WESTERN CONSTRUCTION NEWS

ENGINEERING CONSTRUCTION IN THE FAR WEST

PUBLISHED SEMI-MONTHLY
VOLUME V NUMBER 19

SAN FRANCISCO, OCTOBER 10, 1930

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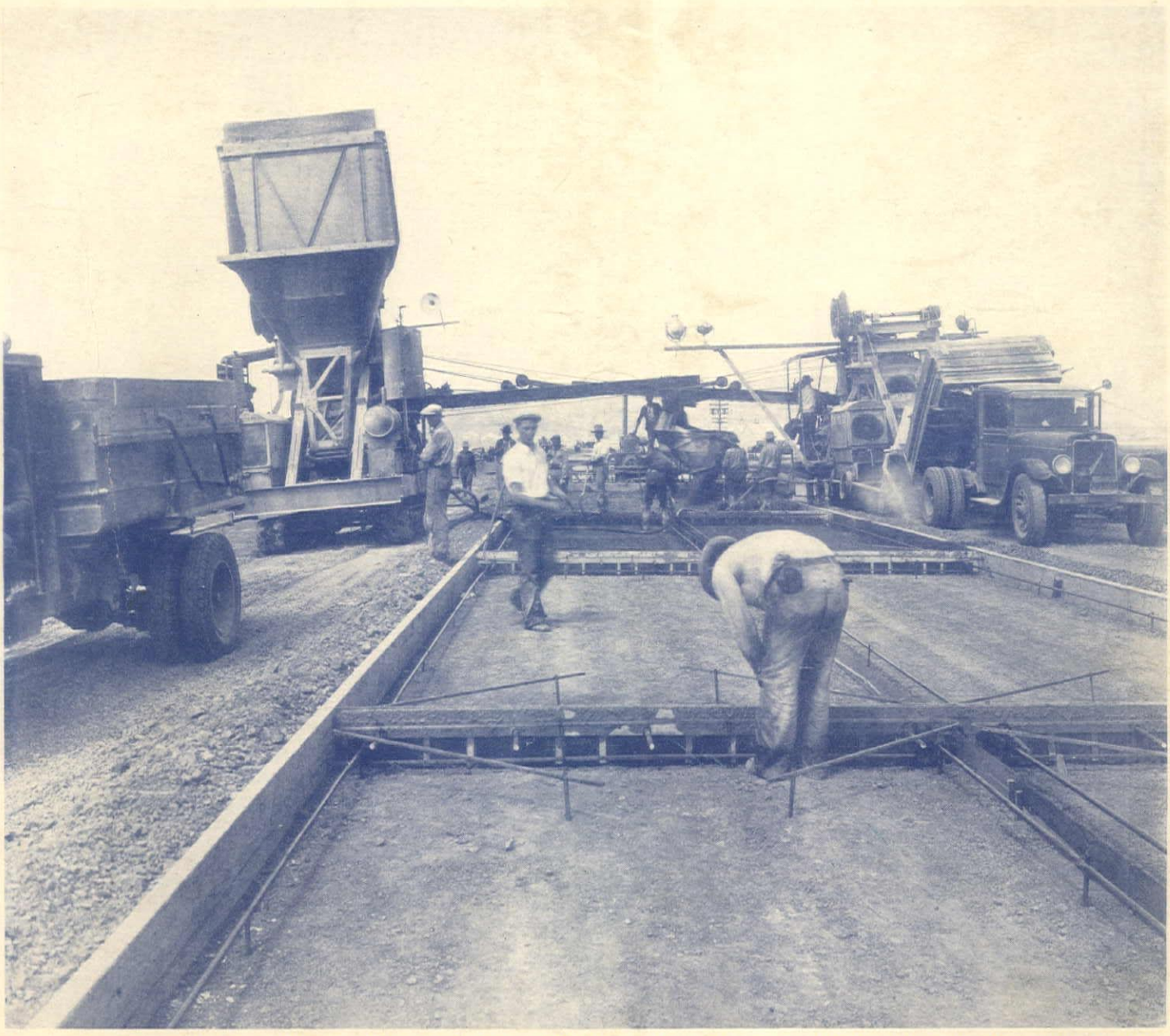
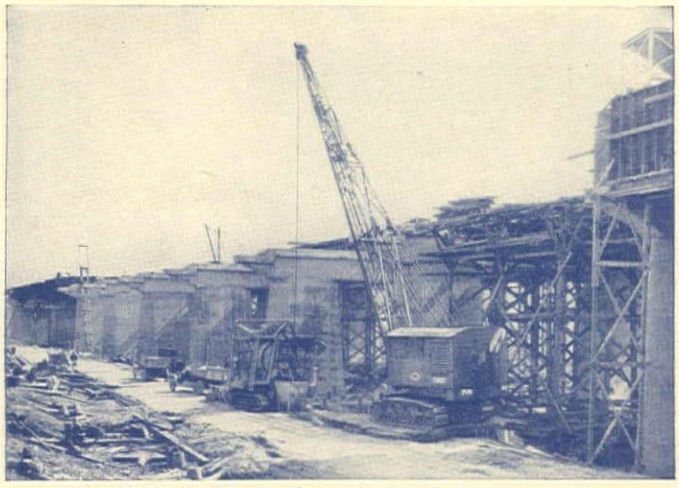
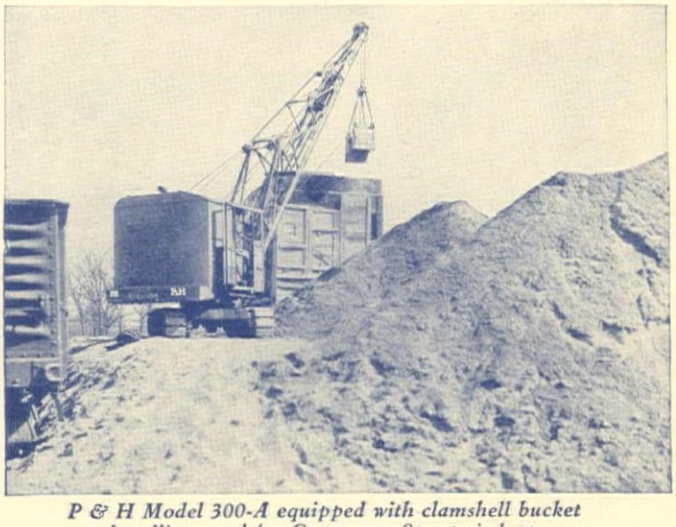


PLACING 20-FT. STRIP OF 11-9-11-in. CEMENT CONCRETE WITH TWO 6-SACK PAVERS ON SOUTH SAN FRANCISCO-BURLINGAME SECTION OF BAYSHORE HIGHWAY, CALIFORNIA, FOR STATE; BASICH BROS. CONSTRUCTION CO., CONTRACTOR



P & H Model 600 Corduroy Crane placing concrete on Commerce Street viaduct job, Dallas, Texas.



P & H Model 300-A equipped with clamshell bucket handling sand for Commerce Street viaduct.

P & H Model 400 placing concrete on Commerce Street viaduct job.

4 P & H's for the Austin Bridge Co., Dallas, Texas

On the great new viaduct in Commerce Street, Dallas, to be one of the largest in the Southwest—the Austin Bridge Company, contractors, have three P & H Corduroy (crawler) Cranes. One is a Model 300-A, ½ cu. yd. capacity; one is a Model 400, ¾ cu. yd.; and the other is a Model 600, 1 cu. yd. All are shown at the left. Since these pictures were taken, the fourth P & H, a Model 700-B, was purchased.

Here is a job requiring the handling of immense amounts of material . . . 32,000 cu. yds. of concrete, 1,000 tons of reinforcing steel and 750,000 pounds of structural steel, besides vast quantities of temporary materials. Speed and reliability were the requirements imposed upon the cranes to be used. P & H's were chosen. Their fast line and swing speeds, easy operation and rugged unit-steel construction have justified their reputation; for the work is ahead of schedule as you read this.

P & H Corduroy Cranes are built in a range of sizes from ½ to 3½ cu. yd. Descriptive bulletins will be mailed on request.

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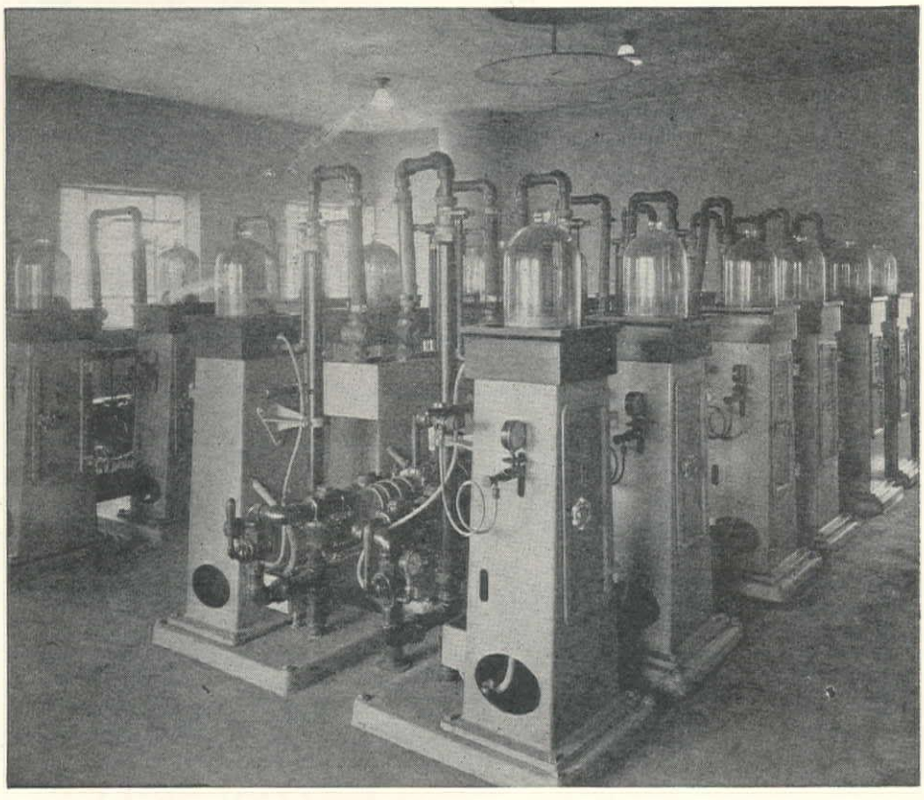
P & H "Corduroy" CRAWLER CRANES

LESS THAN 1% FOR MAINTENANCE



20 minutes · · ·
a small wrench · · ·
a screw driver · · ·
to take apart
a W & T unit,
clean and
re-assemble it.

Seven years ago the largest chlorinating installation in the world was made at the Easterly Sewage Disposal Plant, Cleveland, Ohio. In seven years annual maintenance costs have never exceeded 1% of the low initial investment! Today these machines are in perfect working order.

The simplicity of the W & T Vacuum type Chlorinator is largely the reason for this admirable record. A small wrench, a screw driver—and in 20 minutes this machine can be dismantled, cleaned and re-assembled —all ready for duty. No special skill, no technical knowledge is necessary.

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Manufacturers of Chlorine Control Apparatus
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DEVOTED TO ENGINEERING CONSTRUCTION IN THE FAR WEST

VOLUME V OCTOBER 10, 1930 NUMBER 19

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SUBSCRIPTION RATES

THE annual subscription rate is $3 in the United States and foreign countries where extra postage is not required. To Canada $4 and to foreign countries where extra postage is necessary the annual rate is $5. Single copies 25 cents.

Published semi-monthly by
WESTERN CONSTRUCTION NEWS, INC.

Main Office:
114 SANSOME STREET
SAN FRANCISCO, CALIF.

Eastern Representatives:
F. R. JONES, 201 N. Wells Street
Chicago, Ill.
H. B. KNOX, JR., 101 Park Ave.
New York, N. Y.

Branch Office:
455 WESTERN PACIFIC BDG.
LOS ANGELES, CALIF.

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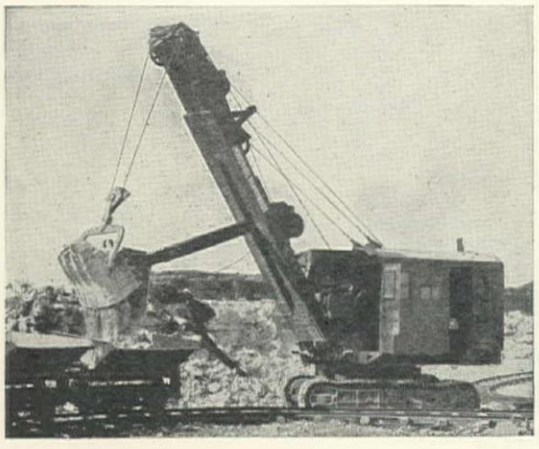
ARE You Paying For an Industrial Brownhoist ~ ~ Without Owning One?

Are you spending thousands of dollars every year on inefficient handling methods—money which could be more profitably applied toward the purchase of a good Crawler or Locomotive Crane? The savings effected by one of these machines would soon pay for it and from then on dividends would quickly pile up.



The Type DC Gas Crawler Crane illustrated is a fast operating, convertible machine of 15 tons capacity. Construction features include two speed hoist, two speed travel, and steering independent of all other motions with any degree of traction on both crawlers, for sharp or gradual curves.

Owners of DC machines will tell you that it is the best crane of its capacity on the market, but it may not be the type best fitted for your work. The nearby Industrial Brownhoist representative can help you decide this point, without prejudice, because we build many sizes of both crawler and locomotive cranes, with gas, steam, Diesel or electric power.

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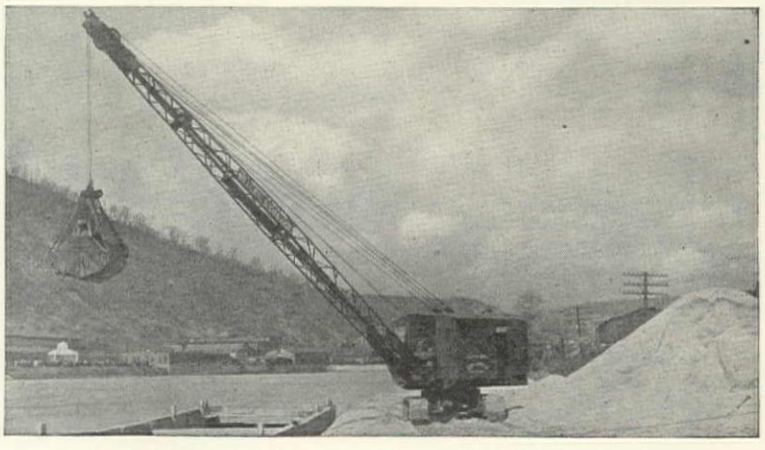

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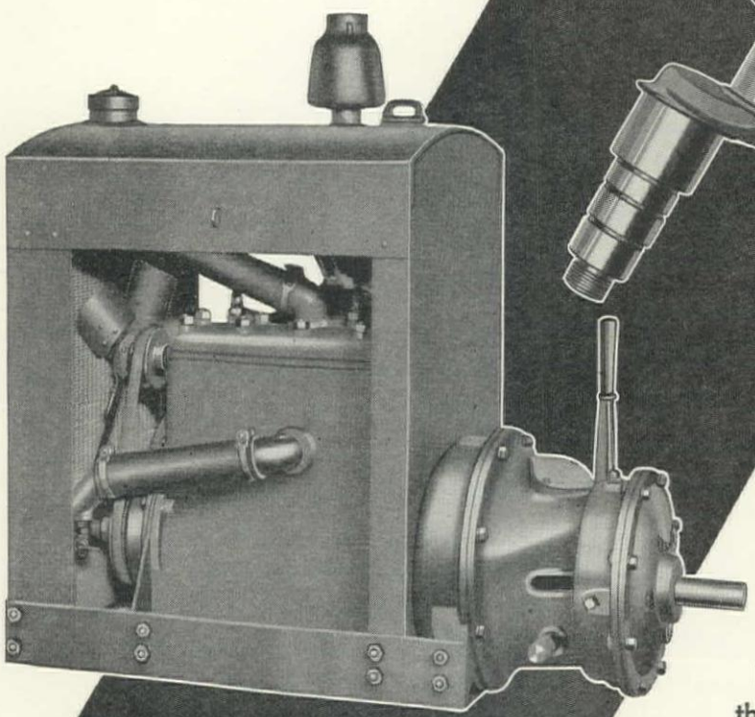

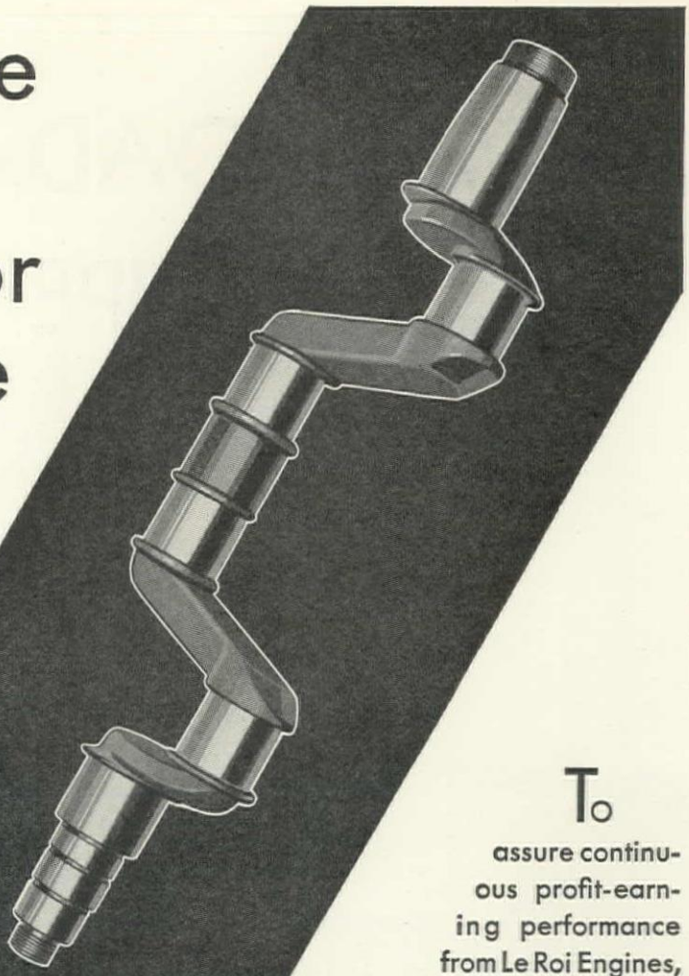

To assure continuous profit-earning performance from Le Roi Engines, the crankshaft is made of the toughest steel obtainable, *and guaranteed for the life of the engine!*

Because of this inbuilt dependability, Le Roi Engines establish unusual records of heavy-duty service. They deliver the maximum rated horsepower under full load, and perform at top speed with the lowest operating costs.

Le Roi Engines are adaptable to a wide range of power needs. As power units in concrete mixers, portable saw rigs, industrial tractors and locomotives, air compressors, hoists, centrifugal and force pumps, portable conveyors, loaders, and other equipment, they are favorably known throught the industrial world.

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LE ROI COMPANY, *Milwaukee, Wisconsin*

LE ROI ENGINES

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NOT ONE SPEED—
NOT TWO SPEEDS—

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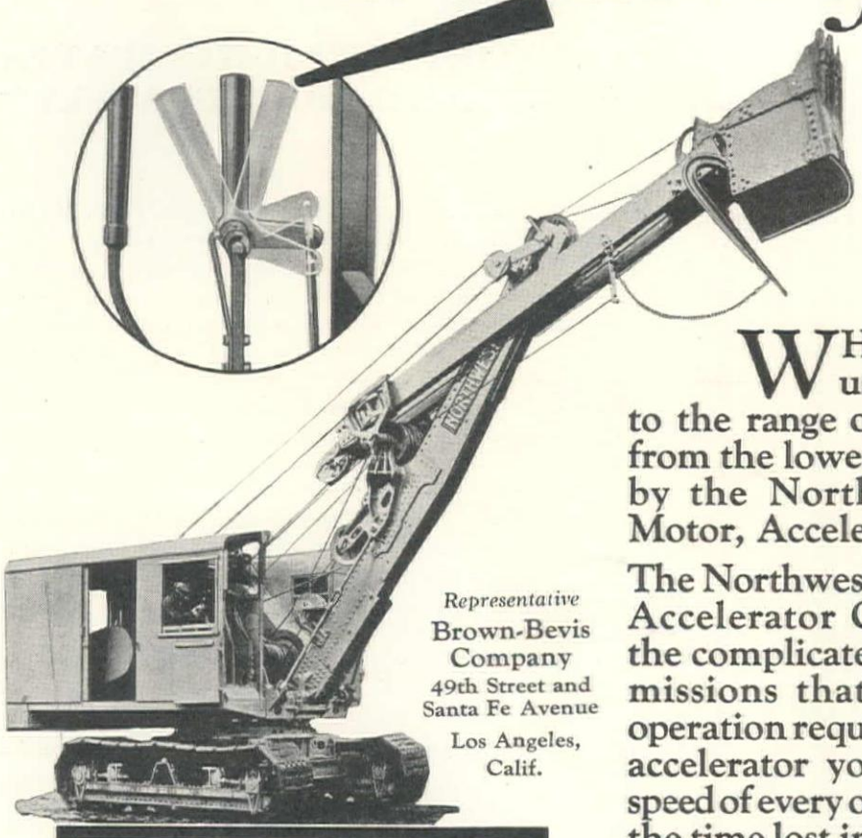
at a touch of a lever



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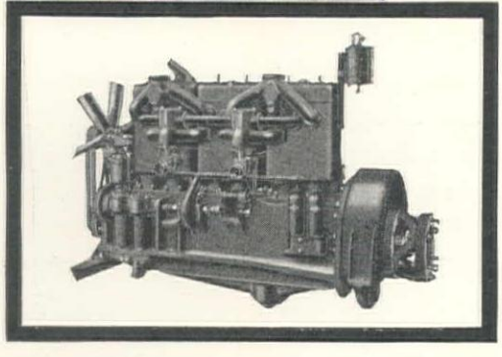

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The Northwest Variable Speed Motor, Accelerator Controlled, eliminates the complicated gear trains and transmissions that the usual two-speed operation requires. With a touch of the accelerator your operator varies the speed of every operation at will, reducing the time lost in hoisting, swinging and traveling, adding 20% to the day's output.

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asks big contractor

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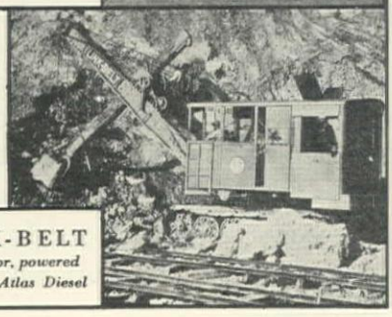
excavator, powered with an Atlas Diesel

BUCYRUS-ERIE
excavator, powered with an Atlas Diesel

P & H
(Harnischfeger) excavator, powered with an Atlas Diesel



LINK-BELT
excavator, powered with an Atlas Diesel

"ATLAS MOTOR NEVER HESITATES ...it's RUNNING 24 HOURS A DAY"

"WE operate 24 hours a day. The engine is a 6½ x 8½ Atlas Diesel. My fuel costs me $3.00 per day ... or $1.50 for each 12-hour shift.

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Specify an Atlas Diesel, for your next excavator. And mail the coupon for complete facts.

**Name on request*

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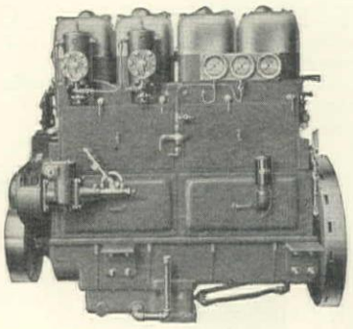

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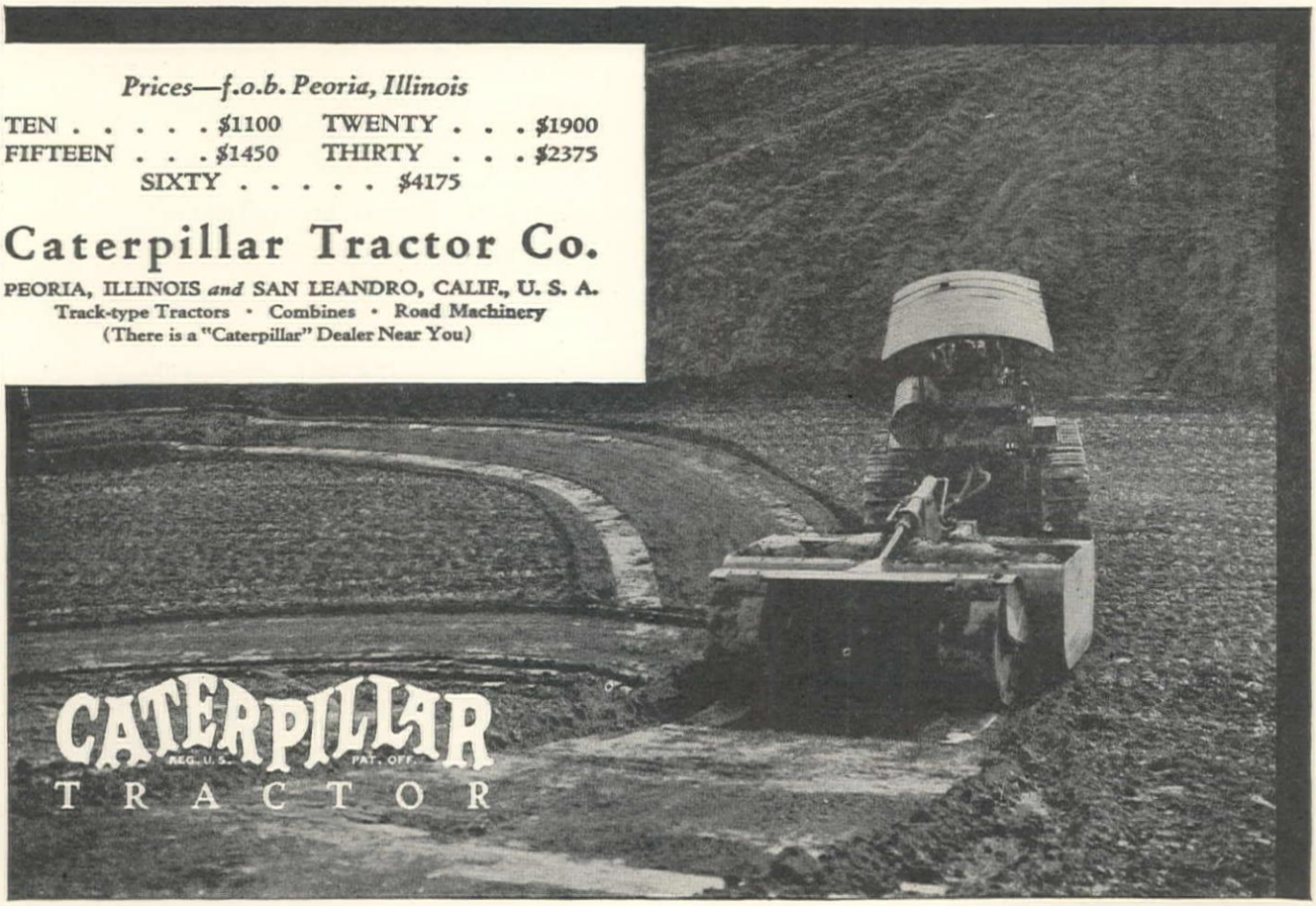

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1. Six-cylinder Diesel engine.
2. Built for shipment on flat car without removing revolving frame and cab from base.
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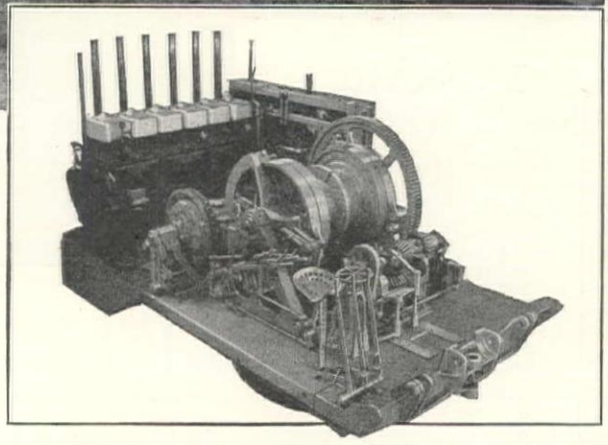

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A-173—10-10-30—WCN

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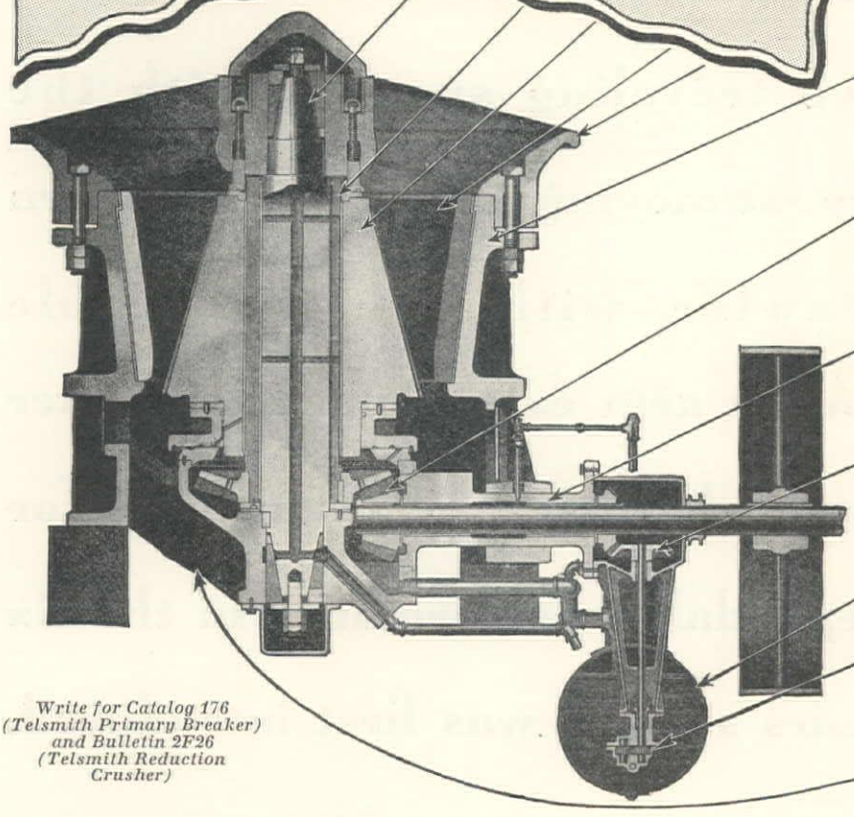

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12 Clean discharge. No clogging. Discharge chute is independent of crusher structure, attachable at any position. No right or left-hand drive.

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B-14

TELSMITH

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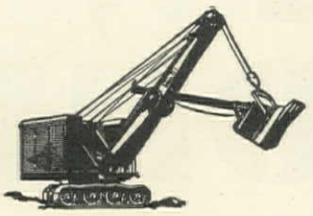
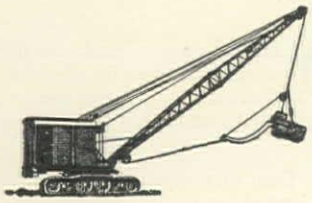


THE CENTER DRIVE CRAWLER with power direct from the motor, with two traveling speeds, with the fewest moving parts of any modern crawler, with interchangeable rocker arm extensions for greater length, has never been surpassed for dependable performance in the six years since it was first introduced.



THE THEW SHOVEL CO.

LORAIN, OHIO

THEW LORAIN

Distributed by: SMITH BOOTH USHER, Los Angeles, Calif.; JENISON MACHINERY COMPANY, San Francisco, Calif. FEENAUGHTY MACHINERY CO., Portland, Seattle, Spokane; AMBLER & RITER, Salt Lake City, Utah

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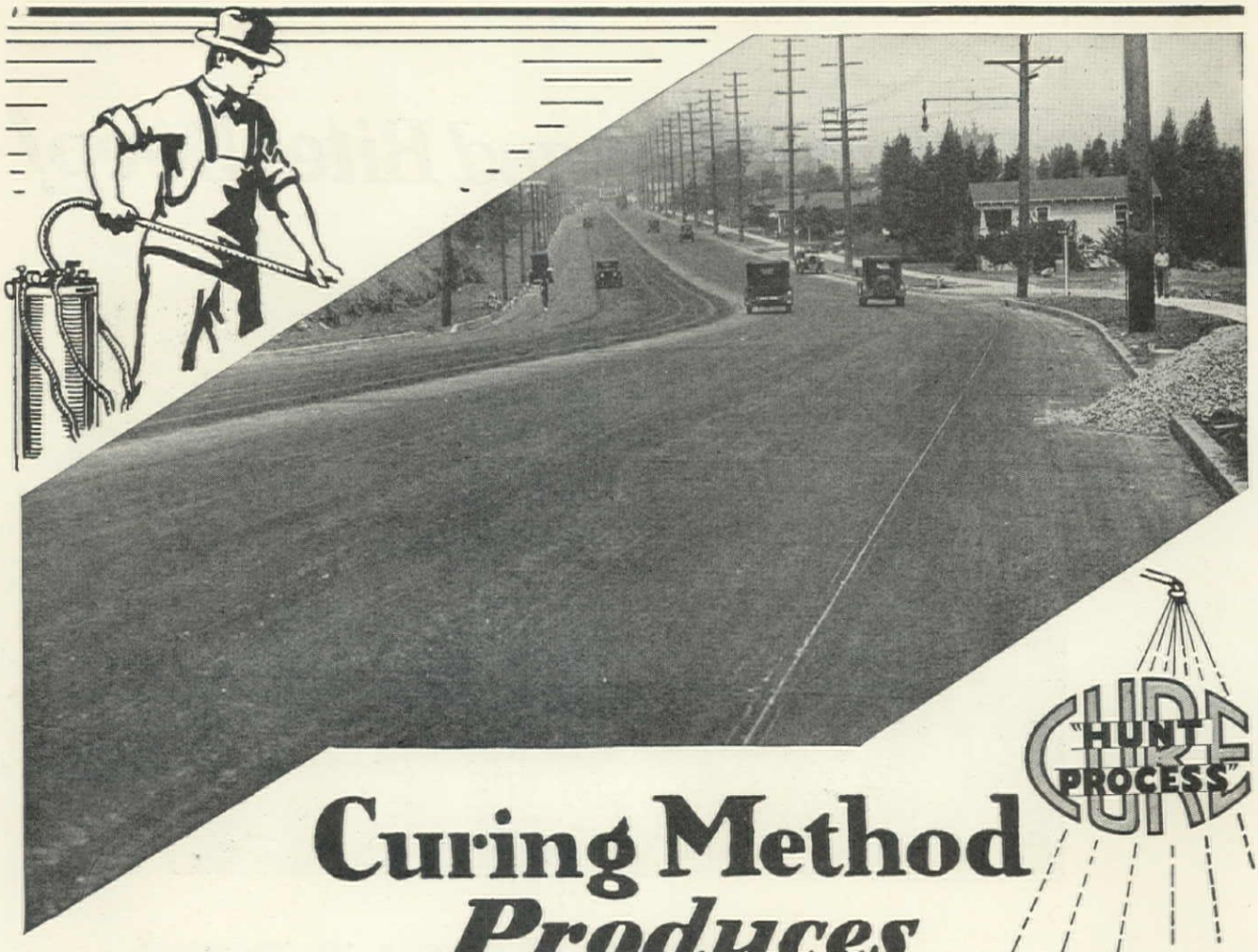

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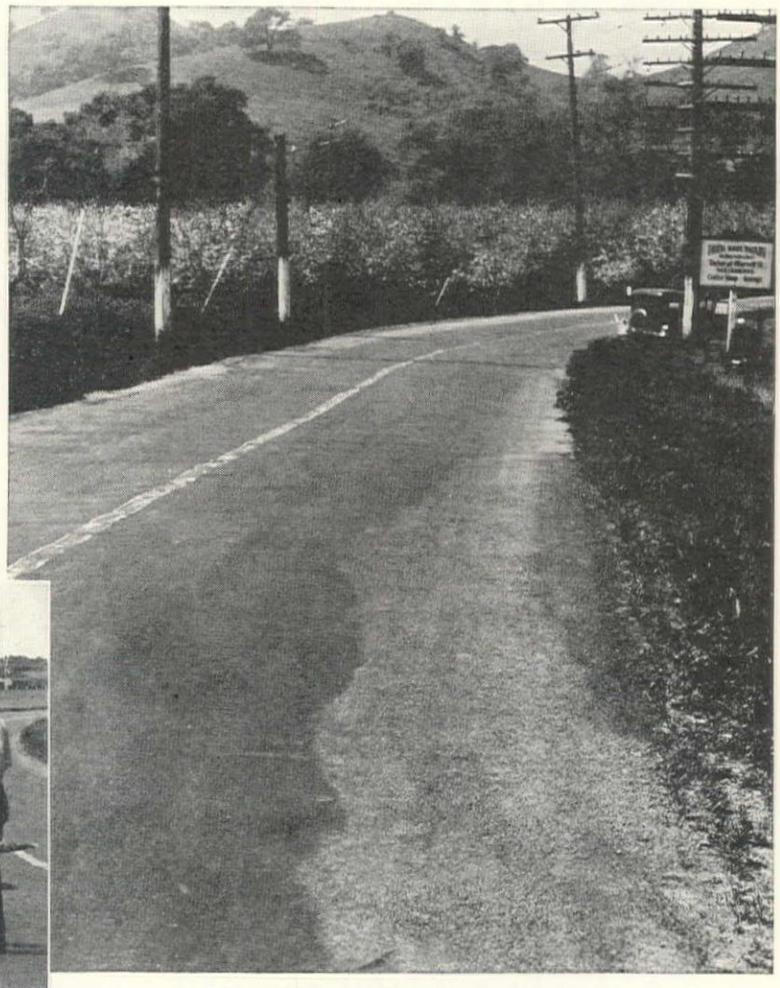

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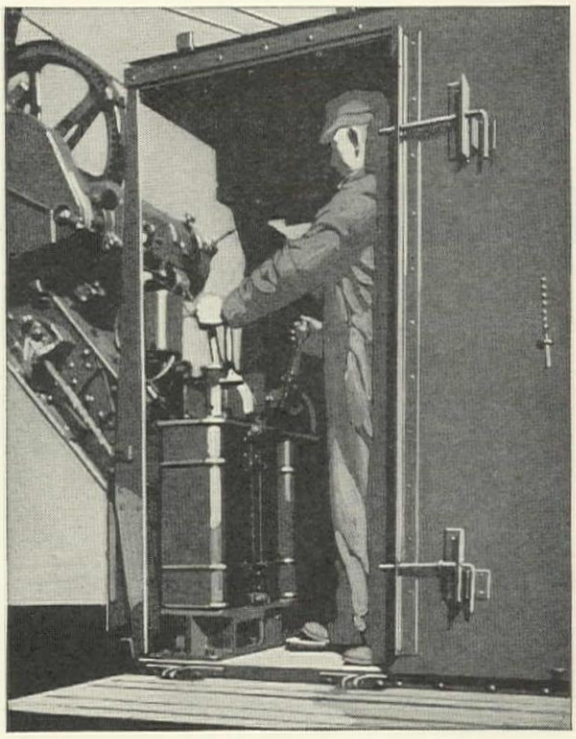

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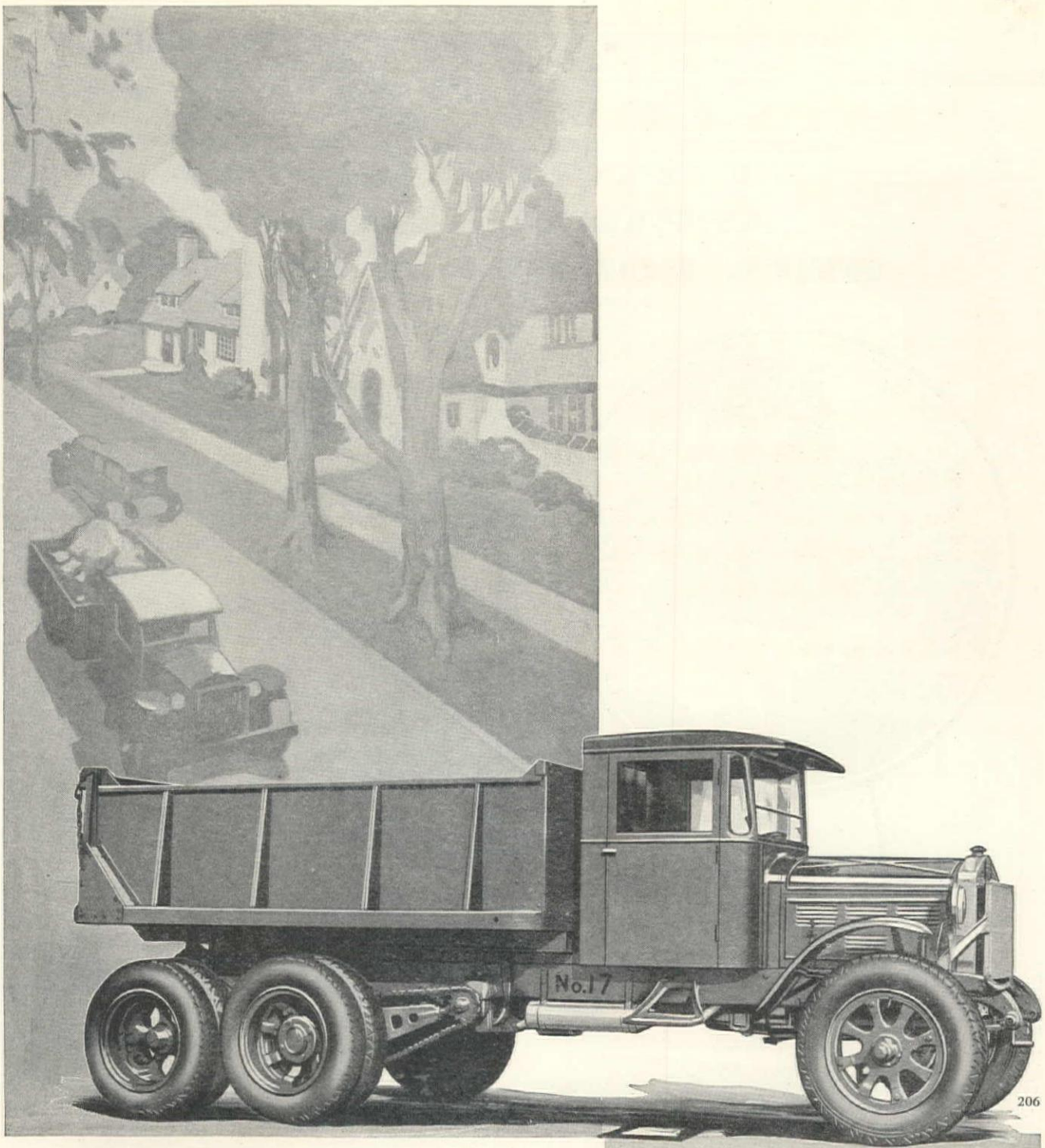

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—*spells* INSTALLATION ECONOMY

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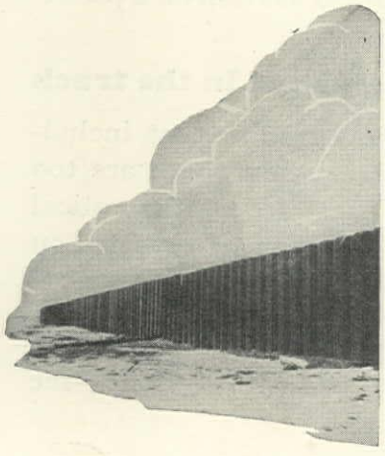
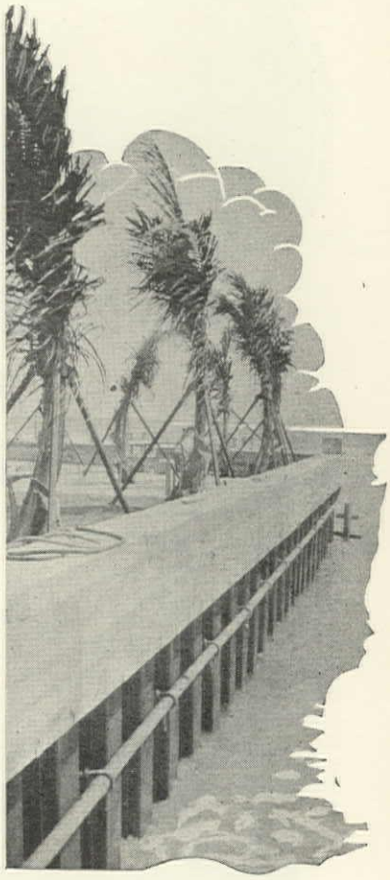
All piling made from Swedish ores. Ordinary carbon steel for fresh water. Polluted water (fresh), copper bearing steel. Seawater, copper bearing steel. Seawater in tropical climates, copper steel with protective coating.



