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Transmountain Water Diversion in Colorado

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BACKGROUND: GEOGRAPHY AND IRRIGATION

With the exception of two projects for the city of Denver, the motivating force behind transmountain water diversion in Colorado has been irrigation. In order to understand the water diversions it is necessary to have some knowledge of the advance of irrigation in Colorado and of the geographic forces which lay behind this progress.

The physical features, the soil, and the climate of Colorado have combined to stimulate the spread of irrigation in the state. Colorado is roughly bisected by the great barrier of the Rocky Mountains, which run from north to south down the center of the state. East of the Rockies lie the Great Plains, which slope gradually downward to the Mississippi. West is a plateau region which extends to the Wasatch Mountains in Utah. Nestled among the ranges of the Rockies in Colorado are four large mountain parks called North, Middle, South Park, and San Luis Valley. Along the crest of the Rockies runs the Continental Divide which separates the waters flowing into the Atlantic from those running to the Pacific.

The rivers of Colorado form an unusually symmetric picture. In the east the South Platte and Arkansas originate close to each other on the eastern slope of the divide. The former flows north and east into Nebraska, while the latter follows a south and east route into Kansas. Across the divide the mighty Colorado thunders down out of Middle Park and traces a path south and west into Utah. The two other important river systems of western Colorado, the Green in the north and the San Juan in the south, join the Colorado outside of the state. While the rivers of the west balance those of the east, the pattern is filled out by the North Platte flowing north out of North Park and the Rio Grande which runs south out of San Luis Valley.

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The Rocky Mountains and the rivers which start in them dominate the history of life in Colorado. Out of the Rockies come the gold and silver which originally attracted people to the state, and along the rivers lie the irrigated farm areas which have allowed agriculture to supplant mining as the chief industry of Colorado.

As far as soil and growing season are concerned the river valleys of Colorado are ideal for agriculture. The soil of the state as a whole is excellent since 75 per cent of it is made up of sandy loams which are easy to cultivate, fertile when water is applied, and extremely productive.[1] The most fertile areas of all are in the valleys, where the residual soil of the uplands is generally held superior to the alluvial soil of the river bottoms.[2] An exception to this is in the Arkansas Valley, where the rich Otero and Rocky Ford alluvial soils are the most highly productive.[3]

Because of the high altitude of Colorado "plants grow more rapidly and seeds mature more quickly than at sea level."[4] As a result it would be possible to carry on agriculture there with a slightly shorter growing season than in other areas. Actually, however, the Colorado river valleys have a season without frost which compares favorably with other parts of the country. The average growing season in the South Platte and Arkansas valleys ranges from one hundred and twenty to one hundred and seventy days; while in the Rio Grande and Colorado valleys it is from ninety to one hundred and twenty days.[5] These figures compare favorably with Iowa and Pennsylvania, two states in which agriculture is a great success.[6]

Rich soil and a more than adequate growing season are not enough to insure the maturing of crops. The third factor in the equation is water, and here the situation in Colorado is not so favorable. In the fertile river valleys the average annual precipitation runs from less than ten to fifteen inches a year.[7] Although corn and wheat can be grown with a relatively small amount of water, a more diversified type of agriculture demands a larger quantity. Since the Colorado farmers wanted to grow a variety of crops in order to feed the miners and since they knew that greater yields could be had

[1]C. W. Beach and P. J. Preston, *Irrigation in Colorado*, U. S. Department of Agriculture, Office of Experiment Stations, Bulletin 218 (1910), 12-13.

[2]*Ibid.*, 12.

[3]*Soil Survey of the Arkansas Valley Area, Colorado*, U. S. Department of Agriculture, Bureau of Chemistry and Soils, Survey 24, 1926 series, 45-46.

[4]*Ibid.*, 3.

[5]Beach and Preston, *op. cit.*, 12; William G. Reed, "Frost and Growing Season," *Atlas of American Agriculture*, U. S. Department of Agriculture (Washington, D. C. 1936), 38-39. In some parts of the Colorado Valley it is a little more than 120 days.

[6]*Ibid.*

[7]J. B. Kincer, "Precipitation and Humidity," *Atlas of American Agriculture*, 6-7.

from corn and wheat with added water, they turned to irrigation.[8] While a lack of rainfall in the most accessible areas of Colorado paved the way for irrigation, the large quantity of water flowing in the many rivers made it possible. The farmers settled in these river valleys and diverted the flow of water by dams and canals to their fields.

Although all crops in Colorado are not irrigated, irrigation has been and is of tremendous importance to the state. In 1890 roughly 50 per cent of all the improved land in Colorado was under irrigation,[9] while in 1939 45 per cent of all acreage harvested in the state was irrigated.[10] Since the census gave up using the designation "improved lands" after 1920, exactly equivalent statistics are not available. These figures do not give the entire picture. Although in 1939 only 45 per cent of crop acreage in Colorado was irrigated, the much greater productivity of the irrigated areas meant that they produced much more than half of the crops grown in the state.[11]

Aided by this geographic background Colorado by 1889 had become a leader in irrigation in the United States both in size and administration. In 1889 Colorado ranked second only to California in number of acres irrigated and in 1939 she still maintained this position.[12] Colorado appointed a state engineer in 1881 and became the first state to provide for the public distribution of water.[13] In so doing she established herself as the leader in irrigation administration throughout the west.

Irrigation was first practiced in Colorado at the headwaters of the Rio Grande by Spanish speaking people who moved up the river from New Mexico.[14] The records of the state engineer list water appropriation rights in this area dating back to 1852.[15] With the discovery of gold in Colorado a great rush began, and irrigation along the South Platte started the following year. Four irrigation ditches in that valley are recorded for 1859, twenty-six for 1860, and by

[8]State Engineer of Colorado, *Second Biennial Report, 1883-1884* (Denver, 1885), 68.

[9]*Eleventh Census of the United States, 1890*, III (Agriculture and Fisheries), "Statistics of Agriculture," 74; "Irrigation," 100.

[10]*Sixteenth Census of the United States, 1940, Agriculture* I, part 6, 234.

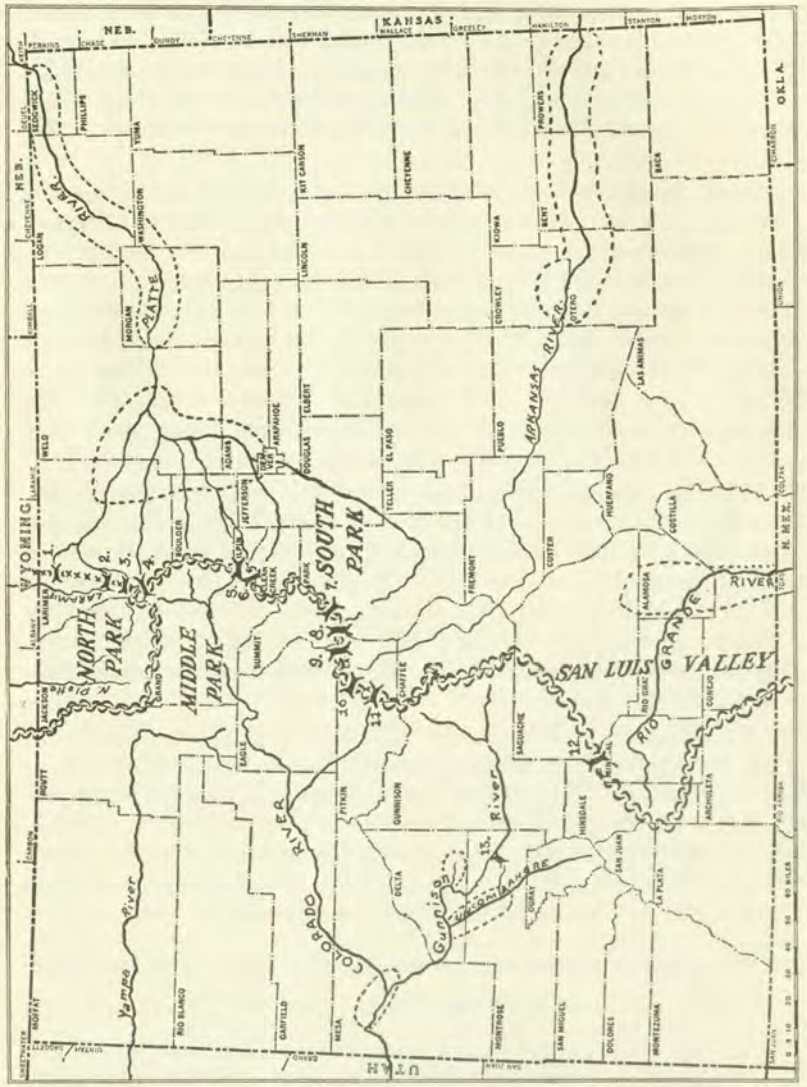
[11]Yield per acre of certain irrigated crops: sugar beets 11.04 tons, corn for grain 28.4 bu. Non-irrigated: sugar beets 4.81 tons, corn for grain 6.3 bu. *Ibid.*, 304.

[12]1889: California 1,004,233 acres irrigated; Colorado 890,725; United States 3,631,381. 1939: California 5,069,568; Colorado 3,220,685; United States 21,003,739, F. H. Newell, *Report on Agriculture by Irrigation, 11th U. S. Census, 1890*, 1; *16th U. S. Census 1940, Irrigation of Agricultural Lands*, 74-75.

[13]Roy P. Teele, *The State Engineer and His Relation to Irrigation*, U. S. Department of Agriculture, Office Experiment Stations, Bulletin 168 (1906), 8, 11.

[14]Percy S. Fritz, *Colorado, The Centennial State* (N. Y., 1941) 326.

[15]State Engineer of Colorado, *Report of 1883-1884*, 91, 94.



xxxx Divide between N. & S. Platte

... Area to be irrigated

Trans. Mt. Diversion Mentioned in paper

Continental Divide

1. Sand Creek
2. Laramie-Poudre Skyline
3. Grand River
4. Colorado - Big Thompson
5. Moffat
6. Jones Pass and Berthoud Pass
7. Boreas Pass
8. Hoosier
9. Fremont
10. Busk-Ivanhoe
11. Twin Lakes
12. Tarbell
13. Gunnison - Uncompahgre

LOCATION OF TRANSMOUNTAIN WATER DIVERSION IN COLORADO

1884 there was a total of 454.[16] Among these ditches are those of Horace Greeley's Union Colony, which was founded in 1870.[17]

Meanwhile a somewhat smaller expansion of irrigation was taking place in the Arkansas and Colorado basins. The records show two ditches in the Arkansas Valley in 1860 and 191 by 1884.[18] The development of irrigation across the divide began in the 1880s when settlers began to realize the possibilities of irrigated orchards in Delta County.[19]

The extent of this early spread of irrigation can be seen in the following figures for 1890. In that year the state engineer listed over a million acres of irrigated land in Colorado, of which nearly seven hundred thousand were in the South Platte Valley. Two hundred thousand more were along the Rio Grande, with the remainder divided between the Arkansas and the Colorado.[20]

By the turn of the century this overwhelming superiority on the part of the South Platte was challenged. While the total acreage of irrigated land in the state had gone up to about 1,750,000 acres, that in the South Platte was if anything slightly lower at 660,000 acres.[21] The Arkansas, Colorado, and Rio Grande had all risen to about 300,000 acres.[22] Between 1902 and 1919 these figures were approximately doubled.[23] Since that time, there has been virtually no change with the exception of the Arkansas Valley which has gone down some 25 per cent, a reduction which was equalized by gains elsewhere. In 1939 the amount of land under irrigation in Colorado was approximately 3,200,000 acres. The distribution was as follows: South Platte Valley, 1,100,000 acres; Rio Grande Valley, 630,000 acres; Colorado Valley, 610,000 acres; Arkansas Valley, 470,000 acres; and elsewhere in the state, 470,000 acres.[24]

The pattern thus formed in the growth of irrigation in Colorado plus the geographic background which lay behind the irrigation united to pave the way and shape the growth of transmountain water diversion in the state. As has been indicated, irrigation as early as 1890 was located primarily in the three large river valleys which lie east of the Continental Divide. In fact only about sev-

[16] *Ibid.*, Appendix, 2-59.
[17] *Ibid.*, 19-20.
[18] *Ibid.*, Appendix, 60-68.
[19] State Engineer of Colorado, *Third Biennial Report, 1885-1886* (Denver, 1887), 191-198, 237.
[20] State Engineer of Colorado, *Fifth Biennial Report, 1889-1890* (Denver, 1891), I, 531-533. The statistics in this paragraph may be a little high. The census for 1890 lists 890,735 acres of irrigated land in Colorado in 1889, but is not useful because it does not break it down by river basins. F. H. Newell, *op. cit.* 90.
[21] *Fourteenth Census of the United States, 1920*, VII, 149-150.
[22] *Ibid.*
[23] *Ibid.*
[24] *Sixteenth Census of the United States, 1940, Irrigation of Agricultural Lands*, 184.

en per cent of all irrigated land in Colorado at that time was west of the Divide. The water, however, so badly needed for irrigation was more plentiful in the Colorado River across the Divide than in any of the rivers to the east.[25] The irrigators along the South Platte, who by 1890 were already beginning to feel the pinch of too little water late in the summer, were aware of this situation, and were beginning to talk of bringing water across the Divide.[26]

While the geography of Colorado thus set the stage for transmountain water diversion, it was the pattern of irrigation growth in the state which to a certain extent shaped its course. Thanks to the early spread of irrigation in the South Platte Valley, transmountain irrigation first appeared there from 1890 to 1910. The somewhat later growth of irrigation in the Arkansas basin led to a transmountain boom there from 1922 to 1932. Growth of irrigation was not always followed by transmountain diversions, however, and in the Rio Grande such diversions were never much of a factor.

