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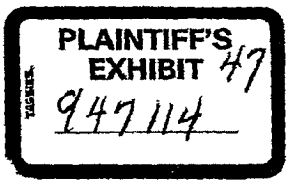
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A BUILDER AND HIS FAMILY



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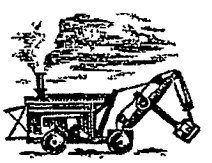
A BUILDER AND HIS FAMILY

1898 ✦ 1948

Being the Historical Account of the
Contracting, Engineering & Construction career of
W. A. BECHTEL
and of how his SONS *and their* ASSOCIATES
have carried forward his principles
in their many activities

Compiled in the Fiftieth Anniversary Year
of Dad Bechtel's start in construction

BY ROBERT L. INGRAM



PRIVATELY PRINTED
SECOND PRINTING
SAN FRANCISCO, 1961

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PREFACE TO THE SECOND PRINTING

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MORE THAN A DOZEN busy years have passed since "A Builder and His Family" was published to commemorate a half century of Bechtel construction and engineering and much has happened in the meantime.

A third generation member of the family has assumed a leading position in our activities, with the election in 1960 of Stephen D. Bechtel, Jr. to the presidency of the company. From earlier duties in the field he has steadily moved ahead through increasing responsibilities and for the past several years has been the senior officer and director for our pipeline, international, financial and equipment operations.

His election as president was a natural development and further strengthens the executive direction of the company at a time when both the volume of work and uncompleted backlog are at all-time highs.

Our organization has more than doubled in size in the past decade. Many who have found stimulating careers within the expanded "Bechtel business family" during this period have expressed the wish to learn more about our modest beginnings and earlier years.

With this desire in mind, Steve's first year as president seems to our senior executives the appropriate time to publish a second edition of "A Builder . . . ," unchanged in any detail from the book which came as a pleasant surprise to the second-generation Bechtels on the fiftieth anniversary of the business.

S. D. BECHTEL

San Francisco, California
July, 1961

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PREFACE

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THE TELLING of this story is long overdue, at least in the form in which it now appears. In choosing to handle its preparation the "hard way" the unique position in which the author and his co-conspirators found themselves was such that they alone had to take the responsibility for not only the facts, but the writing and editing as well. Through their own eyes is pictured a story that is usually told with the direct knowledge and participation of many of the principals. In this book, however, so that the story be objective, we have elected to have it told as we and others have seen it. The results, we think, depict the principles and lifework of a man, his sons and immediate family and also a larger group—the people who have chosen to make his precepts their guideposts to a way of life.

"A Builder and His Family" is not the only Bechtel story that could be told. There are as many facets to it as persons who could write it; however, we, at least, and the author feel privileged to have had a part in bringing into clear focus an era which started fifty years ago and has continued without interruption until the present time—ever changing but always resting on a solid foundation.

TOM PHILLIPS and BILL WASTE

San Francisco, California
March, 1949

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FOREWORD

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THE WORKS of men speak for them, needing no words. However, signal occasions make words appropriate, as in 1948, the fiftieth anniversary of Dad Bechtel's start in the construction business. By then the ranks of old-timers were rapidly thinning; there existed no single, related and permanent record of the work, and no man—not even this narrative's principals—knew *all* the key facts about a half-century's activities.

Consequently, William E. Waste, Vice President of Bechtel Corporation, caused this accounting to be made, and called in Robert L. Bridges, Counsel, for advisory assistance. Other than these two, no one within the firm knew of its preparation, least of all the Bechtels themselves. Therefore, their engineering and construction accomplishment is shown not as seen through their eyes, nor those of their associates, but as viewed by many men—senior engineers and builders, customers, other "construction stiffs," most of them "people who were there when it happened." How they felt was shown by the way their information was offered—eagerly, affectionately.

Should inaccuracies be found they likely will be of detail, traceable to faulty memories. The larger meanings were never in doubt; spirit and import stood out with crystal clarity in every interview and letter. It is hoped this brief book will partially repay its real authors for the pleasant hours and days they gave to re-create events of the past.

Acknowledgment is made to all who contributed and there were many not named here. Especially to A. J. Barkley, retired Southern Pacific engineer; John Q. Barlow, also a retired engineer formerly with Southern Pacific, and Utah Construction Co.; Warren A. Bechtel, Jr., who believed he was giving facts for a short article in the firm's employee magazine; V. G. Hindmarsh, whose aid was enlisted under the same guise; Earle G. Lloyd, retired, co-founder and former Secretary-Treasurer of Industrial Indemnity; E. E. Mayo, Chief Engineer, Southern Pacific Company; Emery Oliver, former Western Pacific engineer; Silas H. Palmer, former Bechtel partner and a Director

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of Pacific Gas and Electric Company; Otto W. Peterson, Chief Engineer, Construction Division, Pacific Gas and Electric Company; and Thomas L. Phillips, Chief Engineer, The Western Pacific Railroad Co. To Robert L. Bridges who gave valued counsel, and Tom Moriarty for aid in research. Above all, to the instigator, Bill Waste, virtually a co-author who devoted hours on end to patiently keeping this pen writing along a straight line.

Altogether, the task has been highly pleasurable. Assembling the facts and documenting the Bechtel achievement through two generations provided an opportunity to come close, indeed, to appreciating its real significance. One saw that for all its individuality this story also had a universal character, for it showed what men could do in the free air of America after the humblest of beginnings and frequent discouragements.

So—to Steve, Warren, Kenneth, Sister Alice, and your organizations of Bechtel people everywhere: here is how fifty years of Dad's work and the "family's" looked from the sidelines.

R. L. I.

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A BUILDER AND HIS FAMILY

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W. A. Bechtel, as he looked when his railroad construction activities were at the peak.

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CHAPTER I

How it started

INTO Oklahoma, then "Indian Territory," one day in 1898 a young rancher came, driving a span of mules. He was looking for a job. Mulepower was a sure ticket to steady wages on railroad construction in those days, so Warren A. Bechtel had no trouble leasing his sturdy animals and hiring himself out to handle them.

Background of a builder

Grading with the old slip scraper was hard work, but hard work was nothing new to a young man who had fought to wring a living out of the Kansas soil following the great Money Panic of 1893. W. A. Bechtel was well prepared for rough going on the railroad job by the two circumstances of sturdy ancestral stock and a rugged outdoor childhood. His family line came straight down from Pennsylvania pioneers. (There is a town of Bechtelsville located in Berks County, at the southeast corner of the state.) He was born on a farm near Freeport, Illinois, on September 12, 1872, grew up there and at Peabody, Kansas, under semi-frontier conditions that developed early self-reliance and a strong body. At Peabody his duties were divided between the family farm, his father's in-town grocery store and the local schools. When he had earned his high school diploma he tried cattle raising for several years with discouraging results.

1898: The railroad got a mule-skinner

In January of 1897 W. A. Bechtel married an attractive visitor from Aurora, Indiana, Miss Clara Alice West. Like many another bridegroom, he wanted his lady to have the good things of life, and the ability of the ranch to provide them looked doubtful at best. By December 23, 1898, when Warren, his first son was born at Peabody, W. A. Bechtel already had turned his energies to better account. Rails were

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being laid in Indian Territory some miles to the south; in the spring of '98 word had reached him that the railroad would look with favor on a well-set-up young man willing to deliver a full day's work, especially if blessed with his own team of work animals.

The eventual outcome of his trip to Indian Territory is recorded in the works of one of the world's largest engineering and construction organizations. But the immediate result was no more important than the addition to the railroad section gang of one more hired hand with a "shanty outfit," except for a change that took place within the man himself. Here, in the heat and dust, he found what he had been looking for—and he knew it.

It would be agreeable to report that the railroad job was his first adventure in construction but this was not strictly the fact. In "off seasons" while ranching near Peabody, W. A. Bechtel had done some local road work, and there was construction precedent in the family even farther back. His father, John Moyer Bechtel, had been a county road commissioner while living at Freeport, Illinois. Certainly, however, the job in Indian Territory marked the genesis of W. A. Bechtel's lifework.

For the right people heavy construction can be an infection. It got into the freshman teamster's blood and stayed there. W. A. had a natural affinity for this kind of work and he relished the satisfaction in accomplishment that is the builder's real reward. Years later a prominent engineer said of him: "He loved construction. Long after he had become a successful contractor, I have seen him peel off his coat and take a turn or two with a team and scraper. He used to climb up on a steam shovel and load a couple of cars, enjoying every minute of it. W. A. came right up from the grass."

Found: a lifework

After the stretch in Indian Territory, he went north into Iowa and Minnesota, and then into Wyoming on Union Pacific reconstruction after Harriman took over the road. But for some time, in the Greeley tradition, his eyes had turned toward the Far West. He went there soon after the new century began, first to Oregon as a gang foreman on the Southern Pacific, and

1899: Eyes West

then to Wadsworth east of Reno, Nevada, where he figured cross sections for the SP Engineering Department. "I landed in Reno," he said, "with a wife and two babies, a slide trombone and a ten dollar bill!" A second son, Stephen Davison Bechtel, had been born at Aurora, Indiana, on September 24, 1900.

The Far West at the turn of the century

The west at this time remained largely a land of promise. In the fifty years following the Gold Rush, giants like Stanford and General Dodge had finished paving the way for the future with highways of steel, yet California, always the leader in western development, by 1900 had attracted a population of only 1,213,400.

The resources were there, but except for gold, still almost entirely untapped. Oil, which was to inspire son Stephen D. Bechtel's engineering vision thirty years later, and water and gas as sources of power, a field in which today's Bechtel interests are highly active, had not been exploited to any considerable extent. People, the factor essential to empire, were still to come in numbers large enough to support a well-rounded economy. The key that could unlock the treasure house was transportation, and transportation meant the railroads.

When Collis P. Huntington, last survivor of Southern Pacific's "Big Four," died in 1900 his company already was operating eight thousand miles of railroad extending from Portland to Guaymas, Mexico, and east to Ogden and New Orleans. But Santa Fe's main line into Oakland had yet to be completed, and Western Pacific was not in full operation until 1907. Southern Pacific was building down the Coast. Northward from Marin County a number of independent short lines would wait seven years for consolidation into the Northwestern Pacific.

So, although all the pioneer rail routes were complete as the Twentieth Century began, western carriers were engaged on the less spectacular but more comprehensive program of shortening distances, improving grades, and adding branch lines.

1902: Some early friendships

V. G. Hindmarsh, now a Vice President of Bechtel Corporation, and George S. Colley, father of International Bechtel's George Colley, became acquainted with W. A. Bechtel at Wadsworth, Nevada. The three men were employed during

1902 and 1903 on realignment of the Southern Pacific's Overland Route, then called the Central Pacific Division. The man who was SP's Supervising Construction Engineer on this job tells how W. A. caught on with the railroad. His name is A. J. Barkley, he is now retired and living in Berkeley. Here, in Mr. Barkley's words, is the story:

Wadsworth, Nevada

"I first met 'Beck' near Wadsworth during the winter while I was inspecting some work being done on the roadbed. I saw a man walking back from the worksite of the contracting firm of Carney, Roy and Higgins. He looked discouraged as he asked me if there was a chance to get a job with the railroad. I told him I knew of no job open at the moment, but that one might be, a little later. I asked him if he wanted a lift in our wagon, by which I meant that he could ride for a while on the buckboard and then walk in back for a while, hanging on. That's the way we did in those days when the weather was cold—and it was bitterly cold up there—with six inches of snow on the ground and a good wind blowing up the canyon.

"He said his name was Bechtel, that he had been promised the job of superintendent by the contractor's agent, but that when he arrived at the site Higgins told him to clear out—that no superintendent was needed. I found out later that he had his family along and was short of money. He looked like a mighty fine man to me, so when I got to Wadsworth I asked at our office if a job was going to be open.

The SP hired an estimator

"Well, there was an opening and we offered it to 'Beck.' He took it, as an estimator. He worked hard and was well grounded. From there he was sent to the Ogden office. A little later I requisitioned a gravel pit superintendent for a quarry at Lovelock, and 'Beck' was sent out. There were fifteen to twenty rock cars on the pit sidings all the time. The rock was loaded by steam shovel, which then was a new idea. It was a tough job and 'Beck' did very well. In those days out on the desert, men worked from sunup till sundown.

"He was learning all the time, but he seemed to me a natural engineer, and I've always thought that good engineers are born, not made. They must have a knack for it in the first place, or all the books on stress and strain won't do much good.

"I was glad to hear of his success in later years. He deserved to succeed. 'Beck' was what I've always thought an engineer should be—a man who understands what is to be done, knows how to do it, and finishes the job economically."

1903: Quarryman at Lovelock

At the Lovelock gravel pit the family lived in a converted box car, one of many improvised homes-on-the-job. Mrs. Bechtel had been reared in genteel surroundings—her parents were people of means and standing in Aurora—but soon after marriage she showed that she, too, had the stuff of pioneers, by adjusting to a modest income and primitive surroundings with resourcefulness and good grace. She proved, in fact, to possess an unusual talent for creating a real home under conditions that were anything but conducive to normal living. This helped W. A. immeasurably, and as time passed, had an important bearing on the children's development as well, because for some years they spent almost as much time living at the jobsites as at home in the cities.

Home was where Mother made it

In 1902 and 1903 Silas H. Palmer was an inspector for E. B. and A. L. Stone, an Oakland contracting firm. His work took him to Nevada and there, on a siding by the gravel borrow, he met W. A. Bechtel and his family in the box car living quarters. Palmer discovered that W. A. had figured out how to squeeze the utmost in profitable work from the new steam shovels, using them in combination with his available manpower and transportation facilities. "His mastery of detail was apparent," Palmer said, "and I was attracted at once by his ability. I told him that a good job was open with the Stones, and suggested that he look into it."

1904: Superintendent, Oakland, California

Accordingly, in 1904 W. A. Bechtel moved his family to Oakland, and became a superintendent for the Stone firm. In this capacity he took charge of building the Richmond Belt Railroad and the extension of the Santa Fe into Oakland. As an employee of the railroads or their contractors, he was adding to experience on many types of railroad work.

Kenneth Bechtel was born on July 4, 1904, while the family lived on Linden Street in Oakland. A few blocks away the tracks of the Key System interurban electric line to San Francisco were being laid, and older brothers Warren and Steve

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remember the excitement when the first Key train came in. At this time, W. A. had charge of filling the swamp at the head of Lake Merritt for Oakland's Lakeshore Park, and of grading Grand Avenue in the Grand Lake District.

Shortly afterward the family moved to Placerville, California, where W. A. ran a slate quarry. To a nearby hill, one night in April of 1906, he took the boys. From that place they looked across sixty airline miles and saw a bright red glow in the western sky. It was light reflected from flames consuming the city of San Francisco, the great fire following the earthquake.

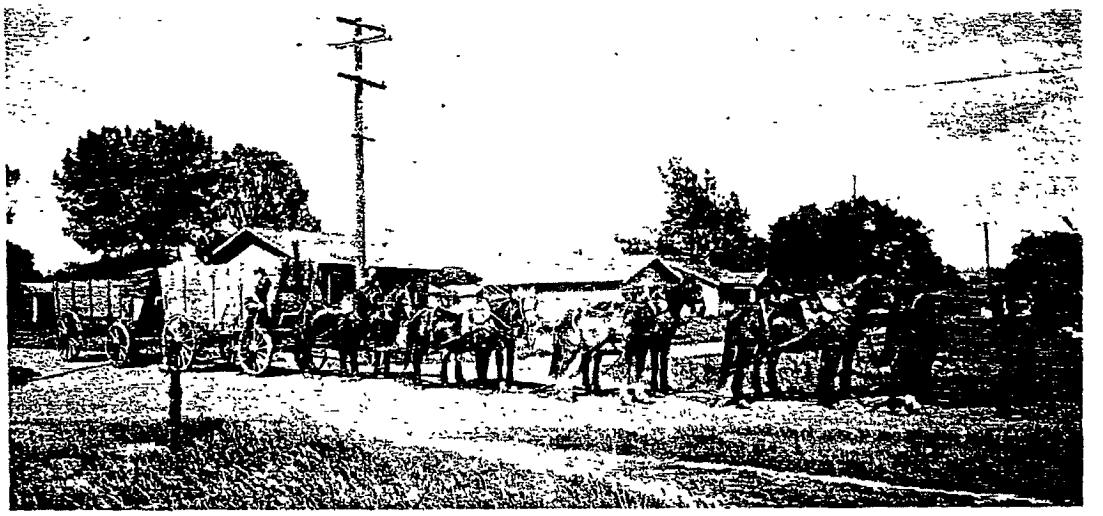
1906: A business was launched

Eight years after his initiation into construction in Indian Territory, W. A. Bechtel was ready to strike out on his own as a contractor. The opportunity came through a subcontract on the Western Pacific main line, then building into Oakland. The site was between Pleasanton and Sunol, and the year, 1906. He hooked up with George S. Colley, his friend from Nevada days and a fellow employee at the Stone firm.

Thomas L. Phillips, later Chief Engineer of the Western Pacific, recalls that first job. "The work consisted of making a cut through limestone," he says, "and the material thus removed was to be used for adjacent fills. There was trouble; the rock broke irregularly, causing a heavy over-break in the yardage excavated. Bechtel was hard pressed to make ends meet on the neat yardage of the cut." Right here, he was to demonstrate a necessary qualification for the successful contractor, the ability in negotiations to present his case in a convincing manner. "He pointed out that the extra material was being used by the railroad for fills, and appealed for remeasurement of the cut. And he got it! As a consequence, instead of losing money Bechtel and Colley made a little on the job."

When the tables turned

There's another story wrapped up in that first subcontract. The partners rented a steam shovel from the prime contractor, who exacted all the law would allow. Bechtel and Colley proved less than persuasive in attempts to get the rental reduced. And when they asked, the young partners were told off in no uncertain terms. Although this contractor then was one of the largest, some years later he had financial reverses and approached W. A. for a five-thousand-dollar emergency



Freight wagons and ten-horse teams were in use when W. A. started in the construction business.



An early contract—grading for Western Pacific's Oroville station with W. A.'s first steam shovel.

loan. Notwithstanding the earlier incident, and the additional circumstance that subsequent high rentals had paid for the shovel several times over, the loan was granted. The incident bears out another characteristic frequently mentioned by old friends: "W. A. was always a fair fellow."

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In 1908 he returned briefly to the status of employee, as Project Manager on the construction of the Sutter-Butte Canal, and on levees built near Marysville in the Sacramento Valley. During this period the family lived at Biggs, California. More railroad work followed, again as a contractor, including some for the Western Pacific, for as Tom Phillips points out: "I had dealings with W. A. Bechtel from 1906 on." In 1909, a direct contract was completed for grading the site of the Oroville station. "W. A. had to hustle for funds," Emery Oliver, then WP's Division Engineer, related forty years later. "Apparently, his finances were low at the time, as I had to guarantee his account with the wholesale grocer in Marysville." Then as now, the contracting business wasn't always strawberries and cream. "However," the veteran railroader concluded, "he finished the job and made a little money."

1909: Oroville and the steam shovel

W. A. now owned the steam shovel he had rented at Sunol and he was proud of this fine piece of modern equipment. It was a Model 20 Marion, a type developed for Panama Canal construction, which had been converted from its former railroad truck mounting to heavy steel traction wheels. Across the cab bold letters proclaimed "W. A. Bechtel Co."—this a full sixteen years before he would incorporate his business! A human touch—and indicative of his determination to build a larger organization.

Early in 1910 he obtained a subcontract to take out two cuts located fifteen miles below Natron, Oregon, on the Southern Pacific extension from Eugene to Oakridge. Here his path crossed that of Heinie Hindmarsh for the second time. Heinie was Resident Engineer on an adjoining section. W. A. ran these jobs himself, using the steam shovel and teams of horses. Thirteen years later his sons would be active in the construction program that completed the 270-mile Cascade Line between Oakridge and Black Butte, near Mount Shasta. And

1910: Early work on the Natron Cut-Off

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here they would improve on Dad's livestock by introducing modern power equipment.

The partnership with Wattis

For some time W. A. Bechtel's activities had attracted the attention of William H. and E. O. Wattis, brothers, who headed up the powerful Utah Construction Co. of Salt Lake City, one of the largest western railroad builders. The Wattis brothers were impressed with W. A. Bechtel's work in Oregon, where the Utah concern held the prime contract. E. O. Wattis had a son, Ray, who was anxious to get a subcontract from his father's company, and the story is that the senior Wattis agreed providing his son would take a steady and experienced man for a running mate. As a result, W. A. Bechtel and Ray Wattis became partners on a subcontract under the Utah firm during construction of irrigation district facilities at Oakdale, California. Their particular job was to drive a water tunnel and build ditches. The new partners looked the ground over, and the material seemed favorable. W. A. was familiar with tunneling from his railroad work; there was reason to believe the new partnership would prosper.

1911: Hard rock at Oakdale

But, like Sunol, all was not as serene as indicated by surface appearances. Hardly had the tunnel portal been opened when the subcontractors ran into a solid ledge of blue diorite. Hand drills were helpless against the hard rock, to lick it they had to buy a Water Leyner Denver drill and drill sharpener. In the light of today's operations this would scarcely merit mention. At the time, however, the event was a milestone, for it marked one more piece of modern equipment W. A. was able to acquire, and another swing away from hand labor, although by necessity.

From Oakdale, Wattis and Bechtel moved north into Mendocino County to take the first of three subcontracts under Utah Construction on the Northwestern Pacific Railroad, which was being extended from Ukiah to Willits. The first two contracts were each for building approximately five miles of line, and the third called for a ten-mile grade north to the King Rock Crossing Bridge.

W. A. Bechtel's brother, Arthur, was a familiar figure on this and earlier work. There was an eleven year difference in

ages, but even as a youngster of fifteen he had gone out [illegible] his brother to work on the midwestern railroad jobs. Heinie Hindmarsh recalls him on the Southern Pacific in Nevada, back in 1902. "Art was just a big kid then, a swamper," Hindmarsh said. "He rode out on the end of the boom, tripping the dump gate of a clamshell. There were no bucket controls in the cab, so a man had to straddle the 'big stick.' Believe me, it took guts to be a crane jockey." The actual combat of man and machine against the forces of nature were always to Arthur Bechtel's liking. Of later days on the Natron Cut-Off, Art enjoyed remembering: "That first Marion shovel we bought was my own baby—and there wasn't another shovel runner along the whole line I had to take my hat off to when it came to pitching dirt."

The family's shovel runner

Before the third Northwestern Pacific job got under way, Wattis and Bechtel obtained another subcontract for a branch running from the main line of the Denver, Rio Grande & Western to a coal mine located near Helper in central Utah. Ray Wattis took charge of the work. He assembled several locomotives, trains of dump cars, and two steam shovels. Wattis enjoyed looking at this prosperous display of equipment. It may have caused him to foresee bright prospects ahead for an operation he could control alone. In any event, he and W. A. formed divergent opinions about their future activities and decided to go separate ways. The partnership was terminated; Wattis thereupon took over the Utah work and W. A. the Northwestern Pacific job in California.

1912: California and Utah went separate ways

As crews moved in to start NWP subcontract number three, W. A. Bechtel returned to doing business as an individual. But he was not alone as far as assistance was concerned. He had some good men at his elbow; Earle G. Lloyd who had joined at Oakdale, old stand-by George S. Colley who came back to superintend the NWP work, and of course, brother Art. Lloyd handled administrative matters and purchasing, Colley knew men and construction, and Art Bechtel, in addition to his winning ways with a steam shovel, proved the best man on employee relations the enterprise could have found. Not that then any of them even had heard the term "employee rela-

NWP: The first real team was put together

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tions." Rather, that Art was blessed with that open heart and friendly spirit characteristic of the outdoor westerner, and men liked him on sight.

A young subcontractor named Al

Other men destined for long association with the Bechtel family came to the NWP camps—Justin Barber, Clarence "Pop" Thorne who recently retired from the Somastic Pipe Coating Division—and Al Berlander, that seasoned veteran still carrying the old tradition forward as Construction Manager of the Trans-Arabian pipe line. Berlander had taken a subcontract for concrete work. W. A. said the success of the entire railroad contract depended on getting the concrete structures finished ahead of grading. It meant bringing in many carloads of cement and storing them for use during the winter while the worksite was cut off from supplies. Berlander stuck on the job early and late right through the winter, matching wits with the weather. He managed to stay in front of the grading crews and finished up in good time. It turned out to be an early example of the initiative that enabled two Bechtel generations to rely on Al with complete confidence.

The chow stuck to a man's ribs

W. A., the old-timers point out, was a good feeder. His camp table was sure to be mentioned wherever construction workers got together. This was sound business policy, because men were easier to recruit and hold if the employer had a reputation for good food and plenty of it, and well-fed men delivered a better day's work. But it also was characteristic of W. A. that he himself liked the best to eat, and would tolerate nothing less for employees. So he hired the finest cooks and bakers he could find and paid them top wages. He ate in camp mess halls with his crews consistently, he often paid surprise visits to his kitchens, and the cook who took liberties with quality or quantity got short shift indeed.

Once on the NWP job, however, he came a cropper. That was the time he altered purchase orders for spaghetti and high-topped boots. Like the cement, both items had to be ordered in quantities sufficient to carry the camp through the rainy season. The laborers were predominantly "eye-talians" who made known their preference for spaghetti as the staple item of diet. The question was—how much of it would they eat before

spring? Earle Lloyd made his estimate—a carload of spaghetti. George Colley put in his order for hundreds of pairs of boots. Then W. A. checked, was amazed at the figures, and promptly cut both orders in half!

Winter closed in, and the north coast rains came. The work went on with no slackening of appetites. Down went the spaghetti supply, deeper and stickier grew the mud until access to the outside world was cut off. Then Lloyd discovered that the new Parcel Post, like the Pony Express, was committed to go through, come hell or high water. Scant days before a crisis developed, a new order was sent to San Francisco and before long the faithful Parcel Post began to arrive.

Spaghetti by mail

"I'll tell you it was a sight," he said, "to watch those pack trains of Parcel Post mules come in, thirty to a string, covered with mud and piled high with spaghetti and boots. The men who had contracted with the Government for mail delivery had just cause to curse the day we landed in their territory, but we had one consolation. The other construction outfits along the railroad gave them even more trouble. They had neglected to stock enough of anything, and kept the poor postmen busy bringing in flour and the other necessities of life." After that, Lloyd recalls, "W. A. asked questions before he changed a food order."

Warren Bechtel was about fourteen years old when the NWP work started, Steve was twelve and Kenneth a youngster of eight. The boys retain bright memories of summer days spent at the NWP camps. They had been on earlier jobs but this project served as the best-remembered introduction to the construction business. And as companions they had George S. Colley, Jr., and his brother Wallace, who came up during the vacation months.

The boys were beginning to share their father's enthusiasm for railroad building and becoming more and more his daily companions. At this time Alice Elizabeth was born to round out the family with a sister, so this is an appropriate place to bring in the affectionate nickname by which W. A. Bechtel became widely known. Years before, when Warren was born, Mrs. Bechtel—like young mothers everywhere—began to call

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They called him "Dad"

her husband "Dad." Because in these years the family so often lived near the work, the name "Dad" soon caught on as a familiar greeting at the camps, and with passing time, it spread into general usage wherever W. A. Bechtel was known. The name took hold because it suited him to perfection—one short rich word that wrapped up a host of warmly human qualities: friendliness, consideration for others, amiability—but also judgment, leadership and respect.

Method-wise, the NWP work marked the earliest use of automobile trucks to haul construction supplies. Dad Bechtel was the first contractor on this railroad to replace four-up freight teams with gasoline-powered trucks, and insofar as known, the first in the country. They were, son Warren recalls, 1912 model Packards and Alcos, with chain drives. Although the trucks of that time were not today's dependable vehicles and construction roads were little more than wide trails, a shop was equipped to keep the new machines running so that supplies were moved at a substantially faster rate. Later, at the Bechtel-Utah San Leandro yard, Dad's men built dump bodies for the trucks, and thereby spearheaded a great advance in heavy materials transportation.

Something new was added

This yard, also, served the three sons as a school for the study of construction equipment. Like all small kids, they were delighted to play on the big shovels and wagons. Growing older, this interest changed to an attitude of inquiry—the whys and wherefores of machinery design and operation. The time was one in which sweeping advances were made in power tools, so the Bechtel boys acquired a thorough education in equipment while the equipment itself gradually was being evolved.

