WCN-05-1930

WESTERN CONSTRUCTION NEWS

CIVIL ENGINEERING AND CONSTRUCTION IN THE FAR WEST

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VOLUME V NUMBER 9

SAN FRANCISCO, MAY 10, 1930

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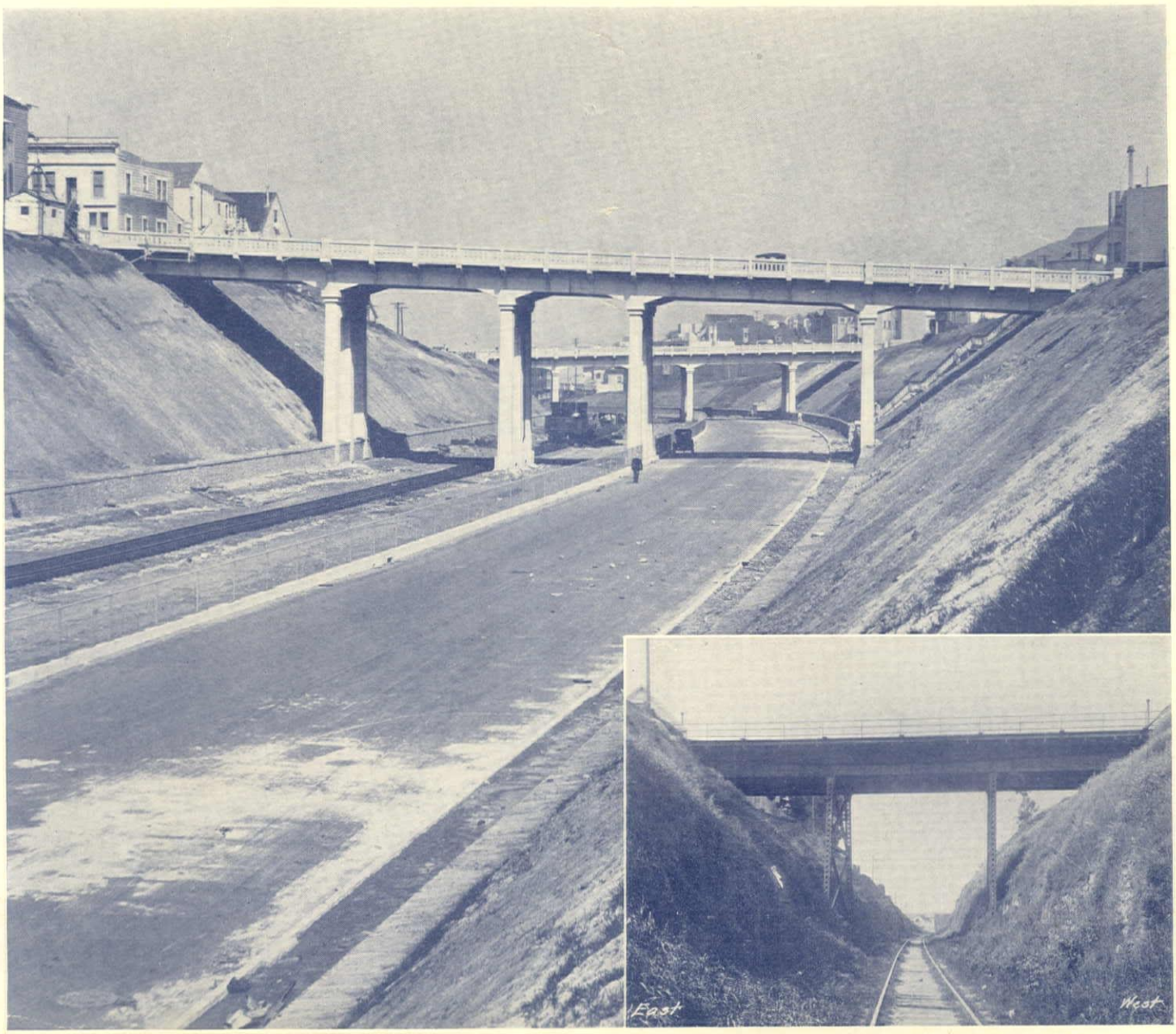


BERNAL CUT, SAN FRANCISCO, MARCH 11, 1930; OPENED TO TRAFFIC APRIL 15, 1930. RICHLAND AVE. BRIDGE IN FOREGROUND, MIGUEL ST. BRIDGE IN BACKGROUND. (INSET) BERNAL CUT APRIL, 1928, BEFORE IMPROVEMENT

THE CHEAPEST WAY TO ERECT STEEL

STEEL erectors in all parts of the country are using P&H Corduroy Cranes to erect steel.

These cranes are mobile. They are provided with steering brakes and can be *moved wherever needed, even in the closest quarters.*

They stand squarely on their own tractions and handle capacity loads without outriggers or stabilizers of any kind. *They are ready to work as soon as moved into position.*

Line speeds range from 150 to 180 feet per minute, assuring high-speed handling. The power clutch control *permits the load to be raised or lowered a few inches at a time.*

These are but a few reasons why steel erectors have found that P&H Corduroy Cranes lower the cost of steel erection. Let us send complete details.

P & H CORDUROY CRANES

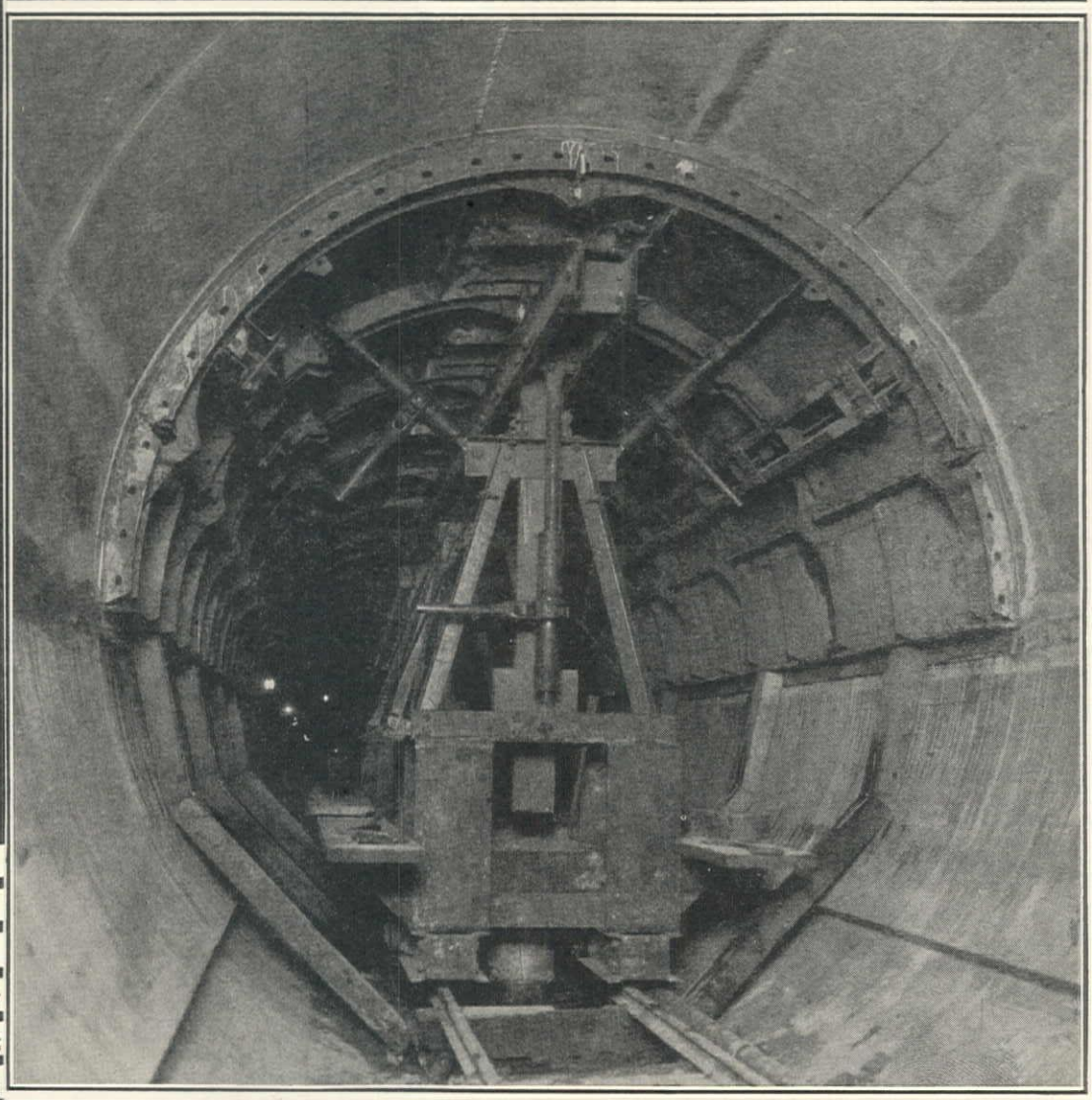
HARNISCHFEGER SALES CORPORATION

Established 1884
3890 National Ave., Milwaukee, Wis.
32 Beale St., San Francisco 2025 Santa Fe Ave., Los Angeles
ROBERT M. TAYLOR, *Pacific Coast Manager*
Service Stations, Complete Repair Part Stocks and Excavators at San Francisco, Los Angeles and Seattle

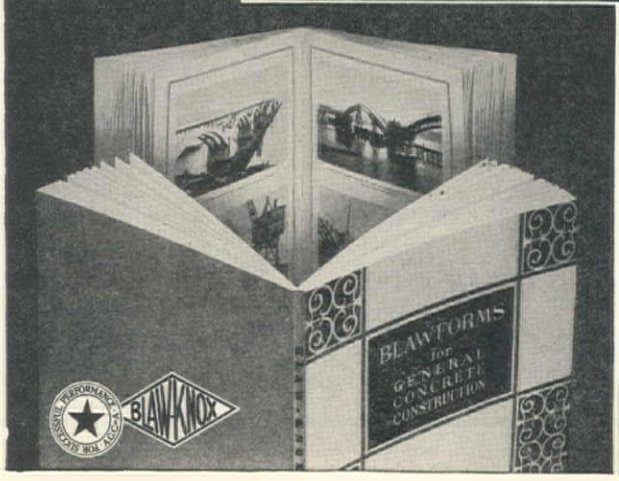
STEEL FORMS

Six sets of Blaw-Knox Collapsible STEEL FORMS, each 20 ft. long, were used to line the mile-long, 9 ft. diameter Beacon Hill Sewer Tunnel for the City of Seattle, Washington.

The forms were equipped with travelers to simplify the moving ahead of the collapsed sections.



A BROCHURE
OF
ENGINEERING
ACCOMPLISHMENT
FREE—TO ENGINEERS
AND CONTRACTORS



When a concreting job is to be done—usual or unusual—it pays to deal with *experienced* BLAW-KNOX.

An engineering consultation on your proposed work will not obligate you in any way.

BLAW-KNOX COMPANY
2089 Farmers Bank Bldg., Pittsburgh, Pa.

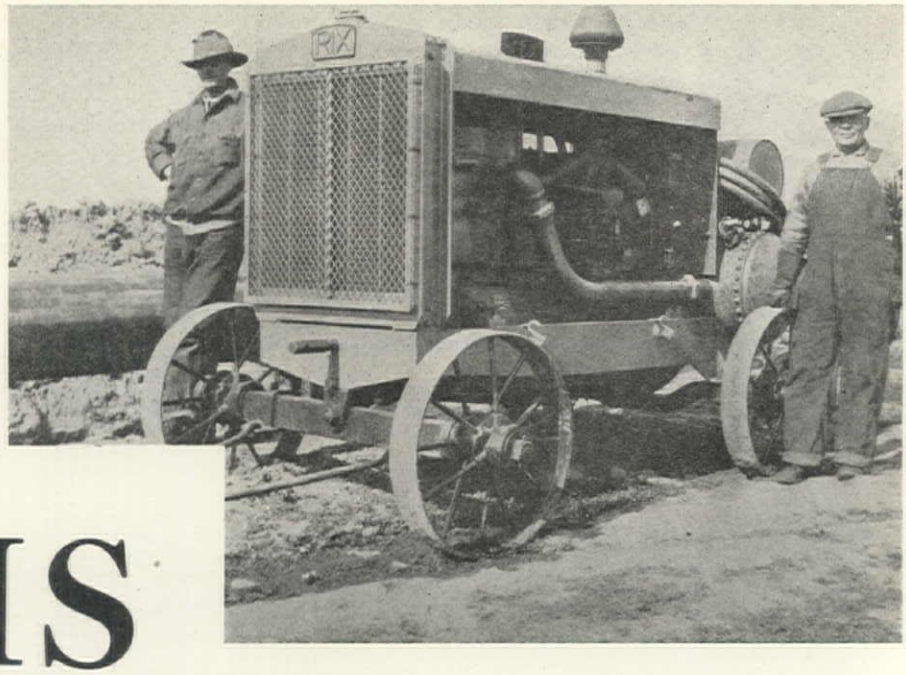
Garlington Bros., 16th Street and Santa Fe Avenue, Los Angeles, Calif.; Harron, Rickard & McCone, 1600 Bryant Street, at 15th, San Francisco, Calif.; J. L. Latture, 312 E. Madison Street, Portland, Ore.; Pacific Hoist & Derrick Co., 818 First Avenue, S. Seattle, Wash.; L. A. Snow Co., 1032 Sixth Avenue, S. Seattle, Wash.

BLAW-KNOX

When writing to BLAW-KNOX COMPANY, *please mention Western Construction News*

SINCE 1877

COMPRESSOR at right is a 220 ft. RIX "6" No. 2, with *"Super-Charger"* (patd). The *Pioneer* RIX line includes compressors of *all* sizes for *all* purposes. Rix Co. are also agents for COCHISE Drills, and exclusive distributors for THOR Pneumatic Tools in Los Angeles and Seattle territories.

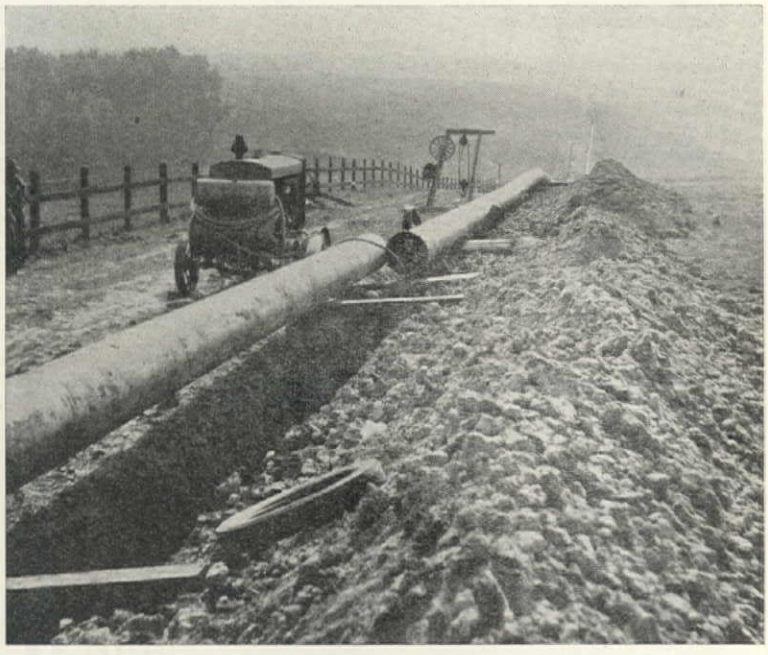


• THIS is the rig to use on jobs like THIS . . . and a hundred others

COULD *you* do a job like this—efficiently, economically, *profitably*. You could with a RIX "6"—and a hundred other jobs. Why not get a RIX—*now*. Think of how much it would save you, how much it would earn for you. RIX *Super-Charged* air power costs only a fraction as much as hand power. And a size *smaller* RIX "6" actually does as much work as other compressors a size *larger*. Because RIX is the *only* compressor equipped with a *Super-Charger* (patd.), which steps up single-stage rating to two-stage performance. Time is money, and RIX saves both. Bulletin 3-D tells the interesting story. Write for it *now*.

RIX COMPANY, INC.
SAN FRANCISCO.....400 Fourth Street
LOS ANGELES.....684 Santa Fe Avenue
PORTLAND.....312 E. Madison Street
SEATTLE.....1729 First Avenue South

Photo at right shows 220 ft. RIX "6" No. 2 with *Super-Charger* testing pipe line.



RIX "6"
PORTABLE AIR COMPRESSORS

"The Compressor with the Super-Charger"

PHILIP SCHUYLER
M. Am. Soc. C. E.
M. Am. W. W. Assn.
MANAGING EDITOR

A. GILBERT DARWIN
Jun. Am. Soc. C. E.
ASSISTANT EDITOR

WESTERN CONSTRUCTION NEWS

CLYDE C. KENNEDY
M. Am. Soc. C. E.
ASSOCIATE EDITOR

❖

CHESTER A. SMITH
M. Am. Soc. C. E.
ASSOCIATE EDITOR

DEVOTED TO CIVIL ENGINEERING AND CONSTRUCTION IN THE FAR WEST

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CONTENTS

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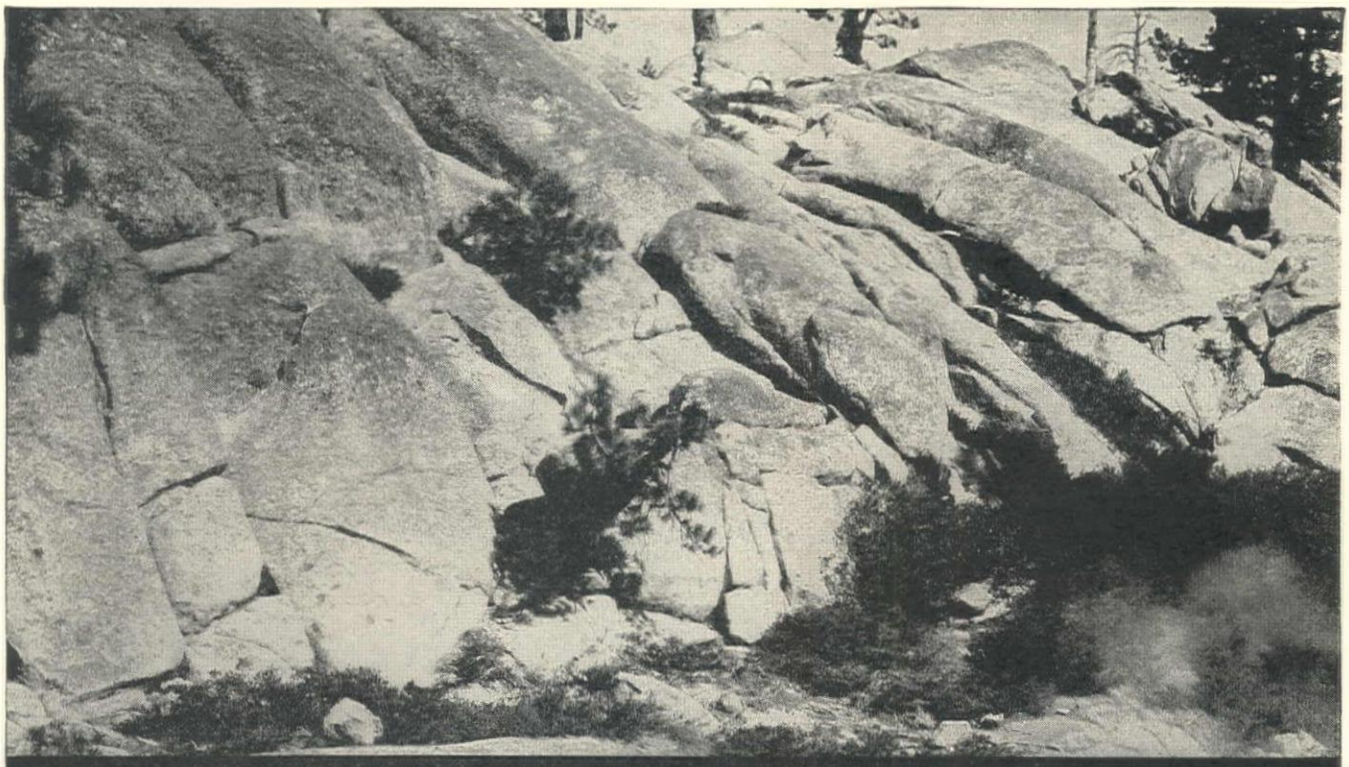


"CATERPILLARS" LICK THE TOUGH JOBS

Grit—granite—grades! High on an aerie of the Sierras, 7,000 feet up, this "Caterpillar" delivers cement to the dam site—delivers it on schedule. Dust and distance and elevation are conquered. Power and traction are converted into time saved and dollars earned. So is proved the stamina and sturdiness which pay profits on the chores of farming and road building and earth moving.

Prices—f. o. b. Peoria, Illinois

TEN	$1100	TWENTY	$1900
FIFTEEN	$1450	THIRTY	$2375
	SIXTY	$4175	

Caterpillar Tractor Co.

PEORIA, ILLINOIS *and* SAN LEANDRO, CALIF., U. S. A.
Track-type Tractors / Combines / Road Machinery
(There is a "Caterpillar" Dealer Near You)

CATERPILLAR
REG. U.S. PAT. OFF.
TRACTOR

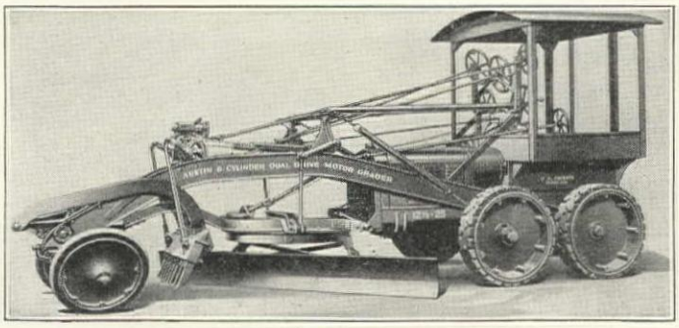
When writing to CATERPILLAR TRACTOR CO., *please mention Western Construction News*

New models with important improvements complete the Austin-Western Line of motor graders

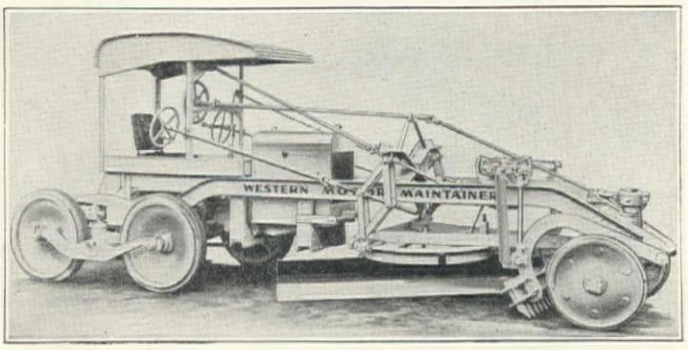
The Austin 6-cylinder 12½-25 Dual Drive has unique driving mechanism

This model meets the demand for a Dual Drive Motor Grader of a size and capacity between that of the 10-20 and 15-30. Unlike most motor graders the new 12½-25 is not built around a standard tractor. Instead it has a 6-cylinder motor and a remarkably efficient type of driving mechanism.

With its 4-point driving contact, the Austin utilizes the full power from the motor. By locating the differential driving shafts between the front and rear drive wheels and mounting the right- and left-hand drive wheels separately, unusual flexibility is obtained. The 12½-25 enjoys the same high tractive efficiency, freedom from skidding or miring and easy handling that distinguish other Dual Drive Motor Graders.



12½-25 Dual Drive Motor Grader



Western Motor Maintainer

The new Western Tandem Drive Motor Maintainer is the most outstanding development ever made in its field

The Western Motor Maintainer with its powerful, efficient Tandem Drive is especially suited to the needs of county highway departments—townships—road districts and villages. It also will meet the needs of contractors looking for a small but powerful machine to level fills and work between forms.

It is completely factory built and freed from the limitations imposed by the use of standard tractors. An unusually low center of gravity with a wide rear base gives the Western Motor Maintainer the stability so necessary on highly crowned or hilly roads. It brings all the operating advantages of 4-point driving contact over four widely separated areas to the medium weight motor maintainer field, for the first time.

The Austin-Western Motor Grader Line also includes:

Austin 10-20 and 15-30 Dual Drive Motor Graders—These machines were the first of the now famous Dual Drive type of Motor Graders. They are built around McCormick-Deering 10-20 and 15-30 power plants.

Austin 10-20 and 15-30 Single Drive Motor Graders—continue to be leaders among single drive machines for satisfactory operation.

Western Motor Grader Attachment for Cletrac 20—An efficient motor grader with crawler tread.

The Western No. 32—a highly satisfactory one-man patrol grader for use with a McCormick-Deering 10-20 tractor.

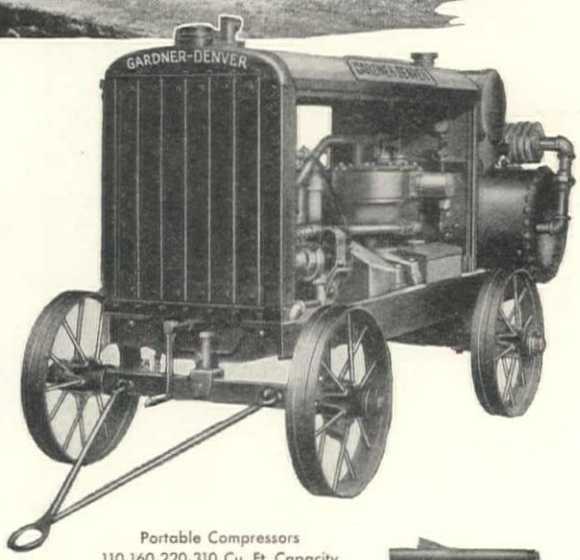
The Austin-Western Road Machinery Co.
435 Brannan Street, San Francisco, California
Chicago Office: 400 North Michigan Avenue

Austin-Western
ROAD MACHINERY

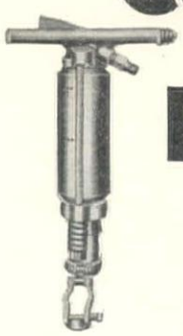
When writing to AUSTIN-WESTERN ROAD MACHINERY CO., *please mention Western Construction News*

Denver Hoist
Models 3-5-6-8-10

G-D Contracting Equipment

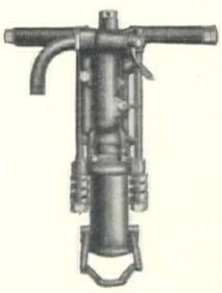


Portable Compressors
110-160-220-310 Cu. Ft. Capacity



Paving Breakers
Models 415-15-15H

Sheeting Driver
Model 15HS



Hand Sinkers
Models 411-95-11

Clay Diggers
Models 28-28A-128B

In these times of constantly increasing competition in contracting of all kinds, it is not enough to supply your men with labor-saving tools and equipment, but these also must be the most efficient and dependable that can be obtained. Gardner-Denver Portable Compressors and Industrial Tools meet the most rigid specifications and exacting demands and they are earning increased profits for contractors, everywhere. Our representatives will be glad to demonstrate them and prove our claims.

GARDNER-DENVER COMPANY

QUINCY, ILL. DENVER, COLO.

SALES OFFICES THROUGHOUT THE WORLD

GARDNER-DENVER

When writing to Gardner-Denver Company, *please mention Western Construction News*

HOW MUCH PROFIT

does the contract price allow?

Bids that must be screwed down to the last dime, offer attractive profits only through lowered costs. Here's a way to widen the gap between cost and contract price.

Bucyrus-Erie equipment knocks the props out from under ordinary excavating costs. Making records for speed, standing up under gruelling day-in-and-day-out service, *earning bigger profits.* Bucyrus-Erie shovels, draglines, clamshells, dragshovels and cranes—all types of power—have earned outstanding leadership in construction work everywhere.

Let us tell you how a Bucyrus-Erie will put profits into your job against the stiffest competition.

Representatives throughout the U. S. A. Offices or distributors in all principal countries. Branch Offices: Boston, New York, Philadelphia, Atlanta, Birmingham, Pittsburgh, Buffalo, Detroit, Chicago, St. Louis, Dallas, San Francisco.

BUCYRUS-ERIE COMPANY, manufacturers of the only complete line—all sizes, types and powers. *General Offices:* South Milwaukee, Wis. *Plants:* South Milwaukee, Wis., Erie, Pa., Evansville, Ind. *West Coast Branch Offices:* 989 Folsom Street, San Francisco. Clyde Equipment Company, Portland, Ore., Seattle, Wash. Concrete Machinery & Supply Company, Los Angeles, Cal.

