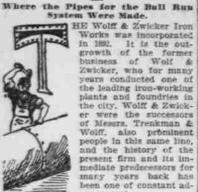
and the substantial manner in which they have been built reflects no more on the water committee than it does on the Bul-leu Bridge Company, under whose direcless Bridge Company, under whose dir-tion all this important work was done.

A GREAT PLANT.



In 1833 the contract for the Bull Run system

HOFFMAN & BATES.

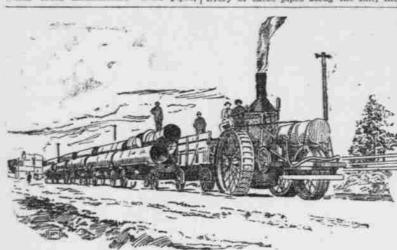
Their Large Contract With the Water Committee. HE principal contract in con-nection with the construction of the Bull Run pipe line was that for the manufacture and laying of the riveted steel pipes, which was awarded to Hoffman & Bates, for the sum of \$465,667. This contract called for the construction of the pipe line from Mount Ta-bor east to the head works on Bull Run, a distance of it miles, more than half the dis-tance being beyond the point where the pipe line left the county roads, and

through a rough, hilly and heavily timhered country.

In order to manufacture the pipe it was necessary to provide a plant and erect a shop in which nearly 700 tons of steel plates and rivets could be made into pipe in a period of 10 months, five months in

each of the years '85 and '84.

The work under this contract included the receiving and storing of the steel plates as they arrived from the Pennsyl-vania rolling mills, the manufacture of the pipes of the Bull Run system the receiving and storing of the steel was awarded to Hoffman & Bates, lead-ling contractors of the Northwest. This large contractors of the Northwest. This vania rolling mills, the manufacture of firm, having no plant of its own these plates into pipe, the hauling and dewhich could manufacture these pipes, livery of these pipes along the line, the



HAULING PIPE ALONG THE BULL BUN PIPE LINE - Photo by Towns.

sublet the contract to the Wolff & Zwick-idigging of the pipe trench, the laying er Iron Works. In order for this latter riveting and calking of the pipe in the er Iron Works. In order for this latter company to handle an undertaking of the magnitude necessary to turn out the pipes for the line as fast as the specifications of the contract called for, it was necessary for them to enlarge and equip here one of the most complete plants of the kind on the coast. In order to accomplish this it was necessary to have additional capital, and a partnership was formed with Mr. Philip Buehner, who for 15 years had been prominently connected with the Holly Manufacturing Company, of New York. This company is one of the largest manufacturers of waterworks machinery in the world. In addition with being iden-tified with the Wolff & Zwicker Iron Works, the firm now being Wolff, Zwicker & Buehner, this gentleman is also the Pacific coast agent of the Ohio Pipe Com-pany, who furnished, through Mr. Buehner, the pipe used by the Oregon Bridge Company and Perry Hinkle in laying the submerged pipe of the Bull Run system under the waters of the Willamette river at Portland.

The partnership formed by Mr. Buehner with Mesers. Wolff & Zwicker, under the firm name of Wolff, Zwicker & Buehner, was a temporary expedient only, it having been mutually agreed that this partner-ship should terminate on the completion of the work of supplying the pipes for the Bull Run system as per the contract with Mesers. Hoffman & Bates. The contract price for this work, as let to contract price for this work, as let to Hoffman & Bates by the water committee, was about \$460,000. The entire amount of steel pipe supplied by Messus. Welff, Zwicker & Buchner on this contract amounted to over 7000 tons, about 24½ miles of pipe as it is laid. The diameter of this pipe ranges from 25 to 42 inches, While the work of supplying and laying this pipe was in progress, 175 men were constantly employed, and part of the time day and night, on the work, and in addition the Wolff & Zwicker Iron Works

75 miles of distributing mains to be laid throughout the city by the water com-The diameter of these pipes ranged from 18 to 30 inches. The contract price was \$100,000. This firm, during the past year, also furnished the pipes for

trench, the inspection and painting of the pipe and the refilling and tamping of the earth over the pipe again. After secur-ing this contract, Hoffman & Bates gave up their original idea of building their own shops at Fairview or Troutdale for the manufacture of the pipe, and let a sub-contract for the shop work to Wolff, Zwicker & Buehner. This latter firm built an extension to their new shops at the east end of Madison-street bridge, in which the pipe was made, work beginning in June, '83.