1914: Sewell's fleas

One of the young men who joined the outfit in 1914 was Frank Sewell. He came on at Bechtel Camp Six of the NWP as an office man—"even then a necessary evil on construction jobs," Frank used to say. He slept in a building used as an office and warehouse, which housed "three carloads of supplies and two carloads of fleas." After six Spartan months with these bedfellows, he quit and went south for the winter. But when spring came, he wired IF CONDITIONS CHANGED I WILL

COME BACK. Earle Lloyd truthfully replied: CONDITIONS CHANGED, and Frank returned. "I found them changed all right," he said, "they were a damned sight worse!" But he stuck from then on.

Where a contractor's organization jelled

The Northwestern Pacific projects fall into position historically as the "coming of age" period for the Bechtel organization. At the time no single reason was sharply apparent, but looking back in the light of later developments it is plain that here the idea for the insurance business took root, that Dad Bechtel proved to his own satisfaction his readiness to expand operations, and the two older boys at least, cut their eye teeth on the realities of major construction. Kenneth Bechtel, too, learned the "feel" of a construction camp. Most important, Dad's team of top men jelled, and contacts with other outfits working along the NWP convinced them they could hold their own with the best.

The final 106-mile link through the canyon of the Eel was completed late in 1914, and the following year the line was opened to through traffic. That was in 1915, the gala year of the Panama Pacific International Exposition at San Francisco and a great year for Dad Bechtel. He had done his work well; when the time came to settle up with John Tyler, Assistant Treasurer of the Utah Construction Company, Dad's share as subcontractor was a tidy sum. "I never expected to have that much money in a lifetime," he confided to a friend. He had come a long way from the section gang in Indian Territory.

From Perry Street to San Leandro

During the Northwestern Pacific construction, "home base" for the family was a two-story house on Perry Street in the Adams Point district of Oakland. It was a good home in a good residential section. But now that he was in comfortable circumstances, Dad's first thought turned to his family, and he looked for a larger place where the children would have "more room to grow." He found it on Estudillo Avenue in San Leandro, the city which adjoins Oakland to the east. This place generously satisfied the desire for more room by including a large house (which was remodeled and furnished with oriental exhibit rugs from the late Exposition), beautiful gardens, space for a tennis court, and some lands suitable for crop cultivation.

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Perhaps Dad remembered his own youth on the farm. At least, he reasoned, it would be a good thing for the boys to work the adjoining piece and earn something for themselves. So an acre or two was plowed up and put into tomatoes; the boys toiled long and late, and were rewarded with a bumper crop. The quality was high, too. Dad had always been a stickler for good "housekeeping" out on his jobs—Tom Phillips said "he always finished his work in apple pie order"—and his sons proved to be chips off the old block. The three budding tomato growers bought boxes, and sorted and packed their product with the greatest of care until, as an eye-witness testified: "The full boxes looked as beautiful as a de luxe pack of Hood River apples."

Tomatoes and lawn mowers

They were hauled to the commission merchant's and in due time a check came. The amount failed to cover the bare cost of the boxes. Whereupon the bottom fell out of the truck-gardening project and from then on tomatoes were free to friends and neighbors!

Younger sister Alice was very much in evidence at the San Leandro place, an active little towhead who was the special joy of her three "big brothers." And the big brothers, like other kids, were not enthusiastic about the household chores Dad laid out for them on the Estudillo Avenue property. "They didn't care particularly for mowing the big lawns and raking the leaves," Earle Lloyd says—perhaps because already they had flexed their muscles on the more stimulating tasks of heavy construction. The home, however, served Dad's purpose well during the formative years. Before it was sold to make way for San Leandro High School the family moved to the large apartment building overlooking Lake Merritt in Oakland, where Steve and his family still reside.

W. A. Bechtel built this fine community apartment as his family's home and for owner occupancy by a group of fellow-investors. Here on one occasion his daughter proved equal to one of Dad's clever twists. Alice then was a high school girl, at the stage where of all this world's treasures the most-to-be-desired was a small car of her own. Her father listened patiently. "Perhaps when you're bigger," he said. It also hap-

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Home base during railroad construction days—on Perry Street in Oakland.



Urged on by son Warren, Dad sampled flying in its early stages. (Pictured with Mrs. Bechtel and friends, after a 1917 hop.)

pened that in the new apartment the dining room chandelier hung rather low, just clearing the taller heads. One evening, while Alice was particularly eloquent on the subject of a car, Dad glanced up at it and had an idea. "When you're big enough to kick that chandelier from the floor you'll be big enough to have your own automobile," he told her. At the time it sounded like the wisdom of a modern Solomon, but Alice had her commitment and she meant to capitalize on it. Day after day she stretched and practiced with more zeal than a ballerina. Long before Mother Nature added a single cubit to her height she triumphantly kicked the chandelier—and characteristically, Dad made good immediately!

When Alice kicked the chandelier

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CHAPTER

II

AFTER completion of the Northwestern Pacific contract, Dad kept crews and equipment on the line for a year or so, clearing out slides and doing general maintenance work. But from 1916 until the end of World War I he was not as active in construction as theretofore. Two mining ventures, a manufacturing experiment, some land transactions and a brief return to farming occupied his energies.

1915: A fling at mining

During the summer of 1915 Warren and Steve went up to Eureka on a lumber schooner. They met their father there and drove into Oregon. He had invested in a placer gold mine, together with one of the Brownings of Ogden, a family having an interest in the Utah Construction Co., but better known as the inventors and manufacturers of the Browning machine gun. The mine was located on the Sixes River near Port Orford, and into its development the partners poured over two hundred thousand dollars. But two months after operations began, like the California placers fifty years earlier, disaster struck. The local dairymen down river went to court, got a permanent injunction to prohibit debris damage to their farming pursuits, and the Sixes River mining venture was over. Dad tenaciously held on to the property and it remained in his estate until eventually bought by a Chinese who converted it into a seed farm.

During this period W. A. invested in an Arizona copper mine, and bought land rights along the Mexican border. Earle Lloyd went to New York for him on another deal, the Sanifold Manufacturing Company. This was a not-too-happy experiment in manufacturing and distribution. The product was novel, but born of a concept that overestimated the American

urge to cleanliness. The Sanifold tooth brush was, as its name implies, both sanitary and folding. It collapsed neatly to slip into a vest pocket, and the sanitary feature was provided by a built-in cup that completely covered the bristles in the folded position. To own a Sanifold was to be assured clean teeth at any time, no matter how far from the comforts of one's own bathroom. Travelers and campers, however, failed to react in the numbers expected. This experiment in consumer goods cost him a sizable chunk of money. He charged it off to experience, wryly observing that shoemakers should stick to their lasts. And it showed another human side—that the same vision and enthusiasm which made him a great builder could be a liability in an alien type of business. Of course the Sanifold incident has been paralleled times without number when other successful men have stepped out of business character. With Dad it didn't happen twice.

The vest-pocket tooth brush

The mines and Sanifold were offset by profitable land investments which included downtown property in Los Angeles and Oakland. Youthful training in horse trading stood him in good stead on transactions of this sort, as did his knowledge of farming on several agricultural projects he tried. The largest was a bean growing operation on leased land in the Central California delta region, not far from Stockton. Dad's return to the soil was in response to the national plea for increased food production during the first World War.

The "post-Northwestern Pacific" period brought along high school days for the Bechtel boys. Warren attended Fremont High, Steve and Kenneth went to Technical High, both Oakland schools. Later, when Piedmont High opened, Kenneth transferred and received his diploma there. All three boys went on to the University of California, Warren before the United States entered the war, and the others after the Armistice. Kenneth was much too young for war service, no recruiting sergeant could have winked him in. Wishing he were older, he dug into the war program of the Boy Scouts of America with a will, and as a member of Oakland Troop 4 went ahead to become an Eagle Scout. From that day on, his lively interest in the Scout movement never flagged. The two older boys

1917: For the boys—school and war

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joined the United States Army soon after hostilities commenced. Both saw service in France, Warren with the 18th Engineers and Steve with the 20th Engineers.

Construction during World War I did not approach the volume or scope it assumed in the recent conflict. Consequently, whereas the Bechtel contribution to success in the second war was organizational, in 1917 and 1918 it was personal, made by two young soldiers overseas, by Dad in food production and by the helpful home front jobs a young fellow could do in the wartime Scout program.

When 1919 brought the return to peace, W. A. Bechtel and Henry P. Hoey obtained a contract for highway construction along the Klamath River in the extreme northern portion of California. W. A. had worked with Henry Hoey on Southern Pacific jobs, notably at Natron, where Hoey was the railroad's engineer in charge of construction. Highway building headquarters were established at Happy Camp in Del Norte County. The road traverses the Siskiyou Mountains through some of the most primitive country in the State. Bechtel and Hoey's part of it went south down the canyon from Happy Camp to a point north of Somesbar. The job was completed after surmounting a number of unexpected difficulties, and now forms a link between U. S. 99 in the Central Valley and the Coast Highway, U. S. 101, via State 96 and U. S. 299.

The Klamath Highway contract is another milestone because it marks a departure from specialization in railroad construction. Dad had graded county roads in Kansas and streets in Oakland—he had worked in quarries and on levees and canals, but as an employee, not a contractor. Nine years before, the Oakdale water tunnel had been a change from railroad work but merely an isolated case, whereas the Klamath River Highway was the first of an orderly series of moves made outward toward new horizons. Of additional interest—this was the first California contract let by the United States Bureau of Public Roads.

1919: NWP again

In the same year—1919—W. A. went back to the Northwestern Pacific, to recondition the line after it returned to private control following wartime operation by the Federal



The Bechtel family about 1915—Mother, Warren, Steve; (seated) Ken, Alice, and Dad.

Government. Railroad work continued to dominate Bechtel volume for another decade, but from this time on it never again occupied the organization's capacity to the exclusion of other kinds of construction.

1919: From rails to highways, the start of diversification

Dad had made the Natron cuts and built the third section of Northwestern Pacific line as an individual, but the short-lived arrangement with Ray Wattis and the Bechtel and Hoey job on the Klamath were forerunners of later partnerships into which he entered. His opinion was that since two capable men had more experience than one, they could team up and accomplish more than either one separately.

He held positive convictions on the subject of partnerships. First, he confined such arrangements to men he knew to be reliable, on the theory that "when you can't trust a man's word you can't trust his signature." This view led to verbal understandings sealed by a handshake involving many thousands of dollars. His other principle concerned equality of interest. It has been expressed by a former partner in these words: "Dad had no patience with 51-49 arrangements. He used to say 'no man with a sense of self-respect wants to be controlled on that kind of percentage.' "

Dad's views on partnerships

During 1920 Bechtel and Hoey built another highway for the Bureau of Public Roads, running north through San Gabriel Canyon from Azusa in Los Angeles County. Steve and Art Bechtel were down there that summer. A subcontractor named Leone had the portion of the work where a bluff was to be taken down by blasting. Picric powder had been obtained for the purpose; although similar in appearance to common black powder it was several times more powerful. Leone's men, with the approval of the Bureau of Public Roads field engineer, loaded their shots on the generous basis used for black powder. Dad Bechtel had gone back to camp for lunch. Just as he got there the shot was fired. The ground shook, heaven and earth opened up and rock peppered the landscape for miles around. Of course, the mighty explosion moved several times the amount of material required, but because Leone's subcontract was based on the yardage actually excavated, his "mistake" earned him a substantial profit. Dad never

1920: The mighty blast of San Gabriel Canyon

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made up his mind how accidental the big blast was, but he saw to it that Leone learned how to handle picric powder.

1920: The Hutchinson Lumber Company logging railroad

One day in 1920, W.A. received a phone call from his old friend with Western Pacific, Tom Phillips. The Hutchinson Lumber Company wanted a logging railroad built up the middle and south forks of the Feather River into the woods, to connect with the WP at Bidwell. Phillips, who was laying it out, thought Dad was the man to build it. He mentioned a certain day, several months ahead, on which bids would be called, and after some additional conversation, hung up the phone and was soon back at the jobsite, one hundred miles away. But surveys and other preliminary work went slower than anticipated, and the specifications were not ready on time. On the appointed day, having given no further thought to the phone conversation, Tom Phillips came around a bend in the canyon trail and ran smack into Dad, also on foot. "He had that date firmly fixed in mind," Phillips says, "and he was Johnny-on-the-spot at the right moment to look the ground over." When the bids went in, Dad got the job. "Warren Bechtel was up all through the work," Phillips adds, "it was one of his early experiences, and he did a good job, too." The Hutchinson Lumber road was a complete self-contained railroad system on a small scale, with everything from its own "main line," to yards and structures.

Between 1920 and 1925 railroad contracts took the Bechtels into Sonoma County to build access roads and tunnels for the Northwestern Pacific, to Stockton on a yard and round-house for Western Pacific, into Arizona for Union Pacific and to various parts of California on Southern Pacific work. From the early twenties on, the three boys began to occupy positions of increasing responsibility. Warren and Steve alternated as project managers on the Stockton contracts, and thereafter headed up the field work on all principal contracts. Kenneth came out from time to time to lend them a hand, but his primary concern lay in preparing himself for the financial and administrative responsibilities already apparent in the family's growing interests.

Second generation railroaders

On one of the railroad jobs, clearance of the SP's Coram



Mud and motorcycles. Steve burned up the French countryside as a Dispatch Rider—photographed just before the Armistice in 1918 at Camp Mont, Mont Loir-et-cher.



Warren A. Bechtel, Jr., 18th Regiment, Railway Engineers, saw service in France during World War I.



Stephen D. Bechtel, 20th Engineers, American Expeditionary Force, from a picture made in June, 1918.



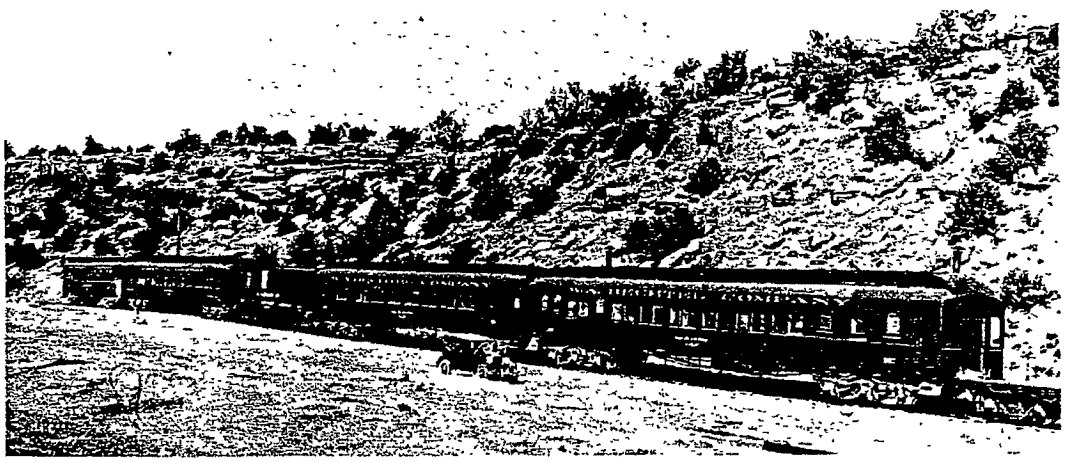
Railroad builders—Dad and the boys during construction of the Natron Cut-Off.



The Bechtel-Utah yard at San Leandro.



Famous for food—these kitchen cars were W. A.'s special pride.



Shop and camp on wheels—a Bechtel work train.

Tunnel near Redding, California, after a fire, Steve Bechtel ran the crew. While his men were shooting in the tunnel he spotted some cars out on the main line and tied up traffic in the whole Sacramento River Canyon for a time. Word went down to the railroad's main office in San Francisco, someone in authority called Dad, and in a matter of minutes he was on his way to Redding. When he got there Steve caught "what for"—on an occasion like this W. A. was in a class by himself—and Steve remembers the set-to as vividly as though it had happened yesterday. Dad was a kindly man but he would not tolerate poor headwork, least of all from his own three sons.

Steve heard from Dad at Coram

While these jobs were in progress the Bechtels chalked up another "first," their first job for a big power utility. This was the Caribou Water Tunnel built for the Great Western Power Company, now part of the Pacific Gas and Electric system. It was completed in 1921 in Plumas County, California, and with W. R. Fontaine as Dad's partner. The water tunnel was two miles long, twelve feet in diameter, and concrete lined. It extended from Butt Valley to a hill above the Caribou Power House. Three hundred men were employed on it.

1921: Caribou Water Tunnel, first job for a power utility

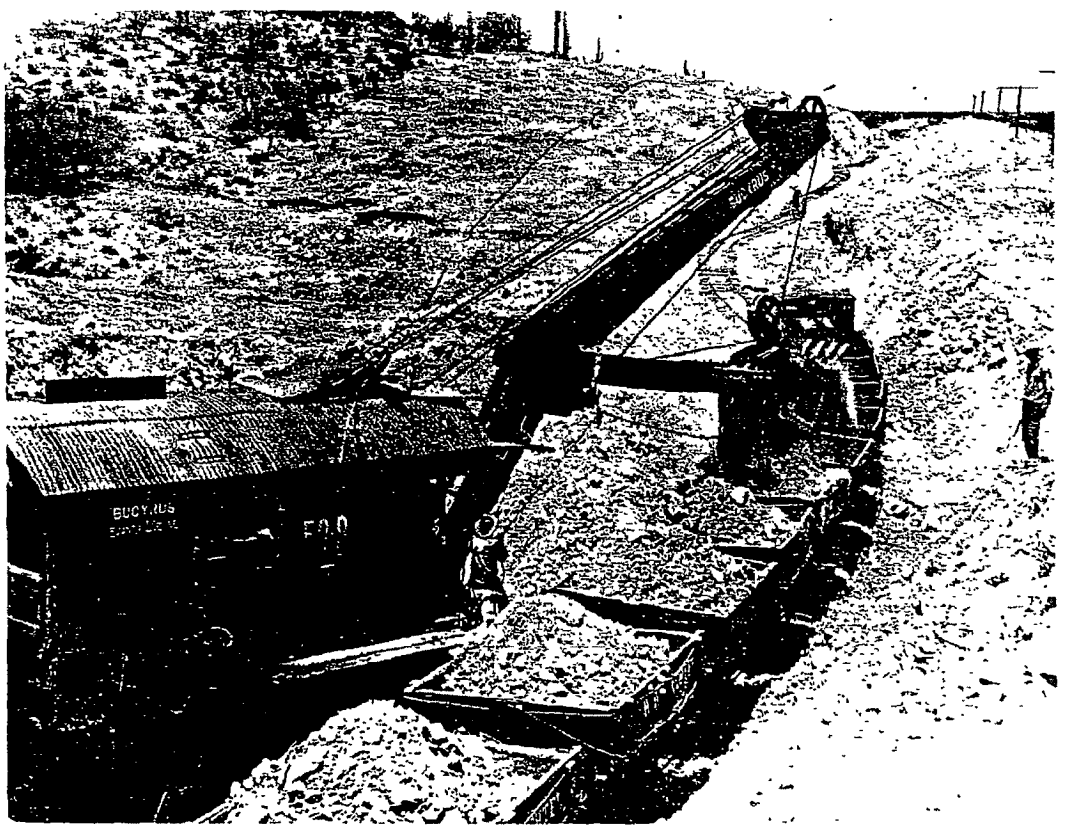
Otto W. Peterson, the present Chief Construction Engineer of Pacific Gas and Electric Company, remembers that Great Western Power welcomed Dad's bid. He points out that Bechtel's work on railroad tunnels was well known to utility officials. The Caribou Tunnel construction was accomplished smoothly, he says, "without incident of any kind."

Behind the scenes in the Bechtel family, however, the Caribou situation did not develop quite as smoothly as indicated by Mr. Peterson. W. A. had been seeking contracts with the big power utilities for a long time; he was anxious to get started and show them what his organization could do. But he had to wait for a tough job, and Caribou was just that. It called for tunneling through mud, and waste disposal proved difficult and costly. Part of this work was subcontracted to several of his best railroad tunnel men, who were having trouble with this problem. Steve came up during the college vacation and figured out a way to save money on getting rid of the excavated material. He made a financial arrangement with the subcon-

Caribou: where a college boy licked the mud problem



Warren's introduction of "Cats" marked an advance in methods, but they chewed up the soft roads in winter.



Steve built the SP's main line into Phoenix, and introduced a new tool—the diesel-powered shovel.

1923: Diesel power in Arizona

As project chief, he was building the SP's main line extension into Phoenix from the former main line running between Tucson and Yuma. He had married Laura Adeline Peart at Hanford, California, in September, 1923, and she went with him to set up housekeeping out on this job. There Steve added another "first," the first diesel-powered shovel, a Bucyrus Model 50-B, driven by an Atlas 110-horsepower, four-cylinder 9 x 12 diesel engine. H. L. Livingston of Bucyrus-Erie remembers this shovel well and points out that it is still working at an Oroville rock plant formerly owned by Bechtel and Kaiser.

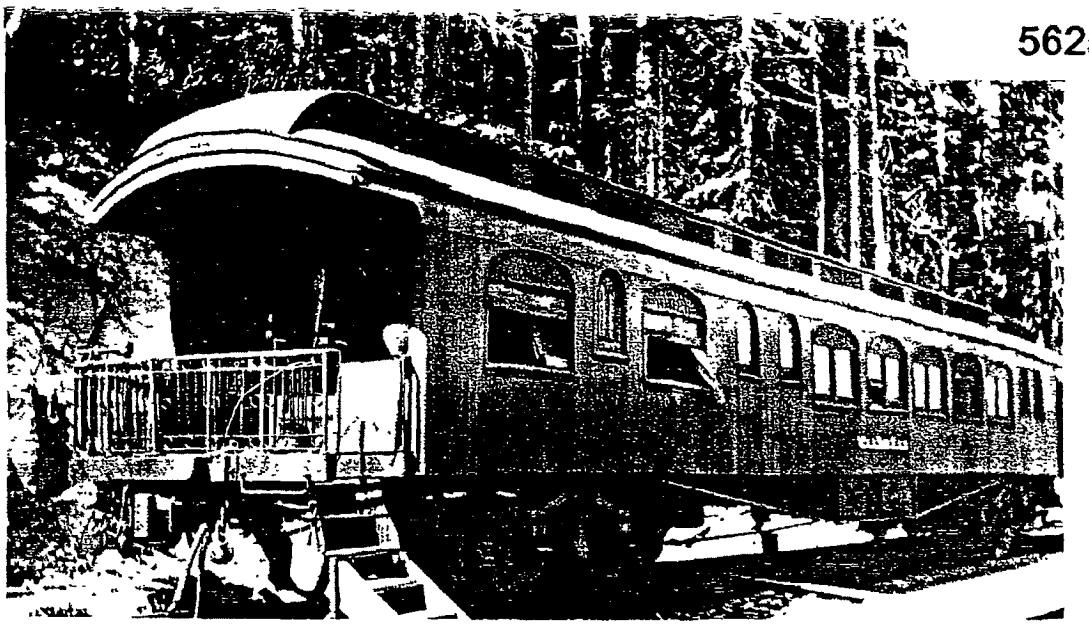
The youngest "construction stiff" on wheels—like father, like son

From Arizona, Steve went north to the Natron job. The contract was for concrete work—retaining walls, culverts and viaducts. With Steve, Jr., who had been born in the meantime, Steve and Laura re-enacted Dad and Mother Bechtel's earlier roles by creating a home on wheels. It wasn't quite the same, though. Bill Waste, who visited them, reports finding a rebuilt Ocean Shore Railroad observation coach transformed into an outfit car, replete with modern comforts! The car was called "WaaTeeKaa." It was named by Mother Bechtel who coined the word by combining the halves of three "baby names," the pronunciations each of her sons as toddlers had used for their given names—"Waa-Waa" for Warren, "Tee-Tee" for Steve, and "Kaa-Kaa" for Kenneth. And in "WaaTeeKaa" the youngest Steve, generation III, was following in father's steps —out on the job from infancy.

1925: W. A. Bechtel Co., a corporation

Up to this time W. A. Bechtel operated his business as an individual or with a partner. By 1925, growth of the organization and the responsible part taken by his sons in its projects caused him to form with them and his brother Arthur, W. A. Bechtel Co., a corporation. It was one of the largest western construction firms, and the contracts on which its corporate life began included train sheds, railroad tunnel enlargements, and snow sheds in the Sierra Nevada. The latter job is noteworthy for one of the earliest uses of pre-cast concrete slabs. This work on the Southern Pacific's main line "over the hump" centered at Emigrant Gap, above Colfax.

Opportunities multiplied as two generations teamed up to capitalize on Dad's hard-won reputation. Warren went to



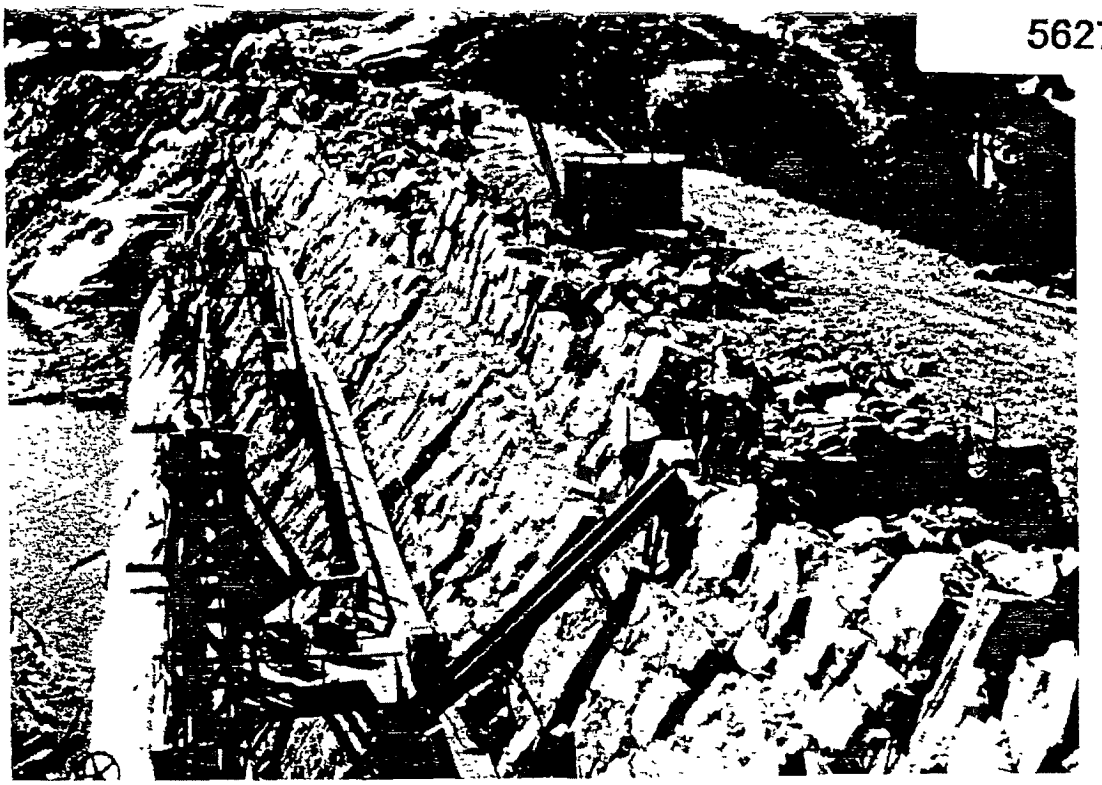
Home to the Bechtels—this outfit car, the "WaaTeeKaa."



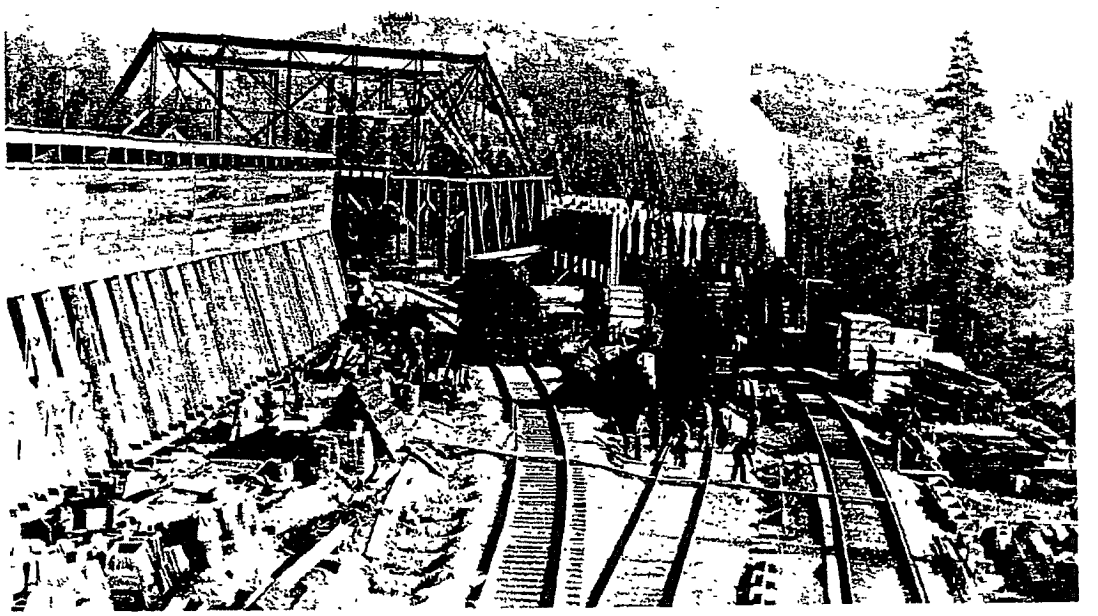
Mrs. W. E. Waste with Steve, Jr., third generation constructor, at Natron Cut-Off



In June, 1927, Dad and Mrs. Bechtel met WABCo's "Cat 60" en route between Emigrant Gap and Bowman Dam.



