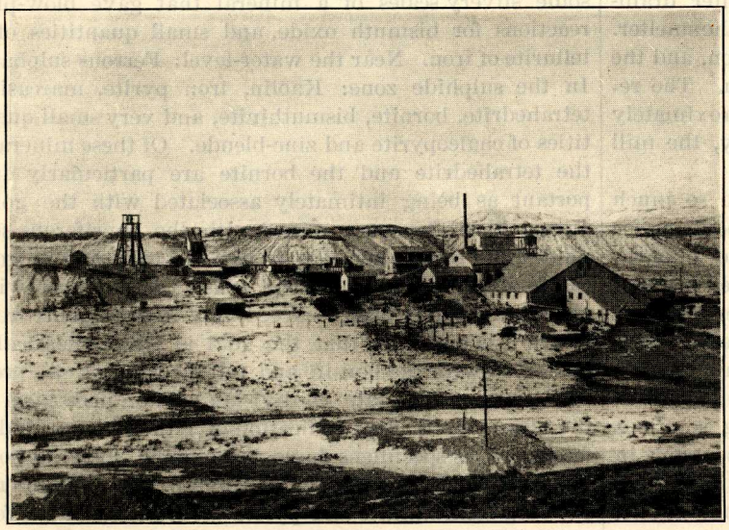
The Combination Mine.---I.

Early Development and Geologic Structure.

Written for the MINING AND SCIENTIFIC PRESS
By EDGAR A. COLLINS.

The Combination mine is situated in the Goldfield mining district, Esmeralda county, Nevada, about one-half mile in a northeasterly direction from the main street of the town of Goldfield.

The Combination No. 1 and No. 2 claims were located in May, 1903, and the first discovery of mineral was made soon after. In October of the same year, the group (consisting of ten claims, aggregating 175 acres) was bonded by L. L. Patrick, acting for Arthur Winslow and J. D. Hubbard, trustees respectively for the United States & British Columbia Mining Co., and a syndicate of Chicago gentlemen. The amount of the bond was $75,000, of which $5,000 was a cash payment, and the balance spread over a period of twelve months. During the life of the bond, the purchasers had the privilege of working the property on a royalty of 25% of the net proceeds, with the understanding that the amounts paid in royalties were to apply on the purchase price of the property. As a matter of fact, the first cash payment of $5,000 was the only money actually required to finance the property, the balance of the payments being met from royalties, as they became due.

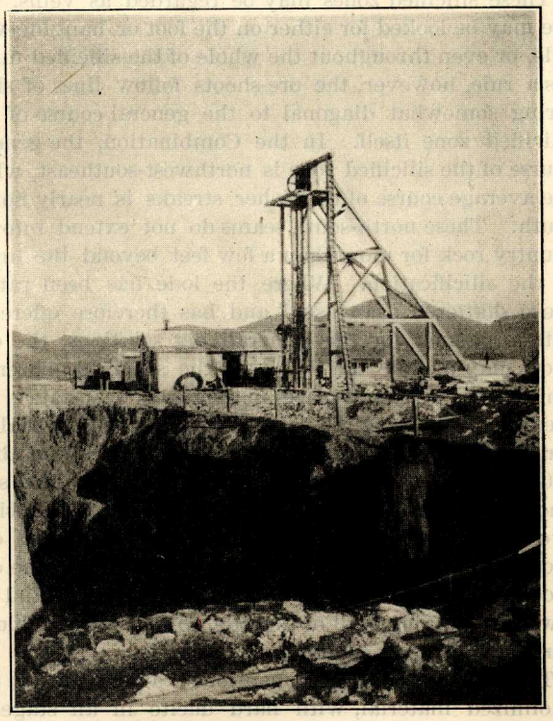


The Combination Mine and Mill.

Work was commenced by Winslow and Hubbard in the latter part of October, 1903, at which time the workings consisted mainly of a shallow open-cut and drift or 'tunnel' about 90 ft. long, which exposed 30 ft. of shattered and oxidized quartz and kaolinized material. This was divided into two portions, namely, about 20 ft. in the open-cut, which, according to samples, averaged $20 per ton, and about 10 ft. near the surface of the drift, which averaged $150 per ton. The value was almost entirely in gold, which was bright and yellow, so that it made a good showing in the gold pan or horn. In addition to this cut and drift there were several other shallow cuts and pits, two of which exhibited a similar material, which sampled from $5 to $10 per ton, while others were location holes in soft decomposed and iron-stained rock.

At this time the town of Goldfield consisted of a few tents, two of which were stores, one was a so-called restaurant providing very inferior food, and three saloons. All were the result of the excitement occasioned by the bonding of the Combination and Jumbo groups of claims, and the spreading of reports of the richness of the ore. Outside of the individual prospecting which was being prosecuted at this time, the only work in progress was on these two properties, both destined to become important mines.

At the Combination, five or six men were put to work sinking a small shaft on the high-grade ore discovered in the drift, and sacking the ore broken in this manner. At the Jumbo claim on the opposite hill, John Harvey, acting for Patsy Clark of Spokane, took a bond on the property immediately after Patrick bonded the Combination, and commenced a small shaft on the hanging wall of the lode. After reaching a depth of 50 ft., he cross-cut the lode and drove a few feet in both directions. Finding the results of his sampling poor, Harvey stopped work, relinquished his bond, and by so doing just missed by a few feet one of the bonanza ore-shoots of the Goldfield district. Shipments of ore from the Combination commenced during November, 1903, and continued without interruption until the commencement of milling operations in May, 1905. The average gross value of the ore shipped during this period was $404 per ton, and it is an interesting fact that the first car of ore shipped from the mine, which averaged $160 per ton, was the lowest in grade that was ever shipped. At first the ore was hauled by teams to Candelaria, a distance of 65 miles by wagon-road, at a cost of $12.50 per ton; but with the advent of the railroad into Tonopah, the long haul was discontinued, and all ore was taken to Tonopah, and there loaded on the cars for shipment to the Selby smelter at Vallejo Junction, California. By shipping from Tonopah on the railroad, a considerable saving in time was made, but owing to the high freight-rates charged, the saving in cost of transport was practically nothing. After it was demonstrated that a satisfactory extraction could be obtained in the mill, all shipments of ore were discontinued, with the exception of a small amount of high-



Main Shaft and Glory Hole.

grade sulphide ore, which was, naturally, the most refractory in the mine. Excess freight-rates were charged by the railroad company on all ore assaying above $300 per ton. This excess rate amounted to 3% of all such excess. Thus on ore assaying $400 per ton, the excess freight rate was $3 per ton in addition to the regular freight charges. In consequence, the richest ore was sacked and stored pending the starting of the mill. This ore, amounting to 129 tons, was then run through a five-stamp battery, and over amalgamated plates, and the tailing then run to an empty leaching-vat, in which they were partially drained. After draining sufficiently, they were sacked and sent to the smelter. The original ore assayed 48 oz. gold per ton, and the sacked tailing assayed 18.3 oz. gold per ton. The recovery by amalgamation was therefore approximately 62%. The battery was run on day-shift only, the mill being locked and guarded at night.

This district is now so widely known, and so much has been written of its geology that it is unnecessary for me to go into the question further than to remark, briefly, that the lodes are shattered and fissured zones of silicification formed by hot solutions, under pressure from below, which, following the lines of least resistance, deposited their silica and the accompanying minerals in the zone of fracturing. It is probable that there were other subsequent flows of mineralizing solutions that to some extent concentrated the precious metals in the more fissured portions. In the main workings of the Combination mine, both country rock and lode consist of altered dacite; this is also the case in the Jumbo, Mohawk, and January mines, but in the main workings of the Florence mine, which is situated about 1,500 ft. distant on the southeast continuation of the same silicified zone or vein, the country rock in close proximity to the vein is an altered andesite.

