Construction of Timber Headframes in the Butte District

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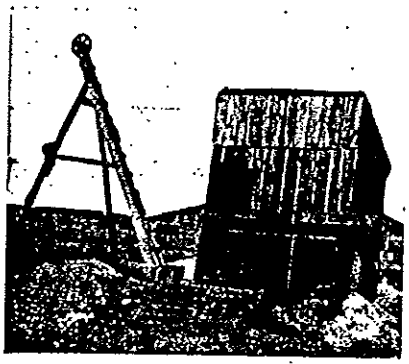

Fig. 1—A "Tripod" headframe applied to a vertical shaft

DEVELOPMENT of headframes in the Butte district, Montana, began in the early days, closely following the discovery period. To unravel accurately the history of their design and construction is difficult, as the early structures were assembled with little or no application of principles of design. Miners and mine carpenters erected headframes either according to the ideas of the "boss" or as dictated by experience in other fields. If the builder had an eye for timber strengths and symmetry, a good structure resulted; if not, he made sure that it would not fail.

All of the earlier headframes were constructed of timber, and, as in other districts during the pioneer stage, were made as simple as possible. Later, when permanency was assured, they were replaced by stronger and more efficient structures.

So far as can be determined, the earliest type of Butte headframe structure, which was and is still being used over prospects, leases, and small mines, is the "Tripod." This is shown, as applied to a vertical shaft, in Fig. 1, and in Fig. 2 as adapted to an inclined shaft. An inspection of these structures is sufficient to give a miner or leaser a working knowledge of their construction. The important detail is the position of the main leg directly in the line of the resultant. It carries the principal working stresses, and, from the standpoint of design, can be considered to be a post or column. The "Tripod" has given remarkable service wherever it has been built substantially.

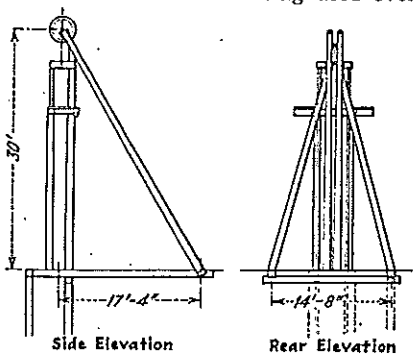

Fig. 3—Timber headframe used at the None-Such mine in 1903

Development of the "Tripod" into a more elaborate structure is shown in Fig. 3, which presents the general details of a headframe used at the None-Such mine in 1903. The headframe was 30 ft. high, from sill to center of sheaves, and was built of rough pole timber. A simple straight-post type of sheave journal box was employed.

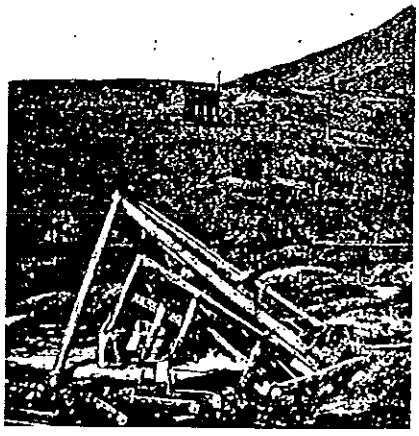

Fig. 2—Application of a "Tripod" to an inclined shaft

The Montana type of headframe, without side batter, was at its zenith in the latter part of the previous century. Structures of this type (see Fig. 4) over the High Ore and Diamond shafts were 100 ft. in height, from sill to center of sheaves. They have since been replaced by more modern steel structures. Six headframes of this type, however, are still in existence in the district. The most noteworthy of these are the Moonlight, Buffalo, and the old Mountain