Bowman Dam—a tough job that called for stacking and fitting big Sierra granite blocks as neatly as a jig-saw puzzle.



Prefabricated concrete slabs—an early use—on railroad snowsheds in the Sierra Nevada.

worked with Gus Ayers, father of Bechtel Corporation's Bill Ayers. The western construction world, for all its accomplishment, is a small one indeed!

1927: Kenneth—a superintendent

In 1927 Kenneth Bechtel first took complete charge of construction in the field. Like the rest of the family he started with railroad work, not far from the scene of Dad's first job. Ken went to central Kansas and built butterfly sheds at a large Santa Fe station, using the pre-cast concrete slab technique the firm employed on the SP's Sierra snow sheds.

Two California highway jobs of 1928 and 1929 were interesting because of the beautiful settings in which they were built. One, the "General's Highway" in Sequoia National Park, invited the artistic touch, for it included masonry bridges using the native stone of the Kaweah River region. Ken supervised the work and his bridges are still beautiful and a credit to the Park. Actually they were expensive monuments partially donated by the firm, which lost money on the extra precautions demanded by the Government. An example—in areas where blasting took place the contractor was required to put metal "pants" on every tree trunk, to protect them for the public's future enjoyment. Ken followed instructions to the letter, did a ship-shape piece of construction, and took with good humor the ribbing he got for his "tree pants." The other road contract covered additions and improvements to the highway system in Yosemite National Park. At this time Warren was in New Mexico and Arizona, double-tracking the Santa Fe from Gallup to Chambers.

1929: A big upsurge began

Even a cursory examination of the Bechtel record shows a remarkable surge starting in 1929. Both in numbers and types of work the jobs increased rapidly and the organization entered on a period of expansion and group associations. All this was transitional in the development of the present worldwide Bechtel interests, but it imposes limitations on reporting. Projects larger than those heretofore recounted must get bare mention or none at all. The purpose of this history is not to present an imposing job list but to search out significant trends and events, and to sketch the people who have given the Bechtel story form and substance.

1929: Another new field—pipe lines

One such event was the firm's first pipe line. It represented a start in a new field which soon became an important Bechtel activity. The first line was built by Bechtel & Palmer in 1929 for the Pacific Gas and Electric Company. It carried gas from Tres Pinos eight miles south of Hollister, to Milpitas just north of San Jose. The old acetylene torch method of welding was used on its construction.

Silas Palmer, remember, was the man who urged Dad to come to California in the first place, from Lovelock, Nevada, in 1903. By 1929 he had become a pipe-line constructor from away back—having built the Coalinga-Monterey "screw pipe" line in 1905. When the Bechtels determined to add pipe lines to their list, Steve remembered his father's specifications for a project partner and turned to this old friend. Palmer says that Steve displayed great energy and interest in pipe-line construction, and adds in words used so often by other senior engineers in speaking of Dad—"Steve learned on the job, by hard work." One development worked out on this job became standard everywhere—the sideboom-equipped tractor. Up to this time, the slow tripod and chain block method of handling pipe had been used.

The following year, W. A. and his sons were to get together with an extraordinary group of western contractors, preliminary to taking on the greatest single construction job yet built. But even this tremendous undertaking could not divert them from their lively concern with pipe lines. Joseph Shaw came to the firm in March of 1930. He was an engineer, and his employment was prophetic of the emphasis on engineering for which the Bechtel interests are now so well regarded. Joe at once went to work on the engineering and cost problems of pipe-line construction. In that year a gas line was built from Tracy to Crockett, jointly owned by Standard Oil Company of California and Pacific Gas and Electric Company. In the preceding year the Bechtels had done some grading for Standard; this and the Tracy-Crockett line established a contact which became a long-standing relationship. As might be expected when both client and contractor have a progressive outlook, again "something new was added." The Tracy-Crockett

1930: Pipe line No. 2, Tracy-Crockett

pipe line was the first in the west on which pipe was electrically welded in the field.

When the line was complete, Steve went east to talk to the Continental Gas people. As a newcomer from the Far West, he had to do some first-rate selling. He asked to bid on the entire contract, covering approximately four hundred miles of twenty-four inch gas line to be built from Amarillo, Texas, to a point on the Missouri River south of Omaha. The owners insisted on completion within a short period of months, and because they considered this too much of an undertaking for one firm, Steve had to be satisfied with one hundred and forty miles.

Bechtel Kaiser—"pipe liners" on a national scale

The job was done by Bechtel Kaiser Co., Ltd., the partner being Henry J. Kaiser, with whom Dad had become acquainted on a road job near Redding in 1921. Later they joined in the operation of a rock plant at Oroville, the forerunner of a number of Bechtel and Kaiser partnerships between 1928, 1933 and later. Kaiser's key people had just returned with him from building roads in Cuba. They had no important commitment at the moment and Steve saw an opportunity to use their talents in this new field. "When Steve sees good men on the loose, he has just one idea—to get them working on his team!" Warren Bechtel said. This Steve did, but it took a good bit of persuasion to get Henry Kaiser to share his enthusiasm for pipe lines.

Why the jobs grew

When work was about to start on the midwest line, the Continental Gas officials urged the contractor to provide two construction crews in order to meet a pre-established average daily requirement of completed line. The Bechtels insisted they could do it with one outfit, but offered to add another if one crew failed to make the necessary progress. At the end of six weeks this one crew was moving almost three times faster than the owner's requirement!

The methods used were soon adopted by other pipe-line contractors. There was nothing mysterious about them. Just better organization and timing—getting men, equipment and materials to the right spot at the right time—to make pipe-line construction a continuous process from trenching to com-

pleted backfill, with the crews moving along the route like a gigantic mole.

1931-'34: More pipe lines, in Montana, Texas, New Mexico, Arizona, and California

As one result of this performance new contracts were obtained—to build gathering-lines in the Texas panhandle for the Texoma Company, the Phoenix Utility pipe line in Montana, and the long El Paso-Douglas-Cananea line in the southwest for Western Gas Company. Altogether, more than one thousand miles of pipe lines were laid between 1931 and 1934, not including work done in California on the Valley Line for Standard Oil Company of California, and the forty-four-inch Calaveras water line for the city of San Francisco, both completed in 1934. George S. Colley, Jr., was head field man on many of these jobs.

To keep the thread of continuity intact, reference is made here to railroad and highway work between 1930 and 1934. In the first category the three most important jobs were Western Pacific's Keddie-Bieber Extension built in California by the Utah Construction Co., W. A. Bechtel Co., the Bonito Dam in New Mexico for the Southern Pacific; and the Dotsero Cut-off in Colorado for the Denver, Rio Grande & Western, built by Utah-Bechtel-Morrison-Kaiser, Inc. The principal highway project during this period was the Coos Bay Highway Bridge on the Oregon coast route, a big and graceful arch completed in 1934 as a group venture which the Bechtels sponsored. Ted Panton had charge of the work, and a young California graduate engineer, Al Orselli, was his aide.

Coos Bay Bridge

1930-'31: Keddie-Bieber, the biggest railroad job

While Steve was out on the second and third pipe-line contracts, Warren was sticking close by Dad's first love—the railroads. During 1930 and 1931 he was on the Keddie-Bieber Extension, the largest single railroad construction contract obtained by the firm. It was a ten million dollar project, carried out in conjunction with Utah Construction Co. Except for five miles through Westwood where Western Pacific uses the Southern Pacific tracks, the contract covered the entire one hundred and twelve mile link joining the main line of the WP in the Feather River Canyon with the Great Northern.

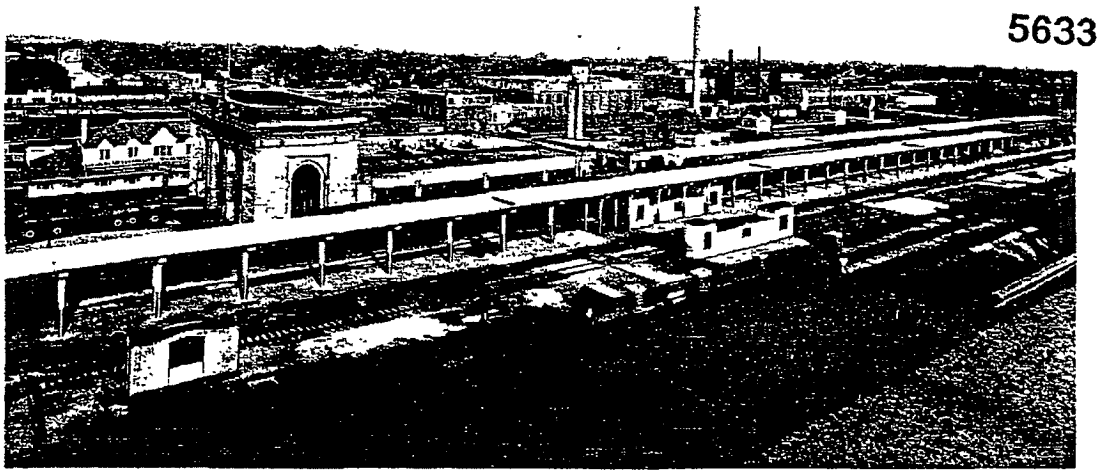
"The Bechtels did a lot of work for us—in fact, they are still doing it," Tom Phillips of Western Pacific said, "but this

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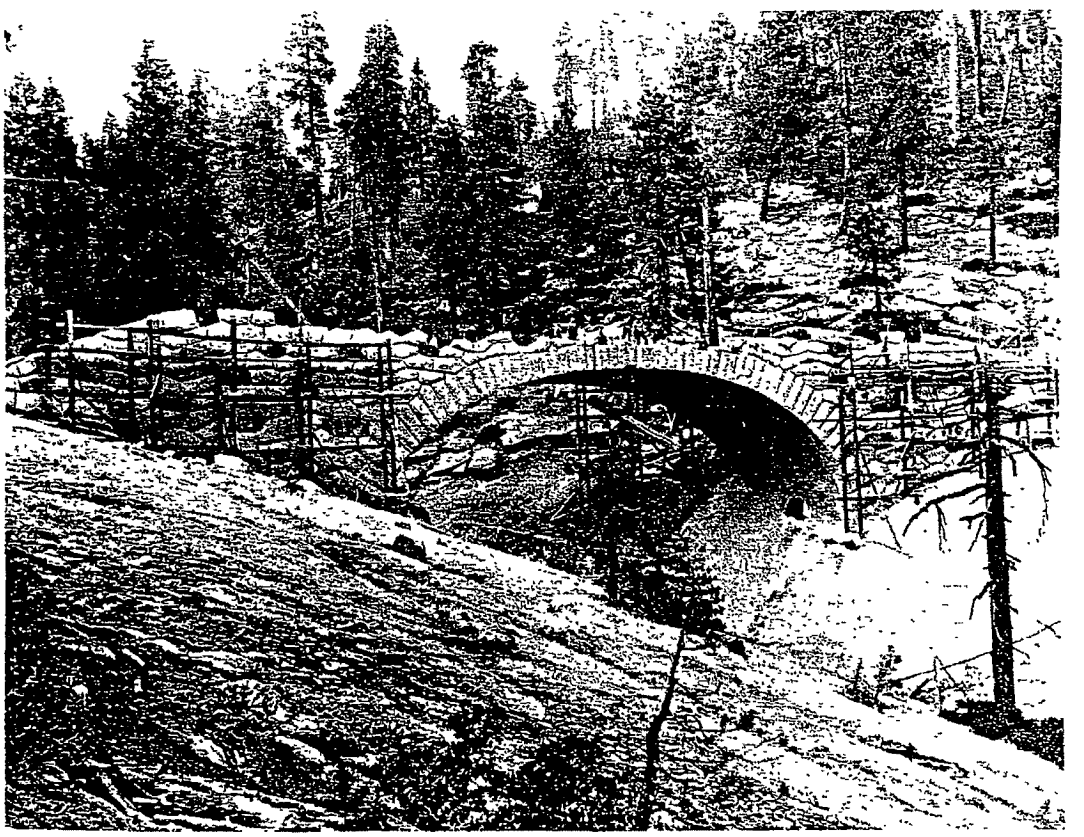
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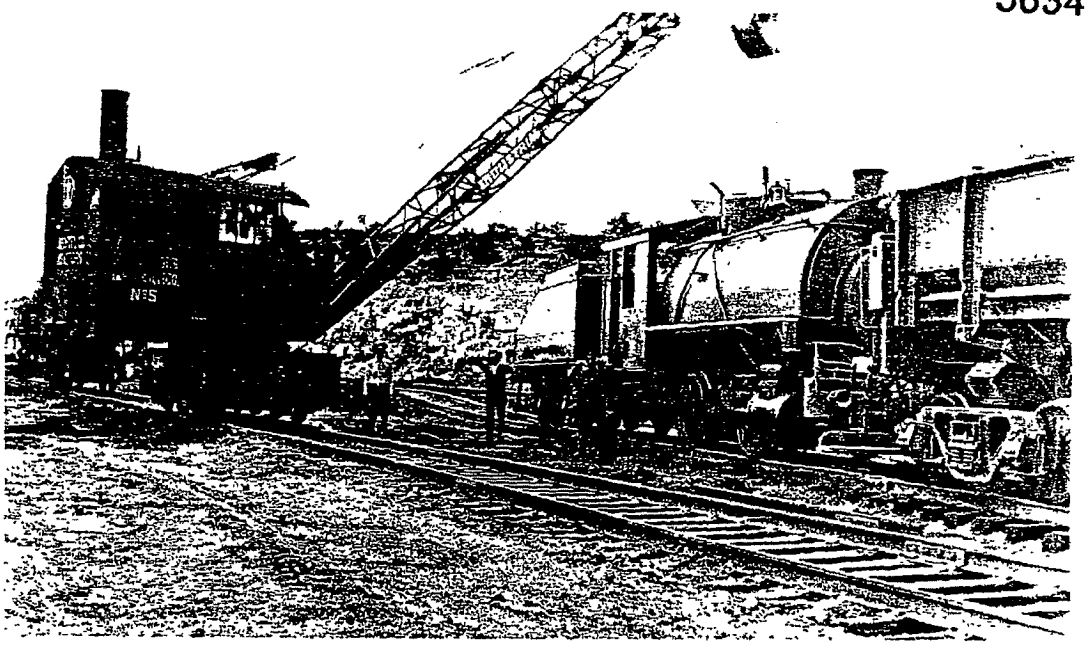
Congratulations poured into Dad Bechtel's office after his election to A.G.C.'s National Presidency. With him on the happy occasion were E. S. Burney, President of Nevada Construction Co., and Bechtel veteran Earle G. Lloyd.



Ken's first big one—butterfly sheds for the Santa Fe in Kansas.



Matching nature's beauty—a bridge of native stone, Sequoia National Park.



WABCo crane and the family's pet locomotive, No. 4, about 1929.



Dad's brother Art had a winning way with men and animals.



Bechtel veterans Waste and Sewell with an old friend—Tom Phillips—in 1936.

was the biggest single chunk. It included grading, tracklaying, ballasting—tunnels, bridges—just about everything it takes to build a railroad. And it was done fast, fifteen months from start to completion. That was one reason we liked to do business with Bechtel. Another was that W. A. was a fair fellow; he used to say 'you write the ticket'—he meant he knew we were reasonable people—and he was always ready to go to work without haggling over details. We could get along fine with a man like that."

So, when the calendar turned over into the 1930's Warren was up on Keddie-Bieber and Steve had become an enthusiastic "pipe liner." Meanwhile, Kenneth Bechtel had gravitated into the administrative and financial work required by the Bechtels' steadily growing business. He had been a Director of W. A. Bechtel Co. since its incorporation, and for fifteen years would remain active in the family's construction operations as Treasurer and administrator. But in 1931 an event took place which pointed the direction Ken's principal interest would take. On July 27th of that year he was elected to succeed his father as President of Contractors Indemnity Exchange. Later the same year he was named first Chairman of its Advisory Committee.

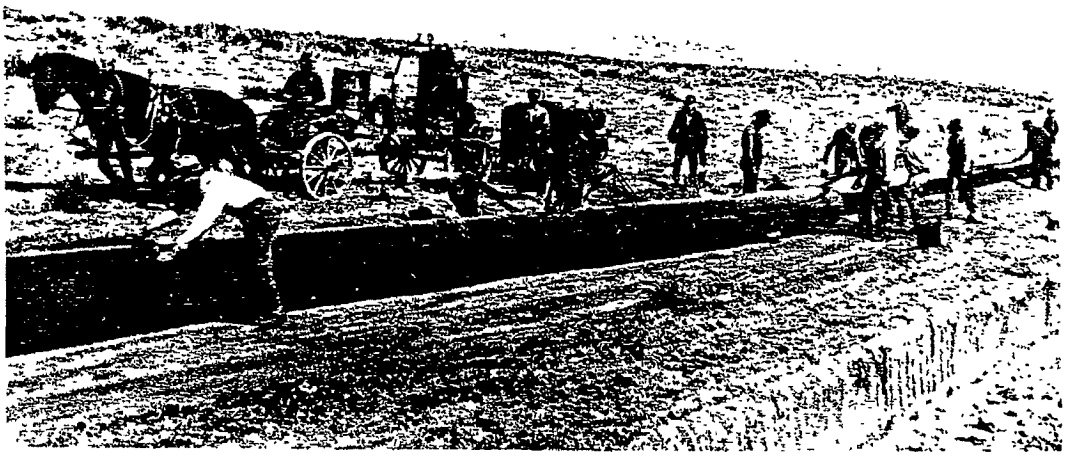
Industrial Indemnity as it grew

In true movie style—a brief flashback to 1920 and earlier. Born out of opinions formed by Dad from studies made by Earle Lloyd during the course of the Northwestern Pacific construction, Contractors Insurance Agency of California had been granted a charter by the State on November 12, 1920, to act as operating company for the newly-formed Contractors Indemnity Exchange. The founders were W. A. Bechtel, Earle G. Lloyd and Arch Borland of Bates & Borland, an Oakland construction firm. Earle Lloyd had handled the insurance coverage of thousands of workmen on the NWP and other jobs. "The NWP work taught us that costs can be controlled by careful planning," he said, referring to employers' liability. "I believe we can do an even better job through coöperation in a bigger field," Dad observed. Following enactment of the California Workman's Compensation Act in 1913, contractors had been forced into an unfavorable position. Because private carriers refused to write contracting risks, the state-owned

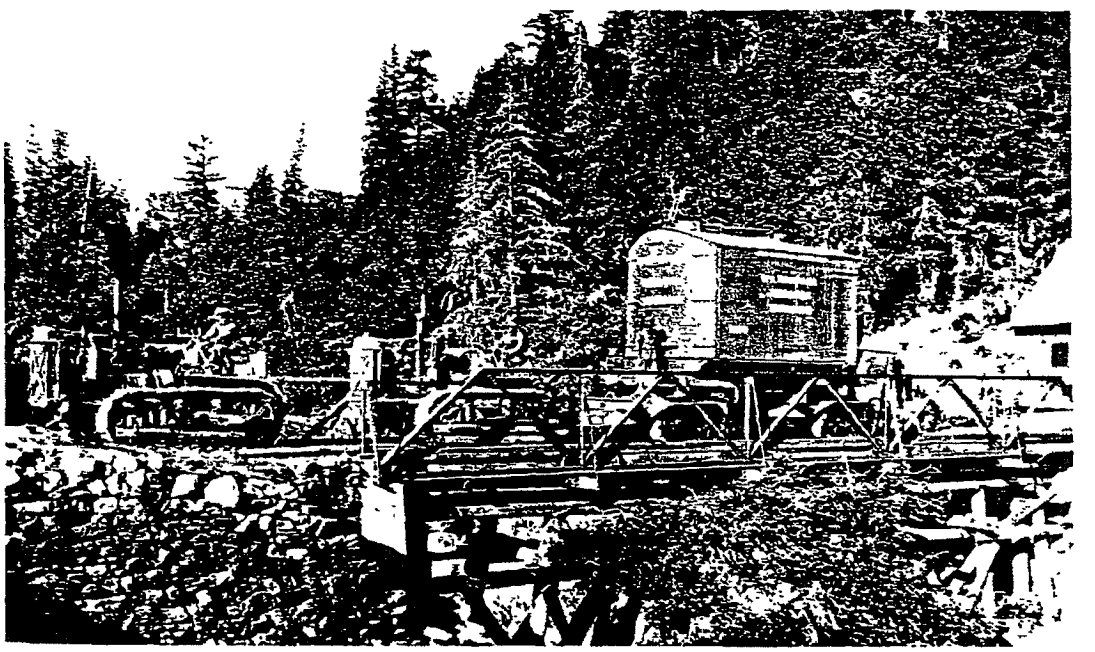
public carrier was forced to accept their business. But no effort was made to provide other than the routine services of premium collection and payment of loss. Such dividends as the contractors earned were in the lowest brackets. The result was high insurance cost, which penalized initiative and ran up the cost of construction.

I. I. to date

How well the new California carrier of compensation insurance answered this need for contractors, and how completely it fulfilled Dad's forecast for employers in other lines of business is evident in the remarkable growth of Industrial Indemnity. Premiums exceeded twenty-one million dollars in 1948. Progress was slow for a long time, however. Amendments to insurance legislation, early concentration of risks within the construction industry, and the business depression presented recurring obstacles. Only in 1935, fifteen years after the start, did premium dollars pass the million mark. And five years more went by before the two million dollar level was reached. Nevertheless, at the bottom of the depression in 1933, the concern made its "Big Change" by increasing assets and changing the names to Industrial Underwriters Inc., and Industrial Indemnity Exchange. As its President, Kenneth Bechtel had a leading part in formulating the policies and organizational changes then put into effect, which have been instrumental in raising Industrial Indemnity to first place as the largest private carrier of compensation insurance in California.



Pipe-line construction—spray painting the Texoma gas line, 1931.



Shoring-up a bridge to withstand heavy loads. As equipment grew larger, the problems of transporting it multiplied.



Hoover Dam.

CHAPTER III

HOOVER (Boulder) Dam has been called "man's mightiest work." Certainly its great size, the difficulties attendant upon remote location, extremes of climate, variations in the flow of the Colorado River, and the problems of caring for an army of workers and large numbers of depression-stricken migrants made the Dam's construction within the short space of five years one of the greatest achievements in history.

1931-'36: Taming a great river

No man, no single contracting firm built Hoover Dam. It was a team job. Looking back, it seems incredible to suppose that it could have been accomplished effectively in any other way. It was an especially audacious undertaking for the group of contractors who tackled it. Their combined experience was impressive by any ordinary standard, but it looked small indeed when they stacked it against the gigantic task waiting in Black Canyon.

Where the idea for Six Companies started may never be known. There are a number of versions; probably the reasonable view is that it started separately with several men and required just the right combination of pre-existing friendships and the right sequence of planned and accidental contacts. Dad Bechtel acquired his early experience as a subcontractor under Utah Construction Co. Dad met Henry Kaiser on a road job, and Kaiser had worked with Warren Bros., the Boston construction firm. Utah Construction was also the link with Harry Morrison of Boise, Idaho, who had joined with them on railroad work. When Morrison went to see Leland Cutler in San Francisco about obtaining a surety bond to bid the Dam, Cutler suggested a talk with Felix Kahn of MacDonald & Kahn, whereupon as Morrison said, "one thing led rapidly

Six Companies Inc., its antecedents

to another." Earlier he had discussed the possibilities of building Hoover Dam with Charlie Shea, a Portland and San Francisco contractor who had a working arrangement with Pacific Bridge Co. of Portland.

So the line-up proceeded simultaneously on two fronts; it was complete when the Bechtel-Kaiser-Warren interest came together with the other, consisting of Utah-Morrison-Kahn-Shea-Pacific Bridge. Six Companies Inc. was incorporated in Delaware in February of 1931, a mere two weeks before the Hoover Dam bids were due. W. H. Wattis was elected President; W. A. Bechtel, First Vice President; E. O. Wattis, Second Vice President; Charles A. Shea, Secretary and Felix Kahn, Treasurer. Properly it was a "joint venture," a form of organization here brought to its highest development.

The joint venture

Just as Dad Bechtel found additional capacity and strength in partnership arrangements, so these western contractors developed an ideal solution to the big problem ahead in this expanded partnership which pooled their skills. Not only Hoover Dam but other large projects were handled in this way. The nature of the work was made the key to the composition of the group. Who could contribute the most—of knowledge, experience, ability? Compatible outfits with proof of good past performance in a given type of construction got the call. In short, the group association or joint venture became an instrument for better service.

Because no two jobs were alike, no two groups were quite alike. Participation was governed by the financial stake of each venturer. No salaries were drawn by the risk takers, thereby earnings were allowed to accumulate for later distribution. Whereas, at Hoover Dam the group did not use one of their members as a "sponsor" or management unit, this form of job control became standard on other projects. The project sponsor, usually the firm best equipped for a particular job, received only a participant's return along with the others. But a sponsor was given a larger participating share, as a rule, and had the added incentive of demonstrating his usefulness to the group on future contracts. Because these men held each other in high esteem, they went ahead in Dad's tradition, sealing their agree-

ments with a handshake, often with nothing more than a verbal understanding. Highly complex and involved arrangements were made by telephone with details left for later confirmation. The stripe of men dealing in millions on a basis of mutual trust soon became generally known, and that custom had almost as much to do with establishing their reputations as the projects they built.

The men of Six Companies

The Wattis brothers and Henry Kaiser already have been introduced into this narrative. Most of the others who enter now will appear in its pages again, for the good reason that having discovered each other's abilities, the men of this group would find many additional opportunities for joint usefulness. Harry W. Morrison is one who came in at Hoover Dam and has remained a staunch Bechtel ally ever since. He is a big man —big frame, big outlook. Like W. A., he got his contracting start laying rails. His firm, Morrison-Knudsen Company, Inc., was formed in 1912. Its headquarters in Boise serve as Mr. Morrison's base camp; in a calling noted for travel he is perhaps the dean of all globe-hoppers. And a typical westerner, he likes to cap a hard day in the field with a round of cowboy songs and hill-billy ballads sung in a clear, strong voice, playing his own accompaniment on the guitar. There is no record that Dad's trombone and Harry Morrison's guitar ever teamed up—but the two head men played the same music in their construction band.

Felix Kahn of MacDonald & Kahn, later retired, is one of five brothers, all distinguished engineers. He came up through the structural steel business, then built some of the largest buildings and industrial plants in the west. When you look at San Francisco's famous Mark Hopkins Hotel you see a typical Felix Kahn job.

The late Charles A. Shea, of J. F. Shea Co., Inc., formed his company in 1914 as a partnership with his father, who started in the plumbing business. Prior to the formation of Six Companies Inc., the Shea organization had been associated with Pacific Bridge Co., of Portland, a pioneer concern dating back to 1869, and headed by Charles F. Swigert. On these partnerships Shea took care of sewer and tunnel work, and Pacific

Bridge the underwater construction. Together they built a considerable part of San Francisco's Hetch Hetchy water system. An interesting sidelight—W. A. Bechtel Co. was active separately on this water line, and Utah built the seven million dollar Hetch Hetchy Dam, with John Q. Barlow as one of its senior engineers and Henry J. "Hank" Lawler as Superintendent. So, as even these few facts indicate, the men of Six Companies were as well prepared for the problems of Hoover Dam as any group of contractors then in business. Between them, they had completed work valued at more than four hundred million dollars at the time their bid was submitted, and they were then engaged on projects totalling some thirty millions.