These silicified zones may be regarded as veins, and ore may be looked for either on the foot or hanging-wall side, or even throughout the whole of the silicified mass. As a rule, however, the ore-shoots follow lines of shattering somewhat diagonal to the general course of the silicified zone itself. In the Combination, the general course of the silicified zone is northwest-southeast, while the average course of the richer streaks is nearly north-south. These north-south seams do not extend into the country rock for more than a few feet beyond the limits of the silicification. Where the lode has been rather more shattered than usual and has therefore offered a better channel for the mineralizing solutions, the ore-shoot may include the whole of the silicified material. This occurs in several places in the mine, for instance, immediately adjoining the point of discovery in the shallow 'tunnel,' the ore-shoot is from 30 to 50 ft. wide and about 120 ft. long. Again, on the second level in the split known as the East vein, the silicified zone for a width of over 20 ft. and a length of 150 ft., is one large ore-shoot. Continuing in a southeasterly direction the ore-shoot narrows to a width of four feet of pay-ore and follows the hanging wall of the lode, so that the soft bluish porphyry forms its hanging wall also.

The ore is, as already mentioned, a mixture of soft kaolinized material, with hard dacite in all stages of silicification, from rock showing the original porphyritic structure to dense flinty quartz. The best ore is found in the small stringers and veinlets, already mentioned, that traverse the main body of the lode. In the oxidized portions of the mine—above the 130-ft. level—these are largely filled with small fragments of quartz mixed with a characteristic yellow or reddish ochery material, which is mainly kaolin formed by the decomposition of the feldspar in the original rock. When the sulphide zone is reached, the rich stringers in the lode are easily followed, as the shattered clayey material is heavily impregnated with sulphides, forming a well-marked dark seam. The richest ore in the mine is usually found on the 'faces' forming the sides of these points, where the gold-bearing solutions have had the best opportunity to precipitate.

The following minerals have been observed in the Combination mine, the names being quoted in the order of their importance. In the oxidized zone: Quartz, kaolin, iron pyrite, gypsum, hydrous ferric oxide, alum, some silvery scales of a mineral that gave blow-pipe reactions for bismuth oxide, and small quantities of a tellurite of iron. Near the water-level: Ferrous sulphate. In the sulphide zone: Kaolin, iron pyrite, marcasite, tetrahedrite, bornite, bismuthinite, and very small quantities of chalcopyrite and zinc-blende. Of these minerals, the tetrahedrite and the bornite are particularly important as being intimately associated with the gold. Free gold is often seen mixed with the cupriferous sulphides, but even when this is not the case, and no gold can be seen under a powerful glass, the specimen will, almost invariably, assay exceedingly rich in gold; from which it is presumed that the gold is either chemically combined with the bornite and tetrahedrite, or else present in a very fine state of division. The appearance of the bismuthinite is no indication of either good or indifferent ore, as specimens have been found showing both free gold and tetrahedrite, and again other specimens, showing bismuthinite and pyrite alone, assay but a few dollars per ton. Similarly in the oxidized zone, no particular change in the value of the ore is noticed when the silvery specks of bismuth oxide appear. The ferrous sulphate is partly mixed with alum and was found on the 130-ft. level as plates with a bluish green color filling the joints of the soft rock forming the hanging wall of the lode. Great care was taken to preserve some of these specimens, but although placed in a tight tin vessel almost immediately, they gradually lost their color, and became dehydrated.

A section of the Combination lode shows the following peculiarities distinctly:

1. Silicification is greatest on surface and is less marked as each succeeding level is reached.

2. Gradual flattening of the vein on its dip, which reaches an angle of 30 to 35° northwest.

The first of these might well be expected in the case of deposits formed by thermal waters followed by only partial erosion. The second, however, is far more of a problem, and it is one that has yet to be studied and satisfactorily explained. The flattening of the vein commenced in the shaft just about the level at which water was first struck—210 ft. At this depth a strong seam came in from the foot-wall side of the shaft, and the ore turned with the wall. Some very rich ore was encountered in the shaft where the splice was made. The greater part of this consisted of partially rounded small boulders of flinty quartz, on the outside of which were concentric layers of the following minerals, in the order enumerated, beginning from the outside: A layer of either marcasite or iron pyrite in botryoidal form; next a layer of quartz with specks of a grayish black mineral, which was later determined as a form of tetrahedrite; and inside this a layer of rusty gold about ⅛ in. thick. In all the specimens found this order of deposition was observed, and in other places in the mine at which faces of similar specimen ore were found the order was identical. It would therefore seem reasonably certain that the free gold was one of the first minerals deposited.

Very rich ore was found in this mine clear from 'grass roots' down to the bottom or 280-ft. level. Taking it

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altogether, however, the richest ore was found between the 180 and 230-ft. levels. Here the vein dipped at an angle of about 45° and consisted of a narrow 'gouge' or selvage of kaolinized material with rounded fragments of quartz heavily impregnated with sulphides. Immediately below this came several inches of the silicified dacite containing stringers and faces of free gold and rich cupriferous sulphide. In many places the rich ore consisted of a rich 'face' only—the rest of the material being low-grade. Underneath this rich seam, the value of the ore dropped immediately to low-grade ore, and sometimes to waste, there being no definite line between them.

As might be expected with such high-grade ore, stealing, or 'high-grading,' as it is generally called, flourishes to an extent unknown in the older mining districts. This is especially true in the case of the bonanza leases, which are worked under high pressure, and where anything in the shape of a delay means the loss of a considerable amount of money. The loss to the mine-owners from 'high-grading' has been estimated at several hundred thousand dollars. This is probably in excess of the true amount, but it must certainly have been very large. Many of the miners that have become expert in the business while working in the mines of Cripple Creek, obtained work in the Goldfield mines, solely for the purpose of stealing ore. These men used to wear a regular harness, to enable them to carry off 40 to 70 lb. of ore on each shift.

In the oxidized portions of the Combination mine, where the richest ore cannot be distinguished by its appearance, panning with drilling water serves to guide the 'high-grader,' and men have been known to 'horn' from 20 to 30 times in a shift. Needless to say, a great deal depends upon the honesty and fearlessness of the mine foreman.

Following the 'high-grader' came many so-called assayers, who ran assay-offices as 'blinds.' Until comparatively recently, it was impossible to do anything to stop ore-stealing. The Miner's Union would not allow change-rooms, and it was impossible to secure the conviction of a man for theft. Since the strike of last December, however, change-rooms have been built at all of the principal mines and several convictions have been secured. This will undoubtedly tend to restrict the wholesale theft of ore.

MINING IN COSTA RICA.—According to a report the following mines have been milling ore during 1906: The Abangarez Goldfields of Costa Rica; the Esperanza Mining Co. (late Boston mine) in the Abangarez district; and the Colburn Mining Co. at Pozo Azul, near Chomes. Development work is proceeding at the Montezuma mine, in the Barranca district, and the Machuca mine, in the Aguacate district. The value of the gold and silver exported was £110,645. The average rate of wages paid to day laborers in the interior has gone up, and now stands at 2s. 4.56d., and in the Limon province, on banana farms and railway work, at 4s. 4.80d. The wages of artisans of all classes have also gone up 20%. This does not, however, indicate any general advance in prosperity among the working classes, since the cost of living has also increased.

TOURMALINE IN CALIFORNIA.—The colored tourmalines of the Pala district, in San Diego county, are well known. The principal varieties are rich, deep-red rubellite, from the Pala Chief mine, and various colored tourmalines, though mainly pink rubellite, from the San Diego Co.'s property, at Mesa Grande.

Decisions Relating to Mining.

Specially Reported for the MINING AND SCIENTIFIC PRESS.

In case of unavoidable shortage of cars, a railroad company may distribute such cars as it has to the several mines on its line of road on a percentage basis, calculated on the production of the several mines. The mine owners are only entitled to their proper percentage of available cars; but such distribution cannot interfere with the right of individual owners to the exclusive use of their own cars. And the railroad company may allot an arbitrary number of cars for development to new mines which have no basis for a percentage.

United States *v.* Baltimore &c. R. Co., 154 Fed. 108. (June, '07.)