An article descriptive of a recent large installation of Larssen piling appears in this issue on pages —— entitled "Alki Avenue Seawall, Seattle, Washington."



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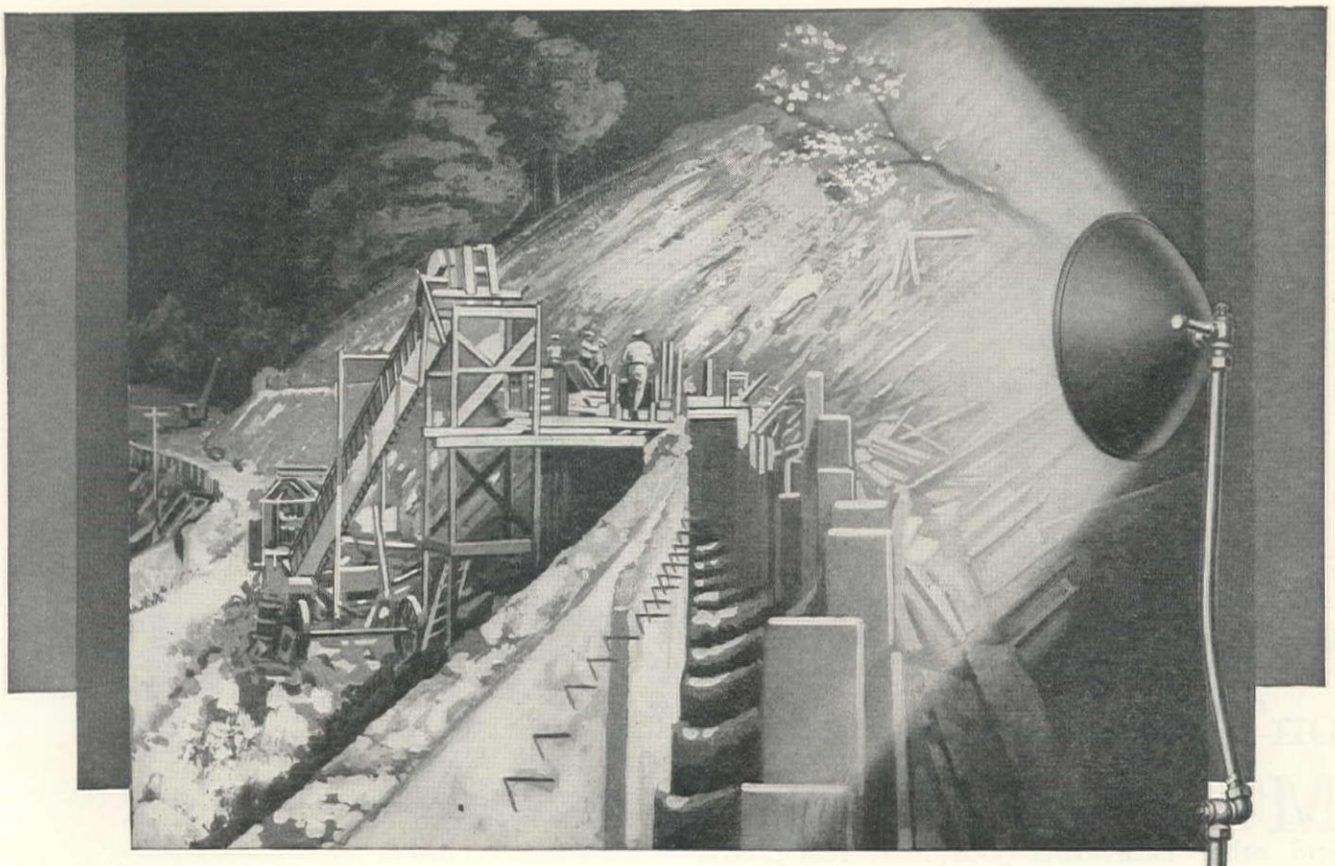

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Without obligation, I would like to have additional information on Carbic Lights. W.C.N. 10-30

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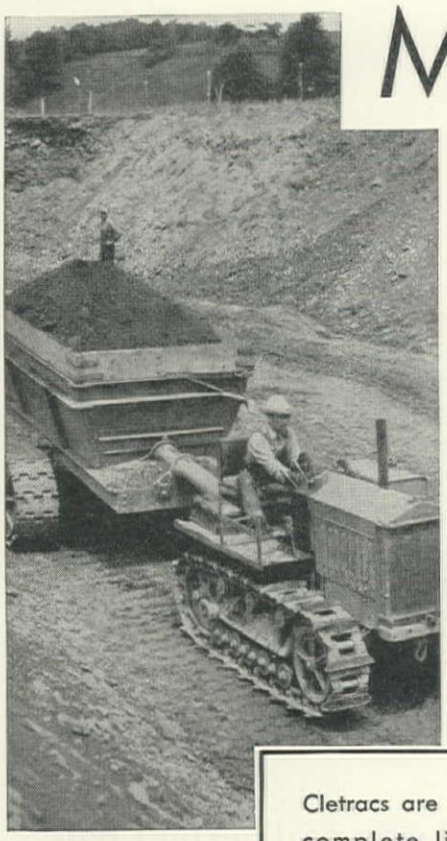

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FASTER travel—more yardage to dirt loads — wider, deeper cuts with larger scrapers and scoops — these are direct short-cuts to money-saving and bigger-profit margins. Cletracs put these short-cuts into operation on every job.

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Matchless draw-bar energy (a generous power reserve above the designated ratings on all models) enables Cletracs to handle far heavier and larger equipment. Less gear shifting — faster, easier work.

Tens of thousands of Cletracs are used by highway departments, road and general contractors and county and municipal authorities. Cletrac's ability to handle all kinds of work speedily and economically has gained for them outstanding preference.

If you don't have first hand information about these better tractors, get in touch with the local Cletrac distributor for a demonstration — or write direct for complete literature.

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Cletracs are built in a complete line which covers practically the entire range of tractor power requirements in both industry and agriculture — a size to meet every power need of outdoor work.

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Lower photo shows Cletrac 80-60 owned and operated by Summit County, Ohio.

When writing to THE CLEVELAND TRACTOR CO., *please mention Western Construction News*

Better Drainage for Houston, Texas

Link-Belt Dragline Used by Contractors

EXTENSION of Houston's drainage system, made necessary by the increased paved area of the city, provides for the removal of 14 inches of rainfall in 24 hours. The work to be done consists of widening, deepening and straightening Brays Bayou, requiring the excavation of about 310,000 yards of sand and clay.

For handling this material, which must be cast over an existing spoil bank 30 feet high, the contractors, Haralson & Cunningham, of Houston, are using a Link-Belt Type K-55 Dragline with 60-foot boom and 2-yard bucket. Each trip of the dragline requires a 180-degree swing. Ample power is supplied by a 6-cylinder 125 H. P. Atlas-Imperial Diesel engine.

Link-Belt dragline-crane-shovel features of design and construction, responsible for high capacity dependable service on this and hundreds of other jobs, are fully described in Book 1095, sent on request, without obligation.

The stability and power of the machine make it easy to handle a 60-ft. boom and 2-yard bucket.

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Builders of Locomotive Cranes for 30 years. Portable Loaders—Crawler Cranes Shovels—Draglines

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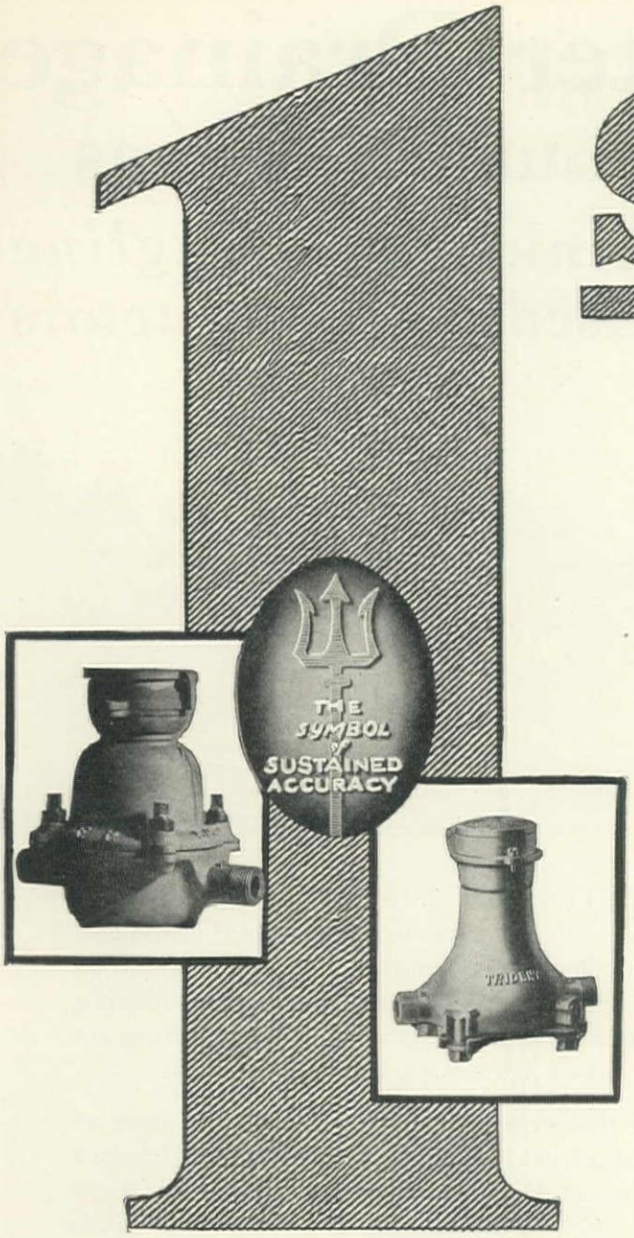

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And Neptune will continue to pioneer in every worthwhile development in water meter design and construction. Future advertisements will discuss above parts in detail.

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VOLUME V | OCTOBER 10, 1930 | NUMBER 19

Crustacean life in San Francisco bay—at one time most abundant—has been practically wiped out from sewage and industrial waste pollution. Furthermore, there are areas in shallower depths where the pollution is so great as to endanger the lives of bathers or those accidentally being immersed.

Pollution of San Francisco Bay

The time has come when the State of California should put a stop to the wholesale pollution of San Francisco bay by sewage and trade wastes from the various cities bordering thereon. The same thing applies to the Sacramento and San Joaquin rivers. Regulation rests with the Bureau of Sanitary Engineering, State Department of Public Health, but its police power is somewhat limited. The next legislature should give it whatever additional authority is necessary, as well as a much larger fund for maintenance and operation of this most important bureau.

The oil companies are quite successfully controlling the fuel oil menace, but other industrial wastes, such as those from meat packing houses, and domestic sewage, flow unstrained and untreated into the bay, much of these onto the mud flats or in shallow water.

Whereas all the cities of Southern California—San Diego treats all sewage and trade waste before it is discharged into the bay—voluntarily or with but little pressure from the State Bureau of Sanitary Engineering, have installed or are constructing screening or treatment plants to prevent pollution of the bays or ocean beaches, most Northern California cities are reluctant—in many instances antagonistic—to cleaning up these nuisances.

As commented upon editorially before, the advent of natural gas, or 'vapor gold', can be looked upon as the fourth great epoch in California and the Far West. The rapidity with which this new fuel is being distributed and converted to use is almost astounding.

The Epoch of Natural Gas

First we build long transmission lines, almost overnight, to our major cities (see article on Tracy-Richmond pipe-line in this issue) and substitute natural gas for artificial gas both for domestic use and in place of fuel oil and coal for steam plants.

Before this is accomplished, a method is devised for liquefying a waste product of natural gas so that it can be transported to outlying cities not economically accessible by pipe-lines (see article on 'Natural Gas for Every Town and City in Pacific Coast States', in this issue). At the same time, another waste-product gas is being successfully compressed for distribution in small containers to isolated houses, ranches, etc., by some of the oil companies. So, within a year or two every community and every outlying home in the Far West will have natural gas available by pipe-line, by railroad, or by truck.

The ever-increasing acceleration in scientific development and engineering construction leaves us aghast at what will be done ten or twenty years hence.

One of the most interesting and largest underpinning jobs ever undertaken is described in this issue—that of a 14-story office building in San Francisco which was endangered from deterioration of the piling caused by a receding water-table; many of which had also been broomed in driving. Termites also had found their way into the center of this built-up block and had seriously attacked a number of piles.

Underpinning a 14-Story Building

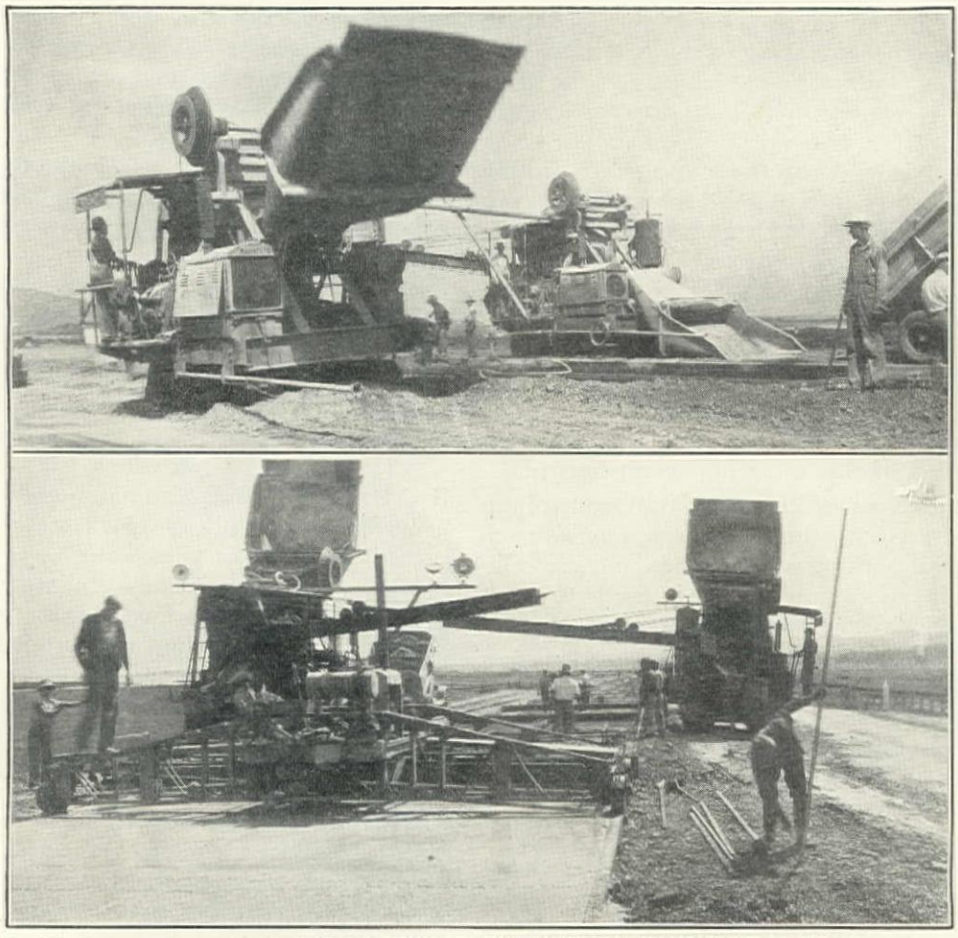
It has not been often, fortunately, that the owner of a large building is faced with such an unexpected problem. This building was originally designed for full height as it now stands, but was built only to the sixth story in 1908; eight stories being added in 1926. It has stood for 23 years without appreciable settlement, even after the height was increased, and might have continued to stand without damage for years to come. But, the owner, without hesitating, chose the safe way and expended over $100,000 to insure his property and the tenants therein against any possibility of disaster. He is to be highly commended in setting an example which we hope will be followed by many others throughout the country, for it will behoove owners of buildings on similar foundations to investigate their condition. There are altogether too many buildings of various kinds in use which are a serious menace to humanity either on account of poor foundations, structural weakness, or because they are fire traps.

In this particular case, the lesson to be learned is that wood piles should be used only when they will be completely submerged for all time, and greater care exercised in driving to prevent brooming.

The editor had the opportunity to watch the progress of this interesting underpinning job, and great credit is due the engineer who planned the work and the contractor who performed it with so much care.

Record Paving Contract on Bayshore Highway from South San Francisco to Burlingame

Basich Bros. Construction Co. of Los Angeles will apparently break the record for portland cement concrete pavement production which was recently established by the same firm on the Logandale-Willows highway (see September 10th, 1930, issue, p. 427). Using two 6-sack pavers, this company averaged 840 cu.yd. per 8-hour day for the last 10 days of paving on the first half of the 40-ft. Bayshore highway between South San Francisco and Burlingame, California. The average for the entire run of 22 days on this strip was 727 cu.yd., considerable lost time occurring on the first six shifts; the best day's run was 863 cu.yd. On October 3, shortly after starting the second strip, 908 cu.yd. was placed in 8 hours.



SIX-SACK RANSOME PAVERS AND LAKEWOOD FINISHER ON BAYSHORE HIGHWAY BETWEEN SOUTH SAN FRANCISCO AND BURLINGAME

The roadway on this project will have four 10-ft. traffic lanes on 40 ft. of pavement, laid in two 20-ft. strips. The pavement is 9 in. thick, increasing to 11 in. within a distance of 2 ft. at the edges of each 10-ft. lane and at each transverse expansion joint.

With minor difficulties overcome and better coordination of crew with local conditions gained on the first strip, the last half of the pavement should be placed at a somewhat higher rate of speed. Toward the close of paving on the first strip it is interesting to visualize the fast delivery of material in that one carload of concrete materials was going onto the subgrade every 15 minutes.

Description of Work—The contract requires placing 11-9-11-in. portland cement concrete pavement on 5.2 miles of 40-ft. heavy-duty highway; a new reinforced concrete culvert on pile foundation, with asphaltic concrete approaches to this structure 40 ft. wide and 6 in. thick; surfacing shoulders adjacent to the pavement with crusher-run base 10 ft. wide and 4 in. thick, treating with light fuel oil, and applying screenings; placing imported borrow on existing roadbed; placing light riprap and douglas fir sheet piling for the culverts; removing, cleaning, painting, and replacing timber guide posts.

The special provisions stated that no detours were available and that traffic was to be carried through the construction. This requirement may be modified to facilitate high-speed paving and obviate loss of time in switching from one 20-ft. strip to another.

It was specified that work should be completed in 125 days, excluding Sundays and holidays.

Bids were opened July 2, 1930, and the contract awarded to Basich Bros. Construction Co. for $402,-982, the lowest of nine bidders. The high bid was $475,338 (see July 10th, 1930, issue, p. 50). Included in the contract are the following items:

Item	Quantity	Unit Price
Imported borrow	85,000 cu.yd.	$0.50
Subgrading	123,100 cu.yd.	0.10
'A' concrete in pavement	32,050 cu.yd.	8.10
Asphaltic concrete	1,025 tons	4.40
Crusher-run base	14,500 tons	2.35
Structure excavation	300 cu.yd.	1.50
'A' concrete in structures	200 cu.yd.	18.00
Reinforcing steel	876,000 lb.	0.035
Fuel oil	2,100 bbl.	2.15
Screenings	300 tons	2.50
Untreated piling	2,250 lin.ft.	0.26
Drive piling	50 each	20.00
No. 1 sheeting	2.5 M f.b.m.	60.00
Light riprap	3,000 tons	2.50
Remove and reset posts	660 each	0.75
Finish roadway	277 sta.	1.00

Preparing Subgrade—Grading is done for half of the roadway at a time, using one Caterpillar '60' and

Placing Carey Rubber Joint for Expansion Filler

Ateco bulldozer, one Caterpillar '60' and 12-ft. Adams blade, 4-up fresnos, two Caterpillar '30s' and blades. One Caterpillar '30' is used to haul the subgrader.

Imported borrow is placed for one-half the width of roadbed at a time and immediately in advance of preparing subgrade. Before placing the imported borrow, the contractor is required to scarify the present surfaced area so as to puncture the seal. Borrow is being hauled by the Newgard-Cavillas Co. of San Ysidro, subcontractor, with fourteen 8-yd., 6-wheel, pneumatic-tired dump trucks (Sterling and Federal). Wood hydraulic hoists are used with the Sterling trucks.

Subgrading is accomplished with a 20-ft. Lakewood subgrader and a set of two Clausen tailing elevators attached to the Lakewood with clevice and hook. The elevators are 4 ft. 8 in. diam. and 16 in. wide and mount 12 elevating cups each. The discharge of tailings is made 18 in. out from the header board. Using this device, the subgrade is worked with three men, displacing 6 men and a 4-up fresno. With it, the final subgrade cuts are made and tailings removed on 1000 to 2000 lin.ft. of 20-ft. roadway in 1½ hours. The same equipment is being used for a dry pull on the rough grade ahead. One Galion 3-wheel, 12-ton roller and one Galion 10-ton roller are used to compact the subgrade.

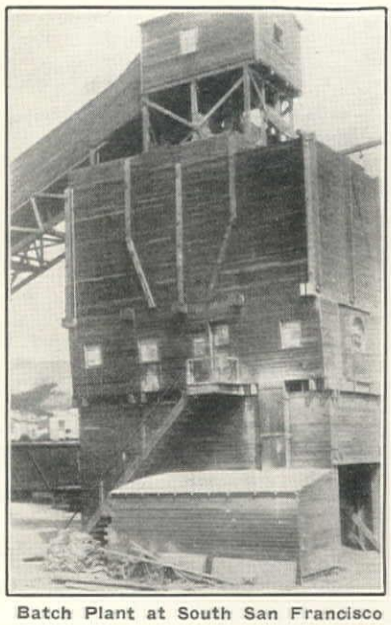
Batch Plant—Rock and sand are supplied from the Bechtel-Kaiser Rock Co. plant at Livermore and hauled by rail to the yard of the South City Lumber & Supply Co., of South San Francisco, where a fast and modern batch plant was available.

At this plant aggregates are dumped through a track hopper and carried on an enclosed belt to the screens. Graded material passes thence by belt conveyor to a battery of three 15-cu.ft. Johnson weigh batchers in a separate structure. Cement in cloth sacks is unloaded from freight cars to an elevating belt and discharged onto a paraffined counter on the charging floor. Here one man straightens the sacks, another cuts them, and two men dump cement direct into the batchers. The ground crew on this plant consists of two men on the batch meters, one checker, and one plant foreman.

Proportioning of materials is accomplished and a 3-batch truck is loaded out in 45 seconds. Santa Cruz cement was used on the first half of the paving and Pacific Portland cement is being used on the last strip.

Batched materials are hauled from the South San Francisco plant to the pavers, an average distance of 3½ miles. The W. H. Bakerbower Truck Co. of Los Angeles has subcontracted this work and is using 24 batch trucks (Reo and Sterling). The trucks back directly onto the paver skip and the skip lift for each batch is made in 8 to 8½ seconds.

Type of Construction—With the use of timber header boards, the contractor is required to nail steel



Batch Plant at South San Francisco

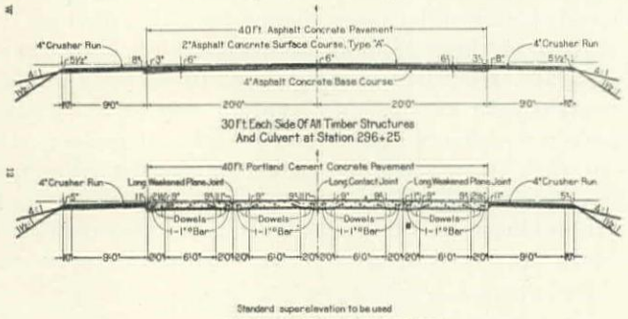
strips ⅝ by 2½-in. by 8-ft. to the top of the forms for the finishing machines to run upon.

The pavement is placed in 20-ft. strips (one-half roadway width) and separated into 10-ft. lanes by weakened plane joints at the center of each strip. This joint is grooved by a special cutting tool operated from a standard Lakewood finishing machine frame. The groove is 2 in. deep and ¼ in. wide. A redwood strip ½ by 6-in., top beveled, is placed upright in the pavement directly beneath the center groove and held

vertically and true to line with metal saddles carried on the longitudinal bar reinforcement.

Transverse expansion joints are spaced at 30 ft. centers; there are no transverse dummy joints. The expansion filler is the Carey rubber joint in strips ½ by 11-in. by 10-ft., using two strips for each 20 ft. width of pavement.

The expansion joints are spanned by dowels 1 in. diam. and 24 in. long. The longitudinal reinforcing



TYPICAL CROSS-SECTIONS

consists of 1-in. plain round bars painted with one coat of No. 1 primer paint (red lead). This paint coat is applied to the longitudinal bars and, after drying and before setting the bars in the concrete, a second application of heavy lubricating oil is applied in a thin coat. Wing bars are set to reinforce the thickened edges near the end of each slab.

These requirements are planned so as to produce a flexible pavement which will conform to subgrade conditions across the salt marsh area adjacent to San Francisco bay.

The light gravity oil for treating shoulders is applied at 140 to 200 deg. F. in two equal applications totaling ½ gal. per sq.yd. The base course for the asphaltic concrete approaches to structures is 4 in. thick and covered by a 2-in. type 'A' surface, which uses 1½-in. maximum rock.

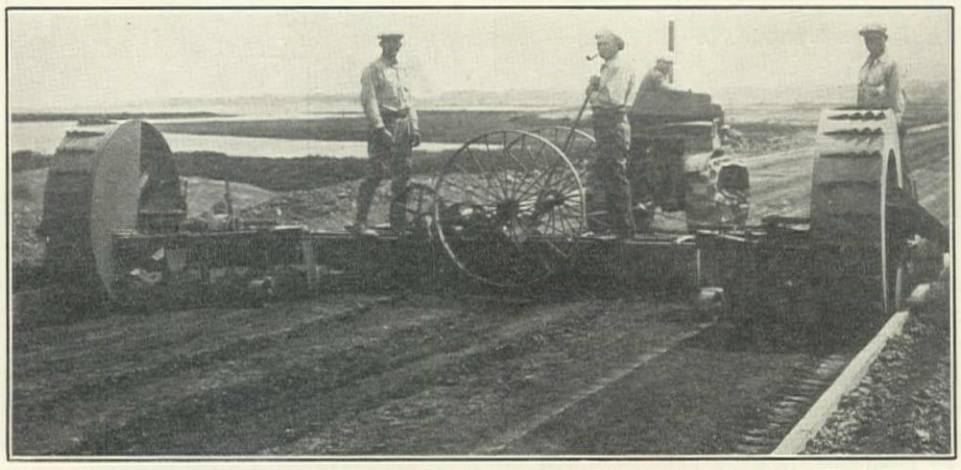
Paving—Two 27-E Ransome pavers are used, one on each side of the 20-ft. strip. These machines have an average batch cycle of 63 seconds, the specified mixing time used being 50 seconds. The daily run on the first strip (laid between September 2 and 30) averaged 1200 lin.ft. of 20-ft. pavement. The crew then backed up to the South San Francisco end of the work and began paving the last strip without loss of time. This was possible as the road had been closed in advance of subgrade preparation.

The project will probably be completed about November 15, or between 30 and 45 days ahead of schedule. The time limit of 125 working days is the shortest specified on any California paving contract of this magnitude (32,050 cu.yd. of concrete or the equivalent of 10.4 miles of 20-ft. pavement).

On September 24 probably the largest production in money value for a single day in the history of the California highway system was made when Basich Bros. Construction Co. laid 863 cu.yd. of Portland cement concrete pavement, 1100 tons of crusher-run base in shoulders, and 2200 cu.yd. of imported borrow. As the concrete pavement of 11-9-11-in. thickness requires 59 cu.yd. of concrete per 100 ft. of 20-ft. strip, this day gave a paving advance of 1460 lin.ft. The estimate on the last portion of the first strip averaged over $9000 per working day.

Finishing and Curing—Finishing is done with a 20-ft. Lakewood, followed by a 20-ft. Ord. A second Lakewood has been adapted by the contractor to form the weakened plane joint at the center of the 20-ft. strips, making a total of three finishing machines in line.

Water is supplied from the Spring Valley mains at South San Francisco through a 4-in. welded steel line 5.2 miles long and pumped by a 6 by 8-in. Aldrich vertical triplex pump with a capacity of 220 g.p.m. against 660-ft. head; 1½-in. risers being installed every 200 ft. The pavement is cured with a dirt and water blanket for 8 days; at 14 days it is opened to construction traffic. All other traffic is temporarily detoured over the old San Bruno road as occasion arises.



LAKEWOOD SUBGRADER POWERED BY CATERPILLAR '30' MAKES FINAL SUBGRADE CUTS. TAILINGS REMOVED WITH CLAUSEN WHEEL ELEVATORS

Personnel—J. H. Skeggs is district engineer for district IV, California Division of Highways, at San Francisco, A. W. McCurdy is assistant district engineer, and E. G. Poss is construction engineer. W. A. Rice is resident engineer; Ross Westbrook is street inspector, and Fred Montell is plant inspector on the South San Francisco-Burlingame section of the Bayshore highway.

Paul Wilcox is superintendent for Basich Bros. Construction Co., with Veolis Cox as paver foreman and Nick Sparavola subgrade foreman.

Complete Underpinning of a 14-Story San Francisco Office Building

Method Used to Replace a Wood Pile Foundation with Caissons and Structural Steel

By VAN W. ROSENDAHL

Superintendent, Lindgren & Swinerton, Inc., San Francisco

Editor's Note—Van W. Rosendahl was born in Colorado, shortly thereafter coming to Sacramento, California. Before going to college he spent three years with the California Division of Highways. He graduated from the University of California in 1925 with the degree of B.S. in C.E. Following graduation, Rosendahl spent one year with the Shell Oil Co. on construction of oil reservoirs near Martinez; since which time he has been with Lindgren & Swinerton, Inc., general contractors of San Francisco. During the past four years, Rosendahl has served as engineer or superintendent on construction of several large office and industrial buildings.

General—Buildings may require underpinning for one of four reasons. First, and most frequent, modern high buildings with their deep foundations and sub-basements compel the underpinning of surrounding older buildings. Second, for purposes of addition or increased loadings, a foundation may need additional bearing capacity. Third, a foundation may have insufficient bearing capacity, causing excessive or uneven settlement. Fourth, a foundation may deteriorate from conditions which were unforeseen at the time of construction. This case rarely occurs, for a designer expects the foundation of his structure to be more enduring than the superstructure.

The underpinning described in this article was required because of the deterioration of wood piles, caused by a receding water-table. Considering that the piles were driven in 1907, twenty-three years ago, it would have been improbable at that time to realize that the ground water-level would recede as much as 9 ft. It was my assignment to supervise the reconstruction and it afforded an opportunity to inspect this type of foundation 23 years after construction. Jointly I will present the method used to replace this foundation, and my observations of the condition of the original work.

Events Leading to Discovery—The structure, a 14-story class 'A' office building, is situated in the financial district of San Francisco, with a portion of one of its property lines common to that of a new skyscraper. Along this property line it was necessary to underpin two rows of columns with caissons. As excavation for the work progressed, it was found that the ground-water table had receded 9 ft. below the pile cutoff. Further inspection revealed serious dry rot at the butts of many piles; a large percentage were badly shattered by over-driving; and evidence of termites was found. The dry rot at the extreme butt had penetrated through the heartwood, and gradually decreased in thickness down the pile for a distance of about 5 ft., where the wood was of good quality. This indicated that the recession was gradual, and it can be attributed to the ever-decreasing supply of ground water in the district. All streets are now paved and nearly every block is completely covered with roofs, directing about 95% of the rainfall runoff to the sewers. Each new foundation constructed in this dis-

FIG. 1. DRY-ROTTED AND BROKEN PILES BENEATH OLD FOOTINGS OF SAN FRANCISCO OFFICE BUILDING

trict requires continuous pumping to sewers, which diminishes the existing volume.

Fortunately, the number of rotted piles up to the time of underpinning was not great enough to have caused any appreciable settlement in the building. It was truly evident, however, that within a few years additional rotting would surely cause serious trouble. To remedy the situation immediately would be of less expense, while the piles would be of assistance in supporting the loads during reconstruction. The engineer are carried on while the building is occupied by tenants, without confusion to their business. Column loads in this height of building are very heavy, varying from 400 to 800 tons.

Personnel—Plans and specifications were prepared by H. J. Brunnier, consulting structural engineer, of San Francisco, and the work conducted under his direction. Lindgren & Swinerton, Inc., of San Francisco, were the general contractors. D. J. and T. Sullivan, Inc., of San Francisco, were sub-contractors, sink-

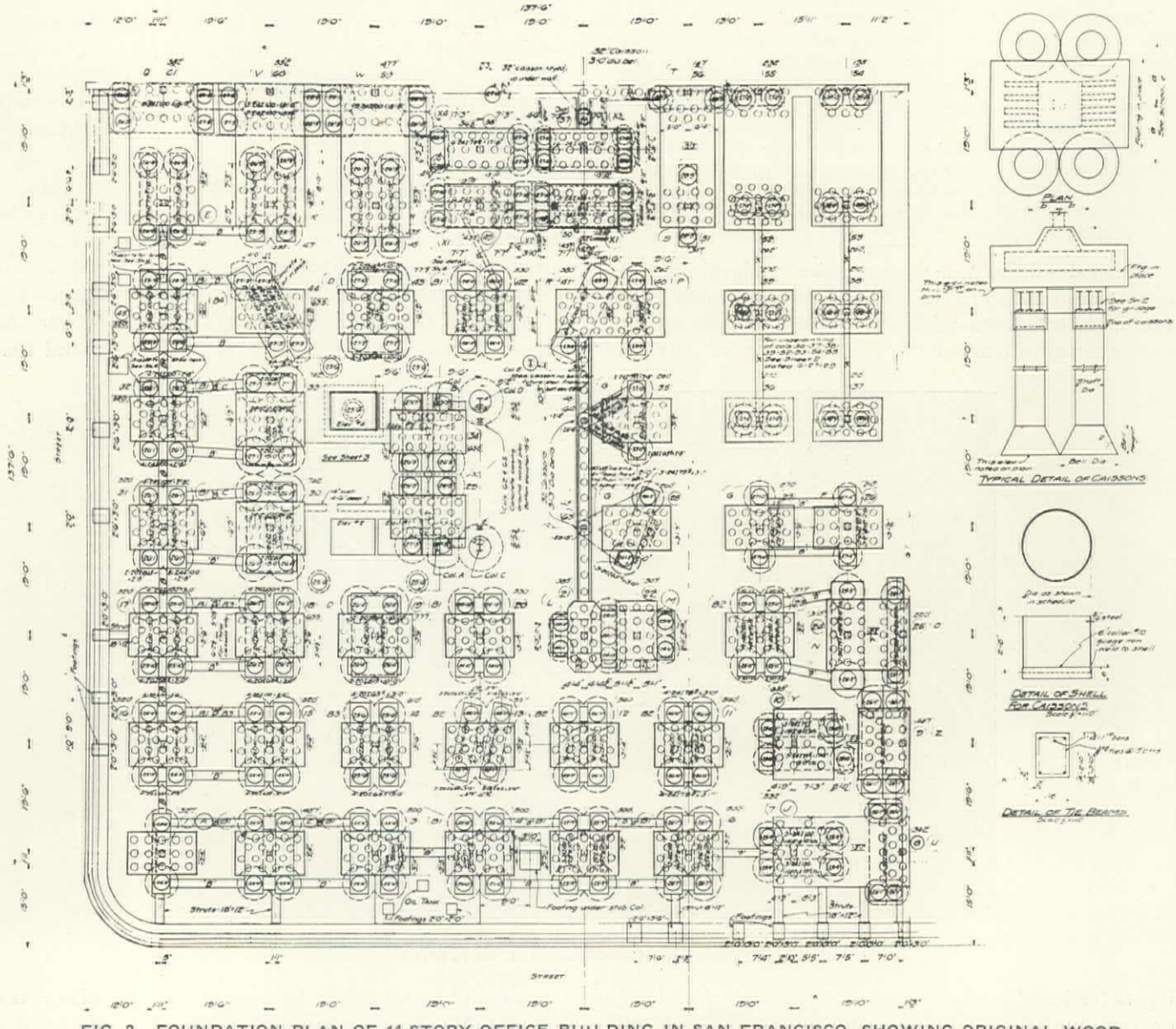


FIG. 2. FOUNDATION PLAN OF 14-STORY OFFICE BUILDING IN SAN FRANCISCO, SHOWING ORIGINAL WOOD PILE FOOTINGS, AND NEW CAISSON UNDERPINNING

recommended to the owner that the underpinning be continued through the entire foundation.

