later transferred to this department, and proved a valuable acquisition.

The Colorado Coal and Iron Company, by J. A. Kebler, the general manager, donated a case showing their coals and cokes, labeled and showing analyses, together with an economic display, nicely arranged in frames, showing the products of the steel works at Pueblo.

Among the first to contribute to the mineral display of the Bureau was Geo. E. Hemler, of Boulder, who forwarded his private collection for exhibition. This is a handsome private collection and has attracted much notice and favorable comment.

"Sec. 19. The mineral specimens heretofore collected by the bureau of immigration and statistics and the World's fair commissioners are hereby transferred to the custody of the Bureau of Mines."

The mineral collection loaned by the state board of immigration to the Colorado mineral palace is still in possession of that company. Acting upon the advice of the Hon. B. L. Carr, attorney general, the matter is referred, with a request that the incoming legislature give explicit directions for gaining possession, there being doubt in his mind as to the proper person to commence action and bear the expense incident to suit.

The conditions surrounding the collection are as follows: Extract from minutes of a meeting of the board of World's fair managers for Colorado, held in the office of the governor, at 1:30 p. m., June 1, 1891, present Governor John L. Routt, A. B. McKinley, J. A. Thatcher and O. C. French.

The secretary read a communication from John Livezey, secretary of the Colorado mineral palace, dated Pueblo, Colorado, May 25, 1891, "making application for the use of ores and specimens which were collected by the different counties of Colorado for the St. Louis exhibit."

After full discussion of the matter, the following resolution was offered by Mr. Thatcher and unanimously adopted:

Resolved, That the secretary is hereby instructed to inform Mr. John Livezey, secretary of the Colorado Mineral Palace, at Pueblo, that the ores and specimens now stored in Denver, known as the St. Louis exhibit, are yet under control of the state bureau of immigration; that before the World's fair board can receive them, it will be necessary to classify them and check them off with the records of the state bureau, and that this board is unable to provide for the taking over of said exhibit at this time, owing to the fact that no part of its appropriation has yet been paid over.

And that the secretary in said communication is further authorized to propose to the Colorado Mineral Palace that if it will defray all the expenses of all the necessary employees in opening, classifying and arranging the said St. Louis exhibit in the warehouse where the same is now stored, in shipping it to Pueblo, in caring for it while on exhibition and returning it to Denver to this board, that said exhibit may be displayed on such terms.

The above proposition was accepted by the officers of the mineral palace, and the collection removed and arranged in the building of the mineral palace company, at Pueblo.

In pursuing this matter, the services of an attorney were required to look up the condition and ownership of the mineral palace, and the courtesy extended the Bureau by Hon. W. L. Hartman, of Pueblo, is here acknowledged, the following being self explanatory:

Pueblo, Colorado, March 21, 1896.

HON. HARRY A. LEE,
Commissioner of Mines,
Denver, Colorado.

Dear Sir—In answer to your favor of the 18th inst., will say that I have just concluded examination of the records and making inquiries regarding the Mineral Palace property, and especially the exhibits.

I find that a deed of trust was given on the real estate only and the franchises to the Stockgrowers' National Bank, April 1, 1891, recorded in book 107, page 208, to secure an issue of bonds amounting to $50,000.

This deed of trust was foreclosed and conveyed to John T. Higgins by trustee's deed, dated June 4, 1894, recorded in book 155, page 259. It simply conveys the real estate by proper description, and the franchises of the company. A careful examination of the indexes fails to show that any mortgage or other lien or conveyance of the exhibits, or of any personal property of the company, was ever given by the Mineral Palace Company.

Mr. John T. Higgins died about a year ago and, although the real estate still stands of record in his name, we are reliably informed that he gave a declaration of trust at the time he received the title, and afterward executed a deed. We understand that the property is now really owned by the First, the American, the Pueblo, and the Stockgrowers'National banks, or possibly by the officials of those banks; and they claim to own all the specimens and exhibits, with a few exceptions of minor importance. These, we understand, are cabinets of specimens belonging to individuals. Mr. D. R. Green, president of the Pueblo National bank, is in charge and control of the property.

I will be glad to be of any service to you. Very truly yours,
(Signed) W. L. HARTMAN.

This collection comprises the ores exhibited at the St. Louis exposition and contains much valuable material and it is hoped means will be provided for its recovery to the state and its placing in the Bureau.

Too much stress cannot be placed upon the importance of having the collection of the Bureau so complete and full that it can at any time be drawn upon for an exhibit to be shown at any exposition desired. In the past the state, counties and individuals have contributed liberally for such purposes, and one of the strong arguments in favor of the collection is the avoidance of future donations for foreign exhibits.

It was expected to be able to report at this time the completion of the purchase of the private collection of Dr. John Ellsner, of Denver. This collection is recognized by all conversant with it as one of the best private collections in the West. Considerable time and energy of the officers of the Bureau have been devoted to this matter, and the same would have been completed had the Leadville strike not interfered. Liberal donations in ore or cash have been made by the mine owners of some of the leading mines in the state. Arrangements

were completed with the mine owners of Leadville, the smelters and railroads to close the matter when the strike stopped further progress. The closing of this matter and getting the collection in place within a short time is hoped for and at that time a complete report of contributors will be made.

To individualize each donation to the Bureau of Mines would exceed the limits of this report, but acknowledgment is hereby made to the following:

DONORS.

Abbott, Amos
Adams, E. O.
Adams, A. P.
Aitken, John
Akers, W. A.
Allen, Dr. J. H.
Allen, Robert
Alexander, W. B.
Alpha Cons. Mining Co.
Alsbough, ...
Anaconda Gold Mining Co.
Armstrong, C. A.
Arnold, J. R.
Baldwin, Hon. J. D.
Baum, W.
Baxter, D. S.
Beam, Walter
Bennett, Will
Bent, C. H.
Best, J. D.
Berg, Gus
Benson, J. W.
Biddlecome, Frank
Biglow, A.
Blades, J. W.
Blow, A. A.
Becker, Henry
Bolsinger, Hon. H. C.
Boehmer, Max
Bonesteel, Dr.
Bohn, Maj. A. V.
Boyd, J. C.
Brewer, Col. L. G.
Brown, Thos.
Brown, Jack
Brunton, D. W.
Broad, Col. W. E.
Budrow, Theo.
Buell, Bela
Bunce, Walter H.
Burns, James
Buschmann, W. F.
Burbridge & Tucker
Campbell, Hon. J. O.
Campion, John
Campion, George
Came, T.
California Mining Co.
Carpenter, J. W.
Carter, Capt. J. S.
Carr, John E.
Carver & Miller
Carney, Hon. Francis
Chamber Com., Salt Lake.
Chandler, John
Chester, J. E.
Christo, D.
Childers, Lem
Christmas Mining Co.
Clemmer, Mrs. A. D.

Clemmons, Joseph
Cohn, S.
Comell, R. W.
Conklin, D. C.
Colorado Fuel and Iron Co
Cone, N. H.
Coan, Capt. A.
Cooper, W. M.
Cowie, James
Cox, W. J.
Crawford, George
Crooke, J. J.
Crowley, P. F.
Clark, A. J.
Creede & C. C. M. & M. Co.
Cripple Creek Cons. M. Co.
Cypher, J. F.
Darling, Col. Richard
Davis, O. J.
Davis, Dr.
Davis, E. L.
Davis, Charles
Davidson, G. A.
Davorak, F. B.
Dawson, P. G.
DeMasters, A. D.
DeWitt, E. G.
Della S. Mining Co.
Dingwall Bros.
Dickey, J. C.
Dougan, Dr. D. H.
Donnlee, Jos.
Doyle, James
Duncan, Robert
Duncan, John
Dunham, W. F.
Edward, A. A.
Elkton M. & M. Co.
Elrick, W. R.
Elliott, J. J.
Emerson, T. F.
Emmet Mining Co.
English, A. L.
Estey, Robert B.
Evans, Hon. J. C.
Farrell, D. A.
Farrell, W. H.
Feuch, J. L.
Fisher, Geo. L.
Fine, Hon. W. J.
Flanders & Co.
Franklin, G. C.
Frank, Col. J. B.
Frasier, Wm.
Fulton, W. C.
Garbutt, Judge
Gehrmann, C. A.
Geisel, John
Gill, Hon. S. J.
Gullett, Hon. A.
Gold Standard M. & T. Co.
Golden Cycle Mining Co.
Goldsmith, F. S.
Hanson, Rasmus
Hayt, Judge C. D.
Hogerty, D. B.
Haley, James
Hartley, J. D.
Harman, John
Hamlin, C. F.
Harvey, Capt. Jas. K.
Harvey, John
Head, Col. Henry
Hemler, Geo. E.
Hartwell, D. C.
Heibler, Thos.
Henderson, Jack
Hensey, C. F.
Headdon, Prof. J. P.
Higgs, Stephen
Higgins, I. N.
Hill, Chas. L.

Hopkins, J. F.
Hoskins, Miles
Hoffman, Dr. D. S.
Hosey, Geo. E.
Hooper, J. A.
Hooper, J. D.
Howbert, Irving
Hull, C. D.
Hughes, Frank
Hughes, Dr. T. A.
Hughes & Shannon
Hulings, W. W.
Hume, J. C.
Hurlburt, Geo. R.
Ingraham Bros.
Isabella Gold Mining Co.
Iowa Mining Co.
Johnson, H.
Jamison, David
Johnson, Lute H.
Josephi, S. A.
Kedzie, Geo. E.
Kafka, Louis
Kennedy, Hon. A. R.
Kebler, J. A.
Killelea, M.
Kermode, Harry
Kirby, Dan
Kinkaid, Hon. John
Kinsey, S. H.
Kirker, J. S.
King, W. J.
Kissock, J. A. C.
Kimball, Gordon
Kline, Adolph
Krusen, N. J.
Landon, Dr. J. P.
Lawrence, Hon. J. S.
Lasch & Chapman
Lawrence, W.
Lemmex, Frank
Langley, J. C.
Lewis, B. W.
Lennox, Wm.
Lee, D. K.
Lee, Mrs. H. A.
Lee, Hon. H. A.
Lee, Dr. E. A.
Leonard, Mike
Leonard, P. W.
Loose, C. F.
Lillie Gold Mining Co.
Lippoldt, Henry
Luebben, H.
Lyon, Thos.
Mansfield, N. T.
Mabee, Geo.
Manley, W. J.
Martin, Ike
Matts, W. F.
Meade, W. E.
Mears, Otto
Miller, J.
Meredith, Joseph
Moffat, D. H.
Murphy, David
Moss, F. A.
Moose Gold Mining Co.
Moses Bros.
Morrisey, John D.
Morehead, Wm.
Mumah, Lem
Munn, Chas.
Mudd, S. W.
Murphy, J. W.
McIntire, Hon. A. W.
McClurg, James A.
McCormack, John
McMahon, John
McConnell, James
McCormack, W. P.
McDonald, A. A.

Nelson, A.
Newall, Hon. S. V.
Newman, Hon. Chas.
Nix, Col. C. H.
Nichols, Arthur
Oliver, Chas.
Omaha & Grant Smelt. Co.
Olympus, John
Oliver, F. G.
Palmer, Chas. F.
Palmer, C. A.
Parshall, W. W.
Parry, J.
Pharmacist Mining Co.
Pershing, J. F.
Pine Bros.
Phillips, Prof. Alvin
Porter, John
Posey, O. P.
Pierson, Hon. T. J.
Pierce, Geo. W.
Poppet, Chas.
Ray, R. B.
Reardon & Roe
Reardon, Geo. W.
Reynolds, A. E.
Rickard, T. A.
Reed, H. W.
Reid, J. S.
Routt, Hon. John L.
Rebecca Gold Mining Co.
Robinson, H. R.
Roach & McKay
Rische, August
Robertson, T. H.
Sanders, Frank
Safely, A. F.
Schaffer, Chas.
Schwartz, A. E.
Schwartz, Mrs. A. E.
Scott, A. W.
Sheehan, Wm.
Shephard, J. H.
Silence, Frank
Sibley, Nat
Stratton, W. S.
Silver Queen Mining Co.
Steele, W. H.
Strong Mining Co.
Stoiber, E. G.
Steele, J. A.
Sullivan, D. M.
Strout, W. H.
Sullivan, Col. M. K.
Sweet, J. I.
Talbot, James
Talbot, John H.
Tarbell, Harry
Tarbell, W. S.
Taylor, J. D.
Taylor, Hon. E. M.
Tabor, H. A. W.
Teats, T. H.
Teresa Mining Co.
Taylor, F. M.
Thatcher Bros.
Union Gold Mining Co.
Victor Gold Mining Co.
Virginia Mining Co.
Washburn, Jones
Walker, J. H.
Walsh, Thos. T.
Wakeman, Fenno
Wagner, Herbert
Watson Bros.
Williams, R. B.
Wilder, Chas.
Wilson, T. W.
Wilson, Geo.
Wood, J.
Wilson, Harold

Wright, Geo. E.	Wright, H. E.
Wood, T. S.	Wygant, Jr., T. H.
Wingate, John	Zacharias, Hon. G. H.

ACCIDENTS.

An earnest effort has been made to investigate the accidents common to mining; to study the causes and endeavor to be in position to advise the best methods for their avoidance. On the scale of insurance, mining in Colorado is classified as "hazardous" and "extra hazardous." This rating has been of such long standing that its general acceptance has resulted in the belief that mining accidents are among the things inevitable, and that a cautious, practical miner is just as apt to meet death as the reckless or alleged miner. Facts do not substantiate such a belief.

It is safe to assert that 90 per cent. of the mine accidents are caused through carelessness or ignorance on the part of the miner, and in many cases, result from acts in violation of established customs or injunctions of the management. If the above be true, it follows that the mine management is lax in discipline; that miners, from constant exposure to risk, become reckless; that a large proportion are incompetent miners, or a combination of the three.

Lax discipline on the part of the management is the primary cause of most accidents. This is demonstrated by the fact that upon large mines accidents are, in proportion, of less frequent occurrence than upon the smaller mines. The reasons for this are that the economical management of a large crew of men and large output demands uninterrupted, well balanced and almost automatic action. This demands a rigid discipline, which is enforced with the ever ready "time check" for any overt act upon the part of the employés.

That accidents are chargeable to miners, who from long practice have become reckless, is also true. It does not follow, however, that this recklessness is always due to shiftlessness. Good miners become very much interested in their work and take pride in so "pointing a hole" as to secure best results. When the drill hole is

ready for charging, the fallacy of "tight tamping" with a steel tamp bar is often indulged in with a perfect knowledge of the risks assumed.

Miners working and "taking down" ore are too apt to place too much dependence upon the hanging and shattered "waste." Their aim is to take down as much ore and as free from waste as is possible. This zeal, common to so-called "good miners," often results disasterously, and confirms the belief that old miners are as apt to be injured as the new ones. Mining is an occupation wherein safety is largely dependent upon the judgment of the individual. This judgment is good or bad according to the man, but as a rule may be said to be commensurate with the experience of the individual miner.

The metalliferous mines of Colorado are infested with too many alleged miners. The result is that common to all classes of skilled labor, viz., the good must do enough work to make up for the deficiency of the bad.

Hard-rock mining is a trade the same as any mechanical pursuit. In mechanical lines, an apprenticeship of a term of years must be served, the pay being commensurate with proficiency until experience entitles the novice to the consideration and pay of the skilled mechanic. In mining, no such test is seemingly applied. A man engineers a windlass, fills buckets or tram cars, "turns" or "strikes" a few holes and "hits the trail" a full-fledged miner. He is employed upon his own declaration, and that he does not kill himself and his associates near him may be termed the greatest accident in hard-rock mining. If our miners' unions were to take hold of this matter and grade their members according to experience and proficiency, and have the novices apprenticed and paid accordingly, they would do much to maintain the standing of the miner and a scale of wages according to ability. A miner may be depended upon to guard the safety of his companions, while an unskilled man is worse than useless and endangers, through ignorance, the lives of his associates.

During the latter part of 1895, accidents became of so frequent occurrence that the following bulletin was issued with the hope of arresting same:

BULLETIN NO. 1.