A trustee operating a mine under a lease for a term of 50 years, with the right to terminate the lease and remove the machinery if the enterprise should prove unprofitable, was held not liable to a beneficiary for surrendering the lease after prosecuting the enterprise for more than 10 years unsuccessfully.

Mexican Nat. Coal &c. Co. *v.* Frank, 154 Fed. 217. (April, '07.)

Where stockholders of a mining corporation applied to a court of equity for protection of their rights against the alleged wrongful acts of the directors, they could not recover for failing to act with reasonable diligence, or present some excuse for not having done so.

Jones *v.* Bonanza Min. &c. Co., (Utah) 91 Pac. 273. (July, '07.)

In an action for the possession of an unpatented mining claim, under a complaint alleging ownership, possession, and right of possession at a specified date and the ouster by defendant of plaintiff, the defendant may show, under a general denial, that the deed under which the plaintiff claimed title was invalid.

Holmes *v.* Salamanca Gold Min. &c. Co., (Cal.) 91 Pac. 160. (June, '07.)

Where a miner was injured by a fall of rock from the roof of a mine in which he was working, it is proper to show, in an action for damages, that the mine was inherently dangerous, and that skillful operators should have known of such condition and taken precaution against it. But it must appear that the conditions at the time of the accident were the same as those at the time to which the testimony related.

Arris *v.* Standard Plaster Co., 105 N. Y. Sup. 440. (July, '07.)

A mining corporation may issue stock to an attorney in payment for services rendered, and in the absence of fraud, it cannot be questioned by a stockholder.

Bogeler *v.* Punch, (Mo.) 103 S. W. 1001. (June, '07.)

A mining company has the right to use a stream of water for mining purposes, but it cannot pollute such stream to the injury of a lower land-owner.

Alabama &c. Coal Co. *v.* Vines (Ala.) 44 So. 377. (June, '07.)

A lease of land for the sole purpose of operating for oil, is not binding on the lessee; and on failure of the lessor to operate for oil, or pay the sum agreed upon in advance, he forfeits all rights under the lease.

Jennings-Haywood Syndicate *v.* Houssiere-Latreille Co., (La.) 44 So. 481. (June, '07.)

The owner of the legal title to coal underlying a tract of land owned by another is not required to exercise particular acts of ownership over the coal in order to retain title thereto, and, to be divested of his title by adverse possession, the possession must have been continuous and adverse for the statutory period.

Gordon *v.* Park, (Mo.) 100 S. W. 621. (March, '07.)

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GOLDFIELD, NEVADA.—I.

Written for the MINING AND SCIENTIFIC PRESS
By T. A. RICKARD.

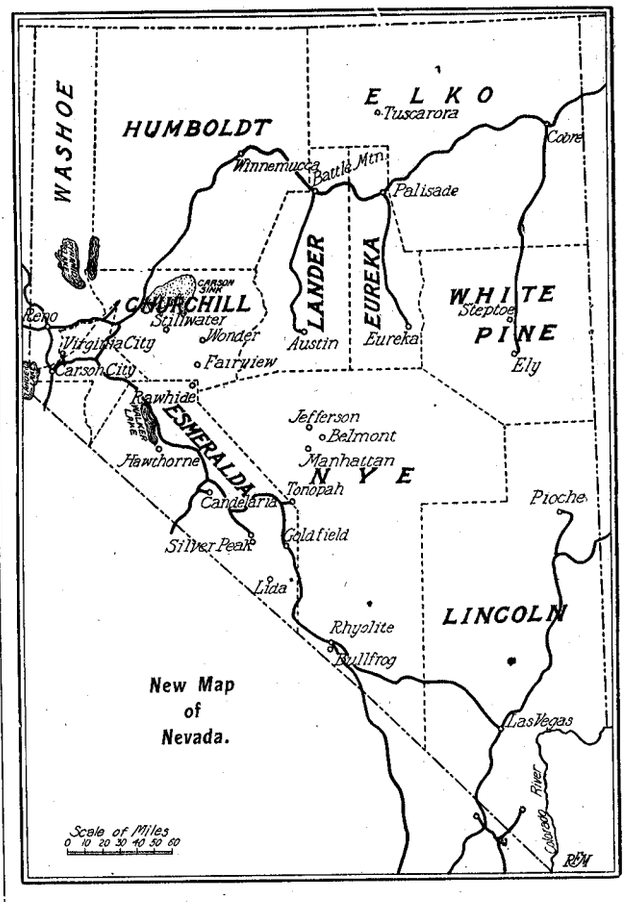
Goldfield has been twice christened. In its very infancy the camp was called Grandpa; this savored of frivolity, so the name was changed to Goldfield. It must have been a spirit of prophetic presumption that led the first discoverers to arrogate for the locality the name of The Goldfield, as if it were the one and only great gold-producing district of the world. But Fate and some fostering star have justified the baptism of the pioneers. Goldfield *is* today *the* goldfield of America.

When Harry Stimler and his partner called the place Grandpa they did not claim that it was the parent of the Mother Lode of California; it was a play on such names as Tonopah, Ivanpah, and Ibapah. These are of Indian origin; *pah* means water. Tonopah is a corruption of Tonumba-pah, which stands for 'water brush.' Iba-pah is red water and Ivan-pah is white water. Thus the Ivanpah range and the Witwatersrand are synonyms, for both mean the 'white water range,' and they sound as unlike as their sponsors, the Indian of the Nevada desert and the Dutchman of the African veldt.

Tonopah not only suggested the first name of the district, it was the parent of Goldfield. When I was in that part of Nevada in the spring to 1899, to make an examination of a copper deposit in the range east of Luning, all this part of Nevada was dead, from an industrial standpoint. Only the decadent glories of the Comstock reminded the traveler that he was in a mineral region once so famous. At Candelaria there was a little mining, and the stage road to Bodie from Hawthorne, up the canyon that led across the State line into California, recalled the excitement of a former era. The country had been abandoned by the prospector. It was one of the has-beens of history. The old trails still left faint lines across the sagebrush desert and over the bare rocky ridges and spoke of a period of strenuous search for gold and silver. Some of those abandoned paths of exploration went close to the places where rich mines have been discovered. The road from the north went close to the present site of Manhattan; in fact, there was an old camp within four miles of the one that sprang into existence in January, 1906. The old road to Montezuma, along which prospectors had traveled for fully 35 years, traversed the big flat east of Lone Mtn., and was within a few miles of both Tonopah and Goldfield. There was a trail that passed within a stone's throw of the Mizpah outcrop, which beckoned the miner for many a long day before Jim Butler thought of testing the black rock.

Like navigators that pass a treasure island in a fog and hear the muffled roar of the breakers only as a warning of danger, so these old prospectors went past the hungry-looking outcrops of silicified rock, never dreaming that they capped the wealth they were seeking with such invincible restlessness.

The first discovery in this region was made at Southern Klondike, a place half-way between Tonopah and Goldfield, which are 24 miles apart in a straight line. This first discovery was made by James Courts in 1898. The name suggests contemporaneity with the great rush to the Yukon. The outcrop of the Tonopah lode was plainly visible to those who went near it; in fact, Courts says that he and his partner used to go over the trail through the Mizpah pass and they employed the cropping of the Mizpah (or Tonopah) vein to shelter their campfire from the wind. At that time Jim Butler was at Belmont. In 1900 he made a trip from Belmont to Southern Klondike, and on his return he tried to make a short cut and so happened to tramp over the site of Tonopah. He saw the outcrop and picked up some pieces of the broken vein, taking them to Southern Klondike, where there was an assay-office run by on old man named Frank Hicks. This assayer threw the samples away, saying that he would not give a



dollar for 1000 tons of such stuff. Butler jokingly offered him a quarter interest for an assay. The ore was full of the black sulphide of silver (argentite) and anyone familiar with silver ores would have known that it was tremendously rich. These gold prospectors were ignorant concerning the other precious metal, so they blundered like tenderfeet.