BUCYRUS ERIE

A86—5-10-30—WCN

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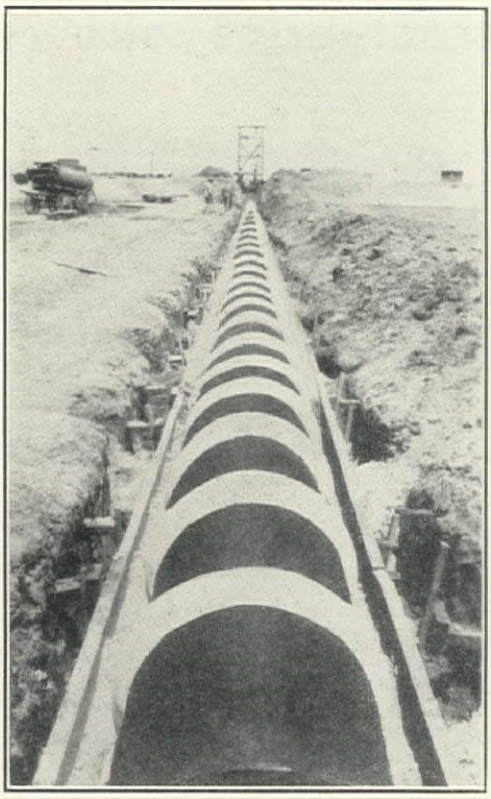
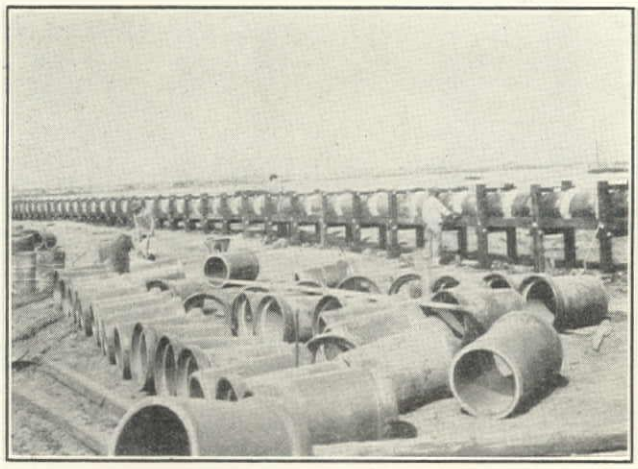


VITRIFIED CLAY—

the Only Everlasting Material for Sanitary Sewers



LONG BEACH *Pump District No. 10, Sanitary Sewer, Long Beach, California*—comprising 28 miles of Vitrified Clay Sewer Pipe in sizes 8″ to 33″. Part of the 21″ Vitrified Clay Sewer Pipe as shown in above illustrations was laid on piles through a section of tide land, and after completion of the sewer there was no infiltration in the line under ground and no leaks in the portion above ground. This sewer was designed by H. Paterson, City Engineer of Long Beach, and constructed by The Torson Construction Co., of Long Beach, California, and Kansas City, Missouri.

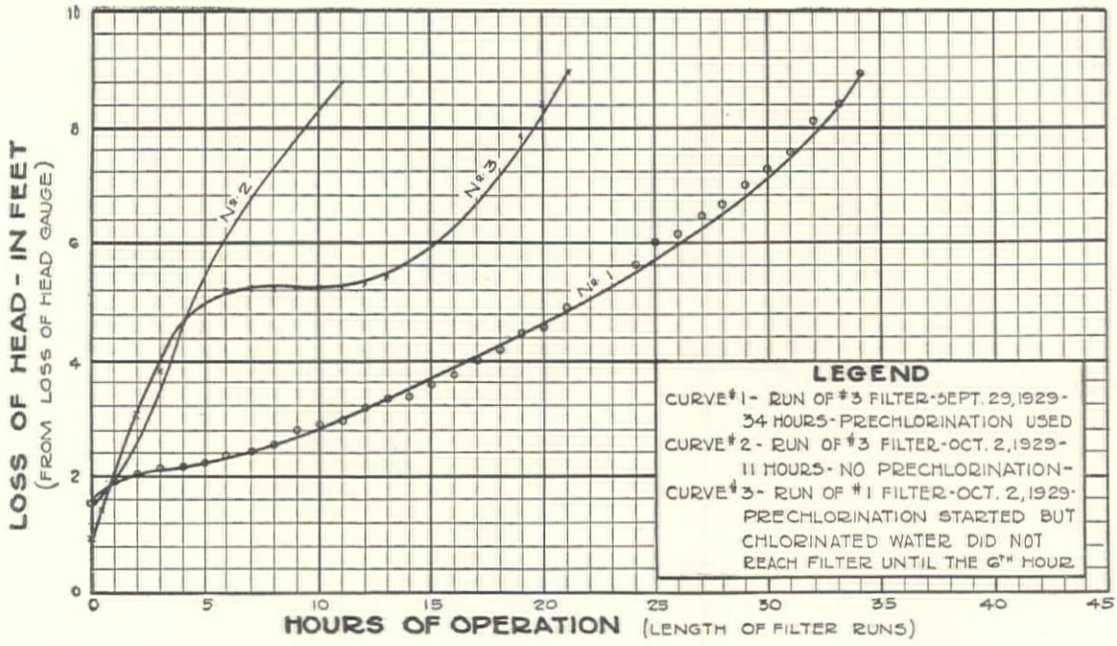
Pacific Clay Products

PACIFIC

Suite 650
Chamber of Commerce Bldg.

1151 South Broadway
Los Angeles

They TRIPLED their FILTER RUN by PRECHLORINATION



EFFECT OF PRECHLORINATION ON FILTER RUNS

Filtration Plant, Barberton Water Dept., Barberton, Ohio

Prechlorination has saved both time and money at the Barberton, Ohio, Filtration Plant. The above diagram proves that conclusively.

Prechlorination is real economy at nearly every water works plant, because:

It lengthens filter runs.
Saves wash water—also filtered water to waste.
Reduces labor.
Controls micro-organisms in basins.
Gives protection against heavy bacterial loads to filters.
Improves coagulation.

"The Only Safe Water is Sterilized Water"

Prechlorination with W. & T. chlorinators is proving a profitable investment in many plants. Write us for technical bulletins on **prechlorination.**

WALLACE & TIERNAN

COMPANY, INCORPORATED

Manufacturers of Chlorine Control Apparatus

NEWARK - - - NEW JERSEY

SA-22

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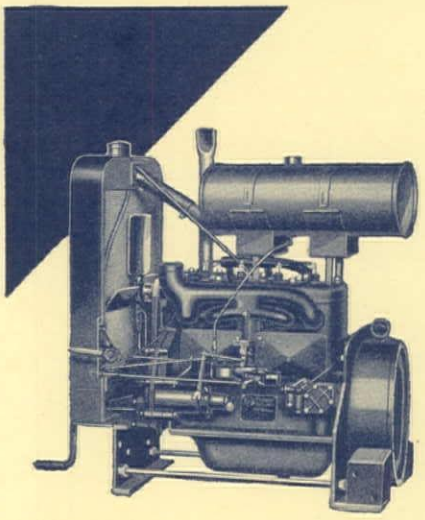
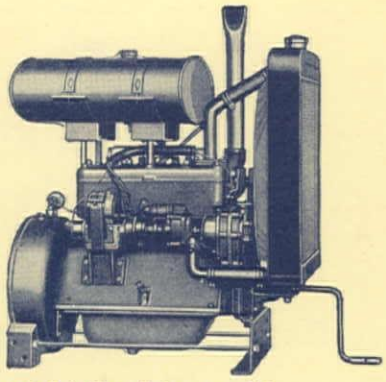
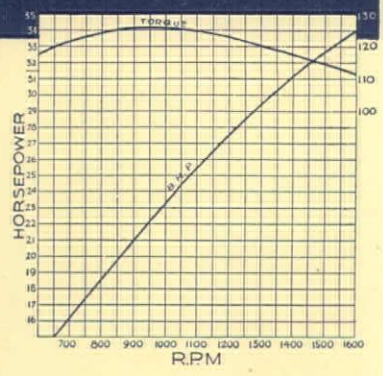
[SEE SIX JENISON MACHINERY COMPANY PAGES FOLLOWING]

PRODUCTIVE POWER

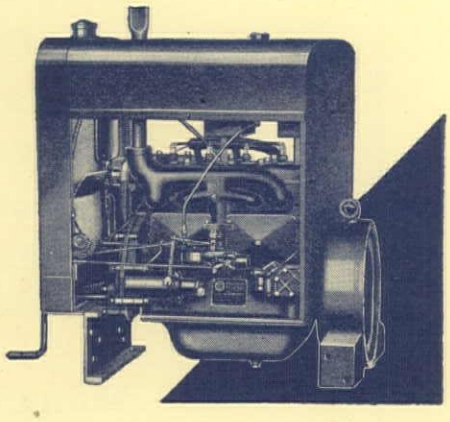




Left and right hand views model W9 Industrial Engine with foot-type flywheel housing and twin front support



Model P27A Red Seal Industrial Power Unit with model W9 Industrial Engine



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Salt Lake City
Lund Company
Mendenhall Auto Parts Co.

Denver
Hendrie & Bolthoff
Gall Auto Specialty Supply Co.

Southern California and Arizona
Brown-Bevis Co.

Northern California and Western Nevada
Jenison Machinery Co.

Los Angeles
Brown-Bevis Co.
Colyear Motor Sales

Seattle, Washington
A. H. Cox & Co.
Colyear Motor Sales

Vancouver
Power Equipment & Supply Co.
Vancouver Parts Co. Limited

San Francisco
Colyear Motor Sales
Jenison Machinery Co.

Portland, Oregon
Howard Cooper Company
Colyear Motor Sales

CONTINENTAL MOTORS · Powerful as the Nation · AMERICA'S STANDARD · SUCCESSFUL PERFORMANCE · A.G.C. of A.

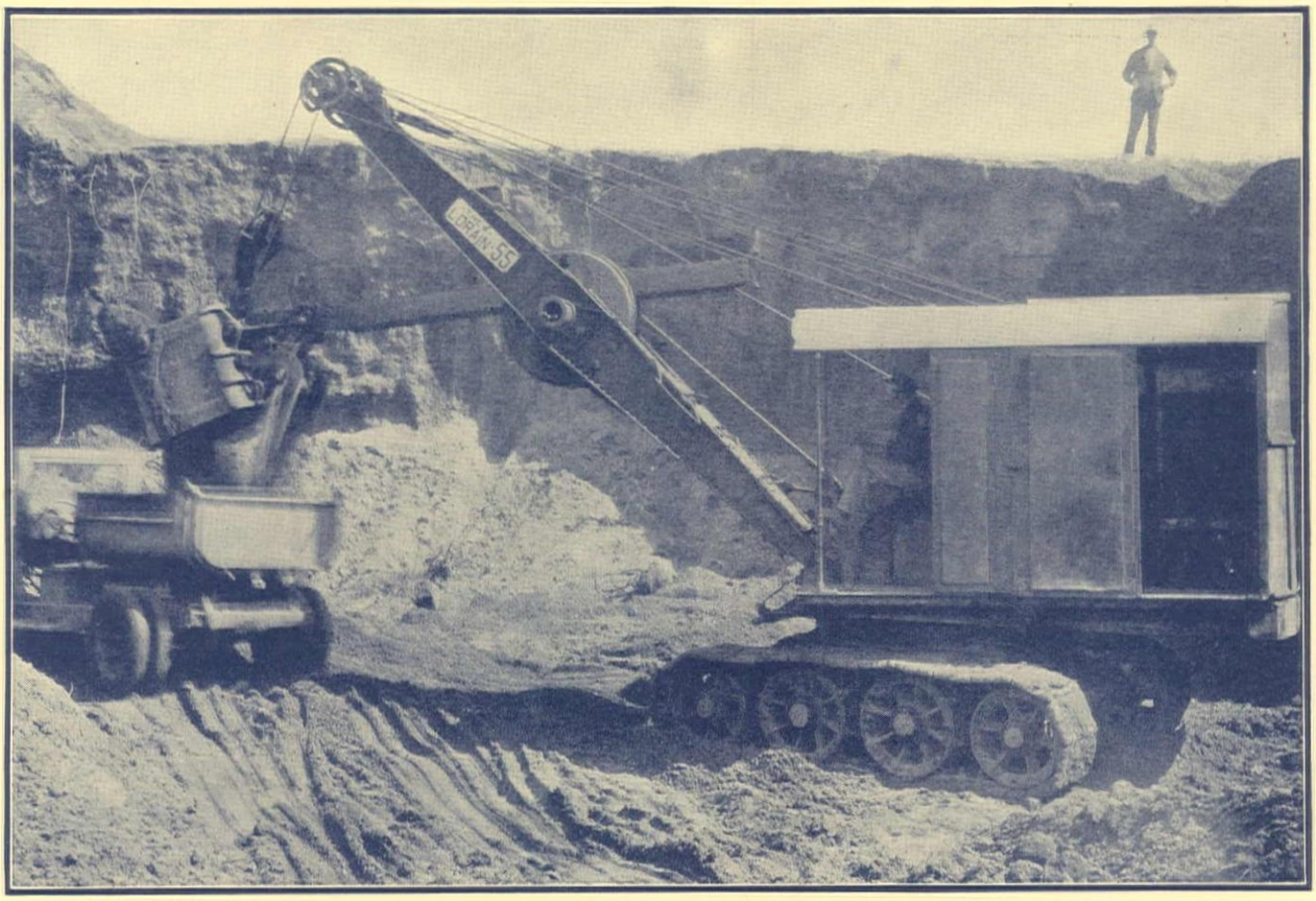
Power that is productive of profitable results is a proven factor with all Continental engines. ¶ Of the many types for industrial uses all are designed for specific purposes — all have the proper power fitted for definite jobs. Let past performance guide you—Specify Continental.

CONTINENTAL MOTORS CORPORATION
INDUSTRIAL EQUIPMENT DIVISION
Office and Factory: Muskegon, Michigan
The Largest Exclusive Gasoline Motor Manufacturer in the World

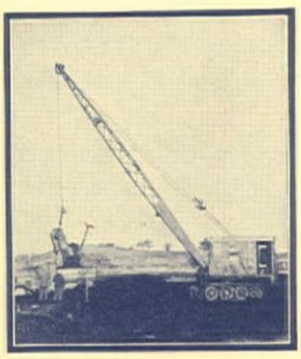
Continental Engines

When writing to CONTINENTAL MOTORS CORPORATION, *please mention Western Construction News*

1 yd. LORAIN 55



A 1 yd. excavating and material handling machine built to the greatest specification a shovel or crane can have—Thew Center Drive.



— A shovel that digs deeper below the treads, dumps higher and farther out than any other shovel of equal length boom and dipper stick.

— A crane that simultaneously hoists, swings, travels with independent control of each operation.

— Mounted on 2 Speed Center Drive Crawler, famous because of low maintenance cost.— Easily extended to longer "64" and "68" tread crawlers with lower ground pressures for crane, clamshell or dragline service.

— Interchangeable to crane, clamshell, dragline, backdigger, skimmer scoop operation.

THEW CENTER DRIVE

THE THEW SHOVEL COMPANY
Lorain, Ohio

Distributed by:
SMITH BOOTH USHER, Los Angeles, Calif., JENISON MACHINERY CO., San Francisco, Calif., HALL-PERRY MACHINERY CO., Butte, Mont., FEENAUGHTY MACHINERY CO., Portland, Ore., Spokane, Wash., Seattle, Wash.

When writing to THE THEW SHOVEL CO., *please mention Western Construction News*

½-YD. SHOVEL

NEW

HUSKY is the word that describes this new half-yard convertible excavator — huskily built throughout. Large-diameter power shafts of heat-treated chrome alloy steel. Double-cone hoisting, crowding and sluing frictions. Base, turntable and boom heavily constructed and completely electric welded. In fact, every part designed to withstand the hard knocks to which small excavators are subjected.

Speed and ease of handling also are features of the Model 4. Accelerator controlled 40-hp. gasoline engine equipped with variable-speed transmission. Travels ⅝ to 3 miles an hour, and will climb a 25 per cent grade. Fast crowding, hoisting and swinging enables this new machine to make five trips per minute in regular operation.

The Model 4 is readily convertible to shovel, crane, dragline, ditcher or skimmer. Write for details and prices.

ORTON CRANE & SHOVEL CO.
608 S. Dearborn Street, Chicago, Illinois
Representatives in Principal Cities

HUSKY

ORTON
Cranes, Shovels & Buckets

Representatives: JENISON MACHINERY COMPANY., San Francisco; LEIGH M. RAILSBACK, Los Angeles
HOWARD-COOPER CORPORATION, Portland, Seattle, Spokane, Boise

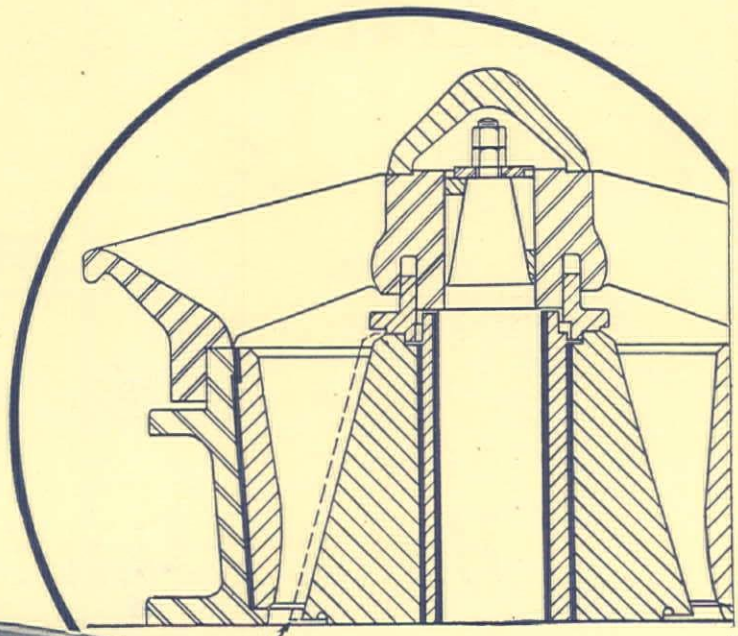
When writing to ORTON CRANE & SHOVEL CO., *please mention Western Construction News*

ONLY Telsmith has the PARALLEL PINCH

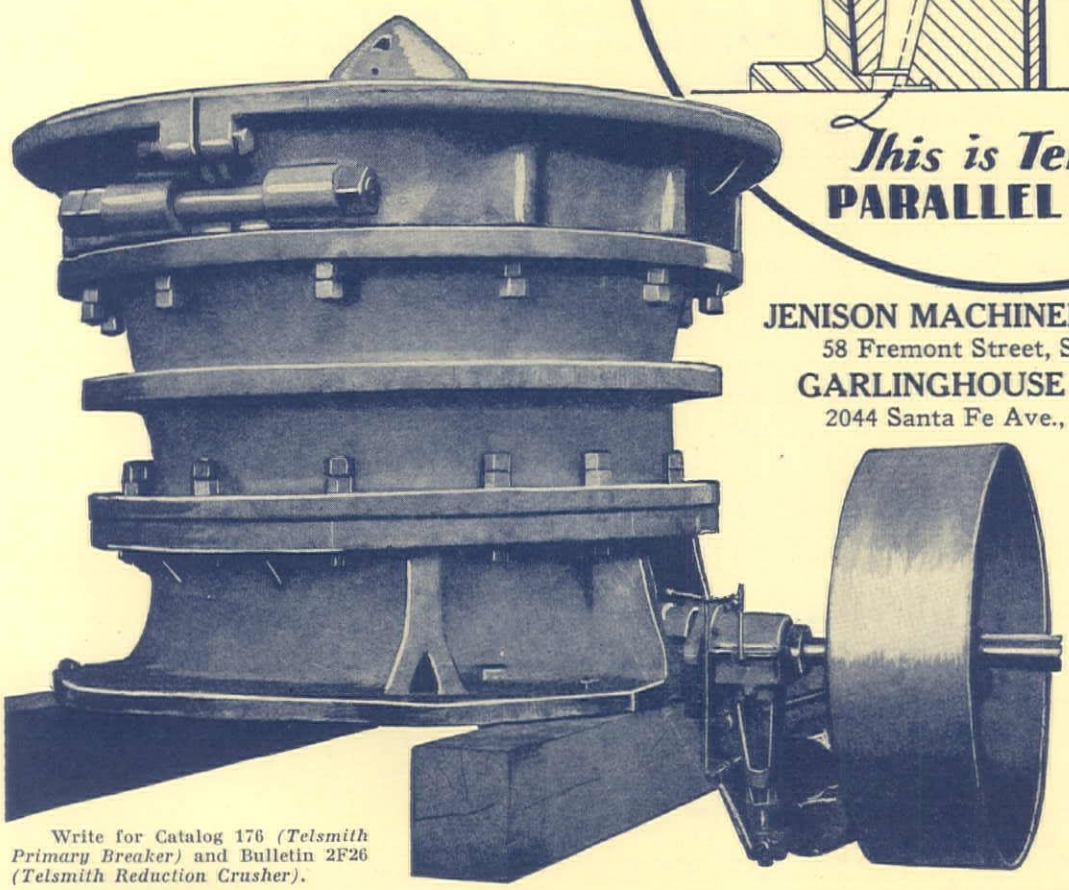
The shaft in a Telsmith crusher doesn't move . . . it's rigidly *fixed*. Between the shaft and the crushing head, inside the cone . . . and almost as long as the shaft itself . . . is Telsmith's long sleeve eccentric. The eccentric rotates on the shaft and *gyrates* the crushing head *horizontally*. It is the eccentric's parallel throw that produces Telsmith's long, straight, *parallel pinch*.

The Telsmith parallel pinch is a horizontal "bite" . . . as long at the top of the head as at the bottom. It takes hold instantly . . . catching the big rock *right at the rim of the bowl*. One long, heart-breaking smash and it's all over. Telsmith never hesitates . . . there's no chance for slippage.

SMITH ENGINEERING WORKS
1826 Holton Street, Milwaukee, Wis.



This is Telsmith's **PARALLEL PINCH**



JENISON MACHINERY COMPANY
58 Fremont Street, San Francisco
GARLINGHOUSE BROTHERS
2044 Santa Fe Ave., Los Angeles

Consult the nearest representative or write or wire TELSMITH *direct*

Write for Catalog 176 *(Telsmith Primary Breaker)* and Bulletin 2F26 *(Telsmith Reduction Crusher)*.

B-11

TELSMITH

When writing to SMITH ENGINEERING WORKS, *please mention Western Construction News*

Universal Truck Crane on construction of underground toll line from Carthage to Joplin, Mo. The machine loads precast manholes on trailer, transports them to job, digs excavation and places manholes (weighing 5 to 8 tons)

Rubber Tired Speed— Crawler Traction

With the sturdy mounting of an eight wheeled truck, the Universal Truck Crane gives you the speed of rubber tired travel on pavement plus the lowered wheel loads characteristic of multiple wheel trucks.

Off the highway, Motor Truck (Christie) Crawlers give this machine mobility anywhere. Crawlers may be attached as quickly as a set of chains, and they will lay down their own steel pavement for the driving wheels. (Applied to Truck Cranes exclusively on Universal's).

THE UNIVERSAL CRANE COMPANY
Lorain, Ohio
ALSO BUILDERS OF THE ½ YARD UNIVERSAL 35

Eight rubber tired wheels to carry the load on pavements —steel track attachable in 15 minutes to transport the machine through mud and mire.

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When writing to The Universal Crane Company, *please mention Western Construction News*

What a Dorrco Bar Screen is doing at Trenton, N. J.

Board of Commissioners
CITY OF TRENTON
NEW JERSEY
Department of Public Works

April 4, 1930.

Abram Swan, Jr.
M. AM. SOC. C. E.
DIRECTOR
A. C. Gregory
M. AM. SOC. C. E.
ENGINEER OF SEWERS AND WATER
P. N. Daniels
CITY SANITARY ENGINEER

Mr. F. H. Jones,
The Dorr Company,
247 Park Ave.,
New York City.

Dear Sir:

In reply to your letter of April 3rd as to screen costs, removal per million gallons, etc., the following is submitted:

Average daily flow	15.9 m g	14
Man hours required with hand raked screen		1.5
" " " " mechanical "		55 cents
Labor cost per man hour		
Power cost for mechanical screen, rate 1.5c per KWH, 1.5 HP motor, average consumption .8 KW, continuous operation.		28.8 c/day
Removal per m g hand raked screen		1.4 cu. ft.
" " " mechanical "		3.0 " "

The bar spacing on both screens was the same, 1.5" clear. We find that we get much less fecal matter with the new screen, and that our pumps are much improved as far as clogging is concerned. The apparatus has been working since last October, and we are very well satisfied with it and with your service.

Yours very truly,

D/H

DORRCO

This letter from Mr. P. N. Daniels, C. E., City Sanitary Engineer, tells the story of the work that is being done by a Dorrco Bar Screen in the sewage treatment plant at Trenton.

It conclusively shows the economy of replacing plain bar screens with Dorrcos—or, of including Dorrco Bar Screens for the coarse screening step on all new sewage treatment projects.

Ask our nearest office for Bulletin 6391

THE DORR COMPANY
ENGINEERS
247 PARK AVENUE — NEW YORK CITY

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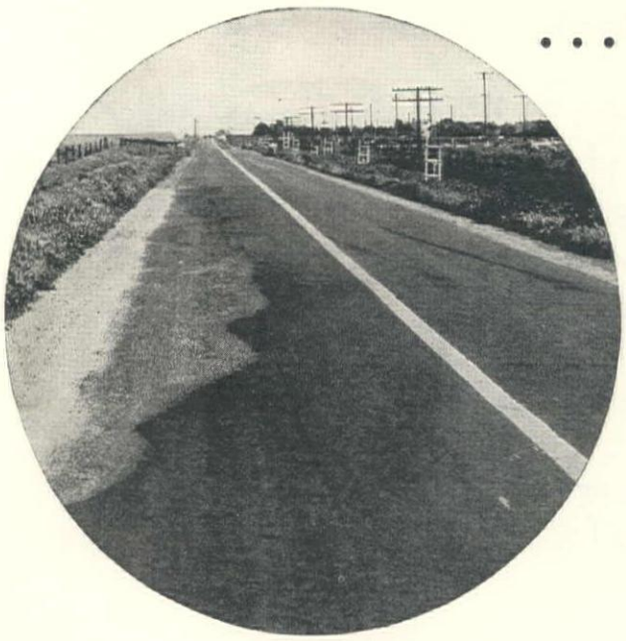
Summer patching!

. . . the quickest permanent job is done with Colas



Colas patches are neat, smooth-riding and easy to lay

POTHOLES and breaks from traffic stresses or foundation failure keep maintenance crews constantly busy.

Hot asphalt or concrete patches require much equipment. They delay traffic and are costly to make. A quicker, less expensive repair method is worth investigating.

With Colas—the uniform cold asphalt emulsion—an hour's work at little expense does a repair job for all time.

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COLAS REG. TRADE MARK

SHELL COLAS

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DIAMOND Portable WASHING and SCREENING PLANTS

NOW PERMIT LOCAL PIT WASHING not considered in the past, owing to the expense of setting up and dismantling the former type of plant.

A DIAMOND No. 40 Portable Timken Roller Bearing Crushing and Screening plant is used as the scalping unit, sizing material as desired. It is then conveyed to the washing and scrubbing screen on a steel sectional conveyor. After the material has been washed, the sand is flumed to a settling tank and the gravel deposited in the bins.

Write for 1930 Catalog

The No. 40 Crushing and Screening plant can be used independently for dry crushing and screening when desired.

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Costing considerably less . . . yet combining the meritorious features of the two well-known hot asphaltic types . . . Bitumuls construction is the demonstrated answer to *all* your paving problems.

No heating costs whatever. Only simple equipment required to construct. Application may be with the popular types of gravity or pressure distributors, or with ordinary pouring pots.

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It is backed by years of extensive research . . . and widespread use throughout the world.

Be sure that your specifications measure-up to Bitumuls. It is unadulterated . . . 99½% pure.

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Please mail me your free manual . . . without obligation

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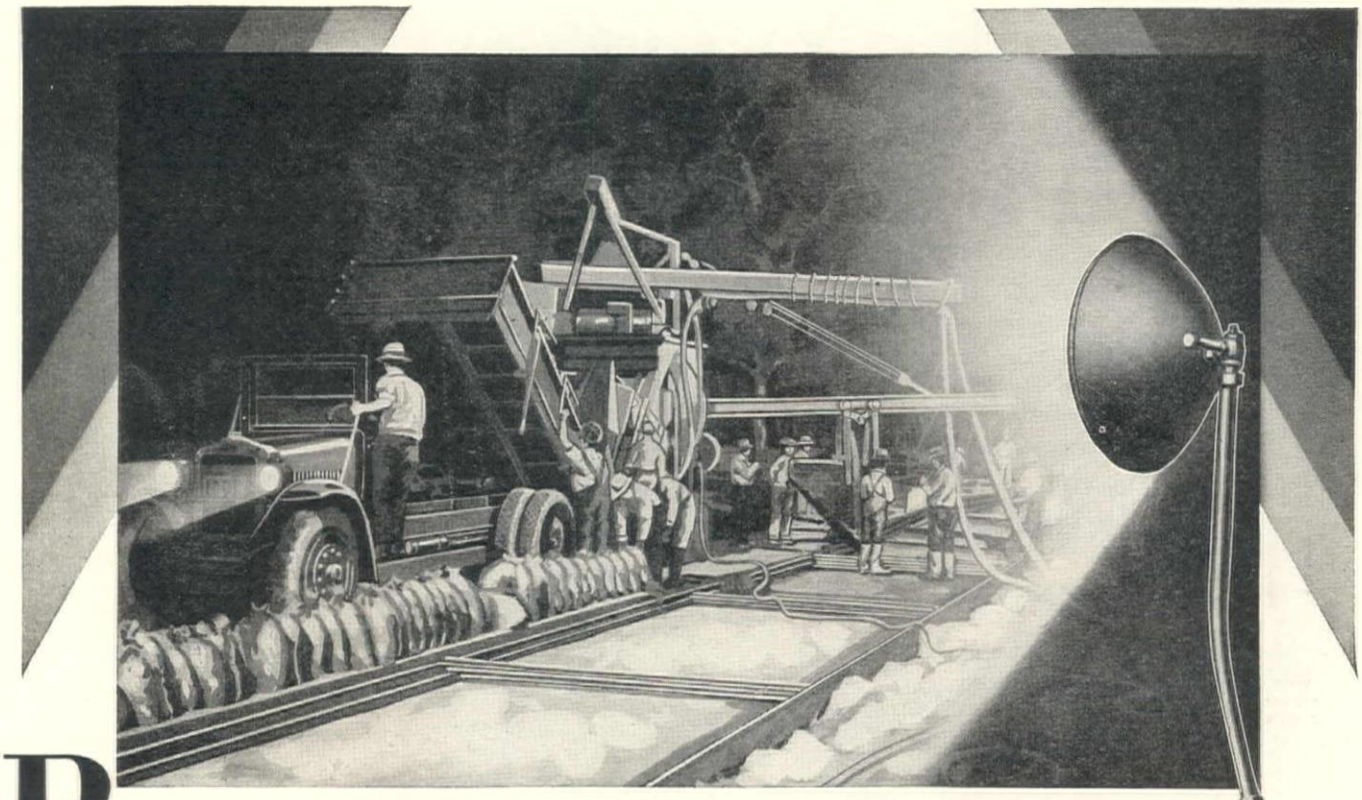

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Carbic Flood Lights afford ideal illumination for night work. Their powerful rays enable your men to work rapidly and safely at night. There is no glare, and no dark shadow. Penetrates fog, smoke or dust to a remarkable degree.

