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Item 105

MINING AT HAMILTON, NEVADA

Geology of the White Pine District—Early Bonanzas—The Silver, Lead, and Copper Belts—Railroad Prospects

*Written for "Mines and Minerals," by W. S. Larsh**

The White Pine mining district, from which the County of White Pine, Nev., derives its name, is situated near the north end of the White Pine range, 36 miles due west of Ely, and about 40 miles southeast of Eureka. The town of Hamilton, situated about the geographical center of the district, was for 15 years the county seat of White Pine County. In 1885 a fire destroyed much of the town, and all the county buildings, whereupon the county seat was moved to its present location, Ely. Today the impression one receives on viewing it, is that of a well-nigh deserted habitat of days long past. Many of the buildings spared by the fire are dilapidated and rapidly falling into decay, and the skeletons of numerous mills, big waste dumps, and its history, are all that is left to tell of its once flourishing condition. The district was organized in 1865, 44 years ago, but did not become the scene of successful operations until 1867, when the rich mines on Treasure Hill were discovered. Prior to that time a company was operating at Monte Cristo, on the west side of White Pine Mountain, with no flattering prospect of success.

Albert Leathers, a workman at the Monte Cristo plant at this time, was guided to Treasure Hill by an Indian, and on September 14, 1867, located the Hidden Treasure Mine. This mine proved to be so sensationally rich in silver, that the spring of 1868 witnessed one of the wildest rushes or stampedes to White Pine since the Comstock boom. In 1869 Hamilton had a population of 10,000, a mining stock exchange, city government, and a waterworks, the water being pumped through a 12-inch pipe over Mokeamoke Ridge from Illapah Creek, 3 miles east. There were three newspapers, two of which were dailies. Treasure City, on the summit of Treasure Hill, nestling amongst the mines claimed a population of 4,000, two banks, waterworks, numerous dance halls, and all the appurtenances of a western mining camp. Eberhardt, south of Treasure City, had a population of 2,000; Shermantown, two miles west of Treasure City, a population of from 2,500 to 3,000; and there were several other smaller communities scattered at various places throughout the district. In all there were more than 25,000 people within the borders of the district.

In 1870 there were 197 mining companies operating, with a nominal capital of $277,564,000 (United States Mining Statistics West of Rocky Mountains, 1870, Raymond, page 173) besides numerous leases and private enterprises. At this time there were 23 mills with 200 stamps dropping on ore. In addition to this there were nine smelters of various capacities, reducing the ores of the lead belts. The ores of Treasure Hill were "dry" and were treated by the Washoe, or pan amalgamation, process. The lead ores were so rich in lead that the bullion derived from the smelters was little better than the crude ore, and none of these smelters were economically successful.

By 1887, the decline of the price of silver and the exhaustion of most of the easily accessible ore bodies on Treasure Hill, practically closed the era of silver mining in the district and it had greatly declined in population and mining activity. Up to this time $22,000,000 in silver had been produced from Treasure Hill mines. No mining has been done on Treasure Hill since that time. The remaining inhabitants turned their attention to the lead mines as a means of livelihood, changed market conditions making it possible to ship the high-grade lead ores at a profit. These mines were operated by leasers and individual owners and only those ore bodies of easy access and high grade have been worked. Those requiring even a comparatively small amount of development beyond the reach of individuals remain yet to be opened.