TRANSMOUNTAIN WATER DIVERSION IN COLORADO UP TO THE COLORADO - BIG THOMPSON PROJECT

Transmountain water diversion in Colorado up to the Colorado-Big Thompson project may be divided into two periods: first, a preliminary period from about 1890 to shortly after 1930; and second, a period of three larger undertakings in the 1930s. The Colorado-Big Thompson project, now under construction, marks a separate period, and will be described in the next section.

The pattern for the preliminary period arose out of the growth of irrigation in the state, and has already been suggested. It included: first, an early development of diversions into the South Platte; second, a later extension into the Arkansas Valley; and third, minor diversions into the Rio Grande. During this preliminary period there was also a fourth area in which transmountain water diversion took place. This was the Gunnison Valley of the Colorado, where the Uncompahgre project was located. This project differed from the others in that it did not take water from one great river basin to another, but rather diverted water from the Gunnison to one of its tributaries by means of a tunnel.

Although miners had built a ditch across Hoosier Pass in 1860 to use west-side water for placer mining at the headwaters of the South Platte,[27] the use of such diversions for irrigation did not begin until 1890. During the 1880s, however, interest began to arise

[25]State Engineer of Colorado, *Fourth Biennial Report, 1887-1888* (Denver, 1889), I, 17-21.
[26]State Engineer of Colorado, *Report of 1883-1884*, 63-65.
[27]George G. Bancroft, "Diversion of Water from the Western Slope," *The Colorado Magazine*, XXI (1944), 178.

among irrigators in the South Platte Valley about the possibility of transmountain diversion.

Even at that early date the rush to secure water rights on the South Platte and its tributaries had resulted in so many claims that late-comers were often denied water in the latter part of the summer.[28] Under the western law of water appropriation the first beneficial user of a certain amount of water from a stream is entitled to that water as long as he wants it, and if there is a shortage of water, priority of appropriation determines who will get it. This doctrine was accepted by Colorado and written into her state constitution.[29] It differs radically from the old English law of riparian rights which granted the right of an undiminished flow of water to every resident along a river.

With this in mind groups of farmers began to weigh the possibilities of appropriating water from the Colorado and North Platte rivers and using it along the tributaries of the South Platte. Since there was relatively little irrigation along the Colorado and North Platte, their appropriation dates would be very early, and they would thus be certain of water.

Another factor which motivated this interest was the realization that vast floods of water were each year flowing out of the state in the rivers west of the divide. There is a discussion of this in the preface to the state engineer's report for 1887-1888.[30]

Even before 1888 the public began to demand some action from the state engineer. In response to this he made a reconnaissance of Grand Lake, at the head of the Colorado, and of a string of lakes, near the source of the Laramie; but he decided that it was unfeasible to divert these waters to the basin of the South Platte.[31]

This popular agitation for transmountain water diversion into the South Platte bore fruit between 1890 and 1910. Water to the South Platte during this period was brought from the Laramie, a tributary of the North Platte, the North Platte itself, and the Colorado. Although the North Platte is not on the western side of the Continental Divide, it is separated from the South Platte by another divide of considerable magnitude.

In 1890 the state engineer remarked that private enterprise had bought up the low passes at the headwaters of the Laramie River.[32] By 1910 these purchases had resulted in three transmountain diver-

[28]State Engineer of Colorado, *Fifth Biennial Report, 1889-1890* (Denver, 1891), I, 13.
[29]State Engineer of Colorado, *Fourth Biennial Report, 1887-1888* (Denver, 1889), I, 22-27.
[30]*Ibid.*, 17-21.
[31]State Engineer of Colorado, *Second Biennial Report, 1883-1884* (Denver, 1885), 63-65.
[32]State Engineer of Colorado, *Report of 1889-1890*, I, 599-600.

sions: the Skyline canal, the Sand Creek ditch, and the Laramie-Poudre tunnel.[33] In the three years from 1910 through 1912 the average annual diversion from the Laramie to the South Platte Basin was approximately 22,000 acre-feet.[34] From 1941 through 1944, in spite of the fact that four minor ditches had been added, the same diversion averaged only about 20,000 acre-feet.[35] This indicates that by about 1910 the water diversion from the Laramie to the South Platte had reached its peak. An acre-foot is the amount of water necessary to cover an acre to the depth of one foot.

Transmountain diversions from the North Platte proper to the South Platte show much the same pattern. While the ditches averaged 3,000 acre-feet a year between 1910 and 1912, the average dropped to 2,500 for the period between 1941 and 1944.[36]

With one slight exception the same pattern appears in the statistics for the last of the three sets of transmountain diversions into the South Platte, those from the Colorado. Although by 1910 there were four ditches across the divide connecting the Colorado with the South Platte, only one of these, the Grand River Ditch, was of any size.[37] Between 1910 and 1912 these four ditches brought an average of 12,000 acre-feet a year from the Colorado to the South Platte.[38] From 1941 to 1944 the annual average of all diversions from the Colorado to the South Platte, with the exception of two large projects built in the 1930s, was roughly 19,000 acre-feet.[39] The cause of this jump was not the construction of new ditches, although one minor one was built, but rather the expanded use of the Grand River Ditch.[40]

From the above it may be seen that aside from the construction of two large projects in the 1930s and the increased use of the Grand River Ditch there has been no increase in transmountain water diversion into the South Platte since about 1910. On the whole, these diversions were not great. The average from 1910 to 1912 was 37,-

[33]Beach and Preston, *op. cit.*, 25; Bancroft, *loc. cit.*, 179.

[34]Actual figure 21,685. State Engineer of Colorado, *Fifteenth Biennial Report, 1909-1910* (Denver, 1911), 39; State Engineer of Colorado *Sixteenth Biennial Report, 1911-1912* (Denver, 1913), 34, 38.

[35]Actual figure 19,605. State Engineer of Colorado, *Thirty-First Biennial Report, 1941-1942* (Denver, 1943), 19; State Engineer of Colorado, *Thirty-Second Biennial Report, 1943-1944* (Denver, 1946).

[36]1910-1912: 3,037. Cf. *ante* footnote 8. 1941-1944: 2404. Cf. *ante* footnote 9.

[37]Hoosier Pass Ditch 1860, Bancroft, *loc. cit.*, 178; Boreas Pass Ditch 1909, Robert Follansbee, *The Upper Colorado River and its Utilization*, U. S. Department of Interior, U. S. Geological Survey, Water-Supply Paper 617 (1929), 53; Berthoud Pass Ditch 1909, Follansbee, *op. cit.*, 52; Grand River Ditch 1903, Follansbee, *op. cit.*, 49-50.

[38]Actual figure 11,928. Cf. *ante* footnote 34.

[39]Actual figure 18,960. Cf. *ante* footnote 35.

[40]Follansbee, *op. cit.*, 50.

000 acre-feet a year or only 3 per cent of the water used annually for irrigation in the South Platte basin during that time.[41]

While the early transmountain boom in the South Platte Valley came between 1890 and 1910, that in the Arkansas basin took place in the ten years between 1922 and 1932. Although an old transmountain mining ditch which dated back to 1880 was put into irrigation use in 1912,[42] the first important diversion was the Busk-Ivanhoe tunnel, started in 1922. This tunnel, abandoned by the Colorado Midland Railroad, is used primarily as a road, but along one side is a metal flume which has been carrying water from the Roaring Fork of the Colorado to the Arkansas ever since 1922.[43] Another transmountain project into the Arkansas Valley was the Fremont ditch built about 1927.[44]

Although irrigation interests built two more small ditches between 1932 and 1936, for all practical purposes they failed to increase the total amount of water coming into the Arkansas basin. The Twin Lakes project, which was put into service in 1935, more than doubled the amount of water being diverted to the Arkansas, but this undertaking was one of the three large projects of the 1930s which will be discussed together at the end of this section. Aside from the Twin Lakes tunnel the annual transmountain water diversion to the Arkansas basin was the same between 1936 and 1940 as it had been in 1932. The additional water added by the two new ditches was compensated by a reduced usage of the old ones. The annual amount diverted in both 1932 and from 1936 to 1940 was about 10,000 acre-feet or roughly one per cent of the water used in the Arkansas Valley at both times.[45]

The third river valley to receive transmountain water was the Rio Grande. Although there are very few data available concerning diversions into the Rio Grande Basin and in spite of the fact that they were very small, there is enough information to indicate that they were as large shortly after 1913, as they were from 1941 to 1944. The Tarbell ditch, built in 1913, diverted an average of 2,000 acre-feet a year to the Rio Grande from the Gunnison.[46] Although

[41]1,248,339 acre-feet used annually 1910-1912. State Engineer of Colorado, *Report of 1909-1910*, 37; State Engineer of Colorado, *Report of 1911-1912*, 32, 37.

[42]Bancroft, *loc. cit.*, 178. Follansbee, *op. cit.*, 51.

[43]*Ibid.*

[44]State Engineer of Colorado, *Twenty-Eighth Biennial Report, 1935-1936* (Denver, 1939), 345.

[45]1932: 10,551 acre-feet diverted; 1,073,520 acre-feet used. State Engineer of Colorado, *Twenty-Sixth Biennial Report, 1931-1932* (Denver, 1933), 272,274. 1936-1940: 10,772 average diverted; 1,389,170 average used. State Engineer of Colorado, *Report of 1935-1936*, 317, 345; State Engineer of Colorado, *Twenty-Ninth Biennial Report, 1937-1938* (Denver, 1939), 411, 375, 379, 417; State Engineer of Colorado, *Thirtieth Biennial Report, 1939-1940* (Denver, 1941), 379, 383, 423, 430.

[46]Follansbee, *op. cit.*, 52.

there were about six ditches in operation between 1941 and 1944 the average annual diversion was only 2,500 acre-feet.[47] The only significance of these diversions into the Rio Grande is that they complete the line of transmountain projects in Colorado, which extends all along the Rockies from the northern to the southern border of the state.[48]

Before going on to the ambitious projects of the 1930s, it is necessary to examine the last of the four areas where Colorado transmountain water diversion took place during the preliminary period. This area is the Gunnison Valley, or more specifically the valley of the Uncompahgre, a tributary of the Gunnison. Here is located the Uncompahgre Valley project of the Reclamation Bureau which differed from the other transmountain undertakings of the preliminary period in three ways. First, it was a large project involving in 1944 the transfer of over 300,000 acre-feet of water.[49] Second, it was a government project. Third, it did not divert water out of any great river basin, but instead merely transferred water from the Gunnison to one of its tributaries. None the less it was a transmountain water diversion, and since it took place in the preliminary period it must be mentioned here.

When the Reclamation Bureau was set up in 1902, it was immediately confronted with the Uncompahgre Valley problem. During the last quarter of the nineteenth century people flocked to this valley led on by the current opinion that the river carried enough water to irrigate 175,000 acres. Since this was far from true, large scale failure resulted, and in 1902 only 30,000 acres, and those inadequately, were irrigated there. The mockery of the situation lay in the fact that just across the ridge in the Gunnison valley there was an enormous flow of water and very little suitable land. In 1901 the engineering and financial facilities of the state proved inadequate to effect a transmountain diversion.[50]

With the establishment of the Reclamation Bureau in 1902, the federal government agreed to take over the undertaking provided the present and future settlers of the valley agreed to pay the costs. This was done, and in 1904 construction got underway on the Gunnison tunnel. Although the tunnel was not fully completed until 1919, a certain amount of diversion began in 1910.[51]

[47]State Engineer of Colorado, *Report of 1941-1942*, 20; State Engineer of Colorado, *Report of 1943-1944*, 17.

[48]National Resources Planning Board, *Rocky Mountain States Region Industrial Development* (Washington, 1942), map facing 4.

[49]Actual figure 313,860. *The Surface Water Supply of the U. S., 1944, part 9, Colorado River Basin*, U. S. Department of Interior, Geological Survey Water-Supply Paper 1009 (1944), 91.

[50]Reclamation Service, *First Annual Report 1902*, U. S. Department of the Interior, Geological Survey (Washington, 1903), 132-135.

[51]William Melcher, *The Uncompahgre Reclamation Project* (Madison, Wisconsin, 1931), 20-23.

Owing to the slowness of construction farmers who had counted on all the water they wanted by 1908 were forced to give up and there was a resultant speculation in reverted land.[52] Delays, increasing costs, and other factors resulted in an inability on the part of the farmers to repay the costs of construction. As a result the government was forced to extend the term of payment, and the project is far from paid off even now.[53]

This description of the Uncompahgre Valley project terminates the history of the preliminary period. This period was marked by the sudden progress of transmountain diversion into the South Platte between 1890 and 1910 and by a later expansion into the Arkansas during the 1920s. While diversions into the Rio Grande were tiny, they did fit into the same pattern as those into the South Platte. Completely divorced from the pattern was the Uncompahgre project completed in 1919.