The initial cost of the Carbic Flood Lights is low, and the operating expense is negligible.

Carbic is distributed by the Union Carbide Sales Company through its national chain of warehouses and is sold by jobbers everywhere.

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Unit of Union Carbide and Carbon Corporation
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Without obligation, I would like to have additional information on Carbic Lights.

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WCN 5-10

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SAFE, because batchmeter sounds pre-alarm warning bell just before mixing period is ended. This gives operator time to check if skip is loaded and free of trucks before starting up the skip automatically by pressing foot pedal.

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HANDLING the entire N. E. C. line, we are obligated to maintain a standard of localized service consistent with the national service standard of N.E.C.! The scope of N.E.C. lines gives you all advantages of centralized buying.

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Builders of Industrial Empire

INTERNATIONAL

One of a fleet of Heavy-Duty Internationals working on Pennsylvania Railroad widening, between Washington and Baltimore

Since 1919, beginning with an output already impressive, International Harvester truck production has increased seven-fold, while the total production of the truck industry has only doubled. The International Truck Line includes the Special Delivery, the Six-Speed Special, Speed Trucks to 3-ton, and Heavy-Duty Trucks to 5-ton.

EMPIRE BUILDERS of the new order . . . *International Trucks!* Once the railroads held sole title to the term, as they forced back the wilderness, but now the heavy-duty motor truck disputes the claim.

Indeed, while the railroads still build empire *the trucks are building railroads.* Granted that the great pioneer trunk lines were laid before the birth of the truck, today the truck is indispensable where new projects face the construction engineer.

Problems of the 'Sixties and 'Eighties somehow found their slow and painful solution, *but the truck is of today and tomorrow.* With its flexible power and efficiency the mountainous labor of load-distribution is infinitely simplified.

The McCORMICK-DEERING Industrial Tractor

A compact, economical power unit ready for most anything. It delivers its power three ways . . . through drawbar, belt, or power take-off. It pulls, pushes, and lifts. It combines with an almost endless variety of equipment. Write for the booklet, "Tractor Power in Industry."

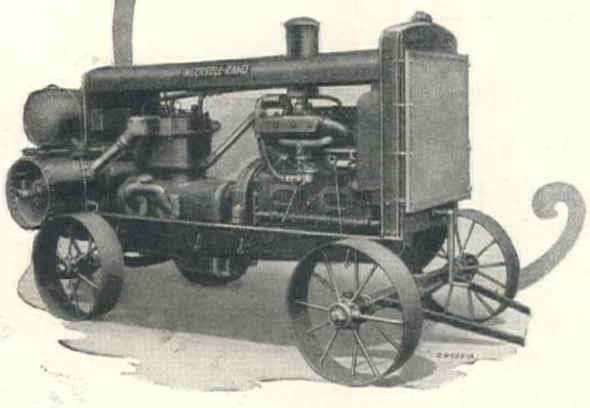
INTERNATIONAL HARVESTER COMPANY

606 So. Michigan Ave. OF AMERICA (*Incorporated*) Chicago, Illinois

Here is a McCormick-Deering Industrial Tractor performing its simplest service—hauling trailers at the drawbar

R-2031

The standard I-R Portable Compressor on steel wheels and axles. There are many sizes and several types of mountings from which to choose.



Nearly Every Job Nowadays Requires Portable Air Compressors

The illustrations above show two radically different kinds of trench jobs—one through rock and one in clay. On both contracts, I-R portable compressors and tools hurried the completion of the work and lowered expenses.

In the confined quarters of a hard-rock trench, the "Jackhamer" Drill is the logical choice. When your job leads through clay, Ingersoll-Rand Pneumatic Diggers can be substituted with excellent results. One tool of this sort will do the work of 3 or 4 men, and will keep at least 5 shovellers busy.

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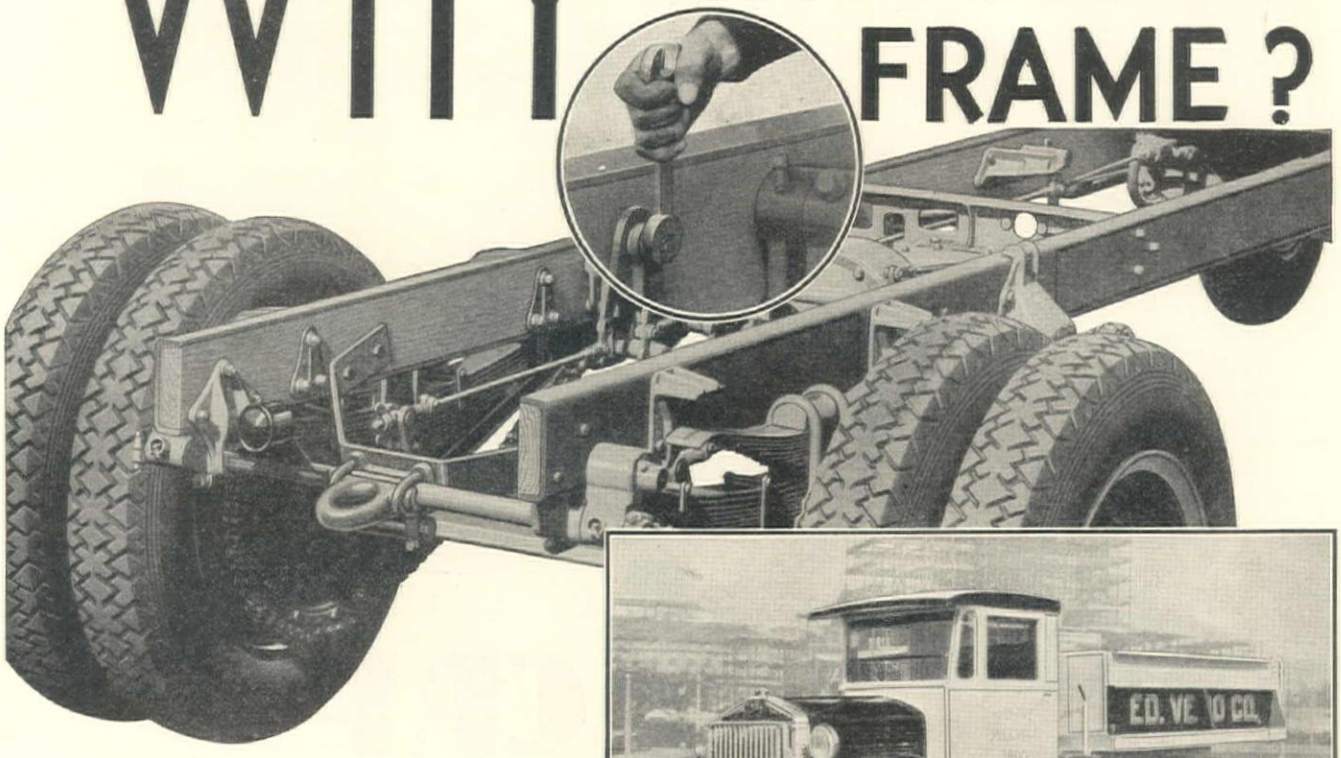
WHY an All-bolted FRAME?



There are *no rivets* in the frame flanges of a Sterling Truck. Frame twists loosen rivets . . . sometimes they sheer off. Replacing rivets is an expert's job . . . and expensive. In a Sterling *all* units are *bolted* through the frame's *wood inlay*—a sturdy plank of solid, seasoned oak, machine-pressed into the steel channel. The snug-fitting, long-bearing bolts pass through both wood and steel and are securely anchored by lock-nuts.

This all-bolted construction gives extra-rigidity to the super-strong, steel-wood frame. Metal-to-metal contact is eliminated. The layer of wood . . . . between metals . . . . acts as a shock-absorber and adds flexibility where most needed. This is real *built-in* protection for the motor and fine working parts . . . and Sterling is the *only* motor truck with these added safeguards against road shock and destructive vibration.

Tremendous pulling power, for heavy hauling at a profitable speed . . . Sterling DC-23, 5½ to 7 ton, chain drive.

As a result Sterling Trucks are not only smoother and quieter in operation but last longer. Repairs are fewer and replacement easier . . . at less cost.

For pamphlet, "Why a Wood-Lined Frame?" write to Driver Dan in care of Sterling Motor Truck Company, Milwaukee, Wisconsin.

Driver Dan Says: «Cushioning the road shocks means comfort in the cab . . . as well as saving the truck and its motor.»

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This improved type of Velocity or "Current" meter, with hard rubber turbine wheels revolving on jewelled bearings, was a NEPTUNE development.

It will accurately measure millions of gallons of water—continuously, full volume flow, year after year—with practically NO WEAR.

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The Trident Crest is only one of a number of Trident Meters for every condition of water-revenue production. Write for Catalog.

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Over 5¼ million Trident and Lambert Meters have been made and sold the world over. Famous for the positive movement of the disc; for interchangeability; for sustained accuracy. Known as "THE CASH REGISTERS OF THE WATER WORKS FIELD."

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VOLUME V | MAY 10, 1930 | NUMBER 9

April was a month of engineering conventions—five being held throughout the Far West on adjoining or overlapping dates. These conventions—the spring meeting of the American Society of Civil Engineers at Sacramento, the annual meeting of the Pacific Northwest Section, American Water Works Association, at Portland, the spring conference of the California Sewage Works Association at Sacramento, the annual meeting of the Montana Section, American Water Works Association, at Missoula, and the annual meeting of the Arizona Public Health Association at Phoenix—drew a total registered attendance of 1200. Four of the conventions are reported elsewhere in this issue and that of the Montana Section, A.W.W.A. will be reviewed in a following issue. Each convention brought the combined engineering experience and thought of its area and field to a common center where, by the formal discussion of prepared papers and informal round table discussions, much information was made available. The contacts which these conventions offered were both pleasing and instructive; the social features offered were a means of increasing these contacts.

An Engineering Convention Month

Associations are growing so numerous that we can usually find one convention, at least, in session whenever we visit a large city. It has become a problem for many engineers, contractors, and equipment and materials manufacturers and distributors to decide which convention they should or can attend.

'State Supervision of the Design and Construction of Dams' was one of the main topics of discussion at the Spring Meeting of the American Society of Civil Engineers at Sacramento, and many worthwhile suggestions were made by M. C. Hinderlider, state engineer of Colorado, and others. Among the suggestions was the necessity for a state-aid laboratory—in California particularly—for testing models of various types of dams, and for completing the 'Stevenson Creek Arch Dam Test' and similar scientific investigations. Those interested have in the past failed to secure this much-needed support from the California state legislature. Since the failure of the St. Francis and other dams, and the establishment of state supervision of dam construction, the state legislature should have become 'dam' conscious. If all engineers and contractors will bring the necessary pressure to bear, it should be possible to secure this adequate financial support from the next legislature.

State Aid Research in Dam Design

Commenting on the enactment by the Legislature of Arizona, in March, 1929, of a law requiring state supervision and control of all dams, W. W. Lane, state engineer, stresses the following: "Certain it is that if the state can avert a single disaster by virtue of the execution of the duties of this Act, then the value of the law is beyond question. * * * If the State of Arizona is to have uninterrupted development of its irrigation and power resources, there must be no failure of dams, nor must dangerous conditions be permitted to exist indefinitely."

We have placed a big responsibility on the engineers employed to pass on the stability of dams, and we should give them all the assistance possible.

Commenting editorially in the June 10th, 1929, issue on the Boulder canyon project—at the time that some engineering periodicals were pessimistic about the dam being constructed—we made the prediction that "Regardless of what transpires, the Boulder canyon project will be constructed". Considerable opposition from various sources 'transpired', but every requirement has now been met. No time has been lost, as it has taken the interval since past-President Coolidge signed the Swing-Johnson Boulder Dam Bill on December 21, 1928, to prepare detailed plans.

Black Canyon Dam

President Hoover has asked Congress for an immediate appropriation of $10,600,000 in order that work on the railroad, camps, diversion tunnel, etc., may be started at once. Commencement of work on the Black canyon dam—again, we urge that it be named the Hoover dam—comes at an opportune time.

Fortunately for the city of Seattle, the low bidder on the substructure for the Lake Union bridge, described by F. W. Crocker elsewhere in this issue, was a firm of experienced contractors, adequately organized, financed, and equipped to undertake such a difficult job. We say fortunately, as it would have put the city council in a difficult position if the low bidder was a 'newcomer' in the business.

'Skill—Integrity —Responsibility'

Anyone who reads of the construction problems incident to this project, should appreciate the necessity for selecting contractors thoroughly conversant with and capable of undertaking a particular job.

Lake Union Bridge, Seattle, Washington

Engineering Features—Cantilever Arch With 800-ft. Main Span on State Road No. 1 for Washington Division of Highways

Construction of the Lake Union bridge over the westerly arm of Lake Union at Aurora ave. can continue without interruption, due to the recent voting of a $1,000,000 bond issue by the citizens of Seattle, Washington. The estimated cost of the project, including damages, right-of-way claims, and approaches, is $4,500,000, of which the bridge proper will cost $3,500,000. The total cost will be shared equally by the state of Washington, King county, and the city of Seattle.

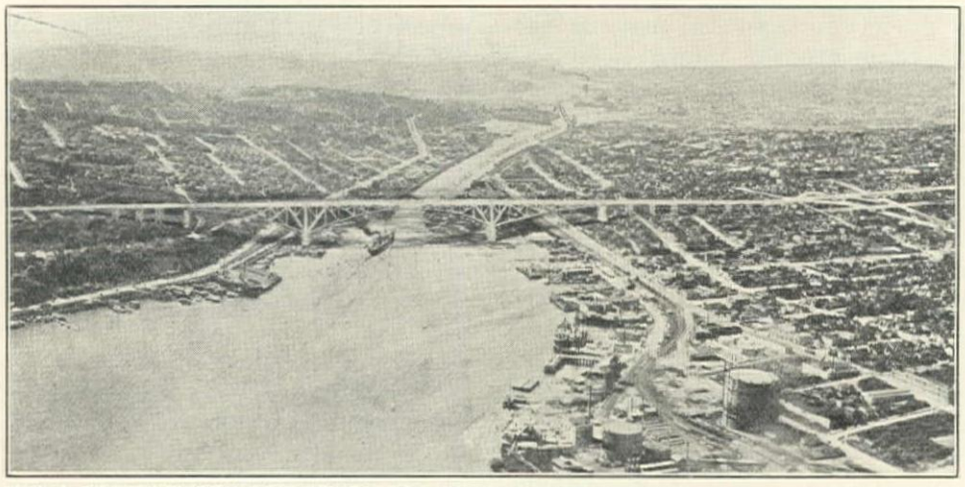


FIG. 1. CANTILEVER ARCH STUDY FOR AURORA AVE. CROSSING, LAKE UNION BRIDGE

This bridge is primarily for through traffic on the Lincoln and Pacific highways. It will relieve the present congestion on the Fremont bridge over the Lake Washington ship canal, and will to some extent reduce traffic on the University st. bridge.

Fig. 2. Alternate Locations for Lake Union Bridge, Seattle. (Aurora Ave. Crossing Selected)

Description—The main structure is to be of the cantilever arch type, with an 800-ft. center span, of which 150 ft. will be the suspended span. The anchor arms will be 225 ft. long on the north and 200 ft. on the south end. There will be three 75-ft. steel spans carrying the bridge approach to high ground on the east side of Queen Anne hill (the south end of the structure) and one 600-ft. reinforced concrete viaduct on the north approach.

The vertical clearance as required by the War Department will be 135 ft. above the regulated high-water level of Lake Union and will prevail over a width of 150 ft. The maximum clearance at the center of the suspended span will be 139 ft. The vertical clearance might be compared with that of the Brooklyn bridge, which is 133 ft. above high water.

There will be a 57-ft. roadway, designed for four 9-ft. traffic lanes, with a 10.5-ft. lane adjacent to each curb. In addition, there will be two 5-ft. sidewalks. The bridge is to carry highway traffic only.

Foundation Conditions—The following extract from a supplemental report upon 'Location of Proposed Bridge over Westerly Arm of Lake Union' by the firm of Jacobs & Ober, consulting engineers, Seattle, to Samuel Humes, director of highways, state of Washington, describes foundation conditions in the vicinity for which bridge studies were desired:

> There is no evidence of any rock formation within reachable depths upon which piers for the main structure could be founded.
>
> The shores of Lake Union from Fremont ave. to Stone Way pitch steeply to a maximum depth of 42 ft., and this depth obtains quite uniformly over the major portion of the lakebed. The immediate lakebed is mud, of a thickness varying from a few feet near the shore lines to maximums of 63 to 142 ft. at the various crossings under consideration. Underlying this mud are strata of sand and clay, with occasionally thin strata of gravel and hardpan. These strata, which are not highly resistant and are easily penetrated with a boring jet, except as to the hardpan at Aurora ave., vary in thickness in the aggregate from 2 to 148 ft., the shallower depths being near the north shore.
>
> Underlying these intermediate strata is a material which is

either firm gravel or is gravel which has accumulated in the path of the jet. But, in some cases, hardpan lying at maximum depths below Lake Union of 186 to 238 ft. for the several crossings is indicated by the borings available.

Selection of Site—Designs for through cantilever bridges, suspension bridges, and cantilever arch

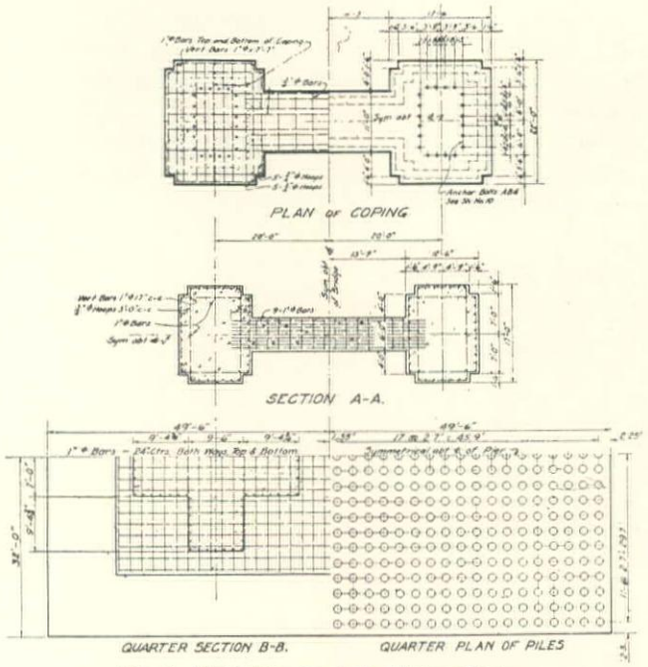


Fig. 3. Main Pier for Lake Union Bridge

bridges were made at the routes designated on Fig. 2. From these data Table I was prepared by Jacobs & Ober, in which a comparative ratio of costs is shown for the different crossings:

TABLE I

Cost Estimates of Main Structure, Exclusive of Approaches

Location	Relative Cost	Average Cost over Aurora Ave.
Aurora ave.	100%	.....
Whitman ave.	107 to 109%	8%
Albion place	121 to 149%	29%
Stone way	137 to 190%	53%

After preparing the above estimates and investigating the economic layout from many angles, these engineers concluded as regards the Aurora ave. crossing that:

1. It is the shortest route.
2. It affords the best alignment, excepting that at Albion place.
3. It has the lowest and shortest approaches, which means a lower construction cost and smaller damage to abutting property.
4. The length of the main structure (the channel spans proper) is the least for all routes considered.
5. The cost of construction is the least of all routes considered.
6. The apparent savings in cost of bridge and approaches as compared with other locations is estimated to range from $350,000 for Whitman ave. to $2,000,000 to $5,000,000 for Stone way.
7. The time of construction is the least for all routes considered, with the possible exception of Whitman ave.
8. On account of higher ground levels for approaches along the Aurora ave. route, any adjustment which may be required by the Federal Government as to the vertical clearance, involving an increase in height of bridge, can be met with less expense at Aurora ave. than at Stone way.
9. If from consideration of appearance or for other reasons the final decision favors a suspension bridge, it should be said that Aurora ave. offers the best location for that type.

This preliminary investigation was started by Jacobs & Ober at the request of Samuel Humes about January 1, 1928. The cantilever arch type was selected, as was the Aurora ave. crossing. The main piers were designed, and a contract was let in December, 1929. The State expects to call for bids on the rest of the work in the near future. This part will be divided into two contracts, one of structural steel work and one for all concrete work, excepting main piers.

Main Piers—Construction of the two main piers and the north anchor pier is in progress, but work has not yet started on the south anchor pier. The cofferdams are about completed, excavation has begun, and it is expected that work on the bearing piles will be well under way by May 15.

There will be 828 timber piles in the south main pier and 684 piles in the north main pier, the length

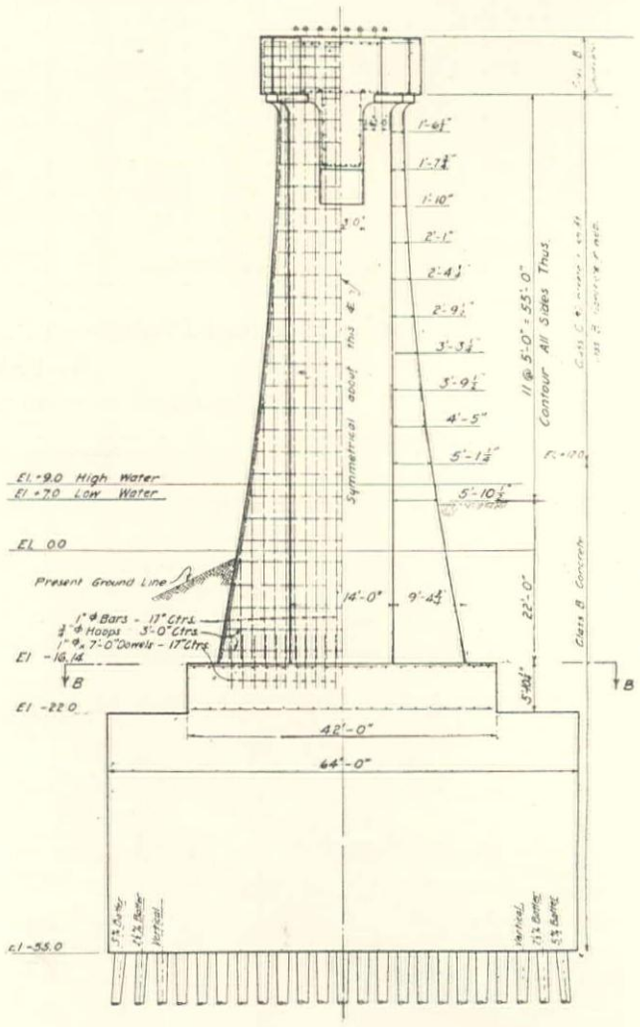


Fig. 4. Main Pier for Lake Union Bridge

of piles being 110 to 120 ft. These piles will be driven to a depth such that their tops are 50 to 55 ft. below the water surface. The work will require a specially-designed pile driver with long, subaqueous leads.

The Pacific Bridge Co., of Portland, Oregon, was awarded the contract for erecting the two main piers and two anchor piers on a bid of $502,274, or about $86,000 below the second and remaining bidder, the General Construction Co., Seattle. Principal items in the contract, divided by piers, are shown in Table II.

Steel Design—In general, the working stress for tension members was taken at 50% of the yield point. A large amount of silicon steel will be used in the superstructure. The working tensile stress for silicon steel was taken at 24,000 lb. per sq.in., and in compression the formula

$S = 22{,}500 - 75\frac{l}{r}$ was used, with a maximum allowable stress of 18,500 lb. per sq.in. Shear on the gross section of the web for silicon steel was taken at 14,000 lb. per sq.in

Each section was designed from an economic standpoint, and the type of steel which would give the least cost used. It was estimated that a saving in weight of one ton in the superstructure would mean an average saving of $70 on the project.

Personnel—Design and supervision of construction is handled by the state of Washington, with Samuel Humes, director of highways, in charge. T. G. McCrory is chief engineer of the Division of Highways and George H. Shearer is the district engineer. R. M. Murray is resident engineer and also engineer of design for the State, and E. G. Osborne is the assistant resident engineer. Jacobs & Ober, Seattle, are the consulting engineers and the actual design is being done in their offices.

TABLE II

Division and Contract Price of Work on Main Piers

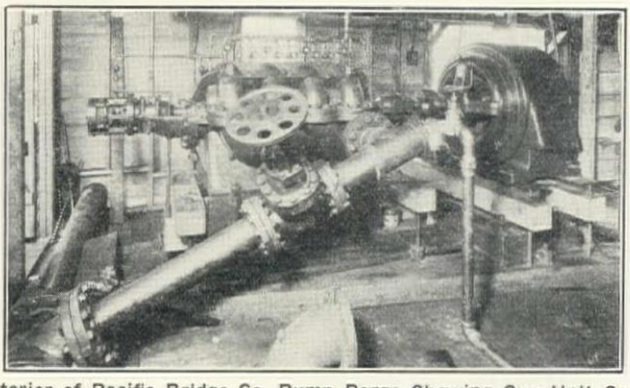
Item	Unit	South Anchor Pier	South Main Pier	North Main Pier	North Anchor Pier
Clear and Grub	Lump	$200	$1000	$1000	$500
Structure Excav.	Cu.Yd.	2,000 at $ 2.75	12,800 at $ 7.80	5,540 at $12.00	1,700 at $ 5.30
'B' Concrete, Dry	Cu.Yd.	1,089 at $10.00	2,070 at $10.00	1,769 at $10.00	1,320 at $11.00
'B' Concrete, Wet	Cu.Yd.	.....	6,870 at $ 9.00	6,185 at $ 9.00	800 at $10.00
Spec. Backfill	Cu.Yd.	1,100 at $ 1.75	5,000 at $ 1.00	.....	.....
Reinf. Steel	Lb.	146,000 at 4½¢	67,000 at 4½¢	56,000 at 4½¢	80,000 at 4½¢
Anchorage Steel	Lb.	59,000 at 7½¢	2,800 at 7¢	2,800 at 7¢	6,800 at 7½¢
Steel Sheet Piling	Lb.	.....	930,000 at ½¢	.....	.....
Timber Bearing Piles	Ft.	.....	100,000 at 32¢	41,000 at 18¢	9,200 at 16¢
Drive Piles	Each	.....	828 at $20.00	684 at $21.00	230 at $10.00
Steel Rails	Lb.	.....	23,000 at 2¢	22,000 at 2¢	.....

Construction Problems of Lake Union Bridge Substructure

By F. W. CROCKER

Chief Engineer, Pacific Bridge Co., Portland, Oregon

General—The normal water surface of Lake Union is at +7 ft. and the high water at +9 ft., referred to the city of Seattle datum. The two main piers—S1 on the south and N1 on the north shore—are the only ones which involve difficulties in construction. Pier S1 has a base 99 ft. long, 64 ft. wide, and 33 ft. deep,



Interior of Pacific Bridge Co. Pump Barge Showing One Unit Consisting of 8-in., 4-stage Buffalo Centrifugal Pump with 300-hp. G. E. Motor; 1100 g.p.m. at 350 lb. Pressure

the bottom of the seal concrete being at elev. –55 ft. (On pier N1, the bottom of the seal concrete is at elev. –52 ft.) As a 33-ft. column of concrete is more than sufficient to balance a 64-ft. column of water, this can be classed as a full gravity seal, that is, the weight of concrete in the seal is more than sufficient to balance the upward hydrostatic pressure on the bottom, without causing uplift on the foundation piles.

Ground surface at this pier varies from +12 to –20 ft., making a total depth of excavation of 67 to 35 ft. The Northern Pacific railway has a track whose centerline is 10 ft. from the southwest corner of the pier, and which must be kept in operation. The necessity for foundation piles and for maintaining existing ground level around the cofferdam made this pier a steel sheet pile job, and it was so specified by the engineers.

A survey made in 1895 gave the elevation of the lake as –22 to –30 ft. at the pier site, indicating that a 12 to 34 ft. fill had been made over the pier site, and that there was a possibility of encountering rubbish and debris of various kinds during the driving of sheet piles. Subsequent events have borne this out, and three locomotive tender tanks have so far been dug out from under the edge of the sheet piles.

Sheet Piling for Pier S1—The Lackawanna deep arch section DP165, weighing 25 lb. per sq.ft. of wall, was chosen, and 72-ft. lengths were provided to give a top elevation of +11 ft. and a bottom elevation of –61 ft., or a 6-ft. toe below the bottom of concrete. This we think amply sufficient, as no great pressure can come on the sheet piles until after the seal is in place and the cofferdam unwatered.

Preliminary excavation was made to elev. –5 ft. before setting sheet piles, which was all the engineers would permit on account of their fear of undermining adjoining property. This required an elevation of +139 ft. for the top of an interlocking sheet pile when

it was entered into one already set, and a steel guy derrick with 140-ft. mast and 120-ft. boom was rigged at the center of the pier for this purpose. The step of this derrick was at elev. +20 ft.