The sub-contract for hanling the pipe was let to Cook & Kiernan, who ployed a traction engine, as well as hor and oxen. For the work of digging the ditch and laying and riveting the pipe, Hoffman & Bates employed a large force of men, their pay-roll amounting in one month in the senson of '93 to over \$20,000. These men were lodged and boarded in tents, generally in two camps about two miles apart. Camps were made in 13 different places during the construction of the line, and no small part of the work consisted in making and moving camp and

providing supplies for the men.

The work of digging the ditch was generally from one-half to two miles ahead of pipelaying. The pipes came from the shops in lengths of about 25 feet, made of six plates. These were laif in the ditch with decricks and bolted together. The pipelayers were followed by the riveters, who drove hot rivets in the holes at the joints. The edges of the pintes outside the rivets were then chipped to the proper bevel and calked to make the joints tight. In this way the whole pipe was connected together like a steam boller. Upon the gether like a steam boiler. Upon the final test the pipe was found to be as tight as any new boller, the only leaks being of the size of a pin through minute openings between the plates.

Mr. Lee Hoffman, the only remaining number of the old firm of Hoffman &

The importance of this work to the working masses of Portland is fully appreciated when it is noted, as stated above, that for during the working seasons of two years the making of the pipe alone furnished steady employment to about the first making of the pipe alone furnished steady employment to about the first making of the pipe alone furnished steady employment to about the first making of the pipe alone furnished steady employment to about the first making of the pipe alone furnished steady employment to about the first making of the pipe alone furnished steady employment to about the first making of the pipe alone furnished steady employment to about the first making of the pipe alone furnished steady employment to about the first making of the figures of the Risdon Iron Works on this contract and special inspection of the figures of the Risdon Iron Works on the Pacific Currer as a contractor in the Pacific Northwest, and it is creditable to his enterprise for years, and it was only after a most careful inspection of the Risdon Iron Works on this contract of the Risdon Iron Works on this contract of the Risdon Iron Works on the Pacific Northwest, and it is creditable to his enterprise for years, and it was only after a most careful inspection of the Risdon Iron Works on this contract of the Risdon Iron Works on the Pacific Northwest, and it is creditable to his enterprise for years, and it was only after a most careful inspection of the Risdon Iron Works on the Risd The men.

The men and the pipes called for in the contract with Messus. Hoffman was ably seconded by Mr. If. D. Bush, an engineer experienced in from the contract with Messus. Hoffman & Bates, Messus. Wolff. Zwicker & Buchner were awarded the contract for The miles of distributing mains to be loss.

The office work was in the contract of this petitors was finally accepted. In addition to supplying all the steel plates the Risdon Iron works also furnition and steel construction, who was supplying all the steel plates the Risdon Iron works also furnition and steel construction, who was supplying all the steel plates the Risdon Iron works also furnition and steel construction, who was supplying all the steel plates the Risdon Iron works also furnition to supplying all the steel plates the Risdon Iron works also furnition to supplying all the steel plates the Risdon Iron works also furnition to supplying all the steel plates the Risdon Iron works also furnition to supplying all the steel plates the Risdon Iron works also furnition to supplying all the steel plates the Risdon Iron works also furnition to supplying all the steel plates the Risdon Iron works also furnition to supplying all the steel plates the Risdon Iron works are contract.

The office work was in the contract of this petitors was finally accepted.

In addition to supplying all the steel plates the Risdon Iron works for the grant was all the contract of the steel plates the Risdon Iron works are contract.

The office work was in the contract of this petitors was finally accepted.

The date of the contract of this petitors was finally accepted.

In addition to supplying all the steel plates the Risdon Iron work for the Risdon Iron work for the contract of the work in the contr

agent of supplies and as paymaster. Mr. E. M. Arthur was bookkeeper during the entire time of the contract.