On his way out Butler got some more of the black mineral and took it to Belmont, where he gave it to T. L. Oddie, who happened to be there in connection with the operation of a quicksilver mine. Oddie was an educated man and was then the District Attorney of Nye county; he lived at Austin, where he had been for several years as representative of the Stokes interests. Oddie sent the specimens to Walter C. Gayhart, an assayer at Austin. Butler promised Oddie a quarter interest, and Oddie promised Gayhart a half of his quarter—all for the making of an assay! Money was scarce; they were all of them 'busted.'

Gayhart's assays showed that the selected specimens ran from $300 to $400 per ton. Oddie thereupon sent an Indian runner to Butler's ranch, which was 45 miles from Belmont, to tell him of the strike; but Butler remained inactive. He was reputed to be "the laziest white man in the world." Even his location monuments are indicative, for they are built of seven or eight stones at the most. He never did a stroke more than necessary, if as much. Meanwhile Gayhart spoke publicly of the discovery and several men left Southern Klondike with the idea of finding it; but they failed. Three months after the assay had been made, Butler went to Belmont; he arranged with Oddie and Wilse Brougher (the recorder for Nye county) to make a trip to the scene of discovery. They gathered the necessary supplies at a cost of $25, which was about all they could scrape together. This was in August, 1900. On arrival at the spot, they located seven claims and then started to work. A small shipment was taken away in their spring wagon. This lot of ore was selected stuff and weighed slightly more than a ton; it was hauled all the way to Eureka, 170 miles distant. The partners received $600 as the result of that first shipment. Thereupon, in October, they started to lease the ground they had located, dividing their claims into blocks of 100 ft. square, to be mined on a royalty of 25 per cent.

When Hicks, the assayer at Southern Klondike, heard of the find, he picked up the specimens he had thrown away and assayed them. Then he claimed a quarter interest, and the matter was finally adjusted by Butler donating him a $^1/_{32}$ interest. He had no legal, nor even moral, right to share in the discovery. Butler's action was generous—generous as the spirit of the West, and of the pioneer the world over.

On June 3, 1901, only seven months after work had begun, the property was bonded by O. A. Turner for $337,000, of which $50,000 was paid at once and distributed, according to their holdings, to the five owners, namely, Oddie, Butler, Brougher, Gayhart, and Hicks. Turner drew at sight on his friend and associate John W. Woodside, of Philadelphia, a snuff manufacturer. In this deal Turner was assisted by J. H. Anderson, who became the first president of the Tonopah Mining Company of Nevada, which was organized with a capital of $1,300,000, of which $1,000,000 was in common shares of $1 each and $300,000 was preferred stock carrying 8%, the latter being subject to recall at any time. One share of preferred entitled the subscriber to two shares of common stock. The common stock rose eventually to $22.50, so that several fortunes were made and lost before it fell to its present price of $8. The mine never needed any working capital, it was a profitable enterprise from the very start. Before the leases expired on the last day of 1901 they yielded $3,000,000 worth of ore. Up to the end of 1903 the mine yielded $5,576,000, of ore averaging $160 per ton. In the following January the late William C. Whitney, the New York traction promoter, bought Woodside's 280,000 shares for $7, and a few months earlier John Anderson sold his smaller holding to a group of Philadelphia men headed by John W. Brock and W. L. Elkins, who was a director at the time of his death. Brock retained his shares and became president, retiring a few months ago. In order to diminish operating expenses, a railroad 60 miles long was built by the Tonopah Mining Co., so as to connect the mine with the Carson & Colorado railroad, a narrow gauge line running south from Reno. Construction was begun in January and the road was completed in May, 1904. In 1905 the railroad gauge was widened to the standard, so as to correspond with a similar change on the branch of the Southern Pacific, with which it connected at Sodaville. This railroad enterprise proved highly profitable for a time and was managed so as to be more remunerative than the mine itself. It aided the development of Goldfield, to which we now return.

By his share in the Tonopah mine, Jim Butler thus became rich and the patron of other prospectors. At the end of 1902 he 'grubstaked' or outfitted Harry Stimler (a half-breed) and William Marsh, two young fellows of Tonopah about 20 years of age. They went south and found rich float on what is now Columbia mountain, which overlooks the site of Goldfield. After searching in vain for the source of the rich float, they prospected northward and found gold in the surface dirt. Thereupon, the Sandstorm was located on December 2, the name of the claim suggesting the state of the weather at the time. The Kendall was located immediately afterward. In both cases free gold was found in the débris of disintegrated rhyolite and this led to a brief excitement, but no large orebodies were uncovered and the interest of the neighboring prospectors soon waned. In the spring following a party of Tonopah men sent a couple of prospectors to the new camp, then called Grandpa, as already stated. The prospectors were A. D. Myers and Tom Murphy. They located the Combination on May 24, 1903. Here let me relate a typical tale of hard luck. R. L. Johns, a lawyer then residing at Tonopah, happened to go into a store and was told by the proprietor that a pool or syndicate was being made for the purpose of sending a couple of prospectors to Grandpa. Would he take a share? It would cost $50 at once, with $50 more to be paid later. Johns said he guessed he would, and later in the day he returned with the money, only to be told that he was too late, another man having subscribed for the share. Johns did not bother about it, until he ascertained that the other fellow had subscribed his $50 with the $50 Johns had himself lent the other fellow the day before. So the reader can imagine the feelings of Mr. Johns when the prospectors found a good lode, which became the basis for a big mine, and one-twelfth of it had been secured by the $50 lent to another man who had jumped in and subscribed for the share our legal friend had expected to take.

At the time the Combination claims were located, no ore had been found. Tom Murphy, who was one of the discoverers, says that he located the Combination because it was the vacant territory nearest the Sandstorm; all the ground south from the latter had been located. Moreover, there was a large outcrop of quartz rock on the Combination, but that did not