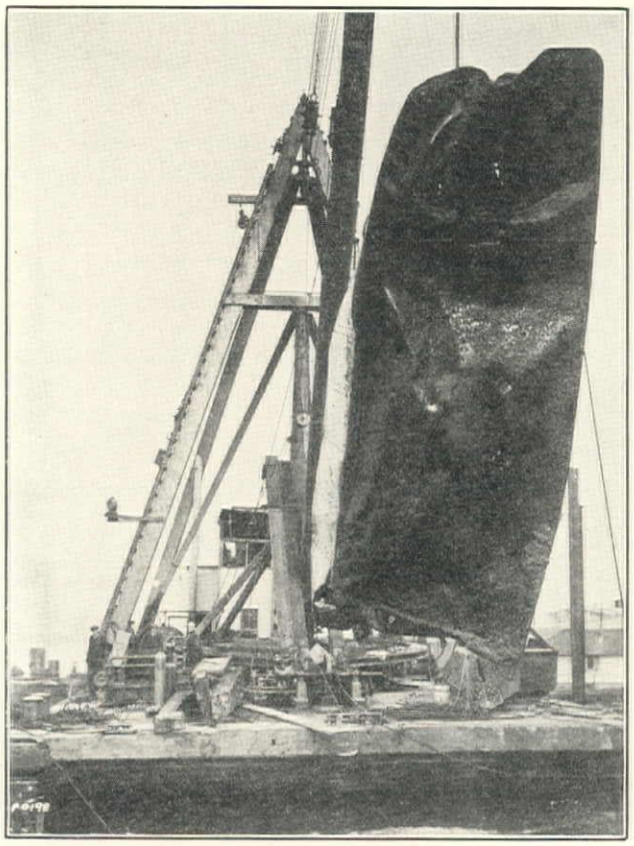
Falsework was driven over the site of the pier for lowering the steel wales into position and later to serve as falsework for the skid driver to be used in driving foundation piles. A guide frame with brace piles was built on all four sides to hold the sheet piles upright. The top of the guide frame on the two high sides was at elev. +40 ft. This falsework was driven with a floating driver. The sheet piles were set with the guy derrick and the closures made before starting to drive them. Driving was done with an 11-B2 McKiernan-Terry hammer hung from the boom of the guy derrick, which, because of its central position, could reach any sheet pile. Considerable excavation and diver work was necessary in removing obstructions from under the toe of the sheet piles.

Borings at this pier site disclosed sand varying from fine to coarse, fine gravel up to ½ in., and a few thin layers of hard, packed clay. It was necessary to use the jetting equipment which had been rigged for the foundation piles for getting nearly all of the sheet piles down to grade. Even then it was necessary to rehead several of the piles where they had been battered by the hammer.

In penetrating 67 ft. of ground, the friction is so great that the blow of the hammer cannot overcome it, and the energy of the hammer is all expended in battering the pile head. In my opinion, no sheet pile driving of such depths as this should be attempted without adequate jetting equipment. A single 5-in. jet pipe was used on this pier, which was about all that could be handled efficiently from the boom of a guy derrick.

Steel Wales and Struts for Pier S1—The foundation piles for S1 are of great length and size and, as they are driven on 2.7-ft. centers, there is not much space left for cofferdam struts. Therefore, the design of struts and wales became a problem in conserving space. The specifications permitted only three lines of struts in the width of the cofferdam and five lines in its length, and the large bays required precluded the use of timber wales. A system of steel wales and timber struts somewhat similar to that used in the New Jersey tower of the Hudson river bridge was worked out. These were designed for hydrostatic pressure, with the water surface at +11 ft. for all wales down to the top of the sea at -22 ft. Bethlehem 18-in. girder beams were used for wales, with timber struts up to 14 by 16-in. and 64 ft. long. All transverse struts were made without splices. The full effect of continuity was considered in the design and, for economy in steel, the end panels with one free end were made shorter than the intermediate panels where both ends are restrained. The steel struts are an expensive feature of construction, and this design resulted in considerable economy. Maximum stresses were 20,500 lb. per sq.in. for steel in combined bending and compression, and 920 lb. per sq.in. for end compression on timber.

All struts and wales placed below the top of seal receive stress only from the excess of ground pressure on the outside, over water pressure on the inside. How much this is, if anything, is problematical. To provide for such stresses as may exist, a movable wale equal in strength to the first wale above the top of seal was provided. The intent is to assemble this wale first, then the four stationary wales immediately on top of it, with all bracing in place. The whole assembly is lowered to position as rapidly as excavation will permit. Thereafter, excavation is completed to elev. -38 ft., and the movable wall is driven to its final position at elev. -37 ft., with twelve 8 by 10-in. driving struts distributed around its perimeter and extending



Derrick Scow 'Ajax' Holding Locomotive Tender Tank Pulled from Under Sheet Piling for Pier S1, Lake Union Bridge

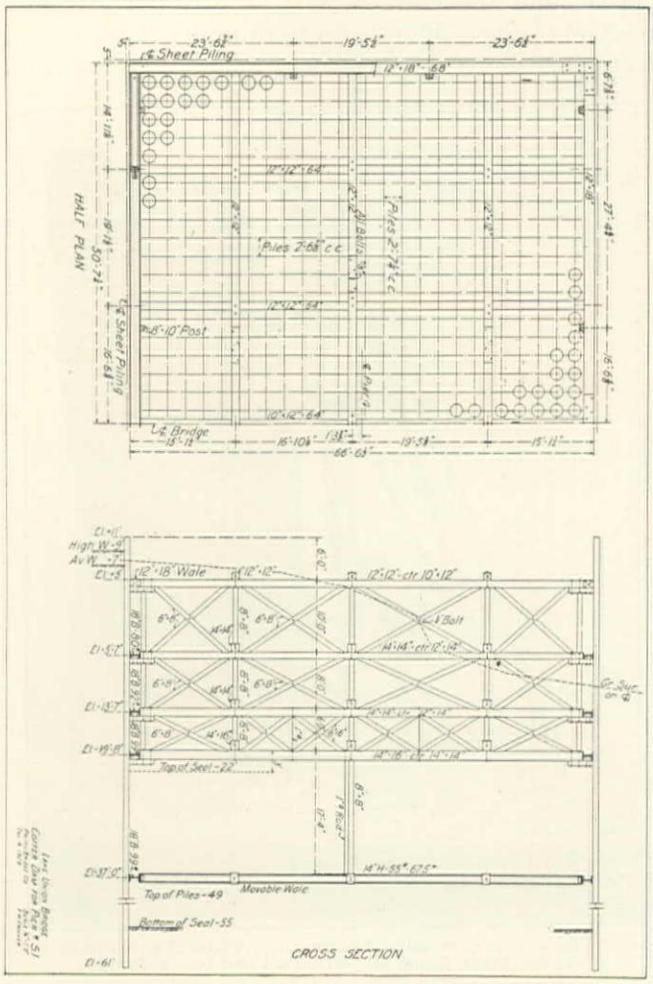
to above the water surface. Then the excavation is completed to elev. -55 ft. To prevent the movable wale from binding against sheet piles that have been forced in during driving, this frame is made 4 in. shorter on each side than the stationary wale. If binding still occurs, it must be rectified by jetting or excavating on the outside of the misaligned sheet piles. The top wale is at elev. +5 ft. and the pressures on it are small. A 12 by 18-in. timber wale is therefore used at this point, a 68-ft. length being required for the ends of the cofferdam.

The ideal way to build a cofferdam of this kind would be to set all the stationary wales and lower them to final position before setting any sheet piles, preliminary excavation being made for this purpose. Then excavation could be made and the movable wale forced down to position. This would eliminate all binding on the stationary wales and would avoid overstressing them while driving. This was the method planned for the Lake Union bridge substructure, but

was not realized because the engineers were reluctant to permit enough preliminary excavation so that the stationary wales might be placed in final position in advance of the sheet pile driving. Also, delays in getting the steel wales—all of which involve special sections—from the east, put their delivery behind that of the sheet piles.

About 15 ft. of driving is required on the stationary wales for pier S1.

As the movable wales must stand with little bracing, the transverse struts were made of 14-in. Bethlehem H-sections, 55 to 67.5-lb., and the longitudinal timber struts were framed between them. The single length transverse H-beams furnish the rigidity for the movable wales. In addition, a line of vertical struts and tie rods extending to the first stationary wales are to be placed on the pier centerline by a diver. These operations have been only partly completed for pier S1.



Half Plan and Cross-Section of Cofferdam

The steel struts and wales were fabricated in Seattle by the Wallace Bridge & Structural Steel Co.

Jetting Equipment for Pier S1—Foundation piles for pier S1 are specified to penetrate to elev. –141 to –177 ft. With the bottom of seal at elev. –55 ft., this means that piles 100 to 130 ft. long must be driven to cutoff with a subaqueous driver.

Jetting equipment consisting of four streams capable of giving 300 lb. nozzle pressure through 1-in. nozzles was specified. This means about 2000 g.p.m. pump capacity at 350 lb. pressure. Two 4-stage Buffalo centrifugal pumps with 16½-in. impellers, each of 1200 g.p.m. nominal capacity against 775 ft. head, were furnished, with two 300-hp., 2200-volt General Electric motors to drive them. At our request, the engineers accepted two 1000 g.p.m. streams at 300 lb. pressure in lieu of the four 500-g.p.m. streams specified. This permits much simpler tackle for the raising of jets; also, it makes two less hose to tangle with the two air hose already leading to the hammer used in the driving operation. Two jets were adopted and the jet pipes were made of 5-in. extra strength pipe with hydraulic couplings, the nozzles being of cast steel, with $1\frac{1}{16}$-in. diam. openings. The United States Rubber Co. furnished the 5-in. jet hose to the 350-lb. specification.

The pump discharges were piped into one main, thus permitting either pump to run either jet, or one pump to run two jets, or both pumps to force their combined discharge through one jet, as may prove necessary. In the latter case, a larger nozzle is necessary so as not to raise the pressure on the hose or pump over 350 lb. per sq.in. As to which of the two elements—pressure or volume—is most effective in securing penetration, our experience so far is in favor of volume. It has already been necessary to use both pumps delivering through one nozzle to secure the final penetration for sheet piles on pier S1.

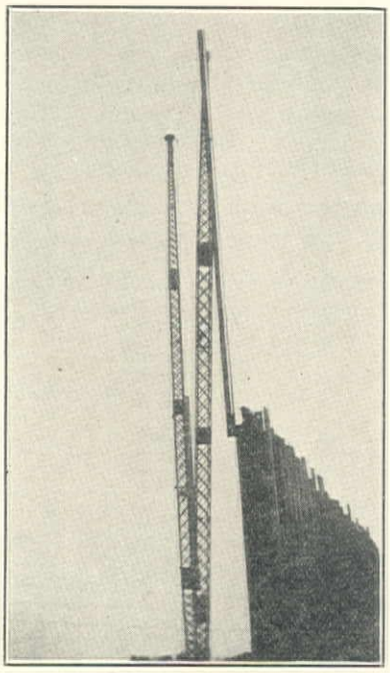
The piles for pier S1 must be driven with a skid driver. To permit moving such a large driver at reasonable cost, as much of the weight as possible must be kept off the driver. To this end, the jet pumps and motors and the compressor for furnishing air for the hammer and its motor, were mounted on a separate machinery barge, to be moored alongside the pier on which the driver is working. The 2000 g.p.m. of jetting water is transferred to the driver piping from the pump barge through 65 ft. of 7-in. hose, designed for 350-lb. pressure. Advantages of this arrangement are that it permits the main jetting equipment to be used for driving sheet piles before the completion of the skid driver; also, it makes a much safer place for a large electrical installation than is the stern of a skid driver. Pumps and motors for the machinery barge were furnished by the Cascade Machinery & Electric Co., of Seattle.

The 5-in. hose has a ⅛-in. rubber tube, 12 ply of 36-oz. duck, and wire insertion between the 10th and 11th ply, and a 3/64-in. rubber cover; the total wall thickness being about 1 in. The 7-in. hose has 14 plies of 36-oz. duck and 2 layers of ⅜ by $\frac{3}{32}$-in. flat wire filled between the spiral with rubber, and has a tube and cover similar to the 5-in. hose. A difficulty about this high pressure hose which may prove serious is its lack of flexibility.

Pile Driving on Pier S1—Borings for this pier below the bottom of seal disclose sand from fine to medium, interspersed with layers of hard, bluish clay up to 4½ ft. thick, and some fine gravel up to ½ in. diam., terminating in 10 ft. of medium soft clay and then in hard clay. Some layers of cemented sand are also disclosed. The hard clay varies in elevation from –141.6 to –177.2 ft. Specifications require that piles shall penetrate to the hard clay and also give the capacity of jetting equipment.

Douglas fir piles 100 to 130 ft. long will be required,

even if driven with an underwater hammer. These were ordered immediately after the award of contract from the K. & K. Timber Co., of Everett, Washington, in order to give the company plenty of time to accumulate the long piles before they would be needed in the work. As driving must be done by a skid driver running on falsework at elev. +20 ft., it was necessary to keep down the weight of the driver. The height



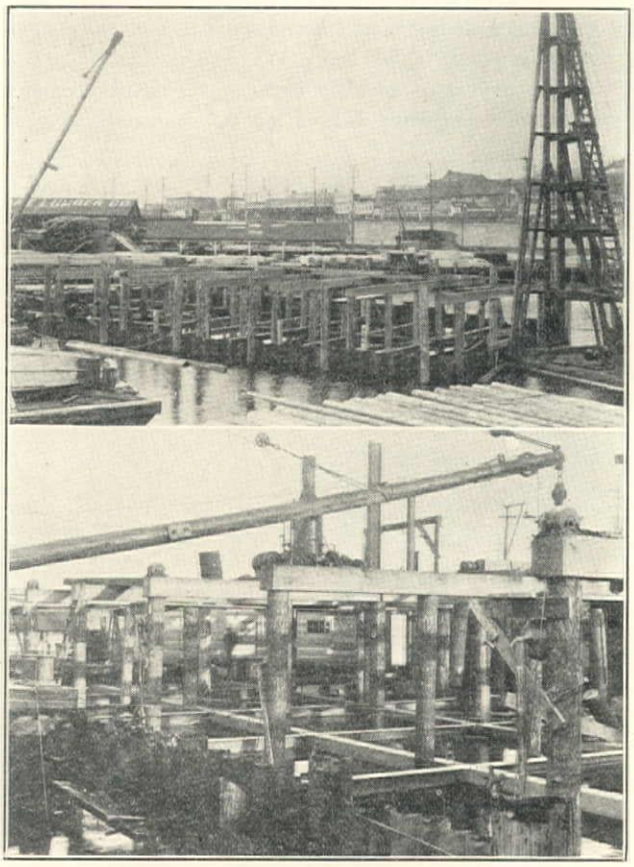
Steel Guy Derrick Setting 72-ft. Interlocking Sheet Piling at Site of Pier S1, Lake Union Bridge

of leads selected was 110 ft. and the length of the two 5-in. jet pipes was 130 ft. This would give elev. +150 ft. for the head of the jet when lifted over a falsework cap and -40 ft. for the same when the point has reached the deepest clay stratum. It is thought that jetting can be successfully done with the head of the jet 47 ft. below water level, but a diver's services will be required in placing the jet point in position to go down along the pile. The jet cable must be attached centrally to the head of the jet to avoid tendencies toward departures from the vertical in jetting. When lifting the jet over a cap, this connection must be broken and attachment of the cable made at a point 40 ft. lower down on the jet. Quick shift of these lines is provided by suitable permanent shackles in both positions.

To guard against wind pressure and give stability to such a high driver, four gunwales have been provided, the outer ones being 20 ft. on centers. There are about 18,000 f.b.m. of timber in the driver frame. Three engines are needed to operate this driver—the 8 by 10-in. main engine farthest aft operating the drop leads, hammer, and pile line; the 9 by 10-in. jet engine operating the two jets; and the fleeting engine operating the head and stern, port and starboard lines. The latter engine does not require a separate stationary engineer.

The hammer is guided in its course below water level by a set of steel drop leads, 107 ft. long. These are made of two 10-in. ship and two 7-in. standard channels, equipped with dogs on the bottom yoke to hold the pile in position with nails. When the hammer starts, these nails are driven loose and the dogs release. This is similar to many underwater hammer installations made in the past. The weight of the steel drop leads is 10,000 lb.

Driving will be done by a McKiernan-Terry 11B-2 hammer operating by compressed air to avoid condensation of steam in underwater hose. Such a hammer can exhaust directly into the water about as efficiently as by carrying the exhaust above the surface. That feature means one less hose to become tangled with other hoses leading to the hammer and jets. The



Pier N1, Showing Falsework, Sheet Piles in Place, and Movable Steel Wale Assembled Ready for Lowering. (Lower) Pier S1 at Similar Stage. Note Battered Condition of Sheet Pile Heads

hammer requires 1200 cu.ft. of free air per minute, and an Ingersoll-Rand X-B2 two-stage, motor-driven compressor with large receiver capacity is provided. This compressor is driven by a 150-hp., 2200-volt General Electric motor, both motor and compressor being mounted on the pump barge with the jet pumps. Compression will be to 130 lb., allowing 30 lb. for loss in friction and overcoming the back pressure in the chamber line when the hammer operates at maximum depth. As this gives a net pressure on the hammer of 100 lb. at maximum depth, it is hoped that the device will operate at full efficiency of 120 blows per minute.

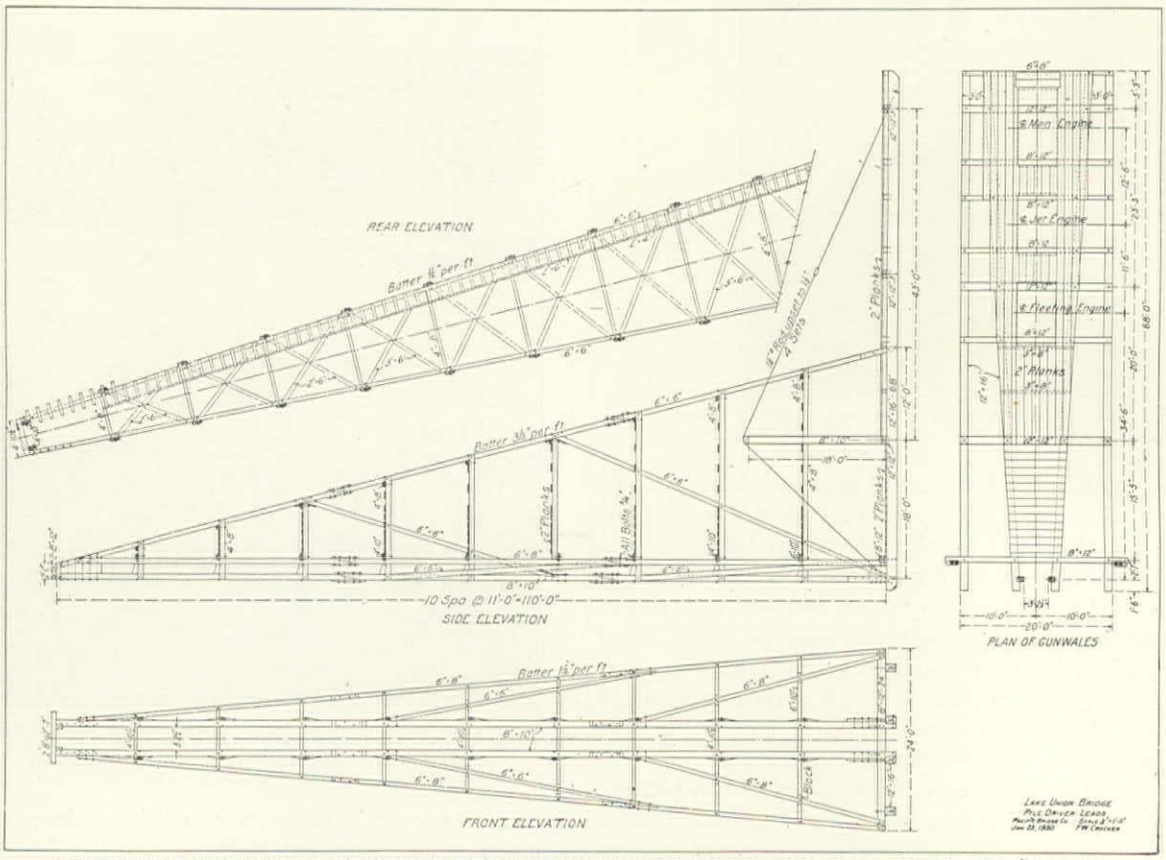
The driving of piles for pier S1 is by far the most difficult feature of the contract, and the success of the pile driving will determine the outcome of our undertaking. It may be that radical changes will be necessary in some of our plans before this driving is completed.

Pier Excavation—Excavation will be done by a

3½-yd. clamshell bucket operated by the 45-ton derrick scow 'Ajax'. This bucket has a Williams mechanism operating a bowl with rounded corners, as developed by our superintendent, A. H. Graham. There are many operations on this work requiring a powerful floating derrick, and as our company has no such equipment on Puget sound waters and none was available for rental, the 'Ajax' was towed from Portland to Seattle during January. The sea-going tug, 'Roosevelt' of Seattle, made the tow and the passage was successful. The bow rake of the 'Ajax' was sheeted first with wood and then with metal. When the scow arrived in Puget sound, practically all of the extra sheathing had been torn off by wave action during the stormy passage. We are in favor of postponing future trips of this kind until calm weather.

Operations for Pier N1—Pier N1 has a base 57 by 115 by 28 ft., the bottom of concrete being at elev. –52 ft. The average ground level at the pier site is at elev. –29 ft. The same construction methods were chosen as for pier S1, and 70-ft. sheet piling was used. On account of greater depth of water, all these piles can be set and driven with the derrick scow, no guy derrick being necessary. Sheet piling for this pier must be driven to elev. –59 ft., or to only 30 ft. penetration. Borings disclose that foundation piles will reach a satisfactory hard stratum in about 60 ft. of length. The overlying material is sand and fine gravel, with occasional thin strata of clay, and the pile driving here should be a simple matter for the powerful equipment assembled for pier S1. On account of the accessibility to floating equipment, and the shallow depths of excavation required, this would have been a good pier to construct by timber crib methods.

Concreting—There are 7744 cu.yd. of tremie concrete in the seal of pier S1 and 6800 in the seal of pier N1. These must be placed as rapidly as possible so as to avoid layers of laitance within the seal. The specifications require a concreting capacity of 150 cu.yd. per hour for these parts of the work. This means a floating concrete plant with two 2-yd. mixers, or else the use of ready-mixed concrete from some of the Seattle plants which are prepared to furnish it. The latter would involve heavy expense in building trestles for access to the pier sites. Also, traffic conditions on adjacent streets are bad, and it is not thought that 150 cu.yd. per hour could possibly be taken through this traffic at certain hours of the day. So a contract was made with the Crosby Lighterage Co., of Seattle, to build the floating plant and to deliver concrete alongside the piers, our company to furnish the tremie equipment, hoist towers, and all other equipment for placing concrete. 'Rex' mixers will be used. As no concreting will be done until June, hoist towers will not be needed until July.



LEADS AND GUNWALES DESIGNED FOR DRIVING 100 TO 130-FT. DOUGLAS FIR PILES ON MAIN PIERS, LAKE UNION BRIDGE

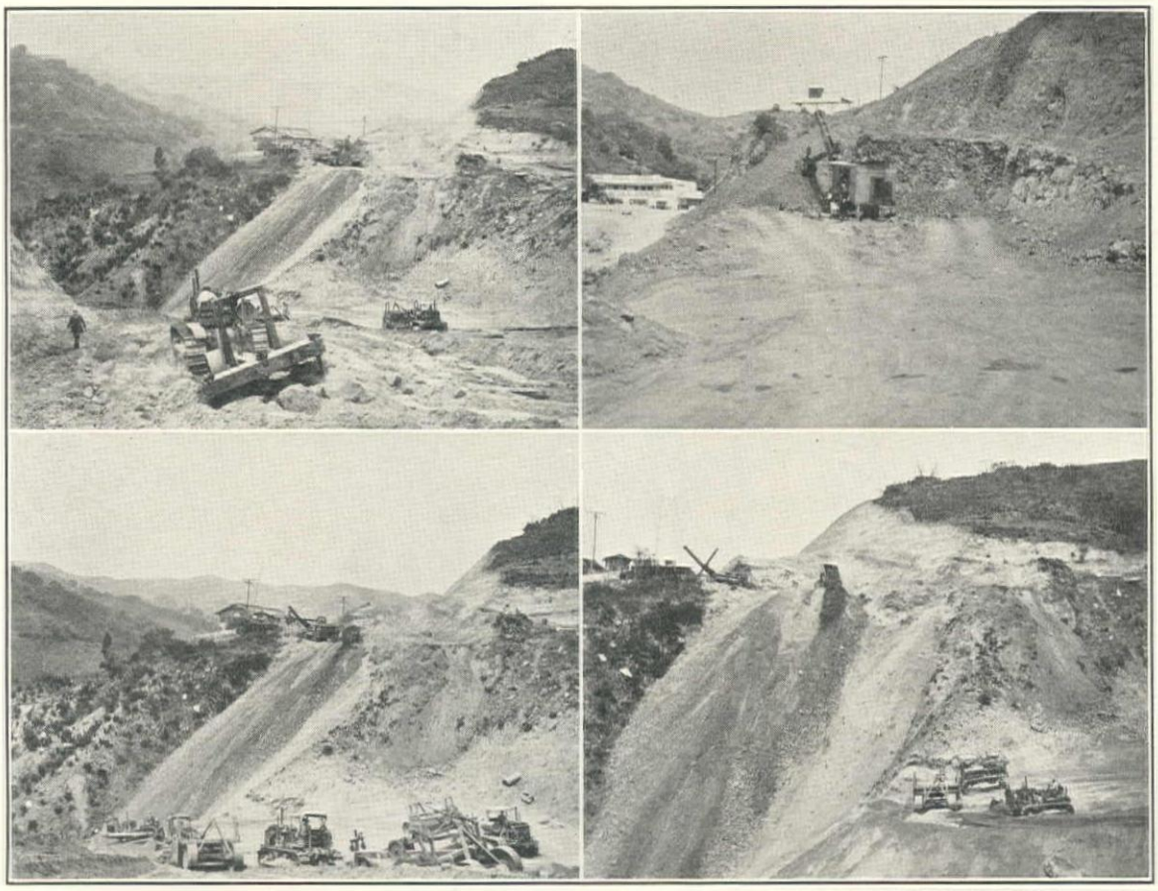
Other problems remain to be solved. An elaborate system of pile loading and pulling tests is required. Piles driven 100 ft. in the ground must be started with hydraulic jacks so as to determine the pulling resistance, and then pulled out entirely with jets so that the points can be examined. For these tests piles 160 to 170 ft. long are necessary.

Personnel—Philip Hart is manager of the Pacific Bridge Co., for which I am chief engineer, and A. H. Graham is superintendent of construction.

Topanga Canyon Road, Los Angeles County, California

Topanga canyon is the largest canyon in the Malibu mountains, Los Angeles county, California, and has many tributary roads. The canyon road forms a connecting link from Santa Monica via the Roosevelt highway to the interior country, terminating at the town of Girard on Ventura blvd. It is the principal one of four roads through the region.

There are many farmers in the canyon, much of the land being devoted to grazing. Before completion of the Roosevelt highway, as many as 1700 cars passed Topanga springs on Sundays. While construction of that highway has somewhat reduced the traffic count, there is still urgent need for a short and modern outlet through the mountains, such as will be available when Topanga canyon road is completed.



(UPPER LEFT) CATERPILLAR '60S' WITH LE TOURNEAU ROOTER AND 8-YD. SCRAPER ON 87,000-YD. FILL. (UPPER RIGHT) BUCYRUS-ERIE 1¼-YD. SHOVEL IN ROCK CUT NEAR TOPANGA SPRINGS. (LOWER LEFT) LEWIS CONSTRUCTION CO. CONCENTRATES HEAVY GRADING EQUIPMENT ON 87,000-YD. FILL. INTERNATIONAL 3-TON TRUCK UNLOADING IN BACKGROUND.

Status of Work—The portion of road from Girard to the summit of the Malibu mountains has been completed, and a 3.2-mile section from the summit to Katherine's kitchen is under contract and the grading will be completed by June, 1930. The last and largest section, 8 miles in length and involving 1,800,000 cu.yd. of excavation, remains to be graded. This section probably will be built in two portions, the first to be let in the fall of 1930 and the other in 1931.

Section from Summit to Katherine's Kitchen—the latest contract was let by Los Angeles county to the Lewis Construction Co., Los Angeles, on January 28, 1930, the contract time being 6 months, and price $97,972. The contractor moved in February 6 and began grading February 10, most of the work being completed by April 25. All trucking was sublet to Carl K. Bryan, of Pasadena.

Contract quantities included 334,423 cu.yd. unclassified excavation at $0.245; 3290 lin.ft. wire linked guard fence at $1.00; 390 lin.ft. 18-in. corrugated pipe at $2.00; 2585 lin.ft. 24-in. corrugated pipe at $2.25; 555 lin.ft. 30-in. corrugated pipe at $3.50; 180 lin.ft. 72-in. corrugated pipe at $17.00; 900 sq.ft. dry rubble facing at $0.50; 34 cu.yd. rubble masonry at $10.00; and 6 concrete catchbasins at $60.00. As extra work, several houses have been moved on skids and a service station at the south end of the project raised 8 ft. to meet the new grade.

The graded roadway is 50 ft. wide, with cut slopes of 1:1 and ¾:1 and fill slopes of 1½:1. The minimum radius of curvature is 200 ft. and the grade is 6%, compensated.

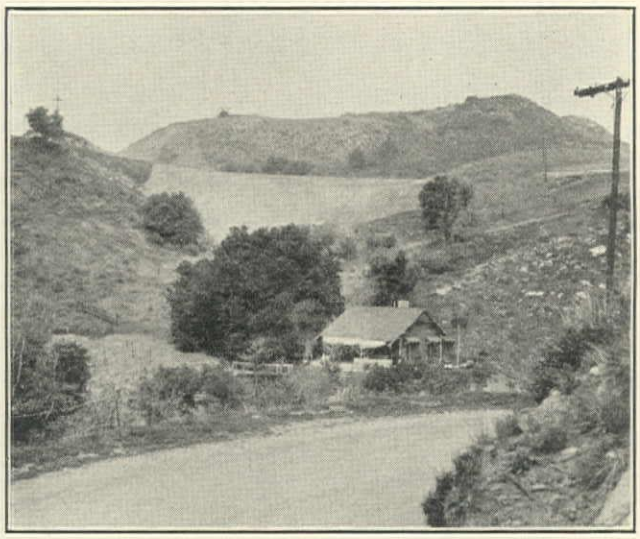
Construction Methods—To move 335,000 cu.yd. of earth and rock in the shortest possible time, heavy equipment was concentrated on the work. With two 1¼-yd. Bucyrus-Erie model DA2 power shovels operating 8 hours per day and tractor-drawn equipment

in use 24 hours a day, 139,000 cu.yd. was moved in March for a 26-day working month. The average daily yardage on the work was 4950. The largest fill (87,000 cu.yd), was made from a 55,000-cu.yd. cut at the south end and a 32,000-cu.yd. back-haul from shallower cuts on the north near the summit. Three Le Tourneau 8-yd. scrapers drawn by Caterpillar '60' tractors were used for grading, aided by a Le Tourneau ripper and bulldozer, a McMillan scraper, and an 8-ft. Russell blade. Caterpillar '30s' were used with the lighter equipment and one 12-ft. Rome blade was also available on the work.