The principal foremen on the line were past year, also furnished the pipes for the Spokane city waterworks system at a cost of \$70,000, and they have also done

William Bates and E. A. Stone, old em-ployes of the firm of Hoffman & Hates. The riveting and calking was in charge of

to any of the great industrial centers of tum by the Aborigines of California" in the Scientific American supplement of Pebruary 3, 1994. The natives gathered their pitch as it floated assbere from the submarine sources in Santa Barbara channel. These springs still flow as they did a hundred years ago. Opposite them, on shore, lie the immense beds of asphaltum from which is now obtained the Alcatran

asphalt used in the Portland reservoirs. From the primitive practice of the aborigines who gathered the mineral tar along the shore, modern inventive shill and enterprise have developed the processes of asphalt production into great in-dustrial importance, and within a stone's throw of where the savage picked up the material before civilization drove him away, the Alcatraz refinery now pours out night and day this unique and valu-

The ancient artisans used the soft, purasphaltum from the fountains of is and from the shores of the Red sea. Their works, uncovered by modern searchers, show the material in as good co ever. The disinterred works of the Call fornia Indians bear the same testimony It has not changed by time. The foun tains of Is, the springs of the Red sea, th submarine sources in the Santa Barbara channel of the Pacific ocean, all gave forth the same character of material. The Alcafraz refinery is now doing the same by mechanical means, merely hastening

The Syrians, the Egyptians and the In lians took it and applied it as they found it; therefore, it lasts eternally, as it would in its native beds. In itself it is indestructible except by fire. It is only the spurious article, adulterated and weakened by the addition of deleterious subsuch as coal tar and residuun

stances, such oll, that fails. The lesson taught by the testimony o centuries has been applied in the Portland work. The asphalt used in the reservoirs a pure natural bitumen, and it seals every re of the brick and concrete backing wax seals a jar of fruit or a bottle of wine. There can be no leaks so long as the linings stand, and the asphalt finish is o elastic that, even though considerable cracks and subsidences should occur, the asphalt coating would stretch and make them tight again.

THE STEEL PLATES.

Furnished by the Risdon Iron Works, of San Francisco.

N the development of the great industries of the coast much credit is due the suc-cessful manufacturer. This success has been the growth of years and of unremitting labor, and the expenditure of vast sums of money. Until within a few years past, man-ufacturing on the Pacific slope had not yet passed the experimental stage, and the restige which the Eastern-made article enjoyed in this market insured a local de-mand for the Eastern product, which was one of the greatest stumbling blocks to the success of the home manufacturer.

That this prejudice against goods manufactured on the coast has been overcome within the past few years is evidence that that the manufacturer here has the plant, the capital and the brains to compete on equal terms with his Eastern competitor. and it is this standing which has already been attained by the home factories which promises the most for the early recovery of the old-time prosperity the coast so In the history of the development of

arge manufacturing industries of the coast, the Risdon Iron Works of San Francisco occupies a particularly prom-nent place. This is today one of the most extensive manufacturing plants of the West, and in size and importance it is second to none on the Pacific coast. In the selection of n aterials for the Buil Run water-works plant, no one was more

carefully considered than that of the steel plates for the pipe line. The importance of this contract can be appreciated from the statement that in the construction of the pipe line over 12,50,000 pounds of steel plates were used. The contract reaches for plates were used. The contract price for these plates was about \$400,000. One of the strongest indorsements of the ability of the coast manufactories to compete with the Eastern factories on more than even terms was the awarding of this contract to the Risdon Iron Works. In bidding for this work this company was forced to enter into competition with the large plants in the East, which had been in ex-

It has been the aim of the management of the Rision Iron Works in fulfilling their contract with the Portland water committee, to do even more than the tract stipulated. This is in line with their policy of sending out nothing from thei shops that has not passed the most rigi-inspection of their experts, and it is thi careful test of everything forces that has earned for them the repu-

RANSOME'S PATENTS. Value of the Concrete Mixer in Con-

structing the Reservoirs. HE out accompanying this article represents what isknown as Ransome's patent concrete mixer. Six of these excellent little machines were used on the reservoirs. Their reputation had preceded them, but atill every one, with the exception of those who had seen them work, was surprised that one such a small portance could turn out 125 cubic yards

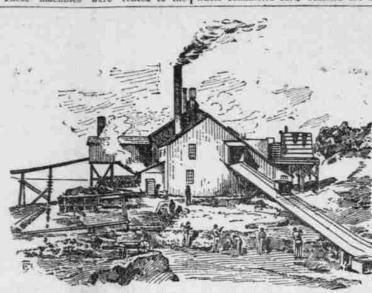
of men, and some of the machinery of the largest coast vessels was turned out by this company.