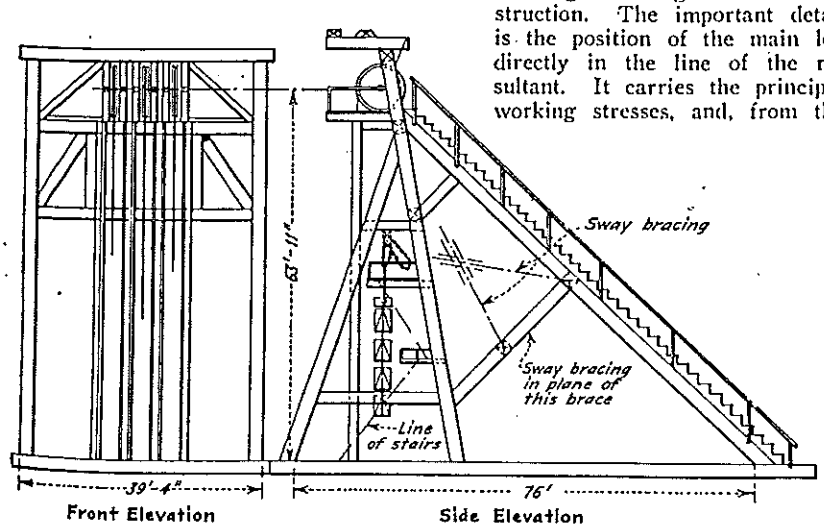

Fig. 4—Montana headframe at the Mountain Consolidated mine

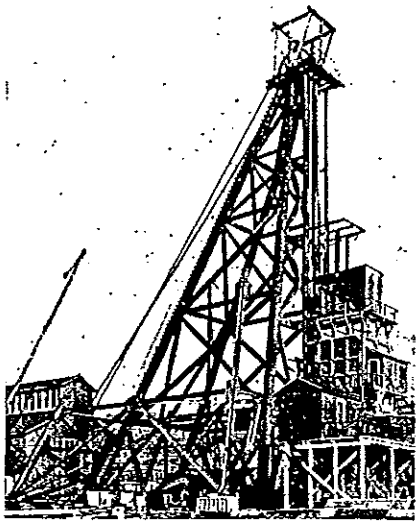

Fig. 6—The timber "A"-type headframe formerly used at the Belmont property

Consolidated structures. None of these properties is producing at present. The old Mountain Consolidated headframe has been used successfully in hoisting from a depth of 3,200 ft., in spite of its age and deterioration. The weight of the cage with loaded Kimberly skip and one rope was 25,000 lb. No data are on record of the performance of such headframes other than that they gave satisfactory service. The type was undoubtedly a development of the "Tripod" to facilitate hoisting from two or more compartments. The Mountain Consolidated headframe, shown in Fig. 4, was probably the most massive of the Montana type. In this structure the main leg was about in the line of the resultant of the gravity and rope pulls.

During the period that the Montana type was most popular, headframes were usually housed. At one time the Mountain Consolidated housing contained not only the headframes but also the carpenter and blacksmith shops. Later, state laws prohibited the housing of headframes. At present none of the headframes of the district are inclosed. In the design of the Montana type, sway bracing in the plane of the back legs is necessary.

Following the Montana type came the modified Montana headframe with side batter. This type is shown in Fig. 5, which presents the general details of the 81-ft. headframe erected at the Berkely mine in 1912. This headframe is still in good condition, and has been employed successfully in hoisting from a depth of 2,400 ft. The weight of the cage, skip, and rope was 30,000 lb.

The modified Montana type of headframe was followed by the "A" structures. At first, these were without side batter, and no examples are extant, except a few old, abandoned, unserviceable structures. The introduction of the "A" type began a new chapter in the development of headframes in Butte. In fact, from this time on, the "A" type became the prevailing design, to the exclusion of all other types. Probably the earliest