On a 68% down grade, the tractor-drawn scrapers were able to handle heavy yardage at a load, where the equipment followed a specially prepared trench. In such cases, the tractor would push several cubic yards of material, the surplus flowing back over the cab and accumulating on the loaded scraper. Ordinary Ford headlights were placed on the tractors and drag equipment to facilitate night operation. While the shift operator took 20 minutes for lunch, a relief driver handled the tractor-drawn equipment; grading was stopped only between 3:45 and 4:10 p.m. to grease tractors and drags. An electric welding machine, mounted on a truck, was used in field repairs.

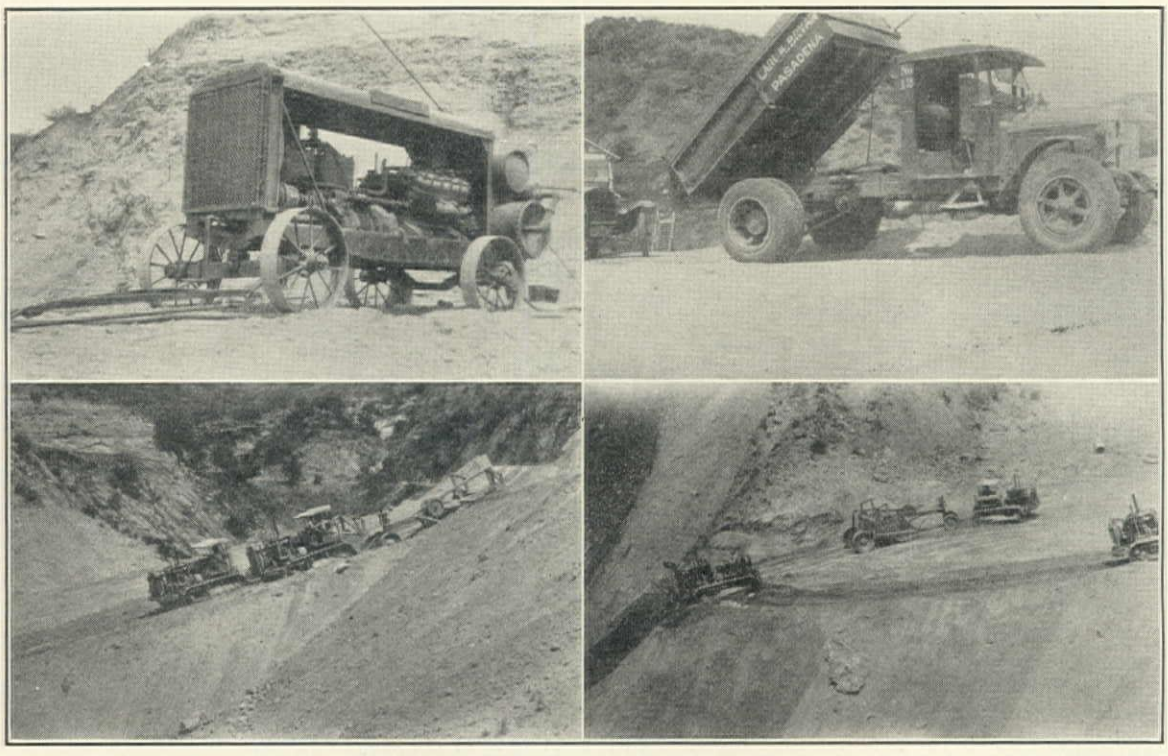
Two 3-ton Sterling and six 3-ton International trucks were used for hauling from the power shovels. Two Gardner-Denver model 310 and one Ingersoll-Rand portable compressors operated Gardner-Denver air tools; 1½ cars of Giant powder being required in the excavation.

Armco corrugated culvert pipe was used, a 72-in. diameter section being placed under a 55-ft. fill. Both 30 and 72-in. pipe culverts (8-gauge) were deformed 5% of the normal diameter by jacking out of shape. Their joints were field riveted, using holes drilled in the shop. On these large pipe, it was found hard to line up holes in the field and the work required a special Armco crew with special equipment.



A 55-ft. Fill on Topanga Canyon Road. Drainage Provided by 72-in. Armco Culvert Pipe Jacked Out of Round and Field Riveted

Personnel—Geo. W. Jones is road commissioner, O. F. Cooley assistant road commissioner, E. A. Burt construction engineer, and C. W. Sprotte assistant construction engineer for Los Angeles county; J. E. Rockhold being county surveyor. Thomas Shea was resident engineer on the Lewis Construction Co. contract, with C. M. Stains as his assistant. H. W. McKinley was superintendent for the general contractor and Nelson R. Smith foreman for the sub-contractor, Carl K. Bryan. A crew of 40 men was used on the work.



(UPPER LEFT) GARDNER-DENVER 310-C.F.M. PORTABLE COMPRESSOR ON TOPANGA CANYON ROAD. (UPPER RIGHT) STERLING 3-TON DUMP TRUCK AT TOPANGA SPRINGS. (LOWER LEFT AND RIGHT) CATERPILLAR AND LE TOURNEAU EQUIPMENT ON LARGE FILL NEAR SUMMIT OF MALIBU MOUNTAINS.

American Society of Civil Engineers

Spring Meeting at Sacramento, California, April 23 to 26, Sets a Record for Decentralized Meetings With Attendance of Nearly 800

The Sacramento section, formed in 1921 and with a membership of only 110—one of the livest of 50 local sections of the Society—finally achieved its desire to secure a zone or decentralized meeting and won national recognition in its conduct of the convention. This convention, the 1930 national spring meeting, in all details was a pronounced success—not a criticism being voiced.

The Sacramento ASCE's are like one family, being composed mostly of engineers in the various departments of the state and city and county governments, in frequent contact with one another. The weekly luncheons and monthly meetings of this section are unusually well attended, the subjects discussed varied, and many of the speakers of national prominence. This 'set up' insured good teamwork in and between the various committees which had the spring meeting in charge. It is true the San Francisco section assisted, but more in a financial way than through its personnel.

Another factor that contributed much to the success of this meeting was the setting—Sacramento in the springtime, with its elm-bowered streets and flowered gardens, is a beautiful spot. In the midst of this, the Hotel Senator, a modern hostelry facing the State Capitol and its famed park, was the headquarters. Most conventions are somewhat marred by the technical sessions held in uncomfortable, unsuitable, and noisy rooms. The Sacramento technical sessions were held in the Assembly and Senate chambers of the State Capitol—ideal meeting places, where the members were comfortably seated, the acoustics good (supplemented by loud-speaker amplification when necessary), with suitable easels for large maps, and screens for motion pictures. The technical sessions were particularly interesting, well attended, and there were not too many subjects nor divisions—a mistake at most meetings. Then add to all this, delightful social functions, several inspection trips of varied and unusual interest, and most of it free or at nominal fees—and nothing more could be desired.

Attendance—The average attendance at similar decentralized meetings has been 300 to 400. Two registration lists were printed and distributed during the convention. The last on Friday morning showed a registered attendance of 732; the final estimate, including some who did not register, being nearly 800, a remarkable showing considering the isolation of the Far West. Of the 732 registrations, 454 were members of the Society, 184 their wives and daughters, and 94 were guests.

PERSONALITIES AT THE SPRING MEETING. FROM LEFT TO RIGHT—(UPPER LEFT) A. F. REICHMANN AND JOHN W. ALVORD. (UPPER RIGHT) JOSEPH JACOBS, CLYDE T. MORRIS, J. H. JOHNSTON, AND C. E. GRUNSKY. (LOWER LEFT) WALTER J. RYAN AND JOHN F. COLEMAN. (LOWER RIGHT) MALCOLM PIRNIE AND SON

California contributed about 500; Washington, Oregon, and Nevada, 7 each; Arizona, 2; Utah, 3; Texas, 1, and 25 were from states east of the Rocky mountains.

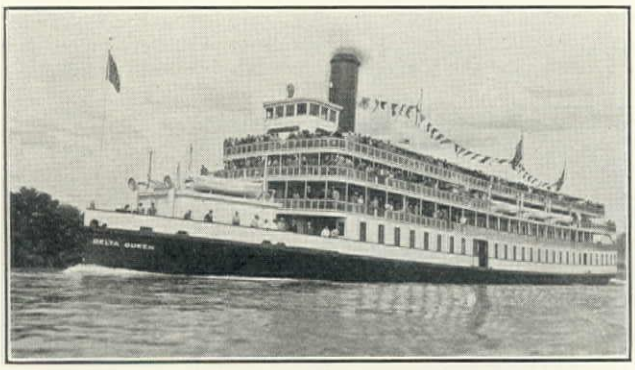
The officers and directors were practically all present: president, John F. Coleman (New Orleans); vice-presidents, Arthur Dyer (Nashville, Tenn.), A. J. Hammond (Chicago), J. M. Howe (Houston, Texas), Frank E. Winsor (Boston); past-president, Lincoln Bush (East Orange, N. J.); secretary. George T. Seabury (New York); directors, Joseph Jacobs (Seattle), J. H. Johnston (Atlanta, Georgia), Morris Knowles (Pittsburgh, Penna.), Harrison P. Eddy (Boston), Allan T. Dusenbury (New Orleans), Frederick H. Fowler (San Francisco), Franklin Thomas (Pasadena). D. A. McCrea (Little

Rock, Ark.), Ole Singstad (New York), A. F. Reichmann (La Salle, Ill.), Malcolm Pirnie (New York), Clyde T. Morris (Columbus, Ohio), and Charles H. Stevens (Philadelphia), also past-presidents C. E. Grunsky (San Francisco), and Chas. D. Marx (Palo Alto, California).

Business Meetings—On Monday and Tuesday, prior to the convention proper, the officers and directors held their usual business meetings, the present membership of the Society being announced as 14,218 on March 1.

The scope of the Society is being rapidly broadened as outlined in the review of the recent San Francisco section dinner-meeting under 'Associations', elsewhere in this issue.

One important activity discussed by the directors was the Special Committee on Dams, of which Thaddeus Merriman, chief engineer of the Board of Water Supply of New York City, will be chairman. There will be seven members—not yet announced. The purpose of this Committee is to adopt a code of fundamentals, on the principles, procedures, and practices which constitute the design and construction, including materials, of dams for impounding water. It is but logical and fitting that the American Society of Civil Engineers should undertake this much needed 'code'. The work of this Committee will in no way conflict with that of the committee of



Excursion of 450 ASCE's down Sacramento River on the 'Delta Queen' as Guests of Alfred E. Anderson, President, California Transportation Co.

the American Engineering Council appointed a few months ago to confer with federal and state legislative bodies on governmental regulation of dam construction.

C.S.W.A.—See report on page 242.

Social Features—It is hard to say which of the social features was the most enjoyable.

The dinner dance on Wednesday evening at the Hotel Senator was so largely attended that there was no room for dancing until after the dinner. Wisely, after-dinner speeches were omitted, there being suitable music during dinner by an orchestra of three women and excellent dance music later by a large orchestra. Another good feature—the charge was nominal, only $3.00 per person.

Thursday evening, the Sacramento section entertained the members at a stag dinner and smoker, at the Elks Club, which was hugely enjoyed by 400, on account of its informality and conviviality—the charge for this was $2.50.

Friday afternoon through the generosity of Captain Alfred E. Anderson, president of the California Transportation Co., 450 members and guests were given a boat ride on the palatial San Francisco-Sacramento river steamer 'Delta Queen', down the river to Clarksburg and return, during which trip an excellent lunch was served and dancing was enjoyed.

The ladies in attendance—184 registered—were entertained on Wednesday afternoon at a reception and tea at the Crocker Art Gallery; on Thursday morning with a motor tour of Sacramento and environs; on Thursday afternoon by Mrs. George Gordon Pollock, whose husband is a member and also a prominent contractor, at a tea in the beautiful garden of their residence; and Thursday evening at a bridge party in the Hotel Senator.

Special Feature—On Friday morning the members attended the dedication of the monument to Theodore Dehone Judah, pioneer engineer and 'father' of the Central Pacific Railroad. W. A. Kirkbride, member, and engineer of maintenance of way and structures, Southern Pacific Co., read an historical eulogy of the life, exploits, and achievements of this engineer, who was the real pioneer in promoting the first transcontinental railroad. Judah came to California to build the Sacramento Valley railroad from Sacramento to Folsom in 1854-6. He reconnoitered, with an aneroid, the route for the Central Pacific over the Sierra Nevada, interested Crocker, Huntington, Hopkins, and Stanford (the 'Big Four'), and in spite of great obstacles—financial and physical—succeeded in getting construction well underway before he died November 2, 1863 (age 37 years), from fever contracted in crossing the Isthmus of Panama. Judah joined the American Society of Civil Engineers in 1854. The constructed railroad varied but little from his first surveys and its standards of alignment and grade are yet acceptable.

The monument consists of a 40-ton granite boulder (see illustration) from the High Sierra, out of which will be hewn a bust of Judah, and was financed by donations from Southern Pacific Co. employees.

TECHNICAL SESSIONS

Wednesday Morning Session—After registration, the members gathered in the Assembly chamber, State Capitol, where Thomas E. Stanton, president of the Sacramento section, introduced C. C. Young, governor of California, C. H. S. Bidwell, mayor of Sacramento, and John F. Coleman, president of the Society, each of whom responded. C. E. Grunsky (San Francisco) past-president, followed with 'Some Reminiscences of Sacramento', describing the growth of this city, which was the center of the gold rush of '49, its early social, political and engineering life and struggles for betterment.

The technical sessions (the papers will be reviewed or abstracted in subsequent issues), with attendances of 300 to 400, began with 'The Problem of Maximum Conservation of Water Resources, with Special Reference to the California Plan', presented by Edward Hyatt, state engineer. Hyatt outlined in some detail (and with slides and maps) the comprehensive plan for the conservation and distribution of the water resources of the state, upon which a large committee of engineers has been at work for several years, and which involves the coordination of water supply, flood control, hydroelectric power, and irrigation, by private, municipal, state, and federal agencies. This paper was discussed by J. B. Lippincott, of Los Angeles, and Fred C. Scobey, of Berkeley.

Wednesday Afternoon Session—The afternoon was devoted to a discussion of 'State Supervision of the Design and Construction of Dams'. M. C. Hinderlider, state engineer of Colorado, who prepared this comprehensive paper for discussion, could not be present and it was read by Fred H. Tibbetts, of San Francisco. The following members presented prepared discussions: Harry W. Dennis, chief civil engineer, Southern California Edison Co., Los Angeles; Nelson A. Eckart (read by George W. Pracy), manager of the water department of San Francisco; George W. Hawley, deputy engineer in charge of dams, state of California. Verbal discussions were given by D. C. Henny, consulting engineer, Portland; C. E. Grunsky, consulting engineer, San Francisco; and A. H. Markwart, vice-president in charge of engineering, Pacific Gas & Electric Co., San Francisco. The danger of one-man control; employment of more consultants; periodic inspection subsequent to construction, were some of the features stressed.

Thursday Morning—Highway Division—'Pre-Qualification of Contractors' was discussed from three aspects: 'From the Standpoint of the Engineer', by C. H. Purcell, state highway engineer, California; 'Legal Aspects', by L. I. Hewes, deputy chief engineer, U. S. Bureau of Public Roads, San Francisco; and 'From the Standpoint of the Contractor', by Walter Wilkinson, president, California branch, Associated General Contractors, Watsonville.

Walter N. Frickstad, city engineer of Oakland, California, followed with a paper on 'Further Developments in the Construction of Low Cost Bituminous Treated Crushed Rock and Gravel Roads', which E. Q. Sullivan, district engineer, California Division of Highways, San Bernardino, discussed. A discussion by A. H. Hinckle, chief engineer of maintenance, Indiana Highway Commission, was then read by R. M. Gillis, Sacramento.

Thursday Afternoon—Highway Division—C. S. Pope, chief construction engineer, California Division of Highways, pre-

sented a paper on 'Western Highway Practice with Special Reference to Some Construction Problems of the California Division of Highways', which was discussed by Joseph S. Bright, construction engineer, U. S. Bureau of Public Roads, San Francisco, and Joseph M. Howe, consulting engineer, Houston, Texas.

Thursday Morning—Irrigation Division—The paper on 'The Proposed Colorado River Aqueduct and Metropolitan Water District of Southern California', by F. E. Weymouth, chief engineer of the district, was read by Julian Hinds, engineer on design, Bureau of Water Works & Supply, Los Angeles. This project entails the construction of an aqueduct from 200 to 300 miles long and of 1500 c.f.s. capacity, much of it in tunnel; a large diversion dam (one 900 ft. high considered) if the Boulder dam is not used; a probable pumping lift of 1600 ft.; and large terminal storage. More than 65 routes have been

Joseph W. Gross (Foreground Rear), Past-President Sacramento Section, Speed-Boating Ole Singstad (Foreground Forward) to Catch Excursion Steamer 'Delta Queen'

considered, and 3 or 4, with many possible variations, are being carefully surveyed. This is a gigantic engineering project. Louis C. Hill, consulting engineer, Los Angeles, read a prepared discussion; and Richard Lyman, consulting engineer, Salt Lake City, and one of the 3 consulting engineers for the district, and Franklin Thomas, professor of civil engineering, California Institute of Technology, Pasadena, gave additional facts verbally. The paper was illustrated with maps and slides.

This was followed by a description of the 'Foundation Treatment of the Rodriquez Dam on the Tijuana River, Mexico', by C. P. Williams, consulting engineer, Los Angeles. This structure is an Ambursen dam under contract by the Ambursen Dam Co. for the government of Baja California. Several faults and variations in bedrock conditions necessitated additional excavation and changes in design, including arches over faults or gouges to support the buttresses. Williams illustrated his remarks with slides and drawings.

C. C. Cragin, general superintendent and chief engineer, Salt River Valley Water Users Association, Phoenix, Arizona, unfortunately could not be present to read his most comprehensive paper on 'The Development of Hydroelectric Power as an Aid to Irrigation, Both in Connection with the Storage of Water in the Mountains and the Pumping of Water in the Valleys', and it was read by F. J. O'Hara, consulting engineer, Phoenix. The Salt River valley project is unique and the development, distribution, and sale of hydroelectric power by the district is an economical adjunct to irrigation. Nevertheless, Cragin believes that hydroelectric power development should not be undertaken by a district except under somewhat similar conditions. A prepared discussion was read by R. V. Meikle, chief engineer, Turlock Irrigation District, California, who stressed the growing tendency for private power utility companies to cooperate with irrigation districts in the development of projects, citing the Melones project as a recent fine example. A. H. Markwart, vice-president in charge of engineering, Pacific Gas & Electric Co., concurred with Meikle. George L. Swendsen, chief engineer and manager, Fresno Irrigation District, California, described verbally the Fresno cooperative districts where there are more irrigation wells than in any other area in the world. The high light of this meeting was the increased tendency toward cooperation between public and private enterprises.

A valuable exhibit of measuring devices was shown by the Irrigation Division in an anteroom of the Assembly chamber.

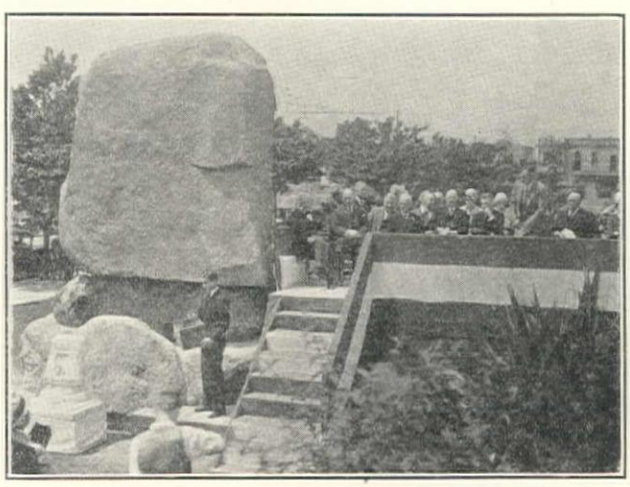
Thursday Afternoon—Surveying and Mapping Division—'The Preliminary Topographic Surveys for the Proposed Colorado River Aqueduct', an undertaking of considerable magnitude, were described by E. A. Bayley, engineer of surveys, Department of Water & Power, Los Angeles, and discussed verbally by DeWitt L. Reaburn, consulting engineer, Los Angeles, and C. H. Birdseye.

'The Aerocartograph Method of Photo-Topographic Mapping' was explained verbally and with illustrations by C. H. Birdseye, president, Aerotopograph Corp. of America, Washington, D. C., and discussed by Joseph W. Gross, consulting engineer, Sacramento, in the absence of Thomas G. Gerdine.

J. R. Jahn, civil engineer, Berkeley, California, described and exhibited a logarithmic stadia rod of his design which would greatly increase the ease and speed of stadia surveying.

Thursday Afternoon—Structural Division—W. H. Kirkbride, engineer of maintenance of way and structures, Southern Pacific Co., gave an interesting description, illustrated with slides and motion pictures, of the Suisun bay bridge under construction by his company at a cost of $12,000,000. N. F. Helmers, of Siems, Helmers & Schaffner, substructure contractors, followed with some details of the sand island method of pier construction, and stressed the extreme care in engineering preparation exercised by the company on this and similar contracts. E. J. Schneider, contract manager, U. S. Steel Products Co., San Francisco, superstructure contractor, followed with details of utilization of some portions of the steel structure as falsework for erection of the remainder.

'The Salt Springs Dam' of the Mokelumne project of the Pacific Gas & Electric Co. was described in detail by O. W. Peterson, engineer of general construction. This rock-fill dam will be 330 ft. high and will contain over 3,000,000 cu.yd—the highest dam in the world of its type. Peterson showed a number of slides and a complete motion picture of the project. D. C. Henny, consulting engineer, Portland, and L. F. Harza, consulting engineer, Chicago (Harza's paper read by Frederick



Dedication of Monument to Theodore Dehone Judah, Pioneer Engineer and 'Father' of Central Pacific Railroad. Thomas E. Stanton, President, Sacramento Section, Standing, with John F. Coleman and W. H. Kirkbride Seated on His Right

H. Fowler) discussed the subject of rock-fill dams, the problem of securing a water-tight membrane or facing, and the necessity for not only adequate cross-sectional area but ample spillway capacity.

Field Trip to Suisun Bay Bridge—Between 310 and 320 took the special train (cost $2.05 for round trip) or journeyed by auto to the Suisun bay bridge near Martinez on Saturday. The contractors, Siems, Helmers & Schaffner, provided launches for visiting the different piers and the U. S. Steel Products Co. provided the luncheon. This was a particularly interesting and instructive trip, as it was possible at this time to inspect all stages of construction.

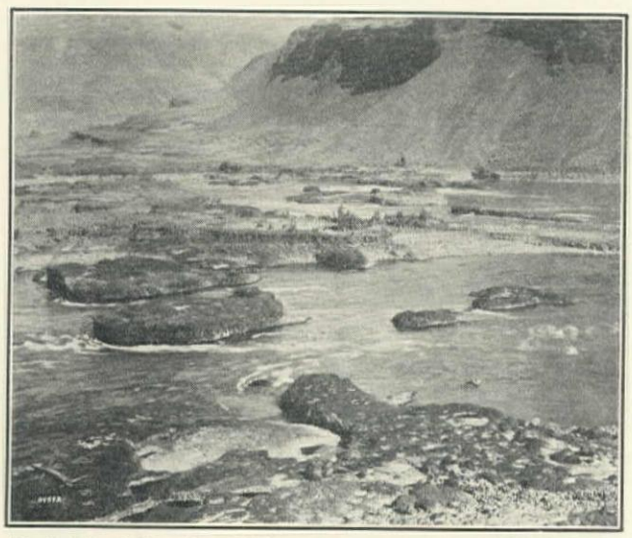
Field Trip to Salt Springs, Pardee, and Stockton Dams—About 30 members availed themselves of this instructive trip, remaining overnight at the Salt Springs dam as the guests of the Pacific Gas & Electric Co.

Rock Island Hydroelectric Development for Washington Electric Company

Stone & Webster Engineering Corp. Begins First Development to be Constructed on Columbia River—Damsite 13 Miles Below Wenatchee, Washington—Initial Primary Horsepower 60,000 with 240,000 Ultimate

The Washington Electric Co. (Puget Sound Power & Light Co.) awarded a contract in January, 1930, to Stone & Webster Engineering Corp. for the first stage of a 240,000-hp. development at Rock island on the Columbia river 13 miles below Wenatchee, Washington. This plant will be the first major power development to be constructed on the river, the initial and ultimate costs being $6,000,000 and $15,000,000.

The Puget Sound Power & Light Co. supplies electricity to a large part of western Washington. At present, the company's power supply is taken from hydroelectric plants on the western slope of the Cascade range and supplemental steam plants. Rapid growth of the company's business will enable it to absorb the large block of power available at the Rock island site. Some of the power will be used locally,



Rock Island Damsite 13 Miles Below Wenatchee, Washington, on Columbia River

but much of it will be transmitted 125 miles over the Cascades and distributed in the Puget sound region. The large flow of Columbia river, even in seasons of drought, will produce a minimum output at Rock island larger than that similarly obtainable at Muscle shoals. (Columbia river reaches a fall and winter minimum at Rock island of 24,000 c.f.s. and a summer maximum of 500,000 c.f.s.)

The Rock island development is on the main line of the Great Northern railway and on State highway no. 10 between Wenatchee and Spokane, Washington. At the damsite, the river is divided into two channels by an island 50 acres in extent. The development consists primarily of a dam 60 ft. high and 3500 ft. long, between the east and west banks of the river, a heavy concrete slab in the bottom of the stream supporting piers and gates. Integral with the dam and extending from the east bank is a powerhouse. Spillway gates with 530,000 c.f.s. capacity occupy all the available space between the powerhouse and west bank. Near the south end of Rock island, the War Department has reserved a lock site to meet ultimate navigation requirements. A fish ladder 20 ft. wide and with 12-in. steps will be constructed at each abutment.

The initial development includes a powerhouse enclosing four 15,000-kw. vertical units with impeller blades in the runners, and a dam on the east channel with temporary crest elevation of 581.5 ft., the ultimate crest being at 599 ft., U.S.G.S. datum. The dam will back water 20 miles, creating a reservoir with a surface area of 3300 acres.

Progress—Construction began in February, 1930, and will be completed about August, 1932. Work on the upstream cofferdam in the west channel was rushed in order to complete it as far as possible before high water, which has temporarily held up the work. Excavation for the powerhouse and east wing wall was also pressed while the river was at low stage. The construction plant and camp are nearing completion. Work will be resumed at full capacity about September 1 when high water recedes. About 800 men were at first employed, but it is expected that the peak may reach 2000 beginning in the fall of 1930.

A. W. Leonard is president, W. H. McGrath vice-president, and L. R. Coffin manager of the eastern district, Puget Sound Power & Light Co. W. D. Shannon is general superintendent for the Stone & Webster Engineering Corp. at Seattle.

ERRATA

Minidoka Gravity Extension Main Canal

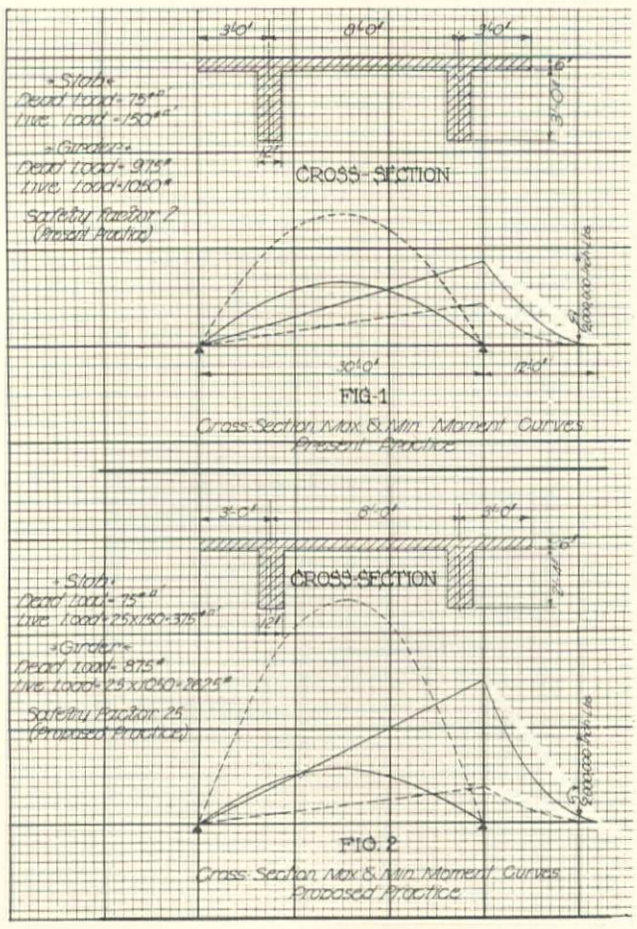
In the article entitled 'Gravity Extension Division, Minidoka Project, Idaho' by E. B. Darlington, March 25th issue, p. 163, it was erroneously stated that Mittry Bros. used six Ingersoll-Rand R39 Leyner-type drills on two contracts, three of these drills mounted on a tractor and three on a steel truss spanning the canal. Those drills mounted on the truss were Gardner-Denver model 17 drifters, the others being correctly described. The three 310-c.f.m. portable compressors mentioned in this section of the article were Gardner-Denvers, one being connected on the main supply line for the truss-mounted drills with a stationary Chicago-Pneumatic compressor, and the other two used for operating jackhammers. Two additional Ingersoll-Rand 310-c.f.m. portable compressors and three Ingersoll-Rand X-71 drills for mounting on another truss are now in operation.