The Risdon Iron Works was established in San Francisco 3 years ago. The general reputation it has carned during this time is a sufficient guarantee that any work intrusted to the company will be handled to the best possible advantage. The officers of the company sure W. H.

Taylor, president; R. S. Moore, vice-president; and L. R. Mead, secretary. Run river to Portland was first conceived by Messrs. Taibot and Cunningham nearly io years ago. It was the recommendation of Colonel Smith, after he had made a must careful examination of the feasibil-ity of the project of bringing this water to Portland, that was a most important fac-tor toward inducing the water committee to purchase the rights of Taibot and Cun-ningham along Bull Run river, and the subsequent success of the work on the Bull Run water system, as before stated, Bull Run water system, as before stated, has been largely due to the unfiving ef-forts of Colonel Smith, who has devoted nearly seven years of his life to the work of directing the construction of the great est water-works system ever completed in the Pacific Northwest.

MR. JAMES D. SCHUYLER. The office of consulting engineer on th construction of the new water works was them work, was surprised that one such a small portable machine could turn out 125 cubic yards of concrete each day.

These machines were rented to the water committee early realized the diff-



ALCATRAZ ASPHALT REFINERY.

water committee for the work by Messrs.

Keatinge & Leonard, of this city, who keep a number of these mixers to rent.

Culty of planning and executing such an enormous amount of work in one short season, and no higher recognition of en-Another Ransome patent largely used was what is known as the "courrete and the foors, roofs, etc., of gate houses and dams were supplanted with twisted iron the use of which was most saliswere the design and construction of the bars, the use of which was most satisfactory, and effected a great saving in



HANSOMES CONCRETE MIXER.

cost. All the floor lights are the "Ran-some patent light," also all the face of the dams, gate houses and retaining walls were of the "Ransoms patent concrete Full particulars of all these mos valuable methods of concrete construction can be obtained by applying to Kenting & Leonard, the sole agents at Portland

THE MEN WHO BUILT IT. Those Who Directed the Work of

Construction. The construction of the Bull Run plant has not only given employment to a large number of men, but it has also called for the display of the highest order of the responsibility of directing the me engaged in the active work of construction. It was the directing genius of the engineers who had the entire charge of the work of construction that was pri marily responsible for the effective man er in which the work of building the plant progressed, and it was the clo plication the gentlemen at the head of th construction of this work gave to the project that resulted in the completion of what is today considered one of the best built waterworks plants in the United States. The gentlemen who were the leading directing heads of the construction work on the plant are mentioned below.

COLONEL ISAAC W. SMITH. Colonel Isaac W. Smith has devoted his entire life to the profession of civil engi-neering. He was born in Fredericksburg. Spottsylvania county, Va. He is a grad-uate of the Virginia Military institute, lo-

ated at Lexington. During Colonel Smith's long career as a successful engineer he has handled some very important work. He was assistant ngineer and astronomer on the boundary nes between the states of Iowa and Min-esota, and between the Creek and Cherkee Indian tribes in the Indian territory. During the Mexican war he was a second fleutemant in the Volfiguer Rifle regi-ment. He was a captain in the engineer-ing corps of the Confederate army. After the war he engaged in land surveys in the territory of Washington, and he also did much public surveying of lands after Washington was admitted as a state. colonel Smith built the lighthouses for the government at Shoalwater bay and at New Dungeness, Smith's island and Ta-toosh island, on the Straits of Fuca. He laid off the city and harbor lines of Taan, and subsequently built the gas and ter works for the Tacoma Light & Vater Company. He was the engineer for the Northern Pacific on the surveys for he lines from Vancouver north to the Yakima river, and up the Columbia. He had charge of the location and construc-tion of the line from Kalama to Tacoma, and he located the line now running from a across the Cascade mountains t he Yakima and Columbia rivers by the

Vancouver island, B. C., Colone smith laid off lands for the board of pub ic works. He also had charge of the ex-plorations for the Canadian government up Fraser river in connection with the construction of the Canadian Pacific railroad. He engaged successfully in mining enterprises in the rich Cariboo district, and he possesses a most accurate knowl-edge of the topographical features of the rovince of British Columbia.