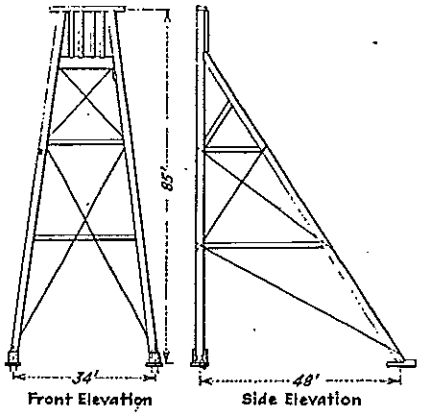

Fig. 7—The "A"-type headframe at the Modoc mine

structure of the "A" type, with side batter, was the old Belmont headframe, shown in Fig. 6, which was 110 ft. high. This has been replaced with a new steel structure, erection of which is also shown in Fig. 6. The Anselmo structure was similar to but smaller than the Belmont headframe. In the application of the "A" type of timber headframe, the design varied greatly, many ingenious details being developed. The following description of several headframes will bring out a few of the more important developments: The Modoc headframe, which has been dismantled,

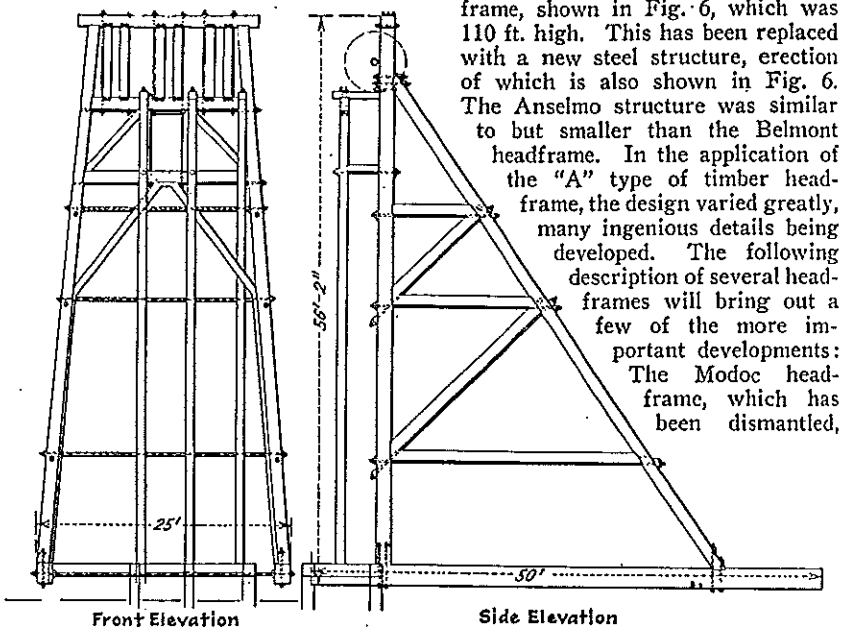

Fig. 8—The Badger State headframe, developed in 1907

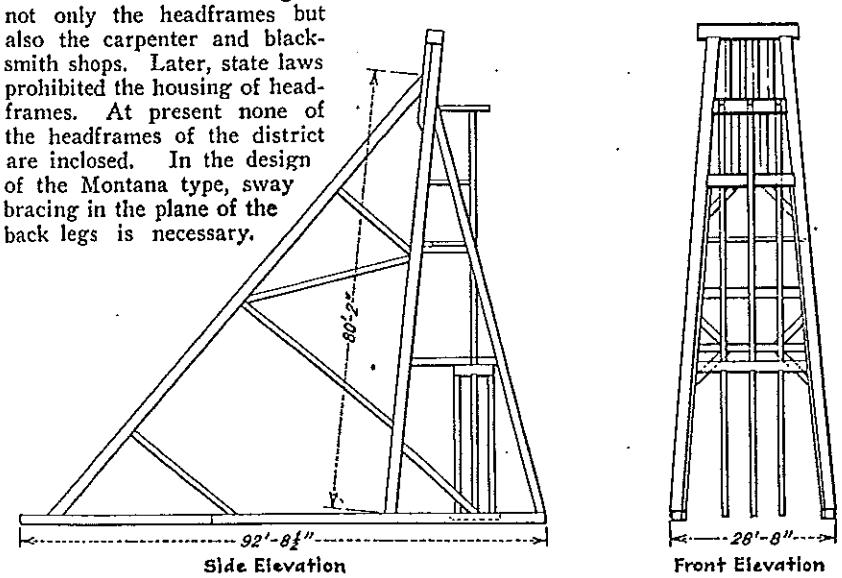

Fig. 5—Modified Montana headframe erected at the Berkely mine in 1912

was a timber structure dating back to 1914. As shown in Fig. 7, it was 78 ft. high from the base of the frame to the center of the sheaves. The structure is noteworthy because it represents a radical change from the full-timber type. Timber struts were used sparingly in its construction, long steel tie rods being introduced where compression was at a minimum. The 22x22-in. timbers indicate the heavy construction then in vogue. Other novel features include the use of short sills and the method of anchoring the front legs.

The Badger State headframe, shown in Fig. 8, was developed in 1907. It was 56 ft. high from sill floor to the center of the sheaves, and was not as massive as some of the "A" type structures already described. Hoisting was carried on through a three-compartment shaft to a maximum depth of 3,400 ft. The weight of the cage, plus loade