Safety Factor and Economy

By V. BOGVAD-CHRISTENSEN*
Assistant Engineer, Department of Public Works, City of San Francisco

Any structure has a safety factor. How large it is can be determined only by loading the structure to failure. Real comparison between different designs should, as far as economy is concerned, take the safety factor into consideration. As to a clear definition of this, there will seem to be discrepancies. Some engineers consider that factor to be the relation between total dead and live load at failure to total dead and live load used in design (present practice), while others, including myself, take it to be **that multiple of the computed live load, which in connection with dead load, causes failure to the structure.**

It is difficult to see any reason for applying a safety factor to the dead load, since this is a fixed amount (in all ordinary cases, at least). As the real safety factor for obvious reasons is unknown, we may rather

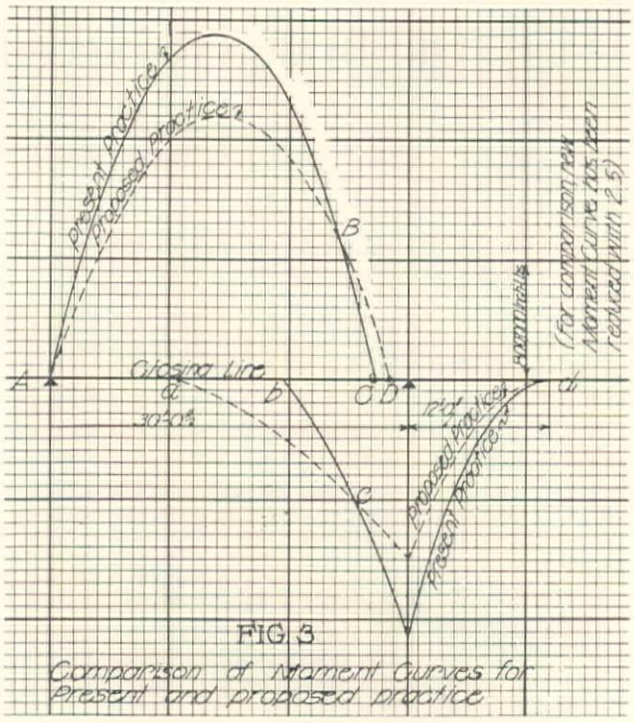


speak of a theoretical safety factor, which, of course, should aim at being as close to the actual one as possible. Besides the allowable stresses used for computation and test results of stresses in materials, a number of other factors influence the determination of the theoretical safety factor.

These may be stated as follows:

1. Inadequacy of theory of computation.
2. Assumptions for dead load, live load, impact, temperature, wind.
3. Computation of approximations.
4. Erection difficulties.
5. Ground conditions.

Inferior material, poor workmanship, lack of professional knowledge, computation mistakes, are within human control and should hardly influence the theoretical safety factor. In every individual case, it would be advisable to make an estimate of the above factors instead of using the present inflexible rules, which in many cases are costly. Since the theoretical safety factor deals with loading conditions for the structure between zero and the load of failure, it would seem most natural in the computation to use the desired ultimate load instead of a more or less arbitrary load between these limits.



It will be shown how a reinforced concrete structure computed for dead load plus ultimate live load to failure and correspondingly somewhat higher allowable stresses compares to a structure computed in the usual way. The procedure is also a safeguard against shortage of negative steel in the top of intermediate spans—since all loading conditions to the point of failure have been investigated—while it is possible with present practice to have parts of the structures computed without any safety factor whatever. The present system for bridges has been patched up some by using dif-

*Associate Member, American Society of Civil Engineers.

ferent percentages of impact and stress for the various members.

The structure chosen for demonstrating the difference in the two methods of computation is a reinforced concrete double T girder over two supports, with a cantilever at one end. In this design the live load is 150-lb. per sq.ft. and the dead load as in Fig. 1 and 2.

Assuming the safety factor in the slab, according to present practice, to be 2 and therefore the possible maximum stress in the weakest part of the structure Fc = 1300 and Fs = 32,000, corresponding to the allowable stresses; Fc = 650 and Fs = 16,000 as generally used at present, the actual safety factor would be $\frac{(75+150)2-75}{150} = 2.5$, if the dimensions of the slab are not changed. The same safety factor, 2.5, is now used for the girders.

As shown in Fig. 2, the cross-section is reduced about 10%, thus effecting considerable saving but offering no possibility for general conclusions. Fig. 3 shows the shortcomings in present practice—between A and B, excessive safety factor; between B and C, inadequate; and between C and D, no safety factor. Similarly, for the negative moments between a and b, no safety factor; between b and c, inadequate safety factor; and between c and d, excessive safety factor. Economy emphasizes a uniform safety factor. **The figures above are not intended as a proposal for general adaptation,** but rather as a challenge to discussion.

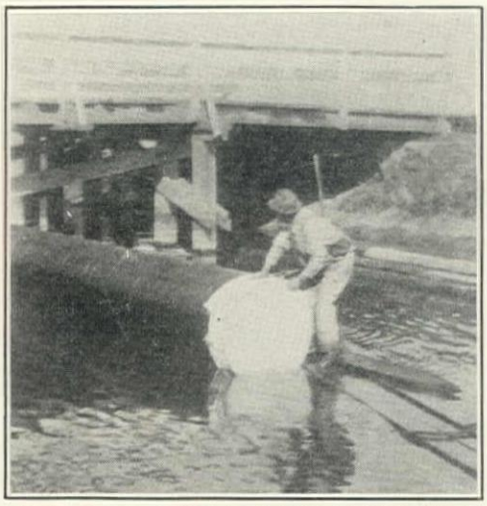
Old Bridge Replaced With Armco Culverts

By E. K. DUPONT

Bridge Engineer, San Joaquin County Highway Maintenance Department, Stockton, California

By employing the simple expedient of floating into place and sinking to position, a considerable saving was made in laying two 36-in., 12-gauge, Armco corrugated pipes at the bottom of a canal carrying water to a depth of 10 ft.

The Problem—An old wood trestle bridge carried the traffic of a county road across a canal, the two structures being at right angles. This bridge was to

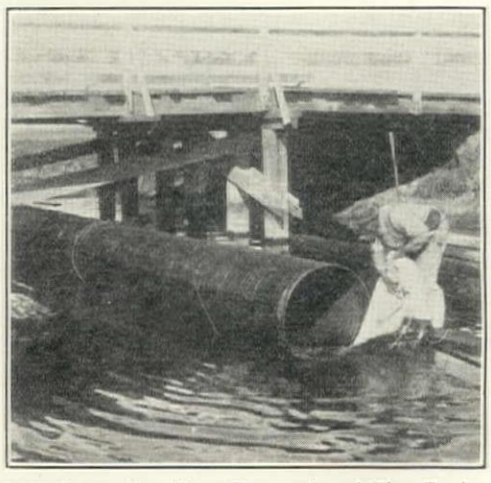


Armco 36-in. Corrugated Culvert Pipe Floated Into Position Beneath Old Trestle, Bridge Preparatory to Sinking

be replaced by an earth fill 15 ft. high, without interrupting traffic. Two 36-in. corrugated culvert pipes, each 70 ft. long, were required to carry the flow. The problem was solved in the following manner.

The Solution—A point on the bank of the canal was selected that offered good launching facilities, and the three sections (two 24 and one 22-ft.) for the first pipe were banded together. As a precaution, the pipe was given a dip coating of hot asphalt, which sealed the seams and joints enough to permit floating. Each end of the pipe was then covered with a square of 16-oz. canvas, with allowance for a 1.0-ft. lap, and the canvas fastened with three turns of ¼-in. rope. The canvas was thoroughly wetted to swell the fibers, and the pipe was skidded into the canal and towed into position under the bridge. A man on a raft at each end of the pipe then untied the canvas covers and the pipe was allowed to sink into place. Contrary to expectations, the pipe did not sink instantly.

The second pipe was treated in a similar manner, being placed parallel with and 6 ft. distant from the first. Next, sheet piling was driven by hand 4 ft. back from the ends of the pipes, and was wired to the supports of the bridge, so as to retain the fill. Pockets



Canvas Cover Has Been Removed and Pipe Begins to Sink in 10 ft. of Water

were cut in the deck of the bridge and the fill (1350 cu.yd.) was made with dump trucks.

The work was done under my supervision for Julius B. Manthy, county engineer of San Joaquin county, California. The pipe was furnished by the California Corrugated Culvert Co., of West Berkeley. A crew from the bridge division of the County Highway Maintenance Department did the work, five men placing the pipe in one-half day.

California Sewage Works Association

Spring Conference at Chico, Davis, Lodi, and Sacramento, April 21 to 22 With Registered Attendance of 118—Review of Plant Inspections, Round Table Discussions, and Principal Addresses

April 21, 1930

Members and guests of the California Sewage Works Association assembled at Chico April 21 to begin the 1930 Spring Conference. Under the direction of H. H. Hume, city manager, and M. C. Polk, city engineer, a 33-car caravan was taken to the new Chico disposal works and sewer farm.

Chico Plant—This plant is Dorr-equipped and has mechanically cleaned bar screens; a clarifier tank 50 ft. square, with skimmer and automatic screen; and a 40-ft. diam. separate sludge digestion tank with heating and gas collection. It serves a population of 8500 and handles 1,000,000 g.p.d., including the morning wash-down from a dry milk factory. The plant was built in 1929 for $55,000 and the entire improvements (6 miles of 18, 21, and 24-in. concrete pipe outfall sewer; 29 miles of vitrified pipe collecting mains and laterals, with bituminous joints; 200 precast concrete, 100 brick, and 6 special manholes; one double siphon on the outfall; and other items) totalled $262,656. Gogo & Rados, Los Angeles, had the general contract and the work was sublet to W. J. Tobin, Oakland; C. Dudley De Velbiss, Oakland, later subcontracting the disposal works. All piping and valves in the plant were furnished by the Water Works Supply Co., San Francisco, and the vitrified pipe was furnished by Gladding, McBean & Co. and N. Clark & Sons. Effluent is ponded and used for irrigation of a sewer farm, the operator of this farm contributing about 2 hours daily to plant maintenance in return for use of the land and effluent. (See 'Unit Bid Summary', May 10th, 1929, issue, p. 52; and Construction Progress in October 10th, 1929, issue, p. 529.)

University of California Farm, Davis—Following inspection of the Chico plant and a description of its operation by H. H. Hume, city manager, the caravan proceeded to Davis, where lunch was served at the University of California Farm. At this time, Delvin Marshall, high school science teacher at Davis, presented three freshman students selected from a mixed class of 27 to read essays on the University Farm sewage disposal plant. These students, Myrtle Hamlin, Lucile Jacobson, and Cools, showed a commendable knowledge of and interest in sewage collection and treatment. The party then visited the two pumping and screening plants, Imhoff tank, sprinkling filter, secondary settling tanks, sludge bed, and irrigation checks for handling the sewage of 700 people and a large volume of barn manure and milk wastes. The disposal works are subject to larger flows of domestic sewage on days of club gatherings and demonstrations, when as many as 20,000 people may be present. The average total flow of sewage is 175,000 g.p.d. The system was described by its designer, H. B. Foster, University of California engineer, and a managers' and operators' school was conducted at the plant by John Jacobson, superintendent of construction at University Farm, assisted by representatives of the State Bureau of Sanitary Engineering. During the school, the use of tools was demonstrated (skimming the flowing-through chamber, determining depth of sludge, etc.) and simple laboratory tests were run.

Before leaving Davis, members of the caravan attended a demonstration of measuring devices for irrigation water applicable to sewage or effluents (weirs, gates, meters, and Parshall flume); toured the University Farm; and inspected some of the blooded livestock.

Sacramento Dinner and Round Table Discussion—An informal dinner was held at the Hotel Sacramento, F. A. Batty, president, presiding. After a short business meeting, a round table discussion was begun with the subject of 'Tree Roots in Sewers'. It was brought out by W. T. Knowlton, D. E. Perry, C. R. Blood, and Carl Wilson, that roots 18 ft. and more in length find their way into small diameter sewers laid with other than lead joints; that willows and elms are the worst offenders; that most of the trouble occurs in sewers laid above a 5-ft. depth; and that when ground water is high, roots do not seek sewer lines but the converse holds as the level is lowered.

MEMBERS OF CALIFORNIA SEWAGE WORKS ASSOCIATION ON SPRINKLING FILTER AT UNIVERSITY OF CALIFORNIA FARM, DAVIS, APRIL 21, 1930

On the subject of 'Manhole Spacing', discussed by F. A. Batty, C. C. Kennedy, Alva Smith, R. R. Ribal, and D. E. Perry, the maximum effective distance for rodding was given for manhole spacings of 300 to 350 ft.; on blocks 600 ft. long and with stoppages in the center, it was stated that rods cannot be used; stoppages were said to generally occur in sewers 8 in. diameter and smaller; lampholes between manholes were recommended on long blocks.

R. F. Goudey gave impressions of plants visited and trends in practice noted on his recent trip to sewage treatment works throughout the east. These impressions included: improvement in the line of mechanical equipment—detritors replacing grit chambers; increase in the use of separate sludge digestion with gas collection and heating; activated sludge plants turning to multi-stage treatment, sludge being aerated and settled as many as three times; double settling to get a better effluent; the tendency for too scant a capacity in clarifier design—with 500 gal. per sq.ft. or even lower capacity better results would be obtained; an automatic chlorinator which varies the feed with sewage flow and adjusts it to demand, whether constant or variable (this chlorinator takes a sample, adds the

indicator, compares with a standard, and then feeds so as to keep the residual chlorine constant); economical removal of large amounts of phenol by adding ammonia and then chlorinating; production of a good effluent by removal of excess chlorine with active carbon. Goudey observed that no one treatment plant has thus far been developed which combines the best features of all plants; the Los Angeles Department of Water and Power has, however, recently completed an experimental plant with a capacity of 200,000 g.p.d., so flexibly designed that all schemes which look possible may be studied and economically compared.

W. L. Jencks described a new sewer joint which is simpler and more foolproof than the old type. In this joint a lip is placed on the end of the bell to serve as a retaining wall, lessening the danger of root penetration and ground water infiltration. H. N. Jenks, for some time an absent member, was welcomed to his first Association meeting. G. A. Parks argued for 'dressing up' sewage treatment plants constructed by bond issue and inviting public inspection so that future bond issues would stand better chance of favorable action. It was noted that a tendency exists in the east to dress up plants so that they will be most attractive and interesting to the eye.

April 22, 1930

Assembling at Sacramento, the caravan visited Lodi for an inspection of the city's activated sludge plant and attendance at an operators' school.

Lodi Plant—This plant was shown by J. F. Blakeley, city clerk, and F. W. Post, sewage works manager. It was designed by Clyde F. Smith and built in 1923 at a cost of $148,000. (See July 25th, 1926, issue, p. 23.) The connected population is 7500, but the plant has capacity to handle the sewage of 20,000 people. The sewage is highly diluted on account of flat water rates (average flow 130 and maximum flow 160 g.p.d. per capita).

At this plant sewage passes a bar screen, goes through a quick-closing valve into a fine-screening chamber where it enters a 4 ft. diameter by 5 ft. Dorrco cylindrical screen, passes to a wet well, is lifted by Byron Jackson municipal pumps to

California Sewage Works Association Members Inspect Chico Plant (Dorr-Equipped) April 21, 1930

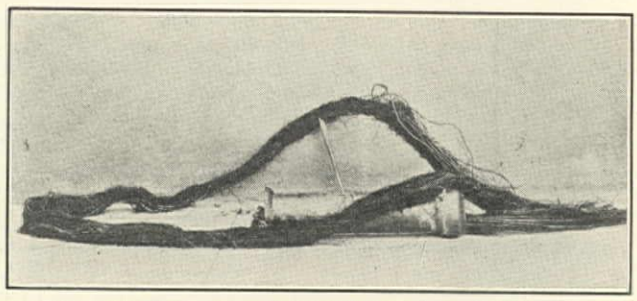
influent channels where it mixes with activated sludge, and then enters the aeration tank which is divided into two units and equipped with filtros plates. The aerated mixture discharges to a settling tank from which the effluent passes over a weir to a chlorine mixing tank. Sludge is collected by a Dorr clarifier and forced into a sludge return channel where it is reaerated. An air lift mixes the sludge with incoming sewage. Screenings are buried and the sludge is dried on open beds and given without charge to farmers for fertilizer, 24 tons of sludge being drawn per year. The sludge is quite stable, has no disagreeable odor, and attracts few flies; effluent is used for irrigation.

During the managers' and operators' school, simple tests were run on raw and settled sewage and effluent, a hydrogen sulphide test was made, and pH determinations were illustrated. Members of the caravan were guests of the city of Lodi at a luncheon held in the Women's City Club, where they were welcomed by the mayor. Attention was called at this luncheon to the recent death of L. F. Barzellotti, city engineer and a member of the Association.

Before proceeding to Sacramento for the remainder of the program, a 2-hour side trip was made to Mather Field to view the maneuvers of the First Provisional Wing, Army Air Service.

Sacramento Pumping Plants—The two screening and pumping plants and 84-in. outfall to the Sacramento river were then shown by C. R. Blood, assistant city engineer, and Carl Hoskinson, chief engineer of the water and sewer pumping plants. The Sacramento sewer system has a connected population of 103,000, including the sanitary sewage of North Sacramento. It is a combined system, serving an area of 21 sq.mi., the maximum rainfall being 1 in. per hour. The city water supply is taken from the river 2 miles above Sump No. 1 (elev. 0 ft.) and 4 miles above Sump No. 2 (elev. −5 ft.). Sewage is screened and lifted from elev. −5 ft. to varying elevations of 0 ft. to +29ft., depending on the stage of the river. The two plants have a total capacity of 364,000,000 g.p.d. In 1929 the total sewage pumped was 7,104,000,000 gal. against 8,722,000,000 gal. of filtered water—a ratio of 80% sewage to pumped water supply. In 1929, screens were cleaned 1042 times and 304 cu.yd. of material—much of it cannery wastes—removed and buried in shallow pits.

Closing Dinner at Sacramento—The Spring Conference closed with a dinner attended by 175 persons, including sani-



Cork Elm Root 22 ft. Long, Removed from 4-in. Sewer (4 ft. Deep) at University of California Farm, Davis

tary engineers assembled for the A.S.C.E. convention and representatives of the student chapters of the Society at California, Stanford, California Institute of Technology, and Nevada. T. E. Stanton, president of Sacramento Section, American Society of Civil Engineers, and J. S. Dean, city manager of Sacramento, welcomed the Association. President Batty explained the objects of and rapid growth of the C.S.W.A. and introduced John F. Coleman, president of the American Society of Civil Engineers, and the four student chapter presidents in attendance. An award of merit for the best designed and operated plant was made to the University Farm, Davis, in the form of a bronze plaque, donated by Wallace & Tiernan Co., Inc.; a similar plaque to be presented each year. A cash prize of $25 was then given the operator of this plant, John Jacobson, this prize being donated by The Dorr Co., Great Western Electro-Chemical Co., Water Works Supply Co., and Western Construction News.

John W. Alvord, consulting engineer, Chicago (Alvord, Burdick & Howson), principal speaker of the evening, chose 'Biological Engineering' for his subject. Alvord remarked that the art of sewage purification commenced over 50 years ago and at about the time when he first began the practice of civil engineering. Early sewers led to water supply bodies—bringing the problem of separating sewage and water supply. Such treatment had its first development in England, a country of large cities and small rivers. Engineering can be classified as 'physical' and 'biological.' The former is mathematical in treatment, is based on the science of physics, and the engineer dealing with physical construction has been successful. Biological engineering deals with construction for water supply and sewerage, and the prevention of infectious diseases. Here enthusiasm and effort have met disappointment, as this branch of engineering has been a slow process of trial and error, trial and failure. The biological engineer can gather statistics but he cannot solve his problems by mathematical equation. He deals with the animate as well as the inanimate and therefore needs more and better judgment and a wider reach and grasp of scientific facts than does the physical engineer. In general principle, the biological engineer knew 50 years ago what he does today, the application and refinement of his processes

remain. For example: since 1888 engineers have looked for an economical fertilizer from sewage waste. Also, sewer gas—a long known by-product—was once considered dangerous but is now being used for speeding the process of separate sludge digestion in cold climates. Enough gas can be gathered from a connected load of 30,000 to 40,000 persons to not only warm the sewage, but to heat and light the plant and be put to public use for partial street lighting, etc. The placing of mascerated cornstalks in a digestion plant will greatly accelerate gas production. Thus, a Corn Belt farmer may heat and light his home. Alvord concluded his remarks with a humorous poem of unusual merit, entitled 'Nutshell Philosophy'.

Harrison P. Eddy, consulting engineer, Boston (Metcalf & Eddy), was the other notable guest and speaker. Eddy traced the differences in knowledge and conception of underlying principles of sewage treatment from the work of Franklin in England, beginning in the 1880s. He cited the disappointment from failure to properly understand and recognize the principles in the intermittent sand filter, until its purpose and use with other processes later became established. He described the process by which sewage is pumped into a treatment plant, digested and decomposed to produce gas, the gas carefully piped and trapped to prevent explosion, and the tank contents heated with steam produced through the burning of this gas. Eddy asserted that the sewage works operator of today has a most difficult position since (a) the disposal of municipal wastes is the last thing in which the public takes any interest; (b) it is hard to secure adequate funds for extension, maintenance, and a qualified staff; (c) there is divided responsibility in the governmental function; and (d) the operator must sell his board of supervisors the need for adequate support. Eddy concluded that such an association as the one in session can perform helpful work in gaining the support of municipalities for plant operators.

NUTSHELL PHILOSOPHY

By JOHN W. ALVORD

Alvord, Burdick & Howson, Consulting Engineers, Chicago

Said the atom to the cell,
"I know you very well,
You were organized from atoms, some million years ago.
But you're seized with an obsession
That 'selection' and 'expression'
Puts you in an upper class above the level I can know."

Replied the cell unto the atom,
"You're the mechanistic stratum,
Proving 'causal antecedence' to the scientific mind.
I have added 'purpose' to you
And developed value through you,
Until 'protoplasm' is the holophrastic naming of our kind."

Retorts the atom to the cell,
"You're a psychologic swell,
You ought to know that 'entropy' will get you in the end.
You could not live without me,
And your feeble jokes about me
Are metaphysic sophistries, you cannot well defend."

Calmly said the cell to atom,
"You will get your ultimatum,
When one of your electrons, from its orbit, tears away.
You are pre-ordained connection,
Absolutely lacking in selection,
And 'attraction' and 'repulsion' hold you in their rigid sway."

Sneered the atom to the cell,
"When you die you make a smell,
And they'll float you to a germ resort, to oxidize your mass.
For the sewage engineers
Have your record by the ears,
And they plan to sell your nitrates, or burn you up as gas."

Coolly said the cell to atom,
"Argue on, ad infinitum,
For a 'causal past' and 'future end' can always interchange.
Still, if you are my 'divergent',
And I am your 'emergent',
I may lift you far above your lowly mechanistic range."

Roared the atom to the cell,
"You cannot take me to your hell,
For your 'emergence' has the taint of sulphurous hydrogen.
I'm glad I'm fatalistic,
And if I'm ever syllogistic,
It's because you've dragged me down into your psychic vale of sin."

Closer, cell looked at the atom,
Noticed then, he was a phantom
Whose electrons left him speechless, wandering out from time and place.
His 'quanta' were contrary,
His proton solitary,
And he vanished in a vortex, unrelated to warped space.

The registered attendance at the Spring Conference follows:

J. C. Albers, City Engineer. Glendale.
H. E. Albro, Councilman, Ventura.
W. A. Allen, Assistant Superintendent, Sewage Disposal Plant, Pasadena.
John W. Alvord, Alvord, Burdick & Howson, Chicago.
F. A. Batty, Engineer of Sewer Maintenance, City of Los Angeles.
Paul Beard (and wife), Civil Engineering Department, Stanford University.
Alexander Bell, Pacific Coast Manager, Wallace & Tiernan Co., San Francisco.
W. E. Bedesen, County Surveyor, Merced.
A. C. Beyer, District Manager, Wallace & Tiernan Co., San Francisco.
T. A. Bither, Representative, California Corrugated Culvert Co., Chico.
J. F. Blakeley, City Clerk, Lodi.
C. R. Blood, Assistant City Engineer, Sacramento.
William Boden, Student, Stanford University.
L. Bowman, County Engineer, Santa Cruz.
L. G. Brian, Student, Stanford University.
Miss Bonnie Brier, Sacramento.
R. E. Brown, City Engineer, Riverside.
Raymond Burgess, Superintendent of Public Works, Gilroy.
J. H. Burke, Water and Sewer Superintendent, Los Banos.
Dr. Butler, Sonoma State Home, Eldridge.
J. F. Byxbee, City Engineer, Palo Alto.
C. W. Capwell, Student, Stanford University.
W. O. Castello, Superintendent of Sewer Department, Sacramento.
Donald Carlson, Student, Stanford University.
V. D. Case, American Concrete Pipe Co., San Francisco.
G. A. Chester, Student, Stanford University.
Mrs. M. L. Christensen, Secretary, North Palo Alto Sanitary District, Palo Alto.
J. E. Christiansen, Junior Irrigation Engineer, University Farm, Davis.
D. T. Conroy, San Francisco.
M. L. Crist, Sanitary Engineer, Burns-McDonnell-Smith Engineering Co., Los Angeles.
A. G. Darwin, Assistant Editor, Western Construction News, San Francisco.
F. E. De Martini, Sanitary Engineer ,State Dept. Public Health, Berkeley.
H. I. Dygert (and wife), City Engineer, Albany.
T. F. Eastman, Drainage Engineer, City of Oakland.
Harrison P. Eddy, Metcalf & Eddy, Boston.
R. Ferguson, Sonoma State Home, Eldridge.
J. L. Fingado, Student, Stanford University.
H. B. Foster, University Engineer, University of California, Berkeley.
R. Fowler, City Engineer, Santa Cruz.
J. A. Francis, Chief Operator, Sump No. 1, Sacramento.
C. G. Gillespie, Chief, Bureau of Sanitary Engineering, State Dept. Public Health, Berkeley.
A. L. Gladding, Vice-President, Gladding, McBean & Co., Los Angeles.
R. F. Goudey, Sanitary Engineer, Bureau of Water Works & Supply, Los Angeles.
George Gray, Student, University of Nevada, Reno.
H. F. Gray, Sanitary Engineer, Berkeley.
John Hamilton, Student, University of California, Berkeley.
T. R. Haseltine, Engineer, Burns-McDonnell-Smith Engineering Co., Los Angeles.
B. L. Hays, City Clerk, Mountain View.
R. S. Hawley, City Engineer, Emeryville.
E. M. Hilton, Sanitary Inspector, National Park Service, Yosemite.
C. M. Hoskinson, Chief Engineer, Water Works and Sewage Pumping Plants, Sacramento.
L. D. Howland, Sales Engineer, Water Works Supply Co., San Francisco.
H. H. Hume, City Manager, Chico.
W. T. Ingram, Student, Stanford.
John Jacobson (and wife), Superintendent of Construction, University Farm, Davis.
W. L. Jencks, Research Engineer, American Concrete Pipe Co., Los Angeles.
C. L. Jenkin, City Engineer and Water Superintendent, Santa Ana.
H. N. Jenks, Sanitary Engineer, San Francisco.
W. E. Jessup, Consulting Engineer, Los Angeles.
H. W. Jewell, Pacific Clay Products Co., Los Angeles.
E. M. Kelly, The Dorr Co., Los Angeles.

C. C. Kennedy, Consulting Engineer, San Francisco.
A. M. Kivari, Pacific Coast Manager, The Dorr Co., Los Angeles.
A. H. Koebig, Jr., Koebig & Koebig, Los Angeles.
Max Kohner, Mayor, Santa Clara.
W. T. Knowlton, Sanitary Engineer, City of Los Angeles .
C. H. Lee, Consulting Engineer, Berkeley.
Ernest Levine, Student, California Institute of Technology, Pasadena.
Philip Levy, San Francisco.
Robert Linton, Vice-President and General Manager, Pacific Clay Products Co., Los Angeles.
W. C. Long, Manager of Sewage Disposal, San Luis Obispo.
G. W. Mallory, Ojai.
F. A. Mason, Napa Hospital.
H. A. Mason, Secretary, Mayors' Conference of Central California, Palo Alto.
J. C. May, Operator, Sacramento.
J. L. McBride, Civil Engineer, Santa Ana.
D. C. McMillan, City Engineer, Ventura.
C. E. Mueller, City Engineer, Sebastopol.
K. F. Mundt, Student, Stanford University.
Laura A. Munson, Civil Engineer, Sacramento.
S. A. Mushen, Consulting Engineer, Alturas.
C. F. Noel, Industrial & Municipal Supply Co., San Francisco.
J. W. Nute, Student, Stanford University.
L. R. Ohlson, Sanitary Engineer, San Jose.
G. A. Parkes, Sanitary Engineer, Culver City.
D. E. Perry, Manager, Marin County Sanitary District No. 1, San Anselmo.
W. B. Phillips, Gladding, McBean & Co., Los Angeles.
A. F. Pillsbury, Student, Stanford University.
M. C. Polk, City Engineer, Chico.
F. W. Post, Sewage Plant Manager, Lodi.
A. M. Rawn, Assistant Chief Engineer, Los Angeles County Sanitation Districts, Los Angeles.
C. A. Reed, City Engineer's Office, Oakland.
E. A. Reinke, Assistant Engineer, State Dept. Public Health, Berkeley.
L. B. Reynolds (and wife), Professor of Sanitary Engineering, Stanford University.
R. R. Ribal, Assistant Engineer, City of Oakland.
G. G. Robles, Operator, Lodi.
W. H. Rockingham, Mechanical Engineer, State Division of Architecture, Sacramento.
R. H. Rupkey, Student, Stanford University.
J. M. Sanchis, Sanitary Engineer, State Dept. Public Health, Berkeley.
Frank W. Seifert, San Diego.
H. E. Shook, Sales Engineer, Great Western Electro-Chemical Co., San Francisco.
Alva J. Smith, Black & Veatch, Los Angeles.
G. W. Sohler, Councilman, Mountain View.
R. A. Stevenson, Superintendent of Water Filtration Plant, Sacramento.
O. E. Steward, Maintenance Engineer, Orange Co. Outfall Sewer, Anaheim.
L. G. Tegtmeyer, Sewer Engineer, City of San Francisco.
O. C. Tretten, Santa Cruz Cement Co., San Francisco.
W. F. Trigiero, Student, Stanford University.
J. H. Van Norman, Chief Operator of Screening Plants, City of Los Angeles.
H. B. Walker, Professor of Agricultural Engineering, University Farm, Davis.
L. E. Webb, Sewage Works Manager, Gridley.
Carl Wilson, Laboratory Director, Department of Water & Power, Los Angeles.
E. L. Wright, Water and Sewer Superintendent, Orland.