The bill establishing the Bureau of Mines, in accordance with the constitutional edict, provides that the officers of this department "shall inspect and determine the safety of devices and methods used in mining" * * * and "take necessary measures to make them safe. * * * On receipt of notice * * * shall inquire into the cause of accidents." "Shall exercise sound discretion in the enforcement" of the act; shall give notice of any defect or practice found "to be dangerous," and "order the same to be remedied." It further provides a penalty for non-compliance with such orders and imposes a mandatory duty, viz.: "Any owner, agent, manager or lessee having charge or operating any metalliferous mine, whenever loss of life or serious accident shall occur connected with the workings of such mine, shall give notice immediately and report all facts thereof to the Commissioner of Mines."

Believing that all mine operators desire to strictly comply with legal requirements, to avoid fatal accidents and throw every safeguard around their employés, the following recommendations are made and an early compliance therewith expected:

EXPLOSIVES.

Explosives must be stored in magazine provided for that purpose alone. Said magazine to be placed far enough from working shaft, tunnel or incline to insure its remaining intact in event the whole stock exploded.

All explosives in excess of the amount required for a shift's work must be kept in the magazine. Under no conditions will the storage of powder in underground workings where men are employed be permitted.

Each mine must have a suitable device for thawing powder and keeping it in condition for use. The water or steam bath is the only absolutely safe device. By a water bath is meant the surrounding of a vessel contain-

ing the powder with another vessel containing water which can be kept at desired temperature. The thawing of powder with dry heat is unsafe. Dry heat, under the most favorable conditions, may exceed a temperature of safety.

Miners should not be permitted to carry powder in their boot legs or elsewhere about their person. A suitable place or places should be provided for preparing charges. At these points there should be a box or cupboard for caps and fuse. This should be securely fastened and so arranged that the caps cannot be jarred out or anything fall into the caps. A cap-crimper should be attached to the side of the cupboard with a small chain.

OILS, CANDLES, ETC.

The storage of oils, candles and other inflammable substances demand the erection of a house for that purpose and at a safe distance from the main buildings. They must not be stored with the explosives. Their removal for use, like the explosives, should be only in such quantities as are necessary to meet the requirements of a day.

FIRE PROTECTION.

All plants using steam, and especially small ones where boiler, engine, blacksmith shop and shaft are all under one roof, must have a hose and hose connection to injector or feed pump and keep same ready for instant use. The line of hose should be sufficient to reach the furtherest point of the plant. As a rule, the water supply in small plants is limited, and safety is largely dependent upon quick action. A few hand grenades hung about the plant in convenient places are great safeguards and should be indulged in. Heating stoves placed in shaft houses should receive even more care in safety equipments than is common in dwelling houses.

TIMBERING.

Next to explosives, inadequate timbering causes more fatality than anything about a mine. The general inclination is the use of too frail and few timbers. No

rule can be fixed for use of timber; the conditions must be met as they arise, and economy in timbering lies in doing well what is done. Strange as it may appear, taking districts as a whole, the best timbered mines are the most inaccessible and above timber line, and the poorest timbered mines are those located in the woods. Temporary work which endangers life is criminal, and mine operators who supply their timbermen with material below the standard asked for, assume very grave responsibilities.

CODE OF SIGNALS.

1 Bell—Hoist (when not in motion).
1 Bell—Stop (when in motion).
1—1 Bell—Lower.
1—1—1——1 Bell—With care, hoist (man on).
1—1—1———1—1 Bell—With care, lower (man on).

Other signals to meet individual demands can be arranged, but the code in full must be plainly printed and placed in the engine room, at the collar of the shaft and at each station or level, together with a notice and penalty for wrong or improper signals.

Wrong or improper signals should be treated vigorously. An employé ascending upon one bell or descending upon two bells should be discharged. In mines working more than one level, signal gongs or speaking tubes should be placed from level to level. The danger of an employé signalling the engineer without first knowing the location of cage or bucket is apparent. Where more than one level is being operated, special signals from lower to higher levels should be established. When established, the stopping of an up-going cage or bucket should be abolished. To illustrate this point: A signals to hoist from sixth to second level; as cage or bucket passes fourth level B stops it. The engineer is at a loss to understand; before executing one he has received another order. Let this be repeated several times and he becomes nervous. A rattled engineer is a dangerous attachment. It should be borne in mind that one bell does not mean "hoist until stopped" but "hoist to surface." Down-going buckets or cages are always

"slowed down" to each level, and can be stopped with impunity, but on up trips no one knows what signal is being obeyed and should not interfere.

THE BELL LINE.

The bell line should be so constructed that signals can be sounded clearly and easily from any station. This essential device is much neglected and should receive more attention. A few iron sheave wheels or rollers so placed that the line will stand clear of timbers is often all that is required.

At stations or levels where the line is used from both sides of the shaft, an attachment should be made so that reaching across the shaft for the line is unnecessary.

HOISTING AND LOWERING MEN.

The hoisting or lowering of employés with a cage or bucket should be permitted or positively prohibited. If permitted, a notice must be posted near collar of shaft, stating the maximum number who may use cage or bucket at one time. This limit is not jeopardized when the men go "on shift," but, unless fixed, may be exceeded at the end of the day's work.

The handling of men with a bucket is very dangerous, and its use is discouraged by this department as much as possible. To issue an order stopping the use of the bucket for handling men would, at the present time, work a hardship in some districts upon both the miner and mine owner, but should the work of the Bureau demonstrate the necessity, action will be taken and the practice stopped.

It is to be hoped that the next legislature will enact a law compelling all new enterprises to use a cage in shafts 200 feet deep and over.

A strict compliance with the section of this bulletin entitled "Daily Inspection" will be demanded of all mine operators hoisting and lowering employés.

DUMP GUARDS.

At the end of each dump tract, when a car is used, there should be a device to prevent the car going over

whether the load clears or not. It is generally supposed that a trammer can let go, but records show that while some do, the majority go over the dump with the car.

THE SHAFT COLLAR.

The shaft collar must be covered and so arranged that persons or foreign objects cannot fall in the shaft. When a cage is used, a bonnet which raises with the cage and falls back to place when the cage goes down must be arranged. This bonnet or shaft cover need not be tight beyond what would stop a small animal from falling in, but the cage in turn must be supplied with a steel bonnet, oval in shape, if solid, and if divided in the middle and hinged at the sides to admit sending down long timbers, the angles of the sides must not be less than 45°, nor the steel less than three-sixteenths of an inch thick.

When a bucket and wooden doors are used, the shaft must be housed in and covered with doors which stand at an angle of not less than 45° pitch, hinged at the lower corners and opening upward or outward. These doors should not be less than four inches thick.

STATIONS.

All stations should have a passageway around the shaft, so that crossing over the working department can be avoided. Where flat doors are used, a guard rail must be kept in place across the shaft and in front of the level, so that it will stop anyone walking or pushing a truck or car into the shaft.

Across the track at some convenient distance an obstruction should be placed, so that cars or trucks can not run by it and into the shaft, or trammers push cars by without removing same.

SINKING SHAFTS.

Shafts equipped with mechanical appliances must be of at least two compartments, and the timbering kept well up with the work.

When sinking and work upon levels above are being prosecuted at the same time, especial care must be taken

to protect men in bottom of shaft by placing close-fitting and strong doors in the working compartment and covering the ladder compartment with a plat, which will insure safety.

THE LADDER-WAY.

All shafts over fifty feet in depth should be divided into at least two compartments, and one compartment set aside for a ladder-way. The ladders should be sufficiently strong for the purpose demanded, and in vertical shafts should have landings at not more than twenty feet apart. The landings should be closely covered, except an opening large enough to permit the passage of a man, and the ladders should be so arranged that by no means could a person fall from one ladder through the opening to the next ladder. The ladders should be firmly fastened and kept in good repair. In incline shafts the landings should be put in as above described, but a straight ladder on the incline used.

The ladders in "upraises" or "winzes" from level to level should be likewise provided and kept in repair. Winzes or upraises are, after abondonment, very essential for ventilation and, in case of accident, very essential as a means of escape. Just as long as they are necessary for the one cause and may be needed for the other, they should be kept in repair and ready for use if required.

MILL HOLES AND WINZES.

All winzes and mill holes running from level to level should be covered or surrounded with guard rails, so that persons walking along cannot step or fall in. Winzes, as a rule, are upon one side of the main drift, and usually timbered a few sets above the drift level. Guard rails are easily placed about these. Mill holes, on the other hand, are often in the center of the drift. These must be securely covered with a door and kept covered.

EXITS, VENTILATION, SANITARY CONDITION.

As soon as practicable, all mines should have double or triple exits. Levels driven each way from the shaft

must be connected by upraises or winzes, equipped with ladders and kept in good condition. These connections aid ventilation and provide exits or means of escape in case of accident. Connections from first levels to surface should also be made, unless underground connection is made with adjoining properties.

Proper ventilation is of such vital importance to mine operators that it is well looked after as a general rule.

The sanitary condition about mines should receive careful attention. The use of abandoned stopes or drifts for closets should not be tolerated, and where meals are eaten underground, the scattering of scraps and refuse matter about levels or stopes should not be permitted.

At the isolated mine boarding house, arrangements should be made for the disposal of slops and refuse matter. It should be the duty of the foreman in charge to look well to the sanitary condition of the bunk house and the cleanliness of his men. A large proportion of the miners are cleanly, but some are not, and a few filthy men injected into a bunk house soon infect the whole, or cause the cleanly man to quit rather than submit to the filthiness of his enforced associate. The condition of a bunk house is almost a sure index to the class of men employed. A cleanly and orderly condition predicts a thrifty, wide awake and healthy crew, and vice versa.

THE INDICATOR.

Upon all plants handling men, the engine should be supplied with a positive indicator. By a positive indicator is meant a device that is geared positively to the drum shaft and moves a target or indicator just as certain as the revolution of the drum raises or lowers the bucket or cage. Indicators arranged to move a target by the use of a string or wire can not be depended upon, and are not as safe as marking the cable with a hemp wrapping or plant.

MINE VISITING.

The desire of persons to go underground, unaccustomed to mines and mining ways, should be discouraged.

It is a novelty, an experience to relate to friends at home, but an experience in which the dangers are little appreciated, and of which it may be truly said "ignorance is bliss." Were it within the province of this department to say who should and who should not enter mines, the line would be drawn sharply, and no one but employés or those having business would be admitted. Such a law would meet the hearty approval of all large mine operators, who appreciate the danger, trouble and expense to a company to be courteous; while the superintendents of smaller mines, whose better judgment is often overcome by a desire to please, would gladly take refuge and not assume the risks entailed.

UNDERGROUND SURVEYS.

Each and every mine should keep an accurate plat of underground workings and have same brought up to date at least once a month by competent engineers. No greater false economy can be practiced in mining than working upon the supposition that those in charge know just where drifts are. Where mines are adjacent, or working upon same vein, and water is encountered, the necessity is apparent and imperative.

BOILERS.

The bill creating the office of state boiler inspector makes mandatory provisions regarding the care of boiler or boilers and necessary reports to inspector. It further provides severe penalties for failure to comply with requirements. Mine operators using steam or other pressure should familiarize themselves with this law and its mandates and thereby insure the safety of all concerned.

THE MECHANICAL PLANT.

In the equipping of a mine with machinery, safety it too often sacrificed to false economy. When the expense of stops and repairs is taken into consideration, the very best machinery of a given capacity to be had, regardless of first cost, is the cheapest. It is well to bear in mind that competition in the mechanical line is so close that skilled labor, iron and steel, have a fixed

market value, and that in accepting a plant of a given capacity from one firm because its bid is $500 or $1,000 cheaper than another firm, the purchaser is simply buying that much less material or skill, and endangering the success of his enterprise.

THE MINE SUPERINTENDENT.

The duties and responsibilities of a mine superintendent covers a scope of requirements unequalled to any other professional calling. One of his most important duties is the formulating of a set of orders, the compliance with which will insure the safety of all under him. Fatal accidents can be too often traced to lack of mine discipline. Laws governing the employés about a mine should be as inexorable as in the regular army. Let the fact become established that failure to comply with regulations, however trivial, means loss of position, without recourse, and the safety of all concerned is almost assured.

THE MINE FOREMAN.

The mine foreman is practically the working superintendent, and upon him devolves the detail of practical mining. The welfare of his employers and the safety of their employés is largely dependent upon his good judgment, and he must of necessity be a thorough miner, a good timberman and a fair mechanic.

THE ENGINEER.

Too much care cannot be exercised in the choice of this officer. His responsibilities are grave and his work more wearing upon the nerves than the muscles. His cargo travels an invisible track and must be guided by hearing and feeling. Safety demands that his whole senses be on the alert and concentrated on his work. His surroundings should be comfortable in a room by himself, and under no circumstances should he be permitted to converse with visitors while his engine is in motion. A law should be enacted compelling all engineers to undergo an examination, grading them by certificates according to ability. Engineers upon mines who handle men should all carry first grade certificates.

DAILY INSPECTION.

All properties using mechanical appliances should be thoroughly inspected and reported upon daily. Some one man should be detailed to perform this duty at a given hour and make a written report. These reports should be filed and show that proper precautions are being taken. His duties should commence with the engineer, who will report the condition of the boiler, engine, cable, fire apparatus, etc. Then commencing at sheave wheel and testing all bolts and nuts on boxes and gallows frame; the cable fastenings and all things connected with cage, bucket, doors or bonnets; descending shafts slowly, examine the bell line, timbers, lining boards, stulls, skids, rollers, guard rails; at stations, doors, etc., etc. He should also ascertain the amount of powder and condition of warmers; ascending shaft by ladders the same care as to detail should be exercised. Also the condition of winzes, upraises and ladder-ways kept open for ventilation and exit in case of accident.

The observance of this provision will prevent accidents and prove economical. It does not debar those in charge from "keeping their eyes open," but they are less apt to see danger than one whose especial duty it is and whose position is dependent upon not overlooking it. This inspection can be made in comparatively short time, and at a time not to discommode the working of the mine.

CONCLUSION.

To those who may feel the above recommendations too exacting, I desire to say there is nothing advised which is not in constant practice upon the older and best managed mines in the state. Because a mine is not paying is no excuse for jeopardizing human life by makshift or temporary safety appliances. The common rule and the source of most all accidents is the desire to first "strike it rich and then make safe." The desire and duty of this department is to reverse the rule so it will read "first make safe and then strike it rich."

Any information desired regarding detail of matters herein set forth will be gladly furnished.

This bulletin was mailed generally throughout the state, and if the number of inquiries and protests form any criterion, it was generally read. So general was the inquiry, especially regarding explosives, that an answer was written and published. There being no fund or provision for the publication of bulletins, this letter was given to the daily press in Denver and the Engineering and Mining Journal of New York. Both bulletin No. 1 and this letter were reprinted in many publications, not only in the United States, but in foreign countries.

LETTER ON EXPLOSIVES.

Denver, February 7, 1896.

The issuance of bulletin No. 1 by the Mining Bureau has given rise to so much inquiry regarding explosives, that I respectfully ask the use of your columns to set forth some of the salient points of the manufacture, composition, use and abuse of the dynamite used in mining throughout the state. It will be my endeavor to avoid technicality and tersely as possible get at facts in a manner comprehensive to all.

Under the most favorable conditions, the manufacture of dynamite is a hazardous business, safety being entirely dependent upon the purity of materials used and the skill and care of the workmen employed. In the manufacture of explosives, as in all lines backed by American ideas and energy, the American product stands preëminent. Although the first plant was established in this country only a little over twenty years ago, the art has to-day reached that point of perfection, brought feats of engineering within the range of possibility and exerted an influence upon modern civilization which entitled it to take rank with the application of steam power.

The aim of the various powder companies is to supply a product which can be transported and handled with safety, give uniform results in blasting, keep in good condition when properly stored and, as far as possible, neutralize all poisonous fumes when exploded. The explosives used almost universally throughout Colorado are compounds having nitro-glycerine for a base, com-

monly called by the miner "30 per cent. powder" or "60 per cent. powder," according to the percentage of nitro-glycerine in the mixture.

The strength of the American nitro-powder is not, as is generally supposed, wholly dependent for force upon the amount of nitro-glycerine present in the mixture. The compound is composed of various elements which in manufacture not only absorb the desired amount of nitro-glycerine, but are in themselves explosives. In blasting, the exploder or cap, which is charged with fulminate of mercury, explodes the nitro-glycerine, and the nitro-glycerine in turn the remainder of the mixture. A line of experiments, conducted by experts, show that the force exerted by this combination exceeds that of the sum of the three exploded separately.