Colonel Smith has had charge of somthe most important improvements of fregon, in which state he has long reided. He was the engineer of the North ern Pacific railroad on the construction and location of the line from Kalama to Portiand. He built the complete system of steamboat locks around the Willamette falls at Oregon City. He was chief engineer of the Oregon Pacific Railroad Com-pany, which runs a line of road from Ya-quina bay east to the summit of the Cas-

were the design and construction of the reservoirs, with their dams, pipe connec-tions and appurtenances, as well as the Portland Heights pumping station. All visiting engineers from the East who have seen the unusual difficulties which have here been met and overcome have expressed great admiration of the ingenuity shown by Mr. Schuyler in this work in the way of special adaptations out of the usual order. Mr. Schuyler is a New Yorker by birth and education, but has prac-ticed his profession for 28 years past ex-clusively in the Western states and territories, his early career being devoted to railroad construction in Kansas, Colo rado, California and Old Mexico. For li years, however, he has devoted his attention to his chosen specialty of hydraulics and in the pursuit of that branch has at-ained a national reputation. He was for several years chief assistant state engieer of California, in charge of the irri neer of California, in charge of the irri-gation investigation, and subsequently designed and constructed the great Sweet-water dam, near San Diego, Cal., a structure whose massive and graceful lines are admired by thousands of vis-itors annually. Mr. Schuyler was engi-neer of the Hemet dam, in Riverside coun-ty, California, which is considerably highty, California, which is considerably high er than the Sweetwater, both of them standing far in advance of all others of their character in Western America. Mr.



Photo by Davies ngineer on many other important water works and irrigation projects throughou the West and in the Sandwich islands He has made some interesting and usefu ontributions to the literature of his pro ession, which have added to his reputa tion among engineers, particularly in the form of papers read before the American Society of Civil Engineers, of which he is a member and past director. He is also one of the very few American member of the British Institution of Civil Engi neers, the oldest, the largest and th nost conservative engineering society is the world. He is a director of the Ameri can Society of Irrigation Engineers, member of the Technical Society of th Pacific Coast, and also of the California Association of Civil Engineers. The first secretary of the water committee was his brother-the late Philip C. Schuyler, a Portland pioneer, whose enthusiasm in behalf of the projected Buil Run water works, now so handsomely completed, is cleasantly recalled at this time by his old

JOHN A. LESOURD.

Mr. John A. Lesourd, the chief draughtn man and inspector of iron work of the Bull Run pipe line, is a gentleman whose abilities are never questioned. Away back in the '70s Mr. Lesourd held the high ly responsible position of chief draughts



man on the construction work of the sys-tem of locks and canal around the Willamette falls at Oregon City, and since that time he has been actively engaged in

Willamette iron works, the leading iron works plant of the state. Mr. Lesourd made the plans for the first marine compound engine ever built in Oregon, and this engine is now doing duty in the steam coaster Alliance. He also superin-tended work in the construction of en-gines and machinery for some of the fast-est river boats of the coast. The machin-ery for the powerful tug Wanderer, the manuficent steamer Victorian the pride magnificent steamer Victorian, the pride of the O. R. & N. Co., and the fast little steamer Cricket, built by Captain Spen-cer, was built under Mr. Lesourd's direc-tion. This latter boat is the fastest of its tion. This latter boat is the fastest of its size or the coast. When active work was first commenced on the Bull Run system, the position of chief draughtsman was tendered Mr. Lesourd, and that everybody connected with this great work has the highest appreciation of Mr. Lesourd's services must be taken as attesting his ability as a draughtsman.