Close on the heels of this preliminary period came the era of the three large projects of the 1930s. These three projects totalled 66,000 acre-feet in 1940, considerably more than all the preliminary projects combined excepting the Gunnison tunnel.[54] The three undertakings were the Twin Lakes tunnel into the Arkansas, and the Moffat and Jones Pass tunnels into the South Platte.

The purpose of the Twin Lakes diversion was to provide 50,000 acre-feet of water for the irrigation of melon and sugar beet farms on the lower Arkansas.[55] The project, which was much more ambitious than any heretofore constructed across the divide, got underway in 1933, and diversions began in 1935.[56] A significant sidelight of the undertaking was the fact that it was financed by a Reconstruction Finance Corporation loan.[57]

While the purpose of the Twin Lakes project was irrigation, that of the Moffat tunnel was city water supply. As Denver grew, her water supply became more and more inadequate. Since there was no longer any unappropriated water in the South Platte, Colorado was obliged to turn to transmountain water diversion.[58]

When in 1929 the Denver and Salt Lake Railroad completed the Moffat tunnel, they leased the pioneer bore of the tunnel to the

[52]*Ibid.*, 24-26.

[53]*Ibid.*, 25-34.

[54]Twin Lakes 27,768; Moffat Tunnel 28,813; Jones Pass Tunnel 9,555. Total: 66,136 acre-feet. The State Engineer of Colorado, *Report of 1939-1940*, 373,430.

[55]"Driving a Water Tunnel under the Continental Divide," *Engineering News-Record*, CXIII (July-Dec. 1934), 752,753.

[56]*Engineering News-Record*, CXIV (Jan.-June 1935), 231; State Engineer of Colorado, *Report of 1935-1936*, 238.

[57]"Driving a Water Tunnel under the Continental Divide," 752, 753.

[58]"Denver Goes to the West Slope for Additional Water Supply," *Engineering News-Record, CXV* (July-Dec. 1935), 357.

Denver Water Board.[59] A pioneer bore is a small tunnel driven first and from which the main tunnel is excavated. For the purposes of this paper this pioneer bore will be referred to simply as the Moffat tunnel.

From 1929 to 1932 the board leisurely set about the task of lining and enlarging sections of the tunnel, but in the late fall of 1932 a freak of nature spurred them into panic-stricken activity. As the winter of 1932-1933 drew near, the customary snow failed to appear on the eastern slope of the Continental Divide. Since the South Platte and her tributaries, and thus the water supply of Denver, are to a large extent dependent upon snowfall, the prospect of a severe water shortage in the summer of 1933 loomed ominously. Crews of men were sent up on the bitter cold divide to finish the lining of the tunnel and the construction of the necessary works on the west side. The feverish work of these men was abruptly terminated early in 1933 when a six and one-half foot snowfall on the east side guaranteed enough water for the summer.[60]

Because of this scare Denver now determined to put through a big transmountain water diversion. This project, which was completed by 1938, brought water directly to Denver and also diverted some into the South Platte below Denver.[61] The city traded the latter supply to irrigation districts down the river for water held by those districts in reservoirs above Denver. Like the Twin Lakes project the Moffat Tunnel was financed by a government loan.[62]

While Denver was putting the Moffat tunnel into use, a somewhat more modest project was also underway to bring water to the city. This was the Jones Pass tunnel which was to divert water from the Williams Fork of the Colorado to Clear Creek, a tributary of the South Platte. The project was completed in 1940, and diverted almost 10,000 acre-feet that year for use in the new sewage plant in Denver.[63] Like the two other projects this also was financed by a government loan.[64]

While 1940 witnessed the completion of the Jones Pass tunnel it also marked the beginning of the tunnel for the Colorado-Big Thompson project. Thus the first era of transmountain water diversion in Colorado had come to an end.

[59] *Ibid.*, 358.
[60] *Engineering News-Record, CIX* (July-Dec. 1932), 791; *Ibid.*, CX (Jan.-June 1933), 35.
[61] *Ibid.*, CXI (July-Dec. 1933), 119.
[62] *Ibid.*, CXIV (Jan.-June 1935), 231.
[63] State Engineer of Colorado, *Report of 1937-1938*, 366; State Engineer of Colorado, *Report of 1939-1940*, 373.
[64] Tolbert, R. Ingram, ed., *Year Book of the State of Colorado 1939-1940* (Denver, 1941), 443.

The Colorado-Big Thompson Project

While Colorado was engaged in transmountain water diversion, other projects of this type were being constructed elsewhere. The city of Boston diverted water from the Connecticut, and New York brought water from the Delaware to provide drinking water.[65] On the West Coast the Boulder Dam project was started in 1928 to divert water from the lower Colorado to Los Angeles and the Imperial Valley. In Utah irrigation interests were diverting water from the Green River to the Utah Lake drainage area.[66] Among these projects was the Strawberry Valley undertaking of the Reclamation Service, which by 1926 was transferring 67,000 acre-feet a year.[67]

Encouraged by these examples and by those already undertaken in Colorado, people in Colorado began to consider the possibilities of a large project to divert water from the Colorado to the South Platte. A series of crop losses and dry summers along this river had created an economic problem in the valley which it was hoped a large transmountain diversion would solve.[68]

The Colorado River Compact of 1922 proved to be a stimulus for a transmountain water diversion. According to its terms the waters of the Colorado were divided equally between the upper and lower basin states.[69] Colorado felt that it would be best for her to put as much as possible of the upper basin water to beneficial use so as to establish her appropriation rights. If California wished to change the compact at a later date, Colorado would have that as a talking point. Transmountain water diversion would be one way of putting more water to beneficial use.

As a result of these and other factors, the Colorado-Big Thompson project was introduced before Congress in 1936 as an amendment to an Interior Department appropriation bill. In its essence this Reclamation Bureau project was to include the diversion of water from the headwaters of the Colorado through a tunnel under the divide to the Big Thompson River and the South Platte. It proposed to divert 310,000 acre-feet of water a year into the South Platte for irrigation purposes and as an added feature it would produce hydroelectric power. The water so diverted would not be used for the irrigation of the new land but instead would serve as supplemental water for 615,000 acres already under irrigation.[70]

[65] *Congressional Record*, LXXXI, (1937), Appendix, 1736.
[66] Ralf R. Woolley, *The Green River and Its Utilization*, U. S. Department of Interior, Geological Survey, Water-Supply Paper 618 (1930), 93.
[67] *Ibid.*
[68] *Colorado-Big Thompson Project. Synopsis of Report by Bureau of Reclamation, Senate Document 80*, 75 Cong., 1 sess., 8. Afterward referred to as *Colorado-Big Thompson Project.*
[69] State Engineer of Colorado, *Twenty-First Biennial Report, 1921-1922* (Denver, 1923), 16-21.
[70] *Colorado-Big Thompson Project*, 1-8.

The project would roughly quadruple the amount of water being diverted into the South Platte, Arkansas and Rio Grande basins,[71] and when fully developed it would produce more electric power than what was currently being used in Colorado.[72] According to original estimates the project would cost $44,000,000 of which $25,000,000 would be repaid by the water users, and the remainder by the sale of power.[73]

The fight in Congress which arose over this proposal brought Colorado transmountain water diversion for the first time before the public eye. It initiated a new era in the history of transmountain diversion in the state, an era of national importance.

The most strenuous opposition to the Colorado-Big Thompson project came from those who felt it would destroy the beauty of Rocky Mountain National Park. Inasmuch as the tunnel would run under the park from Grand Lake to Estes Park, lovers of nature felt that debris from it would mar the beauty of these two towns. Since the towns were located at the west and east portals of the park, it too would suffer. These people, furthermore, believed that the use of Grand Lake would result in great fluctuations in the level of that body of water, thereby leaving an unsightly water line. They deplored the fact that this would set a precedent for the future exploitation of our national parks.[74] Edward Taylor, a Colorado Congressman, declared in March 1936 that he had had as many as two or three hundred protests.[75]

A second point of opposition and one expressed by the *New York Times* was the feeling that the farmers would be unable to pay for the irrigation part of the project.[76]

What the *Times* was actually driving at was that they did not want to have taxpayers in New York or any other state supporting Colorado. This was a third objection and was expressed more directly by Representative Ferguson of Oklahoma, who complained that his state was getting none of the government projects, and that Colorado was getting too many.[77]

[71] 102,154 acre-feet diverted 1944. State Engineer of Colorado, *Thirty-Second Biennial Report, 1943-1944* (Denver, 1946), 16-17.

[72] About 700,000,000 kilowatt hours used in Colorado 1937. Tolbert R. Ingram, ed., *Year Book of the State of Colorado, 1939-1940* (Denver, 1940), 7. 900,000,000 kilowatt hours proposed for Colorado-Big Thompson project, *The Reclamation Era*, XXXII (1942), 21.

[73] *Colorado-Big Thompson Project*, 6-7.

[74] *Supplemental Hearing before the Subcommittee of the House Committee on Appropriations on the Interior Department Appropriation Bill for 1937, Congressional Hearings*, 74 Cong., 2 sess., no. 34, *passim*. Afterward referred to as *Supplemental Hearing*.

[75] *Ibid.*, 2.

[76] *The New York Times*, July 2, 1937, 20.

[77] *Hearings Before the House Committee on Irrigation and Reclamation on Senate Bill 2681, Congressional Hearings*, 75 Cong., 1 sess., no. 161, 17. Afterwards referred to as *Hearings . . . on Senate Bill 2681*.

Since Senator Adams introduced the project as an amendment to the appropriations bill for the Interior Department, it looked as if Colorado was trying to sneak it through. The *New York Times* looked at the rider with suspicion, and therefore opposed the project on theoretical as well as financial grounds.[78]

At a time when the Department of Agriculture was intent on reducing production, many people felt it unwise for the Department of Interior to back a project which would increase it.[79]

While all of these factors played a large part in defeating Senator Adams' rider in 1936, it was the division of the Colorado Congressional delegation which made passage of the amendment impossible. Colorado west of the divide was opposed to the project on the grounds that it might cause the upper Colorado to run dry in the summer. To guard against this they demanded the construction of a reservoir on the west side which would collect the flood waters of the Colorado in the spring and hold them for use later in the season. Since the east side was unwilling to assume the costs of such a reservoir, an impasse was reached.[80]

During the course of discussions in 1936 and 1937 all the above points of objection were overcome, and the project passed Congress in June 1937.[81] In response to the arguments of nature lovers the Bureau of Reclamation pointed out that the undertaking would actually beautify Grand Lake and the entrances to the park. They pledged themselves to dispose of the debris in an orderly fashion, and they proved that the project would reduce the fluctuation of Grand Lake to a point considerably less than the current changes in water level. In refuting the argument that this would cause a bad precedent, they pointed out that the act creating the Rocky Mountain National Park provided for just such a project.[82]

A few salient figures convinced Congress that the farmers of the South Platte would be able to pay for the irrigation share of the costs. Since $25,000,000 had to be repaid in forty years, it meant an annual payment of slightly over $600,000, and inasmuch as 310,000 acre-feet were to be diverted, the cost per acre-foot would amount to only two dollars. Since the price of water along the South Platte at that time was much in excess of two dollars, it appeared likely that the irrigators would be able to pay the expenses.[83]

[78] *The New York Times*, July 2, 1937, 20.

[79] *Congressional Record*, LXXXI (1937), 7414.

[80] *Supplemental Hearing*, 55-56.

[81] *Congressional Record*, LXXXI (1937), 7418.

[82] *Supplemental Hearing, passim*.

[83] *Colorado-Big Thompson Project*, 23-24. Estimates on the total cost of the project have risen from $44,000,000 to almost $130,000,000. *The Christian Science Monitor*, Feb. 11, 1947, 11. This will probably triple the cost of the water per acre-foot, and again raises the question as to whether the money can be repaid.

The Bureau of Reclamation silenced Congressman Ferguson by pointing out that many other states were also receiving government projects,[84] and the rider opposition fell by the wayside when Senator Adams introduced a separate bill for the project in 1937.

Although the defense of the bill from the attacks of those who criticised it on the grounds of agricultural policy was not too strong, it did convince enough people to insure passage. Defenders of the bill argued that the project would not develop new farm areas, but would prevent crop losses on areas already under irrigation.[85] They did not successfully answer the charge of increasing crop production, but this did not prove of sufficient strength to defeat the bill.

Just as the division of the Colorado delegation had helped defeat the bill in 1936, so its unity in 1937 was a vital factor in the success of that year. In a special agreement in 1937 the east side agreed to include a reservoir on the west side in the project, and following that Colorado presented a united front in Congress.