The American dynamite of to-day is not an accident, but is the result of a long line of careful experiments, conducted by eminent chemists, and demonstrated by practical tests. These tests, aided by great advance in the art of manufacturing, have demonstrated that the products can be handled with greater impunity than many other things common to transportation by common carriers. They have also demonstrated that the safety of the compound is dependent upon purity of materials used and care in mixing. During the past few years, competition among various powder companies has been so keen and bitter that gradually but steadily the cost of dynamite to the consumer has been reduced. It is a dangerous contest and a rivalry in which sooner or later, if continued, safety will be sacrificed. To be more explicit upon this point, skilled labor commands a certain price, likewise chemically pure nitro-glycerine. The two, being the most expensive parts in the compound of dynamite, combined the products in a safe mixture. Unskilled labor and impure nitro-glycerine can be had for less money, but the product of this combination is a mixture subject to decomposition. Decomposition in such a compound is practically explosion. Decomposition may not set in for some time, and the great danger of the competition in the manufacture and sale of dynamite is that of forcing some of the competitors

to use impure or cheaper materials and labor in order to meet a lower price and take chances upon decomposition not commencing before the stock thus manufactured is disposed of. This danger point may not, as yet, have been reached. The older powder companies have much invested and a reputation to maintain; the newer companies have much invested and a reputation to make. From the standpoint of safety, however, the bottom price is very little below the market price of to-day.

Powder should be stored in a dry, cool and well ventilated magazine, built for that purpose. A brick or stone magazine is preferable to a frame, both on account of being affected less by sudden changes in temperature and freed from any danger of bullets from careless marksmen. When built of wood, the frame or studding should be covered inside and out with boards and so set that the air can circulate all around, and the inner boards not be but little affected by the heat of the hot sun.

Caps should not be stored with powder.

Regarding the age of powder—When powder has proper care in manufacture and storage, decomposition will not set in. If there is no decomposition there is no chemical change and under these circumstances powder ten years old or older is just as good and safe to handle as powder ten days old.

Thawing powder—One of the main sources of accident is from thawing powder, and the only safe plan is the use of heat from hot water. The powder should not be dipped in the water but placed in a water-tight vessel and the vessel set in hot water, or have a regular powder warmer made. These vessels can be obtained from any of the mechanical firms or from the powder companies at nominal cost. Do not place powder under or on a stove or in the oven. Do not lay on boiler wall or on back plate of a boiler. Do not heat around a blacksmith forge or over a burning candle. Do not lay on hot sand, or, in short, do not thaw powder with dry heat. Do not consider these precautions unnecessary, or reason that because you have done so many times there is

no danger. An explosion is usually fatal, and numberless escapes in no manner reduces the explosive force.

Powder freezes at from 40° to 44° F.; explodes when confined, at from 320° to 360° F.; from a quick application of dry heat, powder is liable to explode at 120° F. A stick of powder heated to 120° F. can be held in the hand with little inconvenience, and this degree of heat is soon reached when placed under or about a stove.

That frozen dynamite is liable to explode from heat quickly applied has been demonstrated many times, and to ignorance, non-appreciation or carelessness of this fact most accidents are due. If you have heated powder about a stove for years without harm, consider yourself fortunate and stop it. If the warning of those who make the powder has no effect, let the accidents constantly occurring from this cause convince you. If you cannot procure a powder warmer, take a five-pound lard bucket, fill it with powder and set in warm water. If you have no warm water, put some sharp rocks in the bottom of a larger vessel to keep smaller vessel off the bottom, surround the inner vessel with water and set two lighted "snuffs" about an inch long under the big can, throw an ore sack over the whole, and in a short time the powder is in good condition for use and no risk been incurred. With slow heat thus applied, dynamite may be heated to temperature of boiling water with safety. Do not use frozen powder to load a hole. It is unfit for use. If it explodes at all it will do poor work. If it does not seemingly burn or explode it may be smoldering or decomposing, and the dropping in of a spoon, a drill or the stroke of a pick or hammer be sufficient to explode what is left.

Great care should be constantly exercised in preparing a charge and loading. The powder should be thoroughly thawed, cut from the wrapping and pressed firmly in the bottom with a wood tamping bar. The cap should be placed firmly on the fuse and crimped with a tool made for that purpose, not with the teeth, and then be well imbedded in a piece of powder and firmly tied in place, this then lowered to powder in bottom of hole, being first assured the fuse is amply long. In

tamping hole, commence with fine, soft dirt and press down carefully around cap, ever bearing in mind that a blow is liable to explode the whole charge. When the hole is filled four or five inches above cap, a little more force and a little coarser tamping may be used, but in filling and tamping keep the fuse stretched tight and keep straight against one side of the hole. Under no circumstances use an iron tamp bar or a drill. With dynamite the point to be accomplished is to tamp close enough to exclude the air. This can be done with a wooden rod, and when air-tight the execution of the blast will be as good as if the tamping had been driven home with a hammer.

Constant care in preparing charge and loading will avoid "missed holes." Next to warming powder with quick, dry heat, "picking out a shot" is the cause of the most fatal accidents. If a hole "misses," do not be in a hurry to return, and especially if the hole was tamped close. More accidents are caused from supposed missed holes than from actual. A small, sharp rock may be tamped into a piece of fuse so that the fire will not pass that point for hours, this is often mistaken for a "missed hole." The hole is picked out, this particular rock removed and an explosion follows. To fully demonstrate this, put some V-shaped clamps on a piece of fuse and see how long it will take to burn by certain points. Long after the fuse is supposed to be out, loosen the clamps and see how quickly it will "spit" at other end. Some holes do miss fire and have to be picked out. In these, great care should be exercised, and not clean down nearer than five inches of cap, then re-load with another charge, and instead of using a small piece of powder, use plenty. A heavy charge on top may destroy the effectiveness of the lower charge, but it will explode it and get rid of a bad job. If the "collar" of the hole is simply blown off, and lower charge has not broken to bottom of hole, do not drop in a drill or spoon to see how much hole is left, leave it alone as long as possible. The lower powder may have frozen and all may not have been consumed.

Caps are charged with fulminate of mercury, one of the most violent explosives and one of the most

unstaple, chemically, and may explode from the slightest jar or least amount of friction. The caps at all times should be stored well away from the powder, and at no time in or around a miner's pocket.

Powder should under no circumstances be stored under ground. Poor ventilation with damp air will produce decomposition, and decomposition, explosion.

There is practically no danger in transporting powder in cases, and especially when frozen. Even well thawed powder will not explode from any of the jars occasioned by a wagon haul or pack train. A case dropped several hundred feet upon rock might explode, but separate sticks would simply break out of the wrapper and no explosion follow.

Powder will burn in the open air and not explode, providing the gases generated in the adjoining powder from the heat of combustion have room to escape. For example: Place two boxes of powder side by side, open one and ignite, leave the other box closed. The burning box will not explode, but the heat will explode the closed box.

The utility of powder is due to its explosive force. Under certain conditions it will explode, under others it will not. Consumers who take pains to study the proper conditions are safe, those who will not must suffer the penalty for carelessness, which in mildest terms applicable is "criminal negligence."

Experience and later observation has shown the foregoing bulletin and letter not free from imperfections. They were compiled at a time when the mining fever was running high and every one who could was rushing into mining. Originality can not be claimed for either, they simply present a terse statement of the modes and systems in vogue upon the best regulated mines in the state, accompanied with the results of observation and personal experience. The bulletin should have been more complete and exemplified with practical illustrations, but under existing law this was not permissible.

The following tables show the number, cause and location of accidents which have received the attention of the Bureau since its establishment:

TABLES

SHOWING
THE

NUMBER, CAUSE AND LOCATION

OF ACCIDENTS

NUMBER, CAUSE AND LOCATION OF ACCIDENTS.

DATE	NAME	MINE	COUNTY	CAUSE OF ACCIDENT	FATALITY
1895					
May 31	A. P. Murphy	Suffolk	San Miguel	Caught between ore bin and tram car	Non-fatal
June 2	B. F. Griffen	Tom Boy	San Miguel	Electric shock, grounded current	Non-fatal
June 6	Charles Jobe	K. C. Humboldt	San Miguel	Falling from ladder down shaft, about 20 feet	Non-fatal
June 7	John Larson	Portland No. 2	El Paso	Falling down shaft. Guards were left open	Non-fatal
June 11[a]	John Graham	Squaw Mt. Tunnel	El Paso	Powder explosion. Loaded 9 holes. First exploded before finishing spitting	Non-fatal
June 12	James Barrett	Something Good	El Paso	Powder exploded. Spitt 3 holes. First exploded before he got away	Fatal
June 13	John Gaffney	Portland	El Paso	Falling timber in shaft	Non-fatal
June 16	Robert S. Price	Bachelor	Ouray	Falling rock in stope while picking down ore	Non-fatal
June 24	Richard Ballard	Genessee-Vanderbilt	Ouray	Falling rock from top shaft while descending in bucket	Fatal
June 25	Richard Edmundson	Columbia-Menona	San Miguel	Struck with tram car at bottom of incline	Non-fatal
June 24	S. O. Boothby	Pony Express	Ouray	Falling rock in stope	Non-fatal
June 21	Batista Diamonetta	Sleepy Hollow	Gilpin	Falling down shaft from bucket while being hoisted	Fatal
July 3	John Poppel	Climax Tunnel	El Paso	Powder exploded while he was picking missed hole	Fatal
July 26	Earnest Nicholas	Maid of Erin	Lake	Falling rock in stope	Non-fatal
July 21	Philio Gamble	Bobtail	El Paso	Falling from bucket down shaft while being hoisted	Fatal
July 21	Horace Seerby	Newell Shaft	Lake	Explosion while putting down hole near known unexploded blast	Fatal
Aug. 1	Hugh McVickers	Ibex	Lake	Returned before blast exploded	Non-fatal
July 26	John McMahon	Ulay	Hinsdale	Falling rock in stope	Non-fatal

July 27	Thomas McGrath	Orient Iron	Saguache	Falling rock in stope while drilling	Fatal
Aug. 10	Frank Hoadland	Silver Age mill	Clear Creek	Caught in belt pully while throwing off belt	Fatal
Aug. 12	Thomas Jackson	Penrose	Lake	Falling ground while cutting station	Non-fatal
Aug. 11	William Lane	Penrose	Lake	Falling ground while cutting station	Non-fatal
July 29	J. W. Elgin	Union M. and L. Co	Lake	Falling down chute, a distance of 68 feet	Fatal
Aug. 17	Ebin Rick	Quartz	Gilpin	Windlass rope broke while going down shaft	Fatal
Aug. 21	Thomas Lawson	Pike's Peak	El Paso	Falling down shaft, 170 feet	Fatal
Aug. 23	Hugh Trimbath	New Guston	Ouray	Caught between skip and shaft timbers	Fatal
Aug. 29	Peter Brunner	Missouri	Gilpin	Falling rock in stope	Fatal
Sept. 10	Alber H. Toney	Last Dollar	El Paso	Falling rock in stope	Fatal
Sept. 19	John A. McLean	Independence	El Paso	Falling rock from top of shaft	Fatal
Sept. 26	Clark McGinnis	Belgian	Lake	Explosion of powder 100 feet from where men were working, caused a fall of rock from the roof which closed the drift, thereby cutting off air circulation, retaining the poisonous fumes and gasses of the powder.	Fatal
Sept. 26	James H. Gray	Belgian	Lake		Fatal
Sept. 26	John Hamill	Belgian	Lake		Fatal
Sept. 26	Edward H. Kuhn	Belgian	Lake		Fatal
Sept. 26	George J. Maggs	Belgian	Lake		Fatal
Sept. 26	C. C. Phillips	Belgian	Lake		Fatal
Sept. 26	James Baxter	Belgian	Lake		Non-fatal
Sept. 26	Alex. Parker	Belgian	Lake		Non-fatal
Sept. 26	John Williams	Belgian	Lake		Non-fatal
Sept. 26	J. W. Reynolds	Belgian	Lake		Non fatal
Sept. 19	Wm. O'Sullivan	Mary Murphy	Chaffee	Stull gave way, burying him under ore.	Fatal

NUMBER, CAUSE AND LOCATION OF ACCIDENTS—Continued.

DATE	NAME	MINE	COUNTY	CAUSE OF ACCIDENT	FATALITY
1895					
Oct. 3	Ed. Meadley	Silver Lion	San Jaun	Returned before blast had exploded	Non-fatal
Oct. 3	M. Purdham	Silver Lion	San Jaun	Returned before blast had exploded	Fatal
Sept. 30	Frauk M. Cooney	Tom Boy	San Miguel	Falling headlong into fly-wheel of rock crusher	Fatal
Oct. 5	Edward Roberts	Buena Vista	El Paso	Picking out missed hole, left from previous day	Fatal
Oct. 6	Charles M. Elrick	Anchor	El Paso	Powder exploded while warming	Fatal
Oct. 15	S. J. Cunningham	Tom Boy	San Miguel	Cave of ground	Fatal
Oct. 19	John Salathiel	American Eagle	El Paso	Tamping hole with iron bar	Fatal
Oct. 19	J. S. O'Brien	American Eagle	El Paso	Tamping hole with iron bar	Non-fatal
Oct. 7	James A. Moore	Matchless	Lake	Drilled into missed hole	Fatal
Oct. 7	Murdock Morrison	Matchless	Lake	Drilled into missed hole	Fatal
Oct. 27	Archie McDonald	Ibex	Lake	Caught by cave or running sand while putting in post	Fatal
Oct. 27	James Tobin	Henriett	Lake	Falling rock in stope	Fatal
Nov. 3	Thos. H. Noison	Columbia-Menona	San Miguel	Picking out missed hole	Fatal
Nov. 10	Thomas C. Lyons	Jessie	Summit	Premature explosion of blast	Non-fatal
Nov. 7	Crist Anderson	Bison	Lake	Falling rock in stope	Non-fatal
Nov. 18	James Walsh	Virginius	Ouray	Powder exploded in Walsh's pocket at mouth of tunnel, cause of explosion unknown	Fatal
Nov. 18	Thomas Corrigan	Virginius	Ouray		Non-fatal
Nov. 18	Emanuel Starvetti	Virginius	Ouray		Non-fatal

Nov.	18	Robert Verder	Virginius	Ouray	Powder exploded in Walsh's pocket at mouth of tunnel, cause of explosion unknown	Non-fatal
Nov.	22	Pete Walker	Mollie Gibson	Pitkin	Block of ground gave way while placing mudsills	Fatal
Nov.	23	J. M. Marshall	Ibex	Lake	Caught by cage in shaft	Fatal
Dec	4	Joseph Plut	Little Johnny	Lake	Blast exploded while lighting fuse	Fatal
Aug.	29	Lui Paternoster	Americus	Gilpin	Drowned by sudden flooding of Americus mine by water from west, standing in Fisk workings	Fatal
Aug.	29	Acilo Avensinni	Americus	Gilpin		Fatal
Dec.	15	Samuel Laschy	Buena Vista	El Paso	Struck unexploded powder with pick	Non-fatal
Dec.	15	Dolphice Collins	Independence	El Paso	Caught between timbers and cage	Fatal
Dec.	18	John Keppeller	Missouri	El Paso	Slipped and fell on rail in level	Non-fatal
Aug.	29	William Prisk	Sleepy-Hollow	Gilpin	Drowned by water coming in from adjoining mine	Fatal
Aug.	29	Martin Ricono	Sleepy-Hollow	Gilpin		Fatal
Aug.	29	Stephen Valera	Sleepy-Hollow	Gilpin		Fatal
Aug.	29	Giovanni Pergher	Sleepy-Hollow	Gilpin		Fatal
Aug.	29	Ben Brocklebank	Sleepy-Hollow	Gilpin		Fatal
Aug.	29	Nicholas Vigus	Sleepy Hollow	Gilpin		Fatal
Aug.	29	Obid Pronse	Sleepy-Hollow	Gilpin		Fatal
Aug	29	James Harris	Sleepy-Hollow	Gilpin		Fatal
Aug	29	Nazarino Marietta	Sleepy-Hollow	Gilpin		Fatal
Aug	29	William Thomas	Sleepy-Hollow	Gilpin		Fatal
Aug.	29	Thomas Williams	Sleepy-Hollow	Gilpin		Fatal
Aug.	29	Thomas Carbis	Sleepy-Hollow	Gilpin		Fatal

NUMBER, CAUSE AND LOCATION OF ACCIDENTS—Continued.