ASSOCIATIONS

AMERICAN WATER WORKS ASSOCIATION

National Convention—The national convention will be held at St. Louis, Missouri, June 2 to 7. An excellent technical program has been prepared, including papers or discussions by the following far western members: S. B. Morris, chief engineer, Water Department, Pasadena; William W. Hurlbut, water distribution engineer, Department of Water & Power, Los Angeles; George W. Pracy, superintendent of city distribution, San Francisco Water Department; L. M. Anderson, controller, Department of Water & Power, Los Angeles; Carl Wilson, laboratory director, Department of Water & Power, Los Angeles; Ralph A. Stevenson, superintendent of water filtration, Sacramento; Burton Lowther, consulting engineer, Denver; V. M. Ehlers, chief sanitary engineer, Texas Department of Health, Austin; Richard Bennett, superintendent, Water Department, Tucson.

Official nominees for office are: president—George H. Fenkell, superintendent and general manager, Board of Water Commissioners, Detroit; treasurer—William W. Brush, chief engineer, Department of Water Supply, Gas, & Electricity, New York City.

The entertainment features include an informal reception and dance, a dinner dance, and parties and shopping tours for the ladies. Water works accessories and equipment will be exhibited by members of the Water Works Manufacturers Association.

Pacific Northwest Section—The third annual meeting, held at Portland, Oregon, April 24 to 26 with a registered attendance of 149, was pronounced a decided success by the officers and members of this active section. All papers for the technical sessions were personally presented by the authors in regular sequence (see program in April 10th issue, p. 196).

Attendance at the annual banquet on April 25 was 139. A short talk was given on the aims and motives of the Association by Jack J. Hinman, national president; other talks being made by Ben S. Morrow, retiring president, and Ernest C. Willard, retiring secretary-treasurer of the section. Golf prizes for the tournament of April 24 were announced at the dinner as follows:

First prize (golf bag), Sam W. Kerr, Mueller Co., Seattle.

Second prize (golf bag), R. W. Martindale, Pacific coast manager, U. S. Pipe & Foundry Co., San Francisco, California.

Third prize (3 matched wood clubs), Ross A. Gridley, assistant division engineer, Public Works Engineering Corp., Salem, Oregon.

Fourth prize (3 matched wood clubs), A. D. Mars, Jr., Neptune Meter Co., Denver, Colorado.

Fifth prize (12 golf balls), H. A. Goode, assistant to commissioner of public utilities, Portland, Oregon.

Sixth prize (12 golf balls), W. B. Severyns, superintendent, Water Department, Seattle, Washington.

Seventh prize (putter and ball), James Q. Osborne, DeLaval Steam Turbine Co., Seattle, Washington.

Eighth prize (putter and ball), J. L. Hill, Pacific States Cast Iron Pipe Co., Provo, Utah.

Ninth prize (raincoat), H. D. Fowler, Pittsburgh-DesMoines Steel Co., Seattle, Washington.

Tenth prize (raincoat), David E. Wallbom, accountant, Seattle, Washington.

Eleventh prize (6 golf balls), S. J. Benedict, assistant engineer, Water Bureau, Portland, Oregon.

Twelfth prize (6 golf balls), Alex Lindsay, superintendent, Water Department, Spokane, Washington.

New officers elected at the business meeting include:

Chairman—Alex Lindsay, superintendent, Water Department, Spokane, Washington.

Vice-Chairman—Carl A. McClain, general superintendent and secretary, Eugene Water Board, Eugene, Oregon.

Secretary-Treasurer—R. F. McLean, superintendent, Water Department, Walla Walla, Washington.

Director—R. H. Corey, division engineer, Public Works Engineering Corp., Salem, Oregon.

Director (holdover)—Fred J. Sharkey, superintendent, Water Department, Wenatchee, Washington.

National Director (until 1932)—W. A. Kunigk, superintendent, Water Division, Tacoma, Washington.

AMERICAN SOCIETY OF CIVIL ENGINEERS

Western Washington Section—A regular monthly meeting was held at the Engineers' Club, Seattle, April 15, guests of the section being John F. Coleman, national president, and George T. Seabury, national secretary.

Tacoma Section—The constitution of this local section (J. L. Stannard president and J. A. Arnston secretary-treasurer) was approved January 13, 1930, the charter membership being 31. Regular meetings are held on the second Monday of each month at the Tacoma hotel. As evidence of its wide-awake spirit, this section has already secured the Society's 1931 national summer meeting.

Los Angeles Section—A regular monthly meeting was held April 12 at California Institute of Technology, Pasadena, as guests of the student chapter. Laboratory demonstrations were given, including the wind tunnel used for the study of aeronautical problems and million-volt electric machines. An 'al fresco' dinner was served in the gardens of Dabney Hall of Humanities, the diners being entertained by radio music and by students in piano and banjo selections. After dinner, the meeting adjourned to the lecture room of the Norman

Bridges Physical laboratory where Archer F. Barnard, section president, introduced Ralph Modjeski, consulting bridge engineer, New York, who discussed the design and construction of the Philadelphia-Camden bridge, using lantern slide illustrations.

A special meeting was held April 30 so that the section might meet John F. Coleman, national president; Joseph M. Howe, national vice-president from zone 4; and George T. Seabury, national secretary. More than 60 members of the section attended the national spring meeting at Sacramento.

Los Angeles section publishes a monthly bulletin, the 'ASCE', of which Walter E. Jessup is editor-in-chief. In the April issue, coming meetings were announced and papers were published as follows: 'Estimate of Amount of Waste Water Flowing into Salton Sea' by J. B. Lippincott; 'The Nicaraguan Canal' by C. P. Gross; 'Beverly Hills Water Treatment Plant' by Arthur Taylor; there was also a memoir, minutes of the Sanitary Group, and a page of 'president's comments'.

San Francisco Section—A regular bi-monthly dinner meeting was held at the Engineers' Club April 28, the following national officers being present: John F. Coleman, president; Joseph M. Howe, vice-president; Frederick H. Fowler, Malcolm Pirnie, A. F. Reichmann, Ole Singstad, and Charles H. Stevens, directors; and George T. Seabury, secretary. Guests from Sacramento section included: Thomas B. Stanton, Norwood Silsbee, Joseph W. Gross, Henry F. Jerauld, George W. Hawley, and Charles E. Andrew. Attendance at the dinner was 161, additional members attending the business meeting and program which followed.

A memoir of Edwin Duryea, Jr., was given by H. L. Haehl. Reports of special committee chairmen were heard, as was the secretary's report giving the net membership of the section as 550. Junior membership prizes were awarded for 'those characteristics which would lead a faculty committee to believe that the man would achieve success and bring credit to the Society' to John S. Hamilton, graduating senior from the University of California, and George A. Chester, graduating senior from Stanford University. Ralph Wadsworth, chairman of the entertainment committee, read a report of the Derleth committee on 'Standardization of the F.F.P. (French Fried Potatoes)'—a most amusing parody on the building code committee and State Board of Registration for Civil Engineers.

John F. Coleman stated that the public has no real conception of what the engineer is and does, and that the Society has now a committee on public information to show the layman in homely language that an engineer is far more than the popularly-conceived surveyor—an occupation incidental to design and the preparation of plans and specifications. Joseph M. Howe described the decentralization of Society activities through local sections, the result of a more liberal attitude by the governing board, and furnished his observations on the functional expansion program to show 'who we are and what we do'. George T. Seabury outlined the four-weeks' trip being made in company with Coleman (and part of the way with Howe), to visit local sections, of which there now are 50. Three geographical divisions of the United States have been formed for decentralized meetings, the annual meeting excepted. The Society will soon begin to publish a magazine for shorter papers and the general assistance of 'Proceedings'. Functional expansion will probably be sought in three ways—through a series of 600 to 1000 short and popular articles on the things engineers have to deal with, by radio talks, and through the presentation of popular lantern lectures on construction projects. Seabury described progress on a proposed amendment to membership qualifications, which will be presented at the 1930 summer meeting in Cleveland. As the final speaker, C. E. Grunsky, past president of the Society, outlined the World Engineering Congress at Tokio, which was attended by 400 foreign delegates—stressing the remarkable cordiality and hospitality of the Japanese.

Fresno Engineers Club—At weekly April meetings of this Club, the following subjects were discussed: 'History and Development of Natural Gas' by E. M. Seels; 'Africa' by C. A. Kent; 'Kettleman Hills' by Ben Walker; 'State Cooperative Snow Surveys' by Arman Sek'emian; 'Public Schools Week'; and 'Rolling Sheet Metal by the Continuous Process' (illustrated) by Clarence Johnson.

Arizona Public Health Association—The third annual meeting was held in Phoenix April 22 and 23, the Association being divided into three sections—health officers, dairy inspectors, and water and sewage. A number of papers on problems relative to these three groupings were presented and discussed by representatives of the State Boards of Health of Texas and New Mexico and of the United States Public Health Service, and others. Governor J. C. Phillips made the principal address at the annual banquet on April 22. The total registration was 123.

American Welding Society—The San Francisco section held a monthly meeting at the Engineers' Club April 25. The topic of the meeting, 'Qualification and Training of Welders', was discussed by H. M. Wallen, lt.com. U.S.N., Mare island; Michael Fisher, Richmond refinery, Standard Oil Co.; W. J. Moriarity, foreman welder, Southern Pacific Co.; and W. P. Brown, Brown Bros. Welding Works.

Oakland Engineers Club—At the meeting on April 18, E. M. Seels of the Pacific Gas & Electric Co. spoke on 'Natural Gas as a New and Better Fuel'. On May 2, Lester C. Uren, of the department of mining and metallurgy, University of California, discussed 'The Oil Conservation Issue'. For the meeting of May 16, W. P. Butler of the Pacific Coast Aeronautical Exposition will talk on 'The Trend of Aviation'. The club now has a membership of over 157.

PERSONAL MENTION

C. E. Dorisey has been appointed city engineer of Mount Vernon, Washington, to succeed Arthur E. Dimock, deceased, and will have charge of the $1,000,000 sewer system under construction. Dorisey was formerly state sanitary engineer of Washington.

George Wilhelm, for many years chief engineer and general manager of the East Bay Water Co., of Oakland, accepted appointment May 1 as commissioner of public works, city of Oakland, to succeed William H. Parker, who was recently indicted in connection with alleged graft. Wilhelm was born in Grass Valley, California, graduated from the University of California in 1900, was first employed by the Pacific Gas & Electric Co.; in 1904 was resident engineer in charge of construction of the Key System 3½-mile pier and subway; was later with the Smith & Williams Land and Construction Co.; and then entered the engineering department of the Syndicate Water Co. which was merged with the Peoples Water Co. and in 1929 purchased by the East Bay Municipal Utility District. Wilhelm is an associate member of the American Society of Civil Engineers.

Harry Neville Jenks, consulting sanitary engineer, of the engineering office of Clyde C. Kennedy, San Francisco, has been retained by **James S. Dean,** city manager, and **Fred J. Klaus,** city engineer of Sacramento, to direct the research studies and prepare preliminary plans and estimate of cost for the enlargement of the pre-treatment works of the Sacramento filtration plant. A bond issue of $500,000 to $600,000 probably will be required for these improvements, which may be submitted to the voters on June 13. If the bonds carry, Jenks will be retained as consulting engineer on the design and construction of the new plant; and in this event a consulting structural engineer also will be employed on the project. The new units will have a rated capacity of 60 to 70 m.g.d., to provide for the unusually high water consumption during the critical summer months.

OBITUARY

Ben R. Pearce, superintendent of highway construction in Arizona, died at his home in San Diego on April 3 at the age of 36 years.

Cost Engineering vs. Building Construction

By F. J. EARLY, JR.
Engineer, P. J. Walker Co., San Francisco

Not long ago a prominent San Francisco building contractor in the course of a discussion sallied forth with "Early! what in blazes is a cost engineer?" It was a direct question and called for a similar answer. I was frankly stumped, and after making a quick inventory of stock phrases, could not find one that would adequately describe the functions of a cost engineer. Two weeks later, after numerous mental references to that question, I was still shy an adequate definition. Thus accepting the above as a challenge, I have prepared the brief for the case of Cost Engineering vs. Building Construction.

The first job for a cost engineer is to find the cost of the building under construction to date. To date is to be interpreted as a previously specified date, generally being one of many dates evenly spaced over the calendar during the construction of the building.

"That's easy," you say, "just add up your paid and unpaid invoices, estimate the value of material ordered, then add in your payroll expenditures, and there is the answer. That doesn't require any engineer, why my office boy could——"

The first task is easy and most essential, equally valuable, and closely linked with the next task insofar as the objective is concerned, the cost of work yet to be performed. I am sorry to interrupt our agnostic, but the continuation would probably be "What is it going to cost to finish? Why man, that is impossible. I had a job where we had to pile for a terminal building with friction piles, and every four out of five we put in would keep right on slipping, and I bet they are sinking yet. No man in the world could tell when we would have enough piles to hold that building. The finest engineers in the State all disagreed, and it would have taken a seer to guess which one had the right answer."

Let us investigate a logical method of arriving at the cost to complete a partially completed structure. The computation of the uncompleted quantities of work such as the number of brick to be laid, square foot of forms to be erected, etc., are second nature to an engineer, and also reading of plans or blue prints which is highly necessary in order that no mistake be made in the remaining quantities of work.

This must be turned into dollars by the insertion of the cost per thousand of brick per square foot of forms, etc., for both labor and materials. The cost of materials is known from previous invoices, and for the labor costs it is clear that at this time the original estimated unit cost should not be used, but the actual unit costs as determined on the portions of similar work already completed in the building. This adds another ramification to the cost engineer's work; he must see that the field clerk has correctly recorded the labor cost for the previous complete phases of the work, and familiarize himself with them as to their exact scope. The subject of relations of field clerks and the cost engineer will be discussed later. Then allowance for slightly different conditions to be encountered in the remaining work must be made, such as the re-use of concrete, form lumber, etc.; which will increase the labor cost and reduce the material cost in this specific instance.

The length of time required for various operations, and the effect upon the time required for completion of an operation when it must be performed simultaneously with others, is a readily apparent qualification if the cost of overhead is to be computed with any degree of accuracy.

I might slightly diverge here into the realms of finance and the absolute necessity of watching the dollar, in order to produce a successful enterprise. Here again your cost engineer proves worthy of the name—he is a veritable 'watch dog' through his checking of the unit costs submitted by the job clerks. His discovery of an unusual cost will cause the alarm, the remedy for which might be simple and quickly effected, once the condition has been discovered. A discovery of this sort on a large project oftentimes will pay the cost engineer's salary for five years or more. Do not misinterpret this as a defense of the man who does not catch this condition, that would result in an overrun, in time, but as a statement that the locating of such a condition once in five years that can be corrected, will pay his salary.

Previous mention was made of the necessity of cooperation of the field clerk and the cost engineer. The fact being, that for the engineer to obtain the essential data that he needs, he must instruct the field clerk and be in constant contact with him. Under these conditions it is only natural that he should supervise this work, as the other duties of the field clerk, consisting of ordering material, checking invoices, payroll, etc., are routine—routine with which the cost engineer familiarizes himself as a matter of course in his other work.

To go still further, the very work of the cost engineer, it is plainly seen, makes him an expert upon unit labor and material cost. Consequently in preparing an estimate for new work, or special changes on a job that is already in progress, he is the logical man to furnish the units. This work being by far the most important function of the estimating department, it would place him in charge of this department, with its work being restricted to tabulation of sub-contract bids and computation of quantities from drawings. It seems sound of reason that a man that estimates, and can later visit the job and view the result as to the correction of visualized conditions to be encountered and cost, will in a short time develop into a far more accurate estimator than the man who rarely leaves the office; and by removing from his sphere the task of computing quantities this is accomplished.

Air Power 75 feet under water cuts piles in 3 minutes

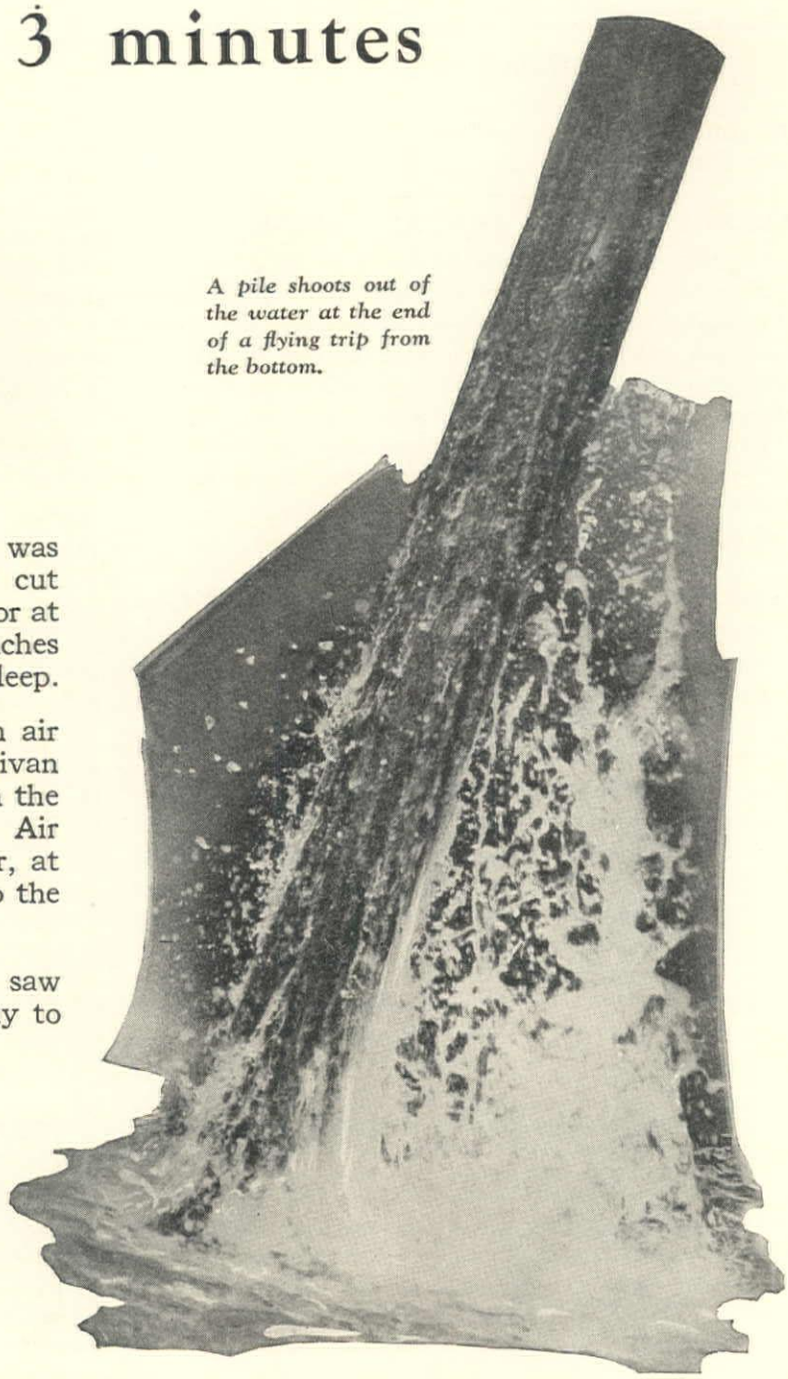
A striking contrast to hand sawing was witnessed recently—when air power cut 1,000 piles from the bottom of the harbor at Vancouver. Piles were 14 to 18 inches thick, and set in water 40 to 75 feet deep.

Two divers did the cutting with an air saw, using air at 100 lbs., from a Sullivan Vibrationless Compressor. A lever on the saw handle held the saw to the pile. Air was exhausted directly into the water, at the 40 foot depth, but was brought to the surface on deeper cutting.

Only 3 minutes were needed to saw through a pile, and start it on its way to the surface.

This profit-making application of air is one of hundreds on which Sullivan Air Equipment is at work. Many ideas are pictured and described in Sullivan booklets, free on request. Ask for "Speed Up With Air."

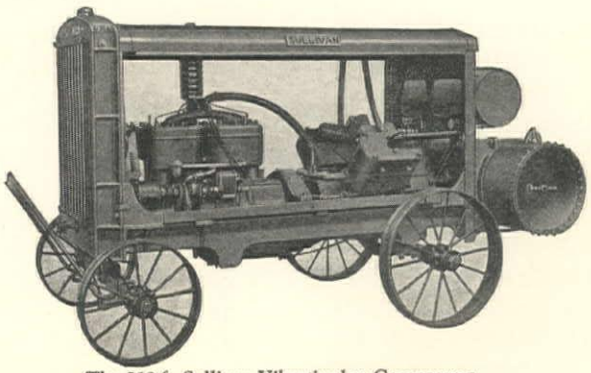
Pictures by courtesy of Construction Methods



A pile shoots out of the water at the end of a flying trip from the bottom.

SULLIVAN AIR POWER EQUIPMENT

Compressors, Concrete Breakers, Clay Spaders, Rock Drills, Drill Sharpeners, Portable Hoists



The 310-ft. Sullivan Vibrationless Compressor . . . one of nine Sullivan sizes.

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ITEMS OF INTEREST

CHOAPA DAM, CHILE

The Ambursen Dam Co. has secured a contract for the construction of a multiple arch dam, 200 ft. high, near Santiago, Chile; to cost $750,000.

ALEXANDER DAM (KAUAI, HAWAII) FAILS

On March 26, the Alexander hydraulic fill dam, under construction by the McBryde Sugar Co., on the island of Kauai, Hawaii, failed—the cause, apparently, being too rapid sluicing without allowing the core to properly drain and settle. The dam was to be 125 ft. high and the fill was up to 95 ft. when the failure occurred. A ten-day rainfall increased the saturation and the lower slope gave way, permitting the major portion of the dam to 'flow' downstream, killing several laborers. The dam will be reconstructed.

SAN FRANCISCO WATER IMPROVEMENTS

The Board of Public Works has authorized the following construction:

Upper Alameda Tunnel—To divert water from Alameda creek to Calaveras reservoir. Diversion dam (to be constructed later); and 6 by 7-ft. (horseshoe) concrete-lined tunnel, 9850 ft. long. This tunnel was started from one portal several years ago by the Spring Valley Water Co., and about one-half has been completed. The present appropriation of $80,000 is for construction up to July 1; it will cost $470,000 to complete the tunnel and diversion dam. Alameda creek will furnish 13,000,000 g.p.d. additional supply.

Sunset Wells—An appropriation of $235,000 has been made to complete wells, pumping plant, and pipe-line, commenced before the system's recent acquisition. There will be eventually 20 wells, 14 to 16 in. diam., 250 to 275 ft. deep, including 2 old wells, 14 about completed, and 4 to be drilled later. Each well is to be equipped with a vertical deepwell pump, and all will discharge into a 500,000-gal. sump, from which the waste will be pumped through 10,300 ft. of 20-in. steel pipe (to be constructed) to a connection with the distribution system.

Pleasanton Wells—An appropriation has been made of $12,000 for lowering the wells and pumps, and for pumping from lower water-bearing strata. After July 1, more wells will probably be drilled.

PRODUCTION OF ELECTRICITY AND CONSUMPTION OF FUELS DURING 1929

Preliminary figures of the total production of electricity by public utility power plants in the United States during 1929 indicate an output of 97,294,000 kw-hr., an increase of nearly 11% over 1928.

The low precipitation throughout the country during 1929 resulted in a shortage of water in most of the streams used for water power and, in consequence, the production of electricity at this type of plant was 1½% less than in 1928, whereas the water power output during the previous 7 years had shown average increases of 13%. As a result of the 1929 condition, fuel-burning power plants were forced not only to supply the usual yearly increase in the demand for electricity, but also to make up the deficiency in output at water-power plants.

The annual increase in output of electricity by the use of fuels for 1927 and 1928 was about 5½% and in 1929 it was 18%. The increases in consumption of coal, oil, and gas over 1928 were 9, 41, and 46%, respectively. Although the unusual increase in the output of electricity by fuel-burning plants might have been expected to reduce their efficiency in the use of fuel, this was not the case. The average rate of fuel consumption was reduced from the equivalent of 1.76 lb. of coal per kw-hr. during 1928 to 1.69 lb. in 1929, or a saving amounting to 2,200,000 tons of coal and about $9,000,000.

BONITA ROCK-FILL DAM, NEW MEXICO

The Southern Pacific Co. recently awarded a contract to the W. A. Bechtel Co. of San Francisco, for the construction of a rock-fill dam on the Bonito river at elev. 7280 ft., near Capitan in Lincoln county, New Mexico.

The Bonita dam is being built to store the spring runoff at the head of a 140-mile pipe-line from Bonito river; the reservoir formed will impound 1170 ac-ft.

The dam will be of the rock-fill type, 92 ft. high above streambed and 440 ft. long on crest. The principal quantities involved include:

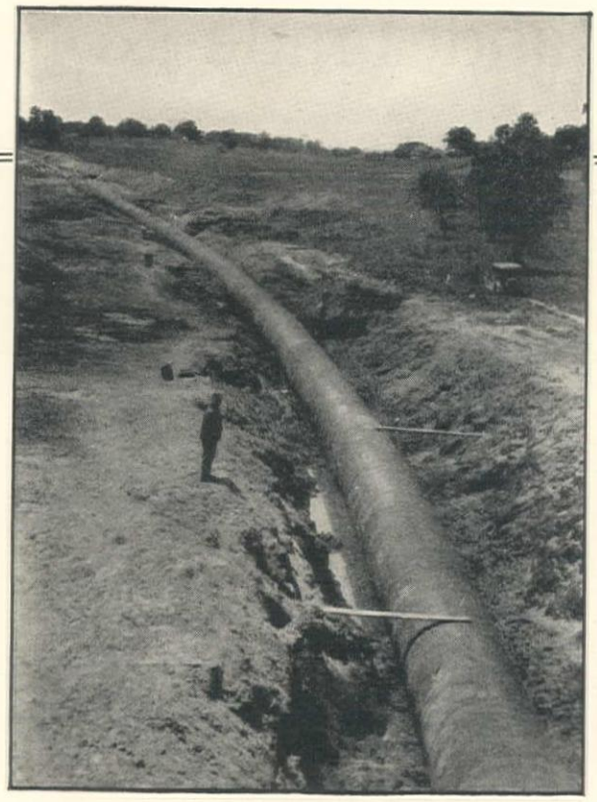
20,000	cu.yd. stripping of damsite
2,300	cu.yd. tunnel cut-off and cut-off trench
1,000	cu.yd. spillway excavation, wasted
1,300	lin.ft. drilling and grouting
95,000	cu.yd. loose rock fill
15,600	cu.yd. derrick-placed rock
2,000	cu.yd. mass concrete
2,400	cu.yd. reinforced concrete
200,000	lb. reinforcing steel
2,000	cu.yd. excavation for relocation of county road

Hauling and placing of sluice gates, etc.

PROPOSED BURRARD ST. BRIDGE AT VANCOUVER, B. C.

The proposed Burrard st. bridge will cross False creek, a secondary harbor with 13 ft. tidal range and 20 ft. main channel depth at low water, there being little current at the bridge site. The northeast approach is from Burrard and Pacific st. and the southwest from Cedar and Cornwall st. The bridge will consist of a high level vehicular deck (90 ft. clearance above high water) with provision for a future double track railway on a lower deck.

The bridge proper will be 2817 ft. long between abutments and 80 ft. wide, providing a 60-ft. roadway and two sidewalks. The channel span will consist of a through fixed truss 294 ft. 2 in. between centers of supports; two deck truss spans connecting with the north and south shores give a total length of 1140 ft. Reinforced concrete viaducts will carry the structure to its abutments; piers and towers flanking the channel will be of reinforced concrete. Approximate quantities in the highway portion are: 3300 tons of structural and 2000 tons of reinforcing steel, and 50,000 cu.yd. of concrete. Plans and specifications will be available about the last of July. J. R. Grant, Bekins bdg., Vancouver, B. C., is the consulting engineer.



A Mile of *Flexible* Construction

Carries this Outfall Across a Marsh

WHEREVER unstable soil conditions would necessitate expensive foundation work, the lightweight, continuous construction of Armco Corrugated Iron Pipe offers a ready solution. The 84-inch Armco sewer outfall pictured above, laid in ground so unstable that excavating equipment mired in it and heavy, rigid pipe sank from its own weight, is now satisfactorily serving a midwestern city.

The successful meeting of situations of similar difficulty is the nationwide record of Armco Corrugated Iron Pipe. Tested by 24 years of actual service and endorsed by 50,000,000 feet already in use, it fully meets the requirements of economy, dependable protection and speedy construction demanded of modern municipal improvements.

For further information concerning the varied municipal uses of Armco Corrugated Iron Pipe, write for our bulletin, "Planning Municipal Drainage for Today and Tomorrow."

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SPOKANE, WASH.