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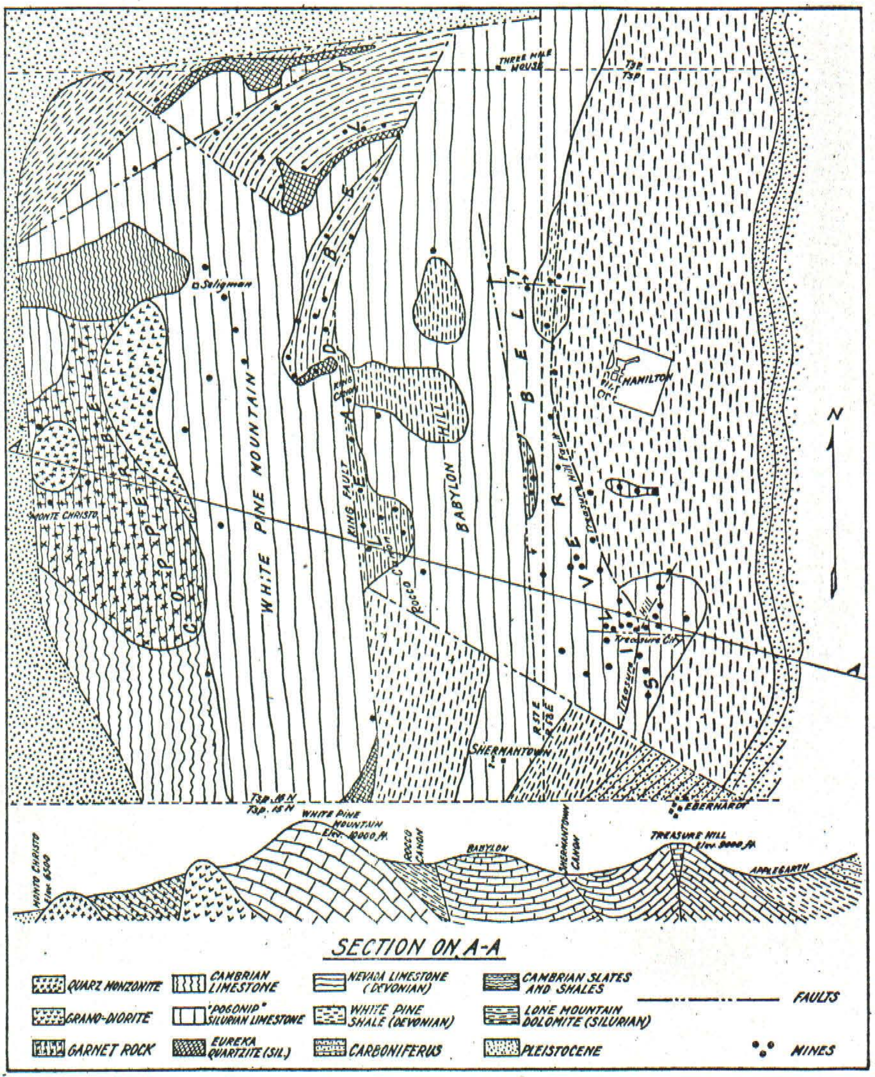

Fig. 1. Geologic Map of White Pine Mining District (Hamilton) Nevada

Topography and General Description. The White Pine range is one of the larger members of the Basin ranges, lying about midway between the Wasatch and Sierra Nevada uplifts. Like all the Basin ranges it has a general northerly-southerly trend and is separated from the Pancake range on the west and the Egan range on the east, in which Ely is situated, by broad desert valleys. The White Pine district covers a portion 16 miles square, of the northern end of this range, where the strata are locally intensely faulted and folded producing a rough and uneven topography which is not apparent in other portions of the range. White Pine Mountain, on the western border of the district, presents a bold and precipitous outline and rises out of the deserts on the west to an elevation of over 10,000 feet. It is about 10 miles long by 3 miles wide and attains the greatest elevation of any part of the district. On its northern and eastern slopes considerable areas of balsam and white pine timber are to be seen. The southern and western slopes are clothed with scrub cedar, sage brush, and bunch grass. A number of clear mountain springs gush from its sides only to lose themselves in the arid reaches of the desert. East of White Pine Mountain, high rolling hills of irregular topography and lesser elevation extend to Mokeamoke Ridge on the eastern border of the district. The general north-south trend of the ridges is interrupted by an easterly-westerly anticlinal swell from Monte Cristo, which ends in the high dome of Treasure Hill, the next highest point in the district, with an elevation of 9,000 feet. This is locally known as the "Monte Cristo uplift." Except for scattered patches of scrub cedar and mountain mahogany, the hills and ridges east of White Pine Mountain present a smooth and