DATE	NAME	MINE	COUNTY	CAUSE OF ACCIDENT	FATALITY
1895					
Aug. 31	John T. Hughes	Farnham	El Paso	Picking unexploded hole	Non-fatal
Aug. 18	John Steyens	Cashier	Gilpin	Bad air—gases	Fatal
Aug. 18	Thomas Flynn	Cashier	Gilpin	Bad air—gases	Fatal
Aug. 23	Henry Sedgwick	Dolly B	Lake	Engineer missed his mark	Non-fatal
Nov. 10	A. Lindquist	Tom Boy	San Miguel	Cave of ground	Non-fatal
Sept. 2	Martin Hatter	Tom Boy	San Miguel	Cave of ground	Non-fatal
July 26	James Moore	Ulay	Hinsdale	Falling rock in stope	Non-fatal
July 29	Antonio Paris	Silver Pick	San Miguel	Drilling into unexploded blast	Non-fatal
Sept. 28	D. L. Hunt	Divide	Gilpin	Returning before blast exploded	Non-fatal
Sept 29	Geo. S. Foisom	Elizabeth	Elbert	Plank falling down shaft	Fatal
July 28	Joseph Ladeneuer	Ulay	Hinsdale	Falling rock in stope	Non-fatal
Nov. 19	Charles Miles	Aspen	Pitkin	Cave in of ground	Fatal
Nov. 22	George Wilder	Commodore Tunnel	Mineral	Drilling into unexploded powder	Non-fatal
Dec. 27	John T. Barber	Annie C. Tunnel	Boulder	Explosion of blast	Fatal
1896					
Jan. 7	Wm. G. Williams	Strong	El Paso	Falling down shaft	Fatal
Jan. 7	Thomas Mourat	Morning Glory	El Paso	Blast exploded before he was hoisted to surface	Non-fatal
Jan. 7	Martin Pruett	Marion	Lake	Falling rock while timbering	Fatal

Jan.	3	John Cole	Union	San Miguel	Picking out missed hole	Fatal
Jan.	3	Benj. Mitchell	Union	San Miguel	Picking out missed hole	Non-fatal
Jan.	9	Leon Beauchet	Tenderfoot	El Paso	Thawing powder by hot sand process	Fatal
Jan.	9	Joseph Smith	Tenderfoot	El Paso	Thawing powder by hot sand process	Fatal
Jan.	10	William Corbin	Winze Tinze	El Paso	Drilled into unexploded hole	Fatal
Jan.	10	John L. Lapping	Winze Tinze	El Paso	Drilled into unexploded hole	Non-fatal
Jan.	9	Chas. A. Sutton	Tip Top	Gunnison	Falling rock in stope	Non-fatal
Jan.	9	B. C. Kelley	Tom Boy	San Miguel	Cave of ground	Fatal
Jan.	5	Thomas Phillips	Salisbury mill	Clear Creek	Caught by coat and arm in mill shaft	Fatal
Jan.	11	Antonio Rosseau	Indian Girl	Eagle	Loose brace fell down shaft, striking him on head	Non-fatal
Jan.	13	Edward A. Wise	Black Wonder	El Paso	Thawing powder under stove	Non-fatal
Jan.	13	James Maxwell	Black Wonder	El Paso	Thawing powder under stove	Fatal
Jan.	9	John McCormack	Forepaugh	Lake	Falling from bucket down shaft	Fatal
Jan.	9	Benj. B. Taylor	North Star	Gunnison	Falling rock in stope, while timbering	Fatal
Jan.	16	M. Donavon	Penrose	Lake	Falling rock down man-way	Fatal
Jan.	27	John Signa	Mammoth	Gilpin	Falling roller dropping out of shaft	Non-fatal
Jan.	13	Stefan Wienewski	Cashier	Gilpin	Falling to bottom of shaft while attempting to get in bucket	Fatal
Jan.	27	John Harvey	Cashier	Gilpin	Struck cap, picking out missed hole	Non-fatal
Jan.	27	Bortollo Mattivi	North Star	San Juan	Falling rock from foot-wall	Fatal
Jan.	4	Thomas H. Sheldon	Anna Lee	El Paso	Caving in of shaft	Fatal
Jan.	4	Wm. E. Loane	Anna Lee	El Paso		Fatal
Jan.	4	Thos. H. Harnan	Anna Lee	El Paso		Fatal

NUMBER, CAUSE AND LOCATION OF ACCIDENTS—Continued.

DATE	NAME	MINE	COUNTY	CAUSE OF ACCIDENT	FATALITY
1896					
Jan. 4	John Mallory	Anna Lee	El Paso	Caving in of shaft	Fatal
Jan, 4	Jos. Densmore	Anna Lee	El Paso		Fatal
Jan. 4	Pat Mee	Anna Lee	El Paso		Fatal
Jan. 4	Jas. Hancock	Anna Lee	El Paso		Fatal
Jan. 4	Mike McGurk	Anna Lee	El Paso		Fatal
Jan. 4	Marshall Kistler	Bohn	Lake	Struck with rock from blast	Non-fatal
Feb. 5	Erick Beker	Union	Lake	Falling down man-way	Fatal
Feb. 2	Asa Webb	Japan	San Miguel	Hang-fire shot	Fatal
Feb. 2	Edward Ingersall	Japan	San Miguel	Hang-fire shot	Non-fatal
Jan. 31	James Purmort	Giles	Boulder	Drilled into missed hole	Non-fatal
Jan. 31	Charles Purmort	Giles	Boulder	Drilled into missed hole	Non-fatal
Feb. 10	Samuel Leslie	Robinson	Ouray	Knocked down shaft by cage	Fatal
Feb. 10	John Owens	Portland	El Paso	Struck by tram car at trap door top of ladder way	Non-fatal
Feb. 12	John Leonard	Bushwacker	Pitkin	Falling rock in stope while drilling	Non-fatal
Jan. 30	James A. Wheeler	Frontinac	Gilpin	Picking and drilling out missed hole	Non-fatal
Feb. 10	James Greco	Ulay	Hinsdale	Powder exploded while tamping hole	Fatal
Feb. 17	Pierce Powers	Fritzhaugh	Lake	Refiring missed hole	Fatal
Feb. 18	Orvill Sheek	Buena Vista	El Paso	Falling down shaft while timbering	Non-fatal

Feb.	23	Michael Shea	Bushwacker	Pitkin	Carried down chute while cleaning it out	Fatal
Feb.	19	A. A. Van Deren	Muldoon	Douglas	Tunnel caved in while timbering	Fatal
Feb.	23	J. W. Donnelly	Free Silver Shaft	Pitkin	Caught between cage and shaft timbers	Fatal
Feb.	27	Joseph Wuhr	Black Girl	Ouray	Premature blast	Non-fatal
Jan.	19	J. D. Sullivan	Cleveland	Lake	Thawing powder in oven of cook stove	Non-fatal
Jan.	19	Gelindo Leonesi	North Star	San Juan	Box of caps exploded	Fatal
Mch.	4	J. Weichselbaumer	Ute and Ulay	Hinsdale	Jumping on tram car	Non-fatal
Mch.	11	Jas. W. Searle	Columbia Menona	San Miguel	Falling from mill frame	Non-fatal
Mch.	15	John Aldgrin	La Plata	Lake	Premature blast	Fatal
Mch.	16	Benj. Bosworth	Jennie B	Larimer	Hanging wall caved in	Fatal
Oct.	19	L. J. Arrick	Burlington	Eagle	Falling from bucket down shaft	Fatal
Mch.	23	E. Kohlberg	Union	San Miguel	Pulled car off cage while in motion	Fatal
Mch.	13	Edward Hosking	Sleepy Hollow	Gilpin	Falling timbers	Non-fatal
Feb.	12	Frank Langles	Sleepy Hollow	Gilpin	Falling rock	Non-fatal
		Wm. Burley	Sleepy Hollow	Gilpin	Falling rock	Non-fatal
Mch.	25	John Mills	Sleepy Hollow	Gilpin	Falling rock	Non-fatal
Mch.	13	John Murchison	Mollie Gibson	Pitkin	Struck with stick from circular saw	Fatal
Mch.	27	John Hay	Little Daisy	El Paso	Shaft house frame blew down	Fatal
Mch.	27	John Hannan	Little Daisy	El Paso	Shaft house frame blew down	Non-fatal
Apr.	3	James A. Purmort	Giles	Boulder	Tamping powder with iron bar	Fatal
Apr.	3	Giles L. Rice	Giles	Boulder	Tamping powder with iron bar	Fatal
Apr.	5	Mort Branson	Giles	Boulder	Tamping powder with iron bar	Fatal

NUMBER, CAUSE AND LOCATION OF ACCIDENTS—Continued.

DATE	NAME	MINE	COUNTY	CAUSE OF ACCIDENT	FATALITY
1896					
Apr. 8	John Bolam	Argentum	Pitkin	Falling from platform in engine room while oiling sheave	Non-fatal
Apr. 9	George James	Mollie Gibson	Pitkin	Caught between cage and shaft timbers	Non-fatal
Apr. 16	Edwin Judkins	Lost Annie	El Paso	Vertigo. Falling down shaft	Fatal
Mar. 28	Marion Murdock	Gem Extension	Clear Creek	Falling rock in stope	Non-fatal
Apr. 1	James Baker	Grand Central	Boulder	Bale broke letting bucket down shaft	Non-fatal
Jan. 15	Allen McLeod	Belmont	San Miguel	Cave of ground in stope	Non-fatal
Apr. 5	Niell O'Donnell	Phoenix-Burroughs	Gilpin	Trolley wheel ran over his foot	Non-fatal
Apr. 5	Chas. R. Stewart	Bohn	Lake	Falling down shaft while hoisting No. 7 pump	Fatal
----------	Wm. Truan	Saratoga	Gilpin	Falling rock in stope	Non-fatal
Apr. 8	James A. Ryan	Geyser	Custer	Falling rock in station	Non-fatal
Apr. 8	James Scott	Tom Boy	San Miguel	Caught in chain of pulley block	Non-fatal
Jan. 28	Gust. Marken	Tom Boy	San Miguel	Picking out missed hole	Non-fatal
Apr. 9	G. H. Brockett	Tom Boy	San Miguel	Cave of ground	Non-fatal
Jan. 19	Chas. Dahlstrom	Tom Boy	San Miguel	Powder exploded while loading hole	Non-fatal
Jan. 19	John Swanson	Tom Boy	San Miguel	Powder exploded while loading hole	Non-fatal
Apr. 15	S. K. Benedict	Ute and Ulay	Hinsdale	Rope broke attached to tram car. Car jumped track	Non-fatal
Apr. 22	Andrew Hector	Albro	Clear Creek	Falling rock in stope	Fatal
Apr. 22	A. L. Stephens	Albro	Clear Creek	Falling rock in stope	Non-fatal

April 15	Ewell Cross	Bull Domingo	Custer	Struck with cable	Non-fatal
April 27	Martin Hawkins	Revenue Tunnel	Ouray	Falling ground in stope while repairing same	Fatal
April 27	Peter Buckley	Victor	Gunnison	Quick fuse	Non-fatal
May 7	Olof Nelson	Spot Cash	Lake	Falling rock from roof of drift	Fatal
May 7	Thomas Dugan	Portland	El Paso	Falling talc from roof of stope	Non-fatal
May 6	Wm. Curnow	Bon Air	Lake	Falling rock while timbering	Fatal
May 9	Ed. Doran	Victor	El Paso	Picking out missed hole	Non-fatal
May 5	Mike D. Ryan	Forest Queen	Lake	Timber falling down shaft	Fatal
May 9	John S. Reed	Utica	Boulder	Struck by descending skip	Non-fatal
May 2	John O. Parry	Crown Point	Clear Creek	Plank fell down shaft	Non fatal
May 9	John W. Thomas	Lamartine	Clear Creek	Falling rock in stope	Non-fatal
May 15	John Carlin	Mineral Farm	Pitkin	Falling rock in stope	Non-fatal
May 17	Wallace Colby	Henriette	Lake	Falling dirt in drift	Non-fatal
May 17	Herman Brendle	Kansas-Burroughs	Gilpin	Falling rock in stope	Non-fatal
May 22	Lewis Caumo	Cimerron	San Miguel	Falling wall in stope	Fatal
May 22	Samuel A. Thompson	Lucky Guss	El Paso	Hammer slipped from handle while striking	Fatal
June 9	M. J. Geary	Argentum	Pitkin	Fell while timbering raise	Non-fatal
June 10	James Bullock	Hiawassee	Hinsdale	Hammer struck rock and glanced	Non-fatal
June 19	Thomas L. Brown	Come Up	Hinsdale	Drilled into unexploded blast	Non-fatal
June 19	C. L. Sugmand	Come Up	Hinsdale	Drilled into unexploded blast	Non-fatal
June 19	Andy E. Caroline	Old Lot	Gunnison	Falling from carpenter's trestle	Fatal
June 22	Nick Peterlin	Queen of the West	Gilpin	Falling down shaft	Fatal

NUMBER, CAUSE AND LOCATION OF ACCIDENTS—Continued.

DATE	NAME	MINE	COUNTY	CAUSE OF ACCIDENT	FATALITY
1896					
June 22	Virgin Berkey	Inter-Ocean	Boulder	Slipped from ladder, fell down shaft 125 feet	Fatal
July 1	Samuel E. Shafer	Windfield	Fremont	Cave in of side wall of shaft	Fatal
July 9	John Turnquist	Tom Boy	San Miguel	Flying rock from blast	Non-fatal
July 9	W. C. Hayes	Columbia-Menona	San Miguel	Falling rock in stope	Non-fatal
July 12	James E. Lyon	Bachelor-Commodore	Mineral	Rope broke while adjusting cable	Non-fatal
July 14	Wm. Trevithan	Tom Boy	San Miguel	Falling down up-raise	Non-fatal
July 14	John Newton	Nautauge	Clear Creek	Falling rock	Non-fatal
July 14	W. R. Hart	Tom Boy	San Miguel	Insecure staging	Fatal
July 13	Olin H. Adams	Columbia-Menona	San Miguel	Falling rock from wall	Non-fatal
July 18	S. Olevetta	Revenue tunnel	Ouray	Took hold of live electric wire	Fatal
July 7	Chris Johnson	Valley View	San Miguel	Premature blast—short fuse	Non-fatal
July 17	J. Hillegher	Rebecca	El Paso	Falling from shaft into sump	Fatal
July 18	Wm. Cleff	Golden Ocean	El Paso	Bucket drawn through sheave wheel	Non fatal
July 20	James Rundle	Smuggler-Union	San Miguel	Falling rock in stope	Fatal
July 24	J. H. Shay	Smuggler Union	San Miguel	Falling rock in mill hole	Non-fatal
July 22	Gustaf Moberg	Stanley	Clear Creek	Falling rock in stope	Fatal
Aug. 9	Geo. Blackwell	Tom Boy	San Miguel	Falling rock in stope	Non-fatal
July 10	John Sherman	Tom Boy	San Miguel	Falling rock in stope	Fatal

May	30	Geo. Reynolds	Tom Boy	San Miguel	Struck with hammer while drilling	Fatal
Aug.	14	Chas. Lowdenback	Columbia-Menona	San Miguel	Falling rock from hanging wall, loosened by blast	Non fatal
July	29	J. Navallo	Columbia	San Miguel	Falling rock in stope	Non-fatal
Aug.	15	Richard Phillips	Durant	Pitkin	Discharge of box of caps	Non-fatal
Aug.	24	A. A. Pollard	Pelican	Clear Creek	Falling scale in stope	Non-fatal
Aug.	23	J. D. Harris	Empress Josephine	Saguache	Falling down shaft into sump	Fatal
Aug.	23	J. W. Campbell	Smuggler	Pitkin	Falling down timber chute	Non-fatal
Aug.	23	James Bowers	Smuggler Union	San Miguel	Insecure staging	Non-fatal
Aug.	23	J. A. Claque	Smuggler-Union	San Miguel	Insecure staging	Non-fatal
July	11	B. J. Elliott	Galena	Gilpin	Caught his hand in drum hoist	Non-fatal
Aug.	31	S. Heggman	Mary Murphy	Chaffee	Falling down shaft	Fatal
Sept.	17	D. MacLeod	Independence	El Paso	Drilling into unexploded blast	Fatal
Sept.	17	Wm. W. Leadborough	Independence	El Paso	Drilling into unexploded blast	Fatal
Sept.	19	N. W. Smith	Jo Reynolds No. 2	Clear Creek	Caps and powder exploded while preparing to load	Fatal
Sept.	18	Joshua Sipes	Toledo	Gilpin	Ground caved in stope	Fatal
Sept.	17	John McKenna	Sweet	El Paso	Fell from bucket down shaft while being hoisted	Fatal
Sept.	20	Park Parkinson	Buena Vista	El Paso	Falling rock in stope	Non-fatal
Sept.	20	Fred A. Patton	Buena Vista	El Paso	Falling rock in stope	Non-fatal
Sept.	8	Wm. Short, Jr	New Jersey	Gilpin	Ladder gave way—he fell to bottom of shaft	Non-fatal
Sept.	10	Wm. Lynn	Smuggler	Pitkin	Falling rock in stope	Fatal
Sept.	24	John Kraft	Tom Boy	San Miguel	Falling rock from up-raise	Non-fatal
Sept.	19	A. J. Peterson	7-30	Clear Creek	Picking out missed shot	Fatal

NUMBER, CAUSE AND LOCATION OF ACCIDENTS—Continued.