March 4, 1931: The bids

The Government set March 4, 1931, as "B" Day for bids. When the chips were down, of the many organizations which previously had shown lively interest, only three made application. The project's size, combined with difficulties of location and terrain, made estimating a tremendous task; furthermore, the hazards were so obvious that even the most carefully worked-out bid was extremely risky. The figures showed Six Companies an even five million dollars below the next lowest offer, and almost ten millions under the highest bidder. In their ambition to win, it looked like they had left five millions on the table. Furthermore, they found out they were only twenty-four thousand dollars above the Bureau of Reclamation's estimate of actual cost. Success would require ingenuity all the way.

One week later: On the job in Black Canyon

Six Companies Inc. got the job for $48,890,996. Within a week the nucleus of the construction organization was complete. Superintendent Frank T. Crowe arrived at the site on March 11th. "I was wild to build this," he told an interviewer from *Fortune* magazine twelve years later, "the biggest dam ever built by anyone anywhere." Frank Crowe was a University of Maine engineer with more than twenty years of service with the Bureau of Reclamation. He built the Jackson Lake Dam in Wyoming and the Tieton Dam in Washington. Six Companies got him through Morrison-Knudsen and Utah.

Crowe knew his business and minced no words about it. Once asked what his biggest hazard was at Hoover Dam, he

promptly snapped "the Directors!" These gentlemen saw his point, and gave him a closely-knit four-man Executive Committee, for most of them were men of his own rugged stamp. Such as Dad Bechtel and Hank Lawler, who for many years held informal "board meetings" every Saturday afternoon over the pinochle table. Between them they would decide what was going on and tackle their problems while the cards dropped—to these old timers the height of joint-venturing.

A "temporary" job

Soon after the contract was announced, suppliers anxious for a piece of this big business began to descend on Steve. A close friend, Bill Waste, heard from him by phone one day in April, 1931. "Come over and give me a lift," Steve said, "I want you to front for me with all these peddlers." That was Bill's start with the Bechtels, he went to work the following Monday morning. Salary was not discussed. "I thought it was a temporary job," he says, "but in no time at all I was at Steve's side helping him direct the buying. Before it was over we purchased between eight and ten million dollars worth of supplies."

The Bechtels' contribution

"W. A. Bechtel Co.'s direct share of the work was largely administrative, but as officers and directors the Bechtels put their construction knowledge into the common pot," said Bill Waste, who was there almost from the beginning. William H. Wattis, in his seventies and ailing when elected President, died six months after the contract award. The partners picked Dad Bechtel to succeed him. Later, Steve was elected First Vice President; became a member of the four-man Executive Committee which directed actual work, and Administrative Director. Warren Bechtel, busy with other Company work, was able to spend about half his time at the Dam in the first year; after that the press of outside duties kept him away more of the time. He served on the Board, as did Kenneth.

Hoover Dam: some statistics

The technical story of Hoover Dam's construction has been told many times. The bare statistics of the contract were these: the project was divided into five parts; first, the river diversion works necessary to pass the Colorado River around the damsite, consisting of upper and lower cofferdams about ninety feet high, and four of the largest rock tunnels ever built, averaging four thousand feet each in length and fifty-six feet in

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diameter; second, the dam proper, a concrete arch seven hundred twenty-seven feet high and eleven hundred eighty feet across at the crest; third, two giant spillways each large enough to accommodate a battleship; fourth, two outlet systems leading from four great intake towers through rock tunnels to the powerhouse and valve houses; fifth, the powerhouse, largest of its kind ever designed. Additionally, the volume of development work—cableways, roads down the sheer cliffs, a railroad, a permanent city for workers, communications, and such incidentals as mammoth aggregate and concrete plants—was rivalled for magnitude only by later foreign projects. To do all this the Government established a working time of 2,565 days—approximately seven years. It was done in five years—at a saving to the public treasury of five and one-half million dollars.

Nature played a rough game

The human side of man's conquest of the Colorado has been preserved by George A. Pettitt in *So Boulder Dam Was Built*, a book published in 1935. He states the twin problems that made for urgency—widespread unemployment which only public works could relieve, and recurring floods that threatened disaster to the people of California's Imperial Valley. And he documents the victory of spirit over nature's mightiest forces—man-killing weather and floods that tossed the great preliminary works aside like match sticks. Every man who was there carries vivid memories of these and a hundred other battles not recorded in printer's ink.

Aug. 28, 1933: A builder laid down his tools

Meanwhile the fame of the men who were winning this fight spread around the engineering world. Six Companies' President was urged by the Russian Government to inspect the great Dnieprostroy Dam, just completed. "It's a good time to see what the rest of the world is doing," Dad told his partners. With three sons on the job at home, the invitation offered an opportunity to compare notes on men and methods. So he was off to the U.S.S.R. accompanied by his first and best partner, Mrs. Bechtel. And there, in Moscow on August 28, 1933, he died. It was a great shock and a great loss, but the family and his host of friends could find solace in the knowledge that he left as he had lived—and as he would want to go—active

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to the very last, a construction man on a construction mission.

Dad's homecoming gave the country and his profession an opportunity to show where he stood in their hearts. Let Gilbert Darwin speak for the many who memorialized him in the nation's press. Mr. Darwin, then editor of *Western Construction News*, wrote in the September, 1933, issue:

Oakland, California--Sept. 19, 1933

" 'Dad' Bechtel is gone. His end came with tragic suddenness. An international figure—beloved and respected by thousands—he was a self-taught, highly-successful builder with intense pride in a job well done. Outstanding in his characteristics were a loyalty to old friends and faithful employees no matter what their station; a simplicity and kindliness of manner enduring from his pick-and-shovel days on railroad construction until his death at the height of activity and power; honesty; tremendous vitality; prodigious industry; a great sense of humor and enthusiasm.

" 'Dad' Bechtel did a world of good things few people will ever hear about. Success never changed his attitude toward life or construction. He paid the closest attention to all details of his work; kept up his equipment in first-class shape; operated good camps; was on the alert for new and improved methods and materials of construction. A prominent railroad executive, from a background of over twenty years acquaintance, says of him: 'No engineer ever had to go after Bechtel to do a good job.'

"The many useful monuments built by 'Dad' will endure from generation to generation, silent tributes to his genius in development of the western empire. His brother and three sons are left to carry on the ideals of Bechtel contracting organizations in memory of a fine man who built well and loved his fellows."

W. A.'s fraternal and association memberships

The press accounts emphasized the great warmth of W. A.'s personality, devoting fully as much space to his richly human qualities as to his many notable achievements. Little was written about his honors and affiliations. Nevertheless, he joined in fraternal and association activities, choosing them carefully—a necessity for a man so thoroughly occupied by the two things nearest his heart—family and work.

Dad was a Mason and a Knight Templar, and of this fellowship he was deeply and justly proud. He was also a loyal Elk. In the field of association service he contributed substantially to the advancement of the construction industry—as a Charter Member of the Associated General Contractors of America, and in 1929, as A.G.C.'s National President. He was the pioneer of western builders in this organization, holding a personal membership long before the formation of its first Pacific Coast chapter, and his active participation in association work had a lot to do with putting the western contractors "on the map" with their eastern contemporaries.

His election to the Presidency of A.G.C. was reminiscent of the old story about John Alden, Miles Standish and the courtship of Priscilla. Dad campaigned vigorously in behalf of another man—and was amazed when the membership turned the tables and made him the overwhelming choice for President. Later he had the satisfaction of seeing this office ably filled by another westerner—his friend and associate—Henry J. Kaiser. First, W. A. Bechtel and then Henry Kaiser gave A.G.C. the vigorous early-day leadership under which some of its greatest strides were made.

1934-'38: Parker Dam

Dad's last venture was the San Francisco-Oakland Bay Bridge job. He did not live to see it built. But the sons who Gilbert Darwin charged to carry on, and their associates in Bridge Builders, Inc., saw it through. At about the time of the first Bay Bridge contract and before Hoover Dam was completed, Six Companies obtained a contract to construct Parker Dam, 155 miles down the Colorado. Parker was a major undertaking in its own right, but the vast work in Black Canyon and the dramatics of matching engineering wits against the winds and tides of San Francisco Bay tended to overshadow its importance. Frank Crowe straddled both Hoover and Parker as top construction man, with Perry Yates on the job down at Parker as his good right arm. Parker was built under subcontract by J. F. Shea Co., Inc., between 1934 and 1938 to impound waters for the Los Angeles Aqueduct, and as a source of power. It is three hundred twenty feet high, eight hundred fifty-six feet long at the crest.

1933-'36: Big feet for the world's largest bridge

Bridge Builders, Inc., received two contracts on the Bay Bridge—one for the pier foundations of the East Bay cantilever span, the other for painting the entire structure from shore to shore. Steve was a prime mover in this joint venture, which marked the introduction of eastern firms into the group on an active basis. The work was covered well by inviting in three outstanding organizations, on underwater construction, pile driving, and steel work. Missouri Valley Bridge and Iron Co., and Dravo Corporation of Pittsburgh furnished the men who put the caissons down, and a New York firm, Raymond Concrete Pile Company, built the cofferdams. The Bechtel service was in the field of management and administration; Steve was Vice President of Bridge Builders, Inc., and Bill Waste was Administrative Manager.

The Bay Bridge brought the men of Six Companies Inc., into direct competition. Transbay Construction Co., which included Morrison-Knudsen, MacDonald & Kahn, Shea, and Pacific Bridge, bid spiritedly against their former (and later) Bechtel and Kaiser partners, who were members of Bridge Builders. The latter firm, as noted, was awarded the East Bay piers and the painting job; Transbay Construction got the piers for the western crossing. The rivalry grew as the work progressed. Transbay set their lowest pier depth at minus two hundred forty-six feet, to make it the world's deepest. But Carl B. Jansen, now Dravo's President and then Bridge Builders' General Superintendent, quickly revised his depth figure for Pier E-4 (near Yerba Buena Island on the east crossing) from minus two hundred forty-two feet to minus two hundred forty-seven feet—and Bridge Builders had the satisfaction of setting the deepest bridge footing in the world.

The contract for foundations from Oakland to the island embraced building steel caissons, launching them at an Oakland dock, towing them to the pier site, then getting them down and anchored into place on the Bay bottom before building up the permanent concrete pier structures. Missouri Valley's E. H. Connor, dean of caisson men, laid out the method. Sinking the big caissons was a touchy job. They had to go down with the utmost precision, and rest exactly in the

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designated spot. Winds and tide had to be reckoned to a nicety; the engineers were given no margin for error in computations, and when the big minute arrived, every member of the well-rehearsed crew had to respond with split-second accuracy. Commuters still remember watching the bridge builders jockey those bulky "boxes" with the sharp cutting edges, and sinking them one by one until they bit deep into bearing surface far below the ooze of the Bay floor. Later, after steel rose into the sky and a web of wire had been woven, the decks of the ferry boats were grandstand seats for the world's biggest bridge painting job. When it was finished the great Bay Bridge in its sparkling aluminum coat was as beautiful as any masterpiece of the silversmith's art.

1934-'38: The group built dams, jetties, tunnels

The joint-venture idea worked well for the extensive public works built in the thirties. It multiplied the contractors' capacity; in addition to Hoover and Parker and the Bridge, group members operating as Columbia Construction Co. built Bonneville Dam on the Columbia River; Ruby Dam, and the Gray's Harbor Jetties in Washington. As Six Companies of California they constructed a section of the Oakland to Contra Costa County highway and did the troublesome initial work on the Broadway Low Level Tunnel. Utah-Bechtel-Morrison-Kaiser Co., completed two Colorado jobs, lining the Moffatt Water Tunnel and building Taylor Park Dam. This list, partial and not entirely chronological, covers a period of simultaneous operations extending from 1934 through 1938.

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Laura Bechtel launched a pier caisson named in her husband's honor during construction of the San Francisco-Oakland Bay Bridge.

CHAPTER IV

PUBLIC work had been advantageous to the participating contractors. It enabled them to build well-rounded organizations and increase their resources. But even while group work of this nature was in full swing, Steve Bechtel made plans to enlarge the firm's direct service to private industry. In 1936, a subsidiary called Industrial Engineering Co. was set up to manufacture and apply Somastic Pipe Coating. Here was a straw pointing the next direction his thinking would take. His keen interest in pipe lines and pipe coating was significant, both found their major market in the petroleum industry.

The petroleum age

"Steve's vision was of energy—all types of it, but particularly of oil as a universal power source," a close associate pointed out. And his ability then to foresee the tremendous growth that has since taken place in the petroleum industry led to the conception of a new engineering and construction facility to meet its needs. As "Mr. Customer" at Hoover Dam, he had re-cemented a friendship formed at the University of California. The friend was John A. McCone. McCone gave promise of his brilliant later career by making an outstanding record at the University. Working closely with Reese Taylor, another college mate later President of Union Oil Company, he helped put together the Consolidated Steel Co., after working his way up in a predecessor concern. When Hoover Dam got under way Consolidated's new Maywood plant had just been completed. With a depression on, McCone faced the necessity of finding business for the new plant and lots of it. Hoover Dam was the place where the most steel was needed right then, and he convinced Steve that Consolidated had the answer.

McCone sent an up-and-coming young salesman to get the orders and look after the account. Steve was never one to overlook good men. He already had John McCone in mind as a possible future associate, and he took stock of the redheaded steel salesman too, Alden G. Roach by name. Five years after Hoover Dam when Steve conceived a new organization to engineer and build processing plants for the oil companies, he thought of it in terms of John McCone as a team mate of the Bechtel brothers. And he kept in touch with Roach, who became Consolidated Steel's President; and in 1948, President of Columbia Steel Company and a Director of United States Steel. Alden Roach came into the Bechtel family at a later stage, as a member of the Board of International Bechtel, Inc., and of Industrial Indemnity.

1937: Bechtel-McCone-Parsons Corporation

In 1937 the new company was formed, Bechtel-McCone-Parsons Corporation, with headquarters in Los Angeles. Ralph M. Parsons was brought in, with a specialized technical staff drawn from an earlier Chicago organization. BMP became a rare entity in business annals, an assured success. Two contracts were waiting to go on its books, and more followed quickly—showing the oil industry's confidence in these men engaging in, for them, wholly new type of endeavor.

Emphasis on engineering

BMP was big and mature right from its opening day of business. Its formation brought a new facility to the west, completely self contained, able to design, engineer, procure equipment and materials, and build the complex processing structures of petroleum refining and industrial chemistry. From the standpoint of the Bechtel development, BMP marks the beginning of its primary concern with engineering on a large scale, which would grow to include staff specialists in all main divisions of the science of petroleum.

Hydrogenation at Richmond. Refinery job No. 1

Warren Bechtel said it used to be an education to watch Dad sell. "He did it simply and sincerely—with a lot of persuasion. But he didn't seem to be selling at all. Steve had the same knack, and the advantage of many more kinds of work behind him and wider contacts." Steve called on his sales ability now, at the Standard Oil Company of California's offices. He wanted to build Standard's new hydrogenation plant at the Richmond

refinery. He was so sure he was right, so sure the petroleum industry needed a complete refinery engineering and construction facility in the west, that he told Standard "we'll go to Richmond and do the job for nothing!" That kind of assurance was catching, particularly when it came from a man who did what he said—as the oil company officials had occasion to know from his pipe-line work. It was a big step, on other than a routine type of refinery, but Standard gave him the contract.

Construction of the hydrogenation plant began in the summer of 1937 and was completed the following January. Meanwhile, by November, Standard had seen enough on the first job to place its second refinery contract, this for a duo-sol plant at Richmond. In April, 1938, Glacier Production Company ordered engineering and construction of a complete refinery at Cut Bank, Montana. In July, Union Oil Company awarded year-old BMP the engineering and construction contract for its new solvent treating plant at Oleum. Then Hercules Powder Co. selected the firm to build an ammonia plant at Hercules, California. Here was a new field with problems closely related to petroleum processing—industrial chemistry. Not yet two years old, BMP already had behind it the successful record of five plants under way or completed, no two alike. Refineries and chemical plants are that way—even two plants utilizing the same basic process will differ materially. That's one reason why this class of work is a stiff test of engineering and construction ability.

A fast start: five plants in two years

Several men occupying responsible positions in the present Bechtel organizations were prominent in BMP's operations. Heinie Hindmarsh, who had known Dad Bechtel and the boys for so many years, joined W. A. Bechtel Co. to help out after Dad passed away. When BMP was formed he switched over to take charge of all construction. Heinie's career shows the wide range of work that can be covered successfully by a really well-grounded man. Twenty-four years of railroad engineering for the Southern Pacific, plus shipbuilding and various types of heavy construction were in the kit of experience he brought to BMP. On top of this he was an executive having labor's confidence and respect. In the field of labor policies and

The men of BMP

labor negotiations he carried on the enlightened policies Dad Bechtel initiated, and adapted them to the vastly greater requirements of the later activities. He also brought a large following of superintendents, foremen and mechanics, which gave the new firm an excellent reservoir of skilled manpower right at the outset.

Another experienced man who joined in May of 1937 was Perry Yates. He worked closely with Hindmarsh as the coördinator between engineering, purchasing and construction. Perry has come into this narrative before—as a "neighbor" when Bowman Dam was being built by Warren Bechtel in 1926, and as a Six Companies field engineer at Hoover and Parker Dams. But prior to his employment by BMP he also had acquired specialized experience in the firm's kind of work—with Shell Oil Company as an engineer in the construction of oil refineries.

To the new from the older Bechtel firm came Earl F. English, a senior executive who had seen extensive service with public utilities, east and west. He had been Executive Vice President of Pacific Public Service Corporation; understood both management and engineering, and had a background that enabled him to undertake a variety of important assignments for the Bechtel interests.

Team strength grew

John C. Byrne was another early arrival. As an executive of Consolidated Steel Corporation, John McCone had watched the rise of this young M. I. T. graduate from laborer to Estimator. "Excellent judgment on costs and job production," was McCone's comment based on nine years of observation. In December, 1937, John Byrne came to BMP and was put in charge of estimating, schedule making and cost control.

All of these men were with the new company as it ended its first year. More key people were added in the following years. Jerome K. Doolan, a Stanford-trained engineer seasoned by eighteen years of engineering and management, joined in August, 1940, and took over project management of the shipyard built for Consolidated Steel Corporation at Orange, Texas. Ed Dorresten, who had been made Sales Engineer the preceding December, followed Perry Yates to Missouri on muni-



John A. McCone and Stephen D. Bechtel.

tions plant construction and then opened BMP's San Francisco office as Manager. His business life had been devoted entirely to refinery and chemical installations, so he was right at home in this class of work. And George E. Walling was brought in when the pressure of wartime responsibilities required an outstanding man to direct the accounting operation. He was one of nationally-recognized Lybrand, Ross Bros. & Montgomery's aces.

Until 1937, when Bechtel-McCone-Parsons Corporation was formed there had been just the one Bechtel business, evolving from Dad's contracting activities. Now there were two, cleanly divided according to function—W. A. Bechtel Co., engaged in heavy construction, and the Bechtel-McCone firm specializing in the engineering and construction of processing plants, principally refineries.

1938: Pipe-line and railroad construction

While BMP, Athena-like, was springing full-grown into the world of refinery engineering, WABCo continued to build pipe lines and railroads. During 1938 two lines were laid in the high country, across the plateaus of Wyoming and down through the canyons into Utah. Somastic Pipe Coating crews, operating from a railhead plant, applied coating to a large part of the Mountain Fuel Supply Company's line into Coalville, Utah. Pipe line owners discovered that lasting protection against corrosion was a good investment at the top of the continent as well as in the tidal areas where Somastic previously had found its best market. Farther east, Bechtel pipe-liners under George S. Colley, Jr., put in a line for Continental Oil Co., from Lusk, Wyoming to Cheyenne. And in the Los Angeles basin more lines were woven into the network already there—for Hancock, Richfield, Shell, and the Southern California Gas Co. Warren Bechtel continued to oversee the Company's services to the Western Pacific, building tunnels, sidings and culverts. These were the principal heavy construction contracts of 1938.

The two years, 1939 and 1940, brought the next important development. With "operations normal" for W. A. Bechtel Co. in heavy construction and young BMP running as smoothly as its new Richmond hydrogenation plant, Steve Bechtel pre-

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1939: Preparations for foreign service

pared to gear up for service on a global scale. Enthusiastic about future possibilities but making sure of his ground, he set about laying a foundation that soon would enable him to say: "We will build anything, any place, any time."

One of his first moves was to bring Van W. Rosendahl into the Bechtel fold. Another was to talk with William V. McMenimen, President of Raymond Concrete Pile Company, ex-partner on the Bay Bridge job, and with pipe-liner Hal Price and other friends.

Van Rosendahl joined the organization in 1939. The Bechtels had known him and watched his progress for a long time, primarily in the construction of large buildings but also on pipe lines and general construction. He had been an athlete during undergraduate days, both he and John M. Rogers (now Executive Vice President of the international Bechtel interest) rowed on varsity crews at the University of California, a school that sent three eight-oared shells to the Olympic Games and three times won the world's championship. Soon after he came with the firm, events took place which brought about the Bechtels' entry into foreign work, a field which later became his special charge.

Associates on early foreign projects

Steve had good reason to renew the association with McMenimen of Raymond. The nature of this firm's work frequently took it into foreign countries to build harbors and similar developments. The Raymond business grew out of the idea of the cast-in-place concrete foundation pile, and widened to include various types of engineering and construction. When the Bechtels undertook the first foreign projects this well-established organization again became a valued ally.

Another was H. C. Price, of Bartlesville, who originally met the Bechtels as a welding subcontractor on the midwest pipeline jobs of the '30s. Price started in a small way as a pioneer in the electric welding process; in 1928, after seven discouraging years, he was able to make the first successful electric weld on a pipe line, and thereafter built his firm into one of the country's largest welding organizations.

A third associate at this time was Williams Brothers Corp., of Tulsa, large pipe-line contractors. These three—Raymond,

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Price, Williams—separately and together—formed the starting lineup with which Bechtel foreign activities began. Here once more was the versatile joint venture, made up of men and firms who were competitors one day, partners the next. Oil-rich Venezuela furnished the locale for the work. The 125-kilometre, 16-inch Mene Grande pipe line was built from Oficina in the interior to Guanta on the coast; eight supplementary contracts included dock construction and 132 miles of telephone lines. George S. Colley, Jr. ran the pipe-line job. Bill Hanna, breaking in, was one of his younger assistants. Forty miles of the Mototan-Mene Grande road were cut through the jungles and the Guanta Highway was surfaced to Oficina. Three pipe-line contracts were executed for the Standard Oil Company of Venezuela. Harbor and wharf installations were made at Ciudad Bolivar for the Venezuelan Government. Altogether these projects added up to a good-sized volume for the first year of foreign work.

1940: Venezuela—fountainhead of foreign work

Meanwhile, international politics were taking an ominous turn. The chips were down when Hitler invaded Poland in 1939. No great foresight was needed to see that before this war ended the United States would be drawn into it. Like others, the Bechtels were alert to the implications and lost no time getting their resources ready for the country's service. Each step they took—formation of the refinery engineering and construction facility; cementing relations with other constructors; their entry into foreign work; and the addition of minds and experience to the top echelon—moved closer to the goal of greater capacity. Their organizations would need great strength and capacity, sooner than anyone realized.

Sept. 1, 1939: War in Europe

For the time being, heavy construction went on as usual. In the United States more pipe lines were built in 1940, the principal ones being the one hundred seventy mile Fort Peck line in Montana and the Illana job—a line two hundred seventy miles long laid through Illinois and Indiana. Also in the same year the organization completed one of its early buildings of the industrial type, although this one—East Bay Iceland in Berkeley—was not a factory but a skating rink. The 1947 National Figure Skating Championships were held there, and

1940: Construction

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competitors pronounced its ice floor one of the best in the country. But engineers who visited the place looked up at the ceiling, not down at the ice, for the rink has a tremendous roof supported by a clear span, three-hinged arch type truss that invariably catches an engineer's eye.

1940: Refineries

Two refineries were on the year's agenda for BMP, an alkylation plant at Watson, California, for The Texas Company, and a delayed coker for Union Oil Co., at Oleum. Of the domestic work, the most significant was contained in two heavy construction contracts between Phelps-Dodge Corporation, the big mining concern, and W. A. Bechtel Co. These contracts covered excavations for thickener tanks and concrete foundations for an immense copper reduction works at Morenci, Arizona. Unknowingly, Morenci turned out to be the "kick-off" of construction for war. Although originally not a government-sponsored defense project, the Morenci job reflected the nation's concern over copper, and it proved to be a forerunner of heavy defense and war responsibilities for the Bechtels. Narrowed down to southwest copper, Morenci marked the first of three separate Bechtel-built open pit mines with their processing plants and attendant facilities.

1940: A copper mine

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CHAPTER V

WORK for the naval and military forces started in earnest during June of 1940. These were group ventures—sponsored by other partners—truly big jobs. Some of them required up to three years to finish. The first assignment was to engineer and construct the Navy's Air Station at Corpus Christi, Texas, a project that employed seven thousand people. Next, in August, came Fort Ord near Monterey, California. John McCone got Jerry Doolan and Jerry Komes to check the group's estimate. Both recently had come into the organization, as noted previously. The need for additional key men was being met promptly, they came and stayed on—how they grew with the organization and where they landed is a matter of later record.

1940: National defense; the start of America's biggest construction job

Fort Ord was built under Harry Morrison's joint sponsorship with Ford J. Twaits. The same sponsors also constructed Camp Roberts, near Paso Robles, which got under way in November, 1940. Group work was give and take. These partners led off on defense work, soon the Bechtels and various members of the group sponsored other projects which were shared with the partners.

One piece of direct work done at this time also belongs in the defense category. Because it was closely related to BMP's special qualifications in engineering and equipment installation, BMP engineers were awarded the design of a central heating and steam plant for the Army, and its construction men, the job of building the plant at Elmendorf Air Field, Anchorage, Alaska. When the direct contracts at Anchorage and Morenci were added to group projects started in 1940, the total exceeded one hundred and eight million dollars for strategic

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construction. Pearl Harbor was still a year away, but already the Bechtels and associates had deployed their forces on the nation's second line of defense.

Events to come showed that thus far the engineers and field crews and office people had "just begun to fight!" Steve Bechtel would be everywhere, from San Francisco to Washington to Manila and way points. Warren would be digging in, literally, in Arizona and northern Mexico to provide more copper for munitions and a thousand and one other war-essential uses. And Ken, financial man and administrative head, soon would be the family's Number One Shipbuilder as well. Shipyards and ships, naval bases stretching clear across the Pacific, the Army's principal western depot and Port of Embarkation, two big powder plants, and a score of other jobs piled in—group work, Bechtel-sponsored work, direct work. All of these responsibilities came during 1941 and before Pearl Harbor. They were so complex and so many that merely to segregate and document them is difficult. How difficult they must have been for the contractors to absorb and get under way can be imagined, when sometimes only minutes or hours were permitted for decisions, only days for organizing. That capable organizations could be assembled quickly, smoothly and simultaneously on dissimilar projects at widely separated places now seems past belief. But they were, just as all over America other men and women were doing other kinds of "impossible" jobs, adding to the sum that was the miracle of 1941—preparedness in a year. And it was done by these men with the confidence and humility Dad Bechtel taught his three sons, and those who worked with them, and their associates and assistants. A typical instance of the years of preparation by American business people that preceded and made possible America's year of preparation—just enough soon enough, to save the nation from quick defeat.