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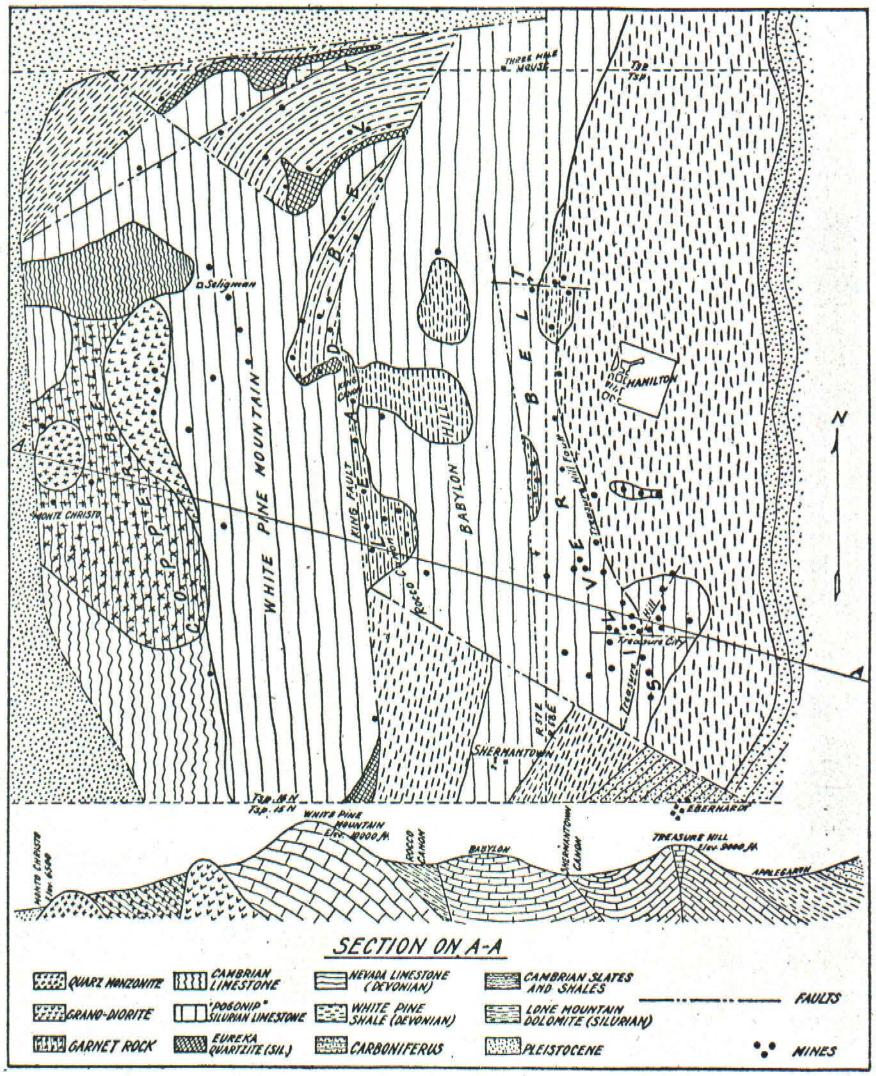

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* Mining Engineer, Hamilton, Nev.

Geology.—The geology of the White Pine district is not unlike that of many other productive districts in the Basin range region. The ores occur in deposits and veins in Paleozoic strata. Their position and mode of occurrence can be compared to those of Pioche, Reveille, and Eureka, Nev.; Tintic, Utah; Wood River, Idaho, and other localities in the Basin range region. The silver ores of Treasure Hill and the silver-lead ores of the "Base Metal" range owe their origin to the folding and faulting of the limestones which produced the fissures and channels in which ore-bearing solutions circulated. Absence of igneous rocks in these two belts, however, is a noticeable feature. On the other hand, the copper ores on the west side of the mountain are derived from an invasion of porphyries.