DATE	NAME	MINE	COUNTY	CAUSE OF ACCIDENT	FATALITY
1896					
Sept. 19	Samuel Brathan	Gem Extension	Clear Creek	Falling rock in stope	Non-fatal
Sept. 22	John Hoffman	Nellie Hoffman	San Miguel	Premature explosion	Non-fatal
Oct. 3	Carl Peterson	Stonewall Jackson	Summit	Falling from bucket while ascending shaft	Fatal
Oct. 9	Edward Anderson	Modoc	Boulder	Falling rock in stope	Fatal
Aug. 10	Lem Childers	Bachelor	Ouray	Falling rock in stope	Non-fatal
Oct. 9	George Myers	Centennial	Clear Creek	Falling down shaft with bucket	Fatal
Sept. 30	Basilio Bertoldi	Crown Point	Gilpin	Falling rock from wall	Non-fatal
Aug. 10	A. D. Taylor	Bachelor	Ouray	Fall of loose ground	Fatal
Aug. 10	Thomas Kane	Hobo	El Paso	Picking out old hole loaded with frozen powder	Non-fatal
Oct. 7	J. W. Curren	Gold Coin	El Paso	Ladder broke, he fell to bottom of shaft	Fatal
Jan. 4	John Kenney	Columbia	San Miguel	Tram-cable broke and fell upon him	Non-fatal
July 24	Frank Ferando	Terrible	Ouray	Falling rock in stope	Non-fatal
Jan. 10	J. Brown	Arcade	Gilpin	Insecure staging. Fell to botton of shaft	Non-fatal
Jan. 11	Andrew Rossau	Cleveland	Eagle	Falling timber from bucket of rubbish	Non-fatal
Jan. 15	Allen McLeod	Tom Boy	San Miguel	Falling mineral in stope	Non-fatal
Jan. 26	H. R. Morris	Little May	Gunnison	Thawing powder on blacksmith forge	Non-fatal
Jan. 27	M. Doan	Near Victor	El Paso	Picking out missed hole	Non-fatal
Feb. 6	Harry Tyler	Last Dollar	El Paso	Fell from bucket while being hoisted	Non-fatal

Jan. 5	Andy Morton		El Paso	Accidental explosion of blast	Non-fatal
Feb. 6	John Martin	Atchison	Boulder	Falling down shaft	Non-fatal
Feb. 12	Pat Casserly	Lawrence Mine	El Paso	Thawing out powder in stove oven	Non-fatal
Feb. 12	Michael Flaherty	Elkton	El Paso	Caught between cage and side of shaft	Non-fatal
April 13	William Curran	Saratoga	Gilpin	Falling rock in stope	Non-fatal
April 11	Matt O'Brien	Suderburg	Gilpin	Fell down shaft 100 feet	Non-fatal
April 5	Ralph Hardy	Magnolia Shaft	El Paso	Bucket caught in cribbing, rock fell, striking him on head	Fatal
April 1	Harry Stull	Era	El Paso	Thawing powder over forge fire	Non-fatal
April 1	Joseph Wiggins	Era	El Paso	Thawing powder over forge fire	Fatal
April 1	Wm. C. Caskey	Era	El Paso	Thawing powder over forge fire	Fatal
April 12	J. D. O'Donnell	Gold Exploration	El Paso	Explosion of air pipe	Non-fatal
Feb. 24	Edwin Goodwin	Good Looks	Boulder	Cave of rock and dirt in tunnel	Non-fatal
Feb. 29	Wm. Sheetf	Carbon	Clear Creek	Cave of rock and dirt in tunnel	Non-fatal
April 14	Martin Davey	Monitor	Gilpin	Falling rock in stope	Non-fatal
April 20	Tom Zabra	Chase	Gilpin	Bad air	Fatal
April 21	E. Christian	Weldon	Lake	Falling ore from chute	Fatal
April 30	John Roberts	Rocky Mt. Tunnel	Gilpin	Falling rock in stope	Fatal
May 11	Ed. Duncan	Victor	El Paso	Struck missed hole, which exploded	Fatal
May 13	Ed. Pullham	Robert Emmett	Gilpin	Falling from bucket down shaft	Non-fatal
May 18	John Curley	Rigi	El Paso	Powder exploded in sand pump	Non-fatal
May 26	Geo. W. Cook	Keno	Lake	Falling down ore bin	Non-fatal
June 10	John Lee	Lee stamp mill	Gilpin	Caught hand in machinery while oiling	Non-fatal

NUMBER, CAUSE AND LOCATION OF ACCIDENTS—Concluded.

DATE	NAME	MINE	COUNTY	CAUSE OF ACCIDENT	FATALITY
1896.					
June 20	Hort Owings	Theresa	El Paso	Drilled into unexploded blast	Non-fatal
July 7	P. J. Hagerty	Holy Cross	Eagle	Cave in of the mine	Non-fatal
July 15	Wilson Lyle	Claude	El Paso	Fell from bucket while being hoisted	Fatal
July 21	J. W. Case	Ruby	El Paso	Knocked off bucket while being hoisted	Non-fatal
Feb. 26	Thomas Johns	Pheonix-Burroughs	Gilpin	Falling down ore chute	Fatal
Aug. 10	Tim O'Neil	Doris	Lake	Overcome by bad air	Fatal
Aug. 22	Harry Dunn	C. C. & Gold Tunnel	El Paso	Premature blast	Fatal
Aug. 4	Pete Monteith	Smuggler-Union	San Miguel	Fell from electric pole	Fatal
Oct. 19	Neil Boyle	Della S	Pitkin	Blast exploded while lighting fuse	Non-fatal
Oct. 18	Jerry Donnally	Smuggler	Pitkin	Tram car jumped track	Non-fatal
Oct. 20	Wm. Richardson	Geneva	El Paso	Falling through ladder-way	Fatal
Oct. 17	John Hauli	Lost Lode	San Miguel	Explosion while carrying powder	Fatal
Oct. 24	David Williams	Little Diamond	El Paso	Drill fell from top of shaft	Non-fatal
Oct. 18	Joe Oterto	Revenue Tunnel	Ouray	Loose rock fell from overhead in stope	Non-fatal
Oct. 19	John Pearce	Champion	Gilpin	Fell down shaft a distance of 15 ft	Non-fatal
Oct. 18	Jacob Franks	Queen of the West	Gilpin	Fell down shaft 20 ft	Non-fatal
Oct. 24	Mike Lamb	Last Dollar	El Paso	Knocked off of scaffold while taking down rock	Non-fatal
Oct. 26	C. F. Beecher	Ibex	Lake	Cave of ground	Fatal

Feb.	3	Frank Fox	Dollie B.	Lake	Explosion while spitting fuse	Non-fatal
Oct.	27	Frank Ginoli	Ajax	San Juan	Falling ore in stope, jarred loose by blast	Non-fatal
Oct.	28	Charles Oates	Alps	Gilpin	Falling rock	Non-fatal
Oct.	29	Frank Clough	Bachelor	Ouray	Glancing blow of ax while timbering	Non-fatal
Oct.	31	Charles Nelson	Caledonia	Ouray	Cave in of the dump	Fatal
Nov.	2	Joseph Jones	Corydon	Gilpin	Falling rock from side of drift	Non-fatal
Nov.	3	Nathan B. Quick	O. K.	El Paso	Picked out missed hole	Fatal
Nov.	3	Clarence Hood	O. K.	El Paso	Picked out missed hole	Fatal
Nov.	4	Wm. Collicott	Saratoga	Gilpin	Falling rock	Non-fatal
Nov.	5	Louis A. Brown	Mokane	El Paso	A shot failed to explode with other shots and going back to see the cause when explosion occurred	Non-fatal
Nov.	5	Harmon Shepard	Mokane	El Paso		Non-fatal
Nov.	6	Barth Albasini	Silver H.	Gilpin	Falling down shaft	Non-fatal
Nov.	8	Henry Mueller	Irish Mollie	El Paso	Missed hole being picked out	Non-fatal
Nov.	9	George Flagg	American Eagle	El Paso	Picking out missed hole	Fatal
Nov.	29	Fred Ohlig	Silver Lake	San Juan	Took hold of live electric wire	Fatal
Nov.	20	Campbell Taylor	Grizzly Bear	Ouray	Falling rock from wall while timbering	Non-fatal
Nov.	22	Chas. A. Henderson	Anchoria-Leland	El Paso	Drilling into known unexploded blast	Non-fatal
Nov.	22	Jean Leabo	Anchoria-Leland	El Paso		Non-fatal
Nov.	22	Harvey Forrest	Anchoria-Leland	El Paso		Non-fatal
Nov.	24	J. M. Malgren	Dead Horse	El Paso	Explosion of box of caps	Non-fatal

TABLE OF ACCIDENTS.

Cause of Accident.	Fatal.	Non-Fatal.	Total.
Falling material—			
Falling rock in stope and drifts	27	48	75
Falling rock, timber, etc., down shaft	5	8	13
Falling rock when timbering	7	2	9
Total	39	58	97
Men falling—			
Falling from ladder	5	5	10
Falling down shaft	10	6	16
Falling from bucket	7	4	11
Falling down winze or mill hole	3	7	10
Total	25	22	47
Machinery—			
Caught by cage and other machinery	12	7	19
Water—			
Water from adjoining mine	14	0	14
Shaft—			
Cave in of shaft	8	0	8
Explosives—			
Explosion, before through igniting fuse	5	7	12
Explosion, picking out missed hole	9	9	18
Explosion, before being hoisted	1	0	1
Explosion, drilling into or near unexploded hole	7	12	19
Explosion of caps	1	2	3
Explosion, returned before all blasts exploded	2	8	10
Explosion, thawing frozen powder	6	5	11
Explosion, using metal tamp bar	5	3	8
Explosion from caps and powder in pocket	1	3	4
Explosion while preparing charges	2	0	2
Explosion, unaccountable	6	5	11
Total	45	54	99

Miscellaneous—			
Injury from tram-car	0	6	6
Electric shock	2	1	3
Bad air	4	0	4
Struck with hammer while drilling	1	1	2
Insecure ropes and cables	3	2	5
Insecure staging	0	4	4
Overwinding cage or bucket	0	2	2
Cleaning down ore chute	1	0	1
Struck with rock from blast, failed to give warning	0	3	3
Missed footing, fell in level	0	1	1
Bursting of air-pipe	0	1	1
Total	11	21	32
Grand total	154	162	316

To transcribe the record giving detail of each of the above accidents would exceed the limit of pages permitted by statute, therefore, nothing beyond a terse statement of the most striking cases will be quoted.

ACCIDENTS FROM FALLING ROCK.

Accidents from falling rock are hard to deal with, for the reason that safety and avoidance of accident from this cause depends upon the individual judgment of the miner. In none of the above cases have the owners, managers or lessees of the various properties been charged with neglect, failure or refusal to furnish all material necessary for making safe. There is and must of necessity be an element of risk to the miner every time he returns to work after firing a round of holes. A large portion of the burden given the blast is broken free and clear of back or breast of drift or stope as the case may be, but another portion is shattered and hanging, and is taken down by the miner with pick and gad. This work is the source of nearly all casualties from falling rock, and is found to be due almost wholly to carelessness on the part of the miner in ascertaining before commencing his work whether or not the blasts have

loosened the rock above or at the sides. No one appreciates the danger more than the miner, and yet carelessness, almost criminal, is indulged in until accident occurs. Whether this carelessness be due to over zeal, born of a desire to see how effective the blasts have been, or to oft repeated exposure to danger, cannot be ascertained.

The non-fatal accidents are found to be caused usually from comparatively small portions of rock which have been shattered and remain hanging from one to four feet behind the breast or bottom of blast. The miner begins the work of picking down near the breast, the shattered pieces fall and an accident is recorded.

In the various mines of the state all characters of ground are found, classed by the miner as "good" or "bad" ground. It is generally supposed that "bad" or treacherous ground causes most accidents. Such, however, is not the case. "Bad" or "running" ground is usually placed in the hands of the best miners, and accidents from this character of ground are rare as compared with the comparatively "good" ground. The danger of a cave or slip of ground, large enough to produce fatality, it not always easy to determine. The fissure veins, as a rule, cut the formation at nearly right angles. If the formation cut by a vein lies horizontal, the vein stands perpendicular, and little trouble is found in sustaining the walls with stulls, if anything at all is required. As a rule, however, the formation lies at an angle with the horizon and the vein has a corresponding dip or pitch from the vertical. This produces a hanging and foot wall to vein. If the hanging wall be intact, one solid rock mass, supported at top and bottom of drift, it is safe, but if, as is generally the case, the wall is fractured and broken in large blocks, or by so-called "slips," the danger is apparent. These large blocks may, when "sounded" by the miner in the usual manner, appear safe, owing to their size, and yet be apt to fall out at any moment when the far end of the "slip" is reached, and the key or sustaining wedge removed. The same principle will apply to the ground or vein stuff above, if large, blocky and running in slips.

Of the twenty-seven fatal accidents herein reported, the foregoing is a general description of the cause. This demonstrates the greatest danger in mining and should emphasize the importance of the employment of none but skilled miners and the devising of some method by which the constant admonition of the foreman to "watch the ground," "take no chances," would be constantly heeded.

As an example of over zeal on the part of the miner, the accident to Alex D. Taylor, on August 10, 1895, at the Bachelor mine, Ouray county, may be quoted. Mr. Lem Childers, the superintendent, found Mr. Taylor taking down ore under a block of ground he considered unsafe, and calling his attention to it told him to take the rock down. Mr. Taylor thought the rock would hang until he had the ore picked down, but was again told to take it down. Mr. Childers, after going through all the stopes, returned to where Taylor was working and found him still taking down ore. He passed under the rock and told Taylor he must not work there but take the rock down. He had just finished the sentence when the rock fell, killing Taylor instantly and breaking Mr. Childers' leg. While this is an aggravated case, investigations have shown that in a number of cases the orders of the superintendent or foreman were not heeded and accidents followed. This indicates a lack of discipline that should not exist. The person in charge should, if he issues orders, enforce them immediately. He is responsible, and men who presume to argue or use their own judgment after receiving instructions, should be summarily discharged.

TIMBERMEN.

Acidents to timbermen require little comment. Their labor is the making secure of unsafe places and their escapes from injury almost miraculous. As a rule, they work in pairs, and while one watches the other works, both ever on the alert for the unexpected. While their escapes are many, the record of seven deaths out of nine accidents shows that when caught the result is usually fatal.

SHAFT ACCIDENTS.

Accidents from falling bodies down shafts are, as a rule, due to carelessness of some one working above. Men working in the bottom of a shaft or ascending or descending upon a bucket have little chance to protect themselves. The following brief record will be of interest:

On June 24, 1895, at the Genessee-Vanderbilt mine, Ouray county, at the end of a tunnel driven several hundred feet into the mountain, an excavation was made and a hoister and gallows frame erected. From this point a vertical shaft was sunk 700 feet. The shaft was well timbered, two compartments, working shaft well lined. Richard Ballard and John Sheehan were descending upon the bucket. At about 300 feet below the collar of shaft, a rock about the size of an ordinary tea cup, which had fallen from the top, struck Ballard on the head, crushing out one-half of his brain, which was found in the bucket, knocking him from the bucket, where he fell the remaining 400 feet to the bottom of shaft. There is no doubt that Mr. Ballard was instantly killed, his fall being incidental.