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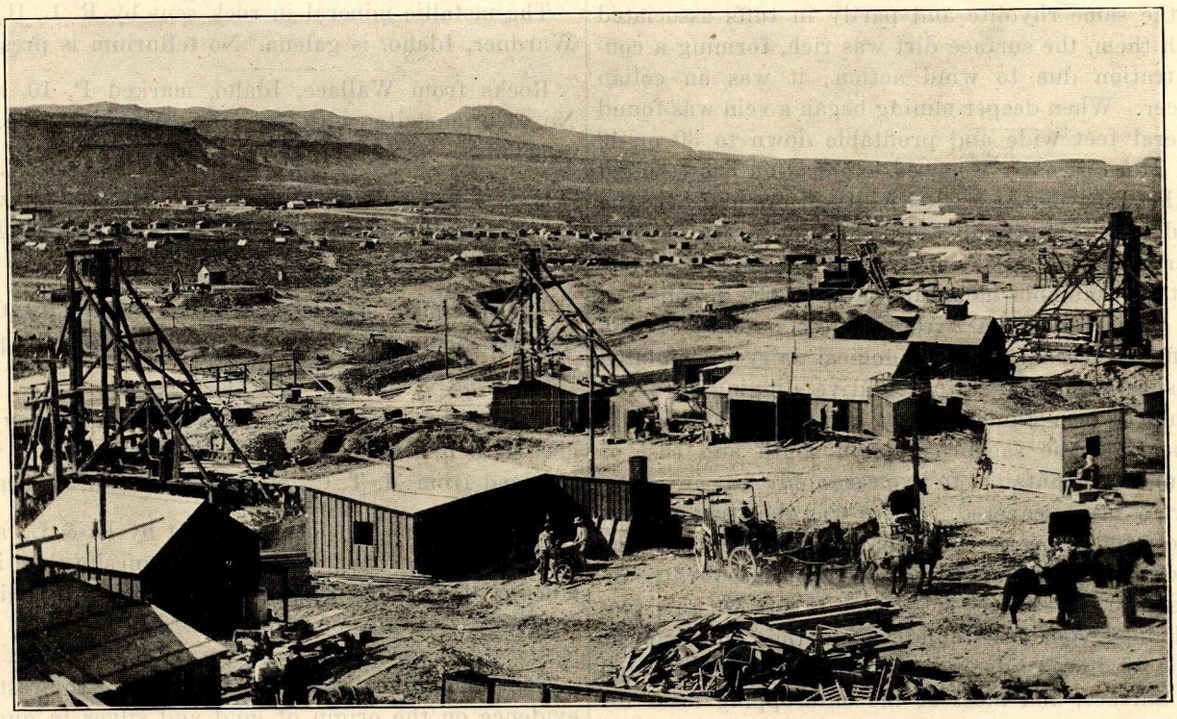
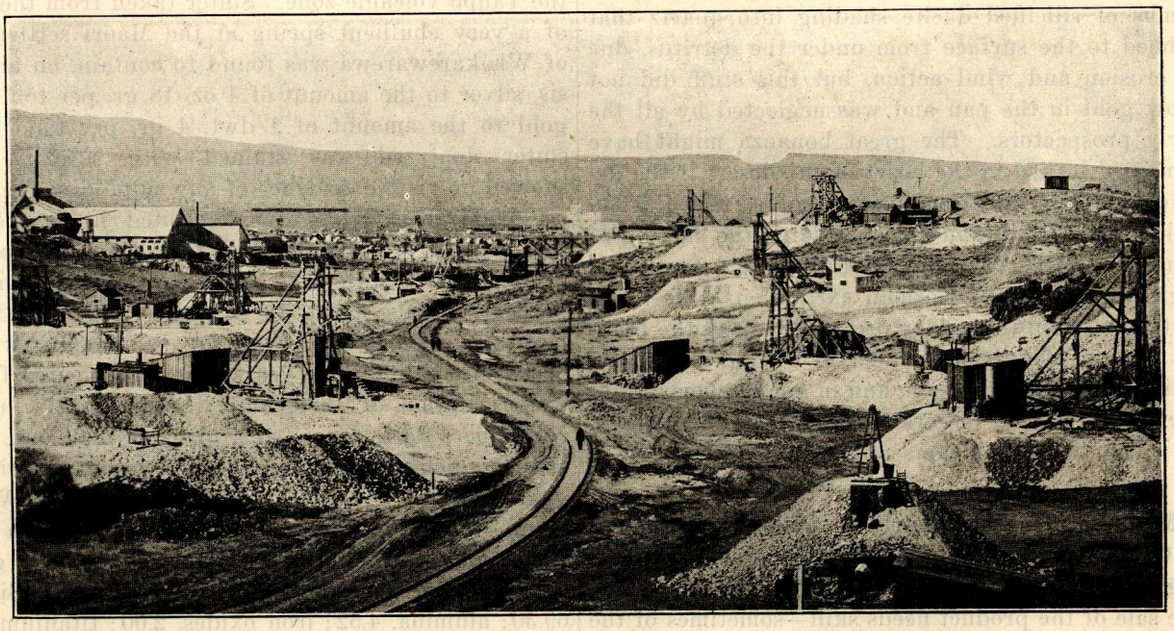
mean much, for there were many similar combs of silicified material rising above the desert all around Columbia mountain. Myers, who was Murphy's partner, made a cut near the top of the hillock because there the detritus was thin; he found a stringer carrying gold in the midst of a mass of barren quartz. This stringer panned nicely and assayed as high as



North end of Town. Frances Mohawk. Lone Mtn. Hayes-Monette Lease. Nevada-Goldfield Reduction Works. Mackenzie No. 1.



Combination Mill. Combination Fraction. Baby Florence No. 2. Railroad to Bullfrog. Mohawk. Combination Fraction. Winston Lease.

$83 per ton. Then he went down the side of the ridge and drove a short tunnel, which cut the lode at 20 ft. below the surface. He found good ore. This led to the big orebody now marked by the cavernous pit named the 'glory hole.' In the following October the Combination No. 1 and 2 claims and eight other locations were bonded by L. L. Patrick, acting for Arthur Winslow and J. D. Hubbard, who were trustees for two exploration companies. The ground was bonded for $75,000, of which $5000 was cash. This $5000 was the only money ever required, for the remaining payments were paid, as they became due, out of royalties on ore mined by successful lessees. On March 1, 1907, the Combination mine was sold to the Goldfield Consolidated Mines Co. for $4,000,000. In the previous 25 months the Combination had yielded $786,000 in profits to the owners, besides enriching many lessees. So ended a most profitable mining adventure; and it is pleasant to relate that among the beneficiaries was a scientific geologist and mining engineer, for Arthur Winslow was State Ge-

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ologist of Missouri before he applied his technical training to the exploitation of a bonanza.

The early discoveries made in the Goldfield district gave no indication of the marvelous wealth it was destined to produce. The first find, on the Sandstorm, was bunchy and close to the surface of the rhyolite, which occurs in thin flows. This yielded fully $500,000. On the Kendall claim, which is partly in the same rhyolite and partly in tuffs associated with them, the surface dirt was rich, forming a concentration due to wind action; it was an eolian placer. When deeper mining began a vein was found several feet wide and profitable down to 30 or 40 ft. More recently renewed exploration has resulted in the discovery of a good width of ore at 70 ft., the gold being remarkably free. Another patch of gold-bearing débris was found on the Velvet, half a mile east of Columbia mountain; also in the rhyolite on the Cimarron claim. All of these patches of rich stuff—the cream of the geological dairy—stimulated prospecting and led to tentative digging into the combs of iron-stained quartz and silicified rock that appear on the sagebrush plain south and east of Columbia mountain. In two cases only was any noteworthy ore uncovered. There was the stringer that Myers found on the Combination and there was the outcrop on that part of the Jumbo subsequently included in the Bowers & Kernick lease. On this spot a defined vein was found within the 'blow-out' or comb of silicified dacite. A stope now breaks through the surface, and most of the outcropping mass for about 20 ft. in width will assay $20 to $25. But there was nothing to indicate the presence of the wonderful orebodies of the Mohawk mine; in places there were combs of silicified dacite shading into quartz that bobbed to the surface from under the detritus, due to erosion and wind action, but this stuff did not show gold in the pan and was neglected by all the early prospectors. The great bonanza might have remained locked in the heart of the desert if the developments in the Combination mine, which is on adjoining ground, had not stimulated the sinking of shafts in search for 'impossibilities,' as a local geological authority of German extraction, calls them. But they found the golden ore, rich beyond the fondest dreams of avarice, wonderful beyond the expectation of geological vision, and in quantity enough to turn a dozen good fellows into ordinary millionaires, as will be related in the sequel.

Manufacturing as Compared With the Reduction of Ores.—In a manufacturing establishment the buying of supplies presents no special difficulty, while the sale of the product needs skill—sometimes of the highest—and even then at a sacrifice of profit. A mine reduction-plant may be considered to have no anxiety regarding its principal supply of ore, or, at least, if the supply is not forthcoming, it is helpless; on the other hand, its product is easily sold at the market quotation, at any rate, to the metals selling companies. A custom reduction-plant needs skillful buyers, who, with good money in their hands, make every endeavor to procure ore, and sometimes fail to get it in sufficient quantity or quality.

The Prospector.

Owing to the large number of specimens forwarded to this department, it has been found necessary in future to make a charge of 25 cents to subscribers for each determination, and $3 to non-subscribers.

M. F. B., of Boston, Mass., sends a specimen of serpentinized rock containing pyrite.

The metallic mineral in rock sent by R. L. H., of Wardner, Idaho, is galena. No tellurium is present.

Rocks from Wallace, Idaho, marked P. 10, are: No. 1, quartzite with specular hematite; No. 2, quartzite.

G. G. C., of Schurz, Nev., sends: No. 1, quartzite; No. 2, quartz porphyry; No. 3, limestone with gypsum veins; No. 4 and 5, quartz.

The specimens sent by E. I. F., of Baker City, Oregon, are gneiss, the larger piece containing much pyrrhotite and some veinlets of pyrite.