Mr. Lesourd is a native of France. He has been long, enough in the United

has been long enough in the United States, however, to become thoroughly wedded to the forms and customs of the American republic. He first arrived in San Francisco 40 years ago last September. Pursuing the precarious calling of mining for a short time, he finally decided that the Northern field would afford him better opportunities for advancement than be could look for in California, and in 1857 he came to Oregon. His residence in this state has been a continuous one since that time. It is not only the success of Mr. Lesourd himself which crowns his life-time's work, but the opportunities for advancement he has been enabled to afford his son, Frank E. Lesourd, a native Ore-gonian, has resulted in the younger Mr. Lesourd's attaining a distinction as an expert draughtsman that has secured for ilip a position among the leading traughtsmen in the United States. Frank Lesourd received his best training unler his father's eye in the mechanical engineering establishment, the Willamette iron works of this city. He is now hold-ing the highly responsible position of in-spector and superintendent of construction of the Cascade locks gates, one of the of the Cascade locks gates, one of the most important government undertakings of the United States. These gates are now under construction at Sparrow's Point, near Baltimore, Md. This position was tendered Mr. Lesourd by Major Thomas H. Handbury, who was stationed at Portland in charge of the government works have and as the hone was somether. works here, and, as the honor was one that was entirely unsolicited by Mr. Lesourd, the appointment can only be taken as a most fitting recognition of the great abili-ties developed under the successful tutorage of his father.

C. E. OLIVER. One of the rising young civil engineers of the coast is Mr. C. E. Oliver, who has held the important position of assistant engineer of the Buil Run system since

May, 1890. Mr. Oliver has learned civil engineering by years of practical effort, and the result of his labors on the Bull Run pipe line is the best recommendation of the benefits of this practical education. Mr. Oliver was born in Marion county,



Iowa, in 1856. He was appointed principal assistant engineer of Portland in 1880. He held this office until 1884. It was during the period of Mr. Oliver's incumbency that many of the most important work in improvement of streets were laid out and the personal supervision which the gentleman was called upon to exercise over these improvements resulted in his gaining much practical experience. In 1836 Mr. Oliver did some preliminary work in the surveys for the contemplated Bull Run pipe line, and during 1837 and the following year he was engaged principally in land surveying and in railroad work. In 1889 and 1880 he made the surveys and superintended the laying of the pipe line from the city to Palatine Hill. In June of the latter year he was appointed in-spector of the city water works, which important office he held until he was made essistant engineer of the great plant, or

which he has since been engaged.

In addition to the work connected with his office as assistant engineer, Mr. Olive since May of the present year has per-formed the duties of superintendent of construction of reservoirs. Among the important services Mr. Oliver rendered in the construction of the pipe line was his securing the rights of way for the line from Bull Run river to Mount Tabor, and the subsequent rapid laying of the pipe along this route was due largely to the ability the gentleman displayed in set tling the question of rights of way. Mr. Oliver, from his long residence in

this city, is classed among the Portland boys by his numerous friends and ac-quaintances, and they are all proud of the record be has made here as a success ful civil engineer RALPH H. MOORE.

A distinctive and original feature in the Bull Run system is shown in the design



Photo by McAlpin & Lami and execution of the gatehouse chambers which comprise the entire distributing system, and the complete mechanism for controlling the water for the various reservoirs and the main city supply. The otherwise complicated mechanism of the distributing system is greatly simplified by the interior arrangement of the gate

This entire work, covering hundreds of tons of iron and steel work, was furnished and placed in position by the Risdon Iron Works of San Francisco, under the imme-diate supervision of Ralph H. Moore.