On September 19, 1895, at the Independence mine, Cripple Creek, rock was being hoisted, five men in the bottom engaged in sinking. The bucket dumper failed to close door over shaft and in dumping bucket the rock went down shaft. John A. McLean, with another man, got on bucket to go to the bottom to ascertain the extent of injuries to their fellow workmen. At 100-foot level, the cross-head above bucket caught on rock which had lodged from that dumped into shaft. The rock was jarred loose, struck McLean and knocked him from bucket, and he fell a distance of 400 feet, striking on an iron bucket in bottom of shaft, causing instant death.

On January 16, 1896, at Penrose mine, Leadville, M. Donavon and G. Richards were returning to work at top of sixty-foot upraise, where they had fired shots before going to supper. Richards went up ladder to re-

move boards covering upraise, which in this class of work are placed so as to prevent rock falling down man-way and breaking ladders. In removing the boards, a 200-pound rock fell down man-way, striking Donavon, killing him instantly, who, not waiting for the signal, had started to ascend.

EXPLOSIVES.

Accidents caused by explosives demonstrate either a recklessness or ignorance bordering on criminality. There is no doubt that drilling into and picking out missed holes cause some explosions, but investigation and experiments have led to the conviction that in most cases the real cause is "slow fuse."

Fuse is so constructed that the central punk or filling, when once ignited, is hard to extinguish. Its speed in burning may be retarded, but if left alone long enough it will in most cases eventually burn through. The tests made to determine this were as follows: Take two pieces of fuse, same length, leave one free, pass the other through a series of iron clamps and screw down tight. Ignite both at same time and note difference in time it requires for fuse to burn through. Next, take some iron clamps, with one side V-shaped, pass fuse through a series of these and screw down tightly, that is to say, using as much pressure as fuse will bear without being cut into. Ignite this and note results. It may require a little patience, but if the experiment is carefully conducted, instances will result where fuse, several hours after it is supposedly extinguished, will be found to have burned through. Instances of retarding burning fuse as above will be found to be the exception, not the general rule, and it must be borne in mind that accidents from explosives are the exception, not the rule, otherwise the use of high explosives would not be tolerated. A miner loads a hole with considerable care. At first the powder is pressed in bottom of drill hole, the cap and fuse are lowered and covered with fine tamping. When the cap is securely covered, the fuse is drawn tightly to one side of the drill hole, coarser tamping used and more power in packing exerted. A series of

small, irregular, angular rocks may therefore be so combined under pressure by this process as to form a parallel case with the V-shaped clamps.

A miner picking out a "missed hole" or supposed "missed hole," proceeds with great caution. He has no intention of getting nearer than four to six inches of the cap, and having drilled and loaded the hole knows well when this point is reached. But in removing the tamping he may relieve the pressure at certain points which retards the burning fuse, and an explosion follows.

In this connection, the accident at the Japan mine, Telluride, on February 2, 1896, will prove of interest.

A cross-cut was being driven, five by seven and one-half feet in the clear, and air drills were used. It was customary to fire a round of fifteen holes, equally distributed over the breast. The day shift fired at 5 p. m. and counted thirteen shots. This fact was reported to the night shift, who took the usual precaution in looking after missed holes. This investigation developed nothing dangerous, and they proceeded to "muck back" the rock from shots, set up drill column and commenced drilling their round of holes. After events showed that the blast in the right hand lower corner had not exploded. Three holes were drilled immediately over this missed hole, viz., top, breast and upper cut holes. The drill was then swung to the other side of column and the top and breast holes were drilled on left side of tunnel. The drill was again changed and the "center back hole" (a hole at the top and center of tunnel) was being drilled when an explosion occurred with fatal results to Asa Webb and serious injury to E. L. Ingersoll. The explosion occurred five hours after the fuse had been lit by day shift, and the only reason that can be assigned is that of slow fuse.

That fuse is retarded in speed of burning is further demonstrated by the above table, which shows that ten miners, all of whom were experienced, concluded some of their shots had missed fire and returned just in time to receive discharge of blast, proving fatal in two instances and serious injuries to the other eight.

The "slow fuse" belief is again strengthened by investigating and closely questioning the survivors of "missed hole" accidents. Without exception, exery one has stated positively that great care was being exercised; that the spoon used for removing tamping could not have come in contact with the cap; the nearest approach to cap with spoon admitted being four inches, the remainder varying from six to twelve inches.

Twelve accidents, five fatal and seven non-fatal, have been investigated, caused by miners attempting to light too many blasts at one time and remaining too long after lighting the first one. This delay is usually caused by the "spitting" of the fuse, which necessitates lighting a match to relight a candle to ignite remaining charge. Delays of this kind are not always taken into consideration by the miner or he would use longer fuse to provide more time.

The thawing of powder has been productive of eleven accidents, six fatal, five non-fatal.

Chas. M. Elrick, Anchor mine, Cripple Creek. Ten years' experience in mining. Warming powder before a fire. Explosion. Fatal.

James Maxwell, Black Wonder mine, Cripple Creek. Fifteen years' experience in mining. Ten sticks of powder warming under stove. Explosion, killing Maxwell, injuring E. A. Wise.

W. C. Coskey, Era mine, Cripple Creek. Thawing powder at forge. Explosion; lived two hours. Also caused death of J. Wiggins.

At Tenderfoot mine, Cripple Creek, Leon Beauchet, two years a miner, and Joseph Smith, ten years a miner. Thawing powder with previously heated hot sand. Explosion; fatal to both.

Edward A. Wise, Black Wonder mine, Cripple Creek. Thawing powder under stove. Non-fatal.

J. D. Sullivan, Cleveland mine, Lake county. Five years a miner. Thawing powder in oven of cook stove. Lost right hand.

H. R. Morris, Little May mine, DuBois mining district. Powder warming on blacksmith forge. Probable loss of both eyes.

P. Cassidey, Lawrence mine, Victor. Warming powder in oven of stove. Seriously injured.

Harry Stull, Era mine, Cripple Creek. Thawing powder over forge fire. Injuries serious.

The accident to John Cole and Benjamin Mitchell at the Union mine, Telluride, is deserving of special attention. Cole was a miner of thirty years' experience, and Mitchell fifteen years. Firing a round of holes upon leaving, one missed fire. The following morning some of the tamping was removed and an attempt made to fire the lower charge by reloading in the ordinary manner. A report followed and they supposed the lower charge had exploded, but on returning to work they found the powder "burning." They again retired and waited one hour. Upon again returning there was no evident sign of danger, and they felt confident that what powder did not explode had burned out. Cole took a spoon in his hand, dropped it into the hole, an explosion followed, with fatal results to Mr. Cole and serious injury to Mr. Mitchell.

There can be no doubt that this accident was due to frozen powder and should prove a warning to others. The blast remaining over night, the powder was frozen. The top charge, therefore, only exploded the cap in the lower charge. This cap being near the top of charge had cleared the hole of tamping. The heat generated by the explosion of the cap started decomposition, requiring only a jar to complete, viz., explosion, which was provided by the dropping in of the spoon.

While the use of an iron bar or drill for tamping a charge is in all places prohibited, and the danger is fully appreciated by the miner, yet this office records eight accidents from this cause, five fatal, three non-fatal.

From the careless handling of caps, one death; two, serious injury.

From carrying caps, powder, etc., in pocket, one death, three men injured.

From the keeping of caps and powder in one place for men to prepare charges, two explosions of powder and caps, two deaths.

Under the caption of explosives, unaccountable, the records show eleven accidents, six fatal, five non-fatal.

The six fatal accidents occurred at the Belgian mine, Leadville, being caused by suffocation, brought about by an explosion of powder and the consequent fall of rock shutting off air current. This company had their powder magazine underground, and used for thawing a five-gallon oil can, cut open at sides, the can covered with sand and the sand heated by short candles or "snuffs." It was at first supposed that the cause of explosion was from this powder warmer, which exploded the powder being warmed, and this explosion in turn exploded the magazine. This theory is made very doubtful by the evidence of one of the survivors, who states there was no powder on the warmer at the time of the explosion. If this be true, credence of which is strengthened by other details, this explosion can only be accounted for on the ground of decomposition, produced by lack of proper air and ventilation.

This explosion caused the death of six men and injury of four others, and whatever may have been the cause, its reoccurrence should be avoided by absolutely prohibiting the storage of powder underground.

In addition to the above abuses in the handling of powder may be added thawing powder by dipping in boiling water, heating over a candle, thawing upon back plates of boiler. In one instance, two boxes (100 pounds) were found upon back plate of boiler, "so as to keep good and hot for use." The boxes were so hot they could not be handled with naked hands. Immediately below it were ten more boxes. The order to remove was resented by the person in charge, who said he "had done that for four years and never had an explosion." That no casualties from these causes are as yet of record in this department may be classed as accidents bordering on the miraculous.

The study of high explosives develops much difference of opinion among experts. Explosions occur; the causes are largely matters of theory. During the past few years great advancement has been made, and it is logical to expect greater advancement in the future. The

nitro-compound, commonly called "powder" in Colorado, is not an accident, but the result of years of careful research under the management of the best talent obtainable. The result of this labor and research is a compound possessing great explosive force and at the same time one that can be utilized when handled with ordinary care. It is safe to assert, however, that no powder expert, who of all others appreciates the safety of nitro-powder, could be induced to work with the average Colorado miner. The above table and notes on the handling of explosives in the state, demonstrates either an ignorance or carelessness demanding careful consideration.

SHAFT ACCIDENTS.

The Anna Lee disaster at Victor, on January 4, 1896, caused by the caving in of the main working shaft and killing eight men, is a warning that should be heeded.

The Anna Lee had sunk a shaft upon and near the center of a pipe of ore, elliptical in form and many times larger than the shaft. This ore was removed and the working shaft was sustained by square setts, braced in all directions against the sides and ends to a depth of several hundred feet.

The investigation showed that this network of timber had been causing considerable trouble for some time prior to the accident; that the day before the accident another run of ground was threatened in one of the levels of the Portland, and the general superintendent was giving that his personal attention, considering it the more dangerous of the two; that the evening before the accident he had a conference with the superintendent of the Anna Lee, who reported same in bad condition, and at that time told him he could not leave the Portland to help him, and if in his judgment the place was unsafe, to pull the pump, take the men out and shut down. These same instructions were given the same evening by the general manager to the night foreman. The night foreman had but a short time prior been superintendent and had but recently been succeeded in that position by the superintendent then in

charge. He, therefore, felt loth to assume the responsibility of closing down the mine and concluded to carry out the instructions of the superintendent in cutting hitches and adding new timbers. He testified that a short time prior to the time for quitting shift there was a movement so alarming he left men on to report same to superintendent when he came in the morning, also his belief that the place was unsafe and he thought they ought to stop work, together with the general orders he had received from the general manager. The superintendent received this word, but descending shaft to see progress made by night shift, he found his orders executed and felt a few more braces would secure the ground. He accordingly placed his men to execute the work. The general manager was evidently uneasy and to satisfy himself went to the property and descended into the shaft. He left shaft about fifteen minutes prior to the accident, and testified that upon leaving the shaft house he felt confident from his talk with those in charge that the impending danger had been arrested.

MEN FALLING.

Accidents from falling from ladders are found to be caused by feet slipping, hands slipping, or ladders, ladder-ways or supports giving away. The records how five fatal and five non-fatal accidents. The fatal accidents are caused by improper construction of ladders, the same having no landings, and where landings exist, not placed so as to arrest the fall, but permit the unfortunate to go through to the bottom.

The fatal accident to James W. Curry, at the Gold Coin mine, Victor, was caused by faulty construction of ladder. The cribbing around collar of shaft had been raised preparatory to placing hoister. This necessitated overhauling the ladders and made ladders eighty feet long. Two new ladders were placed at top and connected with lower ones. These had been in use several days. Mr. Curry was descending, and when a few feet from top stopped to speak to some one. Taking hold of rung with both hands, he swung himself back to look up, the rung pulled off and he fell to bottom. An

investigation proved these ladders to be constructed of good, clear material and safe, the sides being made of two by four-inch select lumber and rungs of one by four-inch select lumber. It further proved that the carpenter in constructing ladder had failed to nail one end of the rung which pulled out with Mr. Curry and caused his death.

The coroner's jury empaneled to investigate the above case, censured the Bureau of Mines for "neglect of duty." In conversation with one of the jurymen after the verdict, he said: "Censuring your department was absurd, but some one had to be censured, and your's being a political office was conceded to be the best mode to withdraw attention from the mine management."

Stephen Weimeyski, Cashier mine, Gilpin county. Missed his footing in geting in busket and fell 100 feet. Fatal.

Edwin Judkins, Lost Annie mine, Victor. Fell from plat in shaft while driving nail, thirty-five feet; cause, vertigo. Fatal.

J. Helligher, Rebecca mine. Cripple Creek. Pushed tram car into shaft, falling in after it. Fatal.

J. D. Harris, Empress Josephine mine, Bonanza. He and partner lowered trap door at level to protect men in bottom. After firing shots they returned and opened trap door, then went to place of safety and awaited smoke to clear. Harris started to return to work, and it is supposed forgot about opening the door, and walked into shaft. Fatal.

Thomas Lawson, Pike's Peak mine, Altman. Was tramming. Level equipped with flat door. He received empty bucket on track, opened door and went to breast and loaded bucket, returning, pushed same into shaft and fell in with it a distance of 170 feet. Fatal.

W. G. Williams, Strong mine, Cripple Creek. Was assisting timbermen in shaft. Started down ladder for square and it is supposed took hold of rope to slide down to drift, and in so doing pulled rope out of pulley and was precipitated thirty-five feet into drift below, causing instant death.

Batista Diamonatti, Sleepy Hollow mine, Black Hawk. Deceased and partners were at station in the dark, the lights having been extinguished by blasts. Men coming up on bucket called to be stopped; deceased gave signal as requested. The bucket was stopped, and when lights were procured was missed and afterwards found in bottom of shaft. Supposed to have fallen in shaft and under guard rail after having given the signal. Fatal.

S. Heggman, Mary Murphy mine, Bromley. Had had no experience in mining, just been employed as helper to the blacksmith and as "tool nipper." Went with the shift boss into the mine to learn his duties. They had gathered together dull steel and were returning to shaft, but the trammers stopped headway. The shift boss told him to wait until the trammers got out of the way. Shift boss heard a slight noise and later discovered Heggman had fallen down shaft. Fatal.

George Meyers, Centennial mine, Georgetown. Had twenty-two years' experience in mining. Had been leasing but had decided to quit and had gone down after his tools. How the accident happened no one can tell. It is supposed he left the door up, placed the tools in the trolley bucket used in the level and got in the bucket to ride to the shaft. He, bucket, tools and all were found in bottom of the shaft. Fatal.

Ralph Hardy, Magnolia shaft, Cripple Creek. Ore bucket caught in cribbing, dislodging a large piece of rock which fell on Hardy's head, mashing the skull. Lived two hours.

John Larson, Portland No. 2, Victor. Shaft guards at level had been left up. Larson walked into shaft and fell eighty feet. Not seriously injured.

Orville Sheek, Buena Vista mine, Cripple Creek. Timbering in shaft, fell fifteen feet, breaking three ribs. Not fatal.

John Martin, Atchison mine, Boulder. Fell down shaft breaking shoulder. Not fatal.

A. W. Elgin, Union Leasing and Mining Company, Leadville. Was tramming. Stepped into ore chute and fell sixty-eight feet. Fatal.

Erick Beker, Union Leasing and Mining Company, Leadville. Was working in upraise, stooped to remove plank preparatory to descending. Lost his balance and fell a distance of fifty feet. Lived one hour.

Thomas Johns, Phœnix-Borroughs mine, Central City. Throwing ore from stull in stope. Lost his balance and fell fifty feet. Lived two days.

W. Richardson, Geneva mine, Cripple Creek. Trap door of ladder-way was left up. Deceased stepped through, falling a distance of 150 feet. Fatal.

One fell down ore chute a distance of ten feet, two ribs broken, non-fatal.

One fell down timber-chute, injured back and shoulder, non-fatal.

Three accidents by falling down upraises, one fell a distance of thirty feet, one a distance of twenty feet and one a distance of ten feet, resulting in one broken arm, two sprained ankles.

The main cause of accidents either from falling down shafts, chutes or mill holes is due to the fact that fences or safety appliances, so that men cannot walk into same, are not constructed, or the carelessness of employés by leaving bar or door up where the same are in place. Many accidents would be avoided were more rigid discipline enforced, making the miners more careful of the welfare of their companions and compelling the mine owners to place safety appliances so that it would be impossible for men to walk in. Where it is essential for circulation of air to keep the trap door over the ladder-way open, a guard rail should be provided or a door should be constructed of slats strong enough to prevent its breaking, and with opening enough to admit free circulation.