Within the White Pine district the White Pine range widens out to the west to almost twice its usual width, this portion having been subjected to intense folding and faulting subsequent to the general uplift of the range. Mokeamoke ridge on the east is a synclinal ridge of erosion, and undisturbed by the later faulting and folding involved in the elevation of Treasure Hill and White Pine Mountain. It is composed of Carboniferous strata. Just east of Treasure Hill this ridge is offset about one-half mile east and from there continues its course southward, where, beyond the confines of the district, it again forms the main ridge of the range. Treasure Hill is a quaquaversal uplift of the "Nevada" (Devonian) limestones and White Pine shales, with its longest axis north and south. White Pine Mountain is topped with the lower Silurian, or "Pogonip," formation and at its west base exposes about 1,000 feet of Cambrian slates and limestones. A great fault running along the west base of the mountain and another at the north end bring the Carboniferous strata of the desert in juxtaposition with the Cambrian and Silurian of the mountain, showing a displacement of probably 10,000 feet. Within the district are numerous faults and folds of minor displacement and intensity which impart the rugged and irregular topography.

The normal position and thickness of the sediments here is as follows: Starting with 1,000 feet of exposed Cambrian limestones and slates at the base and naming them in ascending order: 1,000 feet of Cambrian; 3,500 feet of "Pogonip" limestone; 350 feet of "Eureka" quartzite; 1,500 feet of "Lone Mountain" dolomite (Silurian); 2,000 feet of "Nevada" limestone; 1,200 feet of "White Pine" shale (Devonian); 200 feet of sandstone and 4,000 feet of limestone (Carboniferous); making a total thickness of nearly 14,000 feet.

There are three distinct mineral ranges, or belts, in the district; the silver belt, at the top of the Nevada limestone and beneath the White Pine shale, running north and south from Treasure Hill; the copper belt on the west side of the mountain in the igneous rocks and in the Cambrian; and the lead belt or "Base Metal" range, about half way between the other two, and faulted between the summit of the "Pogonip" and the Nevada limestone. The relation and position of the belts can be more readily grasped by consulting the geological plan and section of the accompanying illustration, Fig. 1.

There are three fault systems: First, an east-west system; second, a north-southeast dipping system; and third, a north-southwest dipping system observable about 300 feet below the surface in the mines of Rocco cañon.

The Silver Belt.—The most striking features of the silver deposits were their great richness at the surface and their comparatively shallow depth. Hague, in his description of the district (United States Survey of 40th Parallel, Vol. 3, page 418), notes four different kinds of veins or deposits on Treasure Hill, and while the ores do occur in all the positions he describes, it is the opinion of mining men today that the "saddle-reef" theory will cover all of them. Treasure Hill is an anticlinal dome, mainly composed of Nevada limestone, but the White Pine shale is, in areas, still left in its correct position overlying it. A great fault runs east and west along the south base of the hill, passing a little north of Shermantown and extending to White Pine Mountain. A north and south fault runs along the axis of the fold and divides at the southern end of the crest of the hill into two parts, one part running easterly through the Hidden Treasure Mine, and one running northerly along the western side of the hill, extending beyond the north end of it for over three miles where it disappears in a fold. This is known as the Treasure Hill fault. There are also numerous minor faults and tension cracks. At the time of the uplift the shale covered the limestone. The limestone, being brittle, was shattered, but the shales being more yielding and flexible bent to a considerable degree and formed an impervious roof. The silver-bearing solutions coming up along the faults and breaks in the lime were arrested upon striking the shales and compelled to spread out along the contact. In this manner they filled the tension cracks and any other openings in the limestone, and left ore bodies on this contact in the vicinity of the faults. The shales were afterward removed by erosion and the ore bodies in the limestone exposed at the surface. Again, ore from seams to pay bodies was uncovered in many other places in the district on this contact at the minor faults, while a string of small mines extended along the Treasure Hill fault, northward, as far as it persisted.