Following the adoption of the project by Congress in June, 1937, Secretary of the Interior Ickes held hearings to determine its feasibility. At this hearing opponents of the project presented the same arguments that had been aired in Congress, but in spite of this Ickes declared it feasible. When on December 28, 1937, President Roosevelt gave his approval, the ways were cleared for the actual building.[86]

Plans for the project called for elaborate construction on both sides of the Continental Divide as well as the giant thirteen mile tunnel. On the western side dams at two spots on the upper Colorado would create Granby reservoir and Shadow Mountain Lake. A pumping plant at Granby Reservoir would pump the water to Shadow Mountain Lake, from which it would flow into Grand Lake. The water would cross Grand Lake, enter the tunnel and flow by gravity under the divide.[87]

Once on the eastern slope the water would commence its downward course to the valley of the South Platte. It would first pass through a power plant at Estes Park and then enter the Big Thompson River. By means of an intricate network of dams, canals, siphons, and reservoirs, part of the water would be diverted to the Cache la Poudre River and Saint Vrain Creek before reaching the South Platte. Ultimately four power plants in addition to that

[84] *Hearings . . . on Senate Bill 2681*, 17.
[85] *Supplemental Hearing*, 34-35.
[86] "Colorado-Big Thompson Project Argued at Hearing," *Engineering News-Record*, CXIX (July-Dec. 1937), 808; "Transmountain Tunnel Found Feasible" *Engineering News-Record*, CXX (Jan.-June 1938), 39.
[87] *Colorado-Big Thompson Project*, 1.

at Estes Park would be set up to put the water to work on its way to the valley below, but only the plant at Estes is necessary for the operation of the project. Power from this plant will be sent back across the divide to run the Granby pumping plant.[88]

Work began first on the special Green Mountain Reservoir, which was designed to hold a large amount of water and protect the interests of the west side. Although started in 1938, this was not finished until 1945.[89] Meanwhile the tunnel was begun and completed between 1940 and 1944.[90]

After V-J Day work was accelerated, and by the end of the year the dam across the Colorado for Shadow Mountain Lake was completed.[91] At present work is in progress on the dam for Granby Reservoir, the pumping plant at Granby, the power plant at Estes Park, and on other features of the project.[92] In short the essential elements in this undertaking are now completed or underway and before long the dream of bringing a large body of water across the divide may be realized. The speed with which the project is finished depends upon Congress and since at present this body seems anxious to cut the budget of the Interior Department, the South Platte may have to wait quite a bit longer for her water. There is talk, however, of using the tunnel and temporary equipment to divert a small amount of water this summer (1947).[93]

In a sense the Colorado-Big Thompson project is the culmination of all the smaller undertakings of the era from 1890 to 1940. It is also the harbinger of even greater undertakings in the future. One of these, the Gunnison-Arkansas proposal, would divert 800,000 acre-feet of water a year to the Arkansas Valley, while another, the Blue River project, would bring 400,000 acre-feet into the South Platte Basin near Denver.[94] Although there is no way of knowing whether or not these projects will be built, they do serve to indicate the growing size and importance of this present era of transmountain water diversion in Colorado.[95]

(To Be Continued)

[88] *Ibid.*, 1-2.
[89] *The Reclamation Era*, XXVIII (1938), 255; XXIX (1939), 39; and XXXII (1942), 228.
[90] *Ibid.*, XXXI (1931), 62-65, 218-219; *Engineering News-Record*, CXXXII (Jan.-June, 1944), 856.
[91] Secretary of Interior, *Annual Report for Year Ending June 30, 1946*, 107.
[92] *The Reclamation Era*, XXXII (1946), 211, 284.
[93] *The Christian Science Monitor*, February 11, 1947, 11.
[94] *Ibid.*
[95] On June 23, 1947 the Alva B. Adams Tunnel of the Colorado-Big Thompson project was dedicated and put in partial use. —Ed.

The Trial of Proportional Representation in Boulder, Colorado, 1917-1947*

LYNN I. PERRIGO

The Hare system of proportional representation employed in municipal elections at Boulder for thirty years finally has been dropped by a decision of the local electorate November, 1947, thus ending for the present, at least, a long and involved contest over this progressive but controversial feature of the city charter.

The experiment began in 1917 as a part of the movement for more efficient, non-partisan municipal administration. Boulder had had a typical experience with partisan government under town trustees from 1871 to 1882, and under a city council from 1882 to 1917. Perhaps it was not so much a revulsion against partisan politics as it was a reaction against the municipal ownership tendencies and the reforming zeal of the "Better Boulder" party that led to the movement for "business management" in municipal affairs. After the reformers had forced prohibition by local option in 1907 and had obtained approval of a bond issue in 1909 to build a municipal light plant (which was thwarted later), a meeting of citizens who had "had enough of Better Boulder" urged that a business man's ticket be elected to restore the city "to a business and progressive basis."[1] At that time the city manager plan, barely in the experimental stage elsewhere, was not especially advocated; yet obviously something of the sort was wanted.[2]

Soon citizens petitioned the council for a charter convention to take advantage of the provision in the state constitution which permitted cities to adopt the form of government desired locally.[3] By that time news had spread about Galveston's commission form of government, which had been adopted by two cities in Colorado, Grand Junction and Colorado Springs.[4] However, this did not seem to be quite what the business leaders sought, and their spokesman wrote: "Students of government have repeatedly advised the adoption of the commission form, but the average Boulder citizen is content, as long as the city is governed wisely, to be ruled by the old, but still efficient method."[5]

In other words one group did not like the existing system if the opposition was in control, but liked it if their own party was in power, and at that time the business men had their candidates in office.[6] Consequently, after a petition of some "reformers" for a vote on a charter convention was accepted by the council on August 8, 1910, the leading newspaper and the "Tax Payers' League" opposed it on the ground that the special elections and convention would cost $14,000. As a result the proposal was defeated by a vote of 1804 to 1129.[7]

The next year the reform party came back into power, and once more the business men began clamoring for a "business" government, or at least a modification of the existing system by paying the mayor a greater salary and expecting more of him. They obtained this in effect by putting into office a wealthy, retired business man, W. L. Armstrong, who gave almost full time to the city.[8] The movement for a charter and the city manager form did not lapse, however, but with the support of the Commercial Association, the leading newspaper, and many university professors was brought to a vote again in 1915 only to be lost once more. This time the defeat, 832 to 676, was said to have been due in part to bad weather on election day and in part to satisfaction with the Armstrong administration.[9]

Regardless of this defeat, the proponents, now combining all the reform elements in the city, nominated one of their aggressive leaders, F. J. Klingler, enlisted the support of nearly all local organizations, and defeated Armstrong in 1917 by a vote of 1450 to 1327 after a hard-fought campaign.[10] Although the margin was narrow, the charter advocates were then in control and the subsequent steps were easy. The council approved a petition for a special election, a mass meeting nominated twenty-one convention delegates representing seven occupational groups, and they were unopposed and duly elected by a very light vote in August, 1917.[11] The convention, under the presidency of Professor Ira M. DeLong, met and

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[1] *Boulder Daily Camera*, March 3, 1909, *et passim*, 1907-1909.

[2] In 1906 Staunton, Virginia, employed a "superintendent", and the manager plan emerged at Sumter, S. C., in 1914 and was adopted at Dayton, Ohio, later that year. H. A. Stone, Don K. Price, and Kathryn H. Stone, *City Manager Government in the United States* (Chicago: Public Administration Service, 1940), Chapter I.

[3] Minutes of the Boulder City Council, June 21, 1909.

[4] *Camera*, Jan. 8, 1910.

[5] *Ibid.*

[6] A. A. Greenman was mayor. *Ibid.*

[7] *Ibid.*, June 21, 28, July 26, Oct. 31, Nov. 1, 5, 1910; Minutes of the City Council, July 25, Aug. 8, Nov. 21, 1910.

[8] *Camera*, Jan. 22, 23, Feb. 21, April 2, 9, 1913; Jan. 3, Feb. 2, 1914.

[9] *Ibid.*, Jan. 13, 14, 15, Feb. 19, March 3, 16, April 7, 1915; Council Minutes, April 20, 1915.

[10] *Ibid.*, April 17, 1917; *Camera*, *passim*, Oct. 6, 1916, to March 6, 1917; Boulder Commercial Association, *Boulder's Crisis* (n.d., in University of Colorado Historical Collections).

[11] Council Minutes, June 30, Aug. 7, 1917.

proceeded quietly with the revision of a tentative draft of a city charter into the form finally adopted at another special election in November.[12] Among the delegates at the convention were two women; one, Mrs. Thomas A. McHarg, successfully advocated the adoption of the Hare system of counting votes, and the other, Mrs. Scott Campbell, became the sole woman member of the new city council elected by the Hare system for the first time in December, 1917.[13]

In 1918, when Boulder came under the newly adopted charter, which provided for the city manager form of administration, 98 other cities in the United States already had adopted that plan.[14] However, at that time only one other city in the nation had tried the Hare system, and since that city, Ashtabula, Ohio, later dropped it, Boulder then became the city with the longest experience under this innovation. This never became a widely popular innovation, for in 1945 only eight cities in the United States were employing the Hare system.[15]

The principal objective of this system is to provide always that minority groups have some representation. The voting is simple, for the electors merely indicate their first, second, and third, or more choices by the use of numbers, 1, 2, 3, 4; but the counting of the votes is complex. The total number of ballots is divided by one more than the number of places to be filled, and any candidate who gets more than that number of votes is elected. Any surplus votes of an elected candidate are not counted for him, but are credited to the second choices indicated on them. On the first count only one or two, or perhaps none, will have the required total. Then the one with the least number of votes is dropped and the second choices on his ballots are counted for the candidates to which they go. Quite likely one or two of the higher candidates then will have enough votes to be elected. Next, another low contestant is dropped and his votes are transferred. This procedure is repeated sometimes seven or eight times until finally enough candidates have the required total to be elected.[16] For example, the first tally of votes to name three councilmen for two-year terms in the first election under the Hare system at Boulder, in 1917, appeared as follows with a "quota" of 201 votes:[17]

Candidates	First count	Transfer Gillaspie surplus	Transfer Pomeroy votes	Transfer Greenman votes	Transfer Forsythe votes	Elected
F. Forsythe ..	71	+13= 84	+ 7= 91	+14=105	—105= 0	
C. Gillaspie ...	299	—98=201				(1)
E. Greenman..	70	+12= 82	+ 4= 86	—86= 0		
L. Herman ...	114	+33=147	+14=161	+22=183	+ 18=201	(2)
F. Moys	110	+20=130	+15=145	+16=161	+ 22=183	(3)
G. Pomeroy ..	46	+ 8= 54	—54= 0			
C. Ricketts ...	93	+12=105	+ 9=114	+11=125	+ 33=158	

After Boulder launched its city manager plan, things moved smoothly for awhile; but soon that form of government, and the Hare system along with it, were severely assaulted. In bitter fights waged in 1923 and in 1925 the local politicians tried to regain control of their city. The first attack was led, odd as it seems, by F. J. Klingler, who once had campaigned vigorously for the charter. Now, however, he contended that, "like all efficiency features of autocracy, we have since learned that these cannot be harmonized with the ideals of self-government and our American institutions."[18] The storm broke when some citizens charged that city officials were conspiring with a paving company to pave all the streets in the city.[19] This was followed by a petition for the recall of the council members and for submission of amendments to curtail the responsibilities of the city manager and to abolish the Hare system.[20] A similar petition was later accepted, and, following a viciously fought campaign, the defenders of the charter won handsomely, 2,730 to 1,340, in a special election on April 10, 1923.[21]

The losers did not give up, however. A new petition obtained the designation of November 3, 1925, for another vote on the same set of amendments.[22] This time the campaign to stop the paving of the streets, to abolish the Hare system, and to make the city manager "subordinate" to the council was led by Herbert S. Hadley, ex-governor of Missouri and then a professor of law at the University of Colorado. After another bitter fight the defenders of the charter again emerged victorious, 1,709 to 1,284.[23]

In both of these contests the Hare system had been one of the issues at stake, and again in 1933 the critics of that method of voting sought its abandonment. In this campaign and at other times several criticisms were directed at the Hare system. One was

[12] *Camera*, Aug. 22, 1917; F. L. Moorhead, compiler, *Charter and Code of Boulder, Colorado* (Boulder Publishing Company, 1925), 20-21; Council Minutes, Nov. 6, 1917.

[13] Interview with Mrs. Scott Campbell, April 19, 1946; letter from Mrs. Thomas A. McHarg, April 24, 1946; Council Minutes, Dec. 11, 1917.

[14] Stone, Price, Stone, *op. cit.*, Chapter II.

[15] Boulder *News Herald*, March 30, 1923; Marguerite J. Fisher and Edith E. Starrett, *Parties and Politics in the Local Community* (Washington: National Council for the Social Studies, 1945), 87.

[16] The rules of this system are given in *ibid.*, 88, and in *Camera*, Nov. 3, 1941, Nov. 7, 1945.

[17] Council Minutes, Dec. 11, 1917.

[18] Quoted in *News Herald*, Feb. 6, 1923.

[19] *Camera*, July 29, 1922.

[20] *Ibid.*, Aug. 26, 1922.

[21] *Ibid.*, and *News Herald*, *passim*, 1922-1923; election broadsides in University of Colorado Historical Collections; Council Minutes, April 10, 1923.

[22] *News Herald*, Oct. 3, 1923; Oct. 2, 1925; Council Minutes, Sept. 5, 1925.