A very simple device and one which would save the life or serious accident to many in the course of a year, would be the placing around stations and at the head of ladders large iron staples, made wide enough in the span to afford a good hand hold and the driving of these

staples in a place most convenient for starting down or up a ladder and getting into or out of a bucket at the stations.

Seven fatal, four non-fatal, total eleven, is the record of men falling from buckets while being hoisted.

Phillip Gamble, on the Bobtail mine, of The Portland Gold Mining Company, at Victor. Cause, got on bucket to be hoisted, overloaded same contrary to the warning of his fellow workmen and standing orders of the company; knocked from bucket by a roller at a point 350 feet from bottom where incline shaft changed to vertical. Fatal.

John McCormack, Forepaugh mine, Leadville, was with companion ascending shaft with lumber to repair shaft. When point was reached to stop, let go of cable with both hands to reach for bell cord, lost his balance and fell a distance of 100 feet. Instantly killed.

L. F. Arrick, Burlington mine, Red Cliff. Feet slipped. Fall of thirty-seven feet from bucket. Lived two days.

Thos. McKenna, Sweet mine, Cripple Creek. Deceased was hoisting from bottom to surface. The engineer threw off friction and failed to apply brake, falling a distance of 137 feet. Fatal.

Carl Peterson, Stonewall Jackson mine, Breckenridge. Deceased was being hoisted to surface with windlass, having two picks and two miners' candle-stocks in his hand, one foot through loop at end of rope. Lost his hold and fell head first, about forty-five feet down shaft. Fatal.

W. Lyle, Claude mine, Cripple Creek, was being hoisted away from lighted blasts, lost his hold on rope and reached the bottom of the shaft at time blast exploded. Fatal.

Of the non-fatal accidents, two fell out when near the bottom, causing broken arms; one was knocked from bucket by timber, broken arm; one was being hoisted away from lighted blast, fell off bucket, breaking arm, but succeeded in getting in the bucket again and was hoisted out before blast exploded.

MISCELLANEOUS.

As a rule, the metalliferous mines in the state are fairly well ventilated; good air being essential to the good work of the employés. In Gilpin county there seems to be a gas or gases which are opened up as work progresses in driving a level or stoping ahead. Just what this gas is has not been determined, although efforts have been made to procure some and have a determination made. It is probably carbonic acid and may be in liquid form, which is liberated by the blast, and sometimes in sufficient quantities to produce fatal results. In the cases from Gilpin county, the air a short time prior to the accident was reported by the miners as being good. One case from Lake county. A miner on going into deserted workings was overcome with the gas, and in his attempt to reach surface fell into a sump and was drowned before aid could reach him.

Accidents caused by engineers overwinding cage or bucket.. No fatalities. One sprained ankle, caused by jumping from the cage, the other a broken arm from being hoisted into sheave wheel.

CAGE ACCIDENTS.

The main cause of cage accidents is found to be faulty bell or signal lines. It is a fact worthy of attention that in many of the deep mines throughout the state, the signal lines are so arranged that it requires all the power possible for one man to exert to give the required signal, and usually, where men are being handled, two men are used to give the proper signal. This is entirely unnecessary, and a little time and expense upon the part of the management would rectify same so that men at stations could give the signal easily, or men ascending or descending between stations could grasp the line and stop the cage or bucket.

Another cause is overloading cage, so that in being hoisted the men on the outside are crowded and caught under projecting timbers in shaft. Were the working

shaft lined or a limit of number to be hoisted, established and enforced, accidents of this kind would be reduced, if not avoided entirely.

Accidents from being caught in machinery or falls from staging demonstrate the necessity of more careful fencing of fly wheels, etc., and more carefully constructed ladders and staging for oiling and repairing sheaves and other overhead machinery.

Three accidents, no fatalities, are on record, caused by miners failing to give their brother workmen notice of blasting.

From the breaking of windlass rope and cage cable, two fatal accidents are recorded and two non-fatal.

From insecure staging in mines, no fatalities, four accidents.

WATER.

On the afternoon of August 29, 1895, at 4 p. m., word reached the Bureau regarding a disaster at Sleepy Hollow and Americus mines, located at Black Hawk, Gilpin county, Colorado.

Everything possible was done to devise ways and means to stop the rising water and save the lives of some of the men underground. The mine not being equipped with pumps, the buckets were run to full capacity and a crew of men put to work with view of placing pumps in the incline of the Bob Tail. It soon developed that the Bureau had no funds available for paying for the work. Further, that there was no other department of state from which funds could be drawn for this purpose. The work was accordingly stopped, and what had been done paid for by the officers of the Bureau.

A consultation was held with the mine owners affected by the disaster, and it revealed the fact that each was willing individually to do all possible, but owing to misunderstanding and litigation of long standing, no collective action could be gained.

On September 1, a joint meeting of all interested was held in Denver, and after several hours it was agreed that if the Bureau would furnish pumps, equitable arrangements would be made for operating same,

and that each would, in addition, run the buckets in each shaft to full capacity. Prior to the arrival of the Palmer pump, one of the pumps belonging to the Bob Tail company was refitted, lowered to place and put to work, making fair headway in lowering the water. On September 16, the Palmer pump was lowered to place and connected, and proved even better than was expected.

On September 20, the body of Thomas Williams was recovered in the Sleepy Hollow. On September 28, the water was lowered to the 500-foot level of the Sleepy Hollow, and the bodies of Martin Ricona and Stephen Valero were recovered. The body of William Prisk was recovered on October 7, at the 600-foot level. On October 9, the body of Thomas Carbis was recovered at the 600-foot level. The bodies of Nazareno Marriatta, James Harris and Ben Brocklebank were recovered October 10, between the 600 and 700-foot levels, in the ladderway. On the night of October 10, the bodies of Pergher Grovani and Nick Vigus were found at the 700-foot level. And on the night of October 11, the bodies of Obid Prouse and William Thomas were found at the 700-foot level east.

The pumping and hoisting by buckets was continuous until October 17, at which time, through a misunderstanding, or the inability of parties of interest to agree as to division of expense incurred by further pumping, the Palmer pump was removed from the incline and hoisting of the water stopped. Several meetings of the mine owners followed, having in view, not only the recovery of the remaining bodies, but perfecting an amicable arrangement which would be permanent in character and enable all to operate their respective properties. An agreement was finaly effected, new machinery ordered, put in place and pumping resumed on November 15. On December 30, 1895, the last two bodies were recovered from the Americus mine, viz.: Olibk Paternoster and Acchile Avanvini.

On February 6, 1896, the water having been lowered sufficiently to permit examination, the Commissioner of Mines again went to Black Hawk, and per agreement

there met Prof. P. H. Von Deist, who had been chosen to represent the Sleepy Hollow and insurance companies. In company with S. V. Newall, representing the Americus, the point where the water broke through the bottom of the Americus drift was examined. The opening was six feet long, with an average width of eight inches. The drift was ordered cleaned up and opening enlarged so as to permit entrance to workings below. Ascending to the 390-foot level, the opening was examined through which the water poured into the Sleepy Hollow workings. Accompanied by Prof. Von Deist, the Sleepy Hollow workings were examined.

Word was received on the 9th of February that the workings in the Americus were clear and that an engineer would join in the work and represent the Americus company. The Americus engineer failing to put in an appearance on the 10th, little was done until February 12, when the underground workings of the Americus were surveyed, the same being a joint survey of three, and connection made with Sleepy Hollow and Bob Tail tunnel.

Investigation showed that the managers of both the Americus and Sleepy Hollow mines were aware of the presence of the large body of constantly rising water in adjoining properties. Further, that care was taken to determine the thickness or extent of the pillar of ground between the Americus and Mabee-Fisk workings; that at the conclusion of this determination it was conceded that the pillar was of sufficient strength to safely retain the water in the Mabee-Fisk workings; that the matter was discussed by the miners and they all felt assured the water could not break through the pillar of ground, but that there was a possibility of the water eventually seeping through, and that this would give ample warning of danger.

The managers of the Americus and Sleepy Hollow were positive in their statements of ignorance of any workings underneath or within the end lines of their territory, and evidenced this statement by personal visits to their mines, assuming the same risk as that assumed by the miners.

The opening between the Americus and Sleepy Hollow, which caused the death of twelve men, was made with the knowledge of both companies. The Americus had extended their drift within the end line of the Sleepy Hollow, following what they claimed to be the Blythe vein. The Sleepy Hollow raised their stope and made connection. Whether this connection was made with or without the consent of either or both parties it matters not. Having been made, and being very advantageous to both mines for ventilation and affording a double exit. Inspector John H. Talbot, on July 3, 1895, having visited the property, gave the following order, the same being on record in book 1, page 11, general records of this Bureau:

Central City, July 3, 1895.

HARRY A. LEE,
Commissioner of Mines.

Sir: The following recommendations were made by me to the management of the Sleepy Hollow Company, Central City, Gilpin county, Colorado:

That all loose ground near the ladder-way from the 500-foot level to a point of connection with the Americus mine, be secured; also, that good and safe ladders be placed therein. Said ladder-way to be used as a means of exit from the Sleepy Hollow mine through the Americus to the surface.

(Signed) JOHN H. TALBOT,
Inspector.

On January 6, 1896, the coroner's jury returned a verdict charging "negligence upon the part of The Sleepy Hollow Mining Company in not providing necessary and efficient means of exit and escape from the mine in case of accident," and "extreme negligence upon the part of The Americus Gold Mining Company."

The preponderance of evidence established the ignorance of the Americus and Sleepy Hollow management as to the presence and extent of the drift and stope run from the Mabee-Fisk 600-foot level, and raised to within four feet of the bottom of the Americus drift. It further established the fact that danger from rising water was appreciated; that steps were taken to determine the actual danger, but owing to ignorance the real danger

was unknown and not appreciated. It appears beyond reason to suppose that men knowing the extent of the water and the pressure exerted, both of which facts were known to the managers of the Americus and Sleepy Hollow mines, would for a moment continue to visit and operate a mine with only four feet of rock between them and certain death.

NUMBER ENGAGED IN MINING.

Counties.	No. Men.
Arapahoe	1,152
Archuleta	45
Boulder	1,353
Conejos	27
Chaffee	482
Clear Creek	1,312
Custer	189
Costilla	18
Dolores	356
Douglas	135
Eagle	162
El Paso	3,575
Fremont	477
Gilpin	2,160
Gunnison	704
Hinsdale	432
Huerfano	23
Jefferson	35
Lake	3,984
Larimer	86
La Plata	410
Mineral	336
Montezuma	45
Ouray	1,167
Pueblo	1,660
Park	381
Pitkin	1,500
Routt	128

Rio Grande	75
San Juan	1,351
San Miguel	1,105
Summit	412
Saguache	268
Total	25,545

The above represents the average number of men employed during the whole year, and does not include employés in general offices of the corporations, the mining and consulting engineers, who maintain their own offices, the United States deputy mineral surveyors, the mining brokers or promoters of mining sales or those owning and operating properties, but giving their time to other vocations.

Many of the districts in the above counties are in the prospective stage of development and are operated spasmodically and not continuously during the year. Owing to this fact, absolute accuracy as to the number employed per annum is impossible. Practically, however, the above number is correct, and represents the average of several compilations at different seasons of the year.

The 25,545 here accounted for may be divided as follows:

Underground miners, timbermen, trammers, etc.	15,924
Topmen, engineers, ore assorters, trammers, carpenters, etc.	3,466
Mill men, smelters, sampling works	5,061
Teamsters and packers	1,094
Total	25,545

Or as follows:

Persons employed under ground	15,924
Persons employed above ground	9,621
Total	25,545

For the purpose of showing the percentage of accidents sustained by those engaged in metalliferous mining in Colorado, the table of accidents reveals:

	Fatal.	Non-Fatal.	Total.
Number of accidents under ground....	142	146	288
Number of accidents above ground....	12	16	28
Total	154	162	316

This, however, is for a period of eighteen months. Reduced to twelve months or one year gives:

	Fatal.	Non-Fatal.	Total.
Number of accidents under ground....	95	97	192
Number of accidents above ground....	8	10	18
Total	103	107	210

Average number of men employed per annum.....	25,545
Number of accidents per annum per 1,000 men employed..	8.22
Average number of men employed per annum under ground	15,924
Number fatal accidents per annum per 1,000 men employed underground.....	5.966
Number non-fatal accidents per annum per 1,000 men employed underground.....	6.091
Number accidents per annum per 1,000 men employed under ground.....	12.057
Average number of men employed above ground.....	9,621
Number fatal accidents per annum per 1,000 men employed above ground.....	0.321
Number non-fatal accidents per annum per 1,000 men employed above ground.....	1.039
Number of accidents per annum per 1,000 men employed above ground.....	1.870

In order to show the mortality in Colorado metalliferous mines, where mining is permitted *ad libitum*, as far as statutory restriction is concerned, as compared with old mining districts, controlled and operated under stringent legislative acts, the following is submitted:

	Deaths per 1,000 Per Annum.
Prussia, 1867 to 1881	1.446
Great Britain, 1874 to 1884	1.595
Great Britain, 1884 to 1894	1.417
Great Britain, 1895	1.36
Victoria, 1894	1.79
Tasmania, 1894	1.47
New South Wales, 1895	1.25
Queensland, 1895	1.24
Germany, 1894	1.18
Colorado, 1896 (under ground)	5.966

A review of the above adds strength to the adage, "Comparisons are odious."

Some action to reduce casualties should be taken. Mining in Colorado has passed the experimental stage and mining operations should be restricted at least to the compulsory observance of fixed rules, and having the practical work of mining under the charge of competent mining men or mining engineers. The mining regulations in vogue in Colorado to-day are those established by custom, and the observance of these customs is taken for granted.

To this cause, this taking for granted, which has a tendency to breed carelessness upon the part of both the management and the miner, most accidents can be traced. The mine management should be commanded by statute to provide certain appliances and enforce certain regulations. The miner likewise should be compelled to contribute to his safety. There is or should be a point where the liability of the mine owner ceases and that of the miner begins.

To attain this point is not an easy proposition, and it cannot be done in a day. Metalliferous mining in the state has been so long conducted *ad libitum* that official interference, especially in small plants, is viewed as interference with personal rights. On large plants this is not the case, for several reasons. Large mines are under the direct control of mining men or mining en-

gineers of many years' experience. They fully appreciate that one great factor in financial success is the safety of their employés. Fixed rules are in vogue governing the employés and these rules are enforced. In other words, there is an enforced discipline upon most of the large mines in the state, which results in comparatively few accidents. To make this condition of affairs general, rather than the exception, is one of the gravest duties of the Bureau. This can be attained by a set of rules enacted by the legislature, setting forth mandatory provisions regarding matters about mines, which by experience are shown to be dangerous to those employed and of too common practice. It is not expected that these rules will be perfect, but the same can from time to time be amended as necessity requires.

A review of the number and character of recommendations made and accidents recorded will show the prevalence of abuses. The number of places working throughout the state precludes the possibility of two inspectors covering the whole each year and promulgating a set of rules for each mine or prospect. With a view of making the Bureau of Mines more effective in its work, assisting it in promoting safe methods in mining, and relieving it of too great detail, the suggestions under the head of "Recommendations" are respectfully submitted.

STATEMENT OF DISBURSEMENTS OF THE BUREAU OF MINES APPROPRIATION.

Appropriation 1895-6		$14,167.00
Commissioner of Mines, salary	$ 3,823.88	
Commissioner of Mines, expense account	678.00	
Inspector John H. Talbot, salary	612.50	
Inspector John H. Talbot, expense account	255.09	
Inspector A. C. Morrison, salary	2,225.00	
Inspector A. C. Morrison, expense account	827.60	
Inspector L. N. White, salary	1,625.00	
Inspector L. N. White, expense account	541.25	
Clerk hire	1,547.50	
Incidental office expense	970.00	

Paid counsel	300.00	
Covers for show cases	30.00	
Drayage, expressage, specimens, hauling, packing and arranging specimens	712.62	
Balance	18.56	
	$14,167.00	$14,167.00

GENERAL OBSERVATIONS.

The endeavor of the Bureau has been to lay a foundation for future work which will redound to the benefit of the state. Practical results and not the development of theories have been the objects aimed at.