Responsibility—I wish to emphasize the responsibility assumed by the consulting engineer, general contractor, and sub-contractors in performing work of this nature. Great skill, care, and precaution are necessary. Loads must be transferred without settlement. Unequal settlement would cause serious damage to elevators and other mechanical equipment. Working area is limited to the space between piers, demanding careful planning of procedure. Operations ing caissons and placing structural steel. Materials were furnished as follows: caisson steel by Western Pipe & Steel Co., structural steel by Pacific Coast Steel Corp., and transit-mixed concrete by Golden Gate Atlas Materials Co.

Design—Complete plans were made with reference to the original foundation plans of 1907. The locations and dimensions checked with these original plans, but many unknown conditions demanded revisions in design for the underpinning. Oil tanks, a sewage ejector, new elevator pits, machinery footings,

and other mechanical features not shown on the plans prohibited the use of many designs. In these cases the problems had to be studied at the job, after the earth had been removed from the footings.

Several important features influenced the method to be used. The geological formation, as shown in Fig. 4, indicated that new footings must extend into a hard clay stratum, 25 ft. below the pile caps. As every advantage for support had to be taken until the load was to be transferred from the piles, no work should decrease the bearing capacity of the piles. The shifting of the load to the new footings should be done in a manner that would eliminate settlement. While safety is a predominating factor, the method should be economical, as the owner receives no income from his expenditure.

To satisfy these features, a general design was made

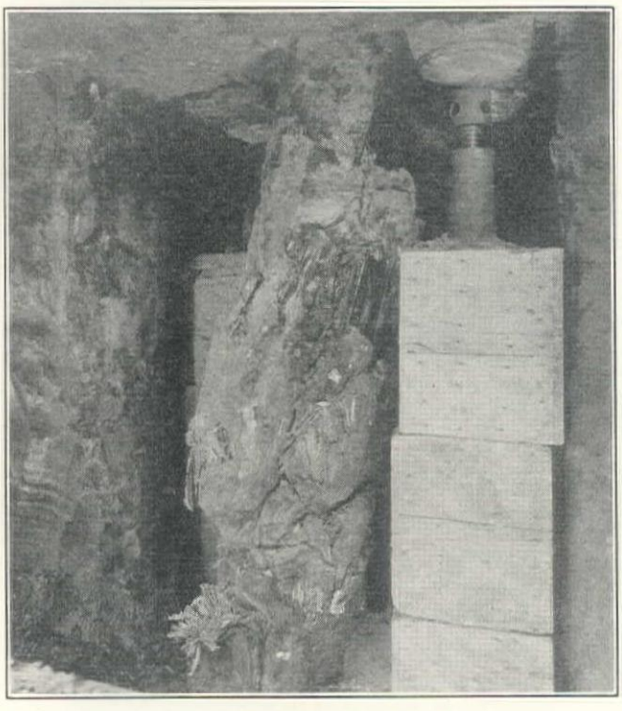


Fig. 3. Pile Telescoped, Showing Fracture

using caissons and structural steel needle beams. A typical case will be considered as shown in Fig. 2. Two caissons are placed on either side of the pile cap and sunk to the hard clay stratum. Bells are cut into the clay, diameters varying with the required area, but not exceeding twice the diameter of the caisson. Grillage beams are then placed parallel to the old footing and on top of the caissons. The purpose of these grillage beams will be explained under 'Underpinning'. Needle beams then span from grillage to grillage below the pile cap. The steel is then encased in concrete. This type of design permitted underpinning without settlement whatsoever.

Plant Layout—The plant included a chain and bucket sand elevator, concrete receiving hopper, pumps, compressor and air spades, and supply and exhaust ventilating fans. The layout of this equipment is shown in Fig. 5. After the original installation, it was necessary to alter only the ventilating system as excavation and backfill progressed.

Excavation and Backfill—The basement floor was a 6-in. concrete slab, without reinforcing, resting on sand. This slab was heavily loaded with stationery and supply rooms leased by tenants of the building. These rooms could not be disturbed. The boiler room with its heavy mechanical equipment was in constant operation. Consequently, as excavation advanced it

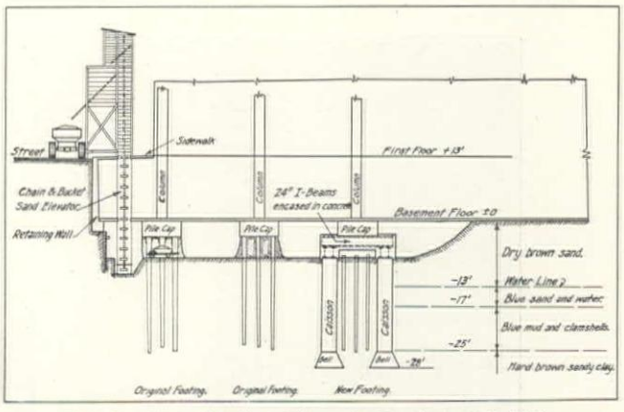


Fig. 4. Cross-Section Through Portion of Building Showing Footings

was necessary to shore and support the slab overhead. In order to provide sufficient working area, 1500 cu.yd. of sand had to be removed from around the footings. In addition, 2000 cu.yd. of concrete were to be placed in the new work, which made a total of 3500 cu.yd. of sand to be hauled away.

The earth was hand-excavated and delivered by wheelbarrows to the pit of a sand elevator. This machine elevated the material to bunkers above the sidewalk, as indicated in Fig. 4. No labor was necessary after dumping at the pit and trucks were kept in constant operation by storage in the bunkers. The output

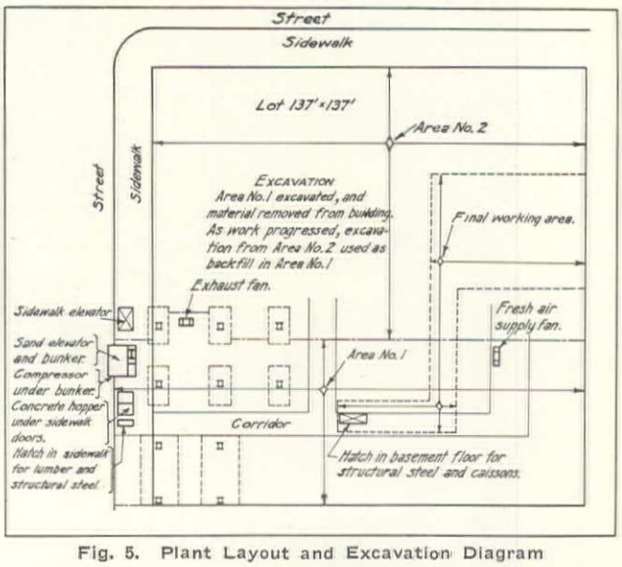


Fig. 5. Plant Layout and Excavation Diagram

averaged 130 cu.yd. in an 8-hour shift. Fig. 5 shows the area first excavated. As the underpinning was completed in this area, new space was opened and the material backfilled around the new work.

Upon completion of the job, 1500 cu.yd. of sand backfill was returned to the building to fill the final working area. The backfilling had to be thoroughly tamped in 6-in. berms, working gradually on a slope up to the basement floor. The final top layer, about

12 in. thick, was rammed horizontally. As presence of water in sand increases its volume, the backfill was placed dry, insuring a solid, compact mass.

Shoring—Preliminary shoring of the slab was done with house movers' blocks and screw jacks. Later, horizontal timbering was placed into notches cut into the pile caps, and wedges were driven between the timber and slab. The jacks were then removed, and clear unobstructed corridors between footings allowed free passage of men and materials. In order to provide adequate head room, the excavation exposed about 4 ft. of the pile butts. Wherever the space between piles was sufficiently large, a mat bottom was placed on the sand and a jack inserted. In most cases,

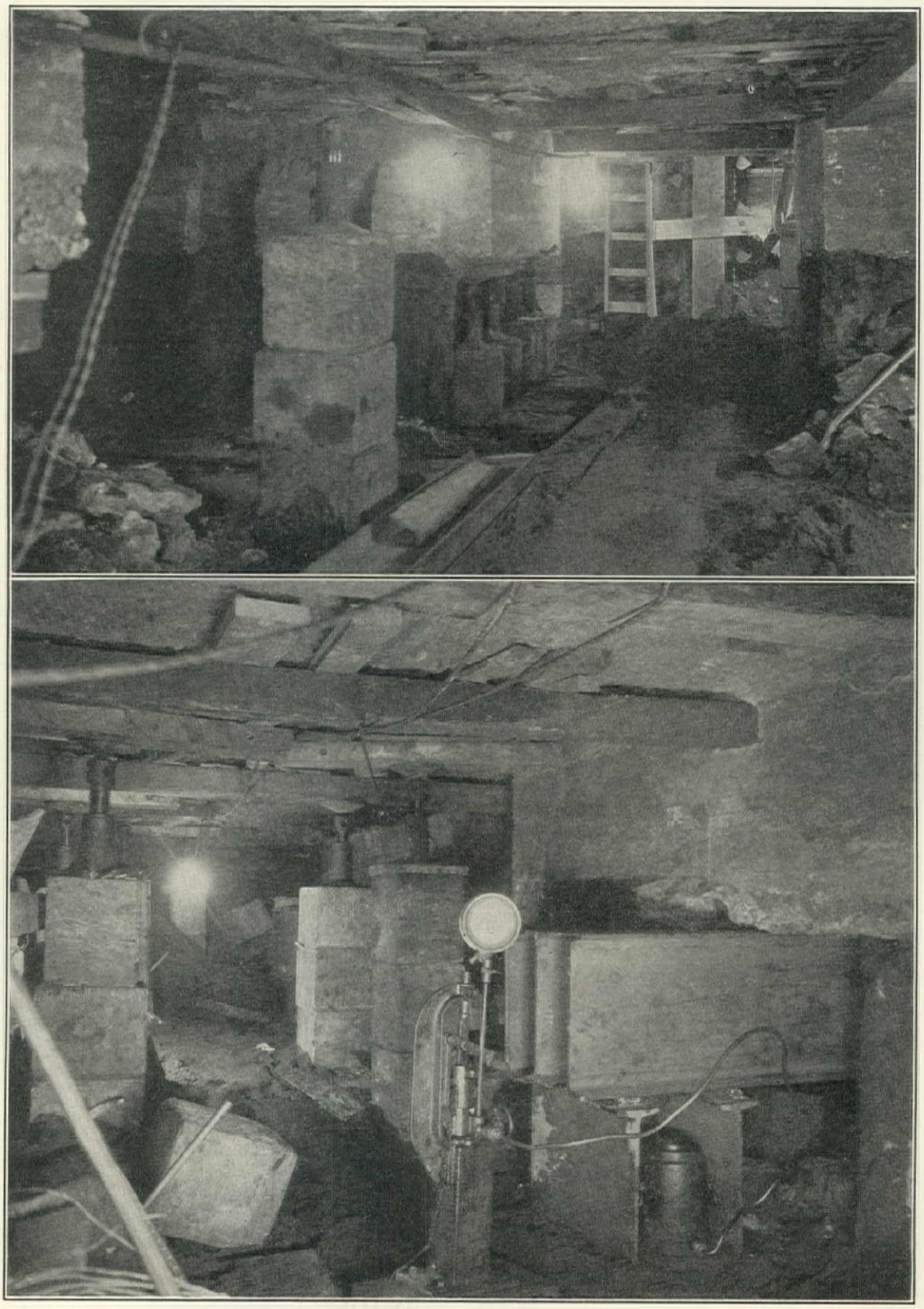


FIG. 6. (UPPER) SHORING UNDER BASEMENT SLAB AND PILE CAP, SAND ELEVATOR IN BACKGROUND. (LOWER) ONE-HALF OF STEEL IN PLACE. HYDRAULIC JACK IN POSITION FOR APPLYING LOAD

eight or more jacks could be placed under a single footing. Each day these jacks were 'felt', or pulled up, compressing the ground and assisting to carry the column load. In cases where the butt of a pile was badly rotted and of no bearing value, the butt was cut off and a jack placed between the remaining piece and the footing. This made it possible to temporarily renew the value of a pile.

Sinking Caissons—In the selection of a type and method of sinking caissons, it was essential to consider that construction should not disturb the material supporting the piles. The caissons were made up in 30-in. lengths of $\frac{3}{16}$-in. sheet steel. Diameters were 32, 36, and 40 in., the sizes varying with the loads to be supported. Seams were butt-welded; a 6-in. collar of No. 10 gauge steel being welded on the lower edge. Before placing successive joints, the collars were covered with a compound to prevent leakage of water. This type provided a water-tight caisson that could be forced through sand and water to the blue clay. Here the water was automatically sealed and the shell could be excavated without the loss of sand from the exterior.

The joints were forced down by hydraulic jacks bearing against some type of rigging to suit the conditions. Fig. 8 shows one system used in a very narrow space, where the bottoms of the two piers were of different elevations. The shell was excavated by hand and material hoisted in buckets with a block and tackle. Air spades were required to cut the clay stratum in which the entire bell was made. Caissons were immediately filled with concrete after excavation.

A unique example of an over-driven pile was found when one of the caisson cylinders struck an obstruction which proved to be a pile which had shattered under driving and had turned horizontal. A section had to be cut out from this pile to permit the caisson to be sunk.

Underpinning—Transferring the load from the piles to the caissons was the most difficult and hazardous operation. All temporary jacks under a footing were pulled up to take as much load as possible. Then the

Fig. 8. Hydraulic Jack Forcing Steel Caisson Into Position

sub-grillage was placed on the caissons parallel to the footing and spaced 12 in. between the flanges. This space allowed a 100-ton hydraulic jack to be placed on the caisson directly under the proposed location of a needle beam. Fig. 6 illustrates this arrangement. Each footing required from six to twelve needle beams. A minimum number of piles were cut at a time to permit one beam to be placed in position. After placing

FIG. 7. UNDERPINNING COMPLETED. COMBINED FOOTING SUPPORTS WALL COLUMN AND INTERIOR COLUMN

the beam, the hydraulic jacks under either end were pumped until the top flange touched the lower points of the rough concrete. Steel shims driven between the beam and concrete provided a uniform bearing. Then the jacks were operated again until the gauges indicated the required load in tons to be applied to the beam. Steel shims driven between this beam and the sub-grillage secured the load. Jacks were released and moved over to the next position.

Using this method, it was safe to cut off more piles to provide room for the next beam. These operations were repeated until all structural steel was placed.

Concrete Work—Transit-mixed concrete assisted in reducing the area required for a plant. A receiving hopper built under permanent sidewalk doors occupied only 30 sq.ft. Concrete was transported in buggies and poured into chutes through holes cut in the basement slab.

Levels on Columns—Level marks established on every column at the start of the job served as a safety barometer. Each night these levels were checked by a surveyor and a report was given to the superintendent. It is gratifying to state that the construction caused no appreciable settlement.

The magnitude of the work is as follows:

Dimensions of building	137 by 137 ft.
Number of columns underpinned	65
Average column loads	400-800 tons
Structural steel used	350 tons
Concrete placed	2,000 cu.yd.
Caissons required	225
Area excavated	20,000 sq.ft.
Excavation to perform work	8,000 cu.yd.
Sand removed from building	3,500 cu.yd.
Backfill returned to building	1,500 cu.yd.

Conclusion—The actual reconstruction of the foundation is the most interesting feature of this work; but the more important lesson is to be learned from the old pile foundation. From a structural standpoint a wood pile is entirely satisfactory, but when there is the least possibility of water-table recession it is certainly advisable to lower the cutoff elevation or to use piles of a non-deteriorating material. The dangers of over-driving piles is equally important. Twenty-five per cent of the piles under this building were badly shattered and broken. In most instances, the break occurred within 6 ft. of the butt. An inspector will often demand hammering to be continued after a pile has reached practical refusal. He may think that it has met with some obstruction which will give way with additional driving. When the pile begins to move again, is it passing by this obstruction, or is it broken?

Work of this character requires the employment of men specially fitted and trained, many of them being known in the industry as 'sand hogs'; others familiar with underpinning and house moving, and concrete foundations. Between 30 and 45 men were employed on this job over a period of 8 months.

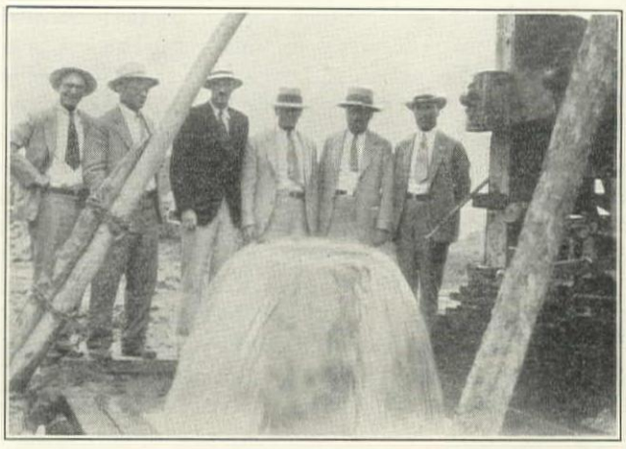
Bridge River Tunnel, B.C.

The 2½-mile tunnel for the Bridge river development of the B. C. Electric Railway Co. has been concrete lined for 800 ft. of arch and 6000 ft. of invert.

RIVERSIDE BRINGS IN ARTESIAN WELL

The city of Riverside, California, recently brought in an artesian well flowing 2,900,000 g.p.d. as an addition to its domestic water supply. The flow of this well is controlled by means of one 12-in. and one 8-in. valve and is carried by a 16-in. pipe to a 30-in. concrete transmission main leading to the city.

The Riverside water system has a storage capacity of 17,000,000 gal. and the supply is obtained mostly from artesian wells. There are 175 miles of 4 to 42-in.



cast-iron, steel, and concrete mains and 9035 services consisting of steel pipe (dipped) ¾ to 3-in. diam. Meters, of which there are 8040, are ⅝ to 3-in. The range in pressure is 15 to 120 lb.; there are 965 fire hydrants in the system.

Shown in the illustration from left to right are the following city officials who made a trip to view the new artesian well: R. L. Boulden, superintendent of the light department; W. A. Scott, superintendent of the water department; J. S. Long, mayor; G. A. Mills, city clerk; and H. H. Hammond and Thomas Flaherty, water commissioners.

MUNICIPAL HYDROELECTRIC PLANT FOR CENTRALIA

The city of Centralia, Washington, is developing a municipal hydroelectric power and light plant at a cost of $1,000,000. The contract for this plant was awarded to the Puget Sound Bridge & Dredging Co., of Seattle, on April 29, 1930. Because of an emergency, the city required that the work be completed by October 1, 1930, and included a penalty clause of $400 per day in the contract. The construction time was so short that a number of contractors declined to bid. The plant was placed in operation September 15, two weeks in advance of the fixed completion date.

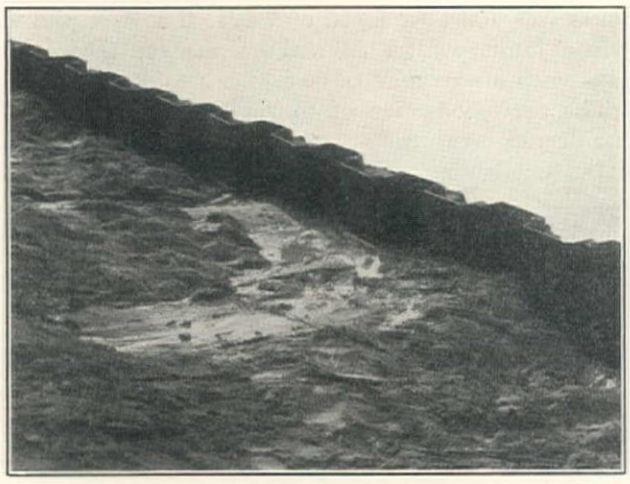
John W. Roberts is president; H. W. McCurdy vice-president and general manager; and Raymond J. Huff, secretary-treasurer of the Puget Sound Bridge & Dredging Co. This firm has been operating 41 years and has branch offices in Dallas, Texas; Portland, Oregon; and Vancouver, B. C.

Alki Avenue Seawall, Seattle, Washington

By D. A. BOYLE
Superintendent, Department of Streets and Sewers, City of Seattle

Temporary Wall—In 1915, the city of Seattle constructed 5400 lin.ft. of temporary wooden seawall extending along the north side of Alki ave. from Luna park westerly. This avenue is in the southwest section of the city, known as Alki point, and bounds the southerly portion of Elliott bay.

For the 1915 improvement, a 10-ft. hydraulic fill was made, an old street-car trestle was removed, and



Alki Seawall, Elliott Bay, Seattle, Reconstructed with Larssen Steel Sheet Piling. Before Concrete Coping Was Poured

cement concrete pavement in 18-ft. strips was subsequently laid on each side of the car track to make an attractive marine drive. The wooden seawall was placed 18 ft. north of the pavement and adjacent to the beach. As the fill consisted mostly of loose sand, this wall had to be kept in good condition to prevent the fill being washed away.

Construction of a permanent wall was delayed from year to year, and the Seattle Street Department was called upon to keep the temporary wall repaired. In 1927, rock riprap was laid the full length of the 5400 ft. as further protection for the marine drive. In 1929, the necessity for immediate construction of a new seawall at this location was recognized and I recommended that, for rapid and economical construction, a steel sheet pile wall should be built. The city council followed the recommendation and appropriated $85,000 and directed me to build the seawall.

Permanent Wall—The specifications called for the completed wall to weigh not less than 20 lb. per sq.ft., the piling to be 18 ft. long and of approved design. The Puget Sound Bridge & Dredging Co. was awarded the contract on August 12, 1929, for furnishing and driving in place 972 tons of Larssen steel sheet piles, section 1, at $65.25 per ton (5400 lin.ft. of wall). This Larssen pile section weighs 20 lb. per sq.ft. of completed wall and is 15¾ in. wide and $\frac{5}{16}$-in. thick in the web.

Driving Conditions — The piling was to be driven just inside the wooden wall on a batter of ½ in. per ft., topping 18 in. below the pavement curb. (The wooden seawall had a batter of 1:3.) The steel sheet piling was to penetrate 10 ft. through the old fill and about 8 ft. into the beach.

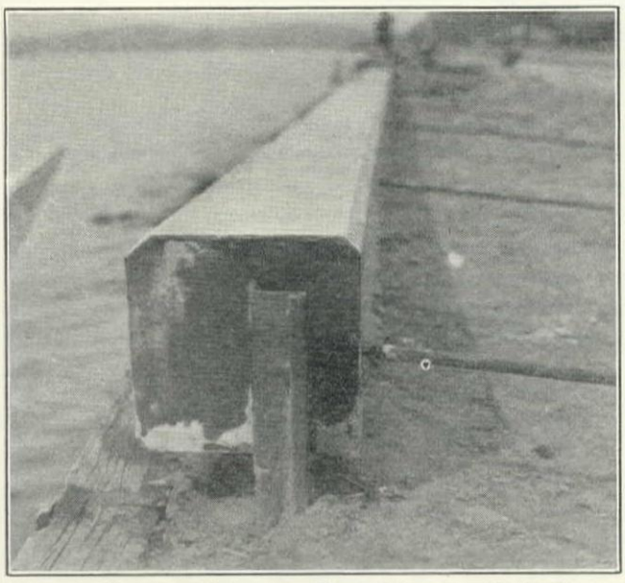
The wooden seawall had been braced at 10-ft. intervals for its entire length by 12 to 18-in. diam. tie logs at right angles to it and about 6 ft. below the top, being located at the high tide mark. An attempt was made to drive the sheet piling through these tie logs with little success, and it was decided to dig down to each log by hand and saw out a section so as to allow passage of the steel wall. Later, where it was inconvenient to cut them, 13 of these old tie logs ranging from 10 to 15-in. diam., were driven through. It took 5 to 15 minutes, however, of hard driving to accomplish this and also used too much steam to be practical.

Driving Steel Sheet Piling with McKiernan-Terry Hammer Behind Old Wooden Seawall, Alki Point, Seattle

Driving Methods—The steel sheet piling arrived September 16, 1929, in good condition, with little of the original paint removed. All exposed metal was painted before driving. The driving rig had a rack holding 18 piles and was equipped with skids. Power

was supplied from a steam derrick also on skids. The steam hammer to be used was not immediately available and 13 days were lost waiting for it, driving being commenced on October 10.

A full supply of piles was first placed in the rack on the driving rig. Two guides were used, one about 6 ft. from the ground and the other at a higher elevation and placed on the desired batter. No particular difficulty was experienced in threading the piles except for about 25 of the 4111 used. These few had to be pulled into place with block and tackle because of too tight a fit in the interlock. Most of the others dropped into place of their own weight. The average time



Reinforced Concrete Coping on Top of Larssen Steel Sheet-pile Seawall, Alki Point, Seattle

required for placing the 18 piles in driving position from storage along the roadway was 60 min.

The piles were driven two at a time by means of a special driving cap covering almost two pile heads. A 9-B-2 McKiernan-Terry double-acting steam hammer weighing 6800 lb. was used. Between 140 and 180 blows were required, the hammer delivering 120 to 130 blows per minute, to drive the piles to grade. The average driving time for 18 piles was 30 minutes.

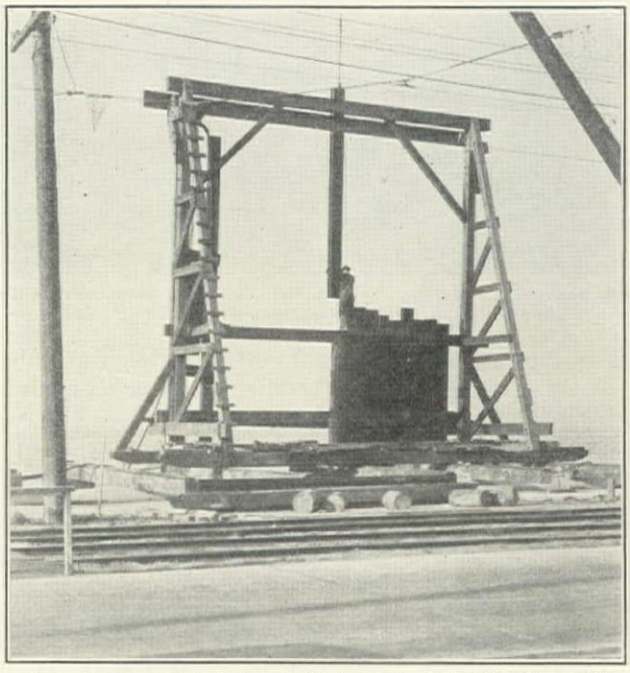
The driving hammer traveled along an I-beam at the top of the rig, in the reverse direction to that in which the wall was being built. This was necessary to prevent the tops of the piles from creeping forward. In this regard it was also found to be important to have the piles placed as nearly vertical in the rack as possible, and to hold them in this position with a brace or two until driving began, also keeping the hammer leads plumb. The tendency of the piles to lean in the direction in which the hammer was traveling sometimes caused a squeezing of the last few piles to be driven in a set and resulted in one or two of these piles pivoting several inches off line, or the binding and carrying below grade of a pile already driven. Binding was somewhat prevented by driving wedges in the interlock. Altogether, 95 of the 4111 piles were 2 to 4 in. below grade and 45 were 6 to 18 in. above grade due to binding.

Fifteen piles struck large boulders and had to be left 2 to 3 ft. high. Driving was not hard on the whole, and fewer obstructions were encountered in the beach than had been anticipated. A good line was kept by watching the placing of the skids on the driving rig and setting piles accurately in the rack. It was found to be advantageous to brace the master or end pile to prevent its twisting off line. Thirty-five piles were pushed 1 to 3 in. off line by boulders or some other obstruction.

The piles battered but little with the use of a driving cap into which they were keyed. Wedge plates to increase the fit around the ends of the piles were found to be useful in hard driving.

The driving rig and derrick were pulled ahead on skids under their own power and required an average of 15 minutes to get into position for a new set of 18 piles. The average time required to thread, drive, and move ahead for each set was 1 hour and 45 minutes. The greatest number of piles set up and driven in 8 hours was 108 (142 lin.ft. of wall). The last pile was driven January 31, 1930, making an even 60 working days with an average of 68.5 piles per day.

The crew consisted of four pile-driver men at $9, one derrick engineer at $10, and one foreman at $11. Labor for driving was about $4600. For removing the



Skid Traveler Pile Driver with Rack to Hold 18 Piles, Alki Seawall, Seattle

tie logs there was an average daily crew of nine laborers at $5.60, the labor cost totalling $3200.

Coping and Tie Rods—A reinforced concrete coping, 17 in. wide by 16 in. deep, was later placed along the top of the wall, with ½-in. expansion joints at 40-ft. intervals (every 30 piles). The top of this coping is about 12½ ft. above the beach level. Steel tie rods 1 in. diam. were buried in the coping at 13-ft. intervals (every 10 piles) and extended 38 ft. across to the opposite side of the pavement and into 2-ft. by 4-ft. by 8-in. concrete anchors. The coping was built to insure the stability of the wall and also to give it a trim appearance; its cost, including tie rods and anchors, was $13,544 for 5400 lin.ft. or $2.51 per lin.ft.

The cost of the wall is $78,509 or $14.54 a lin.ft.

Tracy-Crockett Section, Kettleman Hills-Richmond Natural Gas Pipe-Line, California

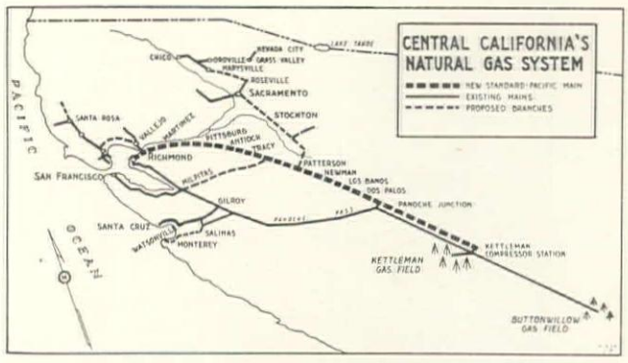
Bechtel & Palmer Lay 46 Miles of 26 and 22-Inch Electric-Welded High Carbon Steel Pipe for Standard-Pacific Gas Line in 99 Working Days

Bechtel & Palmer, of San Francisco, completed a contract on June 1 for 46 miles of the 200-mile Kettleman Hills-Richmond natural gas transmission line for Standard-Pacific Gas Line, Inc. This line rounds out a tremendous interconnected system and serves a rich industrial section of Contra Costa county, adding the advantage of cheap fuel to the natural harbor facilities of San Francisco bay. It is routed from Kettleman Hills through Los Banos, Tracy, Antioch, Pittsburg, Martinez, and Crockett to Richmond and augments the 250-mile Buttonwillow-San Francisco bay line which was put in service last year. (See May 10th, 1929, issue, p. 230.)

The natural gas supply is taken from the 7236-ft. discovery well, Elliott No. 1, which was brought in during 1928 after 22 years of pioneer prospecting in this new field and has a daily capacity of 17,000 bbl. of crude and 30,000,000 cu.ft. of gas; supplemented by two recent wells having a combined capacity of 100,000,000 cu.ft. per day. The Kettleman field is said to be one of the largest oil and gas reserves in California. Elliott No. 1 had an initial capacity of possibly 100,000,000 cu.ft. of gas and 85,000,000 cu.ft. until the spring of 1930.

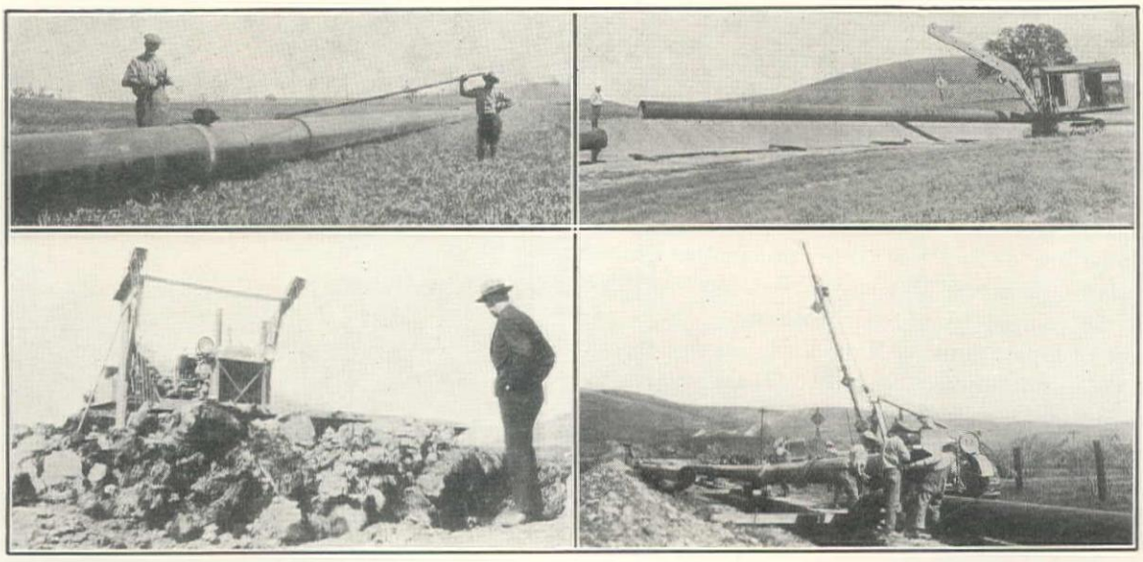
Extent of Work.—The Bechtel & Palmer contract extended from Tracy Junction to Crockett Junction. All materials were furnished by the Standard Oil Co.

This 46-mile section involved a total outlay of $2,000,000. The contract included trenching, welding, pipe-laying, and backfilling. There was 27 miles of 26-in. high carbon welded steel pipe, $\frac{5}{16}$-in. thick, in 40-ft. joints weighing 3404 lbs. per joint, and 19 miles of 22-in. pipe of the same wall thickness and joint length, weighing 2896 lb. per joint. Of this line, 6000 tons was 26-in., the total weight of pipe and joints in the contract being about 10,000 tons.



Ten miles of the line is protected against corrosion by a special asphalt mastic.

Remarkable speed was made on the contract. Deducting rain, the average of all operations was 0.4 mile per day.



(UPPER LEFT) ELECTRIC ROLL WELD ON TRACY-CROCKETT GAS LINE. (UPPER RIGHT) BUCYRUS 20-B CRANE HANDLING PIPE STRING. (LOWER LEFT) CATERPILLAR '60' AND MASTER BULLDOZER BACKFILLING TRENCH. (LOWER RIGHT) CATERPILLAR '60' WITH W-K-M SIDE BOOM AND PIPE TONGS PLACING STRING IN POSITION FOR BELL HOLE WELD

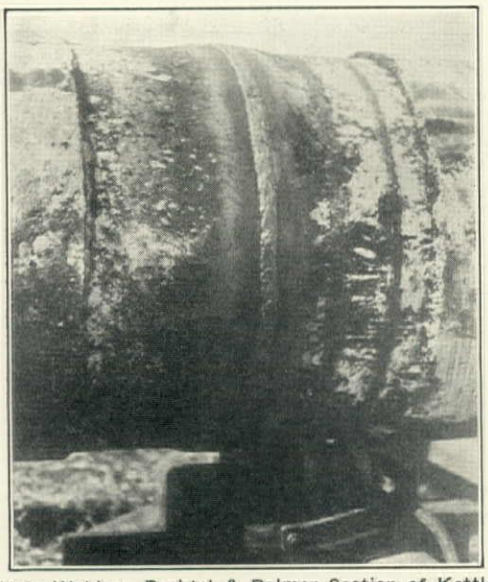
Organization—Standard-Pacific Gas Line, Inc., is jointly controlled by the Standard Oil Co. through Pacific Public Service Co. and the Pacific Gas & Electric Co. through Coast Counties Gas & Electric Co. Originally the two companies planned separate lines and actually began construction before the joint organization was effected. Through the new company it was possible to eliminate duplication of facilities

while providing ample capacity for present needs, and to effect a saving in construction costs of nearly $9,000,000.

The Bechtel & Palmer contract was supervised by the Standard Oil Co. Subcontractors included R. P. Easley, of Antioch, on a portion of the trenching and the A. O. Smith Corp., of Milwaukee, who did the welding.

The A. O. Smith Corp. furnished all pipe and joints under a direct contract with the Standard Oil Co.

Construction began February 1, 1930, and was completed in 120 days, despite the loss of 21 days on account of rain. Except for rain, the operation was continuous, each phase of the work following closely on the one preceding.



Bell Hole Weld on Bechtel & Palmer Section of Kettleman Hills-Richmond Natural Gas Pipe-Line

The new line has a present daily capacity of 138,000,000 cu.ft. of natural gas and an ultimate capacity of 200,000,000 cu.ft. per day. It is the largest and heaviest pipe-line of the type to be laid in the United States to date and is the first major Standard Oil pipe project to be jointed by electric welding.

Sequence of Operations—All pipe was manufactured at Milwaukee and shipped by rail to storage yards at the following points: Tracy, Byron, Brentwood, Concord, and Pinole. The necessary pipe protection was applied at the storage yards. Pipe was hauled and strung with a fleet of pneumatic-tired trucks and trailers, each handling a 10-ton load. The 46 miles of trench, involving 150,000 cu.yd. through earth and rock, was done with three Buckeye trenchers. Welding on the main joints was done with electric arcs, using portable Smith generators. Caterpillar tractors equipped with side booms and one Bucyrus crane were used to handle and lay the strings of pipe. Backfilling was accomplished with Caterpillar tractors and bulldozers.

There were no ravine or stream crossings requiring special structures.

Protective Coating—Eight miles of the line lay through highly corrosive soil and required a protective coating of ½-in. asphalt mastic. In addition, two miles crossed a salt water marsh near Martinez, where, besides the mastic coating, the pipe had to be weighted with concrete blocks at each joint.

Previous experience on the recently constructed pipe-line from Kettleman Hills north, where some sections of pipe were seriously pitted from soil corrosion before the line was completed, showed the necessity for developing a more dependable protective coating. The asphalt mastic was developed by the Standard Oil Co. especially for this line. It is composed of sand, mineral dust, and asphalt and is similar to floor and sheet asphalt paving. No equipment for placing the coating was available before the project was planned, so it was designed, assembled, and put in operation within one month. The mastic was rolled on by machine from a hopper. Use of the coating increased the weight of each joint 40% and made the handling problem more difficult.

Hauling and stringing of pipe was done by the Lang Transportation Co. of Los Angeles under direct contract with the Standard Oil Co. In advance of hauling, dirt tote roads had to be constructed along the 30-ft. right-of-way, using Caterpillar '60' tractors and Master bulldozers for this purpose.

A fleet of Mack trucks was used to haul and distribute pipe from the five storage yards. These yards were about equally spaced with regard to facilities. The Lang Transportation Co. kept the hauling and stringing well ahead of the other operations despite the handicap of spring rains.

Trenching—A portion of the trenching was done by Bechtel & Palmer, using two ladder type and one wheel type Buckeye trenchers; the remainder was sublet to R. P. Easley of Antioch. Very little trenching was done by hand.

About one-fourth of the trench was dug through solid rock and hardpan, the rest of the 150,000 cu.yd. being in earth. No shoring was required on the work. The trench averaged 5 ft. deep and 3 ft. wide and was dug at an average rate, deducting time out for rain, of 0.5 mile per day.

Caterpillar '60' with Bechtel & Palmer Boom and Rope Sling Lowering Welded Pipe into Trench. Note Use of Removable Telescopic Tripod Leg with Side Boom

Pipe Bends—To be safe and stable, the pipe-line had to fit the trench accurately so that movements resulting from temperature changes or other stresses would not be localized at the bends, with resulting overstress and possible rupture.

The pipe was of large diameter and thin wall and could not be bent in the field without buckling. Ac-

cordingly, two types of joints were devised to care for changes in alignment and grade. For large angles, miter joints were cut and acetylene welded. Other angles up to 12 deg. were made with Smith wrinkle-belly joints. These joints are shaped like an accordion and contain three corrugations. They were formed in the shop, inserted in the field by electric welding, and assumed the proper angle when the line was lowered into the ditch. These wrinkle belly joints were used in the great majority of cases and were quickly applied.

Welding—Electric arc welding was used on the main joints because of greater speed over alternate methods. However, all cutting and welding of specials was done with gas. The electric arc welds were neither brittle nor porous, as processes had been developed which put protective coatings on the welding electrodes. With this development and careful handling, the defects of bare-wire welding were eliminated.