A specimen of porphyritic rock which may be classed as quartz-porphyry or rhyolite-porphyry was received from M. T. C., of Red Mountain, Colorado.

Minerals from Tacopa, Cal., sent by K. & L., are: No. 1, calcite; No. 2, resembles magnesite, but is a silicate of alumina, magnesia, soda, and some lime. Probably a variety of amphibole.

Gold and Silver in Thermal Springs.—Interesting evidence on the origin of gold and silver in quartz veins is given by certain hot springs in the centre of existing hydrothermal activity in New Zealand, the Taupo volcanic zone. Sinter taken from the rim of a very ebullient spring at the Maori settlement of Whakarewarewa was found to contain, on analysis, silver to the amount of 4 oz. 18 gr. per ton, and gold to the amount of 1 dwt. 4 gr. per ton. The sinter analyzed was stained with sulphur, but showed no visible evidence of any sulphides. Analysis made from the sinter deposited in a wooden trough used to conduct water from the same spring at Whakarewarewa gave the following result in the precious metals: Gold, 12 gr.; silver, 15 dwt. 3 gr. per ton. The great geyser of Waimangu, which broke into action some years after the terrible Tarawera eruption of 1886, and remained active until November, 1904, deposited a blackish material, consisting chiefly of sulphides, but containing neither gold nor silver. Some mud obtained by Dr. Wohlmann, the Government balneologist, from a hot spring in the sanatorium grounds at Rotorua gave the following somewhat remarkable analysis: Silica, 69.30; alumina, 4.52; iron oxides, 2.00; titanium oxide, 0.58; lime, 1.00; magnesia, 0.10; soda and potash, 1.30; sulphur, combined, 1.40; sulphur, free, 6.09; organic matter, 10.01; water, 3.70%. Microscopic examination of the deposit showed that it consisted mainly of quartz and amorphous silica with a little feldspar. The mud also contained 5 gr. gold and 6 dwt. 1 gr. silver per ton. It is evidently not a deposit from the spring, but is merely a silicious tufa impregnated by the thermal solutions.—J. Mackintosh Bell in *The New Zealand Mines Record.*

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GOLDFIELD, NEVADA.—II.

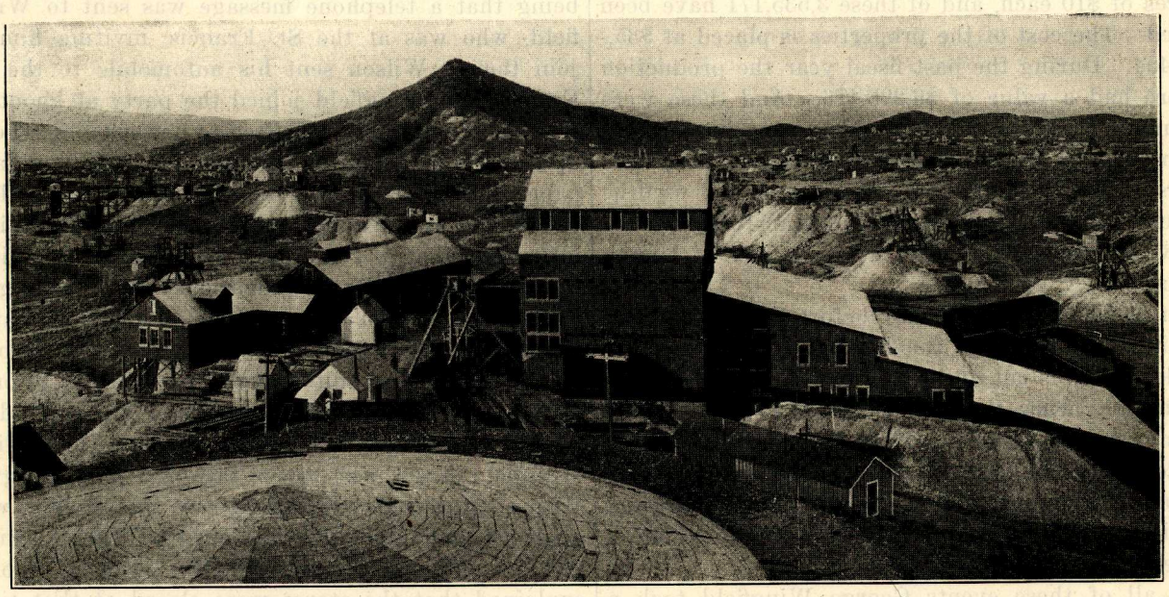
Written for the MINING AND SCIENTIFIC PRESS
By T. A. RICKARD.

The story of the mines that made Tonopah and Goldfield famous is interesting, but the most picturesque story is that of which George Wingfield is the central figure. When Tonopah was discovered by Jim Butler in 1900, Wingfield was barely 21 years old. Already he had been variously a cowboy, a gambler, a prospector. In the spring of 1901 he went to Tonopah. He came thither from Winnemucca, where he had made a little money and owned some property, but being ambitious for a larger field he left a town that was only a point to punctuate the transcontinental line of the Southern Pacific, and started for the districts that were awakening the desert to busy life. He wandered from Winnemucca to Tonopah, where he went into partnership with Tom Kendall, who owned a saloon. Shortly after he joined Jack Hennessy in starting a roulette table in a room adjacent to Kendall's saloon. This gambling establishment was named the Tonopah Club. It made money fast. In three years Wingfield and Hennessy cleared $300,000. For those unacquainted with local conditions, it may be well to add that it was honest gambling, that is, there was no trickery or device to interfere with the hazard of fortune. The players took the chances of the game, just as they do at Monte Carlo. The Tonopah Club was not as gorgeously furnished as the casino by the shore of the Mediterranean, but George Wingfield ran his place just as squarely as that absurd anachronism, the Prince of Monaco.

As soon as Wingfield began to make $75,000 to $100,000 per annum, he placed the profit from the game in mining stocks and prospects. Tonopah was flushed with newly made wealth. In 1902 and 1903 the lessees on the Mizpah claim made money hand over fist. There was activity in every kind of gambling, from roulette to grubstaking. The chances of the desert were at least as good as those of the table. Wingfield got Nixon interested in some claims called the Boston-Tonopah group, situated at the back of Oddie Mtn. This was the first business deal with Nixon. George S. Nixon was president of the First National Bank of Winnemucca; he is now Senator from Nevada. Many tales have been invented to explain the first association of the two men who later became partners in mining enterprises involving enormous sums of money, but the facts are sufficiently romantic without adornment with the tinsel of fabrication. Wingfield knew Nixon when both of them were living at Winnemucca, and Nixon was known to be a man ready to back any reasonable venture. But the Boston-Tonopah was no good; it was within the mineral belt, but not in the rich ground.