skip and rope, was 25,000 lb. This headframe had symmetry and was well balanced. The sheave journal bearings were of the angled post type, and the diagonal and horizontal bracing consisted of both timbers and tierods. This structure has been replaced by a new steel structure.

The Anselmo headframe, which was erected in 1923, is shown in Fig. 9. This is one of the best designed of the newer timber structures of the "A" type, and is in active service today. It possesses considerable rigidity, and at present is used in hoisting from a depth of 2,100 ft. The structure rests on a filled-in gulch. Ore cars are hoisted in cages to the surface, and are hand trammed along a trestle and dumped directly into railroad cars. The headframe is 70 ft. high from the sill to the center line of the sheaves. Unspliced 18x18-in. timbers were used for the main posts or columns.

A headframe known as the Number Three at the property of the East Butte company, which is shown in Fig. 10, was erected in 1903. It is probably the heaviest "A" type headframe in the Butte district. The structure, besides having given good service and being free from vibration, is in a fine state of preservation; no evidence of deterioration can be detected in its members. An unusual feature of its construction is that no sway bracing in the plane of the back legs has been employed. The bracing in the plane of the front legs is also different from that used in the design of the other headframes in the district. Doubling-up timbers are also included in its design.

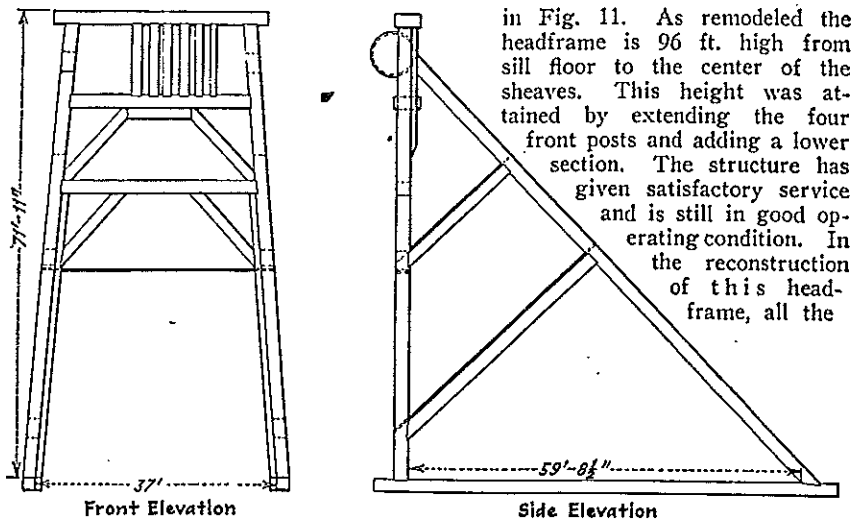

Fig. 10—Number Three headframe, erected in 1903

The unusual massiveness of this headframe is evident on examining the various members. For instance, the cap or crown piece is a solid timber, 25x46 in. in cross-section and 33 ft. 3 in. in length.