Mr. Moore is a native of San Francisco That he has attained the great success h has before reaching his 30th year is evi dence of his great natural engineerin ability. In 1889 he graduated from the university of California, at Berkeley, in the course of mechanical engineering, and in 1890 he accepted a position with the Ris-don Iron Works, with which he has since

sible position of chief draughtsman in the tire work is but a slight recognition of the ability of Mr. Moore and of the capacity, of the Risdon Iron Works for turning out work of this character in all its perfection. D. D. CLARKE, PRINCIPAL ASSIST-

Mr. D. D. Clarke is of New England birth and education. He came to the Pacific Northwest in early manbood, and for 30 years has been identified with the public works of Oregon and Washington. Mak-ing his home in Portland from 1894 to 1873, he was engaged first upon the staff of the city surveyor, and later, during the rail-road construction of that period, served as assistant engineer upon both the East and West Side roads, After spending three years in Olympia in connection with the work of the United States land survers, he removed to Tacoma, where he resided from 1876 until 1890. During this period be was almost continuously in the service of the Northern Pacific Rail-road Company as assistant engineer, the last two years immediately in charge of the terminal improvements made at Ta-

oma.

During the construction of the Tacoma. water works, in 1884-5, by Colonel Smith, now chief engineer of the Portland works,



Mr. Clarke was his principal assistant. He has been a member of the American Society of Civil Engineers since 1882. His gan in March, 1893.

F. H. YOUNG. Mr. F. H. Young, assistant engineer of the Bull Run pipe line, early had the benefit of a thorough education in the profession to which he proposed to devote the best years of his life. He was born in Eric county, Pennsylvania, in 1858. After having taken a thorough course in civil engineering at the Western Pennsylvania university, he at once devoted himself to field work, in which he gained a most valfield work, in which he gained a most val-uable fund of practical information. He followed this work successfully for 17 years. He worked on many of the im-portant railroad surveys, both in this country and in Mexico. Some of his most important work was done in the improve-ments of harbors in the state of Wash-ington with Richard Nevins, jr. Mr. Young enjoyed a high reputation as a civil expineer before he came to Portcivil engineer before he came to Port-land, and it was not long after his arrival in the city before his abilities were recognized by the tender of his present post-

tion on the Bull Run pipe line.

Mr. Young has been constantly engaged on the water works since 1891. He located the bridge across the Sandy river in Febthe bridge across the Sandy river in Feu-ruary, 1882. In October of the same year he located the distributing reservoir at Mount Tabor. Commencing active work on the pipe line itself in January, 1893, he located the line from the Sandy river to the headworks, eight miles up the Bull Run river. At the close of last scuson's work he was transferred to the office and work he was transferred to the office and assigned to the duty of testing all mate-rials used in the construction of reser-coirs, such as cement, gravel, sand, brick, ete. In this work Mr. Young has had the fullest confidence of his superiors, and the able and impartial manner in which he has given his decisions in all cases has



F. H. Young. yon for him the esteem of everybody who nas furnished materials for this important public undertaking.

E. E. COOPER. Mr. E. E. Cooper has hed direct charge of the construction of the concrete con-struction work on the Bull Run pipe line mder Mr. Schuyler. His work has been principally confined to reservoirs 1, 2 and 4. The position has called for the constant attention of a man thoroughly versed in all the intricacles of the civil engineer's profession, and the manner in which Mr. Cooper performed the duties of this re sponsible trust has entitled him to the

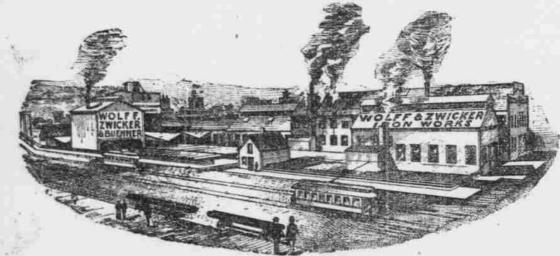
Mr. Cooper is a native of Clinton county, New York. He attended school at St. Paul, Minn., where he took a full course at the Minnesota state university. He was first employed by the St. Paul & buluth Rallroad Company. From this work he entered the service of the Northern Pacific Rallroad Company in 1871. One of the most interesting incidents of Mr. Cooper's career in rallroad construction work was the help he rendered in starting the fire to thaw the ground which en-abled Colonel Smith to turn the first shovelful of earth on the construction of the great transcontinental line, the Northern Pacific.