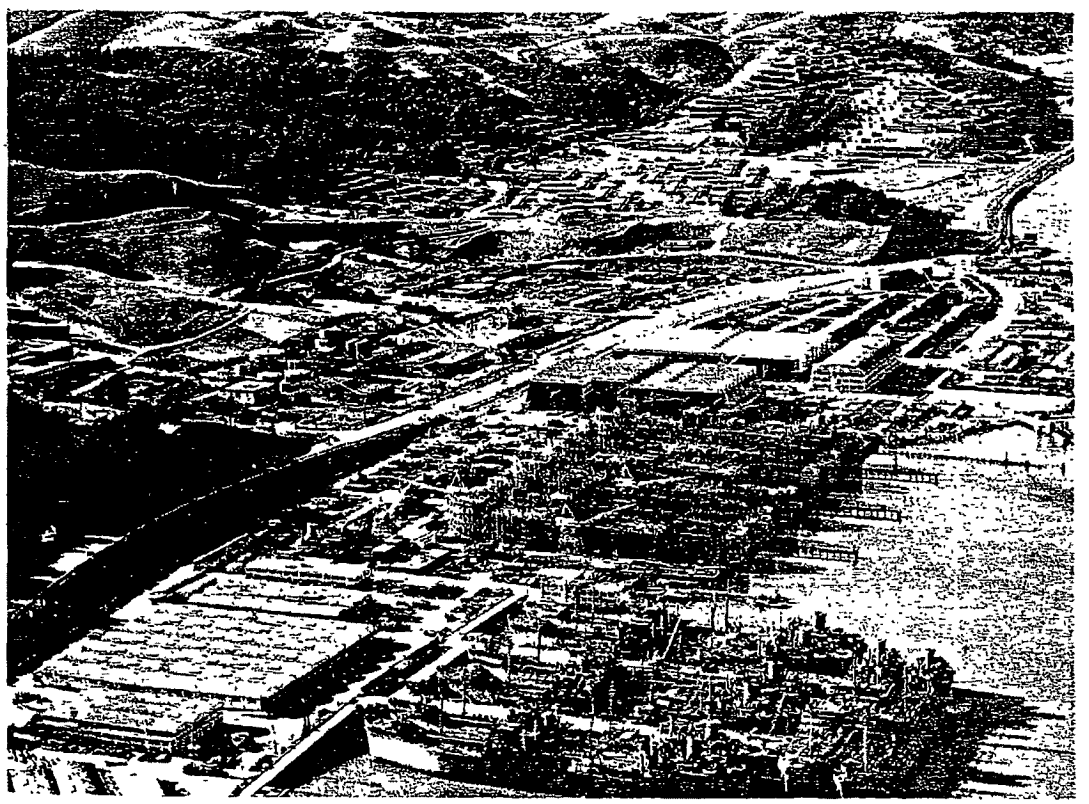
1941: Uncle Sam piled it on

At the time the three Bechtel sons were heavily engaged in organizing these vast war activities—in February of 1941—their mother passed away. This gentle, understanding lady had been W. A.'s first, last and best partner—keeper of the home fires—helpmeet and mother in the fullest meanings of the

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Once again illustrating the value of working together—Six Companies men at Calship. John McCone, Steve Bechtel, Jack McEachern, Harry Morrison, Gil Shea.



Marinship's pace-setting tanker yard at Sausalito, California.

words. When Mother Bechtel was called away the boys and sister Alice were left with a sadness that was heavy indeed. A pioneer—a stalwart when the going was most rugged—the imprint she left would always be cherished.

Prelude to shipbuilding

The Bechtels' readiness to take on a substantial chunk of the emergency shipbuilding program illustrated the almost prophetic steps by which they prepared for the new responsibility. Back in 1936 when the American Merchant Marine was still in the talking stage, Earl Fisher, Vice President of Pacific Gas and Electric Company and a neighbor of Steve Bechtel's, was appointed to an exploratory Maritime Committee. From time to time he discussed the problems with Steve, who became interested in the possibility of reviving big scale U. S. shipbuilding and shipping. He began to study the situation, to discuss it with his brothers and partners, and to cultivate acquaintance within the existing shipbuilding industry. This pre-conditioning went on for three years, even though projects then in work occupied the time of the three Bechtels and their organizations far beyond the usual hours people allot to business.

The chain of circumstances went something like this: Earl Fisher aroused Steve's interest, after that the Bechtels and John McCone made a study of the shipbuilding industry, from which they concluded that "shipbuilding seemed about to become a big volume business, and therefore was a real possibility for our kind of operations." They were thinking groupwise. Steve succeeded in interesting Henry Kaiser and Charlie Shea of Six Companies, and this had the effect of getting some of the others to look into the matter. One of these associates was J. A. "Jack" McEachern, up from pile driver to head man of Seattle's General Construction Co. Through his friend, Jim Lamont of Todd Seattle Dry Docks, Inc., group members met John D. Reilly, President of Todd Shipyards Corp., in New York. Reilly, in turn, had a tie-up with William S. Newell of Bath Iron Works, in Maine.

Exactly how this combination worked out is a detail outside the scope of this report, but in September, 1939, when the Maritime Commission called for bids on five C-1 cargo ships

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under the Government's long range program, the western group and Todd formed the Seattle-Tacoma Shipbuilding Corp., and were the successful bidders. Then, when the British Purchasing Commission inquired of U. S. Maritime's Vice Chairman, Admiral Howard L. Vickery, concerning shipbuilding facilities for sixty ships, he told them "there's a bunch out on the west coast that never built a ship but they think they can do a job for you." After conferences between the British representatives and the group the sixty-ship order was placed. Thirty were to be built on each coast. Bath came in for the eastern end, and Richmond, California, was set up as the Pacific Coast base of operations.

"... a bunch that never built a ship..."

Next came the start of the American wartime cargo fleet, and further talks with Admiral Vickery. Thereafter things happened fast. In summary: BMP sponsored and built a Naval Shipyard for Consolidated Steel Corporation at Orange, Texas; the group under various sponsors built and operated the nine-ways Todd-Houston yard in Texas, a seven-ways yard and another six-ways yard in Maine, the eighteen-ways Seattle-Tacoma Shipyard, the nineteen-ways Richmond facilities, and the eleven-ways Oregon Shipyard at Portland. Todd Shipyards sponsored some of the yards, Bath Iron Works some, the Kaiser interests some, the Bechtel interests some, and General Construction Co. acted as co-sponsor of the Seattle-Tacoma yard.

Earth-movers to shipbuilders

This represented a big part of the war shipbuilding accomplishment and the first time in U. S. history when the west outbuilt the eastern shipyards. Two Bechtel-sponsored yards delivered five hundred and seventy ships—cargo, transports and tankers—in addition to the hundreds built at other group yards. To these operations was added, in conjunction with an old Bay Bridge partner, Missouri Valley Bridge and Iron Co., a ten-ways yard for Navy LSTs at Evansville, Indiana.

The group's two big Pacific Coast yards, designed, built and operated by Bechtel interests, invite special attention, because they became important to the growth and integration of the present Bechtel organization and a testing ground for some of its key personnel. Individual group holdings in the various

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yards were simplified by adjustments in the partnerships made during the shipbuilding program, which brought about closer control by the Bechtels at California Shipbuilding Corporation's Wilmington operation, and at Marinship in Sausalito.

1941: California Shipbuilding Corporation

Of the two, Calship came into the world first. Its natal day was January 11, 1941, when the Maritime Commission awarded the first facilities contract. Ground was broken three days later and after that the lusty newcomer grew fast in its big crib out on Terminal Island in Los Angeles Harbor. Bechtel-McCone's engineers designed the yard and it was built, sponsored and managed by Bechtel-McCone. All this sounds coldly factual; actually, although Calship was a much bigger undertaking than any of Dad Bechtel's railroad jobs of twenty years before, it soon took on the familiar look of people working together in the pattern of coöperation set up in the Northwestern Pacific camps.

Calship's line-up

Steve became Calship's President, then Board Chairman when John McCone actively took over direction of operations as President. Kenneth Bechtel served as Secretary, and later as Vice President. Bill Waste and George Colley were the first two to go on the new payroll. Bill as Administrative Manager opened shop and started hiring on New Year's Day, a week and a half ahead of contract conclusion. George got under way fast with the big construction job, and stayed until April when he shipped off to Cavite on the Navy's construction program in the Philippines. His shoes at Calship proved a good fit for J. S. "Jap" Connell who stepped in as construction chief, the same "Jap" who now heads Bechtel Corporation's Somastic Pipe Coating Division. When the pressure got really heavy, Heinie Hindmarsh loaned them Harry Benner, his General Construction Superintendent on refinery work.

Jerry Doolan was slated for the post of General Manager, and as soon as Consolidated Steel's shipyard in Texas was completed he returned to California and these duties. Jim Warfield had been hired by Bill Waste as Assistant Administrator. When he went north to help Ken Bechtel start Marinship, Warfield moved up to Bill's former spot. Quite a while later Jerry Doolan also left the yard to take on the problems of building

refineries in the Netherlands West Indies and the Middle East, and then Jim Warfield was made Calship's General Manager. John Byrne and Jerry Komes on the Operating Committee; Pat Ryan the Chief Engineer; J. S. "Jumpy" Sides the Production Manager; and several others who continued with Bechtel-McCone carried the brunt of the load. Group partners who were Board members included Felix Kahn, Treasurer, Les Corey of Utah Construction, Henry J. Kaiser and his son Edgar, Jack McEachern of General Construction Co., Harry Morrison, Gorrill Swigert and Gilbert Shea. Calship's Board looked like a Six Companies reunion.

Ships enough to bridge the English Channel

Altogether, at peak employment this shipyard was a community of 42,000 souls, a population about equal to every man, woman and child in the city of San Bernardino, California. Its first block of three hundred six Liberty Ships placed end to end might have made a bridge twenty-eight miles across the English Channel for Eisenhower's invading armies. Thirty-four ships were in process of construction simultaneously, ten in the pre-fabrication and sub-assembly lines, fourteen on the ways, and ten at the outfitting berths. On one well-remembered day four ships were delivered. More revealing is the over-all average of sixty-five hours between deliveries. Total production was four hundred sixty-seven ships—Libertys, EC-2 tankers, AP-2 and AP-3 Victorys, and transports.

Twenty per cent of the Calshippers were women and less than ten per cent of all workers had ever been employed in a shipyard. Yet these greenhorns helped management achieve savings in man-hours-per-ship up to seventy-five per cent. No wonder John McCone could say in Washington in September of 1946 that "Those responsible for Calship are proud of its record.

"Year after year," he continued, "operating three shifts a day, seven days a week, we produced ships in unprecedented numbers and at low cost. In doing so the stockholders placed in the service of the yard a vast number of executives, engineers, superintendents and workmen, all of whom represented the real assets and resources of this Western group. The skill and ability of those men and their sincerity of purpose in serv-

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ing the country's need produced the ships without which the war would have been lost." It was plain that top management knew where credit belonged, and proudly pointed it out.

The two Bechtel-operated war shipbuilding ventures were active for four years and ten months, and for three years and eight months, respectively. Calship delivered its final ship on October 27, 1945, and Marinship two days later. The throughput of the two yards came to well over a billion dollars; nine hundred nineteen millions by Calship, almost two hundred millions by Marinship. These were sobering figures, for to spend so much money that fast, and intelligently, was a tremendous responsibility indeed. The payrolls in millions were equivalent to starting a new major construction project every week.

Because there were other war tasks for the Bechtels and the group, and because it is convenient to sacrifice chronological sequence in favor of tracing each undertaking through from start to finish, the shipyards are sketched at this point. Accordingly the story moves back to March 2, 1942 and San Francisco, the genesis of Marinship.

1942: Marinship

On that day the Bechtel office received a telegram from Admiral Emory S. Land, Chairman, U. S. Maritime Commission. Briefly, it invited a proposal to initiate a new yard, stating in part: "Your proposal should include a schedule of deliveries bearing in mind that the maximum number of completed ships is desired prior to December 31, 1942,"... this in March of that year! "We are now relying on you," the Admiral wired, "in the interests of this emergency to contribute your individual organizations.... The emergency demands all within your power to give your country ships. Please advise by wire the date we may expect your submission at this office."

Steve, Warren, and Kenneth Bechtel, and John McCone talked together by telephone. They already were loaded with other work. But they realized, as Kenneth later wrote, "that Admiral Land would not have sent out his plea to us unless we really were needed. We decided that if this yard was to go forward I should sponsor it."

Of the available sites on San Francisco Bay, Marin County

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Site selection

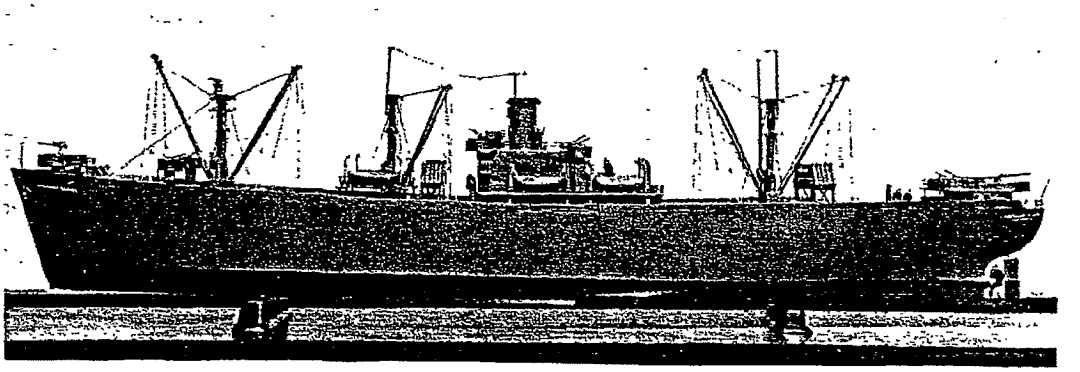
offered the least congestion. That night Ken talked with three friends to discuss possible locations; the next morning with Harry Allen, Ted Panton and Fred Boole he covered every possibility. Within a few hours they found a suitable piece on the Marin County shore near Sausalito, and started negotiations for a lease. A familiar thread reappears, for the selected site consisted largely of early client Northwestern Pacific's property, now owned by another old customer, the Southern Pacific.

One week after the telegram came, preliminary studies were handed to Admiral Vickery in Washington—history repeating again, for it was exactly one week from contract to the arrival of the advance force at the Hoover Dam site. So, on March 12, 1942, a Maritime Commission contract was awarded, stipulating among other things, that the yard be built "in the shortest time possible." Calship had made a good record—from ground breaking to first launching in less than eight months. Marin shaved it by almost two full months when hull Number One, the SS *William A. Richardson,* slid down the ways on September 26th. In fulfillment of Admiral Land's original request, six Liberty ships were afloat in the ninety-five days remaining before 1942 came to an end, with the seventh coming along on January 3rd.

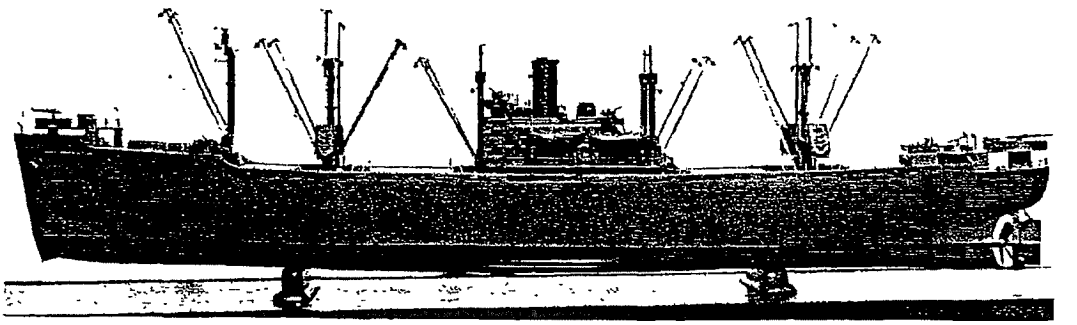
"Tailor-made" tankers and oilers

Marinship, however, was not to be a "volume" yard in the sense that Calship was. On July 4th, the day of the second keel laying and Kenneth Bechtel's birthday, he learned from Admiral Vickery that Marinship had been selected for tanker production. The difference between building standardized cargo ships and building tankers can be likened to the difference between making a ready-made suit and tailoring one to measure. The "tailors" went to work, invited California's Governor Earl Warren to lay the first tanker keel on the anniversary of Pearl Harbor, December 7, 1942, and went on to become the national tanker champs. When it was all over after VJ Day, six-ways Marinship has delivered fifteen Libertys, sixty-two turbo-electric 140,000-barrel T-2 tankers, and sixteen Navy Oilers of similar size and design. Eight of the yard's Navy Oilers later went into Tokyo Bay with the "Big

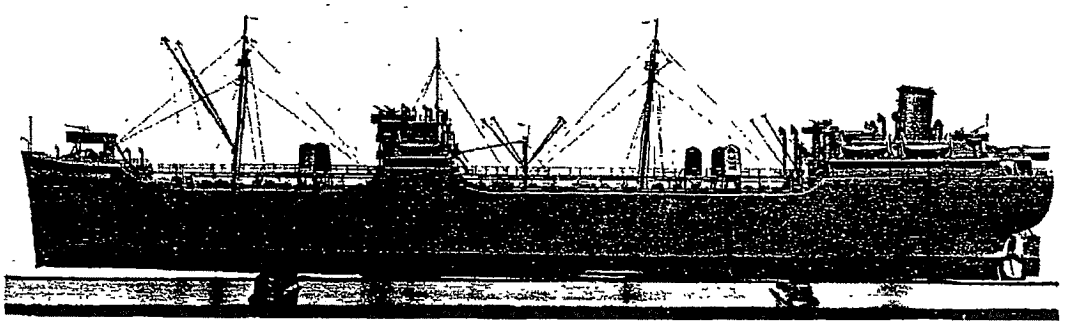
Ney 0218



Of Calship's 467 vessels, 336 were EC-2 Liberty ships (including 30 tanker conversions). Marinship delivered 15 Liberty cargo ships before switching to T-2 tanker production. Each Liberty carried as much as four 75-car freight trains.



AP-2 and AP-3 Victory ships were faster than Libertys, and had longer range. Calship built the nation's first AP-3, the "China Victory"—and went on to deliver another 100 Victorys, plus 30 Victory Transports.



T-2 Tankers, Marinship's primary responsibility, were key factors in establishing American sea supremacy. The yard built 78 of these 140,000-barrel "floating tank farms."

Mo" to acknowledge the Japanese surrender. And Marinship's people continued the family's habit of finding improved ways of doing things better and faster, with a number of shipbuilding innovations. One was the high-level outfitting dock, built to deck height and approached by ramps, which reduced outfitting time materially.

But achievements notwithstanding, the one thing Marin's old hands remember most vividly was its *esprit de corps*, something very special even for those days of employer-employee unity. It soaked all the way through the outfit, you could notice it the minute you checked in at the gate. And it ran clear through the big redwood Administration Building, from the receptionist on up to the President's office. Even at this distance no one cares to put a finger on the exact cause. Probably there were many causes—fellows like President Ken and Vice President and General Manager Bill Waste, Ray Hamilton who headed production, Administrative Manager Bob Digges, Naval Architect Dick Grambow, Russ Quick and Bill Ayers. And in the earlier days, Ted Panton who built the yard. And the partners—Steve, John McCone, Jack Pomeroy, and Felix Kahn; and Harry Morrison and W. V. McMenimen. Give an "assist" to the employees' own magazine, *The Marin-er.* Spontaneous outbursts from the ranks helped, too, like *The Stinger,* that fearless champion of democratic journalism fathered by John Connolly. Certainly John O'Connell who was there (and who now looks after labor relations under Heinie Hindmarsh), got off to a good start in Marinship's healthy labor climate. Some people believe that the personnel knit together quickly because Marin was a smaller operation, if indeed a force of twenty thousand can be considered small.

Why men stayed on

At all events a high degree of morale developed. It was Marinship's version of the old teamwork idea that kept cropping up again and again in this fifty-year story Dad Bechtel began. Some of the yard's key men had been members of the family long before the war and still are, but others who joined here for the first time also stayed on to share in postwar growth. When a man showed he meant to stick and train for bigger things, management caught on quickly and gave him

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the opportunity. In fact, the Bechtels provided permanent careers for so many of their people that the circumstance attracted editorial notice in the 1947 Engineering Issue of the *California Monthly*, alumni organ of the University.

Both Calship and Marin won coveted wartime awards for outstanding service. Both, by the jobs they did, can share in sentiment expressed by Admiral Vickery, speaking specifically of Marinship, when he said: "What we were buying was management brains. I knew the Bechtels and a number of their people. I sent telegrams to about a dozen people asking what they could do. Bechtel called up when he got the telegram and said they were going right to work on it—they made the best record of any of the yards that came in at that time. They were making such a good record that when I saw I had to do something to increase production of tankers, I took that yard myself and shifted it to tanker production."

Joshua Hendy Iron Works

Not merely ships but engines to drive them were produced by a Bechtel-sponsored war industry. The manufacture of ship engines was a production job of the venerable Joshua Hendy Iron Works. The name Joshua Hendy reaches back to California's Gold Rush—in fact Hendy's founder came around the Horn to San Francisco in '49. For seventy-five years this factory's placer mining and sawmill machinery enjoyed a world-wide reputation. After its San Francisco plant was destroyed in the earthquake and fire of 1906, the operation was moved to Sunnyvale, in the orchard country north of San Jose, California.

1940-'42: From sixty to eleven thousand employees

When the group of contractors bought Hendy in November of 1940, the plant employed sixty people. In the following twenty-four months its payroll grew to eleven thousand five hundred, and the original plant expanded to cover a million square feet. Charles E. Moore was President during this program and the war production period, and was followed in that office by John McCone in 1945. Steve and Kenneth Bechtel were Directors, Kenneth also the Secretary. Long-time associate Felix Kahn gave a lot of attention to this group interest as Hendy's Vice President and Treasurer. Les Corey of Utah Construction Co., Gene Trefethen of the Kaiser organization, and W. Gorrill Swigert of Pacific Bridge were others who

served on the Directorate, another throw-back to Six Companies days.

The plant turned out seven hundred and fifty EC-2 reciprocating steam engines for the Liberty ships—really big power plants weighing one hundred thirty-seven tons each. Hendy also manufactured main-propulsion steam turbines (for ships), turbo-generators, turbine-drive reduction gears, diesel engines, ships' line shafting and torpedo-tube mounts. Initiation of turbine manufacture marked the first time engines of this type had been made in the western half of the United States.

1942: Crocker-Wheeler was added

In September of 1942 the Joshua Hendy operation was expanded by the acquisition of the Crocker-Wheeler Manufacturing Company of East Orange, New Jersey. Crocker-Wheeler was also a pioneer in its field—the manufacture of motors, generators, motor-generator sets and large flexible couplings. When the war ended, Joshua Hendy and its Crocker-Wheeler Division stood beside the two shipyards in the reviewing line, for they too had earned the highest merit awards the nation bestowed on its soldiers of production.

Ney 0222

CHAPTER VI

THAT, in essence, was the story of ships and ship engines for victory. It was big and dramatic, but not as big nor as hazardous as another emergency contract. This was the far-flung construction of Pacific Naval Air Bases which grew into the largest and fastest construction job of all time, a statement for which there is the good authority of Vice Admiral Moreell, who had charge of it. The job was undertaken as a group project, or more accurately, as a series of projects.

Pacific Naval Air Bases officially began on May 25, 1939, with the appropriation by Congress of sixty-three millions for the purpose. The story before that is a long one, of devotion by key Navy people to a task filled with heartbreaks—the race lost against time to register with the American people an awareness of vulnerability on the Pacific flank. One who proved tireless on this job was the head of the Navy's Bureau of Yards and Docks, Admiral Ben Moreell. Once under way, PNAB became his baby, a thriving infant striving mightily to grow up in a mere matter of months because it had been born five years too late.

1940-'41: PNAB, nests for the American eagle

From a spearpoint in the Philippines, up through Guam, Wake, Midway—and swinging back out of Pearl Harbor down to Palmyra and Johnston, all of it anchoring on the California base at Alameda—the plan proposed to ring the fortified Japanese mandated islands with air power. Only part of what the Navy knew to be its bare minimum had been provided by Congress even at this eleventh hour, but it was a start and Moreell let no grass grow in getting it under way. This program began as a sixty-three million dollar project and eventually grew to cost about four times that amount. Billions were

Ney 0223

spent for cure where millions might have afforded prevention. Countless lives were poured into that final price, too, contractors' men and Navy people alike.

When the newspapers reported the authorizing legislation, no less than forty contracting firms showed interest. One was the Turner Construction Co., of New York, which under R. C. "Cliff" Wilson, was then completing a testing basin for the Navy in Maryland. This firm soon arranged to tie up with Raymond Concrete Pile and the Hawaiian Dredging Company of Honolulu, headed by Walter H. Dillingham. They called themselves Hawaiian-Raymond-Turner. Two Baltimore firms, the Arundel Corporation and Consolidated Construction Co., formed a separate group. And, as might be expected, the western contractors teamed up once more to offer their services. There were others anxious to do the work, but only these three groups survived the early rounds.

"We can do the job"

Harry Morrison took the lead for the constructors from the Far West. Three days of meetings convinced the Navy that these men could justify their stated position . . . "We can do the job. Details? We'll work them out as they come up, and give you the job you want in fast time." As it turned out, they were selected. But not at the outset. Hawaiian-Raymond-Turner had made a detailed analysis and proposal; they were put to work first, with the western partners held in reserve. The Navy knew that before long there would be enough work to occupy both groups.

David O. Woodbury's book, *Builders for Battle*, gives a thoroughgoing account of the whole adventure—its background, how it grew, and what happened before and after the shooting started out on the jobsites stretching ten thousand miles across the Pacific. Even Woodbury's four hundred pages only highlight the story. But the heroism of Dan Teter's twelve hundred workers on falling Wake is in it, and the story of Marlyn Sheik with fifteen hundred of Harry Morrison's men on embattled Midway—yes, and Gus Ayers and the others getting under way on reconstruction while the smoke still hung over Pearl, and Lowell Dillingham's bunch ingeniously freeing the wedged battleships along the Ford Island shore.

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By January of 1941 money was promised to expand naval facilities in the far Pacific. Time was running out for work in the Philippines, before Congress could vote the funds, the eight PNAB contractors were asked who would take the job. "We will," Steve Bechtel answered, "and the man we will send out is our Vice President, George S. Colley, Jr. He can get people to do what they don't know they're capable of." The Bechtels put the nucleus together quickly—George turned the job of building Calship over to Jap Connell, packed his bag and climbed on a plane for Manila. He had Jack Scarlet for General Superintendent, and Harry Koons, Chuck Snead, Smith, Davis, Combs, Webber, Neal—thirty-seven key men. Workers were recruited at Manila.

1941: The Bechtels "enlist" again

George Colley with George Ferris of Turner and a small group went in by Clipper on April 20th. The Navy's Commander Jim Wilson and his assistants were waiting for them. First order of business was to modernize the installations at Cavite on Manila Bay. There were no blueprints, just a list of jobs the Navy wanted done. "It's up to us," Wilson told them, "we'll have to plan on the spot." Construction headquarters went up right away; draftsmen, purchasing agents and the office crew buckled down. Twenty-seven projects were on the list, at Cavite and out on Sangley Point—dredging, sea plane ramps, hangars, fuel and ammunition storage, powerhouse, living quarters.

A late start at Cavite

Plenty of labor was available. Heavy equipment was a horse of a different color. The dredging job was a big one with no time to wait for equipment from the States. The Philippine Government owned the only available dredge. It was not for hire, authorities stiffly pointed out. Colley and Ferris talked the matter over. "There's only one out," the two Georges decided, "President Quezon himself." The President was at Baguio, ill, with visitors barred. They decided to try, anyway. An old friend got Ferris in—on a Thursday. By Monday the big dredge was on the job at Cavite.

Where there's a will—

Getting steel was the next problem. Practically none in the Islands. Someone had seen a stock of it. Where? At Hong Kong! The Japanese surely knew about it, trying to get it

would be risky business. No other choice—so up to China by air, a taxi cruise of the town, a quick deal, and then a brush with the Hong Kong authorities over—of all things—typhus shots! But the steel went to Manila, right under the Japs' noses.

That was the way things were done during those frantic final weeks. It was a race and everybody knew it. The fifth column around Manila knew it. They watched politely and were careful to spell George Colley's name correctly on their blacklist. By fall Japanese observation planes had seen enough to earn him a high place on the roll of those to be liquidated.

General MacArthur was interested in the naval work. He called Ferris in for an hour's talk. "Young man," said the General, "it does my heart good to hear about the plans you and Colley are carrying out. I pray to God you will finish in time—but I do not think you will."

"I pray to God..." MacArthur said

History records the Philippine disaster of December 8th, 1941. First, Clark Field—then Manila felt the Japs' air onslaught. American airpower in the Philippines had been destroyed—on the ground. Thereafter only time and courage stood before the fall of the Islands. And of Guam as well, where Jack Pomeroy's organization had started work in July. Guam—that years-long center of the whole political maneuver to appease Japan—Guam, where Clark Eldridge and seventy-seven good construction men were taken prisoners. Jack Pomeroy, Harry Morrison and W. V. McMenimen were there just before the outbreak. Jack intended to stay, Mac planned to go on to Cavite, but a typhoon intervened. Thereupon he decided to return to the mainland for Christmas, and finally argued Jack Pomeroy into coming along. By this narrowest of margins the three of them missed being war casualties. They met Earl English on the returning Clipper, homebound on one of his San Francisco to Manila commuting trips for Steve. At Honolulu they picked up George Ferris who had come in from Manila, and left by Matson Liner on December 5th. It was that close!