The headframe at the Number Two shaft of the Pittsmont property, which is shown in Fig. 11, dates back to 1913. It is the only "Four-Post" type of structure in the Butte district, and is still in a serviceable condition. The headframe has been remodeled three different times, once when hoisting was changed from "caging" to the "automatic-skip-dump" method. The original structure appears above the two arrows shown in the side elevation presented in Fig. 11. As remodeled the headframe is 96 ft. high from sill floor to the center of the sheaves. This height was attained by extending the four front posts and adding a lower section. The structure has given satisfactory service and is still in good operating condition. In the reconstruction of this headframe, all the members were reinforced with strap iron, and additional bracing was made available by placing eyebolts on top of the structure, to which eyebolt cable could be attached. The other ends of these cables were to be fastened to ground anchors, or deadmen, should conditions make the use of such cables necessary. Up to the present time, the cable bracing has not been required. The "Four-Post" type of headframe has never received much favorable consideration in the Butte district, as the fact that this is the only specimen of it would indicate.

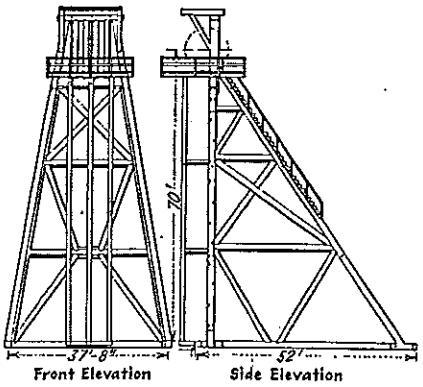

Fig. 9—Details of the Anselmo headframe, erected in 1923

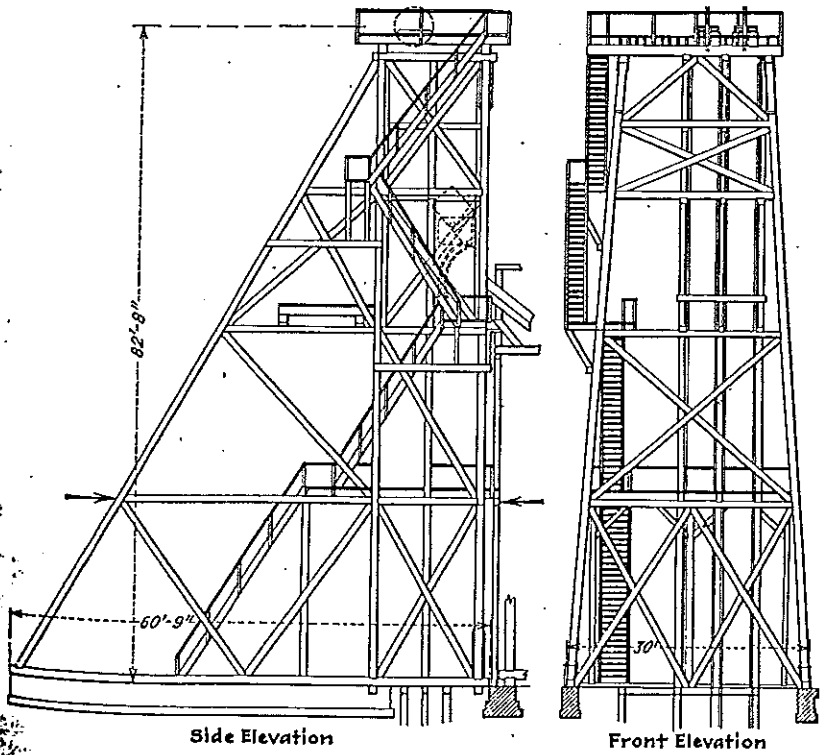

Fig. 11—Number Two headframe at the Pittsmont mine

Few inclined shafts have been sunk at Butte, and only three headframes for this type of shaft are now in existence in the district. None of these structures, however, is in active service at the present time.

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