Mr. Cooper was engaged on the construction work of the Northern Pacific until 1881. From this work he came to Oregon in 1873 to take charge of the construction of the mountain division of the



E.E. COPER McAlpin & Lamb

any of the largest iron-working plants of the course and prevent the water from least establishment of this plant at Forthand has been to the industrial activity of the industrial activity of the course of the constant employment to a lorge number of this plant that would be of benefit the most instant of the same asphaltum to pitch their cancer and prevent the water from least of the summit of the Cast benefit the most insportant works of the summit of the Cast benefit the most insportant works of the summit of the Cast benefit the most insportant works of the summit of the Cast benefit the most insportant works of the summit of the Cast benefit the most insportant works of the summit of the Cast benefit the most insportant works of the summit of the Cast benefit the most insportant works of the summit of the Cast benefit the most insportant works of the summit of the Cast benefit the most insportant works of the summit of the Cast benefit the course of mountains. Casende mountains. The careful and artistly meanner of the plants has a capacity of 400 form of sugar classing in that today is position with the Rison from two fine plants and the course of mechanical engineering, and the course of mechanical engineering, and the course of mechanical engineering and the course of mountains. Casende mountains. The careful the Rison from two fine form the summit of the Cast benefit the most into the course of mechanical engineering and the plants are capacity of 400 form of the summit of the Rison from two fine form two fine form the course of mechanical engineering and the course of the summit of the Cast benefit the Rison form two fine form the curson form t



THE WOLFF, ZWICKER & BUEHNER PIPE WORKS, AND THE WOLFF & ZWICKER IRON WORKS.

parts of the Pacific Northwest,

The immense plant of this firm is lo-cated along the banks of the river at the eastern approach of the Madison-street bridge. It occupies two blocks with a deep-water frontage, and every advan-tage in transportation facilities is afforded by the Southern Pacific railroad, the tracks of which system, covering all parts of Western Oregon, and extending South and East, are but one block distant, and by steamers which ply south on the Wilsette to the most southern points of a highly fertile section, and also north on the same stream to the Columbia, on which latter river boats ply both east and west, Portland's route to the ocean lying along the course of this great stream. Excellent dock facilities are afforded at the site of the plant, and boats can land and discharge cargoes right into the principal manufacturing-rooms of this immense establishment.

The Wolff & Zwicker Iron Works recently turned out over 70 hydrants for the local fire department. These hydrants not only met, but exceeded every requirement of the contract. The facilities of the plant of this company for turning out all used by the early indian races and their shinesy are equal to those enjoyed by

A century ago the Indians in California

tract on the pipe line which was so fin-lehed, notwithstanding that it was the largest and most difficult of all.

THE RESERVOIR LININGS.

Since the earliest history or man, asphaltum has been extensively used in structural work in a variety of forms. The builders of the ditches and reservoirs that supplied ancient Habylon employed it to save North ark, the cradic of Moses, the mummles of Egypt, the wonderful works of the Syrian and Egyptian build-ers, all attest the use of this valuable mu-

other important work, reaching to all | H. McConaughy in TJ, and James Ster- | tation which is a most important facto ling in '94. That the work was well or-gamined in all its departments is shown by the fact that it was successfully com-pleted on time; this being the only con-

tures of the construction of Portland's new water-supply system is the use of asphaltum for the finishing cont of the reservoir linings. Since the earliest history of man, asphaltum has been ex-

supplied the steel plates and part of the from work for such an important under-taking as the construction of the Buil Run pipe line will be of value to everyody interested in mechanical enginee The Important Part That Asphaltum
Played in This Work.

MONG the most interesting features of the construction of the latest improved patterns. In addition to having today the largest pipe plant. on the coast, they are also large manu-facturers of mining, milling, marine am-other machinery. They enjoy the distinc-tion of not only conducting the larges pipe plant in San Francisco, but they als are the largest manufacturers of m machinery on the coast. During the part few years they have built a great number of cutarts mills. Among these mills is that of 246 stamps for the Alaska Mill & Mining Company. This is the largest star mill in the world. The Risdon Iron World has also manufactured some of the larg-est pumplog and boisting plants in the country. Among the great machinery plants recently turned by the company were those for the sugar-best factories at Watsonville and Chino. Each of these plants has a capacity of 400 tons of sugar