Ten welders were used, assisted by a line-up and firing gang and a swing gang. The line-up gang took individual joints and welded them into strings of variable length, the longest containing eight joints. This operation was known as the roll weld as the strings were placed on rollers, turned by hand, and welded ready for the swing gang. The line-up gang averaged 0.67 mile per day, rainy days excluded, and could make 100 roll welds per day on 26-in. pipe and 120 on the 22-in. pipe.

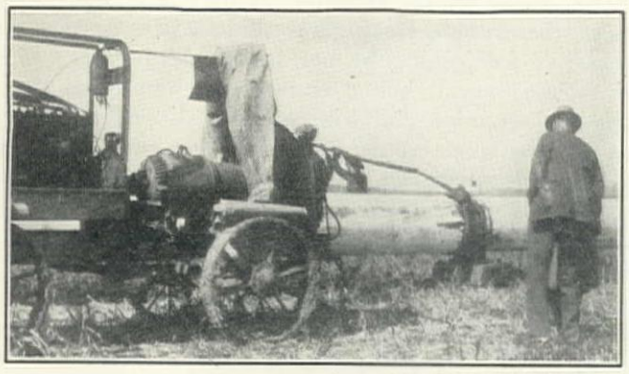
The swing gang took the strings and laid them above the trench, resting on skids where they were accessible for joining by bell-hole welding. The pipe joints had special belled ends into which steel rings 3 in. wide—called chill rings—were slipped to bridge the gap between abutting ends of successive joints. These rings served as backing strips upon which the weld metal was deposited. The swing gang averaged 0.6 mile per day, the average number of bell hole welds per day per welder being 7 for the 26-in. and 8 for the 22-in. pipe.

(UPPER) TWO CATERPILLAR '60S' WITH BECHTEL & PALMER BOOMS JOCKEYING PIPE STRING PRELIMINARY TO BELL HOLE WELDING. SMITH WRINKLE BELLY JOINT IN FOREGROUND. (LOWER) PLACING LAST SECTION OF PIPE IN NATURAL GAS LINE NEAR MARTINEZ, VALVE ASSEMBLY FOR WYE BRANCH IN FOREGROUND

Welding and pipe-laying equipment included eleven gas-driven portable electric generators mounted on 1½-ton Ford trucks, thirteen Ford pick-ups, seven Caterpillar '60' and two Caterpillar '30' tractors, one 20-B Bucyrus crane, one W-K-M side boom attachment, and four side booms of Bechtel & Palmer make.

Pipe Laying—All pipe laying was done by Bechtel & Palmer, using a crew of 180 men for this work and

to assist the welders. The lowering-in gang averaged 0.67 mile per day, using the tractors with side booms and the one crane. For steadying effect, a telescopic tubular steel tripod leg could be attached to the home-made side booms. These booms were equipped with



Portable Smith Generator on Bechtel & Palmer Section of Standard-Pacific Gas Line

Beebe hoists. Strings were picked up from the skids and shifted parallel to the trench and lowered either by two side boom rigs or the crane. Both tongs and rope slings were used to cradle the pipe.

To avoid tensional stress it was necessary to keep a hump in the pipe by leaving an intermediate string above ground while those on either side were lowered into the trench. In this way all the pipe was laid in compression.

Merco-Nordstrom valves were installed at intervals of 3 to 4 miles.

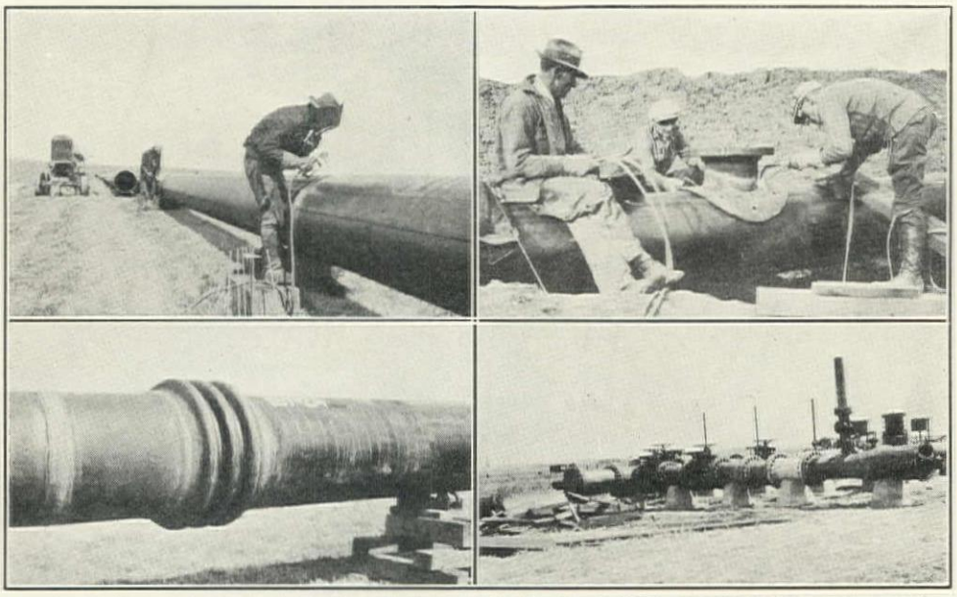
Line Tests—Two Ingersoll-Rand 310-c.f.m. portable compressors mounted on 5-ton Sterling trucks were used to furnish air for the initial and second tests of the line. The initial or soap test was made on 1-mile sections above ground and consisted of coating the joints with liquid soap, applying an air pressure of 100 lb. per sq.in., and inspecting the joints for bubbles. The second test was far more severe and was made on 3-mile sections after the pipe had been lowered. With an air pressure of 100 lb. and gages set along the line, the pipe was required to show no appreciable loss in pressure for 24 hours. The final test was made after completion of the line and consisted in applying a 400-lb. pressure with natural gas.

Backfilling—Bechtel & Palmer handled all of the backfilling with Caterpillar '60' tractors and Master bulldozers. The backfilling equipment was capable of making 2 miles per day but was slowed down by the other operations to an average speed of 0.6 mile per day.

Personnel—The engineering was done by the Standard Oil Co., under H. H. Hall chief engineer, and L. T. Kennedy field engineer.

S. D. Bechtel was in charge for Bechtel & Palmer, with W. L. McClune resident manager and J. E. Estes general superintendent on the work. The crew, including subcontractors, totalled 250.

Bechtel & Palmer were able to complete this contract in record time because of their previous pipe-line experience and high type of organization.



(UPPER LEFT) MAKING ELECTRIC ROLL WELDS AT ENDS OF 40-FT. JOINT, PORTABLE GENERATOR IN BACKGROUND. (UPPER RIGHT) SPECIAL FITTING BEING ATTACHED TO LINE BY GAS WELDING. (LOWER LEFT) SMITH WRINKLE BELLY JOINT INSERTED FOR BEND AHEAD OF BELL HOLE WELD. (LOWER RIGHT) TRACY JUNCTION CONNECTION, BRANCH TO MILPITAS IN RIGHT FOREGROUND AND BEGINNING OF BECHTEL & PALMER CONTRACT IN LEFT FOREGROUND; METERS INCLUDED IN VALVE ASSEMBLY

WESTERN CONTRACTORS OPERATE IN MID-CONTINENT FIELD

The Bechtel-Kaiser Company, Ltd., formed by the Kaiser Paving Co. and W. A. Bechtel Co., is actively engaged in pipe-line and other major engineering construction at this time in the middle west and mid-continent country. Among the projects which they now have under construction is 140 miles of the 1000-mile Texas-Chicago natural gas pipe-line. This contract involves more than $1,000,000 and extends from Forgan, Oklahoma, to Larned, Kansas. The section consists of 24-in. seamless steel pipe $\frac{5}{16}$ in. thick and averaging 40 ft. per joint. It is being laid in 80 to 90-ft. strings and is electric-welded, Dresser couplings being used.

The new construction organization is rapidly expanding to handle other large pipe-line contracts.

Paving Canyon Road, Multnomah County, Oregon

Construction of 3-Mile Major Arterial Highway Nearing Completion at Total Cost of $1,120,000

By GEORGE W. BUCK

Roadmaster and County Engineer, Multnomah County, Portland, Oregon

In 1926, the voters of Multnomah county, Oregon, approved a $2,500,000 bond issue for highway improvements. Several roads were to be reconstructed from the fund, but the major portion was allotted to the Canyon road. This was an old territorial road dating back to the early days of the west. It followed a canyon cutting through the high range of hills which separates the rich Tualitin valley from the city; its original construction to a great extent controlled the location of the city of Portland. The road was first paved in 1918 and, as traffic increased, it became inadequate to meet the congestion. As the Canyon road is destined to become one of the most important arteries leading into Portland from the southwest and connecting with important roads of the state highway system, and in its existing condition had many sharp curves and steep grades, it became necessary to build for the future.

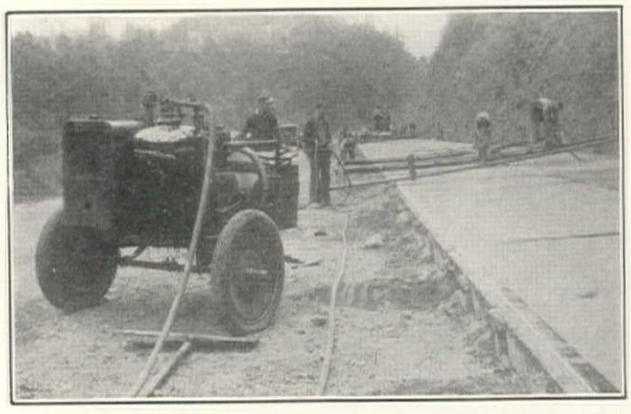
Grading and Temporary Surface—The new highway was graded during 1927 and 1928. It is 3 miles long and has a roadbed 57 ft. wide. The old road followed the bottom of the canyon and in order to obtain light grades and good alignment, it was necessary to build the new road along the steep side slopes.

The realignment involved heavy construction. Altogether, there was 537,846 cu.yd. of excavation, of which 245,162 was solid rock and 103,300 cu.yd. was of intermediate classification. There was 439 cu.yd. of rubble masonry and 202 cu.yd. of concrete walls required to hold the slopes. For constructing a 36-ft. temporary macadam surface, 31,732 cu.yd. of crushed rock was used. These operations were done by Wren & Greenough, of Portland, at a cost of $532,996, the work being under my direct supervision and that of K. A. Sinclair, highway engineer.

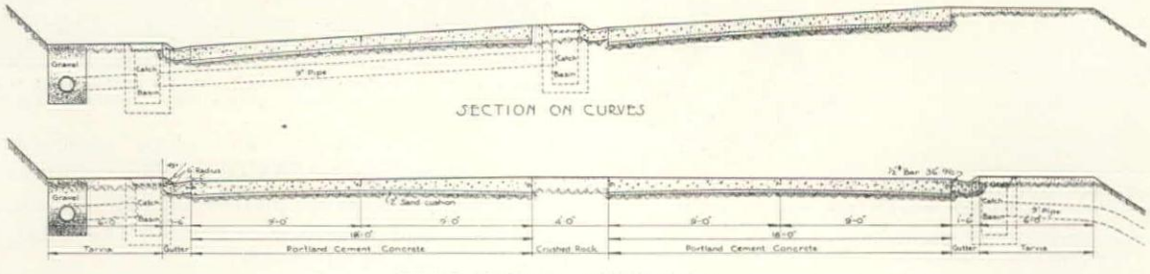
The surface was made into a tar macadam and has been maintained by the county road department until this year to allow for settlement of embankments.

Pavement Design—On June 6, 1930, a contract was awarded to the I. L. Young Construction Co., of Portland, for paving, surface drainage, and incidental items to complete the project.

The pavement is of portland cement concrete, using a 1:2:3½ mix. It was laid in two 18-ft. strips, each to carry one-way traffic, with a 4-ft. strip of crushed rock between the concrete. Each slab is 9 in. thick at the edge and 7 in. at the center (see illustration of pavement cross-section). A 1¼-in. bituminous felt expansion joint was placed at 100-ft. intervals, with transverse contraction joints every 20 ft. A longitudinal contraction joint was also made along the center of each slab by placing wooden strips 2½ in. deep in the green concrete. When the strips were removed, the resulting opening was then poured with hot asphalt.



I. L. Young Construction Co. Applying 'Hunt Process' for Curing Pavement on the Canyon Road



PAVING SECTION CANYON ROAD

A concrete gutter was cast on the two outside edges on tangent and on the inside edge of each slab on super-elevated sections on curves. Eighty-five concrete catchbasins with underdrainage are required to carry off the surface water. A 6-ft. tar macadam shoulder is to be built on each side of the pavement.

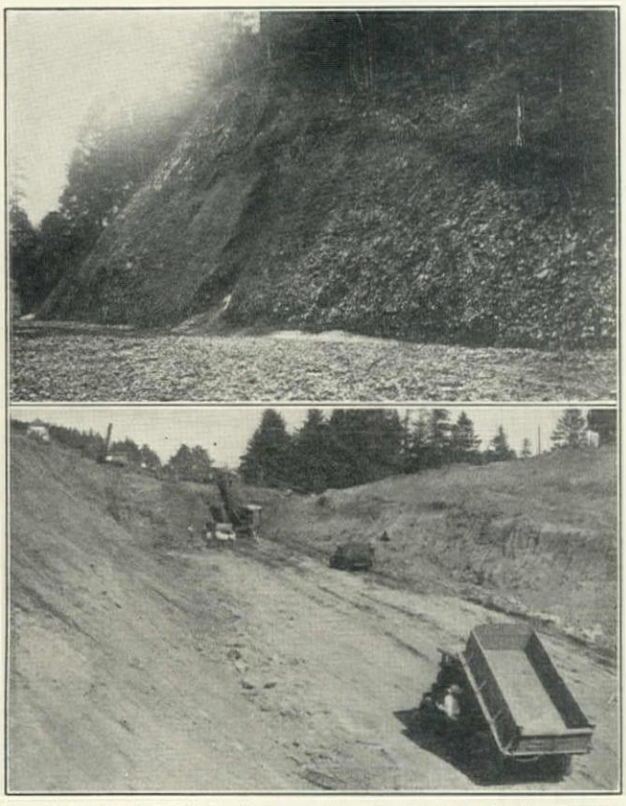
Every precaution known to us was taken to make the pavement smooth, of maximum strength, and as nearly perfect as possible.

Aggregates—Bunkers for the materials were con-

structed at the site of the work and equipped with Johnson aggre-meters which accurately proportioned the gravel and sand by weight. These bunkers were divided into three compartments, one for sand, one for ¼ to 1½-in. gravel, and one for 1½ to 3-in. gravel. By this method, the aggregates were carefully controlled and a uniform gradation maintained.

The materials were batched into 3-compartment White trucks and hauled to the mixer where the cement was added as each batch was dumped into the skip. The cement was furnished by the Oregon Portland Cement Co. and the aggregates by the Central Sand & Gravel Co., of Portland. The sand is from the Columbia river and the gravel from the Willamette river.

Subgrade—In the construction of the subgrade, a Caterpillar '60' with a scarifier was used to tear up the temporary surface, after which a Caterpillar '30' with a grader bladed the loosened material to the center. A Keystone skimmer was then used to remove excess material, which was hauled by trucks and distributed



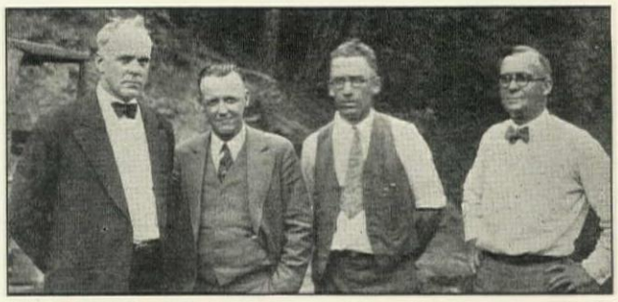
(Upper) Rock Cut 110 ft. Deep at Sta. 45, Canyon Road. Removed in Two Lifts with Marion Gas-Electric Shovels by K. C. Griffin, Subcontractor. Top Lift Sidecast. (Lower) Wet Clay Cut at County Line Containing 44,000 cu.yd. Removed in Two Lifts

to places where it was needed for shoulders, pavement base, etc.

After the subgrade was shaped to the proper contour and thoroughly compacted, a 2-in. sand cushion was laid thereon and kept to the proper elevation by a subgrade templet just ahead of the concrete as placed.

Paving—A MultiFoote 27-E paver was employed, operating two 8-hour shifts and averaging 2640 sq.yd. per day. The maximum yardage placed in one shift was 1700 sq.yd. Actual paving began July 15, 1930, and the first strip was completed on July 31. The second strip was finished on August 22. The mixer was followed by an Ord finisher carrying two screeds and a belt. The pavement was then floated transversely and longitudinally by wooden floats and finally given a broom finish. Curing was accomplished by the 'Hunt Process', which was applied by McEverlast, Inc., of Los Angeles.

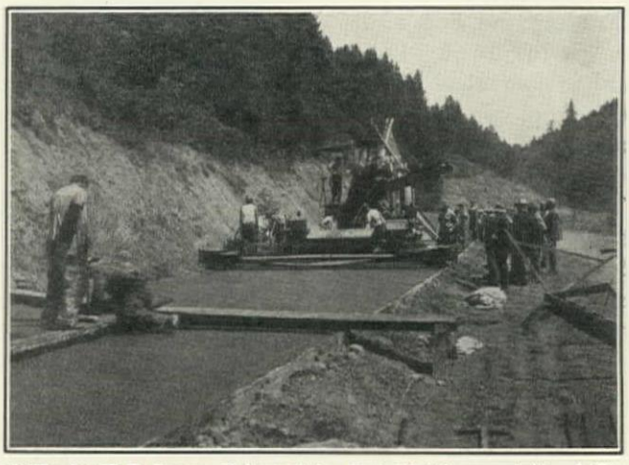
It is believed that this road will be one of the finest



Left to Right—George B. Herington, Executive Secretary, Portland Chapter, A.G.C.; Z. A. Toye; K. C. Griffin, Grading Subcontractor; George W. Buck, Roadmaster and County Engineer

in the northwest and the success of the venture is due largely to the skill and untiring efforts of P. C. Northrup, highway engineer, who is in direct charge. H. E. Devereaux is engineer for the contractor.

Cost—The contract price for the paving and completion of the work is $189,423, making the total cost of the two contracts $722,419. As the road for one-half of its length is inside the city limits of Portland, dam-



MultiFoote 27-E Paver Followed by Ord Finisher and Hand Float Crew, Canyon Road, Multnomah County, Oregon

ages for rights-of-way and slope easements were heavy, amounting to $200,000. The maintenance, removal of slides, construction of main drainage, engineering, and overhead increased the total cost of the road to about $1,120,000.

The estimated completion date is October 10.

Editor's Note—A detailed article by George B. Herington on the grading contract was published in the October 25th, 1927, issue, p. 47, with the unit bid summary in the June 25th, 1927, issue, p. 66. A short progress article on the paving contract was published in the August 25th, 1930, issue, p. 409.

Memorial Park for Portland, Oregon

A state-wide Memorial Park Association is being promoted to acquire and develop a 60-acre park on hill lands south of the park blocks in Portland, Oregon.

Cracks Observed in Dams

By H. M. WESTERGAARD*
Senior Mathematician, Bureau of Reclamation

Introduction—The Boulder Dam Consulting Board, meeting in Denver in April, 1930, recommended a comprehensive study of cracks in dams, the study to include a theoretical analysis combined with a field investigation. This study is one item in a program of investigations of volumetric changes in concrete under conditions applicable to dams. The present report deals with observations made during a three weeks' field trip (May 18 to June 8) during which the following dams were visited (in addition to the site of Boulder dam): Elephant Butte dam, New Mexico (May 20); Stewart Mountain, Mormon Flat, Horse Mesa, Roosevelt and Coolidge dams, Arizona (May 21-22); Big Dalton, Santa Anita, Lake Hodges, Mulholland, Pacoima, Shaver Lake, Exchequer, Don Pedro, Pardee, Calaveras, Lake Spaulding, and Stony Gorge dams, California (May 23 to June 2); site of Boulder dam (May 27); Bull Run dam, Oregon (June 4); Arrowrock and American Falls dams, Idaho (June 5-6).

Acknowledgments are made to the following officials of the Bureau of Reclamation for making this field investigation possible: Elwood Mead, commissioner (Washington, D. C.), R. F. Walter, chief engineer (Denver, Colorado), and J. L. Savage, chief designing engineer (Denver).

In view of the short time available at each dam, the effectiveness of this study became to a large extent dependent on the assistance and cooperation extended by the organizations and engineers in charge of the various dams. Indebtedness is expressed therefore to the following engineers who, in addition to making the visits to the dams possible, have in many cases furnished supplementary information concerning the cracks: L. R. Fiock, El Paso, Texas; C. C. Cragin and F. J. O'Hara, Phoenix, and C. J. Wells, Coolidge dam, Arizona; Geo. W. Hawley and W. A. Perkins, Sacramento; L. C. Hill, H. W. Dennis, H. A. Van Norman, E. C. Eaton and R. W. Carlson, Los Angeles; A. A. Blakesley, Merced; R. V. Meikle, Turlock; F. W. Hanna, Oakland; and R. C. E. Weber, Orland, California; D. C. Henny and Ben S. Morrow, Portland, Oregon.

Cracks May Be Classified—By observing cracks and joints in a number of dams one is impressed with a certain regularity of the phenomena. Without referring to computations of stresses, the observed regularity is sufficient to make the statement that in producing each characteristic feature some simple law of nature is at work. The observed regularity alone makes it possible to state rules for the occurrence of cracks and for the behavior of joints. These rules represent a classification of the cracks. The rules will be stated first without comments. There will be added finally some general comments and suggestions.

RULES FOR CRACKS AND JOINTS

1. An expansion joint may be interpreted as a designed crack. The possibility of using sealing devices (especially copper seals) near the upstream face, and the better appearance on the exposed surfaces are obvious advantages. In other respects the joint functions as a crack. By looking at a number of dams, one cannot help acquiring a considerable amount of respect for the expansion joint.

2. Absence of expansion joints leads to cracks at some of the positions where joints would be used in normal practice. These cracks have irregular shapes and are likely to cause difficulties in regard to watertightness.

3. One or more vertical cracks, parallel to the expansion joints, are observed in a number of cases between two consecutive expansion joints. These cracks indicate that a closer spacing of the expansion joint might have been desirable.

4. No single distance can be stated defining the spacing of the vertical expansion joints necessary to avoid major cracks between them. As a general rule, a smaller height of the dam requires a closer spacing.

5. The scheme of letting some of the vertical expansion joints begin near the bottom of the dam and extend to the top while others (for example, alternate joints) begin near the middle and extend to the top, frequently leads to the short joints extending themselves as cracks, so that the combined length of a short joint plus crack becomes about the same as in the case of the long joint.

6. In general, cracks frequently start out from the bottom of a vertical joint. Joints which are too short, are a common cause of cracks.

7. A crack which has formed as an extension of a joint frequently takes a direction somewhat different from that of the joint. As a general rule the crack will approach the abutment in a direction nearly perpendicular to the abutment.

8. A tendency exists for cracks to form, starting from an inclined abutment and extending in a direction nearly perpendicular to the abutment. Such cracks were observed both on the downstream face and in galleries close to the upstream face.

9. The disturbance arising from cracks of the type just mentioned, as measured by the frequency of the cracks, by the occurrence of irregular systems of cracks, and by the amount of seepage of water, is on the whole the greater, the steeper the abutment.

10. A common and, it seems, important type of crack is the following: The crack starts from the abutment at a place where the slope of the abutment is changing so that the lower part of the abutment is steeper than the upper part. These cracks tend toward having a direction which is not far from being perpendicular to a line with the average slope of the abutment.

11. Instead of a crack forming under the circumstances just described, a joint in the region where the slope of the abutment changes may open up rather widely. This condition is likely to exist where a gravity wing of relatively small height joins the dam proper.

12. More generally, one may expect cracks or open joints at the junction between two parts of the dam functioning differently. The following cases are examples:

(a) At the junction between a concrete gravity section and the concrete core wall of an earthfill section, an uneven settlement is probable and may cause severe cracking.

(b) In an Ambursen dam, cracks may occur across the corbels near the block filling the cut-off trench.

(c) A region of hard concrete joining one of less stiff concrete along an irregular boundary may lead to cracks along this boundary and to cracks extending into the region of weaker concrete.

13. The condition mentioned under 12c may be a result of some irregularity in the construction program, or some irregularity made necessary by the method of construction. These irregularities may lead to a junction of hard and less stiff parts, but in any case they represent a disturbance which may account for some cracks and open joints. For example:

(a) Cracks and open joints may be found at a place where a contractor's tower was supported during construction; or

(b) Difficulties of leakage may occur where a tunnel was left open during the major part of the construction and the hole filled when the dam was nearly completed. The difference of age of the two portions may cause leakage in the joint forming the boundary between them.

14. Vertical joints in curved dams or arch dams and cracks in the arches of multiple arch dams are frequently open at the top of the dam through the whole thickness of the dam

*Member American Society of Civil Engineers.

(or of the barrel) when the water in the reservoir is some distance below the top. There is ample evidence that in most cases these joints and cracks close, at least partly, as the water rises in the reservoir.

15. Unreinforced buttresses designed without joints are likely to crack in a direction sloping upstream as seen from the bottom. Large cracks of this kind appeared with striking regularity in the buttresses of one multiple arch dam. There is evidence that these cracks change their opening in the course of time; that is, they work as expansion joints. In forming, these cracks seek or start from weak places such as openings for doorways.

16. In properly reinforced buttresses cracks may occur, but the reinforcement performs the function of keeping the cracks small. With the buttress built in horizontal lifts, omission of reinforcement (or omission of reinforcement in one direction) in some of the lifts is not necessarily detrimental. The reinforced lifts (or the fully reinforced lifts) may keep the crack small in the whole buttress.

17. Expansion joints in buttresses following smooth lines indicated by the course of the major cracks mentioned under 15 can serve the purpose of avoiding these major cracks. If such a joint is not continued as far as the need for it exists, the joint will tend toward extending itself as a major crack of irregular shape. These cracks are likely to seek weak places, such as openings (doorways).

18. When in a buttress a crack, such as those described under 15 and 17, starts from or seeks out a doorway opening, it is likely to be particularly wide at the opening. If reinforcement is placed around the curved top of the doorway and close to the surface, and if the crack crosses this part, it is likely to cause a pulling out of the steel bars, with cracks following the steel bars in addition to the original crack crossing them. Working of the original crack (opening and closing) will then be severe on the concrete around the opening, and is likely to cause spalling off of the concrete.

19. The conditions mentioned under 15, 17, and 18 indicate that in general openings draw cracks toward them and tend toward exaggerating their widths as observed right at the opening. Cracks may be there because the opening is there. This rule is suggested by the observations of buttresses of the multiple arch and Ambursen dams, but it applies without doubt also to openings in solid dams, such as inspection galleries, sluiceways, and holes for penstocks.

20. A common type of crack which may be observed in inspection galleries and at other openings, and which (as indicated under 18) can be diagnosed in most cases as existing because the gallery or opening is there, is a crack running along the ceiling of the gallery or opening. This crack may run for a distance and then stop. Sometimes it branches out into two cracks which later unite or disappear. Sometimes the crack follows for a distance the edge formed by the ceiling and one of the walls, and it may continue as a horizontal crack in the wall. As a rule, the cracks in the ceilings are not very wide. In several cases where the crack could be observed at an entrance from the outside, it could be followed only a short distance up the face of the dam. In such cases, the crack represents only a minor local effect. In other cases, a certain amount of seepage or dripping from the crack indicates that it may extend for some distance into the mass of the dam. In a gallery running parallel to the faces of the dam, there may be reason for some concern over these cracks if they are wide. In this case, one is led to consider the possibility of the crack extending itself so as to reach one of the faces of the dam, thus dividing the dam into two separate bodies. No evidence was found, however, indicating that this condition had been reached in any of the dams which were inspected.

21. The cracks in buttresses discussed under 15 suggest the possibilities of similar cracks in solid dams. The cracks along ceilings in galleries parallel to the faces of the dam (mentioned under 20) might be cracks of this type, but the evidence in the cases examined is that they are more localized effects. Another place where cracks of this nature may be looked for is in the entrance galleries which are perpendicular to the crest of the dam. Here these cracks should appear as transverse cracks, running through the height of the walls and across the floor and ceiling. Cracks which might be of this type, going part of the way around (for example, traced in walls and ceiling, but not across the floor) were observed in various cases. If these cracks are deep, they might reach, for example, the downstream face and divide the dam into two bodies (compare 20). In the cases examined, however, it is at least highly probable that these cracks were essentially local effects, brought about by the fact that the gallery is there.

22. Horizontal cracks in the walls of galleries are not uncommon. They usually follow the boundary line between two lifts.

23. Cracks sometimes start from a re-entrant corner in a keyway. Such cracks may be observed at the top of the dam, or in galleries. In a gallery, the evidence may be furnished by a vertical crack close to a vertical joint. The position of the crack may indicate that a vertical block has sheared off between the joint, the crack, and the nearest protruding vertical plane in the keyway.

24. Irregular systems of cracks are likely to occur at the junction of two galleries or at a place where the cross-section of the gallery is changed.

25. If two different openings, for example, a gallery and a sluice-way pass each other with a short distance between the nearest points, a system of cracks may develop in the region where the openings are close together, especially if there is water under pressure in one of the openings.

26. When observed in inspection galleries parallel to the upstream face, vertical joints and cracks are as a rule a little more widely open on the wall nearer the downstream face than on the wall nearer the upstream face. The same may apply to horizontal cracks.

27. Galleries close to the bottom of the dam are not likely to show the widest and most frequent cracks. It may happen very well that the severest cracking occurs in a gallery close to the top.

28. There is observed frequently an irregular distribution of the openings of joints; in going from one end of the dam to the other some joints may be open and others nearly closed. This irregularity is observed especially near the top of the dam, and especially in the case of a non-symmetrical site.

29. Strain gage readings taken in galleries across cracks or joints throughout a year or more at regular intervals show the cracks and joints to open and close, the variation of width depending especially on the elevation of the water in the reservoir and on the temperature in the gallery.

30. Hair cracks (less than 0.01 in. wide) can be observed in dams generally on the dry surfaces of concrete. As a rule, these cracks cannot be very deep, and they may be designated as surface cracks; there is little reason to attach a great deal of importance to them.

31. No dam can be expected to be absolutely watertight. Water comes through the drains, and usually some water finds its way to the downstream face through pores, joints, and cracks, forming a few wet spots on the downstream face. If water can reach the downstream face, it can reach the galleries close to the upstream face the more easily. Accordingly, scattered wet spots on the downstream face as a rule indicate a considerable number of wet areas on walls and ceilings of the galleries. Or, scattered wet spots on the downstream face indicate wetness inside the dam.

32. Leakage of water either through the bedrock or through the concrete can be stopped or reduced successfully by grouting.

33. Water leaking through for some length of time leaves a white deposit, either in layers (with ridges up to a couple of inches thick), or, by dripping from the ceilings of galleries in the form of stalactites (in one case as much as 3 ft. long). These deposits tend toward stopping the leakage (only, it may be noted, they fill the crack at the less desirable end). In a great many cases white deposits which are now dry tell the story of past leakage, now ceased. (It may be observed that a very thin white deposit sometimes is noticed shortly after the forms are removed; a very thin deposit therefore probably indicates merely that some water leaked out of the concrete shortly after it was placed; a thicker deposit on the other hand

tells a story of passage of water through the thickness of the structure.)

34. There is naturally no simple correlation between the amount of leakage through a crack or joint and the width of the crack or joint, even at a given depth under the water.

35. The problem of watertightness is serious in high dams. High dams are likely to be rather wet.

36. It appears to be possible to obtain an excellent connection between the concrete and the bedrock. Leakage is more likely to occur along seams in the rock than along the junction between rock and concrete.

37. Sand-cement used in some of the earlier dams accomplished successfully its purpose of reducing shrinkage. The dams built with sand-cement compare favorably with other dams built in the same period in regard to watertightness (in that period the control of portland cement concrete was not satisfactory). The surfaces of a dam built of sand-cement concrete may last well in a moderate climate, but in a climate with severe winters they will suffer severely by weathering.

38. Too rapid construction of a part of a dam may cause weakness in this part, resulting in cracking.

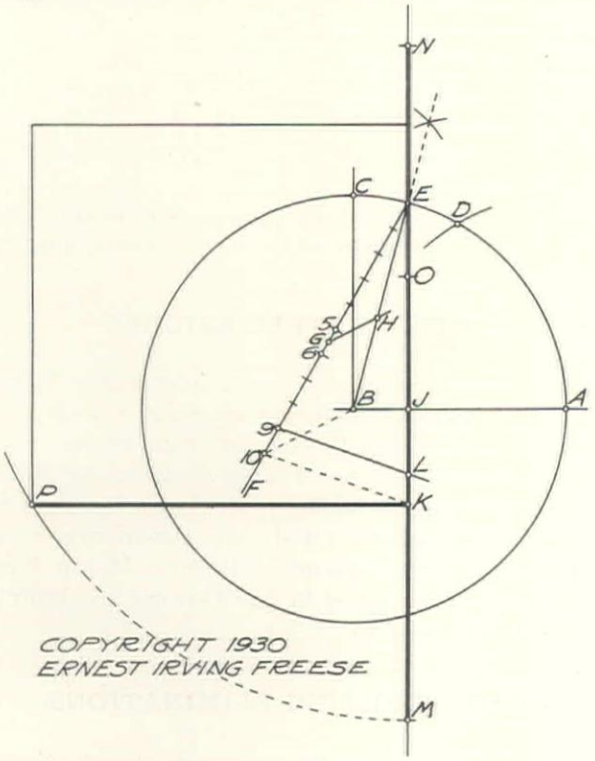
39. Much may be achieved in the direction of watertightness by rigid control of portland cement concrete during construction.

LETTERS TO THE EDITOR

Note—Following the publication of 'Squaring the Circle' in the March 10th issue, we received a number of letters discussing Frandsen's method and submitting alternate solutions. We hesitated about devoting so much space to technical discussions of this kind, but the interest shown by many of our subscribers has prompted us to publish some of these solutions, beginning with the following by Freese.—Editor.

THE EDITOR: Los Angeles, California

Dear Sir—Eureka! Eureka! However, unlike Pythagoras, I stopped to dress. An architect without clothes on, all adrip



from a recent bath, would not run far down the street before the police grabbed him and also cried, 'We have found it! We have found it!' Anyhow, before I read the article by R. M. Frandsen on 'Squaring the Circle' in the March 10th, 1930. issue, p. 130, I had an idea that 'Eureka' was a town somewhere north of San Francisco. Also, I had an idea that an engineer had more respect for exactitude than to cry 'that town up north' just because he had worked 28 years to materialize a 'pi' value of 3.14215698 in connection with his attempt to get even with that aforementioned circle. That value of his cannot be considered as even a rough approximation to 3.14159265—correct only to two decimal places.

Now, who is 'all wet'? I stopped to dress. Here is my attempt at the impossible and it makes Frandsen's bid for fame a fatuous fiasco. And, it will stop all other similar attempts for at least 2000 years hence. "Don't step on my circles", said Archimedes . . . so the soldier stepped on him. When in Rome, I do as the Roman soldiers—step not on circles but on them who would henceforth square them. So, get out your 16-place logarithmic tables and check the following solution:

Let **BA** and **BC** be any two rectangular radii of the given circle. From **A** as a center, revolve **B** to **D**, and bisect **DC** with **EB**. Draw a line through **E**, perpendicular to **AB**. Draw **EF** at any angle, and step off any ten equal spaces thereon, numbering from **E**. Bisect **5-6** at **G** and project this point to **H**, parallel with **10-B**. Make **JK** equal **BH**, and then project **9** to **L**, parallel with **10-K**. Make **KM** equal to the radius of the circle and make **LN** equal to its diameter. Bisect **NK** at **O** and, from **O** as center, radius **OM**, cross a perpendicular from **K** at the point **P**.

Now, 'after all these years', it is time to cry 'Eureka'. Why? Because **KP** is the line that squares the circle and, moreover, the line **MN** is half the circumference.

Trigonometrical Proof

Let the radius of the given circle equal unity. Then: $\mathbf{LK} = \frac{\sin 75^\circ + 0.45}{10} = 0.14159258$, which is the value of the decimal portion of 'pi' correct to six places. Hence: $\mathbf{MN} = \mathbf{LK} + 3 = 3.14159258$. Wherefore, by construction:

$$\mathbf{KP} = \sqrt{3.14159258} = 1.77245383$$
$$\sqrt{\pi} = 1.77245385$$

Error = 0.00000002, or 1/8 in. in 100 miles.

ERNEST IRVING FREESE,
Architect

THE EDITOR: San Francisco, California

Dear Sir—I was much surprised to read in your March 10th issue what purported to be a method for the constructive solution of the quadrature of the circle. I have before me an authoritative little book, Curiosities of Mathematics, by Edward Condon in collaboration with Derrick N. Lehmer of the mathematical department of the University of California. The best answer to the purported solution printed in **Western Construction News** is to quote from Condon's book, as follows:

"Three problems of mathematics stand out above the rest in popular interest. Their history dates back to the beginning of mathematics, they have never been solved, and it is now definitely known that they cannot be solved in the form in which they are considered. They are: (1) The Squaring of the Circle. (2) The Duplication of the Cube, and (3) The Trisection of an Angle. We have named them in the order of their general interest. Though many persons wholly ignorant of mathematics have gravely attempted the solution of the first, the second and third have hardly been noticed by non-mathematicians. The problem of squaring the circle has attracted more popular interest than any known mathematical problem. Its object may be stated in several ways, which are, however, equivalent as may be shown by elementary geometry.

"We are given a circle of known radius or diameter and we require (1) the length of its circumference, or (2) its area. If (1) is required, the problem is known as the rectification of the circle; if (2) is required, it is the quadrature of the circle. Moreover, we may seek to effect either the numerical or the constructive solution of the problem. The numerical solution would aim to provide an exact arithmetical rule for calculating the circumference or the area from the given diameter. The constructive solution would enable one to construct with the aid of the straight-edge and compass, either a straight line equal in length to the circumference or a square whose area would be equal to that of the given circle."

F. S. WESTLING.

Natural Gas for Every Town and City in Pacific Coast States

Pacific Public Service Company, a Standard Oil Company Subsidiary, to Construct Plants in About 100 Communities for Delivery of Butane (Carburated Liquid Gas)—Thebo, Starr & Anderton, Inc., Engineers

The production and distribution of natural gas has been termed the fourth great epoch in the history of California. The rapidity with which this fuel is supplanting artificial gas for power, as well as domestic uses, is literally astounding. Within less than a year it has been piped to most of the larger cities of California, and has taken the place of fuel oil and coal in most of the steam-electric power plants, and of artificial gas in the existing gas plants. Following closely on the heels of these long transmission lines for natural gas comes the liquefaction and transportation in tank cars to isolated communities, of 'Butane', formerly a waste-product gas obtained in the cracking process of extracting gasoline from fuel oil, or from natural gas in the oil fields.

Thebo, Starr & Anderton, Inc., engineers of San Francisco, have spent two years in developing a process whereby this waste product 'Butane' can be carbureted with air and dehydrated in an automatically controlled plant and distributed in the same manner as artificial gas. Of the three waste-product gases produced—Propane, Iso-Butane, and Butane—Butane, with a heat value of 3200 b.t.u., boiling point 15 deg. above zero, and capable of being liquefied at 100-lb. pressure, was found to be the most satisfactory for this purpose.

The process developed by Thebo, Starr & Anderton is entirely automatic. The liquefied Butane is delivered in tank cars to the carburation plant in a city, emptied into a horizontal pressure-type receiver, from which it is withdrawn, mixed with air to reduce the heat value from 3200 b.t.u. to 550 b.t.u., at which value it is held by automatic control, dehydrated to prevent corrosion of distribution pipes, etc., and stored in a pressure-type horizontal tank.

These automatic gas plants using Butane are much cheaper to install and operate than artificial gas plants which have seldom, if ever, been built in cities of less than 5000 population. They can be economically installed in communities of only 1500 population.

Three corporations were organized by Thebo, Starr & Anderton—Natural Gas Corp. of California; of Oregon; and of Washington; and later a holding company, the Natural Gas Properties, Inc. A majority interest in the holding company is held by Pacific Public Service Co. (subsidiary of the Standard Oil Co.), Thebo, Starr & Anderton retaining the minority interest as well as a long-term contract as engineers on investigation, design, and construction.