While Colorado is not wholly a mining state, its rapid growth has been largely due to the development of the mining industry, and the mining industry has contributed enough through fees and taxes to entitle it to just recognition, as evidenced by the following:

Fees received by the secretary of state for filing mining incorporations:

Secretary Rice for the years 1887 and 1888	$ 25,191.00	
Secretary Rice for the years 1889 and 1890 (estimated)	20,000.00	
Secretary Eaton for the years 1891 and 1892	67,398.00	
Secretary McClees for the years 1893 and 1894	50,536.00	
Secretary McGaffey for the years 1895 and 1896	205,151.00	
Total		$368,276.00
Assessed valuation of mining property for the years 1888 to 1896, both inclusive, $56,032.288, at 4 mills on the dollar		224,129.00
Total		$590,298.00 $592,405.00

Unless there is a great change in the prevailing condition of affairs, the farmer, stock grower, merchant and manufacturer of Colorado can hope for little change unless the demand for their product is created at home. The character of this demand must depend largely upon the prosperity of the mining districts.

The mineral resources of the state are almost unlimited, certainly unmeasured, and offer great inducement for the profitable investment of capital. Foreign capital, stagnating at home, is in search of lucrative fields for investment, and will seek the mines of Colorado if the inducement for such investment be properly presented to it.

The Bureau of Mines as now constituted can answer a high purpose in looking after the welfare of the miners, answering questions propounded it by those contemplating investment and getting together a collection for inspection and study by visitors or for showing at expositions, when so ordered by the governor of state; and yet this is not believed to be the full intent of the framers of the law establishing the Bureau.

Thus far, and with but limited opportunity, the experience of the Bureau has convinced its officers that its field of usefulness is wide and that it can be made to do much to advance the material welfare of the state if properly equipped.

Colorado is a recognized mining center. It is the natural chosen field for investment. It possesses the mineral wealth, but lacks the necessary means to take the lead commensurate with its resources. Mining has made great strides forward in the past few years, and is now being recognized as a legitimate industry.

At all times, and especialy during hard times, the owners of undeveloped mining properties are largely compelled to seek the aid of capital for development. It rarely happens that the owner can reach the men with money first hand. This fact discovers the promoter or middle-man. He is, in a degree, a necessary evil, and the more he is multiplied, the greater the evil. Paradoxical as it may be, with his necessary presence, the breach that the promoter is intended to cover is wide-

ened; the price that stands between the proposed seller and buyer is increased, and with his multiplication, this difference is extended with the precision of mathematical progression. As a result of this condition, it is fairly the rule that the owner's proposal reaches the buyer amplified in the proportion of one to five, and the four-fifths of the five falls between the principal parties. The result is obvious.

During the life of the Bureau, many mining deals, thus conditioned, have been brought to its attention, and the unvarying policy has been to state, where known, the simple facts of surrounding conditions, and to leave the question of values, possible or otherwise, severely alone.

The theory of the present administration of the Bureau has been that it is no part of its functions to aid or retard private negotiation or transaction beyond the effect that might result incidentally from the giving out of such geological, mineralogical or economic information as might be in its possession, such information being free to all, the buyer and seller alike.

The general condition of the nation is such that few avenues seem open to profitable investment. As a result, mining is receiving attention and study never before equalled. Capital appreciates as never before that fortunes are made in mining; that while in some instances success is so phenomenal as to border on so-called chance or good luck, success in the main is attained by those who recognize mining as a legitimate industry, and proceed upon a business basis and pursue business methods. It also appreciates that the average mining sale is so encompassed by parties of interest that a disinterested statement of facts is difficult to obtain, unless procured through official sources or by personal representation.

The Bureau of Mines should be as far as possible equipped with facts to furnish information. It should also be permitted to give its official work to an inquiring public by circulating official bulletins. The resources of the state are prolific enough to warrant a plain statement of facts, free from all embellishments of possibilities or probabilities.

It is not possible to cover every district of the state in a short time, but each month or each quarter a bulletin should be issued upon some one district or county. These bulletins should give an accurate description of the history, geological condition, mines, mills, process of treatment and results, together with a classification and location of mines and prospects with maps, etc., etc. A limited number should be distributed free by the Bureau and the remainder sold at a price sufficient to cover cost of printing the whole.

Such publications would bear witness to the existence of certain resources in particular localities. Publications emanating from and circulated by boards of trade do great good, but it matters not how conservative may be the statements therein contained, they are received, accepted and classed as advertisements by interested parties. On the other hand, official bulletins, compiled by officers in charge of bureaus or departments of state are received and accepted without question. Comparatively little is known in detail of the actual resources of the state, either at home or abroad. Numerous compilations, general in character, have in the past been placed in circulation, probably the most valuable being the annual review by the press in the New Year's editions. These of necessity must be general in character and are mainly valuable in attracting attention to possibilities and the state's unequalled resources.

The demands made upon the Bureau of Mines demonstrate a want of detailed information regarding specific resources in certain localities. This work should be prosecuted by the state and the outlying comparatively unknown and undeveloped districts should receive the same careful consideration granted the older and better advertised. It is evident that such was the intent of the framers of the law establishing the Bureau, but that this fact was lost sight of in the making of a later law allowing the Bureau 100 pages for a report and 250 copies for general circulation.

The issuance of bulletins in addition to annual reports is advocated by the Commissioner of Mines for several reasons. The annual report must contain a re-

view of the work of the Bureau, including disbursements, recommendations, etc., which matter is of little interest to those seeking specific, official information. This detail, together with a compliance with the other requirements of the law covering the whole state, would produce a volume too large and expensive to print and circulate generally. Prospective investors, seeking facts, want information regarding specific localities and care nothing for a general review of the state. Property owners in certain localities will procure and circulate a work giving resources, if the same be localized to districts or county, thereby in time reimbursing the state for cost of printing, and placing the burden of expense upon parties of interest.

SMELTING.

The development of the smelting industry of Colorado furnishes a striking example of Western enterprise. The magnitude of the smelting plants, the amount invested and the advantages accruing therefrom to labor and the state at large is little appreciated. From the "blowing in" of the first furnace erected at Black Hawk, by Hon. N. P. Hill, in 1868, to the present time, the advance has been so rapid that to-day Colorado is among the first if not the leading smelting center of the world. It is safe to assert that the development of this industry has contributed more to the rapid advancement of Colorado's welfare than any other one factor. The history, progress and description of methods now in use would not only prove interesting but valuable, but at this time is not permissible.

To the Colorado metallurgist great credit is due. Owing to the varied and complicated ores encountered, old metallurgical formulas have required reconstruction and reduction to practical demonstration. These problems have been met and solved. Successful smelting embodies a triple success, viz., metallurgical, mechanical and financial. The metallurgist may possess the scientific knowledge requisite, but through lack of mechanical ability in moving, mixing and manipulating his stock of ores and fluxes, scores a financial failure. He may be

fortified with mechanical ideas and executive ability, but through lack of scientific knowledge records a financial failure. His duties are constant, not eight hours per day, but twenty-four, and financial success is largely dependent upon his ability to meet requirements as they arise. Regardless of care taken in calculating the charge, the result at lower end of furnace does not always meet expectations and demands a change.

Competition has not only marked a gradual decline in charges for the treatment of ore, but has proven an incentive to advanced methods. The result is a completeness in equipment and processes unequalled in other smelting centers, the whole being under the management of metallurgists who are to-day recognized as authorities throughout the smelting world.

MILLING.

With the exception of districts having ores amenable to treatment by amalgamation, a large proportion of Colorado's mine product up to date has been from properties carrying sufficient value in the ores to yield a profit over and above cost of mining, transportation and treatment charges at smelters. Owing to increased and better facilities for transportation and reduced charges at smelters, the standard of value necessary to yield a profit has been gradually lowered, and mines which ten years ago could not be operated are to-day at work, notwithstanding the low market price of silver, lead and copper.

By far the greatest mineral wealth of the state is stored in the so-called low grade mines. These properties, in order to yield a profit, demand mechanical appliances to either concentrate the values into less tonnage so as to bear charges for transportation and treatment, or reduction works at or near the mines. Monuments in the form of abandoned mills in nearly every camp throughout the state would discredit any claim to discovery in the foregoing statement. The fact has long been appreciated, and many attempts made to change by mechanism a non-paying mine to a paying proposition. Failure in most instances can be traced to non-appreciа

tion in the incentive of the difficulties to be overcome, and under-estimate of the cost of construction, and over-estimate of the "breaking value" of the ore to be treated, and later the lack of capital to make changes in mill essential to success. By success is meant a mechanical application by which the final product obtained yields a profit over and above expense incurred in mining, milling, transporting, etc. Under the above definition there are now numerous successful mills being operated throughout the state. To one who aims at practical success in the handling and treatment of low grade ores, the result is exasperating, especially by the various methods of concentration.

Claims are freely made by a large majority in charge of the various concentration plants of a saving seldom as low as 75 per cent., and ranging as high as 96 to 98 per cent. of the actual value in ore. There is reason to believe that carefully conducted tests would not verify such claims. Owing to the methods pursued in concentration, an accurate estimate of the value of crude ore, the saving made and per cent. lost is difficult to attain. Some of the best plants in the state, however, are under the management of competent mining engineers who do make these determinations. These men place their losses at from 30 to 50 per cent. of the gross value of crude ore treated. It is possible that these statements, after years of patient toil and ample means to change and experiment, may be somewhat exaggerated through chagrin and failure to gain desired success, but it is logical to suppose them to be nearer accuracy than the claims of saving 95 per cent. or better. Devices for concentration are numerous and all possess merit, but as yet, none meet all the requirements. Each low grade mine presents not only a condition within itself, but the conditions are ever changing and notwithstanding the vast amount of brain and capital being daily expended, the concentration problem has not yet been fully solved, and the aggregate of results indicates little advancement over twenty-five years ago.

The number of cyanide, chlorination and other so-called chemical processes is gradually increasing. The

application of electricity to either reduce or expediate reduction has made marked advancement. The saving properties in this class of processes, while more expensive to operate than concentration, seem to be more satisfactory; this is doubtless in part due to the fact that the actual weight and value of each tank, vat or barrel is known, the amount extracted and lost determined and the actual saving ascertained, being a complete determination almost daily and affording the satisfaction to the operator of knowing accurately the results being attained. In concentration the process is constant without break or clean-up, having at all times a load between the head and tail of the mill. This furnishes greater opportunity for error, and upon plants yielding a profit, investigation develops an inclination to err in favor of per cent. saved.

The introduction and successful operation of several chemical mills throughout the state during the past few years has been productive of much investigation, and has developed possibilities to a large number of owners of mining properties, which will eventually result in many additional plants.

There is nothing which so completely demoralizes a mining camp as the failure of a new mill, and on the other hand, nothing that gives the same impetus as a successful plant.

A bulletin issued by the Bureau of Mines setting forth in detail the mills being successfully operated, the character of ores being treated, methods pursued, savings made and processes used, would be of great value to those contemplating the erection of plants. It would be a compilation of experience and practical results and aid materially in avoiding failure. It would also prove a fund of information to those now operating plants, who have neither time nor opportunity to visit and inspect the various methods pursued throughout the state, and doubtless result in beneficial changes. The effect of the success or failure of a new mill or reduction works is far-reaching, and the state can well afford to contribute assistance along this line.

ELECTRICITY.

The application of electricity to mining is a subject worthy of careful consideration. Its practicability has already been demonstrated by several plants, the magnitude of which is not appreciated. This subject, like many others properly coming within the investigation of the Bureau, must be treated in detail to be of practical value.

MINERAL WATERS.

It has been asserted that Colorado can duplicate any mineral springs of merit in the world. This statement can neither be denied nor affirmed. That the state abounds in mineral springs is beyond dispute; that many of these springs possess health-giving ingredients is also established, and that many springs exist whose medicinal properties are entirely unknown is likewise true.

The mineral waters of the state are doubtless of great value, and steps should be taken to develop this resource. No attempt has been made to collect an exhibit of these waters for the reason that no means were provided for determining the mineral contents in suspension.

Several samples have been forwarded the Bureau, and an attempt has been made to have the same analyzed, but without success. A complete analysis of mineral water requires much skill, time and patience, and unless made by one thoroughly proficient, should not be made at all.

This resource will eventually prove of great value, but to be such, demands development. A collection and display of mineral waters, *supposed* to carry certain ingredients, and one *known* by determination to possess these in certain proportions are two very different propositions.

Colorado's marble, slate, clay, silica, building stone, coal, iron, petroleum, gem stones, etc., must at this time be passed. Their importance is known and unquestioned, but to treat officially and satisfactorily would in each case exceed the limits of this report.

RECOMMENDATIONS.

In addition to recommendations under the head of "Explosives," on page 28, the prohibiting of storage of caps and powder in same magazine.

Providing the Commissioner of Mines with authority for the removal of explosives from general supply stores in mining camps where there is no municipal law governing the storage of same, or in mining camps not incorporated.

A provision to cover "Oils, Candles, etc." See page 29.

Prohibiting the use of iron, steel or other metal bar for tamping charges.

A provision to cover "Fire Protection." See page 29.

Providing that no engineer who, in addition to other duties, hoists and lowers men, shall be employed not to exceed eight consecutive hours, time for meals excepted.

Providing that in shafts equipped with two cages, no engineer shall hoist or lower more than one cage when handling men.

Provided that none but licensed engineers be permitted to hoist or lower men.

A provision that no person under 18 years of age be employed as engineer.

A provision regulating speed at which men are hoisted and lowered, and the posting of a notice stating the maximum number of men permitted to be handled at one time. See page 31.

Providing for a positive indicator on all plants where men are hoisted and lowered. See page 34.

Providing that mines hoisting rock from two or more levels shall employ a man to be known as "cager," whose duties shall be to unload and attach all loaded buckets and give all signals to engineer.

A provision for the establishment of a uniform "Code of Signals." See "Code of Signals," page 30.

A provision regarding the construction of the bell line. See "Bell Line," page 31.

In addition to recommendations on "Ladder-way," page 33, a provision that the ladder-way in working shaft shall be partitioned off and be separate and distinct from main working shaft.

Providing for dump guard. See page 31.

Providing for cover of shaft collar on main working shaft. See page 32.

Providing guard rails or gates at station levels, mill holes and winzes. See page 33.

Provision regarding "Double Exits, Ventilation and Sanitary Condition." See page 33.

A provision compelling the leaving of a pillar of ground about the main working shaft sufficient to insure safety.

Providing that all abandoned shafts, pits or other excavations, endangering the life of man or beast, be securely covered or fenced in.

Providing a penalty for failure to report accident to this Bureau within reasonable time after its occurrence.

Providing that all metalliferous mines, employing two or more men, shall report same to the Bureau of Mines. Said report to contain the names of the owners, together with the names of the lessees, if worked by same; the name of the superintendent or foreman in charge, or both; the name of the claim or claims being operated, with the name of the county and mining district, together with the number of men employed, directly or indirectly, the same being classified into miners, trammers, timbermen, ore assorters, mill men, teamsters, etc.

Providing that service of this Bureau upon the superintendent or foreman, reported to this Bureau as being in charge, shall be as binding as if served upon the owner, president, general manager, manager or general superintendent.

Providing a severe penalty for the foreman or superintendent in charge of mining property to willfully misrepresent facts to any officer of this Bureau regarding the mine, such as time timbers have been in place, or anything that would tend to show safety when the reverse was true.

Providing that all metalliferous mines shall keep up a set of working maps, both plan and section, which shall be open to inspection by officers of the Bureau, the same to be compiled by a competent engineer at least once every six months, showing the relation of the workings to side and end lines. And, further, providing that in the event of a mine closing down for an indefinite period, a tracing of working maps shall be filed with the Bureau.

Providing that strangers be not allowed underground unless accompanied by some owner, official or employé deputized to accompany same.

Providing that a time be specified when these general rules shall go into effect, and that copies of same shall be posted in at least one conspicuous place about the mine.

If upon complaint, the above general rules work a hardship upon any particular plant, upon application and setting forth wherein their observance is not reasonably practicable, the Commissioner of Mines may investigate, alter, amend or suspend such general rules as may by him be deemed proper, and such changes shall be posted in writing at collar of shaft and shall also be entered in full upon the records of the Bureau, setting forth complaint, investigation and cause of changes.

A provision for the appointment of local inspectors in the various mining camps, whose duties shall be to examine into, investigate and report upon accidents, when so instructed by the Commissioner of Mines, and who shall receive for such services $. Said Commissioner only to issue such instruction when the expense of the regularly appointed inspectors will exceed that of the local inspector.

Providing a penalty for non-observance of said general rules on and after a stipulated time.