The ore was mainly a chloride (horn silver) and bromide of silver, though there were occasional sulphides. The tales of its richness, related by a few old timers here in camp, are almost incredible. In the Eberhardt Mine a boulder of horn silver was found weighing 6 tons, said to be the largest single mass discovered. There were numerous others of lesser weight extracted but still big enough to be worth a small fortune at that time. From the United States Government Reports (United States Mining Statistics West of Rocky Mountains, 1870, Raymond, page 150) the tonnage up to July 1, 1869, was 8,869 tons whose gross value was $2,017,831, giving an average value of $227.75 per ton. The average fineness was 963. The bulk of the $22,000,000 production credited to Treasure Hill mines came from a lower grade of milling ore, however, which occurred in great bodies below the high-grade ores on the surface. Although no amount of ore was taken out at a depth of more than 300 feet, several shafts were sunk deeper than this, one on the N. Aurora property to a depth of 1,375 feet in hopes that the deposits would "go down." The Eberhardt tunnel was started at the town of Eberhardt, seen at the left of Fig. 1, and driven northerly into the hill 7,000 feet to catch the ores in depth but no bodies of any extent were uncovered. In view of modern mining this tunnel was a failure as it followed along the strike of the strata and did not cross-cut the country, as may be plainly seen from the section in Fig. 1. Although Treasure Hill is at present abandoned, one would certainly hesitate to say its ore deposits are exhausted. In fact it would seem that a careful study of the minor faults, which are numerous, would disclose the position of hidden ore bodies. On the northern slope of the hill along the axis of the fold is 4,000 feet of country capped by the shale and undeveloped except for a few openings at the northern end which disclose ore.

There are roughly 150,000 tons of ore on the dumps of Treasure Hill mines which will run from 16 to 20 ounces in silver, giving a gross value of nearly a million and a half at the present price of this metal. It would take more time than the writer had at his disposal to make even a rough estimate of the tonnage that could still be developed in the old workings, but there is a nice fortune for some one who can treat these dumps and ore of this grade at a profit.

At the west base of Treasure Hill, west of the Treasure Hill fault, is a series of small mines, operated by leasers and individuals. These mines produce annually a small amount of lead-silver ore, grading in silver values more than the ores of the lead belt proper, and less in lead. No mines of magnitude have ever been opened up in this vicinity, and while this may be on account of the lack of sufficient development, the fact remains.

The Copper Belt.—About 5 miles west of Treasure Hill, in the vicinity of Monte Cristo spring, and along the west base of White Pine Mountain, is the largest development of igneous rocks in the district. Here a great dome-shaped batholith of quartz monzonite invades the Cambrian limestones and slates, which are altered to a dense garnet rock for a distance of from 2,000 to 6,000 feet laterally from it. East of this and running northerly about 2 miles to Seligman cañon is a great massive intrusion of gray-brown granodiorite.

Between the monzonite dome and the garnetized limestone is from 50 to 300 feet of brown porphyritic gossan, while at or near the contact of this and the garnet rock, are veins and stringers of copper ore; native copper, chalcopyrite, bornite, and copper carbonates were observed. Up to the past year practically nothing had been done in this locality to develop these ores. In 1907–8 some development work, not on an extensive scale, however, was accomplished. While none of the openings expose the country to much depth, the showings are encouraging and the intelligent expenditure of some money here may open up workable copper deposits.