The present program calls for an expenditure of $10,000,000 in three years for the construction of plants and distribution systems in about 100 towns and cities on the Pacific Coast, ranging in population from 1500 to 20,000. During the remainder of 1930 it is expected that plants will be completed in 30 cities. Systems and plants are under construction in Vacaville, Isleton, Rio Vista, and Suisun-Fairfield, California; Vacaville being completed and the others to be placed in operation by October 15. These distribution systems, but not the plants, are being built under sub-contract by Lindgren & Swinerton, Inc., of San Francisco. A system is also under construction in Calexico, California, by E. A. Irish, of Los Angeles, and one in Brawley, by George Mitchel, of Huntington Park. Another system is under construction in Klamath Falls, Oregon, by the Hutchison Co., Inc., of Oakland, California, and a system is also under construction at La Grande, Oregon. Pipe and other equipment are now ordered and arriving at 12 additional towns for immediate construction in California, Oregon, and Washington.

All field joints are oxy-acetylene welded.

Where satisfactory arrangements can be made, the construction of these distribution systems will be subcontracted by Thebo, Starr & Anderton; otherwise they will be built by this firm's construction division and all plant assembly will be performed by Thebo, Starr & Anderton forces. J. H. Anderton is president; Herbert N. Witt, vice-president in charge of engineering; and William H. Henning, vice-president in charge of construction for Thebo, Starr & Anderton, Inc. R. E. Aitcheson is executive vice-president of the California, Oregon, and Washington corporations, with offices at San Francisco.

Management of all three companys is in the hands of the Standard Management and Operating Co., San Francisco.

ARTISTIC STEEL BRIDGES

For the most artistic long-span steel bridge built in 1929, the American Institute of Steel Construction awarded first prize to the Mount Hope bridge across Mount Hope bay, Rhode Island, designed by Robinson & Steinman and built by McClintic-Marshall Co. First prize for the most artistic short-span steel bridge went to the Mount Pleasant bridge near Mount Pleasant, New York, designed by Jay Downer and built by the Bethlehem Steel Co.

GRADE CROSSING ELIMINATIONS

The Bureau of Public Roads reports the elimination of 385 railroad grade crossings on the Federal aid highway system during 1929, the total elimination since 1917 being 4676.

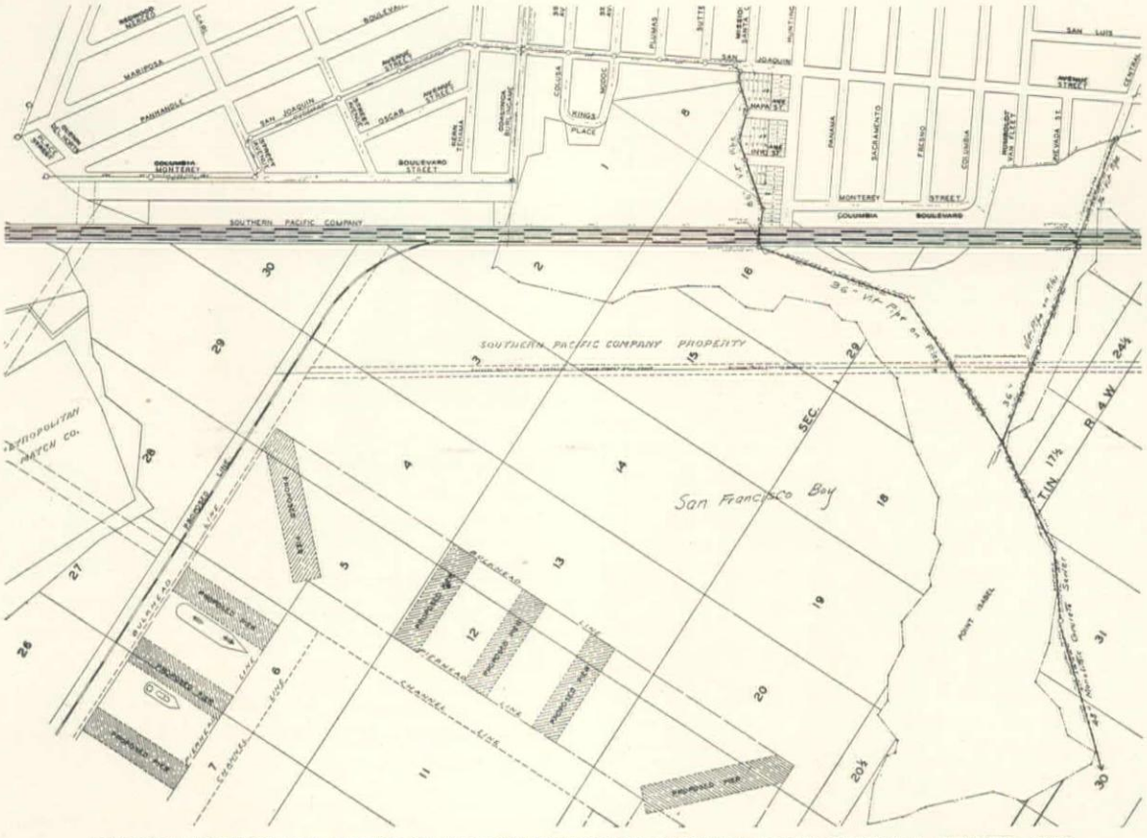
Stege Sanitary District, Contra Costa County, California

Construction of New Outfall Sewer into San Francisco Bay

In 1913, the Stege Sanitary District, comprising 3300 acres in Contra Costa county, California, was formed; a bond issue of $75,000 was voted; and 13 miles of sewers from 6 to 24 in. were laid under the supervision of Haviland, Tibbetts & Dozier, engineers for the District. Two outfall sewers across the tide flats of San Francisco bay were built, the north outfall draining 1800 acres and the south outfall 1500 acres. Sixty miles of additional sewers have been laid since. The inverts of the outlets in 1913 were 1.4 ft. above ordinary low tide, but the mud flats have been raised 4 ft. by the westerly winds depositing sand, mud, and debris, and the ends of the outfall pipes are buried 1 ft.

Early in 1929, Ross L. Calfee, engineer for the District since 1923, was commissioned by the directors of the District to investigate and report on the best method of relief. Extension of the old outfalls to deep water would have been very expensive, as well as inadequate within a few years. These outfalls would also prove a nuisance in the harbor improvement programs of Richmond and Berkeley, adjacent cities. After consultation with C. G. Gillespie, chief of the State Bureau of Sanitary Engineering, Calfee recommended the construction of a new outfall, 48-in. diam., fed by two 36-in. interceptors, along the south shore line of Point Isabel, an undeveloped and isolated point of land, one-half mile from shore. The following quotations are from the 'Findings and Opinion' of C. G. Gillespie in the matter of application of the District.

Though this application is for the disposal of raw sewage in San Francisco bay, admittedly an undesirable practice, this particular outfall should prove to be a marked improvement over the existing outfalls around the shores of San Francisco bay. Point Isabel is an undeveloped and forbidding point whose shores are swept clean by the tidal action striking it from the Golden Gate.



MAP OF PORTION OF STEGE SANITARY DISTRICT SHOWING NEW OUTFALL SEWER AND TWO MAIN INTERCEPTING SEWERS

Sewage solids are apt to be blown against the shore by the prevailing southwest wind, but no uses are made of the shores or of the bay waters for long distances. There is a prospective development of the Richmond harbor which may change the currents and impair the dilution and disposal of sewage at this point. When that time arrives, it may prove necessary to extend the outfall and/or to put in sewage treatment.

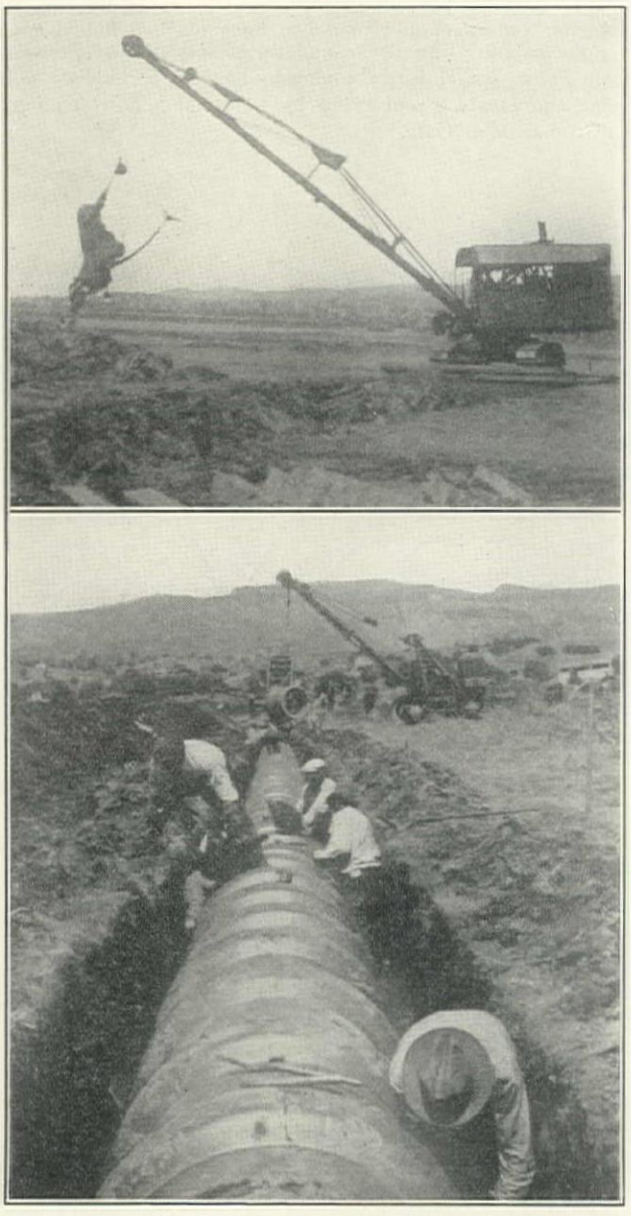
We conclude that for the present there is no tangible health menace or nuisance and recommend that the permit be granted.

Finally, the Board of Supervisors of Contra Costa county ordered the work to be done under the Acquisition and Improvement Act of 1925, as District No. 5, embracing all of the Stege Sanitary District, which includes the city of El Cerrito and a portion of the city of Richmond as well as some unincorporated territory;

an area of 3300 acres with a present population of 5000, and estimated future population of 30,000.

Bids were received on July 6 and the contract awarded to M. J. Bevanda, of Stockton, for $141,079, the lowest of 7 bids. The following are the quantities and unit bid prices.

2,950	lin.ft. of 30-in. vit. pipe sewer	at	$ 7.50
5,500	lin.ft. of 36-in. vit. pipe sewer	at	10.25
326	lin.ft. of 35-in. reinf. conc. sewer (Armco corrugated pipe substituted for 180 ft. for S. P. railroad crossings)	at	23.00
1,875	lin.ft. of 48-in. reinf. conc. sewer	at	20.75
32	brick manholes	at	85.00



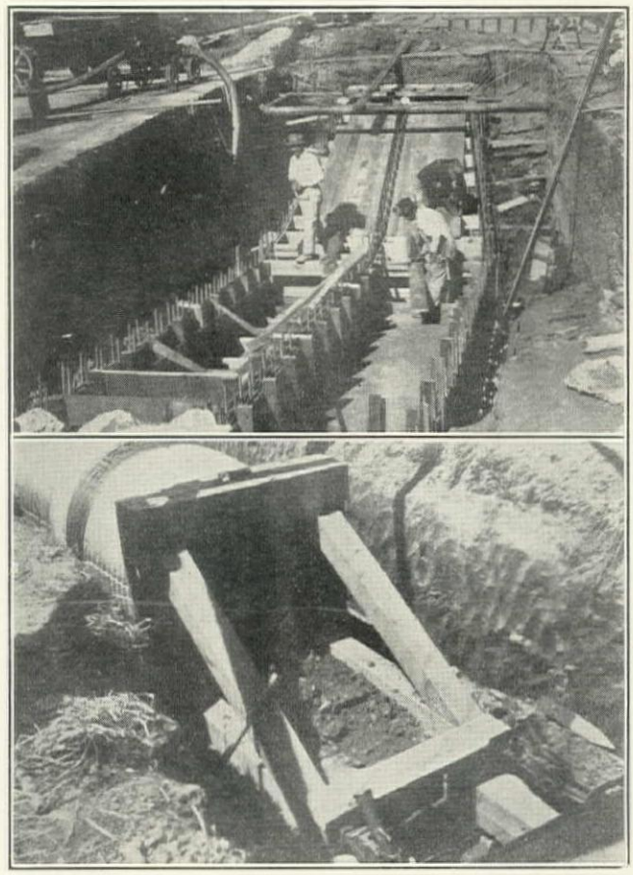
(Upper) P&H ¾-yd. Dragline Excavating Trench for North Intercepting Sewer. (Lower) Laying 36-in. Gladding, McBean & Co. Vitrified Clay Pipe Sewer on North Interceptor East of S.P. Mainline Tracks

2	concrete manholes	at	150.00
	Storm sewer reconstruction	at	2,000.00
2,700	lin.ft. of timber foundations	at	1.25
14,000	lin.ft. of douglas fir piles	at	0.50
40	concrete piers	at	12.00
1	junction chamber	for	300.00

Bevanda sublet the contract to the Fredrickson & Watson Construction Co., of Oakland, who began work August 4, 1930, and have made excellent progress since.

The north intercepting sewer of 30 and 36-in. vitrified pipe has been laid from the upper end to and across the Southern Pacific railroad tracks and half way to the junction with the south intercepting sewer; total length 4700 ft. to September 23.

The trenching east of the mainline tracks of the



(Upper) Constructing Storm Sewer Siphon Under North Intercepting Sewer. (Lower) Jacking 48-in. Armco Pipe Under S.P. Mainline Railroad Embankment; Showing Bulkhead and Jacks

Southern Pacific Co. was done with an Austin 'O' trencher; the pipe laid and ditch backfilled with an Austin backfiller.

Trenching across the marshes—bay mud, blue clay, and sand stratas—is a slow messy job, and is being done with a P&H dragline supported on mats. On one occasion the top strata under the dragline slid out, precipitating the machine into the trench. The dragline is also used to drive the piles—some driving 40 ft. and others only 5 ft.—and to place the pipe on the pile foundations. All the pipe is jointed with either Petrolastic 'xx' (Standard Oil Co.) or Unolax (Union Oil Co.); both asphaltic compounds, heated in a Littleford 'Trail-O' kettle. On the line east of the S. P. tracks, a crew of 8 or 9 men averaged 50 joints per day, using rubber hose as pipe runners on the 30-in. and cast-iron runners (in quadrants, bolted together) on the 36-in. A 36-in. joint requires from 4 to 6 gal. (34 to 51 lb.) of compound, in addition to dry oakum; a 30-in. joint from 3 to 4 gal. of compound.

The 48-in. monolithic reinforced concrete sewer will be built on a clay-sandstone formation and lined with

Ferguson vitrified clay pipe liners above the invert. The vitrified clay pipe and liners are being supplied by Gladding, McBean & Co.

An interesting and unique feature of this job was the driving of two lines, each 80 ft. long, of 48-in., 8-gauge, Armco corrugated pipe under the Southern Pacific main-line tracks—one through blue mud and clay, the other through sandstone. These jobs were supervised by C. M. Colvin of the California Corrugated Culvert Co., of West Berkeley, who describes the methods as follows:

These crossings presented a serious problem, both from a cost and from a railway operating standpoint, since there are 48 passenger train movements alone over this line every 24 hours. A similar job nearby under the same railway some months before had cost $2200 for a temporary trestle alone, and had required also a very vexatious slow order on a normally high-speed track.

It was finally decided by the contractors, and approved by the engineers both of the Sanitary District and the railway, to employ the jacking method.

The north undercrossing, as being apparently the more suitable for jacking, was chosen for the first installation. Since it is essential in sewer work that the line and grade be closely followed, it is important that the backstops be non-yielding, and particularly, that the lining timbers, which are to guide the pipe, are on accurate line and grade and heavy enough to maintain it.

The pipe was placed in successive 16-ft. sections on the lining timbers and jacked into the bore; the connections being made by field riveting. Ordinary track jacks were used to supply the pressure throughout most of the installation; heavier and more powerful (but slower) 50-ton ratchet jacks being used only toward the end. The pressure from the jacks was distributed to the pipe by means of an A-frame jacking collar. Excavated material was removed through the pipe by means of a dolly buggy operating on an improvised track. The water table was kept down by means of hand pumps.

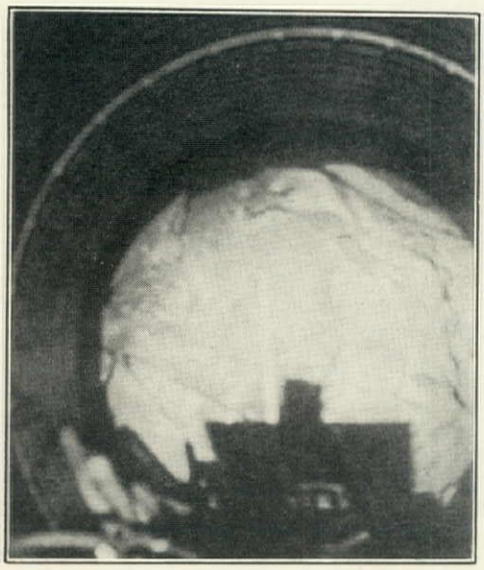
When only 10 ft. in on the first installation, solid rock was encountered; at first a natural sandstone over the bottom half of the face, but later on a dense and extremely hard blue stone across the entire face, which stone had been placed years before as riprap protection for the track against wave action from the bay. This rock of course required air hammers to break, and retarded the rate of progress considerably. It did, however, practically guarantee a true and stable bore, offering little friction to the movement of the pipe, as was attested by the use of track jacks for most of the distance. After the preliminary work was com-

Excavating Trench for North Intercepting Sewer Near S.P. Railroad, Through Sandstone and Bluestone

(UPPER LEFT) POURING JOINTS WITH 'UNOLAX' IN 36-IN. VITRIFIED CLAY PIPE SEWER—NORTH INTERCEPTOR ON PILES ACROSS MUD FLATS. (UPPER RIGHT) DRIVING PILES FOR NORTH INTERCEPTING SEWER WITH P&H DRAGLINE. (LOWER LEFT) 48-IN. ARMCO PIPE JACKED THROUGH RAILROAD EMBANKMENT AND LINED WITH FERGUSON VITRIFIED CLAY LINERS FOR 36-IN. NORTH INTERCEPTING SEWER. (LOWER RIGHT) NOVO ROLLER RING PLUNGER PUMP KEEPING TRENCH DEWATERED

pleted a minimum force of four men per shift—three 8-hr. shifts per day—was employed. One man of each shift was experienced in operating an air gun, while another attended to the compressor, lighting arrangements, etc. The size of some of the stone removed through the pipe was surprising. The bore was kept only one inch greater than the outside diameter of the pipe.

With the metal pipe acting as a conduit, a built-in-



Interior of 48-in. Pipe Being Jacked Under S.P. Mainline Railroad Embankment for North Intercepting Sewer; Showing Sandstone Face

place sanitary sewer of the same internal diameter as the main sewer—36-in.—and lined with vitrified clay liner blocks was built in the pipe on the established

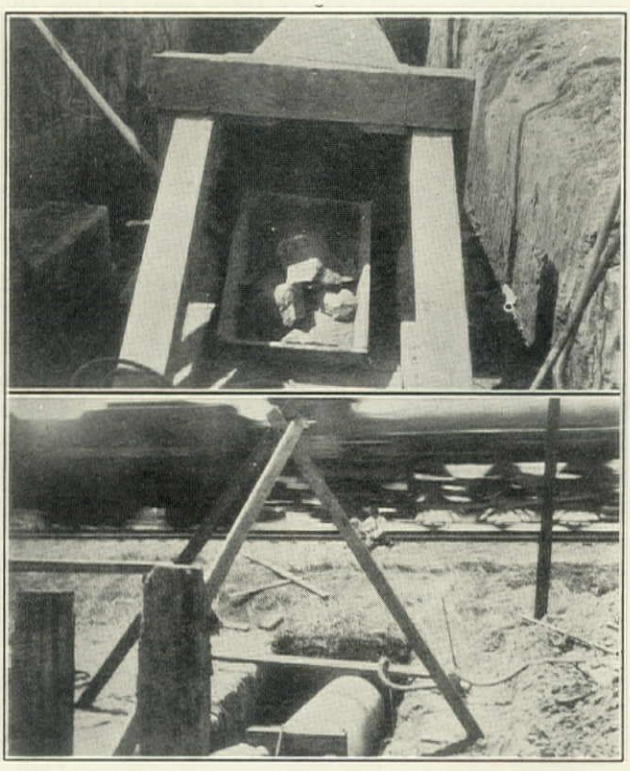
Left to Right—C. M. Colvin (California Corrugated Culvert Co.), Willard P. Smiley (Resident Engineer), and Otto Bonnesen (Superintendent for Fredrickson & Watson Construction Co.)

line and grade. Rammed concrete occupied the space between the conduit and liners. The flow line of the northerly sewer was only 11 ft. below the rail.

Progress was about 1 ft. per hour in the earlier loose rock and clay portion, but only 1 to 3 ft. per shift in the solid rock portion. Even so, this installation cost less than one-half of the cost of the usual open cut method, where temporary trestlework is required.

The south crossing was driven through blue mud and clay, without much difficulty, except that the pipe 'froze' when nearly through, from yielding of the backstop. Nevertheless, it was driven through within ½-in. of grade. The flow line was only 5.7 ft. below the S. P. rails.

These under-track installations saved the Southern Pacific Co. from the necessity for slow-order movement of trains, interruptions, and considerable ex-



(Upper) Jacking 48-in. Armco Pipe Through Sandstone Under Railroad Embankment. Note Size of Broken Stone in Dolly. (Lower) Trains Operated at High Speed During Process of Jacking 48-in. Pipe Through Embankment

pense; and the sewers are stronger and less liable of being crushed or the grades disturbed.

The Fredrickson & Watson contract is being carried out by Otto Bonnesen, an experienced superintendent in this class of work, with Howard Gould as his assistant. Willard P. Smiley is resident engineer for Ross L. Calfee.

GROWTH OF OILED ROADS IN ROCKY MOUNTAIN STATES

According to the Wyoming Highway Department, the accumulated total mileage of oiled roads in the Rocky Mountain states for the period 1927-1930 is approximately 1855, divided as follows:

State	Miles			
	1927	1928	1929	1930
Colorado	0	10	65	209
Idaho	74	315	410	710
Montana	9	34	72	285
Utah	28	68	200	340
Wyoming	35	87	192	311

Where "Traffic must go on"

The ARMCO JACKING METHOD

SIMPLE, quick, efficient, economical . . . the Armco Jacking Method has definitely taken the place of expensive, slow, traffic-delaying open trenching in installing drainage structures and creating openings under busy streets, highways and railroads.

Engineers everywhere are welcoming this revolutionary way of installing storm sewers, conduits and culverts under traffic—a method now proved by hundreds of installations made under widely varying conditions.

Substantial savings usually follow the use of the Armco Jacking Method. Construction time is shortened. No expensive falsework is needed to support car tracks. Costly pavements are undisturbed. No period is required for the maintenance of settling fills.

Together, the Armco Jacking Method and Armco Corrugated Iron Pipe — holder of the continuous service record of over 24 years to date—are effecting large savings for users everywhere. For information on the application of this proved product, with its modern method of installation to your own problems, write

ARMCO Ingot Iron

Armco Culvert Manufacturers Association

Middletown, Ohio

OR THESE MEMBERS

The Burnham Mfg. Co.
WOODS CROSS, UTAH—BOISE, IDAHO

Colorado Culvert & Flume Co.
PUEBLO, COLO.

Pure Iron Culvert & Mfg. Co.
763-769 GLADSTONE AVENUE, PORTLAND, ORE.

California Corrugated Culvert Co.
WEST BERKELEY—LOS ANGELES

The R. Hardesty Mfg. Co.
DENVER, COLO.—MISSOULA, MONT.

Spokane Culvert & Tank Co.
SPOKANE, WASH.

Western Metal Manufacturing Co.
HOUSTON—DALLAS—SAN ANTONIO—EL PASO

California Section A. W. W. A. Convention

PROGRAM, ELEVENTH ANNUAL CONVENTION, HOTEL HUNTINGTON, PASADENA

Wednesday, October 29

All-day golf tournament on Flintridge course. Registration and review of exhibits at convention headquarters.

Thursday, October 30

10 a.m.—General get-together, with registration and review of exhibits. 11 a.m.—Demonstration of valve inserting machine.

2 p.m.—Address of welcome by Robert L. Dougherty, chairman, Board of Directors, city of Pasadena. 2:15 p.m.—'Pasadena Water Department' by Samuel B. Morris, superintendent and chief engineer. 3 p.m.—'Report on Metropolitan Water District of Southern California' by F. E. Weymouth, chief engineer. 3:45 p.m.—Symposium session on the following practical water works topics: (1) 'Protective Pipe Coatings' by K. H. Logan, engineer, U. S. Bureau of Standards; (2) 'Electric-Welded Steel Pipe-Lines' by F. W. Hanna, chief engineer and general manager, East Bay Municipal Utility District, Oakland; (3) 'Fundamental Considerations in Determining the Cost of Rendering Public Fire Hydrant Service' by Edward B. Mayer, assistant engineer, Department of Water and Power, Los Angeles.

6:30 p.m.—Informal dinner at Hotel Huntington. (1) Business meeting with (a) reports of officers; (b) reports of committees; (c) election of officers; (d) selection of convention location for next year. (2) Address by George H. Fenkell, president, A. W. W. A., Detroit. (3) 'Some Problems of the Los Angeles Water Supply' by H. A. Van Norman, chief engineer and general manager, Bureau of Water Works and Supply, Los Angeles.

Friday, October 31

10 a.m.—Symposium session. 'Water Rights' by W. G. Irving, attorney, Riverside. 10:45 a.m.—(1) 'Development of Deep Wells' by Rosco Moss, Los Angeles, and D. A. Lane, Bureau of Water Works and Supply, Los Angeles, (followed by discussion); (2) 'Colorado River Project' by Creighton O. Waldorf, Beverly Hills; (3) 'Maintenance Equipment for Water Works' by C. R. Manbert, construction engineer, East Bay Municipal Utility District, Oakland.

2 p.m.—'Reclamation of Treated Sewage' by R. F. Goudey, sanitary engineer, Bureau of Water Works and Supply, Los Angeles. 2:30 p.m.—'Corrosion Problems' by I. F. Van Giesen, electrolysis engineer, Bureau of Water Works and Supply, Los Angeles. 3 p.m.—(1) 'Relation of Politics to the Management of Municipally Owned Water Systems' by Fred M. Randlett, Pacific Coast manager, Robert W. Hunt Co., San Francisco; (2) 'Stand-by Charges for Water Service' by C. E. Thatcher, manager commercial department, East Bay Municipal Utility District, Oakland; (3) 'Billing and Collecting Methods' by Carl K. Chapin, Pasadena; (4) 'Cost Keeping and Budget Control' by F. M. Faude, Loveland Engineers, Inc., San Francisco; (5) 'Distribution Reservoir Design' by Chester A. Smith, Burns-McDonnell-Smith Engineering Co., Los Angeles.

6:30 p.m.—Informal dinner dance and special entertainment at Hotel Huntington as guests of exhibitors.

Saturday, November 1

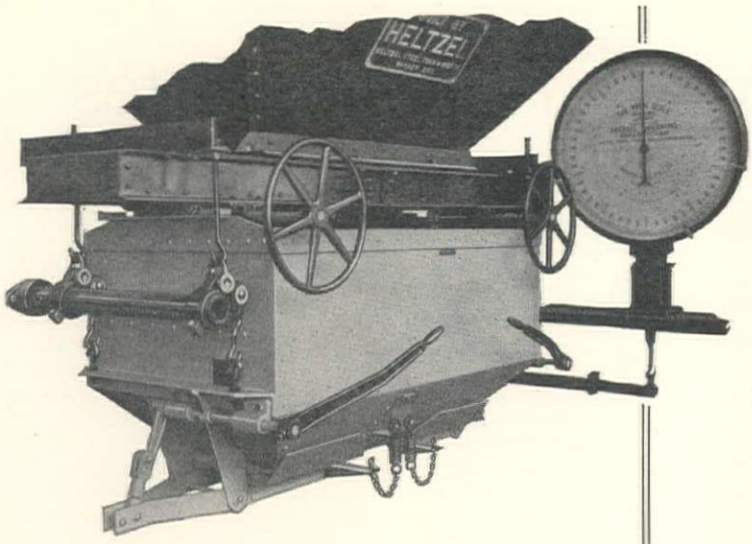
10 a.m.—Members and guests leave Hotel Huntington by automobile to inspect local water plants and properties, then proceed to San Gabriel canyon to inspect Pine canyon damsite of the city of Pasadena. Picnic in canyon.

The present officers of the Section are: President—Chas S. Olmstead, of Monterey; vice-president—W. W. Hurlbut, of Los Angeles; executive committee—W. F. Goble, of Alhambra, and Geo. W. Trauger, of Lindsay; secretary-treasurer—L. L. Farrell, of Oakland. Committee chairmen for the eleventh annual convention are: Reception—Morris S. Jones, Pasadena Water Department; ladies' reception and entertainment—Mrs. Samuel B. Morris, Pasadena; exhibits—J. R. Barker, Neptune Meter Co., San Francisco; golf—W. F. Goble, San Gabriel Valley Water Co., Alhambra; local arrangements—Samuel B. Morris, Pasadena Water Department; membership—W. W. Hurlbut, Bureau of Water Works and Supply, Los Angeles; nominating—John Burt, Marin Municipal Water District, San Rafael; entertainment—R. W. Martindale, U. S. Pipe & Foundry Co., San Francisco; program—Chas. S. Olmstead, Monterey County Water Works, Monterey.

HOTEL HUNTINGTON, PASADENA, CONVENTION HEADQUARTERS, CALIFORNIA SECTION, A.W.W.A., OCTOBER 29-NOVEMBER 1

The following companies will exhibit at the convention headquarters, Hotel Huntington:

The American Brass Co., American Cast Iron Pipe Co., American Concrete Pipe Co., Art Concrete Works, The Atlas Mineral Products Co., Badger Meter Mfg. Co., California Corrugated Culvert Co., California Filter Co., Central Foundry Co., Chapman Valve Mfg. Co., Chase Brass & Copper Co., Inc., Chicago Bridge & Iron Works, Claussen & Co., Inc., C. G. Darling Valve & Mfg. Co., DeLaval Steam Turbine Co., Dresser Mfg. Co., S. R., Ford Meter Box Co., Forni Mfg. Co., Great Western Electro-Chemical Co., Greenberg's Sons, M., Hersey Mfg. Co., Hydrauger Corp., Ltd., Hydraulic Development Corp., Iowa Valve Co., James Jones Co., Johns-Manville Sales Corp., Leadite Co., McEverlast, Inc., McWane Cast Iron Pipe Co., Mueller Co., National Cast Iron Pipe Co., National Meter Co., Neptune Meter Co., Pacific Coast Steel Corp., Pacific Pipe & Supply Co., Pacific States Cast Iron Pipe Co., Paradon Mfg. Co., Pittsburgh-Des Moines Steel Co., Pittsburgh Equitable Meter Co., Rensselaer Valve Co., Ross Valve Co., Sparling, R. W., Thomson Meter Corp., United Casting Co., U. S. Pipe & Foundry Co., Victaulic Co. of America, Wailes Dove-Hermiston Corp., Wallace & Tiernan Co., Inc., Water Works Supply Co., Western Construction News, Western Pipe & Steel Co. of California, Western Well Drilling Co.



We also manufacture steel forms for streets, curbs, sidewalks, curb and gutter, manholes, concrete pipe, steel bins, street joint, measuring hoppers, volume and weighing type, bridges, bulkheads, sub-grade testers, trail graders, mortar boxes, etc.

No Weights or Counterpoises HELTZEL Weighing Plant

THERE are no beams to watch—weights to set on this modern weighing Agrabatcher. Operator merely sets indicators on rim of dial at desired weights — opens the gates and lets 'er flow.

Large 3-foot dial is easily read and quick, accurate weighing results. Scale is completely enclosed—no dirt can get at working parts. Also this scale is approved by U. S. Bureau of Standards.

If you want accurate batching—rapid material handling—freedom from jams at your plant — investigate Heltzel, the modern weighing plant.

"The Heltzel way is the correct Weigh."

Ask your nearest dealer!

Kratz & McClelland, Inc., 522 Bryant St., San Francisco, Calif. Rocky Mountain Equip. Co., 117 Wazee Street, Denver, Colo.
Crook Company, 1220 So. Grand Avenue....Los Angeles, Calif. New Mexico Road Machinery Co.....Albuquerque, N. Mex.
The C. H. Jones Co., 134-140 Pierpont Avenue.....Salt Lake City, Utah

Hotel Savoy

The City's Most Centrally Located Hotel

One Block West from Pershing Square

LOS ANGELES

NOTED for hospitality and comfort, the Hotel Savoy is the ideal stopping place for the discriminating traveler desiring all the conveniences of a first-class metropolitan hotel at reasonable rates. One of Los Angeles' best hotels . . . the Savoy is but a step from theatres, cafes, leading shops, financial institutions, railroad and steamship offices and electric line depots for all resorts. Garage adjoining.

All Outside Rooms — Absolutely Fireproof

Rates Per Day: One Person, with bath—$2.50, $3.00, $4.00. Two Persons, with bath—$3.50, $4.00, $5.00. Parlor Suites—$5.50, $9.00.

The Savoy is the starting point for sightseeing parlor car tours and maintains for the convenience of its guests a complete ticket service . . . for resorts and places of amusement.

Justly Famous for Good Things to Eat

Breakfasts, 30c to 50c · Luncheons, 45c to 75c · Dinners, 75c to $1.25
Also a la carte

FRANK SIMPSON, JR., *Managing Director*

Sixth Street & Grand Avenue

New Equipment and Trade Notes

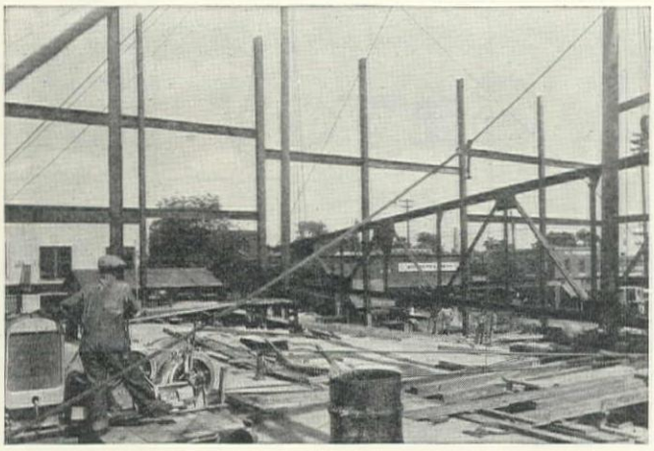
McCORMICK-DEERING TRACTORS FOR PIPE LAYING

The accompanying illustration shows a McCormick-Deering tractor equipped with crawlers and pipe-line boom laying a long section of 12-in. electric-welded steel pipe in a rough

and hilly section of Oklahoma as part of the Texas-Empire pipe-line. Specially equipped tractors, besides performing a variety of heavy hauling work, have been playing a spectacular role in speeding construction on the thousands of miles of oil and gas pipe-lines constructed in recent years.

JAEGER TIMKEN THRUST HOIST

The Jaeger Machine Co., Columbus, Ohio, manufactures single and double-drum Timken thrust hoists ranging from



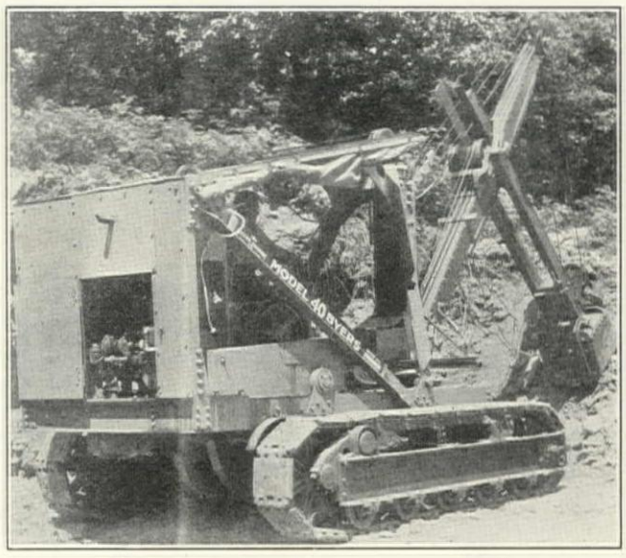
10 to 50 hp. capacity. The 32-hp. hoist in the illustration is operating in connection with two gin poles, one drum line leading to each pole, for steel truss erection. Featherweight controls and positive brakes enable the operator to set each truss exactly in position. Friction is attained by the Jaeger positive thrust action, using Gadtke asbestos compound blocks. Friction return and release are attained by the same screw action of the thrust and, therefore, thrust and release springs are eliminated.

These Jaegar hoists are being used by bridge builders for pile driving, in gravel pits for dragline hauls, by general contractors for material hoisting, and in connection with Lakewood or other mast plants or towers, and for steel erection.

BACON ANNOUNCES BYERS ⅜-YD. UTILITY SHOVEL

The Edward R. Bacon Co., equipment distributor of San Francisco, announces production by the Byers Machine Co. of a covertible ⅜-yd. three-quarter swing, clean-up shovel weighing less than 10 tons. Although designed particularly for work around supply yards and on big jobs, this is said to be an efficient and economical unit for small and medium-sized projects.

The machinery arrangement is similar to the Byers full-circle models with direct drive from the motor to jackshaft by silent chain. The jackshaft and motor bottom are mounted



Byers Convertible ⅜-yd. Clean-up Shovel

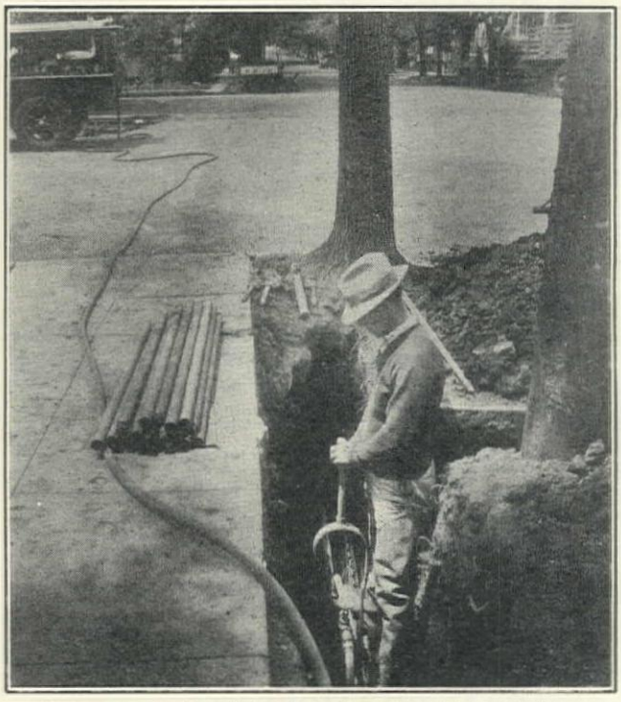
on Timken roller bearings and the deck machinery is mounted in a unit steel casting. The cable-operated crowd is reversible by a single, independent lever and is easily handled, as are the clamshell, dragline, trencher, and skimmer attachments. Two-speed crawlers operate with double speed through a single 5¼-in. travel shaft in the car body and the crawler has negotiated a 40% grade in demonstrations. The machine is powered by a 36-hp. gas engine developing a powerful single line pull of 140 ft. per min. It is said to embody many engineering principles heretofore restricted to larger and more expensive shovels and cranes.

HYDRAUGER, A NEW EARTH-BORING TOOL

Hydrauger, a tool constituting a revolutionary advance in earth boring for the laying of pipe, cable, and other conduit, has been developed. Hydrauger makes it possible for the first time to drill horizontally under a street or highway and accurately control the direction of the bore. Delegates to the California Section, A.W.W.A., convention at Pasadena, commencing October 29, will have an opportunity to see Hydrauger demonstrated.

Hydrauger was developed by engineers of the Pacific Gas & Electric Co. in San Rafael. It is notable for compactness and simplicity of operation. The tool is air-driven from a portable compressor and, when in operation, is connected with running water which passes through the boring bars and extensions and issues in two streams at the auger. The water washes the borings back, incidentally acting as a lubricant, and leaves a clean straight hole.