Dec. 10, 1941: Finis at Cavite

After the first attacks in the Philippines had cleaned out the American air force there, the enemy came over at will on their bombing runs. On December 10th the coup de grace was given

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to the partially completed installations at Cavite and out on Sangley Point. With no more worth doing there, Commander Wilson took them over to Mariveles to build emergency airfields and ammunition tunnels in the mountains. From then until that dark day when the little yellow men arrived, the contractors' forces were put to work on odd jobs in an attempt to bolster the weak land defenses. Most of the men were taken prisoner in Manila and spent three miserable years at Santo Tomas and Cabanatuan. Some, like Chuck Snead, did not return.

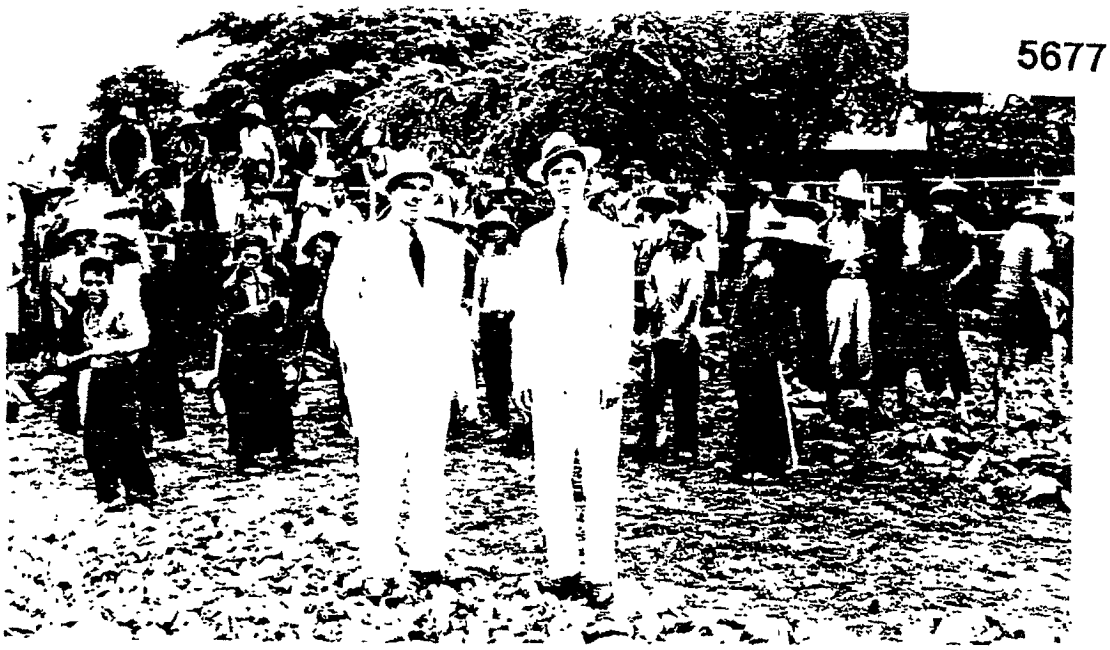
Back at San Francisco, Steve Bechtel was badly upset. Bechtel men had faced danger a thousand times—it was part of the game—but this was something different. Men waiting for the inevitable, like caged animals, was not to his liking. He was in no way responsible for their plight, but it was as characteristic of the sons as it had been of Dad Bechtel to feel a close kinship with the organization's people. George Colley, of course, was Steve's close friend from childhood on. After Cavite fell and while the men were still working around Manila, Steve telephoned George every night, more for encouragement than anything else. On one of these calls—it was December 28th—George said, "You won't hear from me again for about a month." He didn't elaborate. They both knew the Japs had tapped the line. A week later Chuck Snead cabled. Colley had escaped to sea.

"San Francisco calling Manila"

With him went his wife, Marjorie, Harry and Mrs. Webber of his staff, Dr. Ashton Laidlaw of Shanghai, and a very important brief case containing records of the work. They put out in a small pleasure launch, inching their way through two mine fields in the black of night, drawing a warning shot from Corregidor before establishing identity. The chances of reaching Australia seemed slim, for the enemy's navy had been seen to the north, and patrol vessels even now might lay across their course. Colley's plan was to travel at night and hide during the daylight hours. After ten nights they reached Balabac across the Straits of Mindoro, switched to a native sailboat known as a "kumpit," and prepared to run the gauntlet of small Japanese craft known to be ahead. Traveling thus,

Manila to Kuching, the first lap

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Cavite, 1941. George S. Colley, Jr. and Harry Koons of the top Bechtel staff, with Filipino laborers.



Ken and Steve Bechtel, Felix Kahn, Edgar and Henry Kaiser, at Marinship—another Six Companies reunion.

through what George merely calls "bad weather," they made Sandakan in Borneo, to find the Japs already in possession of part of the island. Here they hid out in a tidal river, while attempting to obtain a more seaworthy craft. The nearby town fell into Jap hands, and George decided to swim down river to a native settlement in the hope of finding a boat. Part way there a crocodile took after him, and soon Colley was perched high in a mangrove tree with Mr. Croc patiently waiting below. He was still there when the Japs came several hours later, sweeping the river in a launch. The others had been captured by a separate patrol.

1942-'45: Borneo

First on the leper island of Berhala and then at Kuching they learned what life was like in a Japanese prison camp. Food was bad, some of the time there was not enough to subsist on. Treatment was worse. Harry Webber and nine others were executed for infractions of camp rules. How, for survival, George and his companions managed to set up a food smuggling network, and how he put out a "trap line" of rusty tin cans to catch syrup drippings from a sugar warehouse in that damp climate, are examples of ingenuity he recounts in the privately published book of his experiences, *Manila, Kuching and Return.*

The "return" in that book title came three weeks after August 20, 1945, when the camp commandant called them in to announce the historic atom bomb incidents and the armistice. Not until September 11th, following threat of a wholesale slaughter, did the Australians arrive to insure their freedom. On September 12th, Marjorie Colley, who had been held separately in the women's quarters, was reunited with her husband, and they walked the long distance from the prison camp to Kuching. Arriving there, you can imagine their delight to see evidence of American strength again, in the form of the LCT *Wild Willie.*

A story-book ending

To Labuan they went on the *Wild Willie,* enjoying every minute of the trip. At Labuan they were told a special plane was on the way to pick up George Colley and wife, a courtesy which should have aroused their suspicions. Because the next evening in Manila the reason for the special plane was

Ney 0229

apparent, when George and Marjorie came to the happy ending of their war story. Waiting to welcome them was Steve Bechtel all the way from San Francisco!

1941: Action on the home front

While work went ahead on Naval bases in the Pacific, the men at home had an Army Base and Port of Embarkation to design and build, at Oakland's outer harbor on San Francisco Bay. It became the heart of the Army's Pacific overseas supply, pumping the lifeblood of food, munitions and equipment westward in a steady stream. The W. A. Bechtel Co. engineered this project in 1941. The following year, construction valued at eleven million dollars was carried out as a group venture under Bechtel sponsorship. Some of the supplies that cleared through Oakland came from two other projects built by the organization. These were facilities for the manufacture of munitions. One job consisted of additions made to an existing Hercules Powder Company installation at Belvedere, New Jersey. The other was a completely new plant, engineered and constructed by Bechtel-McCone at Louisiana, Missouri, and known as the Missouri Ordnance Works.

Basic materials:

. . . Powder

Warren Bechtel, who negotiated the Belvedere contract, pointed out that after an explosion in 1940 at Kenville, New Jersey, the United States was left virtually without facilities for the manufacture of smokeless powder. Belvedere remedied that situation, and the Missouri Ordnance Works added materially to Uncle Sam's explosive output. As happens so often, some of the same Bechtel people worked at both ends of apparently unrelated projects. Perry Yates and Russ Quick went east on construction of the powder-making facilities that furnished munitions to the Pacific through the Oakland Army Depot they had just finished building.

. . . Steel

. . . Copper

If powder was short, so were copper and steel. The Bechtels helped in the solutions to both problems, steel at Pittsburg, California, where in mid-war foundations and additions were made to the Columbia mill; copper in Arizona and Mexico. Warren, as recorded, pioneered the Bechtels' war construction program with the first Phelps-Dodge contracts at Morenci, Arizona. Under increasing pressure for copper, Morenci began to grow until, when he finally took his men off the completed

job, it had become one of the world's largest open pit copper mining operations. Like the Canol Project to come, there was an element of hedging in the enlargement of U. S. copper production. After the enemy's initial success in the Pacific, American sea routes were vulnerable. Had the Japanese cut sea access to Chilean copper, the supply of this metal would have been nearly as critical as rubber or tin.

1941-'44: Morenci

Morenci is located in southeastern Arizona, not far from the New Mexico line. It is an old mining district, dating from the erection of a small blast furnace there in 1872. Development on a large scale did not take place until 1942, when Louis S. Cates and associates of the Phelps-Dodge Corporation started operating the present copper reduction works, which efficiently utilizes ore assaying only one per cent copper. Its construction took place in two stages. The first units consisted of a reduction works, with an initial daily capacity of thirty thousand ore tons, a smelter, powerhouse, water system and tailings disposal facilities. Under a separate contract, the constructor graded and disposed of residual matter from the processing plant for the period of one year.

The second stage of the work comprised additions to the plant and mining pit, increasing the daily capacity to fifty thousand ore tons, and the construction of a complete community for workers. The community was no small job itself—five hundred forty-two housing units, two large dormitories, two schools, two stores and major additions to an existing hospital. Two who were active at San Francisco on figure work for the Southwest mining projects were Frank C. Sewell, a key administrative man continuously since Dad's Northwestern Pacific work, and Brantley M. Eubanks, Alice Bechtel's husband, whose service started at Hoover Dam, included the Bay Bridge painting job and some of the early refineries.

Dad Bechtel, as mentioned, once took a brief fling in mining, but in a small way and as a mine owner. Otherwise, before Morenci there was no precedent in the family for mine construction. Here was another new field, but most of the problems were familiar to these old hands at earth moving and concrete work. Even the massive installations of classifiers and

Ney 0231

flotation cells were taken in stride, after the schooling at Hoover Dam on the cement, gravel and blending plants. Experience at Morenci demonstrated again that given good men and methods, good performance is a sure thing. At least the officials of Defense Plant Corporation thought so. For in December of 1941, when the first Morenci excavations and foundations were still the principal show pieces in the Bechtels' mining exhibit, they were retained to design, procure materials and build a second large open pit copper mine and processing facilities near Globe, Arizona, for operation by the Castle Dome Copper Co., Inc.

1942-'43: The second mine—Castle Dome, at Miami, Arizona

This was the Miami project, and among other things it marked John M. Rogers' freshman year with the firm. Rogers was an experienced mining engineer. A friend of Van Rosendahl's, he casually dropped in one day at the San Francisco office, and then—as Warren Bechtel adds—"before he could catch a deep breath I had him on the job down in Arizona." The hot, arid country around Miami offered a pretty fair rehearsal for the Middle East, where John Rogers would see postwar service. Almost at the outset he got in on some good "shooting" when the constructor's powder gang shot off the entire top of Castle Dome in a single blast! Altogether, eleven million tons of overburden were stripped from the ore body to streamline this big mountain. When the benching was done Castle Dome looked like an immense terraced garden ready for landscaping.

Miami was designed to process ten thousand ore tons daily. In operation it exceeded specification by approximately twenty per cent. As at Morenci, construction included the necessary auxiliary facilities and housing, as well as water and electrical systems. The job was completed in April of 1943, whereupon the mine builders moved across the international border to Cananea in the state of Sonora, Mexico.

1943-'44: Over the border

In many ways the work at Cananea was comparable to that just concluded at Miami. Processing capacities were about equal; there were similar installations and structures. Stripping accounted for ten million tons of overburden, just a million less than at Miami. Cananea had its own peculiar features,

Ney 0232

however. One was the chore of training nine thousand Mexican Nationals with a U. S. staff fixed by Mexican Government regulation at ninety-six people. Nine thousand had to be trained in order to get half that number of workers. As fast as the natives learned to run the tractors and trucks, churn drills and power shovels, off they went to other parts of Mexico where such unusual skills commanded a high premium!

Ney 0233

CHAPTER VII

In recapitulation: Bechtel-sponsored and group operations were occupied with strengthening the nation's sinews for war—such projects as advance bases, cantonments, training camps, a military port of embarkation, shipyards and shipbuilding. Direct work, on the other hand, was concerned mainly with facilities for producing the materials of war—steel, copper, oil, gunpowder. As previously recorded, steel and copper called for heavy construction, which meant WABCo, while oil refining and powder manufacture—being process industries—were within Bechtel-McCone's special field. Both companies also were active in the development of electric power for war industries—WABCo by building mountain roads along the Pit River in California to serve Pacific Gas and Electric Company hydro-electric installations; Bechtel-McCone by engineering and building a steam-electric generating plant at Henry Kaiser's Fontana, California, steel mill.

1941-'43: The Bechtel perennials—rails and pipe lines

In addition, land transportation by rail and pipe line was being geared to meet the heaviest demand in history, requiring the kind of heavy construction typical of so much past work. W. A. Bechtel Co. carried on an extensive construction and maintenance program for the Western Pacific Railroad; Bechtel-sponsored partnerships laid pipe lines in the Far West, the mid-Continent, and the East. Lines were built across the plains of Kansas and Texas. In Iowa and Nebraska twenty-four miles of large-diameter pipe was laid underwater at twelve river crossings, in California a four-hundred-mile gas line was converted to carry oil, and in Ohio and Pennsylvania two sections of "Big Inch," the War Emergency Pipe Line, were built. Al Berlander as a superintendent on the latter got a lot of good

Ney 0234



Warren, Steve and Ken—in 1944 at the height of their war production and construction responsibilities.

experience with big-diameter pipe for his postwar work in Arabia. These contracts covered the period 1941-1943.

1941-'45 Refineries—in the U. S. Bechtel-McCone built fourteen during the war

Bechtel-McCone's refinery engineers and field crews kept going around the clock, erecting plants to produce a variety of petroleum products—a de-waxing plant and an asphalt plant at Oleum for Union, a Houdry unit at El Segundo and a lubricating oil plant at Richmond, the latter two for Standard. All were built in 1941 and 1942. Add to these, between that time and the end of the war, ten more refineries of eight basically different types, engineered or built or both, for six major oil companies. Two were butadiene plants supplying products for the manufacture of synthetic rubber. The biggest refinery of all was a complete 100-octane aviation gasoline plant engineered and constructed at Richmond, California. U. S. air power grew tremendously from mid-war on. Every minute counted in the race to keep the supply of aviation fuels abreast of increasing naval and military requirements. Bechtel-McCone's men held up their end—the big 100-octane plant at Richmond went "on stream" just eleven months after construction began. A fine record for Heinie Hindmarsh, Harry Benner, Al Orselli, Jim Brady and the others, on a job complicated by extensive excavations and foundations, some of them put down through deep tidal mud.

Jobs by group members included a mystery project

As group partners the Bechtels participated in construction of the Los Angeles Harbor Breakwater, of docks at Mare Island Navy Yard, others at San Diego and Pearl Harbor, of the Norfolk (Arkansas) Dam and powerhouse, and excavations at Miraflores Locks in the Canal Zone. Another job, done by Morrison-Bechtel-McCone, helped prepare production facilities that dealt the crowning blow to Japan, although at the time the contractors had no idea why they were building big storage tanks at Hanford, Washington. Along with the rest of the world, they found out later. The tanks were for the plutonium project of Manhattan District, key production center for the atom bomb.

If it needed further substantiation, the group idea certainly proved itself during these years, especially from the standpoint of its members' capacity for work. Two more projects remain

Ney 0236

before the inventory of war construction is complete. They were totally dissimilar. Each was the largest of its kind, both presented some of the knottiest problems engineering brains had been called on to solve. They were, respectively, the previously-mentioned Canol Project and the Birmingham Aircraft Modification Center.

1942-'44: Canol opened a new frontier

"Canol," wrote its historian, Richard Finnie, "is an epic of the North, and parts of the North where, in the words of Robert W. Service, 'the mountains are nameless and the rivers all run God knows where.' But Canol is also a war story." It became one of the biggest pioneering jobs of all time, growing out of the enemy's threat to Alaska in the spring of 1942. Nor was the threat remote. Less than one month after construction began on Canol, the Japs moved into the Aleutians. Two conditions were essential to a successful Alaskan defense: access to the United States by a land route and a self-contained petroleum supply. Both called for quick action. Prior to completion of the Alaska Highway not a truckload of supplies could get to the Territory by land; before Canol, not a drop of gasoline or oil.

When the Army's Corps of Engineers got the green light on the Canol Project late in April, 1942, they invited three firms to undertake its construction, W. A. Bechtel Co., H. C. Price Co., and W. E. Callahan Construction Co., an old line Dallas and Los Angeles concern. In May a contract was executed between the War Department and Bechtel-Price-Callahan, a pro-tem partnership of these three firms and six associates, among them Bechtel-McCone, J. H. Pomeroy & Co., Inc., Gunther and Shirley Company, and R. A. Conyes. The Standard Oil Company of California was named to consult on design and construction, and the firms of J. Gordon Turnbull and Sverdrup & Parcel were retained as Architects-Engineers.

One tenth of North America for a jobsite

On May 27th the advance guard of the construction forces reached Edmonton, which was made headquarters. To the north waited the biggest of all jobsites, much of it unexplored, in the Canadian Territories of Mackenzie and Yukon, and in Alaska. The supply route reached from Edmonton to Waterways, down the Athabaska River to Athabaska Lake, down

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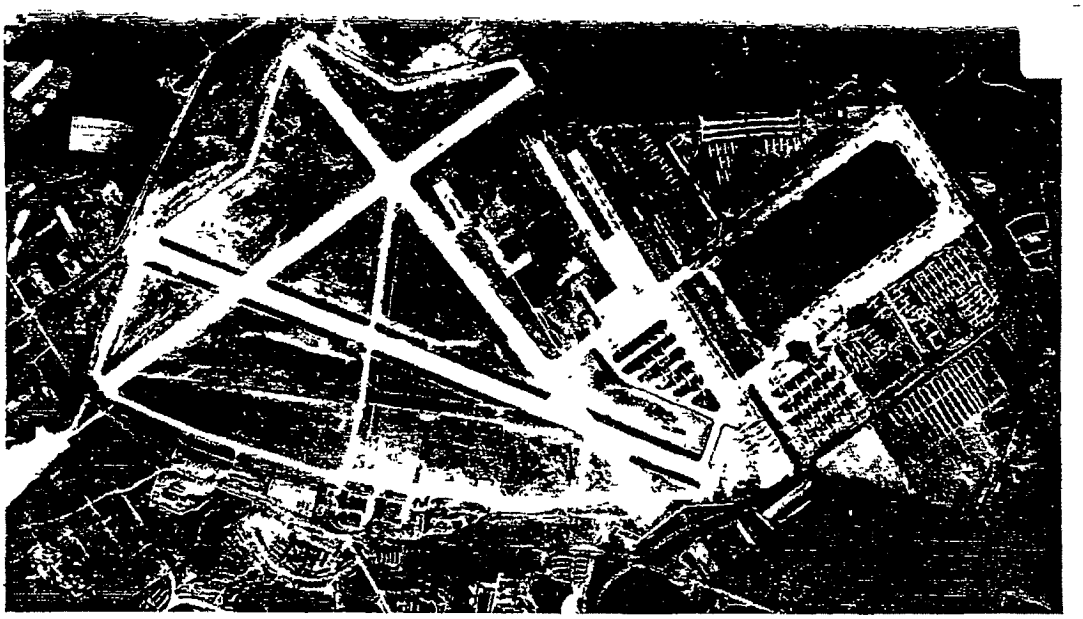
the Slave River, across Great Slave Lake, and on down the Mackenzie River to Norman Wells. "Down" means down the rivers, therefore to the north. The northern leg from Edmonton to Norman Wells comprised a route by rail, water and portage of more than fourteen hundred miles. From Norman Wells the pipe line started west, went five hundred miles over the Mackenzie-Yukon Divide to Johnson's Crossing on the Alaska Highway, along the Highway eighty miles to Whitehorse, then north six hundred miles to Fairbanks. As supplements, a pipe line was built over White Pass from Carcross sixty-seven miles to Skagway at deepwater, and another—a gasoline line—from Carcross eastward to an air field at Watson Lake, a distance of two hundred sixty-five miles. In all, here was a man-sized job—almost twelve hundred miles of main line, more than two hundred thirty miles of branch lines, with pumping stations along most of the route, plus a refinery, a tank farm, and storage facilities at Canadian terminal points and in Alaska.

Communications and supply—biggest headaches for the builders

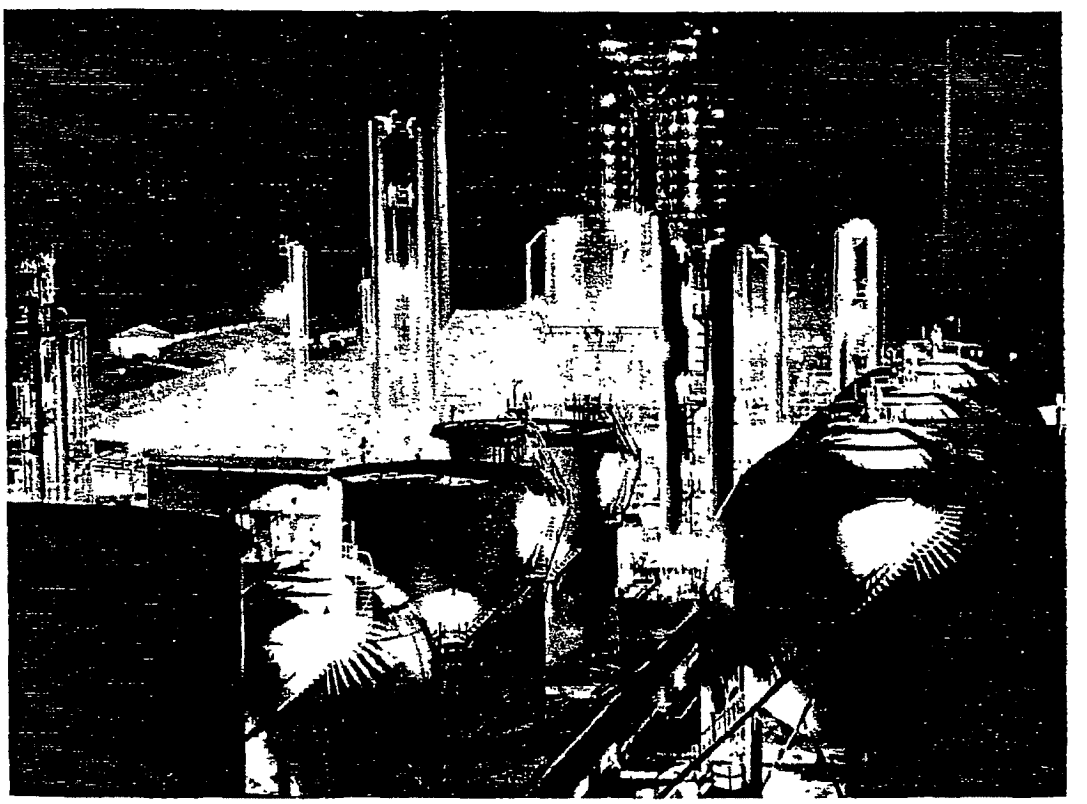
These specifications covered only part of the task. By far the larger part was the job of moving men, equipment and supplies through a vast primitive empire, and setting up camps and communications. Here, in a cold war that was really cold, was a problem in logistics to the tenth power. Sometimes exploration kept only one jump ahead of transportation, and transportation barely abreast of construction. All this, incidentally, took place in rugged country under extremes of weather that Canol veterans will never forget. Mosquitoes, flies and gnats added to the discomfort. During the winter even daylight ran short in this sub-Arctic wilderness. There was muskeg to overcome—soft, soupy sinks of decaying vegetation that swallowed everything poured into it. Permafrost was another unfamiliar hazard—frozen subsoil that could not be thawed but must be insulated and covered. Miniature glaciers formed where water from warm underground springs came to the surface, and built up layers of ice that halted traffic.

To solve the supply problem a complete system of inland waterway transportation was set up consisting of two thousand miles of access roads, numberless bridges, and a chain of

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Birmingham—12,000 feet below sprawls the wartime Aircraft Modification Center built and operated in Alabama by Bechtel-McCone.



One of many Bechtel "musts"—a war-essential aviation gasoline refinery at Richmond, California.

brought the United States and Canada still closer together."

A study in contrasts

Canol and Birmingham furnished the biggest contrast of all the wartime jobs. "Birmingham" means the Aircraft Modification Center, built and operated in that Alabama city. Canol called for ingenuity. So did Birmingham. But whereas Canol's problems were mainly heavy construction problems calling for brainwork plus fortitude and brute strength, Birmingham's involved planning, engineering, and scheduling with the precision of a watchmaker. Because first of all it was a job for engineers, the Birmingham project gravitated to the Bechtel organization which strongly emphasized the engineering function—Bechtel-McCone, with John McCone taking the top responsibility.

1942-'45: Aircraft modification

Under a December, 1942 contract with Defense Plant Corporation, BM as group sponsor, constructed the facilities on a two hundred eighty-five acre site. The main building covered approximately one and one-half million square feet of floor space, and other structures accounted for four hundred seventy thousand square feet of additional area. This contract also included installation of utilities, storage tanks and equipment for production.

A stiff test of engineering skill

The modification of aircraft began in February, 1943, months before the big plant was complete. Here was something entirely new, requiring mechanical engineering skill of a high order, precise scheduling, administrative ability, and flexible minds able to handle quick changes as part of the day's work. The purpose of the Aircraft Modification Center was to take planes fresh from the production lines of the aircraft factories and adapt them to new tactical requirements or special geographic conditions. Many times the question was asked —"why build planes, then tear them down and rebuild?" The answer—necessity. Actually, it was the only way to avoid sweeping changes in the original production lines—changes involving delays for re-tooling which would have nullified the entire plane production program. Consequently, the men who had built dams and oil refineries and powder plants took responsibility for a brand new technique—and sent Perry Yates, who had seen service on all these types of work, down

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to Alabama to modify war planes. And as they had done time and time again when new problems arose, they rounded out the staff with the specialized technicians this particular type of work required.

Precision manufacturing in volume

Modification meant major changes, which averaged about ten per cent of the man-hours required to produce the original planes. To Birmingham came a large proportion of the bombers from Willow Run, and before long, from other plants. At the peak, eight thousand eight hundred employees were on the payroll. Altogether, five thousand seven hundred ten planes were modified for the Air Corps in two and one-half years of operations. B-24s led the list with thirty-eight hundred, B-29s were in second place, with more than fifteen hundred. Everyone remembers the pride Americans took in the sleek big B-29s after this bomber design was taken off the secret list. And everyone in Bechtel-McCone's San Francisco and Los Angeles offices remembers the thrill when the first photographs of these big beauties arrived from Birmingham. It brought home the realization of an important share in the mounting U. S. air supremacy.

The rest of Birmingham's output was made up of work on four other types of planes, C-109s, P-38s, A-26s, and M2Xs. In October of 1943, production commenced on the fabrication and assembly of B-24 wings for the Ford Motor Company. More than six hundred sets were manufactured at Birmingham. And before the plant closed at war's end, BM went into the automobile business. The final Birmingham contract was for the remanufacture of the Army's quarter-ton trucks, better known as Jeeps. Five thousand six hundred went through and came out like new, plus modern features to suit changed requirements. In addition, one thousand Chevrolet trucks were assembled for the Army, and a large number of pieces of miscellaneous automotive equipment put back in first-class shape. So Birmingham, which began on the ground with the pouring of concrete and took to the sky to implement U. S. air power, came back to earth to revitalize motor vehicles.

May 7, 1945: The Germans give up

In Reims, France, at 2:41 a.m., May 7, 1945, the Germans signed an agreement of unconditional surrender. Only the

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mop-up in the Pacific was still ahead, although as late as June, President Truman called for doubling the western forces. It was not necessary. On August sixth the first atom bomb fell on Hiroshima and the next day bomb Number Two wiped out most of Nagasaki. A week later Radio Tokyo broadcast the Japanese surrender offer and enemy officials surrendered officially in Tokyo Bay on September 2.

September 2: V-J Day

Victory was complete. The whistle blew on construction for war, only clean-up and terminal negotiations remained to finish the job. Identified with no single war project but advisory on several, were three members of outside firms who were invited into the highest councils of the Bechtels. Two of them, John L. Simpson and Robert L. Bridges, later became Directors of Bechtel Corporation. The third was Gordon Johnson, like Bob Bridges a partner in Thelen, Marrin, Johnson and Bridges, Attorneys-at-Law, and a valued aide to the Bechtels during the emergency. All three had been associated with the business before the war, but the growth of activities after Pearl Harbor greatly increased their opportunities for service.