The Lead Belt.—As the accompanying plan and section, Fig. 1, will show, the lead belt lies about midway between the silver and copper belts, both geologically and geographically, and along the east base of White Pine Mountain. The mines in this belt are almost wholly within the Lone Mountain dolomite, the upper member of the Silurian. By some unexplainable dynamics the dolomite has been extensively faulted while the formations between which it lies have only been folded. Within this formation, and more narrowly within the faulted areas, occurring in beds and fissures, the remarkably high-grade lead ores are found.

The Great Valley and Mother Lode mines seem to mark its southern limits, and it ends to the north where the great east west fault submerges this formation, giving it a length of ver 5 miles.

These deposits were discovered shortly after those of Treasure Hill and several early attempts were made at smelting these ores. The crude methods and prohibitive transportation charges, however, made them unprofitable at the time. Two decades later, when mining had been abandoned on Treasure Hill, attention was again directed to them. More favorable market conditions made it profitable to export the best grade of these ores to Salt Lake and San Francisco for reduction, and from these mines have since come the ores that have employed, for more than 20 years, the small remaining population of the district.

The fault-fissured zone, in which the mines on this belt occur, varies from 300 to 1,500 feet in width; in position above the Pogonip and below the Nevada limestones, and bounded on the east and west by fault fissures both of which are mineralized. The west fault dips east at 45 degrees and is conformable to the foot-wall. The east fault stands at a much higher angle, probably 75 degrees, and cuts the bedding of the hanging wall at nearly right angles. Thus a wedge-shaped body of shattered dolomite tapering downward fills the displacement between the major faults.

Both fissures are lines of great displacement. Along the east fault, in places, the White Pine shale is brought down to the dolomite, indicating a throw of about 2,000 feet. While on the west fault the displacement appears to vary from 100 to 1,500 feet over most of its length, submerging 350 feet of Eureka quartzite. In four isolated places, however, the Eureka quartzite is left lying undisturbed against the Pogonip. As the dolomite fills the zone between these main faults, it may be termed the gangue or veinstone, as a whole, of a single fissure vein.

The alteration of the dolomite by contact metamorphosis is remarkable. Ordinarily a dark blue-gray sandy rock, in the faulted area of the mines it is changed to a compact, sparry, coarsely crystalline, white marbleized rock, losing its bedding, original color, and structure, and, except for its lithological position would be unrecognizable.

The ore-bearing zone is displaced by the earlier east and west faults which, south of the Monte Christo uplift have a downthrow to the south, and north of it, a downthrow to the north. As far as is known none of the east and west faults pass into the foot-wall formation, and generally they are not very radical in their throw.

There are two distinct classes of ore deposits recognizable: First, those of Rocco cañon, forming in nearly horizontal beds, at or near the top of the dolomite between the fissures; and second, those of King cañon and northward, forming in and along the main fissures. The fissures, where not covered by alluvium, are traceable by following the spongy iron gossan which fills them. This gossan at the surface carries from 4 to 15 ounces in silver per ton and occasional boulders of lead carbonate and galena, varying in size from a few pounds to masses of several tons weight. The lead is found in the gossan as if it had been left stranded by the leaching process which has oxidized the iron. At no point has the sulphide zone been reached to determine the nature and value of the ores at a permanent water level. In the King and Peterson mines depths of 150 and 105 feet, respectively, have been attained neither of which has reached the sulphide zone. These are the two deepest mines on the east fissure. On the west fissure, in the McEllin Mine, a depth of 500 feet by tunnel, has been attained with the same result.

It has been thought by many that the silver mines of Treasure Hill were shallow deposits, and this opinion is entertained by a few regarding the bedded ores of Rocco cañon; but all authorities agree that the lead belt fissures descend to unknown great depths.