Diameters of holes bored range from 2½ to 10½ in. Bores have been made up to 120 ft. long with variation of only 2 to 3 in. at the end. One division of the Pacific Gas & Electric Co. has 7 machines now in use and is making tremendous savings in pipe-laying costs. An outstanding example is an



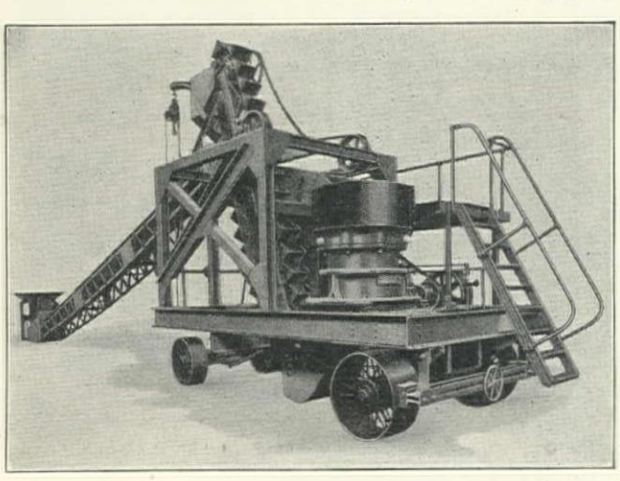
Hydrauger Boring Hole Beneath Pavement in Petaluma

instance in which Hydrauger completed a 90-ft. bore in 40 minutes under a concrete highway where pipe crews had labored for 4 days attempting to push the pipe through by the old jacking method.

Hydrauger has been placed on the market by the Hydrauger Corp., Ltd., 1298 Bryant st., San Francisco. Patents are pending.

TELSMITH PORTABLE CRUSHING PLANT

The Smith Engineering Works, Milwaukee, announces production of the first portable crushing, screening, and loading plant ever to be equipped with a gyratory crusher. This new Telsmith wheel-mounted portable plant is of all-steel construction and will deliver two accurately sized products con-



Telsmith Portable Crushing, Screening, and Loading Plant

forming with specifications for gravel and hard-surfaced roads.

Equipped with No. 32 reduction crusher, the plant will deliver sand and minus ¾-in. rock. Or, with a 6-A or 8-A primary breaker, it will deliver sand and minus 1½-in. rock. There is no oversize, as the crusher is in a closed circuit with the screen. For quarry operations, addition of a 10-A primary breaker or a jaw crusher at the foot of the feed conveyor, converts the device to a two-crusher plant with a large capacity of ¾ or 1-in. rock. For only one final product, a single deck vibrating screen and one finished product conveyor are furnished, the steel conveyor for the coarse finished product being omitted.

PACIFIC COAST HEADQUARTERS FOR ALLIS-CHALMERS

The Allis-Chalmers Manufacturing Co., Milwaukee, manufacturer and distributor of 'Monarch' wheeled and track-type tractors, recently opened a Pacific coast headquarters and warehouse at 4053 Harlan st., Emeryville, California, with C. J. Deutch as Pacific coast manager. The Emeryville warehouse carries a complete stock of all types of agricultural and industrial tractors, as well as a complete stock of parts. With this centrally located supply depot, 'Monarch' tractor users are assured of prompt service.

Several new dealers have been appointed for Northern California, and more dealers will be added in the territory which is still open.

B. Hayman Co., Inc., Los Angeles, will distribute Allis-Chalmers model E and model U tractors and a diversified line of industrial and road building equipment for the latter unit in southern California and one Arizona county.

R. B. Randall, for the past two years Pacific coast manager of the shovel and crane division of Link-Belt Co., has been promoted to manager of the central district for the same company with headquarters at the Chicago plant, 300 w. Pershing road. 'Buckets' Randall was well known on the Pacific coast where he was successful in establishing excellent dealers for the Link-Belt Co. and promoting sales of Link-Belt shovels and cranes. A. Eilersgaard, who for many years was chief engineer of the shovel and crane division of Link-Belt Co. at Chicago, succeeds Randall as Pacific coast manager with headquarters in the Hearst bdg., San Francisco.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, etc., required by the Act of Congress of August 24, 1912, of Western Construction News, published semi-monthly at San Francisco, California, for October 1, 1930.

State of California, City and County of San Francisco, ss.: Before me, a Notary Public in and for the state and county aforesaid, personally appeared S. H. Wade, who, having been duly sworn according to law, deposes and says that he is the business manager of the Western Construction News and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 411, Postal Laws and Regulations, printed on the reverse of this form, to-wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are:

Publishers—Western Construction News, Incorporated, 114 Sansome St., San Francisco, Calif.

Editor—Philip Schuyler, 1462 Trestle Glen Road, Oakland, Calif.

Managing Editor—Philip Schuyler, 1462 Trestle Glen Road, Oakland, Calif.

Business Manager—S. H. Wade, 637 55th St., Oakland, Calif.

2. That the owner is: (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding 1 per cent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a firm, company, or other unincorporated concern, its name and address, as well as those of each individual member, must be given.)

Western Construction News, Inc., 114 Sansome St., San Francisco, Calif.; S. J. Sanders, 1848 San Ramon Ave., Berkeley, Calif.; S. H. Wade, 637 55th St., Oakland, Calif.; Philip Schuyler, 1462 Trestle Glen Road, Oakland, Calif.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: (If there are none, so state.)

None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

5. That the average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the six months preceding the date shown above is: (This information is required from daily publications only.)

S. H. WADE, Manager.

Sworn to and subscribed before me this 1st day of October, 1930.

(Seal) ELEANOR J. SMITH,

Notary Public in and for the City and County of San Francisco, State of California.

(My commission expires December 29, 1930.)

UNIT BID SUMMARY

Note: These unit bids are extracts from our Daily Construction News Service

STREET AND ROAD WORK

SACRAMENTO, CALIF.—STATE—GRADING AND SURFACING—AMADOR COUNTY

Contract awarded to Yglesias Bros., Spreckels Theatre Bdg., San Diego, $149,461 to California Division of Highways, Sacramento, for 4.3 miles grading and gravel or stone surfacing in AMADOR COUNTY from Amador City to Martell. Bids from 15 lowest bidders as follows:

(1) Yglesias Bros. $149,461
(2) E. C. Coats 152,109
(3) Contoules Const. Co., S. F. 152,983
(4) O. A. Lindberg, Stockton 158,230
(5) Fredrickson & Watson, Oakland 165,766
(6) Lilly, Williard & Biasotti 166,286
(7) Geo. Pollock Co., Sacramento 173,158
(8) Granfield, Farrar & Carlin 178,987
(9) Larsen Bros. $179,916
(10) V. R. Dennis Const. Co., San Diego 181,473
(11) Clark & Henery Const. Co. 183,267
(12) M. J. Bevanda, Stockton 184,784
(13) W. H. Hauser, Oakland 185,522
(14) Hemstreet & Bell, Marysville 185,945
(15) C. Emil Force, Piedmont 188,429

Bids submitted on the following items for the construction of this project:

(A) 11½ acres clearing and grubbing
(B) 116,000 cu.yd. roadway excavation (Location A)
(C) 42,300 cu.yd. roadway excavation (Location B)
(D) 530,000 sta.yd. overhaul
(E) 3,307 cu.yd. structure excavation
(F) 13,100 cu.yd. gravel or stone surf.
(G) 280 cu.yd. 'A' concrete (struct.)
(H) 23,100 lb. reinf. steel
(I) 736 ft. 8-in. corr. pipe
(J) 90 ft. 12-in. corr. pipe
(K) 2,726 ft. 18-in. corr. pipe
(L) 434 ft. 24-in. corr. pipe
(M) 932 ft. 30-in. corr. pipe
(N) 406 ft. 36-in. corr. pipe
(O) 188 ft. 48-in. corr. pipe
(P) 118 ft. corr. pipe (clean and relay)
(Q) 925 M gallons watering
(R) 5.7 miles new hog-tight prop. fence
(S) 1,830 cu.yd. screenings (stockpiles)
(T) 2.2 M redwood (dense select all ht. structural)
(U) 8.2 M redwood (select all ht. structural)
(V) 237 stations finishing roadway
(W) 135 monuments

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
(A)	$150	$150	$100	$150	$125	$100	$75	$300	$150	$100	$120	$150	$200	$100	$150
(B)	.50	.45	.60	.58	.48	.47	.50	.55	.58	.75	.55	.55	.57	.55	.58
(C)	.50	.60	.50	.50	.78	.73	.70	.70	.75	.75	.63	.85	.80	1.00	1.00
(D)	.01	.01	.01	.015	.01	.01	.01	.01	.01	.01	.02	.02	.02	.02	.01
(E)	1.50	1.30	1.00	2.00	1.50	1.25	1.50	1.50	1.50	1.50	1.75	1.50	2.50	1.50	1.25
(F)	2.50	2.80	2.20	2.00	3.20	3.20	3.50	3.30	3.20	1.80	3.50	3.00	3.00	2.75	3.25
(G)	25.00	25.00	25.00	30.00	20.00	32.00	22.00	30.00	25.00	30.00	25.00	24.00	25.00	25.00	22.50
(H)	.05	.06	.05	.07	.05	.05	.06	.05	.06	.06	.06	.06	.05	.06	.05
(I)	1.00	.50	.30	.50	.50	.25	.40	.40	.40	.50	.30	.50	.20	.30	.50
(J)	.40	.60	.40	.50	.50	.50	.50	.40	.40	.50	.40	.50	.30	.40	.50
(K)	.50	.70	.50	.60	.50	.50	.60	.50	.45	.50	.60	.75	.50	.50	.50
(L)	.75	.80	.60	.60	.50	.50	.90	.50	.65	.75	.80	1.00	.60	.75	.60
(M)	1.00	1.00	.70	.60	.75	.75	1.20	.60	.90	1.00	1.00	1.00	.70	1.00	.75
(N)	1.00	1.20	.85	.75	.75	1.00	2.00	.70	1.10	1.50	1.50	1.50	1.00	1.25	.75
(O)	1.50	1.60	1.20	1.00	1.00	1.00	3.00	.70	1.50	2.00	2.50	2.00	1.50	2.00	1.00
(P)	1.00	1.20	.60	1.00	1.00	.80	2.00	.50	.80	1.00	1.00	1.00	1.00	1.00	1.00
(Q)	2.50	3.00	3.50	2.00	2.25	2.50	3.00	4.00	2.00	1.25	2.50	2.50	2.50	2.00	3.00
(R)	$650	$500	$500	$800	$500	$750	$400	$600	$750	$600	$600	$850	$450	$600	$600
(S)	2.50	3.00	2.20	2.50	3.20	3.25	4.00	3.40	3.50	2.50	4.00	3.00	2.75	3.50	3.00
(T)	$100	$90	$60	$90	$100	$95	$100	$90	$100	$125	$100	$100	$100	$95	$100
(U)	$100	$85	$60	$90	$100	$90	$110	$90	$95	$125	$90	$100	$95	$95	$100
(V)	5.00	5.00	5.00	6.00	5.00	5.00	8.00	5.00	5.00	12.00	8.00	5.00	10.00	7.50	5.00
(W)	3.00	3.00	3.00	3.50	3.00	3.00	4.00	5.00	3.00	4.00	4.00	4.00	3.00	3.00	3.00

Other total bids were submitted for the construction of this project:

J. M. De Luca, Oakland $189,620
H. H. Boomer, San Francisco 195,045
Finnell Co., Sacramento $197,409
McCray Co., Los Angeles 208,524

SACRAMENTO, CALIF.—SAN MATEO COUNTY—STATE—BIT. TREATED CRUSHER RUN BASE

Fredrickson & Watson, 354 Hobart St., Oakland, and Fredrickson Bros., Stockton, who bid $120,819, low bid to California Division of Highways, Sacramento, for 7.3 miles surfacing with bituminous treated crusher run base in SAN MATEO COUNTY from Redwood City to San Mateo. Bids received on:

(1) 73,800 tons crusher run base
(2) 9,350 tons screenings (surf. treatment)
(3) 600 tons emulsified asph. (surf. treat.)
(4) 2,100 bbl. light fuel oil
(5) 325 cu.yd. structure excavation
(6) 748 timber guide posts
(7) 76 culvert markers
(8) 386 sta. finishing roadway

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	TOTALS
Fredrickson & Watson and Fredrickson Bros.	1.12	2.00	21.00	2.00	.75	2.00	2.00	2.00	$120,819
C. W. Wood, Stockton	1.25	2.25	19.00	1.50	1.00	1.00	1.00	4.00	130,530
N. M. Ball, Porterville	1.25	2.85	25.00	2.00	1.00	2.40	2.50	5.00	142,337
Basich Bros. Construction Co., Los Angeles	1.35	2.44	23.00	1.65	.50	2.40	2.00	3.50	143,169
M. J. Bevanda, Stockton	1.42	2.00	22.75	1.70	1.50	2.50	2.50	3.00	144,421
Hemstreet & Bell, Marysville	1.44	2.65	23.00	1.72	1.00	2.40	1.90	2.50	151,691
Peninsula Paving Co., San Francisco	1.37	2.70	25.00	2.00	1.10	4.50	5.00	6.00	151,970
J. Casson, Hayward	1.65	2.40	21.00	1.50	1.50	1.50	1.00	4.00	163,189
V. R. Dennis Const. Co., San Diego	1.46	3.50	23.00	1.80	1.50	3.00	3.00	6.00	163.328
C. Mankel, Sacramento	1.69	2.77	24.00	1.76	1.50	2.55	2.28	5.00	173.215
Granite Const. Co.	1.80	2.45	23.50	1.80	1.00	2.75	3.00	8.75	179,615
W. A. Dontanville, Salinas	1.83	2.55	23.00	1.85	2.00	2.75	2.25	5.00	181.389
Healy-Tibbitts Const. Co., San Francisco	1.85	2.25	22.90	1.75	1.00	3.00	3.00	10.00	181,639
F. W. Nighbert, Bakersfield	2.14	3.00	25.10	2.10	1.50	2.35	2.18	5.00	209,792

SACRAMENTO, CALIF.—STATE—GRADING AND SURFACING—EL DORADO COUNTY

C. Emil Force, 70 Bellevue Ave., Piedmont, $83,909 low, to California Division of Highways for 1.7 miles grading and surfacing, ELDORADO COUNTY, from Clarks Corner to Placerville. Bids from:

(1) C. Emil Force, Piedmont $83,909
(2) E. C. Coats, Sacramento 84,405
(3) Hemstreet & Bell, Marysville 90,825
(4) The Adams Co., Angels Camp 92,252
(5) Chigris & Sutsos 92,463
(6) W. H. Hauser, Oakland 94,512
(7) Geo. Pollock Co., Sacramento 96,216
(8) Kern & Kibbe, Portland $98,403
(9) A. Teichert & Sons, Sacramento 99,823
(10) Granfield, Farrar & Carlin, San Francisco 100,171
(11) J. M. DeLuca, Oakland 104,551
(12) Larsen Bros. 105,156
(13) Clark & Henery Construction Co. 105,827
(14) Contoules Const. Co., San Francisco 105,985
(15) Finnell Co., Inc., Sacramento 120,302

Bids received on the following items:

(A) 17 acres clear & grub.
(B) 90,000 cu.yd. road exc.
(C) 129,000 sta.yd. overhaul
(D) 2,600 cu.yd. str. excav.
(E) 9,500 cu.yd. gr. or stone surfac.
(F) 290 yd. 'A' conc. (struct.)
(G) 5 yd. 'E' concr. (rails)
(H) 300 lb. bronze plates
(I) 39,300 lb. reinf. steel
(J) 206 ft. 12-in. corr. pipe
(K) 1,114 ft. 18-in. corr. pipe
(L) 202 ft. 24-in. corr. pipe
(M) 956 ft. 36-in. corr. pipe
(N) 126 ft. 8-in. perf. underdrain
(O) 100 ft. 6-in. wr. iron pipe
(P) Move & reset headwalls
(Q) 470 cu.yd. remove concrete
(R) 1.9 mi. new property fence
(S) 1.1 mi. move and reset fences
(T) 1,650 ft. remove gd. rail
(U) 1,250 cu.yd. light riprap
(V) 150 cu.yd. stone fill hd. place
(W) 120 cu.yd. rub. mas. (ret. walls)
(X) 91 sta. finishing roadway
(Y) 53 monuments

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
(A)	$100	$130	$100	$110	$125	$100	$70	$85	$125	$100	$100	$200	$75	$175	$200
(B)	.39	.40	.45	.44	.48	.45	.45	.535	.53	.55	.585	.58	.55	.58	.75
(C)	.01	.01	.01	.01	.01	.02	.01	.01	.01	.01	.01	.01	.015	.02	.01
(D)	1.25	2.00	1.50	1.50	1.25	1.75	1.50	2.00	1.50	1.25	1.50	1.75	1.50	1.50	1.00
(E)	2.75	2.00	2.30	2.40	2.30	2.75	2.90	2.50	2.65	2.45	2.50	2.50	3.00	2.30	2.50
(F)	$22	$27	$25	$22	$22	$25	$25	$24	22.50	$22	$25	$27	$25	$24	$25
(G)	50	70	35	60	35	65	50	30	75	35	70	60	75	75	70
(H)	.60	1.00	.75	.50	.75	1.00	.40	.35	.45	.60	.50	1.00	.75	.50	.50
(I)	.04	.06	.06	.05	.05	.05	.06	.07	.05	.05	.06	.05	.06	.06	.05
(J)	.50	.50	.40	.60	.30	.30	.50	.50	.50	.45	.40	.35	.50	1.00	.35
(K)	.60	.60	.50	.70	.40	.50	.50	.60	.60	.45	.50	.45	.75	1.00	.50
(L)	.80	.70	.75	.80	.75	.75	.75	.75	.75	.50	.75	.60	1.00	1.00	.60
(M)	1.20	1.00	1.25	1.00	1.00	1.00	1.50	1.00	1.00	.60	1.25	1.00	1.50	1.00	1.00
(N)	1.40	1.70	1.25	.50	1.00	1.50	.50	3.00	1.25	1.60	1.00	1.20	2.00	1.50	2.00
(O)	1.50	1.00	1.25	1.80	1.26	1.75	.50	2.00	3.00	1.00	1.00	2.00	1.50	1.00	.65
(P)	$10	$25	$15	$25	$15	$15	$20	$12	$20	$70	$15	$10	$10	$25	$10
(Q)	2.25	2.00	2.00	2.00	2.00	1.00	3.00	1.00	2.00	0.55	1.75	3.00	2.00	3.50	1.00
(R)	$400	$500	$400	$480	$475	$400	$400	$450	$500	$500	$500	$400	$500	$750	$600
(S)	100	300	350	220	300	300	100	400	300	300	300	300	330	350	300
(T)	.15	.40	.20	.20	.20	.15	.20	.02	.10	.40	.20	.05	.10	.40	.50
(U)	1.50	2.00	3.50	6.00	4.50	2.00	3.00	1.50	2.50	5.00	3.00	2.00	2.00	1.75	3.00
(V)	.75	1.50	3.00	3.00	2.00	4.00	3.00	1.50	2.00	3.50	3.00	1.00	1.50	1.50	5.00
(W)	8.00	$12	$12	6.00	9.00	12.50	$14	$12	$15	$11	$14	$12	$12	$17	$14
(X)	4.00	5.00	5.00	5.00	5.00	6.00	8.00	7.00	5.00	4.00	5.00	8.00	8.00	$12	$10
(Y)	3.00	3.00	3.00	3.00	3.00	3.00	4.00	3.00	4.00	3.00	3.00	3.00	4.00	3.50	3.00

SACRAMENTO, CALIF.—STATE—GRADING—TRINITY COUNTY

H. H. Boomer, Mills Bdg., San Francisco, $31,476, low bid to California Division of Highways, for 0.8 miles, TRINITY COUNTY from West Boundary to Burnt Ranch. Bids received on:

(1) 56,200 cu.yd. roadway excavation
(2) 12,500 sta.yd. overhaul
(3) 800 cu.yd. structure excavation
(4) 137 cu.yd. rubble masonry
(5) 156 ft. 18-in. corr. pipe
(6) 46 ft. 24-in. corr. pipe
(7) 54 ft. 54-in. corr. pipe
(8) 110 ft. 60-in. corr. pipe
(9) 72 ft. 84-in. corr. pipe
(10) 40 stations finishing roadway
(11) 58 monuments

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	TOTALS
H. H. Boomer, San Francisco	.48	.04	1.50	10.00	.75	1.00	2.00	2.50	3.50	10.00	4.00	$31,476
Hemstreet & Bell, Marysville	.48	.02	1.50	15.00	1.50	2.00	3.00	3.25	4.00	5.00	3.50	32,017
Chigris & Sutsos, San Francisco	.54	.01	1.75	17.00	.75	1.50	4.00	5.00	6.50	5.00	3.00	35,996
W. C. Colley, Berkeley	.5475	.02	2.25	17.00	1.25	1.75	3.00	3.50	5.00	6.00	3.50	36,774
Englehart Paving & Const. Co., Eureka	.57	.01	2.50	15.00	1.50	1.75	3.00	4.00	5.00	5.00	5.00	37,980
J. M. Deluca, Oakland	.68	.02	1.50	16.00	.75	1.00	2.00	2.50	3.50	6.00	3.00	43,070
Contoules Const. Co., San Francisco	.69	.02	1.50	18.00	1.00	1.00	2.00	2.50	3.00	10.00	3.50	44,098
Finnell Co., Sacramento	.95	.02	2.50	18.00	1.25	1.50	2.00	3.00	5.00	10.00	4.00	59,800

SACRAMENTO, CALIF.—STATE—SURFACING—COLUSA COUNTY

D. McDonald, P.O. Box 170, Sacramento, $95,140, low bid to California Division of Highways for COLUSA COUNTY. 8.1 miles gravel base from Williams to Maxwell. Bids on: (1) 71,000 cu.yd. gravel base:

	(1)	TOTALS		(1)	TOTALS
D. McDonald, Sacramento	1.34	$95,140	C. Mankel	1.71	$121,410
V. R. Dennis Const. Co.	1.44	102,240	Hemstreet & Bell, Marysville	1.72	122,120
Basich Bros. Const. Co., L. A.	1.57	111,470	Fredrickson & Watson	1.80	127,800
C. W. Wood, Stockton	1.60	113,600	Lilly, Willard & Biasotti, Stockton	1.84	130,640
A. Fredrick Anderson, Oakland	1.69	119,990	A. Teichert & Sons, Sacramento	1.84	130,640
J. C. Compton, McMinnville, Ore.	1.70	120,700			

DENVER, COLO.—GOVT.—GRADING—WYOMING

Award of contract recommended to Robinson Const. Co., Twin Falls, Idaho, $108,780 for 8.7 miles grading Salt Creek-Smoot Project, Lincoln County, WYOMING, for Bureau of Public Roads. Bids on:

(1) 93,300 cu.yd. roadway excavation
(2) 2,700 cu.yd. structure excavation
(3) 30,800 cu.yd. borrow
(4) 8.864 mi. finish earth graded road
(5) 14,800 cu.yd. selected material (top course)
(6) 18,000 cu.yd.mi. overhaul (sel. material)
(7) 316 cu.yd. 'A' concrete
(8) 104 cu.yd. 'B' concrete
(9) 85 cu.yd. 'D' concrete
(10) 32,200 lb. reinf. steel
(11) 2,766 ft. 24-in. corr. pipe
(12) 290 ft. 30-in. corr. pipe

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	TOTALS
Robinson Const. Co.	.50	2.00	.35	$200	.30	.30	33.00	33.00	33.00	.09	2.80	3.50	$108,780
V. P. Strange, Salt Lake City	.60	2.25	.35	100	.90	.25	36.00	36.00	36.00	.07	3.00	4.00	124,912
Callahan-Walker Const. Co., Omaha	.68	2.50	.30	150	.40	.35	30.00	30.00	30.00	.08	3.50	4.00	126,215
Engineer's estimate	.50	1.50	.30	100	.50	.30	35.00	30.00	35.00	.09	2.75	3.50	106,898

SAN DIEGO, CALIF.—CITY—GRADING—EAST TORREY PINES ROAD

Daley Corporation, 4430 Boundary St., San Diego, who bid $112,032, low bid to the City for the grading of the East Torrey Pines Road. Bids received from:

(1) Daley Corp., San Diego $112,032
(2) Lewis Construction Co., L. A. 116,049
(3) Watson & Sutton, San Diego 118,560
(4) Jahn & Bressi, Los Angeles 118,645
(5) C. R. Butterfield, San Pedro 128,363
(6) Triangle Rock & Gravel Co. 132,083
(7) J. G. Donovan & Son, L. A. 134,398
(8) R. G. LeTourneau, Stockton 137,125
(9) H. W. Rohl Co., Alhambra 139,491
(10) Gist & Bell, Arcadia $139,504
(11) R. E. Hazard Contracting Co. 139,925
(12) Eltinge T. Brown, Los Angeles 143,107
(13) Yglesias Bros., San Diego 149,721
(14) V. R. Dennis Const. Co., San Diego 153,050
(15) Schelling Co., Glendale 175,115
(16) Crook & Henno, Los Angeles 186,240
(17) Bert Noble, San Diego 201,323

Bids on the following items for the construction of this project:

(A) 66 sta. grubbing and clearing
(B) 341,600 cu.yd. roadway excavation
(C) 650 cu.yd. structure excavation
(D) 3,460,000 sta.yd. overhaul
(E) 94 sta. finishing roadway
(F) 16 10-ft. B2 curb inlets
(G) 214 ft. 18-in. heavy reinf. conc. culvert
(H) 205 ft. 18-in. double heavy reinf. conc. culvert
(I) 78 ft. 18-in. double med. reinf. conc. culvert
(J) 201 ft. 24-in. heavy reinf. conc. culvert
(K) 312 ft. 24-in. double heavy reinf. conc. culvert
(L) 443 ft. 30-in. double heavy reinf. conc. culvert
(M) 25 cu.yd. concrete for cradling
(N) 1 L. headwall

	(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)
(1)	8.50	.267	.75	.0035	5.00	$134	1.90	2.10	1.98	2.90	3.20	4.83	12.00	40.00
(2)	15.00	.26	1.50	.005	10.00	100	2.20	2.30	2.40	3.30	3.50	4.50	20.00	50.00
(3)	5.00	.279	.50	.0045	3.00	100	1.95	1.95	1.95	3.00	3.25	4.90	15.00	15.00
(4)	7.00	.275	.75	.005	5.00	55	1.70	1.80	1.90	2.75	3.05	4.00	20.00	50.00
(5)	20.00	.295	1.25	.005	7.00	170	1.75	2.00	1.80	2.60	3.00	4.60	12.00	60.00
(6)	10.00	.28	.75	.0075	5.00	190	2.50	2.60	2.60	3.25	3.50	5.25	16.00	86.00
(7)	10.00	.31	1.25	.005	10.00	200	2.00	2.25	2.10	3.05	3.35	5.20	15.00	$200
(8)	10.00	.30	1.00	.0075	6.00	100	2.00	2.20	2.10	2.90	3.40	5.00	12.00	20.00
(9)	10.00	.33	1.00	.005	5.00	120	2.50	2.25	3.50	3.40	3.50	5.20	15.00	40.00
(10)	15.00	.33	1.00	.005	10.00	100	2.00	2.20	2.10	2.75	3.00	5.00	20.00	50.00
(11)	4.00	.2925	.75	.01	4.00	40	1.25	1.35	1.45	2.00	2.25	3.00	20.00	50.00
(12)	20.00	.335	1.50	.005	7.00	150	2.25	2.50	2.35	3.50	3.75	5.40	20.00	75.00
(13)	25.00	.38	1.00	.0025	5.00	170	2.50	2.75	2.75	3.25	3.50	5.00	18.00	50.00
(14)	15.00	.34	1.50	.0075	20.00	125	1.80	2.05	1.85	2.80	3.10	4.85	15.00	$100
(15)	15.00	.38	1.50	.01	7.50	150	2.24	2.33	2.45	3.13	3.41	5.24	15.00	$100
(16)	15.00	.385	1.50	.0125	15.00	80	2.40	2.50	2.65	3.70	4.00	6.40	28.00	60.00
(17)	7.00	.45	1.00	.01	10.00	200	4.00	4.00	4.00	5.00	5.00	6.00	20.00	40.00

PHOENIX, ARIZ.—GRADING AND STEEL BRIDGE—ASHFORK-KINGMAN ROAD—STATE

M. H. Slocum, 2055 Veteran Avenue, Los Angeles, who bid $80,056, submitted low bid to the Arizona State Highway Commission for 7.4 miles grading, draining, and bridge on the Ashfork-Kingman Highway. Bids received from:

(1) M. H. Slocum, Los Angeles ..... $ 80,056
(2) Black & Grover, Clifton, Ariz. 99,663
(3) Gist & Bell, Arcadia 103,508
(4) N. G. Hill & Co., Phoenix 105,554
(5) Henry Galbraith, Jerome, Ariz. 106,299
(6) General Const. Corp., L. A. $110,067
(7) F. D. Shufflebarger, New Mexico 111,872
(8) Mt. States Const. Co., Pueblo 115,253
(9) Skeels & Graham Co., Tucson 122,417

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
11,886 cu.yd. roadway exca.	.45	1.10	1.00	.80	1.50	1.35	1.20	1.20	1.30
1,237 cu.yd. drainage excav.	.20	.50	.50	.40	.50	.41	.80	1.20	1.00
700 cu.yd. slide and overbreak	.3375	.825	.75	.60	1.125	1.0125	.90	.90	.975
384 cu.yd. struc. excavation	1.25	1.25	1.50	1.00	1.00	3.00	1.30	1.50	2.00
53,228 cu.yd. borrow excav.	.23	.27	.30	.30	.30	.41	.275	.38	.40
10,848 sta.yd. overhaul	.01	.04	.02	.03	.03	.03	.05	.05	.03
4,670 cu.yd. subgr. stabilizer	.60	.80	.75	.80	.75	.52	1.00	1.90	1.50
12,377 cu.yd.mi. subgr. stabilizer haul	.12	.25	.25	.15	.20	.22	.24	.20	.20
96 cu.yd. Class 'A' concrete	21.00	24.00	25.00	28.00	27.50	30.00	25.00	24.30	30.00
116 cu.yd. Class 'B' conc.	18.00	23.50	24.00	26.00	24.00	25.00	23.00	23.00	30.00
6,300 lb. reinforcing steel	.045	.0525	.06	.06	.07	.07	.07	.06	.055
294 ft. corr. metal pipe, 24-in.	2.65	2.75	3.00	3.25	3.00	4.00	3.15	3.00	3.50
182 ft. 30-in. corr. metal pipe	3.15	3.45	4.00	4.00	4.00	4.75	3.65	4.00	4.50
212 ft. 36-in. corr. metal pipe	5.15	5.40	5.00	6.25	5.25	6.60	5.50	5.00	6.50
11,014 ft. stand. line fence	.125	.10	.10	.08	.05	.10	.06	.08	.10
360 ft. cable guard fence	1.00	.90	1.00	1.00	1.00	1.00	1.00	1.00	1.00
STRUCTURES OVER 20-FT. CLEAR SPAN									
538 cu.yd. excavation	1.25	1.00	1.50	4.00	1.00	3.00	2.50	2.00	4.00
34 cu.yd. 'AA' concrete	60.00	50.00	70.00	70.00	75.00	55.00	65.00	50.00	70.00
958 cu.yd. 'A' concrete	18.00	24.50	25.00	27.00	25.00	23.00	27.00	23.00	27.50
85,935 lb. reinforcing steel	.045	.0525	.06	.06	.06	.045	.055	.055	.055
410,154 lb. struc. steel	.06	.0575	.06	.065	.055	.0575	.07	.066	.06
1,050 sq.yd. protective coating for concrete	.10	.10	.50	.30	.15	.25	.50	.30	1.50

SACRAMENTO, CALIF.—STATE—SAN MATEO COUNTY—CONCRETE PAVING

Basich Bros. Construction Co., 3788 South Vermont St., Los Angeles, $89,162, low bid to the California Division of Highways, for grading and concrete paving of 0.9 of a mile in SAN MATEO COUNTY, through the town of South San Francisco. Bids received from:

(1) Basich Bros. Construction Co., Los Angeles $89,162
(2) Hanrahan Company, San Francisco 89,487
(3) N. M. Ball, Porterville ..... $ 96,660
(4) W. A. Dontanville 104,365

	(1)	(2)	(3)	(4)
5,000 cu.yd. roadw. exc.	.30	.25	.50	.40
17,000 sta.yd. overhaul	.02	.01	.02	.01
2,670 cu.yd.str. excav.	.80	1.25	1.25	1.35
22,500 sq.yd. subgrade	.09	.10	.09	.10
4,700 tons cr. run base	1.50	1.00	1.60	2.15
910 tons asphalt	5.60	4.50	6.50	6.00
5,950 yd. "A" conc. (paving)	7.64	7.77	8.00	8.25
990 yd. "A" conc. (curb, etc.)	12.50	16.00	12.00	15.00
94 yd. "A" conc. (struct.)	17.00	16.00	17.00	20.00
169,000 lb. rein. steel	.0375	.03	.04	.04
344 ft. 16-in. rein. conc. pipe	1.00	1.00	.90	2.00
100 ft. 18-in. rein. conc. pipe	1.50	1.50	1.50	2.25
1,800 ft. 8-in. metal underd.	1.20	1.25	1.40	1.90
9 catchbasins	55.00	50.00	40.00	60.00
1,300 cu.yd. rem. concr. (paving, etc.)	1.00	1.00	2.00	2.00
Remove and replacing lighting system	$700	$300	$1,000	$480
49 sta. finish roadway	2.00	5.00	5.00	5.00

SAN FRANCISCO, CALIF.—CITY—SUNSET BOULEVARD SECTION C

California Construction Co., Standard Oil Bdg., San Francisco, $103,844, low bid to the Board of Public Works, City Hall, San Francisco, for the improvement of Section 'C', Sunset Boulevard, from Noriega to Santiago Streets. Bids received from:

(1) California Construction Co., S. F. $103,844
(2) James M. Smith, San Francisco 107,765
(3) Charles L. Harney, San Francisco 110,778
(4) Myer Rosenberg, San Francisco $111,336
(5) Fay Improvement Co., San Francisco 119,618
(6) E. J. Treacy, San Francisco 129,804

	(1)	(2)	(3)	(4)	(5)	(6)
116,200 cu.yd. excavation	.18	.155	.31	.18	.20	.20
122,300 cu.yd. imported borrow	.12	.155	.01	.18	.20	.27
193,600 sq.ft. 2½-in. asph. surf., 10-in. mac. base	.135	.15	.13	.125	.135	.146
48,000 sq.ft. 2-in. asph. surf., 6-in. 'F' conc. base	.205	.25	.24	.20	.21	.22
160 tons asphalt conc. conform pavement	5.00	6.50	6.00	6.00	5.50	6.00
90,800 sq.ft. 4-in. waterbound macad. pav.	.025	.025	.03	.03	.027	.03
45,800 sq.ft. 6-in. waterbound macad. pav.	.035	.0325	.04	.04	.042	.04
13,700 sq.ft. concrete sidewalk	.13	.10	.12	.12	.12	.12
13,600 lin.ft. unarmored concrete curb	.45	.35	.70	.60	.60	.60
100 lin.ft. concrete curb reset	.20	.25	.25	.30	.16	.20
18,200 lin.ft. 2 by 6-in. redwood headers	.07	.055	.08	.08	.09	.10
240 lin.ft. 15-in. vitrified sewer	2.00	1.40	2.50	2.00	2.40	2.00
240 lin.ft. 12-in. vitrified sewer	1.50	1.00	2.00	1.50	1.60	2.00
700 lin.ft. 10-in. vitrified culvert	1.50	.80	1.00	1.50	1.50	1.50
5 brick manholes	$100	70.00	80.00	80.00	90.00	90.00
12 brick catchbasins	$100	80.00	80.00	80.00	85.00	80.00
540 lin.ft. 3-in. black pipe conduit	.80	.55	.60	.60	.72	.45
1,600 lin.ft. 1½-in. black pipe conduit	.40	.20	.30	.30	.30	.18
9,940 cu.yd. loam	.90	1.00	1.00	.90	.90	.80
1,860 cu.yd. manure	2.50	2.50	2.50	2.50	3.00	3.00
3 tons of hay (slope protection)	50.00	50.00	50.00	50.00	38.00	25.00

WATER SUPPLY SYSTEMS

WHITTIER, CALIF.—REINF. CONCRETE RESERVOIR NO. 4—CITY

Southern Construction Co., 806 Rodeo Drive, Beverly Hills, Calif., who bid $69,038, submitted low bid to the City of Whittier, Los Angeles County, for construction of reinforced concrete-lined Reservoir No. 4, to have capacity of 10,000,000 gallons. Bids received on:

(1) 43,000 cu.yd. excavation
(2) 510 cu.yd. concrete footings
(3) 77,000 sq.ft. concrete lining
(4) 8,570 sq.ft. roadway
(5) 1,300 cu.yd. concrete roof
(6) 350 cu.yd. conc., walls, culv., etc.
(7) 2,710 ft. 4-in. drain
(8) 80 lin.ft. 6-in. drain
(9) Lump sum ventilators

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	TOTALS
Southern Const. Co.	.40	15.00	.14	.10	20.00	15.00	.25	.30	$ 600	$69,038
A. G. Schmidt	.53	12.61	.1118	.1011	19.98	7.96	.338	.437	685	69,114
Carpenter Bros.	.47	8.30	.135	.12	22.94	9.58	.10	.15	150	69,474
Oberg Brothers	.60	10.40	.1173	.07	20.60	10.00	.25	.50	280	72,013
Blue Ribbon Blds.	.52	7.00	.15	.06	24.50	5.00	.32	.35	565	73,054
Gist & Bell	.58	8.00	.16	.10	20.00	12.00	.50	1.00	500	74,332
H. M. Baruch	.49	6.04	1.24	.09	26.40	12.80	.50	1.00	1070	75,774
Owl Truck Company	.43	8.80	.15	.12	33.60	8.15	.36	.41	813	83,900
Robinson & Roberts	.63	10.60	.17	.10	25.00	10.00	.28	.35	740	83,969
W. M. Ledbetter & Co.	.48	12.75	.274	.225	21.96	14.40	.30	.40	575	85,176
Nead Const. Co.	.45	10.30	.173	.088	32.00	11.00	.40	.60	537	85,797
M. H. Slocum	.70	6.70	.1685	.072	30.60	10.50	.20	.30	625	91,754
Byers & Dunn	.60	17.00	.18	.15	25.00	20.00	1.00	1.25	500	92,425

GRANTS PASS, OREGON—CAST IRON PIPE, VALVES AND HYDRANTS, ETC.—CITY

Contract awarded as follows by the City of Grants Pass, Oregon, for furnishing and delivering cast iron pipe, gate valves and hydrants:

(A) CAST IRON PIPE—Contract awarded to U. S. Pipe & Foundry Co. for the Class 100 Cast Iron Pipe and contract awarded to Pacific States Cast Iron Pipe Co. for the 12-in., 10-in., 8-in., and 6-in. cast iron pipe. Bids received on the following items:

(1) 4,500 lin.ft. 16-in. cast iron pipe, Class B
(2) 4,500 lin.ft. 16-in. cast iron pipe, Class 100
(3) 10,500 lin.ft. 12-in. cast iron pipe
(4) 1,800 lin.ft. 10-in. cast iron pipe
(5) 14,000 lin.ft. 8-in. cast iron pipe
(6) 2,500 lin.ft. 6-in. cast iron pipe
(7) 65,000 lb. cast iron specials

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Pacific States Cast Iron Pipe Co., Portland	3.04	2.65	1.70	1.30	.9625	.6825	.059
U. S. Pipe & Foundry Co., Seattle, Wash.	3.03	2.47	1.71	1.32	.9850	.7075	
National Cast Iron Pipe Co., Los Angeles	3.05		1.72	1.34	.99	.71	.06
American Cast Iron Pipe Co., Seattle, Wash.	3.06		1.74	1.37	1.04	.73	.059
Pacific Water Works Supply Co., Seattle		2.79	1.85	1.46	1.07	.73	

(B) VALVES, HYDRANTS, Etc.—Contract awarded to Rensselaer Valve Company, for furnishing valves, hydrants, etc. Bids received on the following items:

(1) 90 fire hydrants
(2) 90 auxiliary valves
(3) 90 steamer connections
(4) 4 gate valves, 16-in.
(5) 20 gate valves, 12-in.
(6) 4 gate valves, 10-in.
(7) 22 gate valves, 8-in.
(8) 60 gate valves, 6-in.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Rensselaer Valve Co., Seattle, Wash.	53.00	25.00	6.00	103.65	46.60	40.30	26.45	17.75
Kennedy Valve Mfg. Co., Elmira, N. Y.	40.09	26.35	2.20	127.71	60.18	46.71	31.23	21.26
A. P. Smith Mfg. Co., Seattle, Wash.	53.50	26.75	5.75	99.75	53.40	41.35	26.65	18.65
Hugh G. Purcell Co., Seattle, Wash.				135.00	60.00	44.00	26.00	16.50
M. & H. Valve Company, Alabama				112.00	56.00	44.00	28.70	18.90
Consolidated Supply Co., Portland				142.45	74.00	58.80	49.97	31.85
National Cast Iron Pipe Co., L. A.	53.00	41.00	7.00	123.00	66.00	53.00	35.00	23.00
Pacific Water Works Supply Co.	52.50	26.10	4.50	87.20	50.30	36.90	26.90	16.75
Crane Company, Portland	47.15	24.63	5.24	128.00	55.00	47.50	29.00	18.00
Helser Machine & Iron Works, Oregon	62.20	31.50	2.40					

Baar & Cunningham, Spalding Building, Portland, Oregon, are the Consulting Engineers.