The counsellors—Simpson, Bridges, Johnson

John Simpson was well qualified to advise on decisions involving major policies, finance, and foreign operations. He was a transplanted Californian, a native son and U. C. graduate in the class of '13, out of Woodland via Berkeley and San Francisco to New York, his headquarters as Vice President of the J. Henry Schroder Banking Corporation, international financiers. His judgment provided the benefit of an exceptional background in finance and world commerce. Bob Bridges was engaged principally with contracts and tax matters, in which he worked closely with George Walling of the Bechtel organizations. The job of winding up the war contracts was especially heavy. On this, Bob was aided by Mynderse Van Hoesen of the same law firm. Gordon Johnson's contribution was in the field of labor relations, mainly as counsel to, and a teammate of Heinie Hindmarsh. John Simpson, Bob Bridges and Gordon Johnson each brought to management special abilities of a high order which had a direct bearing on the successful war record—another case where the custom of cultivating a

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reserve of key men paid dividends when the right time came.

The war years: not always smooth

One final accounting remains to complete the record of the war years. The foregoing report has been confined to the larger aspects of the constructors' activities. Since the larger view was overwhelmingly good, the story gives the impression of a series of engineering triumphs amounting virtually to superhuman performance. The first people to reject this inference would be those who did the job, for it is wholly foreign to the competent, down-to-earth thinking that made their accomplishment possible. There were rough spots, discouragements, some mistakes. There were times when employees' tempers gave way to the incessant pressure of emergency schedules. On several occasions the top men arrived at divergent conclusions on policies and procedures, differing as strong personalities will. The important thing was that when a decision was made, all of them accepted it wholeheartedly. Both within the Bechtel organizations and within the group partnerships there was one inviolable rule—put the cards on the table, and thereafter give the winning hand full support.

Again democracy works

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CHAPTER VIII

VICTORY was not final until the Japanese accepted surrender terms on August fourteenth. But the signs were clear to the war contractors much earlier, and by the start of 1945 their plans for conversion were under way. Certainly the change to a peace economy required no other type of business to make greater adjustments. For the Bechtel organizations in particular, the year marked the end of one cycle and the beginning of another. The functions and activities of the two firms were consolidated into one. And three of the four principal executives, Warren Bechtel, Kenneth Bechtel and John McCone, retired from active direction in the engineering and construction business. So too, did Steve Bechtel, for about one year.

1945: Conversion to peace

Warren Bechtel, being the eldest of the brothers, had been in harness the longest. He always had been an outdoor man with a liking for construction at first hand, living and working out on the jobs. But growth had shifted top responsibility from project direction in the field to over-all management. So, after thirty action-packed years climaxed by his fine performance on the three big copper mines, Warren decided to take time out. This he did, while still managing to keep tab on the newer developments. And logically, for he had a large part in the Bechtel organizations' upbuilding, and the works constructed under his direction are among the most substantial in the family's inventory.

Warren A. Bechtel, Jr.

Kenneth Bechtel's farewell to construction, like Warren's, came after an outstanding record in war service—as the President of Marinship Corporation. In 1945 he moved his operational base over to Industrial Indemnity, full time. The two men now in charge of Bechtel administration and finance, Bill

Kenneth K. Bechtel

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Waste and George Walling, have good reason to appreciate the solid groundwork Ken laid during his years of stewardship. That he could discharge the responsibilities put on him by expanding operations in engineering and construction, and simultaneously shape the insurance firm into the State's largest private carrier of its kind, shows that he received his full share of the family vitality and ability to think straight under pressure. During all this busy period and since, he gave liberally of time and effort to the Boy Scouts of America. He has been elected National Vice President, to membership on the National Executive Board, and Chairman of Region Twelve. These are working jobs, not mere titles. Ken did not leave his first love because it wanted him less, but because flourishing Industrial Indemnity needed him more. And because there his demonstrated skill in administration and finance found a wider field for expression.

John A. McCone

At war's end, John McCone took a major role in the adjustment program, particularly on termination agreements made with the Government on the Calship and Birmingham contracts, and in the eventual sale to private interests of one Joshua Hendy plant. The numerous and complex problems involved in these tasks required a vast amount of paper work, a great deal of patience, and negotiating skill of a high order. The issues at stake were large and important, their satisfactory resolution took time and the direction of a key executive. The Joshua Hendy interest, in particular, called for John McCone's close attention. In addition to these activities, he accepted membership on the Air Policy Commission at President Truman's invitation. Thus his service to the country was continued after the close of hostilities, and his experience made available in the formulation of the future national air policy. During the trying years when the Bechtels might have wished themselves able to be several places at once, John furnished additional leadership of their own caliber. Without him the accomplishment inevitably must have been less.

1945: Resources consolidated

The organizational changes of 1945 were changes of evolution, brought about in consequence of orderly growth. The separate firm of Bechtel-McCone, originally formed to spe-

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cialize in petroleum refinery engineering and construction, had spread to include allied types of work. Now, readying for the requirements of postwar operation, BM's resources of brainpower and experience were brought together with those of the older Bechtel entity in a single, brand-new firm. To use an overworked word—the new organization was "streamlined" for greater efficiency and coördinated control, in a form like that of other large American firms—a corporation with divisions engaged on the separate classes of work.

Bechtel Brothers McCone Company

The new corporation was Bechtel Brothers McCone Company, soon familiarly known as "BBM." Steve Bechtel was on the directorate, along with Kenneth and John McCone, but like them, he retired from the active management of operations. This job went to six Bechtel veterans—Bill Waste, BBM's President; Vice Presidents Van Rosendahl, Heinie Hindmarsh, Perry Yates and Jerry Doolan, and Secretary-Treasurer George Walling. Steve's business interests had grown through the years. He wanted time and freedom to explore the postwar future for foreign construction. In addition, he was occupied with the wind-up of the war projects, and among his other interests were an equipment company, an Oakland property management operation, and two steamship companies—Pacific Tankers, Inc., and Pacific Far East Line, Inc. Also, he had been elected to the Board of Directors of the United States Line, and participated in several other business enterprises.

Stephen D. Bechtel

Three foreign refineries, transitional from war to peace

Two years before the end of the war, and therefore, before the organizational changes noted above, construction started on the first two of three foreign petroleum refineries, and in March of 1944 the engineering began for a third. They were, respectively, a 100-octane gasoline refinery at Curacao in the Netherlands West Indies built by a N.W.I. corporation owned by Bechtel-McCone interests and Raymond Concrete Pile Company for a subsidiary of Shell; the ninety thousand barrels-per-day 100-octane gasoline plant constructed for The Bahrein Petroleum Company Ltd., on the island of the same name in the Persian Gulf; and the refinery engineered and built for the Arabian American Oil Co., at Ras Tanura, Saudi Arabia, the two latter projects by Compañia Constructora

Bechtel McCone, S. A. All three were put up under the direction of Heinie Hindmarsh. Reference to them has been reserved until this point in the story because, although started during the war, they were forerunners of the present era of Bechtel activities. Especially the two in the Middle East—representing a development of great significance to future preparations for national defense, to the conservation of U. S. oil reserves, and to coming events for the Bechtel organization and its associates.

1945: The job list

Similarly, almost all of the domestic work that got under way in 1945, before the August surrender, belongs in the post-war inventory. An exception was the Army contract for Jeep remanufacture at San Leandro, California. The truck repairs were made there on ground historically appropriate to this type of work, for this was the property where Bechtel employees built the first motor truck dump body a full generation before. Otherwise, the principal 1945 projects were authorized by private owners in anticipation of production for civilian markets.

Refineries and chemical plants

Three processing plants and a major industrial project led off the year. For Western Electro-Chemical Co., a perchlorate plant was engineered, and built at Henderson, Nevada. This was a return to Hoover Dam country, for Henderson is close by Boulder City. It was called "Railroad Gap" in those days. In February a contract was awarded for Phillips Petroleum's toluene plant at Borger, Texas, and shortly thereafter, General Petroleum Corp. called in the organization to engineer and build an absorption plant at Riverdale, California. In the field of refinery engineering and construction, the predecessor Bechtel companies had initiated in the two preceding years a maintenance service, similar in function to that provided in railroading for the Western Pacific, and embracing engineering, purchasing and construction. Such continuing contracts were put into effect by Associated Oil Co., at its Avon, California, refinery, and by the Standard Oil Company of California at El Segundo and Richmond.

The previously-mentioned 1945 industrial project was by all odds the largest to date. By "industrial" the Bechtel people mean buildings, equipment and facilities for the manufacture

of goods other than the products of petroleum or chemistry. There is good reason for the distinction. The petroleum and chemical processes require specialized training and skills peculiar to themselves, particularly within the engineering branch. Whereas other types of industrial plants, regardless of wide differences in purpose, impose somewhat related problems and consequently may be handled by the same group of engineers and constructors.

The big industrial job was the H. J. Heinz Co.'s food processing plant at Tracy, California. Heinz was an "early bird"—with the first major civilian project authorized since the war's outbreak under the Government controls then in effect. Ground was broken March 26, 1945. By October almost five hundred were employed on the contractor's force. Construction involved a large masonry job—the laying of one million bricks. An idea of the size of this Heinz "57" operation was contained in the fact that a ton of tomatoes can be processed every minute of the working day in season, and comparable amounts of other foods. One of the most impressive features was the manufacturer's strict adherence to self-imposed quality standards. All food lines were of stainless steel. The big evaporators, the peelers used for strained foods, the beautiful cookers and kettles combined to make a "dream kitchen" on a gigantic scale. The Bechtel organization not only constructed this building and its supplementary facilities—it also made the precision installation of the equipment, laid more than nineteen miles of in-plant piping, and did a big wiring job. Soon after completion Heinz called the constructor back for an encore, on a substantial enlargement program.

A ton of tomatoes per minute

In December the pipe-liners matched the Industrial Division's first postwar project with the first major postwar pipe line to be built in the west. For Standard Oil Company of California they laid the one-hundred-seventy-six-mile Kettleman Hills-Los Medanos twenty-inch line through the San Joaquin Valley, near the route covered ten years before by Bechtel crews under George Colley. This time Marinship alumnus Ray Hamilton returned to his earlier love to handle the pipe-line negotiations. Bob Bowman and Bill Hanna ran

1945: Kettleman Hills to the Bay

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the job. Bill, who had cut his eye teeth on pipe-line work for the Bechtels under George Colley down in Venezuela, now followed George's footsteps up the same old California Valley.

From the time of their first pipe line, the Bechtel organizations have been close to new and improved construction methods, either as the actual developers, or as early users. The Kettleman Hills line now introduced three procedures, in line with the progressive attitude of Standard Oil Company's top engineers, Harry Hall and Marshall Evans. These were semi-automatic pressure welding, the use of electric-weld pipe having extra-high yield points (called "high strength pipe"), and Gamma-ray photographs for spot-checking weld quality. One hundred miles of the line was Somastic-coated. When the Kettleman line was in operation the Stanpac gas line, previously converted to oil, was changed back to gas, a line which had become axiomatically a Bechtel construction responsibility.

Finally, 1945 was a significant year from another standpoint. It ushered in the great expansion program of the far western utility companies, and the first major power contract in this program for the Bechtel organization. Southern California Edison Co. selected BBM to handle the equipment adjustments made necessary by a change in frequency from fifty to sixty cycles. This job included engineering, purchasing and construction. Re-cycling involved literally thousands of changes throughout the entire electrical system, affecting equipment using electrical power in many kinds of applications. It affected not only the utility company, but a large proportion of its customers. An endless variety of problems arose to tax the engineers and constructors. One of them, as shown by a report from the field crew, illustrated both the nature of the work and its requirements. The report read: "The 1500-horsepower 360-RPM motor which is pictured (in the report) drives a sheet rolling mill. The mill was shut down at 12:30 a.m. on June 13th; the motor removed to a rewind shop where both stator and rotor were rewound to the new sixty-cycle design. New bearings were poured and the mill was put into operation at 12:00 midnight, June 22nd. We believe," the report concludes, "this should establish some sort of record!"

1945: Start of a 10-year cycle for the power utilities

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Work of this type, and the engineering and construction of facilities to generate and distribute the additional electric power, later became the function of the firm's Power Division. The concept of this Division grew out of the entire postwar power development, but started specifically with the frequency change contract. Perry Yates, present head of the Power Division, took charge of this initial contract, and his chief assistant on its execution was John Kiely, Project Manager. Kiely came from Calship, where he made an excellent record as Manager of Outfitting from 1942 on. His "frequency changers" gave a good account of themselves on this three-year project, as management expected when Kiely was put in charge of it.

The Power Division

The new year brought heavy activity in construction for industrial chemistry and petroleum refining. By 1946 BBM was well established as one of the largest firms doing this class of engineering, able to step in and deliver turnkey operations from preliminary study through process design to construction. In 1946 there were nine new contracts for large chemical plants and refineries, and a number of smaller jobs. The Industrial Division men, fresh from making an excellent record at Tracy, went to work on three major industrial plants. In a return to public work, construction began of a tremendous concrete siphon on the Friant-Kern Canal, a unit in the (California) Central Valley Project of the United States Bureau of Reclamation. As a group venture through partnership with the J. H. Pomeroy Co., work started on a large breakwater at Guam—Jack Pomeroy's men going back to this old stamping ground where some of their mates had been captured during the war. At Pittsburg, California, the same contractor sponsored group construction of a new tinplate mill and other facilities for Columbia Steel Company where WABCo had been active earlier.

1946: A big year for the process industries

BBM's process and refinery engineering staff had grown to sizable proportions, with experienced men in the key positions and specialized technicians to back them up. Early in 1946 Fred Meyer (whose appointment to the post of Chief Engineer was announced at the close of 1948) returned to the

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Bechtel organization from Japan. On this trip he headed a team in the Oil, Chemical and Rubber Section of the United States Strategic Bombing Survey. Cliff Pehl was another Bechtel man on the expedition. Also, BBM's construction side had developed strength to match its engineering—and the firm's resources of manpower were continuing to grow.

1946-'48: "Gasoline" from coal

From the standpoint of process design, the most interesting 1946 development was contained in a U. S. Bureau of Mines contract. It called for a multi-million dollar demonstration plant to produce synthetic motor fuel from coal. And it was put up at Louisiana, Missouri, where Bechtel-McCone built the wartime Missouri Ordnance Works. Engineering began in May, involving a large amount of exploratory work carried out in conjunction with Government specialists.

A coal hydrogenation plant never before had been built in this country. There was no precedent for the solution of problems concerned with extremely high operating pressures and the flow of liquids and coal paste. Consequently, the design engineers had to develop new equipment. This job was high-powered pioneering, even though they had the counsel of experienced German scientists. Approximately two years were needed to complete the design. Plant construction began in May of 1947, and was carried out under Superintendent Jim Brady. Ray Russell was Project Manager. Some of the equipment was of enormous size, the ninety-ton converters, for instance. A great deal of it required totally new manufacturing designs. But the real feature of the plant was its extremely high-pressure piping—up to fifteen thousand pounds p.s.i.—which not only accomplished the necessary process functions but provided a safety margin well above that of European plants.

1946: Repeat performance in Missouri

Also at Louiciana, Missouri, but for the Army, anhydrous ammonia manufacturing facilities at the Missouri Ordnance Works were rehabilitated after a period of shutdown following the war. This was a real conversion to peace, enabling a powder-making facility to switch over to the manufacture of agricultural materials.

Late in the summer of 1946 work commenced on a sulfonate

project for Standard Oil at Richmond. Earlier in the year, an eighteen months program of engineering and construction was undertaken for the Shell Chemical Corp., at Pittsburg. Three crude oil units were started, one for Associated at its Avon, California, refinery; another for Standard at El Segundo and the third for the same owner at Richmond. Also for Standard, sulphur dioxide and acid treating facilities were built at El Segundo, and extensive alterations made on an alkylation plant near Bakersfield. An asphalt plant near Portland was completed for Shell; for Union Oil, BBM refinery men went to Cut Bank, Montana, and built extensions, where BMP years before had erected one of its earliest refineries. Condensed here into one paragraph are the reasons why BBM's refinery headquarters in San Francisco took on the appearance of Grand Central Station at five-fifteen!

1946: Action in the Refinery Division

The industrial men kept pace. On March 15th they received the first contracts for the facilities which manufacture the paper stock and print the Pacific Coast editions of *Time*, *Life* and *Sunset* magazines. These contracts covered precision installations of paper-making equipment in two plants belonging to Crown-Zellerbach Corporation, one located at West Linn, Oregon, and the other in Camas, Washington. This was the start of a circle, completed by the construction in Los Angeles of the west's largest printing establishment, the Pacific Press, where these magazines and the Los Angeles *Shopping News* are produced. The big "automatic" paper machines and the tremendous presses with their wheels and gears looked like something men from Mars might have designed. They did everything but think, and there was even some doubt about that!

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CHAPTER IX

THE Far West grew up during the war. People came by the hundreds of thousands to work in the shipyards and plane factories, but no one knew how many would remain once the gates closed at the war plants. Peace came, they stayed, found new jobs and sent for friends and relatives. Far from ending, the migration continued—swelling into the greatest peacetime population movement the world has ever known. People made markets, markets needed goods and services, which created jobs and buying power.

1946: The migrants stayed put

As far as the Bechtel people were concerned the west's new maturity brought a greater demand for petroleum products and power and food, and the means to supply them. In addition, large-scale steel production headed toward the Pacific. Jack Pomeroy's men, as noted, were helping Columbia at Pittsburg prepare to meet the increased demand for steel. Henry Kaiser, using war needs as a springboard, had entered into steel production with a new mill at Fontana in Southern California.

Now, in line with earlier construction by W. A. Bechtel Co., at Pittsburg, and the powerhouse built at Fontana, BBM heard from another steelmaker—one of the largest—Bethlehem. In April, 1946, construction started in Los Angeles on the expansion of Bethlehem Steel Corporation's production facilities there. Altogether, this program required an investment of sixteen million dollars, almost ninety per cent of the total going for construction in Southern California. Again it was a case of mammoth excavations and reinforced concrete foundations for the heaviest of heavy equipment, and again the delicate job of accurately setting tremendous machinery—problems that yielded to Bechtel experience. When it was complete, a sub-

Bethlehem Steel

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stantial increase had been made in western steel plant capacity.

From steel to the staff of life was an easy jump for BBM's industrial builders. With the Heinz plant behind them, they were ready to tackle their next food project. When it came along in October it was something special—the opportunity to design, engineer and build an all-new flour mill, new in concept, new in the almost automatic way it would operate. The customer was the Sperry Division of General Mills, Inc. Jerry Doolan headed the project, aided by John Byrne and Jerry Komes.

General Mills

"The mill of tomorrow" will set the pace for future flour plant design. It contains the first commercial installation of a machine that looks like a giant pantograph but actually unloads box cars automatically; of electrically-interlocked conveyors and elevators; of vertical screw lifts instead of the less efficient, conventional bucket elevators. Cleaning equipment not only washes the grain but reclaims feed stock. Protection is provided against explosion; the dust control system is a model; up-to-date solutions to the two age-old problems of milling. But the mill's over-all performance is its most important feature—the rigid maintenance of quality standards with rapid and economical production. On these, General Mills at Los Angeles is in a class by itself, able to manufacture everything from flour to breakfast cereals, biscuit mixes, and soups.

While the new Bechtel divisions grew apace, the men responsible for carrying on the older types of work were very much on the job. "Pipe liners" for example. The Kettleman Hills line was completed by summer; immediately the crews moved east to build lines in two states for the Stanolind Pipeline Company. In Missouri they laid eighty-two miles, and on jobs in Minnesota, a total of fifty-seven miles. The latter contracts included crossings of the Mississippi River.

Again—pipe lines in the mid-West

Construction of the Friant-Kern Canal siphon was a job in another familiar category—public works. This one was like going back to Dad Bechtel's time, and like some of the earliest contracts, it did not turn out so well for the firm, proving that contracting was still a hazardous business. Ted Panton negotiated it with the Bureau of Reclamation and started the work,

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1946-'48: River underpass —the Friant siphon

Johnny Shea's gang finished building this river underpass for a canal. The siphon is located in the dry hills of Fresno County, California. The canal is a part of the Central Valley Project that stretches to both ends of the State's agricultural bowl, from Shasta Dam south to Bakersfield. The Bechtel job consisted of excavating and building a reinforced concrete siphon, twenty-two feet in diameter, to drop the canal waters eighty-five feet under a foothill stream and then lift them to the normal canal level, in a total run of six hundred feet.

The going was really tough. During excavation the drillers encountered rock so hard that they thought they were using rubber bits. One disgusted old-timer said it might be a good idea to make new bits out of the rock itself! Weeks were lost waiting for appropriations. Congress, like other large bodies, sometimes moves slowly. But eventually the siphon took shape, as the concrete men poured around a collapsible steel slip-form which moved along a prepared runway from one position to the next. And they built big rectangular reinforced concrete transition sections at both ends of the line. Finally, in August of 1948, after two long years, General Manager of Construction Al Orselli reported the project complete, and all hands breathed a sigh of relief. The completed siphon, however, could be a source of satisfaction to those who built it, for it fell into place with other difficult jobs licked by perseverance and perspiration, though at a loss to the contractor.

—like the old days

Out on the Western Pacific during 1946, as before and since, BBM maintenance crews policed the mountainous one hundred and seventeen mile Feather River Canyon Route, and construction men added to the railroad's physical plant. When Cook Jack Pasman on the "Kitchen Car" banged his gong to "come and get it"—the old-timers knew an honored custom was still in force. As it had for forty years, good Bechtel food gave the men added zip to construct the passing tracks, the yards, culverts and bridges they built in this particular year.

1946: The traditional kitchen car

June 6, 1946: One more link was broken

In 1946 the final link with the earliest days was broken. Arthur V. Bechtel passed away in Oakland on June sixth. Dad's "kid brother" had served as a Director of W. A. Bechtel Co. until January of the preceding year. He had lived to see

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Steve Bechtel, Jr., pipe liner.

the family's enterprise grow and prosper. First as Dad's "extra right arm" and later as senior counsellor to the boys, he had contributed to its success. Co-founder, shovel runner, job boss, executive—his career paralleled the firm's rise. In sixty-three kindly and useful years, he had endeared himself to thousands—a man without peer for largeness of heart, for friendliness and sincerity. And his passing saddened everyone immeasurably, for there would never be another "Uncle Art."

Time sharpens perspective. Looking back at 1946, not even the volume and variety of work were as important to the firm's progress as the headway made in that year by its program of integration. For in the fall Steve Bechtel returned to BBM as President. At this time he and his associates in the firm acquired the interests formerly held by Kenneth Bechtel and John McCone. Like the fire horse who could be happy only in harness, Steve told BBM's officers how he felt about being asked to resume active personal direction, saying: "My chosen field has been and is engineering and construction. It is the most interesting, stimulating, and in my opinion, one of the finest professional and business fields." Those who knew how completely he lived for his work knew what an understatement that was!

October 9, 1946: Steve returns to active direction

Important decisions were made at the Directors' meeting of October 9th. Basic policies were defined and major duties reassigned as the organizational pattern took shape. Policy stressed the "target" system—concentration on selected projects. And the division of responsibilities was worked out with reference to skills and experience, in order to gain the maximum benefit from each person's ability. Dad Bechtel laid the foundation, his three sons added to it. Now over this base a framework for the future was put together.

The new year—1947—turned with the announcement of new company names. For domestic work: Bechtel Corporation. For work outside the United States: Compañia Bechtel, S. A.; for the Middle East projects: Bechtel International Corporation, and International Bechtel, Inc. Primary functions were established for the key men—Steve Bechtel in direct charge of all operations; Bill Waste over BCo's administration;

1947: New names: —Bechtel Corporation —Compañia Bechtel, S. A. —Bechtel International Corporation —International Bechtel, Inc.

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Van Rosendahl heading foreign activities as President of BIC and IBI, backed up by John Rogers and George Colley; Heinie Hindmarsh in charge of domestic construction; Perry Yates directing the power program; Jerry Doolan overseeing industrial work; the newest member of the executive group, Strib Snodgrass, in charge of engineering; John Byrne as Executive Engineer; George Walling for financial direction; Bob Bridges charged with responsibility for legal matters, John Simpson as Director and advisor. Into the picture had come Stephen D. Bechtel, Jr. "Young Steve" repeated his father's experience cycle—starting life in a railroad car, growing up and serving in his country's armed forces (but as a Marine instead of an Army Engineer), and now—a generation later—took his place in the business.

Young Steve may have thought he came into a far different organization than the one his father and uncles joined thirty years before. In size, scope and degree of organization—it was. But not in philosophy or principles, for Bechtel Corporation was simply the outworking of a half century of development. Its key people had been picked up along the way—Steve, of course, literally born into the business, the others at various steps, some at twenty years, some at ten, at five, and one only a little more than a year before this fiftieth anniversary of the family's service. When Bechtel Corporation came along it got them as seasoned men, so could fit each one into the right particular slot and go on its way as a complete, smoothly-functioning organization. The new firm had another heritage, for on top of experience and special skills, it inherited men who had absorbed a way of life. Because they made it their own, the tradition of Dad Bechtel was not to end but to live on.

Seasoned men

That was—and is—the lineup as this account takes temporary leave of personnel to examine the world's oil situation.

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Prelude to construction in Middle-East—Steve toured Marinship in 1944 with Prince Amir Faisal, Foreign Minister and son of King ibn Saud of Saudi Arabia. IBI has since undertaken a large overseas construction program for the petroleum industry in Saudi Arabia and adjacent lands, as well as extensive work for the King's government.

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CHAPTER



THE two top facts about oil are that its consumption has almost doubled in the past ten years and still climbs, and that most of it comes from shrinking U. S. reserves. This situation presents the alternative of developing new oil fields elsewhere or of draining the American reservoir. Of the approximately seventy billion barrels constituting the world's oil treasure, the United States holds an estimated twenty-one billion. South America has less than half this amount, Europe a mere trace, the U.S.S.R. probably six billion barrels and the Far East about one billion. The rest, approximately thirty-two billion barrels, lays under the windblown sands of the Middle East—which means the countries surrounding the Persian Gulf —Iran, Iraq, Saudi Arabia, Kuwait; and the island of Bahrein.

1947: The world's oil

Oil products to feed the mounting horde of automobiles, trucks, busses, tractors, diesel locomotives, furnaces and oil heaters, kept U. S. wells and refineries busy in 1947 supplying about sixty-two per cent of the world's total, while the oil-rich Middle East in its then stage of development produced only a little more than ten per cent. It is true, of course, that seventy-five of the eighty per cent increase in oil consumption since 1938 was absorbed within the United States. But the era of power development was still to come elsewhere, deferred but not cancelled by the dislocations of war and reconstruction. And for the first time since 1925, in 1948 this nation became a net importer of oil and its products. Obviously, the time for the development of foreign petroleum reserves had come.

—where it came to the surface

The necessary action was taken. World oil leaders, American and British companies in the vanguard, engaged on a far-reaching development program in the Middle East. Their

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The Middle East program

activities were limited geographically to the area of tested reserves located in and adjacent to the basin of the Tigris and Euphrates Rivers and the Persian Gulf. Of the five Middle East oil regions, three became sites of Bechtel engineering and construction operations, in a liaison formed between the contractor (a Bechtel-activated group project), leading American and British oil interests, and the respective governments of the countries involved. Set up to carry through this vast program were Bechtel International Corporation and International Bechtel, Inc. These ventures resulted directly from Steve Bechtel's concern with the opportunities he long ago envisioned for service to the petroleum industry, his prompt postwar activities, and the performance records made by members of the team carefully assembled for this specific purpose.

The line of demarcation between the two firms, Bechtel International Corporation and International Bechtel, Inc. (BIC and IBI), is that the former operates entirely within the United States, on engineering, design, and procurement; whereas IBI does the field engineering and all construction. Steve Bechtel is Chairman of the Board of both companies, Van Rosendahl President of both. Directors include these two top officers and group partners Bob Conyes, Charles P. Dunn (of Morrison-Knudsen), Jack Pomeroy, Hal Price, Alden Roach, and Jack Sverdrup; and two additional men from the Bechtel organization: George Walling and Strib Snodgrass.