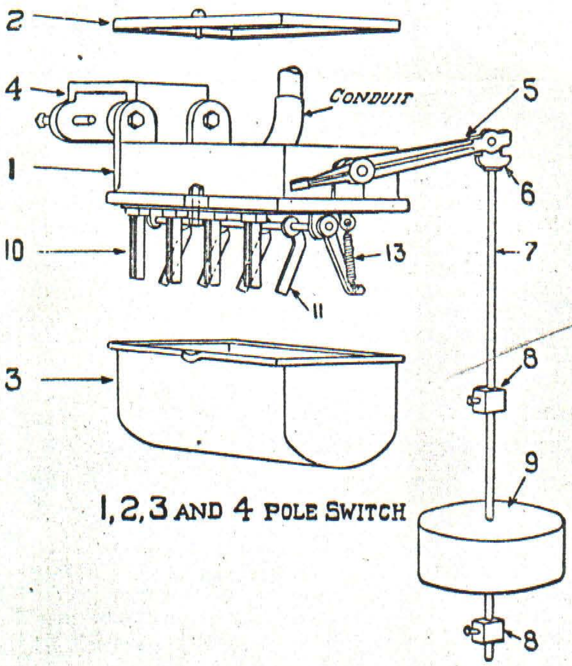
At present the active mines along the belt, naming them from the south northward, are as follows: Great Valley, Rocco Homestake Co., White Pine Lead Co., Nevada Lead Co., Cornell, McEllin, Carbonate King Co., Lo Ben Gula, Peterson and Coyote.

The production from the lead belt to date has been 145,000 tons, averaging 65 per cent. lead and 20 ounces silver per ton, having a gross value of nearly $6,000,000. In this production it should be borne in mind that little, if any, capital other than that taken from the mines has been expended in their development, and that only the highest grade ores have been profitable. That where these mines exceed 100 feet in depth their ores have paid for the deeper workings, and that many comfortable fortunes have been awarded to leasers, individuals, and companies by their operation.

Recently a railroad company has been organized to build a line from Ely to Goldfield. If it crosses the White Pine range at the most feasible place, Little Antelope Pass, it will run within about 8 miles of Hamilton, which will make it possible to market ores of a lower grade than have hitherto been profitable and enormously increase the output of the district.

Sundh Sump Switch

There are many places in mines where an automatic device is convenient and desirable for starting and stopping an isolated pump. The accompanying illustration shows the improved Sundh sump switch, made by the Sundh Electric Co., 115 Cedar Street, New York City. The action of the switch is shown in the illustration. The switch is operated by the pressure of the float 9 against either of the stops 8, attached at suitable points along the rod 7. Movement is communicated to the knife blades of the switch through the rocker arm 5, which is attached to the



1,2,3 AND 4 POLE SWITCH

upper end of the rod 7. The switch is given a quick movement by means of a spring 13. The switch is weather-proof and can be made water-tight if desired. This type of four-pole sump switch is used in connection with small motors where the normal current does not exceed 20 amperes, and where the switch can be thrown directly across the line without the use of the starting resistance. These tank switches are generally used for energizing solenoid starters by closing the solenoid current when the water rises or falls in the sump.

Geological Survey Branch Office

The United States Geological Survey has opened, at Denver, a permanent branch office to facilitate the transaction of its western work, thus providing a base of supplies for the large corps of engineers who are kept in the field many months each year, making geologic studies of mineral deposits, conducting detailed topographic surveys for the base maps of the geologic atlas of the United States, mapping the great national forests, investigating surface and underground waters, and collecting statistics of mineral production.

The office is located in the Commonwealth Building and was opened on the first of April. R. C. Miles, special disbursing agent, is at present in charge.

The establishment of such a branch office will not only serve the convenience of the Survey corps, but it is designed also to meet the great need of the western public for a source of information less remote than Washington. A supply of copies of the publications available for free distribution will be kept on hand, as well as a complete file of the topographic maps, geologic folios, and other publications of the Survey subject to sale. All of these publications will be open to inspection by persons desiring information concerning the subjects treated. Prospective purchasers of maps and folios will be referred to the nearest sales agent, and the free publications will be distributed in Denver to those making application. In short, the Denver office is intended to serve the public in all matters that lie legitimately within the province of the United States Geological Survey.