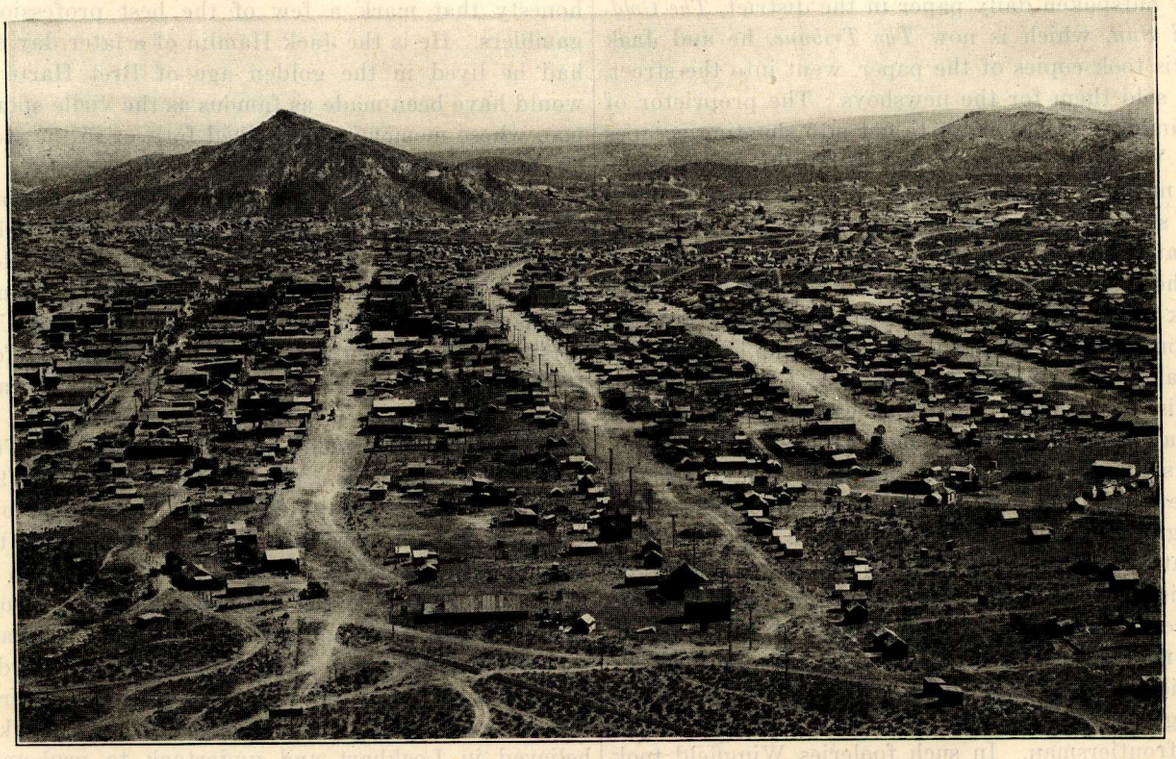
Then came the discovery of Grandpa, or Goldfield, as it was subsequently christened. Wingfield's friend, Tom Kendall, had been partner with Jim Butler in grubstaking Stimler and Marsh, the discoverers of Goldfield. Kendall himself went to see their find, thirty miles from Tonopah. Two days later he stood on Columbia Mtn., which overlooks the present town of Goldfield, and directed Stimler and Marsh to examine and locate the ground to the south, now covered by the Florence and Combination mines. They broke samples from the combs of rock that appeared above the sagebrush and tested them by panning, getting no gold; then they went to the north side of Columbia Mtn. and located the Nevada Boy, May Queen, and a lot of other claims that never amounted to anything. They also located the Booth claim, at the foot of the mountain, for William Booth of the *Bonanza*, a daily paper published at Tonopah. Thus the Combination and Florence ground was not located by the first party of prospectors. This was at the end of 1902. In May 1903 there was organized the syndicate of ten as already stated. Each member of the syndicate was assessed $100, of which $50 was paid up. They sent A. D. Myers and R. C. Hart to Goldfield. Finding some ore, they located the Combination No. 1, 2, and 3 claims, the Hazel Queen, and the Golconda group of six claims, so that ten claims were taken up at this time. Subsequently Myers and Tom Murphy located the Combination Fraction.

Up to this point Wingfield played no part in the exploration of Goldfield, but when the first excitement had passed he bought (for himself and Nixon) some of the shares of the syndicate owning the Combination group, and he also purchased an interest in the first discoveries made by Stimler and Marsh, on the Sandstorm and Kendall. He had become rich, making as much as $200,000 in a single year from the roulette table and successful speculations in local stocks at Tonopah. In the early part of 1904 he bought the various holdings of Con Crooks, who was an old prospector in possession of a number of fractional interests, from a quarter to a half, in over 30 claims, including the Sandstorm, Kendall, and Mohawk, besides groups of claims called the Laguna, Blue Bell, and Conqueror. Crooks had a partner named Harry Ramsey, who now lives in opulent retirement at Berkeley. Wingfield and Nixon bought him out also, not long after they had made their deal with Crooks. Then they purchased Jim Butler's interest in the Sandstorm and Kendall claims. Thus Wingfield and his partner began to have large and scattered holdings in the Goldfield district. At this time Wingfield offered to sell Hennessy a half of all his holdings at Goldfield for $1000, but Hennessy refused it. This is authentic. It is one of the might-have-beens of desert romance. Soon after this unconscious play with fortune, Wingfield began to make money from leases that he financed, providing capital for exploring likely-looking ground. Among these ventures was the Sweeney lease on the Florence lode. In 1905 he made $350,000 from his share in this lease and then he and Nixon, who had remained his partner throughout these transactions, bought a one-third interest in the Florence group of claims. In the autumn of 1906 they obtained control of the Red Top and Jumbo for $1,200,000. It is generally supposed that in this big deal they were financed by others, but I am able to deny such a statement. They had made money enough to swing even a deal involving over a mil-



Mohawk Mine. Columbia Mtn. Florence Mill. Laguna. Winston Lease.

GOLDFIELD, LOOKING NORTH FROM THE LITTLE FLORENCE SHAFT.



THE TOWN OF GOLDFIELD WITH COLUMBIA MTN. IN BACKGROUND.

The Principal Mines Extend from Columbia Mtn. to the Right, Beyond the Town.

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lion dollars. That was the beginning of the consolidation, which was organized on November 13, 1906, under the title of the Goldfield Consolidated Mines Co. The capital is divided into 5,000,000 shares of $10 each, and of these 3,535,171 have been issued. The cost of the properties is placed at $35,085,454. During the past fiscal year the production of ore had a value of $6,296,476. And these were the mines that were hidden under a sagebrush plain diversified by combs of iron-stained rock only five years before. Talk about the creation of wealth! Never was there such a sudden transformation of the waste places of the earth into a hive of human industry.

On April 17, 1906, the day before the earthquake-fire in San Francisco, the big bonanza of the Mohawk mine was cut by the lucky lessees, and during the months when the money markets of the Pacific Coast were closed by the disaster to the City by the Golden Gate, the outpouring of golden ore from the Mohawk, Florence, and Red Top mines redressed the industrial balance and started Goldfield on a career of marvelous prosperity.

In all of these events George Wingfield took a prominent part. He received royalty as owner of claims worked by fortunate lessees and he shared directly in the profits of lessees working on other claims. When only 27 years old he was doubly a millionaire. He proved alert, quick to action, and shrewd in business. When the labor troubles began, in 1906, he showed his fearlessness in facing the agitators. Once when the union tried to boycott the only outspoken daily paper in the district, *The Goldfield Sun*, which is now *The Tribune*, he and Jack Davis took copies of the paper, went into the street, and sold them for the newsboys. The proprietor of a gambling resort is apt to get into shooting scrapes and Wingfield has often had to pull his gun, but he has never taken a human life, his cool courage proving sufficient to carry him through any awkward situation. While he has shown himself reckless, as in the incident above related, he is no fire-eater like Jack Davis, who goes about armed like an arsenal. On one occasion when the miners' strike had reached a dangerous stage, someone took a shot at Jack Davis, who rushed into the local club (the Montezuma), announcing that he had been attacked by the strikers. The electric lights in the club-rooms were turned off instantly and every member pulled his gun and stood at the windows in expectation of an attack. It proved only a false alarm, but when Davis was examined it was found that he wore three overcoats and carried a gun in each of the two pockets, making six revolvers in all. Besides these he carried a bowie knife in his belt and at his back was slung a sawed-off shot-gun. This is the burlesque of the frontiersman. In such fooleries Wingfield took no stock, although ready to assert himself whenever occasion required.