The framework for the group organization was put together during 1946 and announced during the spring of 1947. In January of the latter year, Steve went to Arabia, accompanied by Bob Conyes, Jack Sverdrup and Paul Piggott. By March most of the people in the Bechtel enterprises knew what was up, but for official notification they had to wait for the April issue of their lively house magazine, *Bechtel Briefs*. "Briefs" broke the good news, admitting with editorial candor that "when we last went to press, we knew all the time that BC and its partners had a big chunk of the Arabian pipe-line job—no less than six hundred fifty miles with four pump stations thrown in for good measure. But we had to observe a bit of protocol or whatever they call it in the Middle East, and there

BECHTEL BRIEFS *scooped on the Arabian news*

we were right up against the gun with the biggest news since Boulder Dam all set up in good-looking type and the order comes through—to scratch the horse!"

Problems of pipe-line construction in the desert

Steve Bechtel returned to observe, "I am more convinced than ever of the accuracy of the statement by Bert Hull, President of Trans-Arabian Pipe Line Company, that the chief problems facing those who tackle the job of conquering the Arabian desert are 'water, transport and morale.' You can't help but get this impression when you realize that this thirty-inch, four hundred thousand barrels-per-day line will be the mightiest pipe line ever laid—bigger than any oil line yet completed and almost as long as the 'Big Inch' line running from Texas to New York.

"The task of engineering and constructing this line in a region that hasn't a single permanent structure along its entire route from the Abqaiq field (the pipe-line origin) to beyond the Trans-Jordan border eight hundred miles away, is one that will involve some eight months for planning the line and making the necessary arrangements in the way of men, materials, equipment, transportation, living quarters; and about two years to lay the line itself and to build the pump stations.

Old friends team up again

"I am sure that you will be interested in knowing," Steve told the Bechtel personnel, "that joining with us on the Arabian pipe line program will be our old friends Morrison-Knudsen Company, Inc., Boise, Idaho; H. C. Price Co., Bartlesville, Oklahoma; Bob Conyes, Oakland; and Sverdrup & Parcel, St. Louis, Missouri.

"In addition to the pipe line and public works projects in Arabia (for the Saudi Arabian Government), there is for immediate construction the building of a port facility at Dammam with a fourteen-mile railroad connecting Dammam and Dhahran.

" . . . potentially the biggest development . . . "

"In the Middle East program I cannot help but foresee tremendous possibilities pointing towards potentially the biggest development of natural resources ever undertaken by American interests."

The facts overwhelmingly support Steve's closing appraisal, and his group's part of the task has since grown beyond even

the big job he defined above. This is how it worked out from inception through 1948 at five locations:

1947-'48: "Tapline"

"Tapline" is a short way of saying Trans-Arabian Pipe Line, the eleven hundred mile trunk line under construction from the Persian Gulf to the Mediterranean Sea. When completed, this great desert river will deliver over four hundred thousand barrels of oil daily at Europe's back door. Its source at Abqaiq is the largest of four fields developed in the area; discovered in 1941, and by 1948 producing two hundred thousand barrels per day from only eighteen wells. Tapline construction dates from July 12, 1947, when the first IBI party reached Ras el Misha'ab. Within six months this outpost grew into a miniature city of seventeen hundred people to become a base camp and chief receiving port. Here an old construction gag came to life, the familiar "skyhook" every beginner was asked to find, along with left-handed monkey wrenches and paper stretchers. This particular skyhook unloaded ships three miles out in the Persian Gulf—by towers that went to sea, over which a high line was strung, carrying a machine that looked like a cloud-borne lumber carrier—a veritable aerial jeep.

In the fall of 1947 George Colley arrived to take charge of Tapline's construction, following an interim period of "modernization" after three years in the Borneo prison camp. IBI's Vice President again lined up old sidekick Al Berlander as Construction Manager. Genial Don Roberts, war-developed Bechtel man, carried the load as Tapline's Chief Engineer until ill health forced his return to the States. Bob Bowman was Superintendent; Harry Waste, Project Engineer; and a young veteran of many Bechtel camps, Eddie Zecher, headed the administrative staff.

Channeling "desert rivers"

By mid-November pioneering across the desert was under way. In February, 1948, construction began on the Abqaiq to Qatif line. Big thirty- and thirty-one-inch pipe sections came in at Ras el Misha'ab, were welded into ninety-three-foot lengths, and took off across the sand by truck and trailer in forty-ton loads. An interesting feature of the construction—twenty-four miles of restrained pipe line were laid above ground, half mounted on steel bents, half on concrete pads, and held down

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by bolted ring girders. The Manager of BCo's Pipe Line Division, Ray Hamilton, went to Saudi Arabia "on loan" as consultant, once more working closely with his one-time Standard Oil boss, Harry Hall, Vice President of Tapline, a veteran pipe-line planner and former Chief Engineer, Standard Oil Company of California. The Abqaiq-Qatif line was completed by the end of April, 1948, whereupon the pipeliners laid an eighty-mile line to Abu Hadriya. After that they were on their way to Hafar el Batin, first leg on the long route to the Mediterranean Sea.

Nature still a tough foe

Where the heat stays well above one hundred degrees except when going higher, and men are put to it to cope with the flies (not to mention inquisitive scorpions)—where sandstorms can scrape off a metal surface or a man's whiskers as fast as a shot-blast machine, and rare desert rains drop like Niagara—the development of fast, efficient pipelaying methods is not only economically expedient, but a humanitarian necessity as well. The ingenuity shown was a credit to the policies of B. E. Hull, Tapline's President, and his organization.

Once again, lessons learned as far back as Hoover Dam paid off in Saudi Arabia. The problem of cooling truck engines was licked by using two radiators; all equipment received "double servicing," and big soft sand tires were necessary to get rolling stock across the shifting dunes.

Aramco contracts

Trans-Arabian Pipe Line Company is wholly owned by Arabian American Oil Company, familiarly "Aramco." It operates in Saudi Arabia over an area larger than the State of Texas. American oil drillers named it "Wajid mafi" which is Arabic for "plenty of nothing," an apt description of its barren terrain. In spite of the area's "nothingness" one result of Aramco's activities was the mushrooming of Dhahran into the largest American colony between France and the Philippines; another was that this community became the world's first completely air-conditioned city.

Aramco has one refinery, the previously-reported Bechtel-built plant at Ras Tanura. Its original capacity of fifty thousand barrels per day has been increased to more than twice that amount. IBI did the expansion program, but the firm's assign-

ments were not confined to it alone. An all-around group was assembled to plan, engineer and build docks, a railroad, housing and industrial buildings, utilities, and all that goes to make a complete self-contained development in a far country. J. W. "Walt" Hillman, five-year Bechtel veteran in the Middle East, supervised the work as General Superintendent. Later, Lou Killian, another "Camel Legionnaire," came down from Ras el Misha'ab to become Project Manager.

IBI men at Dhahran

Dhahran, headquarters for the constructor's principal field officers, became the nerve center of all Arabian operations. Head man Rosendahl spotted IBI Executive Vice President John Rogers into the picture early. Rogers was no stranger to these parts, for he went from the wartime Arizona copper projects to Ras Tanura on construction of the original refinery. Dhahran is also home base for Canol veteran Rudy Grammater, IBI Treasurer and administrative chief, formerly Building and Loan Commissioner of the State of California, and since 1941 a Bechtel administrative executive.

One of the far-reaching effects of Aramco's oil development was that it became, by design, a human development as well. More than ten thousand Saudi Arabs acquired new crafts and skills. The progressive monarch of this ancient land turned to good account a generous share of the income his kingdom received from the oil company, and many of the fruits of King ibn-Saud's wisdom and planning were apparent in the work IBI undertook for the Government of Saudi Arabia.

Modernizing an ancient civilization

The constructor received orders to build a deepwater harbor, highways, electrical utilities, a telephone system, hospitals, hotels and other large buildings, airports, and also to purchase necessary equipment and materials. Electrical work included the design and construction of a steam power plant and distribution system for the capital city of Riyadh, to be followed by similar facilities at Jeddah, Mecca and other centers. Jeddah, principal seaport and the seat of foreign legations, is being transformed into a thriving business metropolis. A new port and pier replaces its former shallow harbor and airports were built at both Jeddah and Riyadh. The prime mover in this modernization of a nation, after the King, is His Excellency

the Shaikh Abdullah Sulaiman, Minister of Finance. Executives of IBI point out that his long-range vision and financial planning will transform Saudi Arabia into an up-to-the-minute nation, with higher standards of living for all. That widely-experienced senior officer, BIC's Vice President Earl F. English, looks after this work for the King as the man in charge of its many ramifications within the United States.

Bahrein

From Saudi Arabia over water to Bahrein Island in the Persian Gulf is only a twenty-five-mile jump. Bechtel men had been there from the beginning—on the refinery. Bahrein Petroleum Company Ltd., retained IBI to enlarge it and carry on continuing development work. Most of the men heading Bahrein construction in 1948 were six-year veterans with the Bechtel interests on the island. General Superintendent Bill Hackler rubbed elbows with a supervisory staff of Americans who had been on the ground so long they felt like natives.

They had to be good

Americans going to Arabia were "five thousand dollar beauties," for that was the investment in processing and transportation. Small wonder that many were called but few chosen—or that those who passed the careful screening here at home included the best craftsmen in the business. And the big percentage stuck, many veterans signing up for additional "hitches" in the service of the "Camel Legionnaires."

From Bahrein the story moves up the Persian Gulf to the small independent Arab kingdom of Kuwait, lying between Iraq and Saudi Arabia. Kuwait is ruled by Shaikh Sir Ahmed al Jabir. Development here is by the Kuwait Oil Company, Ltd., jointly owned by British and American oil interests. Burghan field, discovered in 1938, may prove the world's largest when fully developed.

The Kuwait staff was headed by another Arizona copper plant man, Clark Rankin, as Project Manager. He was ex-Canol too, as was Ro Ross, Administrative Manager at Kuwait. The key to this construction was versatility—like their neighbors on the Aramco contracts these men got "a little of everything" in their work orders.

A great deal of preliminary work was necessary—from problems of food and water supply to the logistics of big-scale

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The job in Kuwait

construction. At Shuwaikh a terminal was constructed for water-laden tankers; barges built; and a water line laid to Ahmadi, site of an oxygen plant. A jetty was built at the capital city, also named Kuwait; at Burghan (the oil field) IBI men installed machinery for a shale grinding mill, set up equipment for pump stations, and went to work on the gathering system. This was a real network of pipe, six hundred miles of it. Buildings and housing were erected at Fahaheel; a boat harbor, an oil pier to handle six tankers, a cargo pier, and a four-thousand-foot trestle. Roads, a quarry, harbor dredging, breakwaters, marine loading lines, a powerhouse, and other jobs filled out the agenda.

London

The work was so extensive and varied that close, constant touch with the London offices of the owners became an essential part of it. Accordingly, IBI opened an office there, and sent over Bob Digges, until then Bechtel Corporation's Administrative Manager, to serve as chief liaison officer with the British interests. This former Marinship executive brought a fitting background to his new responsibility.

Opportunity—on a big scale

The foregoing summary of the extensive Middle East projects—necessarily short on detail—is demonstrative of the extent to which leading American and British oil companies were readying the supply for future needs in the second or worldwide stage of the petroleum age. And a consequence of this program was that it furnished another opportunity for the Bechtel interests as group sponsors to demonstrate the volume and the diversity of work they could do. Once more—here was Steve heading a vastly larger project yet in many ways reminiscent of the time when Dad Bechtel's activities branched out in the early twenties.

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CHAPTER XI

WHILE the Middle East work took shape in the forepart of 1947, construction on another foreign contract began in Venezuela. Two repressuring plants were built by Compañia Bechtel, S. A., in the flat country near San Tome, for the earliest of Bechtel overseas customers, the Mene Grande Oil Company. They were completed early in 1948 by Morgan Walker as Project Manager and Roy McAuliffe, construction chief. *Venezuela*

Within the United States, Bechtel Corporation in 1947 added a number of projects to the large volume of construction already under way. Among the new contracts was one for wrapping more than two hundred miles of big 30-inch pipe on the Texas-California gas line. On November first, engineering commenced on the year's largest refinery order, a seven million dollar crude unit for the Standard Oil Company of California at Salt Lake City. Construction was wholly a 1948 job, starting in March and winding up with the plant on stream in November. Under Heinie Hindmarsh and the watchful eye of Al Orselli, the job went through in fast time. And the heavily-engaged Industrial Division added new factory jobs in 1947—the largest, at Santa Clara, California, for Owens-Corning Fiberglas Corporation. *U. S. A.*

On top of the existing carryover, these contracts made 1947 a substantial year in domestic construction. But in Bechtel Corporation's annals it will stand primarily as the time when the western power utilities threw the main switch on their gigantic expansion program. *Power*

The size of the investment in new power facilities was shown by a figure released at the close of 1948. In three years

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Pacific Gas and Electric Company had invested three hundred millions; a comparable amount was required by Southern California Edison's great forward-looking program—two activities into which BCo came early, by invitation. As plans were completed the contracts grew in size and number. By the end of 1947 the name of the firm's Projects Division, headed by Perry Yates, was changed to suit its principal function and it became the Power Division. The rapid growth of this activity traced right back to the alert top man. Steve had anticipated the surge in power well ahead of time, exactly as he had foreseen the shipbuilding program and the big push in oil. Once again the firm was ready when opportunity knocked, able to get under way without lost motion. And his planning was no miracle but the result of keeping close watch on major trends—as natural as breathing for a man who lives to build.

Why BCo got the call

During 1947 new contracts were obtained to engineer and construct power, substation, and electrical distribution facilities in the Los Angeles metropolitan district. Horsepower by wire was the area's urgent need. The utility was giving a prompt answer; its big herds of "horses" galloped over the main lines into new corrals—substations—where they were broken into working-sized teams for home and industrial use. Many of these corrals were Bechtel-built. When the two million dollar Mesa Substation contract was awarded in November of 1947 it became Number Eighteen on the Bechtel list for Southern California Edison. And there was a big order at Long Beach too, a 22,500-KVA turbo-generator installation put through from the start of engineering to steam day in exactly one hundred days!

"Horsepower corrals"

Then in mid-November, PG&E selected BCo for a hydro job in the Mother Lode country, at Electra Power House near the historic Gold Rush town of Jackson, California. It called for setting six 19,000-horsepower impulse-type water wheels, mounted in three groups of two, each group driving a 33,000-horsepower generator. In addition, Bechtel power men did a craftsmanlike piece of wiring there—on a wholesale scale. Electra was this utility's largest hydro-electric project of 1948, converting the station into a modern 133,000-horsepower

Electra

plant—enough power to serve the needs of the California cities of Richmond, Berkeley and Emeryville. Electra went into operation in July.

1947: New directors

Bechtel Corporation continued to integrate its men into an efficient functional set-up throughout 1947. At the Directors' meeting in May the firm's legal counsel, Robert L. Bridges, was elected to the Board, and in October Vice President C. Stribling Snodgrass became a Director.

Strib Snodgrass was the newest of the top men to come with the Company. His election to BCo's Board twenty months after joining the Bechtel interests not only acknowledged his own abilities but showed the importance engineering had acquired in the scheme of things. Under his direction this division grew to include six hundred engineers, technicians and draftsmen. Nearly every type of engineering was represented on the roster. And their top man had an exceptional background. Annapolis graduate, naval officer, petroleum consultant—eventually his path led to the Petroleum Administration for War where, as Director of the Foreign Refining Division and in other key posts, he rendered a notable wartime service. He is a Fellow of the Institute of Petroleum.

The Company's contract officer is a man who handles negotiations and a variety of client relations. His function in the BCo line-up is concerned frequently with engineering, so came under Strib Snodgrass in the Engineering Division. At this stage—in 1947—the position had not been created, but the man who would get it in April of 1948 was already doing one part of the work as sales-engineer. His name—Charles T. Draney, an experienced petroleum engineer and a ten-year Bechtel man, via Bechtel-McCone.

The engineers

Landing refinery contracts means having the right men on the top technical staff. BCo had key engineers to fill the bill, among them: Fred Meyer, Bert Aldridge, Gordon Zimmerman, Hal Weber, Karl Bausch, Porter Thompson, Hugh Hyde, Frank Fischer and "Bubber" Chisholm. And in construction, refinery contracts got the benefit of a home-grown, tested organization.

The Construction Division matched the engineers with its

The constructors

own realignment in 1947. Veteran builder Heinie Hindmarsh, Vice President, stepped up A. G. Orselli to General Manager of Construction. His name has appeared in these pages several times since recording his employment in 1933 on the Coos Bay Highway Bridge. Another California-trained engineer, he went from WABCo to Bechtel-McCone, to Calship, back to BM, on to Arabia for CCBM S. A., then back home to BBM and finally into BCo—quite a shift, but all inside the Bechtel fold. This very fact illustrated an important Bechtel asset—the ability to move key men around and the willingness of the men to go wherever they were needed. Orselli was field boss or construction manager on many of the refineries these companies built. When the 1947 appointment came along he had twenty years of practical experience under his belt.

Two ten-year men were advanced to give Orselli a hand—Harry Benner, and Jim Brady. Benner, a Stanford mechanical engineer, helped on BMP's first refinery—the hydrogenation plant at Richmond. Jim Brady was a civil engineer who switched to construction. He joined BMP when Benner did, and had a parallel career. Both of them travelled around through the Bechtel organizations, but like Orselli, concentrated on the same general types of work and earned key positions. During the fall of 1947 Cliff Pehl was placed in charge of estimating. He was a Panama Canal alumnus who returned to the States as a Bechtel job engineer, another example of preparedness rewarded by promotion.

Heinie's boys

The array of completed refineries was a consequence of BCo's valuable resource of experienced manpower, trained by the firm's senior construction executive. Each of the men who moved into the positions just mentioned had been schooled by Hindmarsh, and a sizable number of field people as well. His patient work was evident all along the line, in dependable superintendents and field managers, fellows like Gene Lippa, Fred Brown, Tom Moran, Edgar Garbarini, Bill Lindauer, Walt Sims, Buzz Barron, J. H. Chamberlain, Bill Hanna, Buck Buchanan, Babe Carter, George Wilcox, Bill Lake, Steve Valline, and others—men who knew their business. Some of Heinie's "stiffs" were called to other Divisions; like Fred Paul

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and Johnny Herkomer to industrial work. And many of them went to Arabia or Kuwait, or Bahrein Island. The youth Dad met in 1902 at Wadsworth, Nevada, was a long time getting under the Bechtel roof, but once there, he made up for lost time by building the men to build the projects.

Building for the future

In October of 1947 in the Industrial Division, under Jerry Doolan and Executive Engineer John Byrne, BCo promoted its other Jerry, Calshipper Jerome W. Komes, to General Manager. Perry Yates, heading the Power and Pipe Line Divisions, announced that another Calship man, John Kiely, had been appointed General Manager of the power forces.

Whenever a man moved up, it meant that his superiors had found the stuff for greater responsibilities; he became an understudy for the job above his own. When Bob Digges who had been at Bill Waste's elbow since Marinship days as Administrative Manager went to London for IBI, Waste had another man groomed for the job at home. Like head man Steve, William R. Ayers was a second generation construction man. His father was of the old school—(Six Companies' Chief Engineer at Hoover Dam and immediate boss there over Perry Yates), but son Bill's aptitude proved to be with figures that go into ledgers and managing the people who do the paper work. Whereas Gus, the parent, tackled construction literally hand to hand, Bill prepared for it with college courses in engineering and business administration. One year after graduation he landed with BMP as a timekeeper, and climbed steadily as experience accumulated, there and at Marinship, then with BBM, and wound up at BCo.

Somastic

Following its commercial inception in the mid-thirties, Somastic Pipe Coating gradually won increasing acceptance from pipe-line operators. Bechtel Corporation in the eleven western states and at foreign locations took over the franchise formerly held by Industrial Engineering Co., and H. C. Price Co., the territory east of the Rocky Mountains. In BCo's divisional scheme, Somastic came under Perry Yates as Vice President, and Jasper S. Connell, the "Jap" Connell of Calship, the Canol Project and other Bechtel jobs, as General Manager. His assistant, Austin S. Joy, was a veteran in the sale and applica-

tion of this coating. Somastic headquarters are at Watson, in Southern California.

Although two more key positions were to be filled in the following year, BCo's organizational mold was essentially complete at the close of 1947. In the December employee magazine, Steve Bechtel's message told of his pleasure in the fact "that these men, officers and managers, have been identified for many years with our family interests. I am sure," he added, "that through this management service we can offer diversified experience in large capacity and with centralized responsibility." The modern team, like Dad's much smaller one at the Northwestern Pacific camp, was ready for the future.

". . . identified for many years . . ."

Although the twelve months of 1947 brought the firm a great gain in the disposition of its manpower, it also brought a double loss. Two fine veterans passed away, Edward C. "Ted" Panton in June, and Frank C. Sewell in October.

At fifty-eight, Ted's passing came on short notice just when he figured heavily in Bechtel plans. For thirty years he helped lift the face of the west—dams, railroads, highways, bridges, shipyards, hydro-electric stations, powder plants and what-not —the last fourteen years of this time as a senior construction executive in the Bechtel organizations. A big chunk of the tough Canol job was his; Ted's final charges were the Friant siphon and the later Western Pacific work. Gruff sometimes, hell-for-leather on juniors who somehow liked him for it, he was a man's man in the cast of Hank Lawler. Everyone who served under him understood why Steve said that this loss was a great and personal one, and why the Bechtel family would miss one of its ablest builders.

Edward C. Panton

Frank Sewell had retired in 1946 after serving Dad and the boys for his whole business lifetime. His death cut another link with the past, for as a youngster he came to work at the Northwestern Pacific camps, grew up under Dad while keeping a watchful eye on the growing Bechtel sons, and with fierce pride shared all their accomplishments. As suited one so long in the family councils, Frank spoke up whenever he thought the occasion justified. He could be a severe critic, for he was another with a gruff bark covering a heart as big as all out-

Frank C. Sewell

CHAPTER XII

WHEN new calendars went up in Bechtel offices on the first workday of 1948 the fiftieth anniversary year began, but no one took time from the heavy press of business to remark the fact. Looking over the schedules the top men knew that this would be the biggest of all peacetime years. The job inventory proved the wisdom of concentration—the "target system" initiated in 1946—for the projects under way were large indeed. In domestic work every year had grown as big as Hoover Dam.

1948: New division names, more top manpower

The name change mentioned earlier was made effective January first, from Projects to Power Division, and another for a similar reason when the former Construction Division was renamed the Refinery Division. Executive-grade manpower continued to come in, with the addition in January of George Gibson as New York Representative, and in April with the return of Ed Dorresten. Ed came to BCo as Manager of Engineering, directly under Strib Snodgrass. It was homecoming for this former Bechtel-McCone man with broad-gauge experience in petroleum and chemical engineering. In late fall engineering's "varsity" roster was filled out by the appointment of fast-coming Fred Meyer to the post of Chief Engineer.

An imposing list of major undertakings were brought to successful conclusion during 1948—refineries, the Friant siphon, Electra Power House, Edison re-cycling project, the coal-hydrogenation plant, and the flour mill. Many of the Southern California substations went into service; in fifteen months up to August, 1948, BCo had been retained on fifty-six separate jobs of this nature. Jack Pomeroy, group sponsor, completed the tin plate mill for Columbia Steel at Pittsburg, and at the

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opening, U. S. Steel officials announced Alden Roach's election to the presidency of Columbia. Across the world International Bechtel's nineteen hundred Americans and six times that many natives were winding up some jobs, making good time on others and starting new ones, in history's largest program of foreign development by private industry.

Tennessee Gas

One kind of heavy construction that really moves is pipelining. The hours are long and the number of working days the same as those in the week—seven—and sometimes they seem like eight. Pipe-line men never talk about cubic yards or tons, it's miles-per-day. So one big job that was started in 1948 and finished in short order was the first seventy-two miles of the two-hundred-ten-mile Tennessee Gas and Transmission Company's thirty- and thirty-one-inch gas line in Texas.

Bechtel-Conyes

The Tennessee Gas line ushered in a new construction unit, Bechtel-Conyes, headed by R. A. Conyes, long a Bechtel associate, ex-Canol partner, top transportation man in the Arabian desert, and a pipe-line veteran. With at least five years ahead of intensive pipe-line construction, Steve wanted him in, to amplify BCo's well-seasoned Pipe Line Division. The big-inch Texas work was done in conjunction with another old associate, Hal Price. On it young Steve served as field engineer, and Ray Hamilton returned from Arabia to start construction.

Refineries

Jap Connell moved Somastic pipe coating crews into Utah and coated sixty miles of the Rangely crude oil line feeding the new Bechtel-built Salt Lake refinery. In March Socony-Vacuum Oil Company gave BCo the green light on its East St. Louis, Illinois, refinery enlargement and rehabilitation program—planning, engineering and construction. Another came along in mid-fall, a seven and one-half million dollar investment representing eighteen months of refinery work, from process design through engineering, procurement and construction. This one at Ponca City, Oklahoma, was for an old Bechtel pipe-line customer, Continental Oil Company.

Fido—the airport watchdog

An unusual 1948 Industrial Division job was "Fido"—which means "fog intensity, dispersal of," in a sort of backwards word arrangement. Actually it is a system of "blotting" up ground fog at plane landing strips, and this contract covered

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Board of Directors, Bechtel Corporation, 1948. Seated, left to right: John L. Simpson, Director; V. G. Hindmarsh, Vice Presid
S. D. Bechtel, President; V. W. Rosendahl, Vice President. Standing: W. E. Waste, Vice President; G. E. Walling, Treasurer; C
Snodgrass, Vice President; J. P. Yates, Vice President; R. L. Bridges, Director, J. K. Doolan, Vice President; J. C. Byrne, Direc

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AFTERWORD

The end of Year Fifty brought no pause for stocktaking. The men of Bechtel went right ahead with their work, concerned with more essential matters than evaluating the past.

This accounting picked it up, but when the time came to draw off totals the sums fell into many columns, like trying to add apples and plums. Nothing less than standing far back and taking a long view of the worksheets made sense at all; even close inspection of the activities under way at one time in 1948 was a case of losing sight of the forest in the trees. Consider:

In that year Bechtel geography spanned half the earth's surface, from a dozen or more frontiers in the U.S. to civilization's cradle, the Middle East. In types of work, contrasts were as great as the design of a petro-chemical process and the reshaping of a granite mountain. In specific projects: pipe lines and pipe coating, pump stations, refineries, chemical plants, mills to make steel and mills to make flour, factories, warehouses, whole communities, railroads, highways, piers and harbor works, tunnels, water systems, hydro- and steam-electric generating stations, substations and a multitude of distributing facilities for power. Add in the recent past: dams, bridges, mines, shipyards, ships and ships' engines, aircraft modification, plus a substantial portion of the Western Hemisphere's defenses.

On the employment rolls at the close of 1948 were estimators, planners, designers, engineers, draftsmen, procurement specialists, recruiters, transportation men, accountants, office people in many categories, and a virtual army of rugged "outdoor guys," ranging from grizzled superintendents to common laborers—construction's children, every one. The executive group had grown larger than the entire management staff of many good-sized firms. Altogether, a full twenty thousand gathered around the family fireside that once warmed only two—Dad Bechtel and brother Art.

What did it mean, this half-century of impact by one western American family on its world and times?

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Dollars? They ran into millions, big figures were a consequence—essential and enabling—but hardly the best yardstick for measuring years of work. The dollars were impressive enough—a reasonable estimate on December 31, 1948 was that the fifty-year total of direct and joint-venture-built projects represented a combined value of five billion dollars.

Size? Yes, as proof of ability and the quality of performance, but otherwise the organization's size was not the main end-product of its accomplishment.

Completed works? To the extent that everyone benefited by their existence. But it is fair to assume that the works would have been constructed in any case, if not by these men, by others. Certainly they were the prime instruments of planning and building, and as such, put into the job all their assets—foresight, courage, brainpower, manpower, varied special skills, honest effort; and more, a consuming love for the work itself.

If none of the foregoing details gave an observer a basis for understanding the first fifty years of "Operation Bechtel," one could be found in the long-range outlook of the men themselves. Their preoccupation with present and future problems showed how they looked at the past—chiefly as an opportunity for building knowledge on experience. Use it fully, add to it, and go on from there. No job has been done so well that the next one cannot be done better.

That frame of mind was Dad Bechtel all over again, "right up from the grass" and carried forward by Steve and his associates, by brothers Warren and Ken, and the thousands who make up today's "family." And they were having the time of their lives adding to mankind's storehouse of useful resources.

Dad had something mighty big and genuine to pass along. In different ways it kept cropping out all the time, amplified over and over, but essentially the same good homespun stuff that built one of the world's great construction outfits. The third generation was coming on, but the flavor of the old days lingered—as when Heinie, like Frank Crowe back at Hoover Dam, told a junior: "Get in there and *break* something—then *I'll know you're working!*"