[23] *News Herald* and *Camera*, *passim*, Sept. to Nov., 1925; Council Minutes, Nov. 3, 1925.

that too many electors spoiled their ballots because they had not learned to mark their choices with numerals instead of with x's. Another criticism was that because the candidates were not given party designations, the voters who did not know them personally, did not know what they stood for. A third charge, not really the fault of the Hare system but of the ruling that candidates should be listed alphabetically, was that from 1917 to 1934 not a single candidate whose initial was in the latter half of the alphabet had been elected. An additional problem was that when the system worked well and people were content, too many electors neglected to vote. On the other hand, the arguments for the Hare system were that when a voter's first choice was lost his second choice still might count, that in this way minority interests obtained some representation, and that the personal choice element in voting made it difficult for a political party to fill a majority of the seats and to control the council.[24]

The Hare system was sustained by a majority of about 500 in the special ballot on this issue in November, 1933, and for a time, at least, this was accepted as a final reaffirmation.[25] The opposition, however, raised the question again in the fall of 1947, when once more a petition called for a ballot on repeal of this feature of the charter.[26] Immediately the Committee to Hold on to the Hare System was organized to combat the attack waged by the Committee for Repeal of the Hare System. Those who wanted repeal contended that the system was "confusing and unfair," and that it caused an average of ten per cent of the voters to spoil their ballots in each election. The defenders argued that the plan provided at once a "non-partisan primary" and a final election, and that party politicians consistently had opposed the system, as evidenced by machine attacks on it in Cincinnati and in New York this same year.[27] When the vote was in, the Hare system finally had gone down in defeat by an impressive repudiation, 3,159 to 1,370; and, incidentally, it had lost in New York, too, by a two to one majority.[28] Thus this method of obtaining proportional representation was abandoned simultaneously in both its oldest and its largest cities of trial in the United States.

[24]University of Colorado, *Boulder County Studies on Health, Sanitation, Recreation, Relief, Municipal Administration, and Business* (Boulder: 1921), page 154; *News Herald*, Nov. 6, 1929; "Attacks against P. R. Repulsed in Hamilton and Boulder," *National Municipal Review* (Dec. 1933), 22:613-14; Don C. Sowers, "Sixteen years of P. R. in Boulder, Colorado," *ibid.* (Jan., 1934), 23:27-30; "Boulder's Thirteenth P. R. Election," *ibid.* (Feb., 1942), 31:127-8; interview with Scott Mitchell (city manager 1920-1926), April 19, 1946.

[25]Council Minutes, Nov. 7, 1933; and the articles in the *National Municipal Review*, cited above.

[26]*Camera*, Oct. 8, 1947.

[27]*Ibid.*, Oct. 27, 30, 31, 1947.

[28]*Ibid.*, Nov. 5, 1947; *Denver Post*, Nov. 5, 1947.

Experiences With a Surveying Party in Southern Colorado, 1869

CHARLES R. MCCORD*

On the 14th of July, 1869, I joined a party numbering nine, under the charge of . . . [Major John E. Clark of Yellow Springs, Ohio], bound for the Spanish Peaks and New Mexico, a distance of from 175 to 220 miles. As we had a light wagon and two small mules, we were all compelled to ride shanks mares. We left on first day about 10 o'clock and walked some twenty-seven miles through the hot sun and fairly burning sand; and I had on a pair of new cow hides, and when we camped for the night I wore fifteen good large blisters which were anything but comfortable. . . . But trifles were grinned at and I carried my share of wood and water for the cook who had to get supper after his day's journey. Having finished our tea we talked of what we expected to see and do after we finished our task of walking.

About seven o'clock a hooting and cracking of whips were heard coming down the road, and in the course of half an hour a mule train was neatly camped on the opposite side of the road from us, numbering fourteen wagons and eight mules to a wagon, bound for Pueblo, Colorado, one hundred miles from where we that night camped . . . I was the first one to propose gaining passage with the train as they were empty, and I was feeling pretty bad. As I made the proposal the Major spoke up and said if I could not stand one day's walk I had better leave the party, but as I was accustomed to Pilgrims, I was not to be put down in my calculations by a gruff old Major. I hobbled over to the train and sat down by the fire of the mule skinners (as they are called in this Western country) and commenced talking with the Train Master. He, upon seeing my condition, very kindly asked me to ride in the bed wagon, one that carries the bedding. I accepted his invitation. The Major upon talking with one of the Mexicans found out that we were going to pass through an Indian country, [and] was very glad to accept an invitation from Mr. Charles, the Train Master, to ride a very nice saddle horse. . . We remained with this train until we arrived at Pueblo when we separated, they going East and we South. That

*Through the courtesy of Mr. Elmer O. Davis these excerpts from a letter written by Mr. Charles R. McCord of Denver to his Quaker mother at Hudson, N. Y., in 1869 have been made available for publication. Mr. McCord, who celebrated his 99th birthday on September 12, 1948, was employed as a chainman on a survey of a portion of the St. Vrain or Las Animas grant, made under the direction of Major John E. Clark, Professor of Mathematics at Antioch College, Yellow Springs, Ohio. The party left Denver on July 14, 1869.—Ed.

helped us along 100 miles, besides the 25 [sic] we walked the day before.

Pueblo. We arrived here Sabbath afternoon and camped on the Fountain Caberion,[1] a large stream emptying into the Arkansas River and on the north side of the town . . . We took our possessions the next morning and struck out for the Muddy Creek, twenty-five miles from Pueblo on foot. We arrived there at sundown, some tired, but feet all sound and harder than ever. This night Dan Stone's revolver went off in bed. No one was hurt as bad as they were scared, as Indians were the first thought of every man in the tent. It rained very hard all night and the water ran under our tent as we did not trench it.

It was a discouraging task the next morning as we left for the Apache Creek through the heavy sand, a distance of some fifteen miles. It rained nearly all day but we gained the victory about sundown and were not long in finding a convenient place and soon had our tent up with a roaring camp fire. I would here say that as warm as the days may be, a camp fire at night always feels good. We finished our supper and a Government outfit drove up for camp along with very westernly speaking. A bull train also [arrived] for camp so we spent a very pleasant evening all hands together talking of the country, some telling adventures of the early days in the frontier and others declaring if they could get funds enough to ever see America again, this country would never have the pleasure of ever seeing them again, and so on. I presume many speeches of mine will sound very queer, but I am giving them in the easy free western life (or rather way).

From this camp we were to find our corner from which we were to start, and the next day we moved up the creek some five miles nearer the foot of the mountains and nearer our work. We found and established our corner, and the next day was Sabbath day. In the afternoon while all was quiet a pistol shot was heard and a cry of "I am shot." All rushed down to find one of our best men shot about one inch above the knee pan . . . [Shooting was accidental]. The driver was dispatched for a doctor which was five miles down the creek. Upon his arrival he said his wife was alone and wanted two of us to go down and stay with her as she was an old lady. So two of us went down and stayed all night with the old lady who was very nervous and talkative. Our hair being cut close to our heads she allowed no bigger rascals could of attacked her than those fellows that slept in the other room, as was her mind expressed to the old doctor the next day.

The camp was moved down the creek again and the wounded man taken to a ranch and kindly provided for by the old doctor's

[1]The French name for the Fountain was Fontaine qui Bouille.—Ed.

wife. Here we had to lay until another man could be procured. The Major took the cook and went to Badito for another man . . . [Another member of the party became ill; the cook ran away "in company with a new ax"]. The Major returned with his men and we tried it again. This Apache Creek is a narrow little stream running down from the mountains and clear as crystal. Small fish can distinctly be seen moving around on the bottom, and when the sun shines beautiful stones of all colors can distinctly be seen.

After the wounded were cared for, the sick well, and the runaway made good, we moved back to our old quarters up the creek and were ready as well as eager to leave civilization and complete our task of crossing the Greenhorn range, as the line ran directly across. Now the Rocky Mountains are not like going up an enormous hill and down the other side, but there are gorges, canyons, and rivers running in all directions, and were it not for the compass the best man in the world could not walk straight across them to save his life . . . But what a romantic scenery, what a noble wild piece of Nature's work . . .

We left the prairie about nine o'clock and commenced our descent [sic] over rocks, through little groves and green parks that would have charmed the most useless, worthless creature in the world. I wondered at the strange speech of one Richardson,[2] an eminent writer, who speaks of the lonesome mountaineers, when their abode is in the most magnificent place this side of the celestial shores. At noon we had made only half a mile, as our course was rough for a compass and the ax man was constantly chopping away the timber. On this line we packed our blankets and rations on our backs as we could not take burros (or jacks) across. Our camp went around to meet us on the other side. We left our blankets in the morning and when we quit work we went back after them and slept there. We continued to do this until a Mr. Bear, a gent that did not belong to our party, borrowed a roll of blankets and some provisions, and then we took them with us. All day we travelled with some thirty-five or forty lbs. on our backs, and with different scenery, enjoying it very much. We traveled on for three days without seeing anything of much interest...

I believe I wrote thee that at this point we divided the crumbs and then were not within a day's travel of camp. Now just imagine the sight from here on top of the very peak of the Greenhorn mountains, with a clear view of the rolling prairie on the east and south and the Huerfano Valley on the north and west . . .

We then crossed the Huerfano Valley, a wide pleasant valley with a stream running through it east and west, that is thick with

[2]A reference presumably to Albert D. Richardson's *Beyond the Mississippi From the Great River to the Great Ocean.* Hartford, 1867.—Ed.

mud the year round and is called the Muddy. North and south is a creek running that is clear and cool, and this is called the St. Charles. The two creeks do not run into each other as the Muddy runs out before it gets to the St. Charles. This is caused by the heavy deep sand. A stream unless very large has to flow very rapidly to exceed two miles from the foot of the mountains. In front of us there towered up the Wet Mountains, another range farther west. On this mountain it rained every afternoon and we were wet to the hide every day. As we had no way to get our camp around this range we were obliged to pack again crossing this. There were days we did not make half a mile on account of perpendicular rocks, very deep canyons, etc. Remember these lines had to be air lines and consequently we had to level the chain going down and up the hills, and there were places where we could not level over from fifteen to twenty links and sometimes not at all.

A mule was packed and taken to the base of the range, when every man was his own mule . . . Two days rations were issued in army style, a chunk of bacon, bread, etc. We strapped on, bid cook [and] packman good-bye, and we were off in high spirits as ever. As we left the Major gave the packman orders to come out with a day's rations for seven men providing we were not back in two days. We had two miles more to finish and all were in a hurry to finish and get out of that wet hole we left. The two days passed and we were out of food, and a mile and a half yet to go. A vote was taken to see whether we should go on or back. They all said go, and go we did . . . We went on the next day and finished at noon, when two pieces of dried apples were given us. Now to get this two miles of air line we located over six, as it was a continuation of canyons all the way, and it was thought best to go around a point making it twice as far, rather than climb the mountains over again, and so we did. At night we got to our blankets and had a cup of tea. We stopped there over night. The next day at noon we had a square meal, when it was sixty-two hours. Now I tell you I was hungry and done justice to the Bacon and Beans...

We then went thirty miles south to the Spanish Peaks. Here is scenery that my ignorant self can not do half justice to on paper. The Peaks are two large piles of rocks standing out on the prairie. It is from eighty to one hundred miles around them. It is two miles in an air line across them and they are I don't know the exact height, but believe it is six thousand feet, not less than five I know . . . [3]These stand on the open prairie and a natural wall runs down from them in two different places. There is also at this place a natural fort that was once occupied by United States troops at

[3]The elevation of the East Spanish Peak is 12,708 feet; the West Peak, 13,623. The plain from which they rise has an elevation of 6,000 feet or more.—Ed.

the time of the Mexican War at Trinidad, then Mexico but now Colorado.[4]

We had to cross these peaks with our line going east and west. We took our blankets and rations and commenced ascent. It took us a day to reach the top without working any. We had to start from a corner of one Mortz, another surveyor, and his corner was on the south side of the east peak . . . We could not find the corner, and the Major had to go to Denver, and we layed off a week for his return, hunting, fishing, and having a grand time in camp.

On his return we went west over the Santa Cristo [Sangre de Cristo] Mountains. This was a very nice green country, large tall pines and but very few huge bare rocks. We finished this line and landed in the San Luis Valley at Ft. Garland,[5] an old United States fort, white-washed inside and out. Col. Hart, the commanding officer of the fort, gave us a room to sleep in, and we all got lousy or gray-backs, and in two weeks I was alive with them and head lice which made me feel very comfortable? especially when I went to bed and got good and warm.

We then came back to the peaks and ran north and south, still in the mountains but farther north. The weather was burning hot through the days, and awful cold nights.

I will answer more regular hereafter. Believe me thy loving and trying son CHARLIE

[4]Since Mr. McCord's trip was made in 1869, his reference to the Mexican War of Trinidad probably is a reference to what is known as the Trinidad War in 1868. On December 25, 1868, an altercation occurred between the Mexicans and residents of Trinidad, Colorado, as the result of the shooting of a Mexican by a stage driver named Frank Blue, or Bleu. The Americans were besieged by the Mexicans, but a messenger was successful in bringing United States troops of the Seventh Cavalry who put an end to the dispute. Accounts of this minature war may be found in the DeBusk Memorial Papers, II, 54-76, State Historical Society Library.—Ed.

[5]On Fort Garland see Major John H. Nankivell, "Fort Garland, Colorado," in *Colorado Magazine*, XVI, 13-28 (January, 1939).—Ed.

A History of Mining Machinery Manufacture in Colorado*

ELLSWORTH C. MITICK

THE STROEHLE MACHINERY AND SUPPLY COMPANY

George Stroehle helped build the first boiler used in Gilpin County, and quickly established a reputation in the manufacture of that equipment. As his sons grew, he taught them the business, and so was able to establish a dynasty leadership for his company. Of ten children, only three are still living: Frederick

*Continued from the January, 1948, issue.—Ed.