CONSTRUCTION NEWS SUMMARY

NOTE: For additional information regarding projects in this summary refer to Daily Construction News Service, date appearing at end of each item.

TABULATION OF AWARDS

Awards for the month of September, 1930, for Engineering Construction projects in the Far Western States, total $21,906,068, as follows:

Paving	$ 3,175,000
Grading, highways	4,572,651
Bridges	927,926
Sewer construction	1,342,245
Water supply systems	1,150,000
Lighting systems	456,000
Railroad construction	3,135,000
Oil pipe lines	5,000,000
River and harbor work	1,660,000
Irrigation and reclamation	487,246
	$21,906,068

LARGE WESTERN PROJECTS

(See Construction News, this issue, for details.)

WORK CONTEMPLATED

Storm drain system, Section 4 of Jefferson St. storm drain for City of Los Angeles.

Sanitary sewers for City of Los Angeles, $5,650,000.

Power plants, distributing system, etc., for City of Los Angeles, $13,300,000.

Wells, pipe-lines, reservoir, water treatment plant, steel tank, etc., for City of Torrance, Calif., $400,000.

Earth-fill dam for Carpenter Irrigation District, Serrano Irrigation Dist., and Irvine Co., Santa Ana, Calif.

Pumps and pipe-lines for Howard Flat Irrigation District, Seattle, Wash., $300,000.

Pumps, wells, pipe-lines, and reservoirs for Camelback Irrigation District, Phoenix, Ariz., $516,000.

BIDS BEING RECEIVED

Grading 40 miles of Flagstaff-Fredonia Highway and constructing steel bridge at Cameron, $800,000, work for Arizona Highway Comm., bids to Oct. 15.

Grading and tunnel on Wawona Road, Yosemite Park, for Bureau of Public Roads, $750,000, bids to Oct. 21.

Grading and asphalt paving in Imperial County, 13 miles from Arroyo Salado to north boundary, for California Division of Highways, bids to Oct. 22.

Grading 5 miles Siuslaw National Forest, LANE COUNTY, Oregon, for Bureau of Public Roads, bids to Oct. 14, work involving 640,000 cu.yd. excavation.

Steel pipe-lines for City of Seattle, Wash., $2,000,000, bids to Oct. 10.

CONTRACTS AWARDED

Concrete and Warrenite Bit. paving Broadway for City of Los Angeles, to Griffith Co., Los Angeles, $486,270.

Rock wall and dredging at Richmond, Calif., for Berkeley Waterfront Company, to Daniel Contracting Co., San Francisco.

STREET and ROAD WORK

WORK CONTEMPLATED

LOS ANGELES, CALIF.—Plans by County Surveyor, protests October 14, for improvement of Doheny Drive near Beverly Hills, a distance of ½ mile. Work involves 5295 cu.yd. excavation, 1834 ft. curb, 6131 sq.ft. gutter, 33,973 sq.ft. 3½-in. sidewalk, 132,641 sq.ft. 2-in. asph. conc. wearing surf., 128,845 sq.ft. 4-in. asph. conc. base, 128,845 sq.ft. 5-in. disinteg. rock base, 7 catchbasins, 316 ft. 16-in. and 76 ft. 18-in. rein. conc. pipe (heavy), reinforced concrete box culvert, ornamental lighting system, water system complete. $55,000. 9-19

SAN DIEGO, CALIF.—Plans by H. W. Jorgensen, City Engr., protests Oct. 20, for improving Eads Ave., involving 191,155 sq.ft. 6-in. concrete paving, 3807 ft. 6-in. 'C' cast-iron pipe, 5 hydrants, conc. sewers, etc. 9-27

PUEBLO, COLO.—Plans by City Engr. for improving Routt St., etc., to cost $85,000.

BIDS BEING RECEIVED

PHOENIX, ARIZ.—Bids to 2 p.m., October 15, by the Arizona State Highway Commission, Phoenix, Arizona, for the construction of the Flagstaff-Fredonia Highway, beginning at Cameron Bridge, and extending northerly approximately 40 miles, consisting of grading and draining, and placing subgrade stabilizer; also construction of a steel bridge. Work involves: ROADWAY—132,000 cu.yd. roadway excavation, 34,000 cu.yd. drainage excavation, 4000 cu.yd. struct. excavation, 310,000 cu.yd. borrow excavation, 15,000 cu.yd. subgrade stabilizer, 32,000 cu.yd.mi. subgr. stabil. haul, 430 cu.yd. concrete, 40,000 lb. reinforcing steel, 2150 cu.yd. cement rubble masonry, 2400 cu.yd. plain riprap, corr. pipe; BRIDGE—7400 cu.yd. excavation, 2400 cu.yd. Class 'A' concrete, 225 cu.yd. plain riprap, 240,000 lb. reinforcing steel, 600,000 lb. structural steel, 5100 cu.yd. cement rubble masonry. 9-19

PHOENIX, ARIZ.—Bids to 2 p.m., Oct. 15, by Arizona Highway Comm. for 8.3 miles Tucson-Florence Highway from Pinal-Pima County line toward Tucson, involving 46,000 cu.yd. borrow excavation.

BELL, CALIF.—Bids to 8:30 p.m., Oct. 13, by City Clerk for improvement of Mayflower and other streets. Work involves 12,049 ft. curb, 47,990 ft. sidewalks, 181,430 sq.ft. 2½-in. oil macadam paving, 297,000 sq.ft. grading, 4436 ft. 8-in. and 4400 ft. 6-in. vitr. pipe. 9-19

BELL, CALIF.—Bids to 8:30 p.m., Oct. 13, by City for improving Loma Vista Ave., grading, vitrified sewers, oil macadam paving. $40,000. 9-19

EUREKA, CALIF.—Bids to 2 p.m., Oct. 14, by County for construction of 4 miles of road in Hoopa Valley. 9-29

MONTEREY, CALIF.—Bids to 7 30 p.m., Oct. 16, by Monterey Union High School Dist. for 8 tennis courts and a Girls' Athletic Field. $18,000. 10-1

SACRAMENTO, CALIF.—Bids to 2 p.m., Oct. 22, by California Division of Highways for: (1) LOS ANGELES COUNTY—64 acres clearing in 5.3 miles from north of La Canada to Colby Canyon; and (2) IMPERIAL COUNTY—13.1 miles grading and asphalt concrete paving from Arroyo Salado to north boundary, involving 361,000 cu.yd. roadway embankment, 10,000 cu.yd. structure excavation, 62,600 tons asphalt concrete, 53,910 ft. treated douglas fir piles, 1315 M ft. b.m. redwood, etc. 9-24

SAN FRANCISCO, CALIF.—Bids to 2 p.m., Oct. 21, by Bureau of Public Roads, 461 Market St., S. F., for 3.6 miles grading and tunnel on Section A5, Route 2, Wawona Route, and Section B2, South Road, Yosemite National Park, involving 96,500 cu.yd. roadway excavation, 3150 cu.yd. cement rubble masonry, 506 cu.yd. concrete, 4230 ft. tunnel excavation for 28-ft. diameter tunnel, 1050 lin.ft. gallery excavation, etc. $750,000. 9-24

SANTA BARBARA, CALIF.—Bids to 10 a.m., Oct. 14, by County for 1.3 miles grading San Julian Road, involving 49,630 cu.yd. excavation, corr. pipe, reinf. conc. work, etc. 9-30

DENVER, COLO.—Bids to 10 a.m., October 10, by State Highway Comm. for: (1) 10 miles in LARIMER COUNTY northwest of Collins, involving 143,700 cu.yd. common excavation, 6000 cu.yd. rock excavation, 88 M ft. b.m. timber, 850 cu.yd. concrete, 78,700 lb. reinforcing steel, 262,600 lb. structural steel, 20,100 tons gravel surfacing, etc.; (2) 2.5 miles in ROUTT COUNTY from Hayden to Craig, involving 40,000 cu.yd. borrow, 8300 tons rock or gravel surfacing, 825 cu.yd. concrete, 60,800 lb. reinforcing steel and 243,000 lb. structural steel; and (3) 2 miles south of Parlin, GUNNISON COUNTY, involving 30,000 cu.yd. common excavation, 12,000 cu.yd. rock excavation, etc.

DENVER, COLO.—Bids to 2 p.m., Oct. 16, by Bureau of Public Roads for: (1) 4.9 miles Rabbit Ears Pass Highway, Routt National Forest, Grand and Jackson Counties, Colorado, involving 116,170 cu.yd. roadway excavation, etc.; (2) 5 miles Black Mesa Highway, Gunnison National Forest, Gunnison County, Colorado, involving 84,000 cu.yd. roadway excavation, etc.; (3) 2 miles Six Mile Creek Highway, Jefferson and Douglas Counties, Colorado, involving 60,000 cu.yd. roadway excavation, etc.; and (4) 4 miles Berthoud Pass Highway, Arapahoe National Forest, Grand County, Colorado, involving 154,000 cu.yd. roadway excavation, etc.

MISSOULA, MONT.—Bids to 10 a.m., Oct. 21, by Bureau of Public Roads, Box 1386, Missoula, Montana, for: (1) 3 miles Pipestone Road, Deer Lodge Forest, Jefferson County, Montana, involving 56,000 cu.yd. roadway excavation, etc.; and (2) 10 miles Clarks Fork Highway, Cabinet National Forest, Sanders County, Montana, involving 159,980 cu.yd. roadway excavation.

CARSON CITY, NEV.—Bids to 2 p.m., Oct. 8, by State for 7.6 miles ORMSBY AND LYON COUNTIES, from Carson City to east of Mound House, involving 54,800 cu.yd. roadway excavation, 22,600 cu.yd. rock or gravel, corr. pipe, etc. 9-19

PORTLAND, ORE.—Bids to 10 a.m., October 14, by U. S. Bureau of Public Roads, Portland, Ore., for 4.935 miles of Sections 5D, 5E and 5F, Roosevelt Coast Highway, Siuslaw National Forest, LANE COUNTY, Oregon. Work involves: SECTION 5D (2.366 miles)—30 acres clearing, 17 acres grubbing, 359,500 cu.yd. excavation; SECTION 5E (0.180 miles)—3 acres clearing, 2.5 acres grubbing, 17,130 cu.yd. excavation; SECTION 5F (2.389 miles)—30 acres clearing, 18 acres grubbing, 262,600 cu.yd. excavation. 9-27

OGDEN, UTAH—Bids to 10 a.m., Oct. 10, by the U. S. Bureau of Public Roads for improving the Salmon-Montana Line, Idaho 30-H, National Forest Road Project, located adjacent to the Salmon National Forest, within the County of LEMHI, Idaho, 5.402 miles. Work involves 54,600 cu.yd. unclas. excavation, concrete structures, corr. pipe, etc. 9-29

OGDEN, UTAH—Bids to 10 a.m., Oct. 15, by Bureau of Public Roads for 2 miles North Fork Payette Project, Valley County, Idaho, involving 20,000 cu.yd. excavation, etc.

OLYMPIA, WASH.—Bids to 10 a.m., Oct. 14, by State for 2.4 miles from Teanaway to Bristol, KITTITAS COUNTY, involving 124,790 cu.yd. excavation. 9-19

OLYMPIA, WASH.—Bids to 10 a.m., October 14, by the Office of the Director of Highways, Olympia, Washington, for 7.3 miles of the Methow Valley Highway, Twisp Vicinity, in OKANOGAN COUNTY. Work involves 21 acres clearing, 112,090 cu.yd. excavation, 18,400 cu.yd. crushed stone surfacing. 9-20

SEATTLE, WASH.—Bids to 10 a.m., Oct. 27, by County Commissioners for (1) 1.3 miles grading and graveling west side of Vashon Road; (2) 1 mile grading Maple Valley road revision, involving 104,000 cu.yd. excavation; and (3) 3 miles grading and graveling Military Road near Des Moines Highway.

BIDS RECEIVED

FLORENCE, ARIZ.—Phoenix-Tempe Stone Co., Phoenix, Ariz., $114,545 low for concrete paving, vitr. pipe sewer, and lighting system for City. 9-22

PHOENIX, ARIZ.—M. H. Slocum, 2055 Veterans Ave., Los Angeles, $80,056 low bid to Arizona State Highway Comm. for 7.4 miles grading and constructing steel bridge on Ashfork-Kingman Highway. (See Unit Bid Summary.) 9-25

SACRAMENTO, CALIF.—Low bids as follows by California Division of Highways: (1) LOS ANGELES COUNTY—F. W. Teschke, 3172 Cahuenga Ave., L. A., $39,544 low for concrete paving at Castaic Creek; and (2) Fredrickson & Watson, 354 Hobart St., Oakland, and Fredrickson Bros., Stockton, $120,819 low for bit. treated crusher run base in SAN MATEO COUNTY from Redwood City to San Mateo. (See Unit Bid Summary.) 10-1

SACRAMENTO, CALIF.—Basich Bros. Const. Co., 3788 So. Vermont St., L. A., $89,162 low for 1 mile concrete paving through South San Francisco, SAN MATEO COUNTY, for California Division of Highways. (See Unit Bid Summary.) 9-24

SACRAMENTO, CALIF.—Geo. E. McDaniels, Marysville, $7843 low for property fence from Bear Creek to west of Williams, Colusa County, for California Division of Highways. 10-2

SAN DIEGO, CALIF.—Daley Corp., 4430 Boundary St., San Diego, $112,032 low for grading East Torrey Pines Road for City. (See Unit Bid Summary.) 9-30

SAN FRANCISCO, CALIF.—California Const. Co., Standard Oil Bdg., S. F., $103,844 low bid to City for Sect. 'C', Sunset Blvd., from Noriega to Santiago, paving with macadam, asphalt, and concrete, vitr. sewers, etc. (See Unit Bid Summary.) 10-2

DENVER, COLO.—Low bids as follows by City: (1) W. F. Pigg & Sons, Denver, Colo., $22,450 low for paving alleys in District 199; and (2) W. F. Pigg & Sons, Denver, Colo., $15,880 low for paving alleys in Dist. 200.

CARSON CITY, NEV.—Utah Const. Co., Phelan Bdg., S. F., and Ogden, Utah, $147,975 low bid to State for 11.7 miles grading and surfacing in LANDER COUNTY from Austin east. 9-25

SEATTLE, WASH.—Low bids as follows by City: (1) Moceri Bros., Seattle, $5059 low for paving 35th Ave. NE.; and (2) R. J. Odman, Seattle, $34,262 low for grading and concrete walks on Brandon St.

CONTRACTS AWARDED

PHOENIX, ARIZ.—To Pacific Const. Co., Phoenix, $6445 for concrete paving Mitchell St. for City.

PHOENIX, ARIZ.—To M. H. Slocum, 2055 Veteran Avenue, Los Angeles, who bid $80,056 to the Arizona State Highway Commission for 7.4 miles grading, draining, and construction of bridge on the Ashfork-Kingman Highway. (See Unit Bid Summary.) 9-29

BERKELEY, CALIF.—To L. C. Seidel, 680 14th Street, Oakland, $26,878 to City for improvement of La Loma Avenue from Buena Vista Way to Glendale Avenue, grading, oil macadam paving, curb and gutter, cement sidewalk, concrete in walls and steps, rubble masonry, reinforcing steel, handrail, catchbasins, manholes, corrugated pipe, and vitrified sewer. 9-30

GLENDALE, CALIF.—To Griffith Co., Los Angeles Railway Bdg., Los Angeles, who bid $47,632 to City for improvement of portions of Verdugo Road, grading, paving with asphalt. 9-27

LOS ANGELES, CALIF.—To Griffith Co., Los Angeles Railway Bdg., L. A., $486,270 for improving Broadway from Pico Blvd. to 41st St., grading, concrete paving, Warrenite Bit. surface, storm drain, sanitary sewer, water and lighting system for City. 9-22

LOS ANGELES, CALIF.—To G. W. Ellis, Bradbury Bdg., L. A., $203,440 low for improving 2.8 miles of Avalon Boulevard for County, grading, concrete paving, corr. pipe, etc. 9-26

LOS ANGELES, CALIF.—To G. M. Duntley, 778 South San Pedro, Los Angeles, Calif., who bid $4469 to Division of Highways, Los Angeles, for applying heavy fuel oil to shoulders on 8.6 miles between Tunnel Station and Santa Clara River Bridge, Los Angeles County. 9-27

OAKLAND, CALIF.—To Jack Casson, Hayward, who bid $4162 to County for the oiling of the Redwood Canyon Road from the City limits of Oakland at 35th Avenue, about 2.6 miles. 9-23

OAKLAND, CALIF.—To Central California Roads Co., 2779 Poplar St., Oakland, $41,602 for improving E. 12th St. from First Ave. southeast, grading, paving with 6-in. concrete base with 2-in. asphalt surface, asphalt resurfacing, vitr. pipe conduit, etc. 9-27

PACIFIC GROVE, CALIF.—To Clark & Henery Const. Co., Chancery Bdg., S. F., $17,310 for improving Junipero Ave. for City, asphalt paving. 9-20

SACRAMENTO, CALIF.—To Yglesias Bros., Spreckels Theatre Bdg., San Diego, who bid $149,461 to California Division of Highways, Sacramento, for 4.3 miles grading and surfacing (gravel or stone) from Amador City to Martell, in AMADOR COUNTY. (See Unit Bid Summary, Sept. 25th issue.) 9-23

SACRAMENTO, CALIF.—To F. W. Nighbert, Box 436, Bakersfield, who bid $14,996 to California Division of Highways for 15.4 miles oiling from 1.7 miles west of Shandon to east boundary, SAN LUIS OBISPO COUNTY. 9-23

SACRAMENTO, CALIF.—Awards as follows by the California Division of Highways, Sacramento: (1) COLUSA COUNTY—To H. Sykes, Patterson, Calif., $4650 for constructing about 5.0 miles of pit run gravel borders between one mile south of Arbuckle and Genevra; (2) YOLO COUNTY—To Harms Bros., Galt, Calif., $4216 for constructing pit run gravel borders on about 5.9 miles between Cache Creek and Zamora; and (3) BUTTE COUNTY—To C. Mankel, 2924½ 35th St., Sacramento, $4470 for constructing pit run gravel borders on about 5.0 miles between the North City limits of Chico and the Northerly County Boundary. 9-27

SACRAMENTO, CALIF.—Awards as follows by California Division of Highways (1) To H. H. Boomer, Mills Bdg., San Francisco, who bid $31,471 for 0.8 mile grading in TRINITY COUNTY from West Boundary to Burnt Branch; (2) To D. McDonald, P.O. Box 170, Sacramento, who bid $95,140 for constructing 8.1 miles gravel base from Williams to Maxwell in COLUSA COUNTY; and (3) To C. Emil Force, 70 Bellevue Avenue, Piedmont, who bid $83,909 for grading and surfacing 1.7 miles in EL DORADO COUNTY from Clarks Corner to Placerville. (See Unit Bid Summary.) 9-29

SAN BERNARDINO, CALIF.—To California Road Oil Service Co., Wilmington, Calif., who bid $10,357 to the District Engineer, Division of Highways, San Bernardino, for oiling about 6.7 miles from 4½ miles west of Running Springs Park to Squirrel Inn; about 0.77 mile from Pinecrest to Strawberry Peak; and about 0.84 mile from Squirrel Inn to Pinecrest. 9-23

SAN BERNARDINO, CALIF.—To G. M. Duntley, 778 So. San Pedro St., Los Angeles, who bid $2328 to District Engineer, Division of Highways, for oiling about 1.9 miles in San Bernardino County from the Pass down Waterman Canyon. 9-23

SAN DIEGO, CALIF.—To Griffith Co., 2104 Main St., San Diego, $34,566 for improving Point Loma Blvd., grading, paving with asphalt, cast-iron mains, hydrants, etc., for City. 9-27

SAN FRANCISCO, CALIF.—To California Const. Co., Standard Oil Bdg., S. F., $97,890 for Sect. D, Sunset Blvd., from Noriega St. to Irving St., grading, paving with waterbound macadam, paving with asphalt surface on concrete and waterbound macadam base, vitr. sewers, etc. (See Unit Bid Summary, Sept. 25th issue.) 9-24

SANTA CRUZ, CALIF.—Awards as follows by County for oil macadam paving: (1) To Granite Const. Co., Watsonville, $3344 for paving on E. Cliff Drive and 17th Ave.; and (2) To Granite Const. Co., Watsonville, $3915 for paving on Soquel and San Jose Road. 9-25

SANTA ROSA, CALIF.—Awards as follows by County: (1) To W. C. Colley, 35 Northampton Ave., Berkeley, who bid $3711 for grading and surfacing ¾ of a mile of Lakeville-Sears Point Road, Sect. A; and (2) To Chas. N. Chittenden, 2046 First St., Napa, who bid $3627 for grading 4600 lin.ft. of the Hilton Road. 9-23

STOCKTON, CALIF.—Awards as follows by County: (1) To Clark & Henery Const. Co., Chancery Bdg., S. F., $38,871 for asphalt paving Lower Sacramento Road from Acampo Road to Forest Lake; and (2) To Geo. French, Jr., P.O. Box 675, Stockton, $16,402 for graveling, asphalt paving, and oiling 40 miles of road near Stockton. 9-30

WOODLAND, CALIF.—To A. Teichert & Son, 1846 37th Street, Sacramento, who bid $3563 for grading and paving highway in YOLO COUNTY, on Beech Street, Woodland. 9-22

DENVER, COLO.—Award of contract recommended to Robinson Const. Co., Twin Falls, Ida., $108,780 for grading and surfacing 8.7 miles Salt Lake-Smoot Project, LINCOLN COUNTY, Wyoming, for Bureau of Public Roads. (See Unit Bid Summary.)

DENVER, COLO.—To J. H. Miller & Co., Denver, Colo., $50,272 for surfacing 2.4 miles near Cimmaron, GUNNISON COUNTY, for State.

BOISE, IDA.—Awards as follows by State: (1) To Fred G. Redmon, Yakima, Wash., $19,735 for 5.7 miles gravel surfacing from Alexander to Soda Springs, CARIBOU COUNTY; and (2) To Idaho Contracting Co., Boise, Ida., $62,783 for rock surfacing from Corral to Elmore County Line, CAMAS COUNTY.

BOISE, IDA.—Awards as follows by State: (1) To Utah Const. Co., Ogden, Utah, $28,924 for 6.4 miles grading from Richfield to Pagari, LINCOLN COUNTY, for State.

BOZEMAN, MONT.—To Standard Const. Co., Bozeman, $10,000 for grading Virginia City Road for County.

HELENA, MONT.—Awards as follows by State Highway Comm.: (1) To Sam Orino, Spokane, Wash., $177,200 for grading 8.7 miles of Butte-Boulder Road; (2) To B. Helean, Missoula, Mont., $50,345 for 5.7 miles grading and surfacing Ravalli-St. Ignatius Road, Lake County; (3) To Tomlinson & Arkwright, Great Falls, Mont., $53,525 for 19 miles grading Chester-Gilford Highway, Liberty and Hill Counties; and (4) To Carlson & Dolson, Billings, Mont., $34,557 for graveling 13 miles of Miles City-Terry Highway, Prairie County.

PORTLAND, ORE.—Awards as follows by Oregon State Highway Commission: LAKE COUNTY—To Union Construction Co., Union, Oregon, who bid $33,809 for the construction of 13.53 miles of highway roadbed on Silver Lake-Picture Rock Pass Section of Fremont Highway; and MALHEUR COUNTY—To E. C. Peck & Company, Drain, Oregon, who bid $77,652 for the construction of 6.0 miles of highway roadbed on Sperry-R.R. Tunnel Section of Central Oregon Highway. 9-29

PORTLAND, ORE.—Award recommended to Max J. Kuney, Spokane, Wash., $77,048 to Bureau of Public Roads for grading 5½ miles of Inland Empire Highway, Colville National Forest, PIERCE COUNTY, Wash. (See Unit Bid Summary.)

TOOELE, UTAH—To Jacob & Gardner, Salt Lake City, $28,500 for grading and paving streets in Dist. 1 for City.

OLYMPIA, WASH.—To Myers & Goulter, Seattle, Washington, $232,787 to the Director of Highways for clearing, grading, and draining about 5.3 miles of State Road No. 3, from Swauk Creek to Ellensburg City Wells, F.A. Proj. 165-E, in KITTITAS COUNTY. 9-19

BRIDGES and CULVERTS

BIDS BEING RECEIVED

PHOENIX, ARIZ.—Bids to 2 p.m., Oct. 14, by Arizona Highway Comm. for overpass 4 miles northwest of Tucson, on Florence-Tucson Highway, involving 254 cu.yd. concrete, 46,000 lb. reinf. steel, 1080 ft. concrete piling, grading, etc. 9-22

LOS ANGELES, CALIF.—Bids to 2 p.m., Oct. 14, by County for: (1) Reinf. conc. bridge over Ballona Creek on Duquesne St., to be 68 ft. long and 82 ft. wide, with wooden pile and concrete footings; and (2) Two bridges in San Gabriel Canyon on Crystal Lake Road. 9-26

MERCED, CALIF.—Bids to 11 a.m., Oct. 15, by County for: (1) Timber bridge over Black Rascal Creek on Bartholomew Road; (2) Concrete bridge over Dutch Slough on Tuttle Road; (3) Concrete bridge over Mariposa Creek on Tuttle Road; (4) Concrete bridge over a canal on Centrella Road; (5) Timber bridge over Rosas Slough on Dos Palos Road; and (6) Timber bridge over a canal on the Lone Willow Road. 9-30

MODESTO, CALIF.—Bids to 11 a.m., Oct. 15, by County for reinf. conc. bridge 372 over Hood Creek. 9-29

OAKLAND, CALIF.—Bids to 10:30 a.m., Oct. 21, by County for timber bridge repairs to Fruitvale Ave. Bridge. $12,500. 9-24

SACRAMENTO, CALIF.—Bids to 2 p.m., Oct. 29, by California Division of Highways for: (1) SAN MATEO COUNTY—Bridge over Redwood Slough, involving 900 cu.yd. concrete, 170,000 lb. reinf. steel, concrete and wooden piles; and (2) LOS ANGELES COUNTY—Bridge at Manhattan Beach, involving 1150 cu.yd. concrete, 193,000 lb. reinf. steel. 10-1

BIDS RECEIVED

SACRAMENTO, CALIF.—Carpenter Bros., 457 N. Canyon Drive, Beverly Hills, $50,545 low to California Division of Highways for concrete, timber, and steel bridge over Alamitos Bay, Long Beach, LOS ANGELES COUNTY. 10-1

CONTRACTS AWARDED

BAKERSFIELD, CALIF.—Awards as follows by City: (1) To Stroud Bros., Bakersfield, $3207 for reinf. conc. culvert on 35th St. and Kern Island Canal; and (2) To Stroud Bros., Bakersfield, $2610 for reinf. conc. culvert on 24th and T St. 9-24

LOS ANGELES, CALIF.—To Oberg Bros., 3470 Hollenbeck Ave., Los Angeles, $183,400 for reinforced concrete arch bridge over Los Angeles River at Atlantic Avenue for County. 9-24

OAKLAND, CALIF.—To Schnoor Brothers, 6016 Claremont Ave., Oakland, $8276 for a monolithic concrete culvert on Fish Ranch Road (Claremont Avenue) near the Claremont Hotel, for City. 9-26

OAKLAND, CALIF.—To W. W. Hayes, Call Bdg., S. F., $50,744 to County for two reinf. concrete bridges over Crandall Slough. (See Unit Bid Summary.) 9-25

RED BLUFF, CALIF.—To H. A. Martin, Corning, Calif., who bid $1850 for the construction of a wooden superstructure bent bridge 175 ft. in length on concrete piers and abutments, over Dry Creek. 9-30

STOCKTON, CALIF.—To J. E. Fitzsimmons, Route 1, Box 80, Stockton, $3535 for the construction of a steel and timber bridge over Little John Creek on the Van Allen Road for County. 9-30

WILLOWS, CALIF.—To W. Halterman, Willows, $2483 to County for reinf. conc. Mehrens Bridge on Range Line Road for County. 9-27

YUBA CITY, CALIF.—To Ward Engr. Co., 315 Montgomery St., S. F., $36,990 to County for reconstructing Nicolaus Bridge over Feather River, involving two 80-ft. steel truss spans, concrete deck and piers. 9-29

PORTLAND, ORE.—Award recommended to O. N. Pierce, Portland, Ore., $15,990 for reinf. concrete bridge over Lint Slough, LINCOLN COUNTY, for Bureau of Public Roads.

WATER SUPPLY SYSTEMS

WORK CONTEMPLATED

LOS ANGELES, CALIF.—Bond election November 4 by the City to vote $13,300,000 for the following work: Aqueduct power plants; power development in Big Pine Creek, Owens Valley; central receiving station and connecting lines; Boulder Canyon power rights-of-way, etc.; local distributing station; overhead and underground distribution systems. 9-26

TORRANCE, CALIF.—Bonds voted by City, $400,000, for: Drilling three wells; laying 1½ miles of incoming water pipe-lines; installation of 33 miles of distribution lines; erection of concrete lined and covered reservoir; erection of water treatment facilities; erection of a 250,000-gallon elevated tank. F. R. Leonard is City Engineer of Torrance, Los Angeles County. 9-27

BIDS BEING RECEIVED

BEVERLY HILLS, CALIF.—Bids to 8 p.m., Oct. 21, by City for 2610 ft. 6-in. and 8-in. cast-iron pipe-lines. 9-29

EL CENTRO, CALIF.—Bids to 7:30 p.m., Oct. 15, by City for furnishing 4000 ft. 6-in. and 3000 ft. 4-in. cast-iron pipe. 9-22

OCEANSIDE, CALIF.—Bids to Oct. 22 by City for water extensions in South Oceanside. $32,000. 9-29

STRATFORD, CALIF.—Bids to Oct. 14 by Stratford Public Utility District, Stratford, King County, for water system improvements as follows: 30,000-gal. steel tank and tower, 1200-ft. well, pump and motor, pipe-lines. $28,000. Plans from Engineer, John B. Benedict, Route 1, Box 225, Hanford, California. 9-20

SEATTLE, WASH.—Bids to 10 a.m., Oct. 10, by Board of Public Works for Cedar River steel pipe-line No. 1 and steel West Seattle pipe-line. 10-2

BIDS RECEIVED

WHITTIER, CALIF.—Southern Const. Co., 806 Rodeo Drive, Beverly Hills, $69,038 low for 10,000,000-gallon reinf. conc. lined Reservoir No. 4 for City. (See Unit Bid Summary.) 9-25

CONTRACTS AWARDED

IONE, CALIF.—To Guth & Fox, 1516 27th Street, Sacramento, who bid $8376 to the State Architect, George B. McDougall, Public Works Building, Sacramento, for two concrete tanks and piping for domestic water system at Preston School of Industry at Ione, Amador County. 9-23

LONG BEACH, CALIF.—To U. S. Pipe & Fdy. Co., Wright & Callender Bdg., L. A., $73,800 for 18,000 ft. 4-in., 54,000 ft. 8-in., and 18,000 ft. 12-in. cast-iron pipe for City. 9-30

OAKLAND, CALIF.—To C. A. Bruce & Sons, Pleasanton, who bid $3944 to County for Arroyo del Valle Dam near Arroyo Sanatorium, 3 miles from Livermore. 9-23

SAN BRUNO, CALIF.—To J. Pestana, 1232 35th Ave., Oakland, $113 for cast-iron pipe extensions, hydrants, and valves in Fifth Addition for City. 9-25

GREAT FALLS, MONT.—To Lease & Leigland, Great Falls, Mont., $95,365 for constructing 4,000,000-gallon concrete-lined reservoir for City.

GRANTS PASS, ORE.—Awards as follows by City: (1) To U. S. Pipe & Foundry Co. for 4500 ft. 16-in. cast-iron pipe and to Pacific States Cast Iron Pipe Co. for 12-in. to 6-in. cast-iron pipe; and (2) To Rensselaer Valve Co. for furnishing valves, hydrants, etc. (See Unit Bid Summary.) 9-23

SEWER CONSTRUCTION

WORK CONTEMPLATED

LOS ANGELES, CALIF.—Bond election Nov. 4 by City to vote $5,650,000 for sanitary sewers. J. J. Jessup is City Engineer. 9-22

LOS ANGELES, CALIF.—Plans by L. W. Armstrong, Chief Storm Drain Engineer of the City of Los Angeles, City Hall, Los Angeles, for the construction of Section 4 of the Jefferson Street Storm Drain System. Work involves 9065 ft. 12-in., 15,265 ft. 15-in., 6995 ft. 18-in., and 5587 ft. 21-in. cement pipe, 4093 ft. 24-in. dbl. med. rein. conc. pipe, 337 ft. 24-in. heavy rein. conc. pipe, 310 ft. 27-in. medium rein. conc. pipe, 2100 ft. 27-in. double med. rein. conc. pipe, 487 ft. 27-in. heavy rein. conc. pipe, 700 ft. 27-in. dble. heavy rein. conc. pipe, 1223 ft. 30-in. double med. rein. conc. pipe, 114 ft. 30-in. heavy reinf. concrete pipe, 326 ft. 30-in. double heavy rein. conc. pipe, 2628 ft. 33-in. dble. med. rein. conc. pipe, 626 ft. 33-in. dble. heavy rein. conc. pipe, 1417 ft. 36-in. dble. medium rein. conc. pipe, 1254 ft. 36-in. dble. heavy rein. conc. pipe, 1642 ft. 39-in. dble. med. rein. conc. pipe, 291 ft. 39-in. dble. heavy rein. conc. pipe, 1801 ft. 42-in., 3538 ft. 45-in., 639 ft. 48-in., 2894 ft. 51-in., 2747 ft. 54-in., 473 ft. 57-in., 179 ft. 57-in., 1052 ft. 60-in., 1171 ft. 63-in., and 1493 ft. 66-in. dble. med. rein. conc. pipe, 962 ft. 66-in. dble. heavy rein. conc. pipe, 738 ft. 81-in. and 828 ft. 84-in. heavy rein. conc. pipe, 27 ft. 81-in. and 42 ft. 87-in. monolithic conc. storm drain, 665 ft. 87-in. dble. med. conc. storm drain, 1188 ft. 87-in. and 1122 ft. 90-in. heavy conc. storm drain, 739 ft. 7 ft. by 4 ft. 9 in. heavy rein. conc. box (Section A), 30 ft. 7 ft. by 4 ft. 9 in. heavy rein. conc. box (Section B), 118 ft. 8-in. cast-iron pipe, 271 manholes, 777 catchbasins, 12,800 sq.ft. variable thickness conc. pav., 11,400 sq.ft. curb, 9000 sq.ft. sidewalk, 50,600 sq.ft. gutter, 27,000 sq.ft. conc. local depression, 113,250 cu.yd. excavation. 9-22

BIDS BEING RECEIVED

MT. VERNON, WASH.—Bids to Oct. 10 by City for constructing vitrified or concrete pipe sewer system to cost $110,000.

BIDS RECEIVED

SAN DIEGO, CALIF.—V. R. Dennis Const. Co., Box 183, Rt. A, San Diego, $27,368 low bid to City for disposal plant at San Diego State Teachers College. 10-1

CONTRACTS AWARDED

ALAMEDA, CALIF.—To J. Pestana, 1232 35th Ave., Oakland, $6832 for vitr. storm sewer on High St. from Santa Clara Ave. to Estuary for City.

BERKELEY, CALIF.—To W. J. Tobin, 527 Balfour Ave., Oakland, $2506 to City for vitrified sewer in The Alameda, San Pedro and Laurel Lane. 9-30

ELSINORE, CALIF.—To Atlantic Const. Co., 333 N. 18th St., Montebello, $16,936 for sewer extensions for City. 9-25

LOS ANGELES, CALIF.—To Skoro & Pizula, 4751½ S. Gage Street, Los Angeles, who bid $47,951 for constructing sewers in 98th Street and Alabama Street Sewer District, for the City. 9-22

MADERA, CALIF.—To Thompson Bros., P.O. Box 1288, Fresno, $18,403 to City for vitrified sewers, ejector, sump, etc. 10-2

SAN FRANCISCO, CALIF.—To T. E. Connolly, Sheldon Bdg., San Francisco, who bid $251,617 to the Board of Public Works for College Hill Tunnel Sewer. Work involves reinforced concrete sewer in tunnel, vitrified pipe sewers, junction structures, manholes, etc. (See Unit Bid Summary, September 25th issue.) 9-24

SURETY BOND AND CASUALTY INSURANCE DIRECTORY

SURETY BONDS are required on all Public Work and are being required more and more on Private Contracts. The present day contractor must be in a position to furnish corporate surety bonds guaranteeing the fulfillment of his contracts. These companies are prepared to furnish such bonds promptly for experienced and responsible contractors. Communicate with one of them and arrange for your bond before you submit your next bid.

SANTA CRUZ, CALIF.—To L. Cardwell Const. Co., Santa Cruz, $1177 for vitr. sewer in Plateau Ave. 9-24

WESTMORELAND, CALIF.—To Miracle Construction Company, 1604 Dale Street, San Diego, $13,966 to Westmoreland Sanitary District for Imhoff tank and main outfall sewer. 9-22

DURANGO, COLO.—To Burnett & Co., Durango, Colo., $10,983 for constructing sewer in District 7 for City.

BUTTE, MONT.—To M. F. Kelly, Butte, Mont., $17,860 for constructing Dewey Ave. sewer for City.