For instance, there was an episode in San Francisco last September. The *Examiner*, one of the Hearst papers, in its customary way, had exploited a story to the discredit of Wingfield. A few days later, Theodore Wores, Edgar Mizner, and J. C. Wilson happened to be at Tait's restaurant. With them was Dent Robert, managing editor of the *Examiner*. One of the party mentioned Wingfield's name and Wilson spoke of him in a kindly way, the result being that a telephone message was sent to Wingfield, who was at the St. Francis, inviting him to join them. Wilson sent his automobile to the St. Francis and Wingfield joined the party at about 11 o'clock. Soon the talk drifted to newspapers, whereupon Wingfield said that he intended to start a daily paper in San Francisco. Robert told him of the difficulties and expense incident to such an undertaking, intimating that it would cost several millions. Wingfield replied that he had the money and, turning to Robert, said: "You seem to know all about the paper business." Thereupon Wores explained that Robert was the managing editor of the *Examiner*. At once Wingfield spoke bitterly of papers in general and of the *Examiner* in particular. Robert called him a liar. Wingfield struck him in the face and pulled a gun. Mizner interfered. Wingfield saw that Robert was unarmed and told him to go out and "get a gun," and he would wait for him while he did do so. Wores explained that the stores were closed at that time of night and no revolver could be purchased until the next day. So the incident closed. Thereafter the *Examiner* was silent as to the doings of Mr. Wingfield.

Wingfield is respected by his associates and liked by those who know him. "You cannot bluff him," they say. He is "a man of his word," generous to a fault, and possessed of the mingled recklessness and honesty that mark a few of the best professional gamblers. He is the Jack Hamlin of a later day and had he lived in the golden age of Bret Harte he would have been made as famous as the virile sportsman whose memory is enshrined forever in the story of Poverty Flat.

Another chapter in the romance of the Nevada of today is contributed by the Lockhart and Parker partnership, with which is associated the development of the Tonopah Extension and Florence mines. Alexis Dupont Parker was the treasurer of our University Club at Denver when I lived there, before 1902. He was also chief accountant for the Colorado Southern Railway. Since then he has become an important mine operator, by force of luck and Tom Lockhart. Parker is a graduate of Racine (1879); he was intended for an Episcopal clergyman, but, abandoning that avocation, he decided to learn the business of railroading, from the ground up. So he went to work on the Denver & Rio Grande railroad grade. While thus employed he met T. D. Lockhart, a prospector, who had taken a laborer's job in order to make a little money preparatory to further search for mineral wealth. They became friends. Parker believed in Lockhart and undertook to grubstake him, that is, provide funds for the search after mineral wealth. He got a clerkship in the auditor's office of the D. & R. G.; he prospered; having ability he became an expert accountant and did outside work, as, for example, for the International Trust Co. of Denver. Then he left the D. & R. G. and became assistant to the chief accountant of the Colo-

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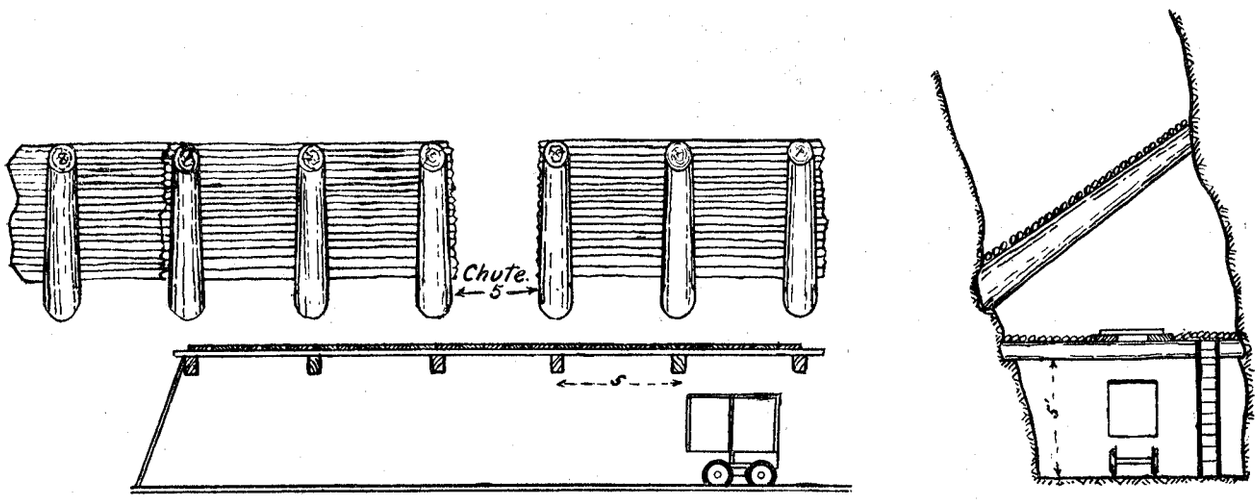
rado Southern, continuing to advance until he became vice-president and practical head of the Colorado Southern Railway. During all these years he helped Lockhart; even when a clerk on a small salary he managed to save some money to send to Lockhart, who prospected far and wide, but without any noteworthy result. In 1900 Lockhart went to Tonopah and located two claims near the Butler discovery; he was informed that he had overlapped some ground already located (the Sand Grass and Red Plume), so he moved off southward and located the Grand Trunk and C. B. & Q. claims. These were on the sagebrush plain, they showed no sign of ore of any kind, and their validity as quartz claims might easily have been questioned. Meanwhile the development on the Mizpah seemed to indicate the direction of that lode, and he began to sink a shaft through a flow of rhyolite that capped the ore-bearing formation. He started a shaft unaided; he would climb down to the bottom and fill his bucket, then climb to the surface and hoist it with his windlass. Eventually this shaft became the main opening of the Tonopah Extension mine and cut ore at 237 ft. In March 1902 Charles M. Schwab bought the Tonopah Extension for $75,000. For several years previous Parker had ceased to contribute to the expenses of Lockhart's prospecting, and legally the latter was absolved from paying his partner any portion of this stake, but he lived up to the spirit of their arrangement and handed $37,500 to Parker. They call Lockhart mean at Goldfield, and he is thrifty enough in all conscience, but his sense of honor must be far more developed than that of many more generous men. He is the type of the canny Scotchman who is as close-fisted as he is honest. After making money by the sale of the Tonopah Extension, Lockhart went to Goldfield and acquired mining property. He got hold of the Florence, paying $7000 down for a part, with an option for $25,000 on enough more of the mine to give control. Wingfield and Nixon took a lease on the Florence, and the royalty paid by them more than enabled Lockhart to complete his purchase. Soon after making this deal Lockhart overheard one of the owners chuckling over having got the best of him, but he was confident in his opinion of the value of the mine. He told Parker about it, informing him that he need not come into the deal unless he wanted to do so. Parker replied that he would share equally with him in all his ventures. He did well. The Florence has produced $3,000,000 altogether, and of this the royalty to Lockhart and Parker has amounted to fully $375,000, as owners of slightly more than one-half of the stock of the Goldfield-Florence Co. The mine is still young and is destined to add largely to the output of the district.

THE 'CHINAMAN' ORE-CHUTE.

An ore-chute with a peculiar bottom to obviate the difficulties of jamming at the doors and of sudden 'spills' or rushes of ore, which may swamp a car and cause delays until the track can again be cleared, is in use in Western Australia, under the local name of a 'Chinaman.' Its construction is clear from the accompanying cut, giving longitudinal and cross sections. Beneath the bottom of the ore-chute, where it comes to the line of stulls above the gangway or level, is a long platform or deck, supported upon sets of timbers at a convenient height above the track. This platform extends a distance of 10 ft. on either side of the chute. Along the central longitudinal line of the platform are sliding or drop-doors at intervals. The ore spills from the chute and spreads out upon the platform until the angle of rest for the pile is attained, which prevents the possibility of more ore running out. The ore is then drawn through the doors in the platform to the cars below.



The Chinaman Ore-Chute.

A concrete trestle is a somewhat novel type of structure built across the Salt river, in Illinois, by the Chicago, Burlington & Quincy railway. The structure is 477 ft. long, with six-pile bents spaced 14 ft. apart, and with an average height of 10 ft. The piles are of re-enforced concrete, 22 ft. long, and were driven by a pile-driver with a 3000-lb. hammer falling 24 ft. The piles are all vertical and are capped by deep concrete cross-girders supporting the slabs which form the floor or deck.

Re-enforced concrete line-kilns in Europe, built without fire-brick or other inside lining, have withstood for several years temperatures from 2200 to 2500° Fahrenheit.

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