W. Stroehle, who directs the activities of the Stroehle Company in Idaho Springs, Colorado, hiring in good times some 25-30 men in his shops; John Stroehle, who directs work in the old shops at Black Hawk; and Mrs. Annie Stroehle Huntington, of Alhambra, California. Two grandsons, Clarence and William, born in 1905 and 1908 respectively, in the old family home at Chase Gulch, were killed in a Manchester Mine accident in the Rollinsville District, November 1, 1940. While inspecting the lower levels of a tungsten mine, the men were being hoisted to the surface in an ore bucket, when something happened; the men were thrown out, falling 150 feet. The deaths of these two men was a great blow to the family, since it was expected that they would carry on the traditions of the Stroehle family, and lead its "since 1865" machine shops.

Work in both Idaho Springs and Black Hawk shops is practically nil today because of the general slump in mining, and the fact that little mining work is today done by steam. Electricity and air have taken the place formerly held by steam as the agency for driving mining machinery. Erection, installation, and repair of equipment by the company usually is performed in Gilpin, Clear Creek, and Boulder counties.

McFarlane, a Great Colorado Name

Born in Bedeque, on Prince Edward Island, in 1849, Peter McFarlane, bearer of a famous name in Colorado mining machinery history, started at the age of sixteen for Pikes Peak to seek his fortune. By 1869 he was in Central City, and there formed with his brother, William O. McFarlane, a partnership called W. O. McFarlane and Company. Their foundry and machine shop manufactured crushing, hoisting, and milling machinery. Peter McFarlane devised and constructed new improvements in stamp mills and auxiliary equipment which increased the efficiency of mechanical operation and recovery of mineral values.[1] The stamp had been adopted as standard crushing equipment by mine operators in Central City and Black Hawk mining districts. It was because of Peter McFarlane's genius that the Gilpin County Bumping Table was developed and introduced following the stamp mill and amalgam plate operations. This device resulted in the saving of additional values which had previously been lost.[2]

[1]In an interview which A. B. Sanford had with Peter McFarlane, March 12, 1924, he explained the difference of the slow and rapid drops of the stamp mills. "Slow drop, dropped from 20-30 times a minute, each one crushing about one ton in 24 hours. The rapid drop increased the output, but decreased the recovery—preventing use of battery plates arranged on inside of the mortar so that 35-40% of all gold content caught there."

[2]Interview with Mr. Frank Shepard, June 26, 1946.

In the early operations of the stamp mills, it was the custom to break the ore by hand sledges and hammers, and then shovel it by hand into the mortars of the stamp mills. The McFarlane shops built the Blake type of ore crushers which were driven by power, and thus greatly increased the capacity of the mills.

The first stamp mills were driven by water power. When steam power was introduced, the McFarlane shops manufactured steam engines for driving the crushing and auxiliary machinery of the mills, also steam hoists to hoist the ore from the mines.

The McFarlane brothers were engaged in general contracting and building as well as machinery manufacture, and as a result of the great Central City fire in 1874, did a large and profitable construction business.

Central City mining activities declined in the '90s, and W. O. McFarlane moved to Denver in 1892, purchasing the machine shops of James W. Jackson at 1734 Fifteenth Street. Jackson's was the oldest and best known of the Denver foundry shops, having been in continuous business since 1870. McFarlane continued the same general type of manufacture as Jackson, turning out Blake and Dodge crushers, stamp mills, automatic ore feeders, ore cars, boilers, engines, hoists, mine pumps, and the only Finlayson Reverse Aerial Tramways in the region.[3]

The old Jackson shops, however, were not large enough for the volume of McFarlane business, and he constructed in 1898 a group of buildings for his business. These huge works at Thirty-third and Blake Streets were among the best in their time, and today remain in excellent condition. The William A. Box Iron Works bought them from McFarlane in 1910, and since 1933 they have housed the Silver-Roberts and Silver Engineering Works.

Peter McFarlane and his two sons, George and Fred, meanwhile had continued activities in Central City as "Peter McFarlane and Sons," until 1912, when they moved to Denver and established shops at 2763 Blake in partnership with Frank Eggers. This company has had a very active history in the manufacture of mining machinery. The name, Eggers, is still retained as part of the incorporated name of September 19, 1916, although Eggers lost his life in an accident sixteen years ago. The company is today headed by Fred McFarlane, who has been active in the work of making mining machinery since 1906. He still retains an interest, socially, in his old home of Central City, especially during the opera season.

Biggest item of manufacture of the McFarlane-Eggers Company today is the Wilfley Pump for A. R. Wilfley and Sons. Over

[3]Writers' Program, *Colorado; a Guide to the Highest State*, p. 75.

sixty per cent of Wilfley's work is done in the McFarlane-Eggers plant.

The McFarlanes really made their name in the development of the mining machinery industry of the state. Today their name is familiar to the lovers of Central City and its opera, since Ida Kruse McFarlane gave the property to the University of Denver. Few, however, realize the role played by the family in Colorado's industrial history.

Four Companies Gone and Generally Forgotten

A perusal of the lists of manufacturing concerns in Denver today will not disclose the names of four companies which have contributed much to the development of mining machinery manufacture in Colorado; moreover, they are generally forgotten. These companies are: Hendey and Meyer Engineering Company, Denver Engineering Works, F. M. Davis Iron Works, and the Queen City Foundry.

April 1, 1878, Arthur Hendey and H. H. Meyer organized the Excelsior Foundry and Machine Shop on a site on Sixteenth Street just below the Colorado Central Railroad depot. Meyer, who had been born in Bremen, Germany, in 1839, and had come to the United States at the age of seven, had received his apprentice training in the Eagle foundry of St. Louis. He came to Denver in 1867, and after working at various foundries, formed the co-partnership with Hendey in 1878 which led to their part in the Denver industrial picture. Meyer did all the drafting and pattern making for the firm. Both Meyer and Hendey possessed the knack for inventing mechanical things. Meyer invented a valve for steam engines which resulted in great savings and safety in operation. Crushing and concentrating machinery in the milling process received a great deal of attention from Hendey, and his fine ore concentrator was popular in the years preceding the Wilfley Table.

Incorporation of the company with a paid up capital of $200,000 came May 31, 1884. H. R. Wolcott was president, Hendey, vice-president, and Meyer, secretary-treasurer of the newly named Hendey and Meyer Engineering Company.[4] Fine gears for mills, and other mining machinery were constructed in their shops.

Ten years later, in 1895, the business and plant were acquired by the Denver Engineering Works, which had been in existence since 1876, and since 1882 had occupied a large plant covering two blocks at Thirtieth and Blake Streets. In 1895 there became associated with the company, Frank E. Shepard of New

[4] *Rocky Mountain News*, June 2, 1884, p. 6, c. 3.

Hampshire, who had attended Boston schools and graduated from Massachusetts Institute of Technology in 1887 with a B.S. in engineering. His practical experience had been gained as a machinist in the locomotive shops of the Boston and Albany Railroad. Later he became boiler inspector for the United States Steamboat Service. The mining industry lured him, though, and in 1889 he came to Colorado, and applied his training to the mechanics of mining and metallurgy. In Leadville, he designed and constructed the Ore Roasting plant for the Union Smelter and Citizens Electric Power Company.

Locating in Denver in 1892, he designed the Flue Dust Settling Chambers of the Omaha and Grant Smelting Company. By 1895 he had become associated with the Denver Engineering Works, of which he became president of 1906. This company manufactured the first ball and rod mills made in Colorado. Other products manufactured were Brunton and Snyder types of ore samplers; crushers and crushing tools; Richard Pulsator jigs and classifiers; electric hoisting plants and equipment for metal and coal mines of Colorado, Utah, Montana, British Columbia, Mexico, and Japan. The company also manufactured the smelting furnaces for the Globe Smelter, Denver; the Arkansas Valley Smelter, Leadville; the Mapimi Smelter in Mexico; and the Mercury Smelter in Salt Lake City.

Mr. Shepard designed and furnished mill machinery and equipment for various ore treatment plants in Boulder, Clear Creek, and Summit counties in Colorado; for the slime plant of Gold King Mill at Gladstone, Colorado; the Gold Prince Mill, Animas Forks; and the Liberty Bell Mill at Telluride.

The Denver Engineering Works, led by Mr. Shepard and his co-director, L. Searing, were unable to continue in business long after their joining the General Iron Works plan for manufacture in 1921, and by 1923 their organization had been largely taken over by Stearns-Roger Manufacturing Company. Mr. Shepard in 1923 was appointed, by the President of the United States, Superintendent of the United States Mint at Denver. He served in that capacity for ten years. Since 1936, he has been associated with the Denver Equipment Company, an organization in which his vast store of knowledge about mining machinery manufacture may make itself felt in a consultative way.

The Queen City Foundry, located at Fourth and Wazee Streets, was founded in 1891, although incorporation was not completed until February 18, 1895. Five Cordingly brothers owned and operated the business of manufacturing crushers, flanges, fittings, machinery castings, and mining car wheels. It was hoped that when they were brought into charter association

with the General Iron Works they would be able to supervise most of the foundry work of that organization. The Mine and Smelter Supply Company contracted through the Queen City Foundry for manufacture by General Iron Works. By 1924, however, the Queen City Foundry had ceased to function as an industry, selling out its interests to the American Manganese Company. Harvey Cordingly, last of the brothers who had originally started the business, died July 10, 1946.[5]

Francis M. Davis, junior partner with A. M. Ensminger in the firm of Ensminger and Davis, operated after 1876 at Eighth and Larimer Streets, was born November 12, 1835, in Jamestown, New York. In 1859 he went to Wisconsin, but returned six years later to his home state. In 1870 he went west to Kansas, and by 1874 on to Denver, where he became acquainted with A. M. Ensminger.[6]

Ensminger retired from the partnership March 12, 1881, and John Smith became junior partner to Davis. The company operated under the name, Denver Foundry and Machine Company, until June 29, 1891, when it was incorporated as the F. M. Davis Iron Works. On December 11, 1888, Davis received the patent on his favorite invention, the Iron Horse Power Hoisting Whim, which received praise wherever it was used.[7] Manufacture of ore cars and buckets, concentration and reduction machines, smelting furnaces, and quarry machinery, also comprised the activities of the F. M. Davis Iron Works. Davis died in December, 1912, and his iron works passed into control of the short-lived Plaines Iron Works.

WILLIAM AINSWORTH AND SONS

Born in Lancashire, England, in 1850, William Ainsworth was brought by his parents to Wisconsin, and as a youth he worked in the factory of the Elgin Watch Company, beginning the trade which was to shape his future as the fashioner of fine instruments.

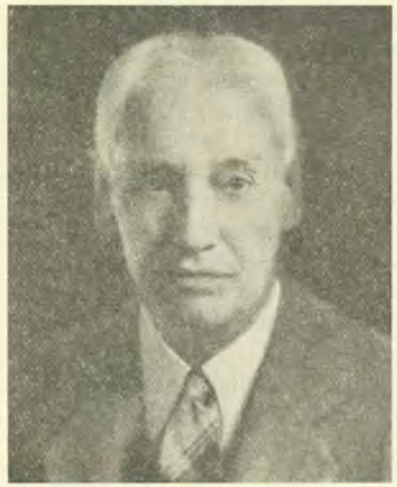
It was in 1874 that he arrived in Denver with a young bride to begin his watchmaking trade. The next year he moved to Central City where a thriving city and mines surrounding it stimulated his genius for understanding the workings of delicate instruments.

[5] *Denver Post*, July 10, 1946, p. 6.

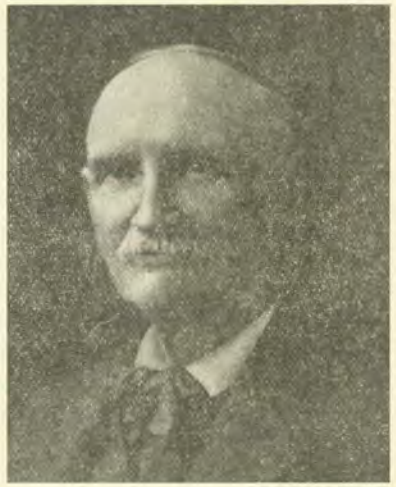
[6] This was used until sufficient depth was reached to justify a steam hoist. It was built entirely of iron and steel, and mounted on heavy iron plate. It could be controlled by one man at the shaft, and regulated by a simple lever. The whim was independent from driving gears, and operations of hoisting, dumping, and lowering bucket could be handled while in constant motion. The No. 1 hoist could handle 800 pounds at 75 feet per minute; and the No. 2 hoist could handle 500 pounds at 125 feet per minute. Its weight was 1200 pounds, and its cost $100.

[7] Copies of some letters in Davis' handwriting are in the possession of the Western Collection of the Denver Public Library.

Those associated with mining, particularly assay balances, had to be purchased by Colorado assayers from Oertling Manufactures in England. Repair work on worn or malfunctioning balances necessitated excessive expenditure of time and money because England was then the only source of repair of these English-made instruments. William Ainsworth, sitting in his little Central City jewelry and watch shop, offered his services to local assayers in the repair of their balances, and soon convinced them that shipment overseas for repair was no longer necessary. His jewelry shop soon became known throughout the state as a reputable establishment for the repair of the balances used in weighing the precious metals mined from Colorado hills.