RENO, NEV.—To Christensen & Company, 109 Sierra Street, Reno, Nevada, who bid $126,184 as follows to City for constructing concrete pipe system:

340 ft. 6-in. conc. pipe sewer	$ 1.60
59,000 ft. 8-in. conc. pipe sewer	1.90
1,300 ft. 10-in. conc. pipe sewer	2.05
145 concrete manholes	75.00

9-24

MACHINERY and SUPPLIES

HEMET, CALIF.—Bids to 7:30 p.m., October 13, by City for: one 20-hp. tractor, one road grader with 8-ft. blade, one road maintainer with six rigid blades. 9-29

RIVER and HARBOR WORK

WORK CONTEMPLATED

BAKERSFIELD, CALIF.—Plans by Landscape Architect, Howard Gilkey, 337 17th St., Oakland, have been submitted to County for artificial lake in connection with the development of the Kern River Park. Work will involve 100,000 cu.yd. earth levees and embankment, 1700 lin.ft. pipe-line. $30,000. 9-23

BIDS RECEIVED

OAKLAND, CALIF.—American Dredging Co., 255 California St., S. F., $13,982 low bid to the Oakland Port Commission, Oakland, for dredging at Grove and Market St. Docks. 9-30

SACRAMENTO, CALIF.—Hemstreet & Bell, Marysville, who bid 28¢ per cu.yd., low bid to the U. S. Engineer's Office for levee 8700 ft. long on the left bank of the Feather River near the Lake of the Woods, about 1 mile above the mouth of the Bear River in YUBA COUNTY, and 3 miles upstream from the town of Nicolaus, California. Work involves 215,000 cu.yd. of embankment. 9-23

SACRAMENTO, CALIF.—W. P. Koetitz, 1424 Fountain St., Alameda, $9100 low bid to U. S. Engineer's Office for placing 4 retards on south bank of Yuba River above retards placed in 1928 at Dantoni Orchard and below lower end of gold dredging tailing piles, about 8 miles above town of Marysville, Calif. 9-19

SAN FRANCISCO, CALIF.—Healy-Tibbitts Const. Co., 64 Pine St., S. F., $39,200 low bid to Park Comm. for two timber wharves and 100 yacht berths at Marina. 9-30

CONTRACTS AWARDED

LOS ANGELES, CALIF.—To Standard Dredging Company, Central Bdg., Los Angeles, $32,190 for suction dredging 111,000 cu.yd. outside of pierhead line, including disposal at Berths 144 to 147, West Basin. Contract for side slope trimming and filling to rear of bulkhead, involving 10,000 cu.yd. of material, was awarded to Merritt, Chapman & Scott Corporation, San Pedro, $4000. 9-26

RICHMOND, CALIF.—To Daniel Contracting Company, 503 Market Street, San Francisco, for rock wall, to be 13,000 ft. in length and involving 250,000 tons of rock, located from the Ford Plant, Richmond, to Point Isabella, work for the Berkeley Waterfront Company. Subcontract awarded to Bundesen & Lauritzen, Pittsburg, for 200,000 cu.yd. of dredging. 10-2

SAN FRANCISCO, CALIF.—To Pacific Coast Engineering Co., Oakland, $10,813 to State Harbor Commissioners for furnishing materials, constructing and installing cargo aprons for Pier 1, on the waterfront. 9-24

SANTA BARBARA, CALIF.—To Shanahan Bros., 406 S. Main Street, Los Angeles, who bid as follows to the City for revetment on E. Cabrillo Boulevard:

13,500 tons riprap	$2.46
4,000 tons asphalt	2.74
OR	
4,000 tons riprap	1.93
850 ft. creosoted sheet piling	1.05
OR	
850 ft. steel sheet piling	1.50
3,000 cu.yd. fill	.30

9-22

IRRIGATION and RECLAMATION

WORK CONTEMPLATED

PHOENIX, ARIZ.—Bond election Oct. 18 by the Camelback Water Conservation District of Arizona, to vote $516,000 for the installation of: Eight 20-in. diameter drilled wells, to be equipped with deep well turbine pumps and motor, 150-hp. capacity; seven booster pumps from 10-hp. to 200-hp. capacity; 8 miles of 11,000-volt transmission line; 100,320 lin.ft. of plain and reinforced concrete pipe, 12-in. to 24-in. diameter; 12,540 lin.ft. 10-in. and 12-in. wrapped and dipped welded steel pipe; two reservoirs of approximately 50,000 gallons capacity each. Acreage of the District is 3314. Plans by Engineer, Reed & Baker, Fleming Building, Phoenix, Arizona. 9-29

EL NIDO, CALIF.—The State Bond Certification Commission has approved the proposed $135,000 bond election of the El Nido Irrigation District, El Nido, Calif., and the date for holding bond election will be set shortly. Work involves: (1) 12 miles of main canal, involving 150,000 cu.yd. canal excavation, 65,000 sq.ft. 2-in. concrete lining; (2) 15 miles of lateral canals, involving 120,000 cu.yd. canal excavation; and (3) Construction of 24-in. to 48-in. siphons with headwalls, bridges, drops, stop-gates and sidegates, etc. 9-22

SANTA ANA, CALIF.—Surveys are being made by Consulting Engineer, A. Kempkey, Hobart Building, San Francisco, and exploration work is under way at the damsite for dam in Santiago Canyon on Santiago Creek for the John T. Carpenter Irrigation District, the Serrano Irrigation District, and the Irvine Company. Dam will probably be earth-fill type. Bids are being received up to Oct. 14 by Carpenter Irrigation District and Serrano Irrigation Dist. each for purchase of $200,000 bonds to finance portion of cost. 9-28

SEATTLE, WASH.—Bonds voted, $300,000, by the Howard Flat Irrigation District of Chelan County, Washington, for the construction of works and bids will be called for shortly. Plans and specifications have been prepared by Consulting Engineers, Willis T. Batcheller, Inc., 929 Dexter-Horton Building, Seattle, for this project to irrigate 1400 acres of land by pumping from Lake Chelan. Work involves: PUMPING PLANT—Electrically driven, to have a capacity of 11,000 g.p.m. and to be constructed at Lake Chelan; SUPPLY LINE—Consisting of 5¼ miles of 30-in. steel pipe; DISTRIBUTION SYSTEM—Work involves the following quantities: 1350 lin.ft. 22-in., 2700 lin.ft. 20-in., 8500 lin.ft. 16-in., 12,700 lin.ft. 12-in., 4380 lin.ft. 8-in., and 1970 lin.ft. 6-in. steel pipe, also necessary valves and fittings. 9-26

BIDS BEING RECEIVED

DENVER, COLO.—Bids to 3 p.m., October 31, by the Bureau of Reclamation, Wilda Building, Denver, Colorado, for furnishing the following for Pumping Station No. 1, Minidoka Project, Idaho; One pump with a capacity of 180 second-feet when operating under a total effective head of 31 ft.; one 800-hp., 2200-volt, 3-phase, 60-cycle, synchronous motor, and auxiliary and control apparatus. 9-30

FAIR OAKS, CALIF.—Bids to 10 a.m., October 11, by Fair Oaks Irrigation District for: (1) Furnishing and delivering only and separate bid for laying only the following quantities of steel pipe; 2000 ft. 30-in. 8-ga. riveted or welded steel slip joint soil-proofed pipe, 2000 ft. 30-in. 10-ga. riveted or welded steel slip joint soil-proofed pipe; and (2) Furnishing and delivering only 2000 lin.ft. 12-in. 12-ga. welded or riveted steel slip joint pipe. 9-20

BURLEY, IDA.—Bids to 2 p.m., Oct. 24, by Bureau of Reclamation for 107,000 cu.yd. canal excavation, 7085 cu.yd. concrete, etc. 10-2

BIDS RECEIVED

REDMOND, ORE.—Kern & Kibbe, 290 E. Salmon St., Portland, $30,000 low bid to Central Oregon Irrigation District for 1878 ft. 12-in. creo. wood-stave flume. 10-2

MISCELLANEOUS

BIDS BEING RECEIVED

SANTA BARBARA, CALIF.—Bids to 2 p.m., Oct. 20, by Supt. of Lighthouses, Custom House, San Francisco, for grading, concrete landings, stairways, rainshed, installing pipe-lines, water tanks, hoisting derricks, etc., at Anacapa Island, Santa Barbara County. 10-2

LIGHTING SYSTEMS

CONTRACTS AWARDED

GUSTINE, CALIF.—To Frank Silveria, Gustine, $5231 for electrolier system for City. 8-26

OPPORTUNITY PAGE

RATES: *Situations wanted, 5c per word,* MINIMUM CHARGE, *$1.00;* HELP WANTED, *no charge to Subscribers;* OFFICIAL BIDS, *15c per line;* ALL OTHERS, *$2.00 per column inch or fraction thereof*

THE BUYERS' GUIDE

Refer to advertisements for addresses of companies listed. Advertisers index on page 70

Acetylene, Dissolved
Prest-O-Lite Co., Inc., The

Acetylene Generating Apparatus
Oxweld Acetylene Co.

Air Compressors
Bacon Co., Edward R.
Gardner-Denver Co.
Ingersoll-Rand Co.
Jenison Machinery Co.
Leitch & Co.
National Brake & Electric Co.
Rix Company, Inc., The
Schramm, Inc.
Sullivan Machinery Co.
West Coast Tractor Co.

Air Compressors—Engines
Atlas Imperial Diesel Engine Co.

Asphalt
Gilmore Oil Co.
Seaside Oil Co.
Shell Oil Co.
Standard Oil Co.
Union Oil Co.

Asphalt, Emulsified
American Bitumuls Co.
Shell Oil Co.

Asphalt Plants and Equipment
Bacon Co., Edward R.
Jenison Machinery Co.
Link-Belt Co.
Spears-Wells Mchy. Co., Inc.
Standard Boiler & Steel Works
Union Tank & Pipe Co.

Asphalt Paving
Warren Bros. Roads Co.

Back Fillers
Austin Machy. Corp.
Bucyrus-Erie Co.
Caterpillar Tractor Co.
Cleveland Tractor Co., The
Harnischfeger Sales Corp.
Jenison Machinery Co.
Link-Belt Co.
Northwest Engineering Co.
Orton Crane & Shovel Co.
Spears-Wells Machy. Co., Inc.
Speeder Machinery Corp.
Thew Shovel Co., The
Universal Crane Co., The
West Coast Tractor Co.
W-K-M Company, Inc.
Worden Co., W. H.

Beams, Channels, and Angles
Pacific Coast Steel Corp.

Bins, Storage and Hopper
Bacon Co., Edward R.
Blaw-Knox Co.
Diamond Iron Works, Inc.
Heltzel Steel Form & Iron Co., The
Jenison Machinery Co.
Link-Belt Co.

Blades—Fresno and Graders
Solano Iron Works

Blasting Supplies
Giant Powder Co., Cons., The
Hercules Powder Co.

Boilers
Montague Pipe & Steel Co.
Water Works Supply Co.

Bolts, Nuts and Rods
Claussen & Co., C. G.
Kortick Mfg. Co.

Bonds (Street) Bought
W. P. Bullock

Bonds, Surety
Aetna Casualty & Surety Co.
Associated Indemnity Corp.
Commerce Casualty Co.
Consolidated Indemnity & Insurance Co.
Detroit Fidelity & Surety Co.
Fidelity & Casualty Co. of N. Y., The
Fidelity & Deposit Co. of Maryland
Glens Falls Indemnity Co.
Great American Indemnity Co.
Indemnity Insurance Co. of North America
Maryland Casualty Co.

Bonds, Surety (Continued)
Massachusetts Bonding & Insurance Co.
New Amsterdam Casualty Co.
Rolph, James Jr., Landis & Ellis

Brick, Common
Gladding Bros. Mfg. Co.

Buckets, Elevator and Conveyor
Bacon Co., Edward R.
Industrial Brownhoist Corp.
Jenison Machinery Co.
Lakewood Engr. Co.
Link-Belt Co.

Buckets, Dredging
Haiss Mfg. Co., Geo.
Harnischfeger Sales Corp.
Owen Bucket Co.

Buckets, Excavating
Bacon Co., Edward R.
Bucyrus-Erie Co.
Haiss Mfg. Co., Geo.
Harnischfeger Sales Corp.
Industrial Brownhoist Corp.
Jenison Machinery Co.
Marion Steam Shovel Co.
Orton Crane & Shovel Co.
Owen Bucket Co.
Taylor & George
Williams Co., G. H.
Worden Co., W. H.

Buckets, Rehandling
Industrial Brownhoist Corp.
Jenison Machinery Co.
Lakewood Engr. Co.
Orton Crane & Shovel Co.
Owen Bucket Co.

Cableways
American Steel & Wire Co.
Bacon Co., Edward R.
Jenison Machinery Co.
Leschen & Sons Rope Co., A.
Worden Co., W. H.
Young Machy. Co., A. L.

Carbide
Union Carbide Sales Co., The

Cars, Industrial
Bacon Co., Edward R.
Jenison Machinery Co.
Lakewood Engr. Co.

Carts, Concrete
Bacon Co., Edward R.
Harron, Rickard & McCone Co.
Jenison Machinery Co.
Lakewood Engr. Co.
Ransome Concrete Machinery Co.

Castings, Iron and Steel
American Cast Iron Pipe Co.
Link-Belt Co.
U. S. Cast Iron Pipe & Fdy. Co.

Castings, Street and Sewer
U. S. Cast Iron Pipe & Fdy. Co.

Cement
Portland Cement Association

Chemicals
California Filter Co., Inc.
Great Western Electro-Chemical Co.

Chlorinators
California Filter Co., Inc.
Wallace & Tiernan
Water Works Supply Co.

Chlorine
Great Western Electro-Chemical Co.

Chutes, Concrete
Bacon Co., Edward R.
Haiss Mfg. Co., Geo.
Jenison Machinery Co.
Lakewood Engr. Co.
Ransome Concrete Machinery Co.

Clarifiers, Water
Dorr Co., The
Wallace & Tiernan Co.

Clay Products
Gladding, McBean & Co.
Pacific Clay Products Co.

Concrete Buckets
Jenison Machinery Co.
Young Machy. Co., A. L.

Concrete Curing
Concrete Curing Co.
Inertol Company, Inc.
McEverlast, Inc.

Concrete Forms
Bacon Co., Edw. R.
Blaw-Knox Co.

Concrete Roads
Portland Cement Association

Conveyors, Portable

Conveyors, Elevating and Conveying
Bacon Co., Edward R.
Bodinson Mfg. Co.
Jenison Machinery Co.
Link-Belt Co.

Cranes, Electric, Gasoline Locomotive
American Hoist & Derrick Co.
Austin Machy. Corp.
Bacon Co., Edward R.
Bucyrus-Erie Co.
Harnischfeger Sales Corp.
Harron, Rickard & McCone Co.
Industrial Brownhoist Corp.
Jenison Machinery Co.
Link-Belt Co.
Marion Steam Shovel Co.
Northwest Engineering Co.
Ohio Power Shovel Co., The
Orton Crane & Shovel Co.
Speeder Machinery Corp.
Thew Shovel Co., The
Universal Crane Co., The
W-K-M Company, Inc.

Cranes, Tractor
Harnischfeger Sales Corp.
West Coast Tractor Co.

Cranes, Traveling
Harnischfeger Sales Corp.
Jenison Machinery Co.
Thew Shovel Co., The

Crushers
Austin Western Road Machy. Co., The
Bacon Co., Edward R.
Diamond Iron Works, Inc.
Jenison Machinery Co.
Smith Engineering Works
W-K-M Company, Inc.
Young Machy. Co., A. L.

Crushers—Engines
Atlas Imperial Diesel Engine Co.

Culverts, Concrete
Portland Cement Association

Culverts, Metal
California Corrugated Culvert Co.
U. S. Cast Iron Pipe & Fdy. Co
Western Pipe & Steel Co.

Culverts, Part Circle
California Corrugated Culvert Co.
Western Pipe & Steel Co.

Culverts, Vitrified
Gladding, McBean & Co.
Pacific Clay Products

Curing, Concrete
Concrete Curing Co.
Inertol Company, Inc.
McEverlast, Inc.

Cutting Apparatus
Jenison Machinery Co.
Diamond Iron Works, Inc.
Haiss Mfg. Co., Geo.
Oxweld Acetylene Co.
Victor Welding Equipment Co.

Cutting Edges
Solano Iron Works

Dams
Ambursen Dam Co., Inc.

Derricks
Bacon Co., Edward R.
Jenison Machinery Co.
Young Machy. Co., A. L.

Diesel Engines
Atlas Imperial Diesel Engine Co.

Ditch Machinery
Bacon Co., Edward R.
Bucyrus-Erie Co.
Cleveland Trencher Co.
Harnischfeger Sales Corp.
Industrial Brownhoist Corp.
Jenison Machinery Co.
Link-Belt Co.
Marion Steam Shovel Co.
National Equipment Corp.
Northwest Engineering Co.
Ohio Power Shovel Co., The
Orton Crane & Shovel Co.
Thew Shovel Co., The

Draglines
Austin Machy. Corp.
Bacon Co., Edward R.
Bucyrus-Erie Co.
Harnischfeger Sales Corp.
Harron, Rickard & McCone Co.
Jenison Machinery Co.
Link-Belt Co.
Marion Steam Shovel Co.
National Equipment Corp.
Northwest Engineering Co.
Ohio Power Shovel Co.
Sauerman Bros., Inc.
Spears-Wells Machy. Co.
Speeder Machinery Corp.
Thew Shovel Co., The
Universal Crane Co., The
Worden Co., W. H.
Young Machy. Co., A. L.

Dragline—Diesel Engines
Atlas Imperial Diesel Engine Co.

Drain Tile
Gladding, McBean & Co.
Gladding Bros. Mfg. Co.
Pacific Clay Products

Drills, Rock
Bacon Co., Edward R.
Gardner-Denver Co.
Ingersoll-Rand Co.
Leitch & Company
Rix Company, Inc., The
Schramm, Inc.
Sullivan Machinery Co.

Dump Cars
Bacon Co., Edward R.
Jenison Machinery Co.

Dump Wagons
Le Tourneau Mfg. Co.
West Coast Tractor Co.

Engineers
Ambursen Dam Co., Inc.
Burns-McDonnell-Smith Engr. Co.
Hunt Co., R. W.
Porter, Geo. J.

Engines, Diesel, Gasoline and Steam
Atlas Imperial Diesel Engine Co.
Bacon Co., Edward R.
Continental Motors Corp.
Hercules Motors Corp.
Ingersoll-Rand Co.
International Harvester Co.
Jenison Machinery Co.
Le Roi Co.
Novo Engine Co.

Excavating Machinery
American Tractor Equipment Co.
Austin Western Road Machy. Co., The
Bacon Co., Edward R.
Bodinson Mfg. Co.
Bucyrus-Erie Co.
Caterpillar Tractor Co.
Cleveland Tractor Co., The
Excavating Equipment Dealers, Inc.
Haiss Mfg. Co., Geo.
Harnischfeger Sales Corp.
Harron, Rickard & McCone Co.
Industrial Brownhoist Corp.
Jenison Machinery Co.
Link-Belt Co.
Marion Steam Shovel Co.

(Continued on page 66)

OPPORTUNITY PAGE

CONTINUED

SHOVELS
CRANES
DRAGLINES
PULLSHOVELS

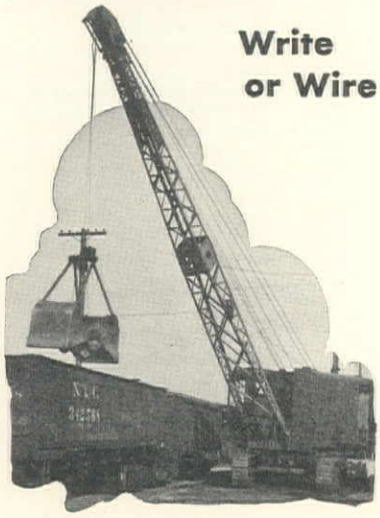
Factory Rebuilt with New Machine Guarantee

(1/2 to 2 cu. yd.)

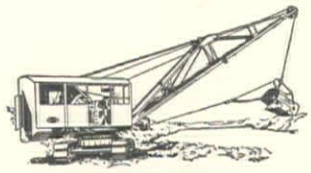
We have a limited number of these machines which have been completely rebuilt in our factory and carry the same guarantee as our new equipment!

NORTHWEST ENGINEERING CO.
23 MAIN STREET, SAN FRANCISCO, CALIF.
4900 SANTA FE AVE., LOS ANGELES, CALIF.

Write or Wire



WONDERFUL BUYS IN USED



DRAGLINES :: SHOVELS :: CLAMSHELLS
TRUCK CRANES :: TRENCHERS
ALL SIZES DRAGLINE AND CLAMSHELL BUCKETS
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2248 East 37th Street, L. A. — LAfayette 1787
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836 Bayshore Blvd., San Francisco
Phone DElaware 3778

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Portable Air Compressors
Concrete-Breakers
W. H. COWEN
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FOR SALE

CRANE

1—25-ton Industrial Locomotive Crane. Standard gauge. 8-wheel MCB trucks. Boiler is Parker scale-proof type, oil-fired AMSE. Length of boom 50 ft. Complete with 1½-cu.yd. high-speed scraper type clamshell bucket. Crane purchased new in 1926. Available for immediate delivery at a very attractive price.

SHOVELS

1—Marion Electric, 2½-cu.yd., 490.

1—Bucyrus Diesel, 2-cu.yd. 50-B.

1—P&H Gasoline, 1½-cu.yd., 700.

Write for our 1930 general catalog. It will enable you to effect real economies in your purchasing.

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Pacific States Cast Iron Pipe

with or without Precalked Joints
Sizes 1¼ thru 12 inches. Standard lengths
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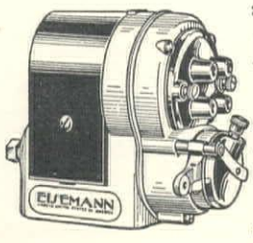

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1480 Howard Street, San Francisco :: MArket 3848
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THE BUYERS' GUIDE—*Continued from Page 64*

Excavating Mchy.(Continued)
National Equipment Corp.
Northwest Engineering Co.
Ohio Power Shovel Co.
Orton Crane & Shovel Co.
Owen Bucket Co.
Sauerman Bros., Inc.
Shaw Excavator & Tools Co.
Speeder Machinery Corp., The
Thew Shovel Co., The
Universal Crane Co., The

Excavating Mchy.—Diesel Engines
Atlas Imperial Diesel Engine Co.

Expansion Joints
Industrial & Municipal Supply Co.
U. S. Cast Iron Pipe & Fdy. Co.
Water Works Supply Co.

Explosives
Giant Powder Co., Cons., The
Hercules Powder Co.

Equipment—Rental
Atkinson Construction Co.
Contractors Mchy. Exchange
Tieslau Bros.

Filters, Water
California Filter Co., Inc.

Fire Hydrants
Industrial & Municipal Supply Co.
Rensselaer Valve Co.
Water Works Supply Co.

Floating Roofs
Chicago Bridge & Iron Works

Flood Lights
Oxweld Acetylene Co.
Taylor & George

Flooring, Industrial
Paraffine Companies, Inc., The

Floors, Mastic
Wailes Dove-Hermiston Corp.

Flumes, Concrete
Portland Cement Association

Flumes, Metal
California Corrugated Culvert Co.
Montague Pipe & Steel Co.

Fluxes
Victor Welding Equipment Co.

Forms, Steel
Blaw-Knox Co.
Jenison Machinery Co.
Lakewood Engr. Co.

Form Ties
J. M. Willard Co.

Freight, Water
American-Hawaiian Steamship Co.

Gas Holders
Chicago Bridge & Iron Works
Western Pipe & Steel Co.

Gates, Cast-Iron
California Corrugated Culvert Co.

Gates, Radial
California Corrugated Culvert Co.

Gates, Sheet Metal
California Corrugated Culvert Co.

Governors, Steam Engine
Gardner-Denver Co.
Young Machy. Co., A. L.

Governors, Turbine
Pelton Water Wheel Co., The

Grader Blades
Solano Iron Works

Gravel Plant Equipment
Austin-Western Road Mchy. Co., The
Bacon Co., Edward R.
Bodinson Mfg. Co.
Bucyrus-Erie Co.
Diamond Iron Works, Inc.
Harnischfeger Sales Corp.
Jenison Machinery Co.
Link-Belt Co.
Smith Engineering Works
Young Mach. Co., A. L.

Hammers, Steam Pile
Bacon Co., Edward R.
Harron, Rickard & McCone Co.
Kratz & McClelland, Inc.
Union Iron Works, Inc.

Hoists, Hand and Power
Bacon Co., Edward R.
Gardner-Denver Co.
Harnischfeger Sales Corp.
Harron, Rickard & McCone Co.
Ingersoll-Rand Co.
Jaeger Machine Works, The
Jenison Machinery Co.
Link-Belt Co.
Novo Engine Co.
Sullivan Machinery Co.
West Coast Tractor Co.
Worden Co., W. H.
Young Machy. Co., A. L.

Hoppers, Steel
Bacon Co., Edward R.
Blaw-Knox Co.
Haiss Mfg. Co., Geo.
Jenison Machinery Co.
Lakewood Engr. Co.
Link-Belt Co.

Hose, Steam, Air and Water
Gardner-Denver Co.
Ingersoll-Rand Co.
Leitch & Co.
Rix Company, Inc., The

Hydro-Tite
Industrial & Municipal Supply Co.

Insurance, Casualty
Aetna Casualty & Surety Co.
Associated Indemnity Corp.
Commerce Casualty Co.
Consolidated Indemnity & Insurance Co.
Detroit Fidelity & Surety Co.
Fidelity & Casualty Co. of N. Y., The
Fidelity & Deposit Co. of Maryland
Glens Falls Indemnity Co.
Great American Indemnity Co.
Indemnity Insurance Co. of North America
Maryland Casualty Co.
Massachusetts Bonding & Insurance Co.
New Amsterdam Casualty Co.
Rolph, James Jr., Landis & Ellis

Iron, Plates and Sheets
American Rolling Mill Co., The

Jacks, Lifting
Jenison Machinery Co.

Kettles, Tar and Asphalt
Bacon Co., Edward R.
Montague Pipe & Steel Co.
Spears-Wells Machy. Co.
Young Machy. Co., A. L.

Leadite
Water Works Supply Co.

Loaders, Power, Truck and Wagon
Haiss Mfg. Co., Geo.
Industrial Brownhoist Corp.
Jaeger Machine Works, The
Jenison Machinery Co.
Link-Belt Co.
Spears-Wells Machy. Co.
Young Machy. Co., A. L.

Locomotives, Electric, Gas and Steam
Jenison Machinery Co.

Lumber
McCormick Lumber Co.

Metal Lath
Truscon Steel Company

Meters, Venturi
Water Works Supply Co.

Meters, Water
Industrial & Municipal Supply Co.
Neptune Meter Co.

Mixers, Chemical
Dorr Co., The

Mixers, Concrete
Bacon Co.,Edward R.
Foote Company, Inc.
Garfield & Co.
Harron, Rickard & McCone Co.
Jaeger Machine Works, The
Jenison Machinery Co.
Lakewood Engr. Co.
National Equipment Corp.
Ransome Concrete Machinery Co.
Young Machy. Co., A. L.

Mixers, Plaster
Bacon Co., Edw. R.
Jaeger Machine Works, The
Jenison Machinery Co.
Young Machy. Co., A. L.

Motors, Gasoline
Continental Motors Corp.
Hercules Motors Corp.
Jenison Machinery Co.
Le Roi Co.

Oxy-Acetylene Apparatus
Oxweld Acetylene Co.

Oxygen in Cylinders
The Linde Air Products Co.

Paints, Acid Resisting
Columbia Wood and Metal Preservative Co.
Inertol Company, Inc.
Paraffine Companies, Inc., The
Wailes Dove-Hermiston Corp.

Paints, Metal Protective
Columbia Wood and Metal Preservative Co.
Inertol Company, Inc.
McEverlast, Inc.
Paraffine Companies, Inc., The
Wailes Dove-Hermiston Corp.

Paints, Technical
American Bitumuls Co.
Columbia Wood and Metal Preservative Co.
Inertol Company, Inc.
Paraffine Companies, Inc., The
Wailes Dove-Hermiston Corp.

Paints, Waterproofing
Columbia Wood and Metal Preservative Co.
Inertol Company, Inc.
McEverlast, Inc.
Paraffine Companies, Inc., The
Wailes Dove-Hermiston Corp.

Pavers, Concrete
Bacon Co., Edw. R.
Foote Company, Inc.
Harron, Rickard & McCone Co.
Kratz & McClelland, Inc.
National Equipment Corp.
Ransome Concrete Machinery Co.

Paving Breakers
Gardner-Denver Co.
Ingersoll-Rand Co.
Leitch & Co.
Rix Company, Inc., The
Schramm, Inc.
Sullivan Machinery Co.

Paving, Contractor
Warren Bros. Roads Co.

Paving Plants
Bacon Co., Edward R.
Jaeger Machine Works, The
Jenison Machinery Co.
Standard Boiler & Steel Works

Paving Tools
Bacon Co., Edward R.
Harron, Rickard & McCone Co.

Penstocks
Chicago Bridge & Iron Works
Lacy Manufacturing Co.
Pittsburgh-Des Moines Steel Co.
Water Works Supply Co.
Western Pipe & Steel Co.

Pile Drivers
Bacon Co., Edward R.
Bucyrus-Erie Co.
Harnischfeger Sales Corp.
Harron, Rickard & McCone Co.
Industrial Brownhoist Corp.
Ingersoll-Rand Co.
Jenison Machinery Co.
Kratz & McClelland, Inc.
Northwest Engineering Co.
Orton Crane & Shovel Co.
Thew Shovel Co., The
Union Iron Works, Inc.

Piles, Concrete
Raymond Concrete Pile Co.
MacArthur Concrete Pile Corp.

Piling
Pacific Coast Steel Corp.

Piling, Redwood
Union Lumber Co.

Pipe, Bell and Spigot
National Cast Iron Pipe Co.

Pipe, Cast-Iron
American Cast Iron Pipe Co.
Claussen & Co., C. G.
Industrial & Municipal Supply Co.
National Cast Iron Pipe Co.
Pacific States Cast Iron Pipe Co.
U. S. Cast Iron Pipe & Fdy. Co.
Water Works Supply Co.

Pipe, Cement Lined
American Cast Iron Pipe Co.
National Cast Iron Pipe Co.
U. S. Cast Iron Pipe & Fdy. Co.

Pipe, Centrifugal
National Cast Iron Pipe Co.

Pipe Clamps and Hangers
Kortick Mfg. Co.

Pipe Coatings
American Concrete Pipe Co.
Inertol Company, Inc.
McEverlast, Inc.
Paraffine Companies, Inc., The
Wailes Dove-Hermiston Corp.

Pipe, Concrete
American Concrete Pipe Co.
Lock Joint Pipe Co.
Portland Cement Association

Pipe, Culvert
California Corrugated Culvert Co.
Gladding, McBean & Co.
Pacific Clay Products
Western Pipe & Steel Company

Pipe Fittings
American Cast Iron Pipe Co.
Claussen & Co., C. G.
Industrial & Municipal Supply Co.
National Cast Iron Pipe Co.
Pacific Pipe Co.
Pacific States Cast Iron Pipe Co.
U. S. Cast Iron Pipe & Fdy. Co.
Weissbaum & Co., G.

Pipe, Flanged
National Cast Iron Pipe Co.

Pipe Line Machinery
Bacon Co., Edward R.
Harnischfeger Sales Corp.
Jenison Machinery Co.
W-K-M Company, Inc.

Pipe, Lock-Bar
Western Pipe & Steel Co.

Pipe, Preservative
Columbia Wood & Metal Preservative Co.

Pipe, Pressure Line
Lacy Manufacturing Co.
Lock Joint Pipe Co.
Western Pipe & Steel Co.

Pipe, Riveted Steel
Lacy Mfg. Co.
Montague Pipe & Steel Co.
Pittsburgh-Des Moines Steel Co.
Western Pipe & Steel Co.

Pipe, Sewer
Gladding, McBean & Co.
Pacific Clay Products

Pipe, Standard
Claussen & Co., C. G.
Pacific Pipe Co.

Pipe, Vitrified
Gladding Bros. Mfg. Co.
Gladding, McBean & Co.
Pacific Clay Products

Pipe, Welded Steel
California Corrugated Culvert Co.
Lacy Manufacturing Co.
Montague Pipe & Steel Co.
Steel Tank & Pipe Co.
Union Tank & Pipe Co.
Western Pipe & Steel Co.

Plows, Road
Austin-Western Road Mchy. Co., The
Bacon Co., Edward R.
Jenison Machinery Co.
Spears-Wells Machy. Co.

Pneumatic Tools
Gardner-Denver Co.
Ingersoll-Rand Co.
Leitch & Co.
Schramm, Inc.

Po'es, Redwood
Union Lumber Co.

Powder
Giant Powder Co., Cons., The
Hercules Powder Co.

Power Units
Bacon Co., Edw. R.
Continental Motors Corp.
Hercules Motors Corp.
International Harvester Co.
Jenison Machinery Co.
Novo Engine Co.

Preservative, Wood, Metal, etc.
Columbia Wood & Metal Preservative Co.
Paraffine Companies, Inc., The

Pumps, Centrifugal
Byron Jackson Pump Mfg. Co.
Industrial & Municipal Supply Co.
Ingersoll-Rand Co.
Jaeger Machine Works, The
Pelton Water Wheel Co., The
Rix Company, Inc., The
Washington Iron Works
Woodin & Little

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OPPORTUNITY PAGE

CONTINUED

OFFICIAL BIDS

UNITED STATES DEPARTMENT OF THE INTERIOR

BUREAU OF RECLAMATION

Pumping Plant Equipment

Washington, D. C., September 15, 1930.

Sealed bids (Specifications No. 514) will be received at the office of the Bureau of Reclamation, Denver, Colorado, until 3:00 o'clock p.m., October 31, 1930, and will at that hour be opened, for furnishing one pump having a capacity of 180 second-feet when operating under a total effective head of 31 feet; one 800-horsepower, 2200-volt, 3-phase, 60-cycle, synchronous motor, and auxiliary and control apparatus, as listed in the schedule, for pumping Station No. 1, Minidoka Project, Idaho. All apparatus will be installed by the Government. For particulars, address the Bureau of Reclamation, Burley, Idaho; Denver, Colorado; or Washington, D. C.

P. W. DENT,
Acting Commissioner.

UNITED STATES DEPARTMENT OF INTERIOR

NATIONAL PARK SERVICE

Grading and Tunnel

Standard Government Form of Invitation for Bids

San Francisco, California, September 23, 1930

Sealed bids, in single copy only subject to the conditions contained herein, will be received until 2:00 o'clock p.m. on the 21st day of October, 1930, and then publicly opened, for furnishing all labor and materials and performing all work for grading from Sta. 0+00 to Sta. 201+13, Section A-5 of Route No. 2, Wawona Route, and widening from Sta. 51+86 to Sta. 70+57 on Section B-2 of Route No. 1, South Road, all in Yosemite National Park, California. The length of the project is 3.697 miles and the principal items of work are approximately as follows:

Clearing, 20 acres.
Excavation, unclassified, 96,500 cu.yd.
Excavation for structures, 1500 cu.yd.
Borrow, unclassified, 13,500 cu.yd.
Overhaul, 121,500 sta.yd.
Finishing earth graded road, 3.697 miles.
Class A concrete, 506 cu.yd.
Reinforcing steel, 15,600 lb.
Cement rubble masonry, 3150 cu.yd.
Corr. metal pipe in place, 2142 lin.ft.
Hand laid rock embankment, 1026 cu.yd.
Hauling borrow and tunnel excavated material, 73,300 cu.yd.mis.
Tunnel excavation, 4230 lin.ft.
Gallery excavation, 1050 lin.ft.
Concrete tunnel lining, 500 lin.ft.
Gunite lining, 600 cu.yd.

Proposals will be received from capable and responsible contractors who must submit with their request for Standard Government Form of Bid an attested statement, on forms to be supplied by the District Engineer, of their financial resources and construction experience. Standard Government Form of Bid will be supplied only to contractors showing sufficient experience and financial resources to properly construct the work contemplated.

Where copies of plans and specifications are requested, a deposit of $10 will be required to insure their return. If these are not returned within 15 days after opening of bids the deposit will be forfeited to the Government. Checks should be certified and made payable to the Federal Reserve Bank of San Francisco.

Guarantee will be required with each bid as follows: In the amount of five (5) per cent of the bid.

Performance bond will be required as follows: In the amount of one hundred (100) per cent of the total contract price. Performance shall begin within ten (10) calendar days after date of receipt of notice to proceed and shall be completed within seven hundred (700) calendar days from that date exclusive of any time that may intervene between the effective date of orders of the Government to suspend operations on account of weather conditions and the effective date of orders to resume work and subject to such extensions as may be provided for under the Special Provisions.

Liquidated damages for delay will be the amount stated in the Special Provisions for each calendar day of delay until the work is completed and accepted.

Partial payments will be made as the work progresses for work and material delivered if such work and material meet the approval of the contracting officer.

Article on patents will be made a part of the contract.

Bids must be submitted upon the Standard Government Form of Bid and the successful bidder will be required to execute the Standard Government Form of Contract for Construction.

The right is reserved, as the interest of the Government may require, to reject any and all bids, to waive any informality in bids received, and to accept or reject any items of any bid, unless such bid is qualified by specific limitation.

Envelopes containing bids must be sealed, marked, and addressed as follows:

Bid for Road Construction. To be opened 2:00 p.m., October 21, 1930.
Projects 2-A5, Grading, and 1-B2, Widening, Yosemite National Park, 807 Sheldon Bldg., 461 Market St., San Francisco, California.

C. H. SWEETSER,
District Engineer, Bureau of Public Roads.

Levee and Sewer

Sealed bids will be received up to 12:00 o'clock noon, Saturday, October 25, by Berkeley Water Front Company, at the office of Ralph A. Beebee, room 1125, Crocker First National Bank Building, 1 Montgomery Street, San Francisco, for constructing:

1st, earth levee containing approximately 57,400 cu.yd.; at Richmond Inner Harbor;

2nd, 100-ft. double 6x6 monolithic concrete storm sewer outfall at Richmond Inner Harbor.

Plans may be inspected at the above office, where specifications are obtainable. Separate bids will be received for the above items. The Company reserves the right to reject any or all bids.

HELP WANTED

As listed by the Engineering Societies' Employment Service, 57 Post Street, San Francisco. Applicants will please apply direct to them.

HELP WANTED—By reliable manufacturer of construction equipment, competent factory sales representative for West Coast. State qualifications and full experience in first letter. Box 425, Western Construction News.

WANTED—First-class mechanic having wide experience on gas shovels, trucks, compressors, pumps, and electrical equipment. To take complete charge; salary open; long road job in the mountains, A-1 camp conditions. References required. Write full details of experience in first letter. Box 400, W.C.N.

ENGINEER, mechanical or electrical, not over 30 years, with 3 to 5 years' experience on hydro-electric plant operation for service and testing work. Must have mechanical skill, agreeable personality and be willing to travel. Salary about $175 per month and expenses in the field. Apply by letter. Headquarters, San Francisco. R-3309-S.

DESIGNING ENGINEER, civil, capable of designing, surveying and planning hydro-electric developments, including dams, etc. Chief emphasis on design. Apply only by letter. Location, Europe. W-1413.

CIVIL ENGINEER, graduate with experience in the design and construction of sewers and water works, to purchase an interest in an engineering business. Some experience in electrical engineering desirable. Apply only by letter. Location, Kansas City. W-499-C-S.

DESIGNER, civil engineer, who can handle concrete, steel, masonry and timber. A fair knowledge of industrial problems will be a help. Must be able and willing to do his own drafting in the ordinary run of work and carry it through to the complete drawings. Man who has had some construction experience as well as office work desired. Single man of Anglo-Saxon origin preferred. Salary, $250 a month, board, room, laundry and medical attention. Apply by letter. Location, South America. W-1644.

ENGINEERING ASSISTANT, technically trained and qualified to design and calculate all stresses in high arch dams by the trial load method of the U. S. Reclamation Service. Apply by letter giving details of experience and salary expected. Location, Arizona. R-3328-S.

SITUATIONS WANTED

SITUATION WANTED—A labor foreman, experienced, sewer construction, concrete, street, curb and gutter walks, pipe lines, general work. R. Smith, 404 Chestnut Street, Redwood City, Calif.

POSITION WANTED. I am a middle-aged man with 10 years' experience as superintendent and foreman on highway and bridge construction, familiar with asphalt, concrete or any other type; also grading. Best of references. 466 49th St., Milwaukee, Wis.

SITUATION WANTED—Estimator and licensed engineer, college graduate, 15 years' experience on building construction and engineering work, steady and reliable, go anywhere. E. A. Root, 4642 W. 18th St., Los Angeles.

THE BUYERS' GUIDE—*Continued from Page 66*

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Byron Jackson Pump Mfg. Co.
Industrial & Municipal Supply Co.
Jenison Machinery Co.
Pelton Water Wheel Co., The
Pomona Pump Co.
Woodin & Little

Pumps, Dredging and Sand
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Jaeger Machine Works, The

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Bacon Co., Edward R.
Jaeger Machine Works, The
Jenison Machinery Co.
Novo Engine Co.
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Fairbanks, Morse & Co.
Industrial & Municipal Supply Co.

Pumps, Sewage Ejector
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Pumps, Sludge
Dorr Co., The

Pumps, Water Works
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Pomona Pump Co.
Washington Iron Works

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Soulé Steel Co.

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Rix Company, Inc., The

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Lakewood Engr. Co.

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Blaw-Knox Co.
Heltzel Steel Form & Iron Co.
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Shaw Excavator & Tools Co.
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Young Machinery Co., A. L.

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American Bitumuls Co.
Shell Co.

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Link-Belt Co.

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Speeder Machinery Corp., The
St. Louis Power Shovel Co.
Thew Shovel Co., The
Young Machy. Co., A. L.

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Western Pipe & Steel Co.

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Lacy Manufacturing Co.
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Pittsburgh-Des Moines Steel Co.
Western Pipe & Steel Co.

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Chicago Bridge & Iron Works
Lacy Manufacturing Co.
Steel Tank & Pipe Co.
Western Pipe & Steel Co.

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Timbers, Redwood
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Link-Belt Co.
Thew Shovel Co., The

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Jenison Machinery Co.
Universal Crane Co., The

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Golden Anderson Valve Co.
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Pacific Pipe Co.
Water Works Supply Co.

Valves, Gate
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Claussen & Co., C. G.
Pelton Water Wheel Co., The
Water Works Supply Co.

Valves, Hydraulic
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Pelton Water Wheel Co., The
Water Works Supply Co.

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Smith Engineering Works

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California Filter Co., Inc.

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Water Wheels
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Water Works Supply Co.

Water-Works Supplies
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