THOMAS B. STEARNS



WILLIAM AINSWORTH

Feeling that through experiences gained in the repair of instruments he had learned the fundamentals of their construction, Ainsworth set to work not only to build an assay balance, but also to make improvements on those already in use. The first fruits of his efforts were noted in 1878 with the completion of the first one. His was the first balance made in America adopting the short beam.

Moving back to Denver in 1880 he set up a small shop at Sixteenth and Larimer Streets (in the Good Block), and began manufacture of his famous "Button Balance." A short time later he moved his shop to Eighteenth and Larimer Streets, opposite the Windsor Hotel. During 1886 he began construction on the site of the present Ainsworth Shops at 2151 Lawrence Street. The original shops are but a very small portion of the recently (1946) completed

plant which is an ultra-modern industrial plant. Ainsworth lived upstairs in that first structure. By 1895 further additions were made, gradually surrounding the original structure.

The majority of the tools used in the factory were of his own design and construction because they had to conform to special requirements for fine workmanship—namely the construction of balance. Lathes and milling machines were made, with the help of a hand planer which Ainsworth had shipped in to shape up the bed of his lathe. Visiting the shops today, one marvels at the vast improvements in machines. A recently-acquired cutting machine automatically does three times the work of one purchased in 1913, and the ones of that year must have likewise amazed the visitor who might have compared their work with that of their predecessors.

In 1894 the Ainsworth Company began manufacture of the Brunton Pocket Transit, which since that day has remained a major item of manufacture. This small instrument (three inches in diameter) was adapted for use by the United States Army in both World Wars, and as a result, the company's major contribution to both war efforts consisted in the manufacture of these transits which the artillery found excellent for range finding.

The number of men employed during the early days of the company was few, usually numbering about three besides William Ainsworth; but following the construction work of 1895 the number has gradually increased, and today there are one hundred men and women in the employ of the company.

Large transits and levels for use in surveying in the mining districts were one major unit of manufacture in Ainsworth activities, but were discontinued after 1938. Business did not greatly increase in the period from 1900-1925, but since then, because of the introduction and manufacture of the analytical balance, which had been looked at askance in earlier days, a boom period of manufacture has been in evidence.

The archives of the Aluminum Company of America contain records which show that William Ainsworth and Sons was among the very first commercial users of aluminum.[8] The company imported limited quantities of aluminum from them as early as 1885, at the cost of $14.00 per ounce, for the purpose of making fractional weights and balances. Besides pioneering in the use of the aluminum balance beam, Ainsworth was the first manufacturer to adopt the all-aluminum case for balances—these in contrast with the wood cases of European and early American manufactures. It is said that giving up wood construction was a real heartache for Ainsworth, for with it passed cabinetwork of rare craftsmanship in which he

[8]Interview with Gordon Clayson, August 12, 1946.

had long taken great pride.[9] One of the first few Ainsworth Assay Balances constructed is held today by the company, and its accurate workmanship is noteworthy.[10]

Edges and bearings of clear, hard agate are made entirely within the Ainsworth factory. Rather than buy stones from others and tolerate occasional variations in either the material or its preparation, agate boulders are imported in their natural form, and every step of cutting and grinding is performed within the factory.

The Ainsworth Company has passed through several stages of management, but since its inception as a proprietorship, in 1874, it has remained entirely within the Ainsworth family. By 1900 William Ainsworth had taken his two sons, Robert G. and Alfred W., into the company as partners. This period of partnership was not dissolved by the death of William Ainsworth in 1917, but lasted until 1923, at which time the articles of incorporation were filed under the name, William Ainsworth and Sons, Inc. Robert G. Ainsworth served as president of the company until ten years ago, when he withdrew his interests from the corporation, and Alfred W. Ainsworth had continued with the company, serving as its president since that time.

Chief assistant to A. W. Ainsworth is Gordon S. Clayson, who came into the employ of the company in 1922, and has for the past 25 years served in various capacities of leadership.

Markets for Ainsworth products: namely, weights and balances, the Brunton Transit, and Ainsworth Analytical Balances, are world wide, with the instruments finding ready use in South America, the Philippines, Mexico, Canada, Russia, China, and Africa.

One of Colorado's pioneer industries thus is that of Wm. Ainsworth and Sons, and its founder, William Ainsworth, walked in his day among other Colorado manufacturers who have contributed immeasurably to Colorado's leadership in the field of mining machinery manufacture, and allied industries.

THE STEARNS-ROGER MANUFACTURING COMPANY

Brooklyn, New York, gave to Colorado mining machinery manufacture one of its real industrial giants, Thomas B. Stearns, founder of the Stearns-Roger Manufacturing Company, which for 62 years has been one of the leading Colorado manufacturers.

Born in 1859, Thomas B. Stearns received a thorough technical education in Brooklyn, graduating from the School of Mines at Brooklyn Polytechnic Institute. A fruitful field for testing his newly acquired knowledge lay in the vigorous west of the 1880s, and

[9]Interview with Alfred Ainsworth, August 12, 1946.
[10]Company catalogue, 1945, p. 3.

the beginning of that decade found him active in mining operations throughout Colorado, Utah, and Montana. He returned to New York in the spring of 1882 for a short time, and then came back to Colorado, where he toured the state studying mining with Nelson Hallock of the Colorado Iron Works. This trip was to train him for opening a Colorado Iron Works office in New York City, which he did, and headed throughout 1882-1883.[11]

He settled in Denver in 1883, and in that year began installation of water works in both Colorado Springs and Durango. His main interest at this time, however, lay in the mining field and the needs of mining companies in the matter of appliances, supplies, and machines. At Idaho Springs and Georgetown he started small plants in 1884 to manufacture and repair mining equipment.

Leadville again drew his interest in 1885, and there in that year was founded the T. B. Stearns and Company, a small concern to manufacture machines for the nearby lodes. A close friend of his, John Roger, who had come from Scotland as a youth, and had travelled the mining camps with Stearns, joined the T. B. Stearns Company. Together they shortly reorganized the firm under the name of Stearns-Roger and Company. During the following year shops were constructed at Leadville to manufacture mining machinery on a large scale. Offices were to be in Denver. Stearns was a strong believer in manufacturing equipment close to the places where the machinery was needed, in so far as practicable and within reach of raw materials and transportation facilities.[12]

Incorporation of the company as the Stearns-Roger Manufacturing Company was completed May 23, 1891, the year which saw the transfer of the Stearns-Roger shops to an area four miles north of the center of the city of Pueblo. A small plant had been in operation in Pueblo since 1889, but the new plant was to be a complete iron works. The proximity of the Colorado Fuel and Iron Company afforded cheap iron and fuel, and freight facilities were available to all parts of Colorado, even if the rates were high.

Business for the most part consisted of general manufacturing for this region, together with design and erection of metallurgical mills, dredges, and power plants. However, with the development of the beet sugar industry, machinery for its culture became an integral, and later predominating, part of Stearns-Roger manufactures. In 1906, a sugar factory, one of the first in the west, was designed and built by this company.

One of the first large contracts undertaken was that in 1889 of the Holden Smelter in Denver, later known as the Globe Smelter,

[11]Records of Colorado Iron Works, Minutebook, 1882.
[12]Interview with Mr. Dickson of Colorado Iron Works.

for the treatment of lead ores. Others were built for Pueblo, Leadville, and Durango.

John Roger moved to New York in 1908, but the company has continued the use of his name, rather than re-incorporating. During World War I, Thomas B. Stearns served as Food Administrator for the state of Colorado, devoting his days to that service, and nights to his manufacturing establishment, which was busy with government contracts; so he did double service for the war effort.

The Pueblo shops of Stearns-Roger were completely destroyed by the great Arkansas River flood of 1921, which carried away bridges, wrecked houses and stores, and took a toll of human life.

THE FIRST THOMAS B. STEARNS PLANT AND CREW, PUEBLO, COLO.

Patterns from Stearns-Roger floated down river, and were picked up in several adjoining states, while the heavy machinery was buried in quicksands, and never recovered.

Pueblo cleaned up the debris, and started to reconstruct. Thomas B. Stearns was along in years, but not too discouraged by this disaster. However, in starting out again, he decided to move his business to Denver. He was well acquainted there, his offices having been located in the capital city during his Leadville and Pueblo operations.

Present in Denver were several manufacturing concerns faced with the necessity of decreasing costs of production because mining had greatly quieted down, and competition and price cutting were keen between these companies for whatever business was in evidence. Some of the shops would have had to close their plants temporarily if a solution had not been worked out between T. B. Stearns, T. A. Dickson of Colorado Iron Works, Gilbert Denton of Vulcan Iron Works, Frank Shepard of Denver Engineering Works,

and Harvey Cordingly of the Queen City Foundry. The plan was to see if these five companies could work together in such a way as to retain the identity of the companies, yet work as one efficient concern in manufacture.

The best equipment, executives, and mechanics of each of the companies were to serve the General Iron Works, the cooperative name of this enterprise. It was agreed that Stearns-Roger, the largest of the organizations, was to manage the General Iron Works. Since they were managers, they were to appoint the man to act as director of the plant. Chosen to this job was a man most acceptable to all contributing members. Mr. Robert Gordan, the man selected, had been with Stearns-Roger since 1900, where he had achieved an enviable engineering record.[13]

While the plan was being put to the test, operations were carried on in rented shops, and work begun on a general plant, at 600 West Bates Avenue, in Englewood. The plant was to manufacture at cost the designs set forth by the engineering divisions of each of the member companies. Sales and financial departments were to be maintained by each of the individual companies. Each concern going into the consolidated plan received a certain percentage of the capacity of the plant, and was given permanent representation on the board of directors which controlled the plant operations.

Stearns-Roger was to serve as general manager for the General Iron Works, but none of the companies was to know what the costs of the other contributing members were. A visit to the General Iron Works consequently may show you a hoist being built for Colorado Iron Works, standing on the floor next to a flotation machine designed by Stearns-Roger or Dorr and Company.

Since 1927 the activities of Stearns-Roger fall into five general classifications of manufacture: mining machinery, sugar machinery, power machinery, oil and gas equipment, and general manufacturing. At the half-century mark in 1935, orders showed 45 carloads of mining machinery being shipped to a large copper company in Central Africa, and the construction of a large sewage disposal and water purification plant for Boulder City, Nevada.[14]

During World War II practically the entire output was devoted to manufacture of power machinery, and oil and gas equipment under direct government contract. As a result, two Army-Navy "E" flags were won by Stearns-Roger for their efforts.

Thomas B. Stearns retained his active interest and control in the company until the time of his death in 1946. Mr. R. Gordan who had long served with Stearns, retired in that year, leaving the direction of the company to Mr. Charles O. Voigt, who had served as Vice President and general manager under Stearns and Gordan. Mr. Voigt also heads the General Iron Works at present.

[13]Statement made by R. Gordan to T. A. Dickson, at time of death of T. B. Stearns.

[14]The basic principle of chemical concentration of ores, or flotation, is easily applied to the sewage disposal and water purification plants of the great cities.

The Stearns-Roger organization is made up of highly-trained engineers who are specialists in their lines. The company can thus analyze, design, and construct practically every type of process or industrial plant needed not only in the mountain region, but also throughout the world. With sixty-two years of service behind it, the Stearns-Roger trademark advertises to the world the quality of machinery manufactured in Colorado.

THE MINE AND SMELTER SUPPLY COMPANY

Like many another present-day manufacturer of mining machinery, the Mine and Smelter Supply Company raised its organization on the inventory of some predecessor. Theirs was the Kennedy Pierce Company, whose history we shall treat first.

The C. E. Kennedy Company consisted from its inception in 1879 until 1881 of a partnership between H. N. Kennedy, C. E. Kennedy, and M. A. Dolan. Business, in the main, was the distribution of rock drills, compressors, hoists, wire rope, and other materials used in mining. First offices of the company were located at 307 Fifteenth Street, Denver. Sales were limited in these two years, and the partnership was dissolved September 20, 1881. C. E. Kennedy continued the business in a private capacity, however, until 1883, at which time he took as his partner, Charles B. Pierce, who had been in the banking business since coming to Colorado from Ohio in 1872. The business was moved to the corner of Seventeenth and Blake Streets (now the site of the Mine and Smelter Supply Company). Largest orders during the 1880s were from the Leadville mining districts.

The old car barns which stood at Seventeenth and Wynkoop Streets were torn down in 1888, and a business block erected. Kennedy and Pierce moved to this location on its completion in 1890. (This building is today occupied by the Hendrie and Bolthoff Manufacturing and Supply Company). However, in 1893 the company again moved back to its former location at Seventeenth and Blake.

It was in 1893 that financial panic gripped the nation, and brought an end to boom times at Leadville. Among those leaving Leadville during the panic were Robert J. Cary and his brother, John Cary, who had been operating a supply store there, and had often done business with Kennedy-Pierce Company. John Cary went to work for Kennedy-Pierce as Sales Manager, but in 1894 accepted a position with Fairbanks-Morse Company, which at that

time was managed by D. P. McDonald. This firm also went into the mining supply business, in addition to their regular business of scales, windmills, etc. Cary remained with Fairbanks-Morse until 1895, in which year he began negotiating with C. E. Kennedy of Kennedy-Pierce for the sale of that company. Kennedy had always wanted to go to California and operate an orange grove,[15] so he disposed of his business to Cary, who on April 23, 1895, organized the Mine and Smelter Supply Company. He had, as partners, his brother, Robert, Eben Smith, a well-to-do mining operator, and his son, Frank L. Smith. A fifth backer was John Y. Oliver.

For the first two years of its existence as Mine and Smelter Supply Company, the corporation acted as a wholesale outlet for mining supplies in Leadville, but in 1897 the company became interested in manufacturing, and moved to Denver, where it soon became one of the leading manufacturers of mining machinery.

Eben Smith was the leading spirit behind early operations of the company, and it is interesting to note a few of his activities connected with mining previous to his association with Mine and Smelter Supply. Born in 1831, "Eb" Smith joined in the California gold rush at the age of eighteen. After he made himself familiar with the best methods of extracting ores, he returned east, and in 1860 met Jerome B. Chaffee in St. Louis, Missouri. There the two learned about the Colorado "Fifty-Niners." Loading a stamp mill on to a wagon at St. Joseph, Smith and Chaffee started for the new bonanza, and arrived in Denver on May 26, 1860. Their idea was to start a mill to treat ores in Colorado.[16] Gilpin County was their goal, and by the end of 1860 the two men had started the Smith and Chaffee Stamp Mill at Lake Gulch.

Central City was Smith's home until 1876, when he went to Boulder to become superintendent of a big-scale mine there—the Caribou. While at Central City, Smith and Chaffee had become acquainted with David Moffat, of railroading fame, and these two, with Moffat, were instrumental in founding the First National Bank of Denver. In 1878 Chaffee and Smith bought half interest in H. A. W. Tabor's Little Pittsburg Mine at Leadville. In 1882 the Tam-O-Shanter Mines in Pitkin County came under their control. Other mines at Red Cliff and Leadville were added. In all these ventures the mining and milling experiences of Eben Smith were recognized by Moffat and Chaffee as being of the biggest value to their business operations, and his mining judgements were usually accepted.

[15]Letter from John Leschen of St. Louis, Mo. (who formerly did business with Kennedy-Pierce), to A. E. Seep of Mine and Smelter Supply Company concerning early history of Kennedy-Pierce.

[16]*The Trail, November*, 1912, p. 9.

Smith was also pioneer in the Cripple Creek district, being one of the builders of the Florence and Cripple Creek Railway; and with Moffat he constructed the largest and most completely equipped cyanide mill in the world at Cyanide, Colorado.[17] In 1893 he moved to Denver, where he became acquainted with the Cary brothers and their interest in forming a concern for the manufacture of mining machinery. With them he joined in organizing the Mine and Smelter Supply Company two years later.

His leadership, as president from 1895-1901, brought rapid expansion to the young industry. By 1898 a separate subsidiary, the Mexico Mine and Smelter Supply Company, was formed, with a store and warehouse in Mexico City. Because of the Mexican revolutions of 1914, though, the subsidiary was forced to close; and the Mexican business was turned over to the El Paso branch office, which, with one at Salt Lake City, had been established in 1900.

Joseph Seep, a Standard Oil Company buyer from Pennsylvania, became interested in the company about the turn of the century, and in 1901 purchased the shares of the business owned by Eben and Frank L. Smith. John Oliver, who had been an original director had died shortly after the formation of the company. Three years later, 1904, Seep was able to buy out the shares held by John and Robert Cary. Thus by 1904 the directorship of the company had completely changed hands, and the name of Seep was to be the most important in the company management from that time until the present.

Just a year after Joseph Seep became president, the company acquired manufacturing rights for the Wilfley Concentrating Table; and its inventor, A. R. Wilfley, became associated with the company as consulting engineer and director until his death in 1927.[18] To date about 24,000 tables of all sizes have been built, making over 60,000,000 pounds of freight going to mining camps all over the globe. The presence of low grade ore in large quantities necessitated the use of Wilfley Tables for concentration of ore by large milling plants.[19]

Another inventor, whose projects greatly facilitated the Mine and Smelter Supply Company development and expansion, was Frank E. Marcy, who in 1912, was manager of the Salt Lake office of the company. He hoped to improve the coarse crushing and grinding equipment, particularly stamp mills, at a time when high-grade ores, requiring finer grinding methods, were being found.

[17]Interview with A. E. Seep, July 14, 1946.

[18]The story of Wilfley and his table is told in the section dealing with A. R. Wilfley and Company.

[19]Interview with Oscar H. Johnson, July 12, 1946.

His contribution was the Marcy Ball Mill, first manufactured by Mine and Smelter Supply in 1914.[20]

Marcy developed a modification of this type of mill in 1917, with the Marcy Rod Mill, substituting the use of rods instead of balls in the crushing process. The largest rod mills ever made, nine feet, 6 inches in diameter, and twelve feet long, weighing over 170,000 ponds, are for copper ore. Marcy's models can be found in the world's copper-producing areas. The pulp and paper industry today uses these ball and rod mills as beaters and refiners of wood pulp.[21]

Manufacture of Marcy Ball and Rod Mills and Wilfley Tables was carried on at the Wilfley Shops of the Mine and Smelter Supply Company at Thirtieth and Huron Streets, but these soon proved inadequate for the total amount of large-scale work in which the company was engaged; so we find them becoming associated with the General Iron Works, not at the time of organization in 1921, but shortly thereafter through contracting with the Queen City Foundry, a charter member of that manufacturing enterprise. When the Queen City Foundry business became defunct in 1923, Mine and Smelter's jobbing contracts for General Iron Works were handled by Vulcan Iron Works. Individual castings as large as 25,000 pounds have been made by General Iron Works for the construction of large Marcy ball mills.

Articles of manufacture by Mine and Smelter Supply Company today provide an imposing list. Besides the standbys, Wilfley Tables and Marcy Ball and Rod Mills, hot milling machines, rock bit grinders, density controllers, rubber push valves, belt feeders, laboratory crushers, pulverizers, circuitrons, placer equipment, amalgamators, and the new Massco-Fahrenwald Flotation Machine, are produced.

Executive offices of the company were located in New York City from 1905 until 1929, but were moved back to Denver at the latter date. Headquarters for the company have since been at Seventeenth and Blake Streets, site of the old Kennedy-Pierce Company. The company board of directors has always consisted of five men, and in the fifty-two years of its existence, only twenty-five men have served in that capacity. President of the company today is Mr. Oscar H. Johnson, who has served with the organization for thirty-five years. Chairman of the Board of Directors, and a past president, is Albert E. Seep, grandson of Joseph Seep, who has

[20]This machine, operating on lumps of ore as big as 3 inches, could crush it to the fineness of 1/48 of an inch and finer—making it suitable for concentration, amalgamating, cyaniding, etc.

[21]Mining machinery modifications have found their way into sugar beet machinery, oil and power industries, and also in highway and "tubes"—under-river constructions.

shown great interest in the early history of his company. He prepared an article for the *Colorado Magazine* on the occasion of the 50th anniversary of the Mine and Smelter Supply Company.[22] Other directors of the company are Herman F. Seep, J. D. Nicholson, and H. J. Gundlach. Over three hundred employees serve the company today, exclusive of those employed by General Iron Works in manufacture of Mine and Smelter equipment. One-third of the employees have been with the company for ten years or longer, with many holding thirty, thirty-five, and forty years-of-service medals.

World War II saw the company play an important role as distributor for equipment where and when needed by the armed forces and as producer of war equipment. No direct war contracts were held and consequently no Army-Navy "E"s flew over the company headquarters, but the furnishing of vital machinery to great copper, nickel, lead, zinc, vanadium, and other metallic mines of the country was of great importance. Robert Sproul, president of the University of California, acknowledged by letter the contributions made by Mine and Smelter machinery to the Atomic Research at Los Alamos Scientific Laboratory.[23] Mr. S. C. Hinkle, Assistant Denver Manager, served on the national steel warehouse advisory committee of the War Production Board.

Today, because the company manufactures mining and milling machinery, and distributes industrial equipment and supplies, the name "Mine and Smelter" may not connote the exact significance of its activities; however, the two main offices of the company, outside of Denver—El Paso and Salt Lake City—service two of the greatest smelting centers of the country. Agents in Australia, South Africa, Canada, South America, Europe, and the Orient find ready markets for the Denver-made machinery of the company they represent.

THE VULCAN IRON WORKS COMPANY

A third member of the present General Iron Works plan of manufacture likewise dips back into the nineteenth century for its origin. This company is the Vulcan Iron Works, situated at 1423 Stout Street, Denver, and still directed daily by the hand of its founder, Mr. Gilbert Denton, Sr., who in 1891 operated a small machine shop which serves as the basis of the present Vulcan Iron Works. Pioneer that he is in mining machinery manufacture, Mr. Denton, who was born in 1860 and came to Colorado in 1889, has seen the continued attempts of Colorado businessmen to take the lead in manufacture, only to be buffeted by discriminatory freight

[22]May 1946, pp. 128-134.

[23]Letter from President Sproul to Mr. A. E. Seep concerning Mine and Smelter's part in the Los Alamos laboratory project.

rates, both on incoming raw materials and manufactured goods being shipped elsewhere.

The small machinery company operated by Mr. Denton from 1891 until 1894 became, on September 26 of the latter year, the Vulcan Iron Works Company, with D. C. West and J. W. Latham as the other two directors in the corporation. Offices and shops were established at 1709 Blake Street; three years later adjacent property on Wazee Street was added. By 1898 Latham and Denton bought out that portion of the control held by West, the two continuing the leadership of the company until Latham's death in 1921.

Thirty to forty men were employed by the company until the time of its association with General Iron Works in 1921. Sales were generally restricted at this time to the area around Denver because of high freight rates which made it absolutely impossible to ship equipment profitably even as far as Wyoming or New Mexico.[24] Items of manufacture consisted of hoisting engines, mine cages, and machinery of all kinds. In 1910 the company was moved to shops at the east end of the Colfax viaduct. That shop is still owned by the company, but has not been actively used since 1924, the date when the General Iron Works plant was completed.

Business was good and profits large during World War I. Vulcan manufactured various kinds of ship machinery. Denver's mining manufacturers generally filled the demands of the United States Navy for heavy ship equipment. Conversion of the shops and tools for such manufacture was seldom necessary, this fact contributing to the splendid record of production established, and the big profits made by the company.[25]

With the death of Latham in 1921, Mr. Denton, Sr., took into the directorship of the company his son, Gilbert Denton, Jr., and his son-in-law, R. H. Fox. These three have complete control of the stock of the corporation today, and guide its efforts in present day mining, milling, and sugar machinery manufacture and design.

Because of its charter interests in the General Iron Works in 1921, Vulcan shops were no longer needed, save as temporary rental shops for General Iron during the building of its massive shops. All designs of the Vulcan engineering staff would henceforth be manufactured through cost contract with the new corporate enterprise of the five contributing companies. Offices were moved to their present location at 1423 Stout, where engineers and salesmen work out

[24]Interview with Mr. G. Denton, Sr., July 3, 1947. The story of unfair freight rates, operating in discrimination against the West fills our economic texts, and the remarks of astute American commentators. The statements of Mr. Denton can be corroborated by interviews with W. H. Leonard and Mr. T. A. Dickson.

[25]*Idem.*

any changes in the equipment to be made or sold, or new lines of design to be introduced.

World War II again brought an enormous number of government orders for navy equipment. Winches and steering tube manufacture kept the company so busy that they were unable to take any orders on their regular lines of mining equipment. A large backlog of mining equipment was built up, and the company today is trying to fill these back orders for shipment, not only in the United States, but to African and Australian mine fields as well.

THE MORSE BROTHERS MACHINERY COMPANY

One of the largest producers and exporters in the field of mining and milling machinery today is the Morse Brothers Machinery Company of 2900 Broadway Street, Denver, whose large plant just north of the Broadway viaduct catches the eye of the passer-by, advertising Denver mining and milling machinery.

Although the Morse Brothers Machinery Company was incorporated in 1898, its origin preceded that date by two years in the form of the S & H Supply Company, which acted as a sales agency for Denver concerns manufacturing milling and mining machinery. In 1898 the Morse brothers, George and Bradbury, decided to add the manufacture of equipment to their supply lines, and reorganized the company as the Morse Brothers Machinery and Supply Company.

The wear and tear on mining machinery is tremendous; and seeing that the vast amount of mining machinery was in need of repair, the Morse Brothers turned their efforts also to the careful rebuilding and reconditioning of all types of mining, ore milling, powerplant, electric, and contractors' machinery equipment. Through this work they were able to study the weak and strong points of the material which they reconditioned. Points relative to repair were passed on to the original manufacturers of the product, as well as incorporated into ideas which the Morse engineers themselves could introduce into goods of their own manufacture.

After the turn of the century the Morse Brothers Company turned to the manufacture of machines for concentration and treatment of all ores, metallic as well as non-metallic. Old smelters throughout the state were purchased by the company, and the machinery therein taken out and reconditioned.

Throughout World War I, the company, like others engaged in their type of manufacture, found sufficient government contracts for ship machinery to keep them occupied. Reconditioning of worn-out equipment too was important in the light of scarcity of new raw materials and the time taken in construction of new machines.

In 1936 the name and ownership of the company was changed. Dropping the word, "Supply," the newly formed company of Morse Brothers Machinery Company was headed by Max Grimes.

The company has turned largely to the manufacture of entirely new machinery—designing machines in their engineering shops, constructing them, and shipping them to all parts of the world. All continents are now served by Morse Brothers machinery, with agents in foreign countries constantly in touch with the offices in Denver.

(To Be Continued)