Western Metal Manufacturing Co.
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ARMCO corrugated PIPE

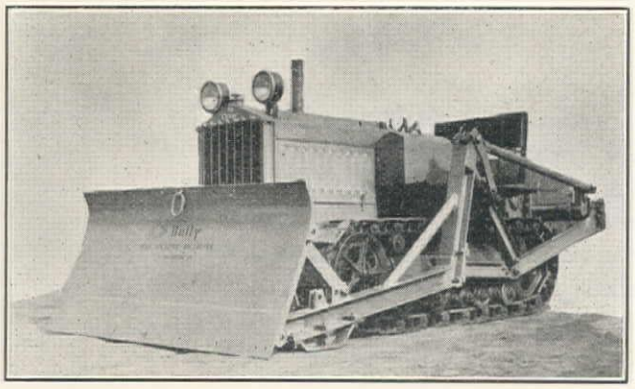
New Equipment and Trade Notes

W-K-M TRACTOR EQUIPMENT

The W-K-M Co., Inc., Houston, Texas, has released a series of pamphlets describing its tractor equipment. The company's products include the W-K-M side boom units, models A-1 and A-2, for attachment to Caterpillar standard '30' and hillside special '30' tractors; the model A-3 side-boom unit for Caterpillar '60' tractors; the W-K-M forced feed 'Day Jaw' crushers for use with Caterpillar '20' and '30' tractors; the W-K-M 'Simplex' gasoline tank filler for automatically refueling tractors, shovels, cranes, trenchers, portable compressors, etc.; the W-K-M boom for attachment to McCormick-Deering 10-20 tractors equipped with model DH Trackson tracks; the W-K-M bulldozer and side winch Fordson attachment for backfilling, spreading, and leveling; the W-K-M model AA winch for mounting on Ford model AA, 1½-ton trucks, and others.

GEAR-OPERATED BULLDOZER AND BACKFILLER FOR CLETRAC TRACTORS

Niess & Co., Inc., Minneapolis, has developed 'The Bully', a gear-operated bulldozer with rigid blade (and backfiller with adjustable blade) for use with Cletrac models 20, 30, 40, and 80-60. The power transmission unit for this equipment is

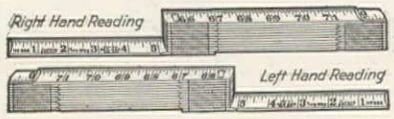


composed of a pinion and bevel gear, with spur pinion and gear segment, employed with a twin disc clutch and brake. The gears are enclosed in an oil-tight housing attached to the tractor transmission case, the clutch and brake being mounted outside of the gear case. The gear operated unit is said to have fast and positive blade action, a wide radius of blade travel on all sides of the tractor, additional clearance by free lift when high obstructions are encountered, and single-lever blade control for locking at the ground or use in the floating position. The tractor drawbar is in the clear, permitting the use of other equipment; the transmission unit does not interfere with tractor use. 'The Bully' requires no sub-frame but is extremely rugged, being electric-welded throughout.

LUFKIN SPRING JOINT FOLDING WOOD RULE

The Lufkin Rule Co., Saginaw, Michigan, announces a spring joint folding wood rule with several new and valuable features. It is known as the 'Two-Way—Red End' rule, and is said to have a number of advantages for carpenters and other mechanics, as well as for those who do common measuring.

On one side of the 'Two-Way rule, figures run from left to right (right-hand), and on the other side from right to left (left-hand)—two features which have never before been incorporated in one rule. Right-hand is the natural direction for much common measuring, while left-hand is most convenient when the rule is held in the left hand with a pencil or saw in the right. With the 'Two-Way' rule, the figures are right-side-up to the user in many measuring operations, where heretofore they were up-side-down. Thus, convenience is served and chances for error are eliminated. For example, with the 'Two-Way': to find the balance of space completing any measurement (when measuring distances longer than the rule), simply extend and turn over the rule and all figures still appear right-side-up. Also, this rule is handy in measuring left and right out of any corner. When measuring a board, building,



or across a room, the 'Two-Way' is equally convenient—if the measurement starts from the left or the right-hand end, or wall. This rule has inside or flat markings on both sides; thus, the portion being used lies flat on the work. Another feature is that the 16ths are on the upper, instead of the lower edge—they naturally fall closest to the edge being measured or marked.

This rule is made in white enamel finish, ⅝ in. wide, with 6-in. sections, and in 4, 5, and 6-ft. lengths. It has rust-proof metal spring joints and trimmings; strike plates to prevent wear of markings of opening and closing; and distinctive, bright, red ends. It is marketed through hardware and tool stores, generally.

FRANCIS H. JAMES JOINS TRANSIT MIXERS, INC.

Francis H. (Jesse) James has recently become chief engineer of Transit Mixers, Inc., San Francisco, manufacturer of Paris 'Transit' mixers. James has had a broad construction experience, being for several years sales engineer for the Northwest Engineering Co. in California.

GLADDING, McBEAN & CO. OPENS NEW YORK SALES OFFICE

Gladding, McBean & Co., clay products manufacturer, has opened a sales office in New York City in charge of Herbert Brown, former manager of the southwest district sales department. Brown is a graduate of the University of California school of architecture and has been with the company for 8 years.

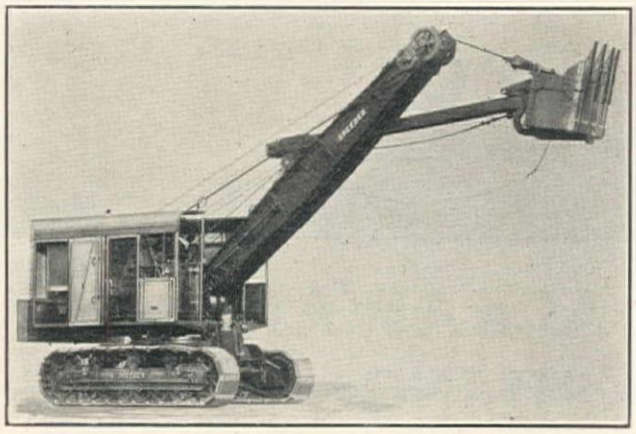
Many vital reasons are said to have dictated the company's move. Among them is the fact that an increasing number of projects on the Pacific Coast have their inception in the offices of Eastern architects, contractors, and owners as the result of westward expansion of trade; contact is needed with Government officials concerned with the award of contracts on the Pacific Coast; and a representative is required to take care of and develop much business that has arisen spontaneously in the East during the past 2 or 3 years, especially in the realm of decorative tile.

SHELL OIL CO. COMPLETES ITS TALLEST AMERICAN BUILDING

The Shell bdg. at First and Battery st., San Francisco, a 29-story earthquake-resistant structure erected at a cost of $4,000,000 and opened for inspection April 28, is the tallest Shell office building in America. The 4500-ton steel frame was erected in 58 working days of 8 hours, or 32 days ahead of schedule, and the entire structure was completed in 10 months. Fourteen floors will be occupied by the Shell Co. and its subsidiaries, and 13 floors will be available for renters. A 4-floor garage has space for 175 cars; all office partitions in the building are movable.

SPEEDER MODEL 90 POWER SHOVEL

The Speeder Machinery Corp., Cedar Rapids, manufacturer of full revolving, fully convertible gasoline shovels, first showed its model 90 at the 1930 Road Show. This is a full 1¼-yd. gasoline, electric, or diesel-powered shovel weighing 40 tons and is the result of 5 years' study, with more than 2 years of actual operation. Features of the new model are said to include: Timken bearing unit-built and friction-free throughout;



Speeder Model 90 with 22-ft. Boom and 18-ft. Dipper Stick

automotive construction; all shafting heat-treated and ground to micrometer limits; shafts and hubs splined at important points; gears, including bevels and the ring or 'bull' gear, cast from special-composition steel and machine cut from solid blanks to a mirror finish; bevel gears heat-treated and hardened; traction bevels running in oil; unit construction to allow removal of drum and vertical shafts, with bearings.

Model 90, like other Speeder shovels, has two working speeds on all operations, drums, travel, and swing. Both speeds are direct drives from the power unit and are actual operating speeds—one a high speed for shovel work, the other a medium speed for crane or dragline work. All drive shafts run at relatively high speeds, thus eliminating tremendous pressures ordinarily put on shafts, gears, bearings, and clutches, and also the need for coarse, heavy gears and clumsy shafting. The lower frame is a steel casting with machined track having semi-tubular side members closed at the top to exclude dirt. The treads are of extra length, 14 ft. 6 in. overall, and the turntable (renewable) is 6 ft. 3 in. diameter.

This model has an automatic swing and travel brake, backgeared, which engages as soon as the swing or travel clutches are released, thus eliminating burning of reverse clutches. The patented reversible drum cable crowd is used, with some notable improvements. An automatic power trip for the bucket is another feature—this trip can be released by the pressure of a finger tip and is fast in action. The rear counterweight is instantly adjustable, providing correct ballast for long boom work and giving an adjustable tail swing. The machine has a ground clearance of 17 in., yet it is only 11 ft. high from ground to top of cab.

GARDNER-DENVER SENDS REPRESENTATIVE TO CHILE

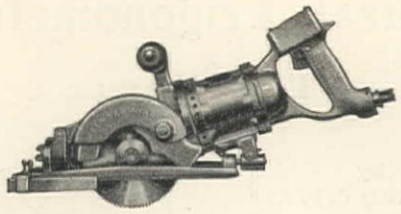
Ian Duncan, formerly of Glasgow, Scotland, has sailed for Santiago, Chile, to represent the Gardner-Denver Co. in the mining districts of that country, his headquarters being with the Chilean agents, Spencer & Waters, Ltd. Duncan recently finished special courses offered in the company's Quincy plant; he was originally scheduled for assignment to the London office.

VAN DORN PORTABLE ELECTRIC SAWS

The Van Dorn Electric Tool Co., Cleveland, announces the addition of three sizes of portable electric saws, 6, 8, and 10-in., to its line. These saws have been developed to increase production sawing of all kinds of wood and, with the use of an abrasive disc, to cut slate, marble, asbestos, transite, tile, porcelain, etc.

The portable saws are driven by Universal motors operating on A.C. and D.C. and conform to modern safety practices, incorporating an automatic safety switch and automatic telescopic guard. The safety switch starts the saw when the trigger is pulled, but cuts off the current when the trigger is released, while the telescopic guard opens as the saw enters the work and closes over the blade when the cut is finished.

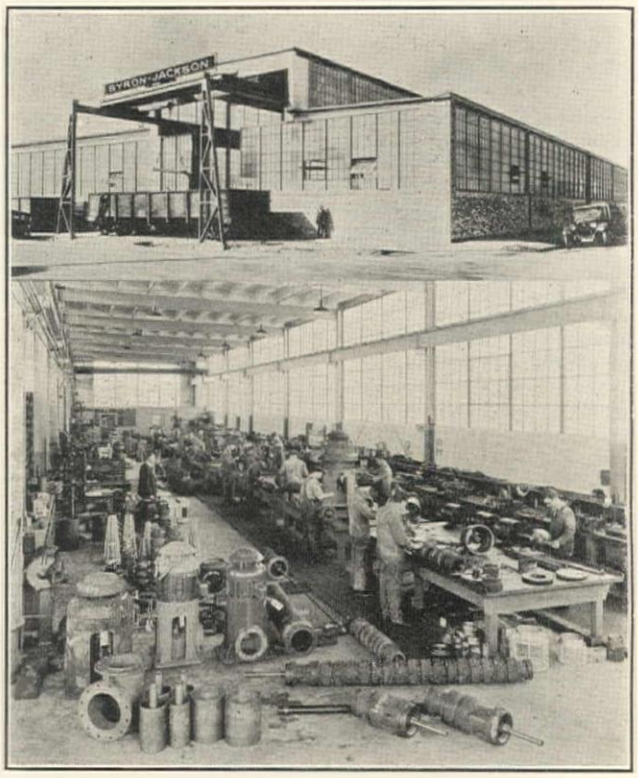
These saws are fully adjustable, having thumbscrew adjustments for regulation of depth and width of cut and a gradu-



ated adjustment for beveled cuts—all at the operators' finger tips. The maximum depth of cut for the three saws is 1¾ in. with the 6, 2½ in. with the 8, and 3½ in. with the 10-in. diameter blade.

BYRON JACKSON COMPLETES DEEPWELL TURBINE UNIT AT BERKELEY

The Byron Jackson Co. has completed a deepwell turbine addition to its Berkeley, California, plant. This is housed in a brick, steel, and glass building 70 by 180 ft. in plan, with provision for a rear extension increasing the area to 100 by



Exterior and Interior of Deepwell Turbine Addition to Byron Jackson Co. Berkeley Plant

275 ft. In the 'pump and build-in head assembly section' there is 125 ft. of specially designed and equipped benches, fronted by eight metal-covered assembly tables, the section being served by an overhead crane. The main section of the building is used for storage and handling of materials, including deepwell turbine rotors and stators, also being served by an overhead crane. Many new tools have been required for the company's machine shops to meet steadily increasing production demands.

UNIT BID SUMMARY

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

IRRIGATION AND RECLAMATION

ELLENSBURG, WASH.—CANAL EXCAVATION, TUNNELS AND STRUCTURES—GOVT.

General Construction Co., Colman Bdg., Seattle, who bid $201,945, submitted low bid on Schedules 1, 2, and 3 combined for the construction of earthwork, tunnels, and structures on Division 3 of North Branch Canal, Kittitas Division of Yakima Project, Wash. Bids received as follows:

SCHEDULE No. 1—Earthwork and structures on North Branch Canal, Station 1688-08.77 to Station 1903-88, bids on following main items of construction:

(1) 21,000 cu.yd. excavation of canal, Cl. 1
(2) 39,000 cu.yd. excavation of canal, Cl. 2
(3) 32,000 cu.yd. excavation of canal, Cl. 3
(4) 1,770 cu.yd. comp. embank. or puddled core
(5) 1,900 cu.yd. excav. for struct. Cl. 2
(6) 1,700 cu.yd. backfill about structures
(7) 200 cu.yd. riprap
(8) 300 cu.yd. concrete
(9) 24,000 lb. reinforcing steel, placing
(10) 464 ft. 36-in. concrete pipe, laying

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	TOTALS
J. A. Terteling & Sons, Moscow, Idaho	.14	.48	.90	.50	.70	.35	3.00	22.00	.03	2.00	$64,886
General Const. Co., Seattle	.10	.42	1.00	.60	.80	.40	2.50	27.00	.03	1.90	67,009
W. H. Puckett Co., Boise	.34	.34	1.10	.50	1.00	.40	2.50	30.00	.04	2.50	74,628
Rumsey & Jordan, Seattle	.20	.45	1.20	.80	.60	.50	1.00	25.00	.04	3.00	77,547
E. T. Fisher, Pt. Angeles	.43	.43	1.10	.60	1.00	.50	2.50	32.00	.03	1.50	80,909
W. L. Geist, Spokane, Wn.	.54	.54	1.03	.90	2.50	.75	1.75	22.00	.03	4.00	89,961
Bolan Constr. Co.	1.50	1.50	4.00	.10	3.00	.40	4.00	12.00	.03	5.00	239,810

SCHEDULE No. 2—Johnson Creek Siphon and Siphon 6, North Branch Canal, bids on:

(1) 4,000 cu.yd. excav. for struc., Cl. 1
(2) 3,000 cu.yd. excav. for struc., Cl. 2
(3) 2,000 cu.yd. excav. for struc., Cl. 3
(4) 480 cu.yd. excav. of tunnel, all classes
(5) 6,200 cu.yd. backfill about structures
(6) 198 cu.yd. concrete in structures
(7) 220 cu.yd. conc. in tunnel lining
(8) 54,000 lb. reinforcing steel, placing
(9) 1,770 ft. 72-in. conc. pipe, laying

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	TOTALS
General Constr. Co., Seattle, Wash.	.20	.85	2.00	8.00	.25	30.00	16.50	.03	6.00	$34,853
W. H. Puckett Co., Boise	.50	.80	2.00	10.00	.50	30.00	17.00	.04	4.00	35,755
Bolan Constr. Co.	1.00	2.00	5.00	9.00	.40	12.00	15.00	.03	5.00	43,398
Joe Ban, Yakima, Wash.	.45	2.45	3.50	7.50	.75	27.50	22.50	.04	7.00	49,935
Barnard-Curtiss Co., Minn.	.50	2.00	3.50	10.50	1.00	27.00	25.00	.05	10.00	58,251
Siems-Spokane Co., Spokane	1.15	1.60	3.50	14.00	.75	45.00	24.00	.04	12.70	67,214

SCHEDULE No. 3—Tunnel No. 5, North Branch Canal Station 1769-50 to Station 1807-25, bids on following main items of construction:

(1) 1,900 cu.yd. excav. of canal, Cl. 3
(2) 7,500 cu.yd. excavation of tunnel
(3) 85 cu.yd. conc. in open and closed transi.
(4) 2,600 cu.yd. conc. in tunnel lining
(5) 41 M ft. BM furnishing and erecting permanent timbering in tunnels

	(1)	(2)	(3)	(4)	(5)	TOTALS
General Construction Co., Seattle, Wash.	1.75	8.20	24.00	11.00	25.00	$100,083
Rumsey & Jordan, Seattle	1.00	9.00	16.00	12.00	1.00	104,382
Chris. Yonlick, Seattle	1.50	9.75	27.00	9.00	30.00	105,680
Coluccio & Ancorates, Seattle	1.50	11.00	18.00	9.00	5.00	113,964
Bolan Constr. Co., Cincinnati	2.00	9.00	12.00	15.00	100.00	120,576
S. A. Dahlberg, Port Angeles	1.50	10.00	25.00	12.50	60.00	121.032
H. B. Stone, Seattle	2.00	11.00	30.00	11.50	30.00	124.910
W. H. Puckett Co., Boise	1.50	10.00	30.00	17.00	85.00	132.420
Geo. K. Thompson, Thorp, Wash.	2.00	14.50	30.00	12.00	25.00	156,876
Siems-Spokane Co., Spokane	1.50	13.00	45.00	18.00	80.00	159 288

The work is located near Kittitas, Washington, a station on the Chicago, Milwaukee, St. Paul & Pacific Railroad.

FAIRFIELD, MONTANA—GOVERNMENT—DIKES

Hall & Booth, Stanley, North Dakota, $83,540 low bid to Bureau of Reclamation, Fairfield, Montana, for constructing dikes No. 1 and 2 for the Pishkun Reservoir enlargement, Sun River Project, Montana, work located 15 miles north of Augusta. Bids on following items:

(1) 22,000 cu.yd. stripping foundation for dikes
(2) 12 acres ploughing foundation for dikes
(3) 230,000 cu.yd. embankment clay, sand and gravel in central portion of dikes
(4) 65,000 cu.yd. embankment, selected clay, sand, gravel and cobbles for upstream portion
(5) 45,000 cu.yd. embankment, selected clay, sand, gravel and cobbles for downstream portion

	(1)	(2)	(3)	(4)	(5)	TOTALS
Hall & Booth, Stanley, North Dakota	.16	10.00	.235	.235	.235	$ 83,540
Smith & Thornquist, Great Falls, Montana	.40	2.00	.30	.30	.30	110,824
Winston Bros., Minneapolis	.30	12.00	.43	.48	.48	158,444
General Const. Co., Seattle	.35	7.00	.43	.48	.48	159,485
L. T. Lawler, Butte, Montana	.50	20.00	.43	.47	.47	161.840
Barnard-Curtis Co., Minneapolis	.25	20.00	.44	.56	.56	168.540
J. A. Terteling & Sons, Moscow. Idaho	.48	15.00	.48	.48	.48	173.940
Morrison-Knudsen Co., Boise, Idaho	.25	10.00	.49	.52	.52	175,520
Martin Day Co., Lincoln, Nebraska	.53	10.00	.53	.53	.53	191 980
Siems-Spokane Co., Spokane, Washington	.48	20.00	.52	.57	.57	193.100
John Phillips Co., S. F.	.40	10.00	.58	.58	.58	206.120
A. Guthrie & Co., Portland, Oregon	.50	25.00	.60	.70	.70	226.300

STREET AND ROAD WORK

OAKLAND, CALIF.—COUNTY—E. 14th ST.—CONCRETE BASE WITH ASPHALT SURFACE

Contract awarded to Jones & King, Hayward, who bid $118,904 on Proposal B (using Type B surface) for paving 2 miles of E. 14th St. for County. Bids received as follows:

	PROPOSAL A		PROPOSAL B		PROPOSAL C	
	A SURF.	B SURF.	A SURF.	B SURF.	A SURF.	B SURF.
(1) Jones & King, Hayward	$147,699	$140,429	$124,424	$118,904	$103,885	$ 99,925
(2) Fredrickson & Watson		149,061		124,561		102,941
(3) M. J. Bevanda, Stockton	143,574	141,757	123,930	122,013	103,958	102,968
(4) Hanrahan Co., S. F.		153,257		131,273		112,253
(5) Calif. Const. Co., S. F.		153,790		131,915		112,635
(6) J. H. Fitzmaurice, Oakland		168,186		141,061		117,101
(7) Heafey Moore Co., Oakland		161,771		141,021		117,841
(8) Central Calif. Roads Co.	162,774	152,504	138,800	133,280	117,620	115,660

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
16,500 cu.yd. excavation	.47	.48	.50	.40	.50	.60	.62	.55
15,000 cu.yd. borrow	.55	.57	.60	.90	1.30	.75	.80	.85
270 ft. 5x29-in. part circ. culverts	4.00	4.60	3.50	4.25	4.50	4.00	4.00	5.25
190 ft. 8x29-in. part circ. culverts	4.00	4.60	3.90	4.50	5.00	4.00	4.00	5.10
1,700 ft. 18-in. vitr. sewer	1.80	2.15	2.10	2.00	1.90	1.75	1.70	1.75
50 ft. 12-in. vitr. sewer	1.40	2.00	1.50	1.00	1.20	1.00	1.10	1.00
10 cast-iron inlet frames and grat.	18.00	17.50	15.00	15.00	20.00	20.00	16.00	18.50
7 manholes	65.00	50.00	50.00	40.00	30.00	50.00	35.00	50.00
17 c.i. cover and frames (manhole)	18.00	15.00	20.00	15.00	20.00	15.00	13.00	17.50
1,000 cu.yd. conc. (struct.)	18.00	14.50	15.00	20.00	18.50	17.50	17.50	18.00
160,000 lb. reinf. steel	.045	.04	.04	.04	.045	.0475	.0575	.035
13,500 ft. conc. curb and gutter	.95	1.00	1.00	1.00	1.00	1.00	1.00	.88
200 ft. concrete curb	.40	.50	.60	.50	.50	.60	.60	.60
30,000 sq.ft. cement sidewalk	.16	.14	.16	.15	.14	.15	.16	.15
PROPOSAL A								
363,500 sq.ft. 6-in. conc. base	.15	.16	.156	.157	.15	.17	.18	.14
363,500 sq.ft. 2-in. 'A' surf OR	.078		.065					.12
363,500 sq.ft. 2-in. 'B' surf	.058	.08	.06	.07	.06	.10	.08	.10
PROPOSAL B (ALTERNATIVE)								
276,000 sq.ft. 6-in. conc. base	.15	.16	.16	.157	.15	.17	.18	.143
276,000 sq.ft. 2-in. 'A' surf. OR	.078		.067					.123
276,000 sq.ft. 2-in. 'B' surf	.058	.08	.062	.079	.06	.10	.08	.103
PROPOSAL C (ALTERNATIVE)								
198,000 sq.ft. 6-in. conc. base	.15	.16	.16	.157	.15	.17	.18	.148
198,000 sq.ft. 2-in. 'A' surf. OR	.078		.069					.129
198,000 sq.ft. 2-in. 'B' surf.	.058	.08	.064	.085	.06	.10	.08	.109

SACRAMENTO, CALIF.—STATE—GRADING—COLUSA COUNTY

R. G. LeTourneau, 122 Moss Ave., Stockton, who bid $139,326 (as stated in our issue of April 30), submitted low bid to California Division of Highways, Sacramento, for 12.7 miles grading from Bear Creek to 5 miles west of Williams, COLUSA COUNTY. Bids received on:

(A) 48 acres clearing and grubbing.
(B) 240.000 cu.yd. roadway excavation.
(C) 340,000 sta.yd. overhaul.
(D) 4,300 cu.yd. structure excavation.
(E) 1,440 cu.yd. A concrete (struc.)
(F) 124,000 lb. reinforcing steel (struc.)
(G) 134 ft. 12-in. corr. metal pipe.
(H) 3,010 ft. 18-in. corr. metal pipe.
(I) 728 ft. 24-in. corr. metal pipe.
(J) 48 ft. 30-in. corr. metal pipe.
(K) 226 ft. 36-in. corr. metal pipe.
(L) 50 ft. corr. pipe (clean and relay).
(M) 2,600 cu.yd. light riprap.
(N) 2 move and reset concrete headwalls.
(O) 672 sta. finishing roadway.
(P) 150 monuments.

	(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)	(P)	TOTALS
R. G. LeTourneau, Stockton	$50	.35	.005	1.00	20.00	.045	.50	.75	1.00	1.25	1.50	1.00	2.00	10.00	5.00	3.00	$139,326
Chas. Harlowe, Jr., Oakland	160	.35	.01	1.50	24.00	.05	.75	1.00	1.25	1.50	2.00	1.00	2.00	10.00	3.00	2.50	154,525
A. Teichert & Son, Sacramento	100	.40	.0125	1.00	20.00	.045	.40	.50	.75	1.50	1.50	.50	2.00	10.00	5.00	3.00	155,338
Yglesias Bros., San Diego	100	.37	.01	1.00	25.00	.05	.50	.50	.70	.70	1.00	1.00	2.00	10.00	5.00	3.00	154,951
Kennedy-Boyles Const. Co., Biggs	75	.39	.01	1.00	22.50	.05	.40	.50	.75	1.00	1.00	1.50	3.00	10.00	3.00	3.00	156,269
Utah Const. Co., San Francisco	70	.35	.02	1.50	25.00	.05	.50	.60	.75	.90	1.10	1.00	3.50	8.00	5.00	3.00	158,556
Mathews Const. Co., Sacramento	82	.40	.015	1.25	23.00	.05	.50	.60	.75	1.00	1.25	.60	2.10	15.00	4.00	3.00	161,183
Fredrickson & Watson & Fredrickson Bros.	80	.43	.02	1.50	19.50	.045	.50	.50	.50	.50	.75	1.00	4.00	10.00	4.00	3.00	169,747
Jasper-Stacy Co., San Francisco	111	.43	.007	1.00	24.00	.06	.50	.60	1.00	1.50	2.00	.60	4.00	20.00	5.50	2.50	174,895
J. P. Holland, San Francisco	80	.47	.01	1.50	23.50	.0425	.50	.65	1.00	1.25	1.75	1.00	1.50	15.00	7.00	3.00	177,971
M. J. Bevanda, Stockton	75	.45	.01	1.00	24.00	.05	.75	1.00	1.00	1.50	1.50	1.50	4.00	25.00	5.00	3.50	178,749
C. G. Willis & Sons, Los Angeles	55	.44	.02	1.50	24.00	.06	.75	.75	.75	1.25	1.25	1.00	3.50	15.00	8.00	3.00	181,802
Granfield, Farrar & Carlin, San Francisco	300	.40	.02	1.50	26.00	.045	.50	.60	.75	1.00	1.25	.80	4.50	12.00	6.00	3.50	185,800
Hemstreet & Bell, Marysville	125	.46	.01	1.50	25.00	.06	.50	1.00	1.25	1.50	1.75	1.60	4.50	15.00	7.50	3.00	191,474
E. C. Coats, Sacramento	150	.50	.01	1.25	30.00	.05	.70	.90	1.00	1.20	1.40	1.00	3.00	20.00	5.00	3.00	201,009
Isbell Constr. Co., Fresno	100	.52	.009	1.50	28.00	.05	.50	.50	.50	1.00	1.50	1.00	2.50	15.00	10.00	3.50	201,805
L. W. Hesse, Merced	125	.54	.02	1.50	29.50	.045	.50	.80	1.00	1.50	2.00	2.00	4.50	15.00	8.00	3.00	218,353

PHOENIX, ARIZ.—STATE—OILING AND SURFACING—DOUGLAS-RODEO HIGHWAY

Skeels & Graham Co., Consolidated Bank Bdg., Tucson, Ariz., $134,124 low bid to Arizona State Highway Comm. for improving Douglas-Rodeo Highway, 26.5 miles from Bernardino northeast. Bids from:

(1) Skeels & Graham Co., Tucson, Ariz. $134,124
(2) Veater & Davis, El Paso, Tex. $138,809

	(1)	(2)
32,750 cu.yd. min. agg. bot.	.80	.92
55,929 cu.yd.mi. haul agg.	.17	.17
277,972 sq.yd. prep. subgrade	.01	.005
42,897 cu.yd. min. agg. top	.80	.85
79,133 cu.yd.mi. haul agg.	.17	.17
453,964 gal. oil app. to rdwy.	.075	.075
26.323 mi. mix, lay, and finish	$525	$525

SUNNYVALE, CALIF.—CITY—ASPHALT PAVING

Contract awarded to Peninsula Paving Co., Standard Oil Bdg., San Francisco, who bid $89,931 for improvement of portions of Washington Ave., Evelyn Ave., McKinley Ave., Iowa Ave., Pastoria Ave., Mathilda Ave., Taaffe St., Arques St., Sunnyvale Ave., and Carroll St., for the City of Sunnyvale. Bids received from the following concerns:

(1) Peninsula Paving Co., S. F. $ 89,931
(2) A. J. Raisch, San Francisco 99,989
(3) Union Paving Co., S. F. 101,951
(4) San Jose Paving Co., San Jose 104,528
(5) L. A. Batchelder, Palo Alto $104,882
(6) Jones & King 110,655
(7) Central Calif. Roads Co., Oakland 111,673
(8) S. M. McGaw, Stockton 113,762

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
472,244	sq.ft. 5-in. asph. conc. pave.	.127	.163	.144	.17	.16	.164	.168	.169
2,332	sq.ft. ¼-in. surf. finish	.02	.01	.01	.01	.02	.024	.04	.04
45,359	sq.ft. 6-in. conc. gutter	.22	.15	.22	.16	.20	.214	.22	18
2.739	sq.ft. 6-in. conc. driveway	.22	.15	.22	.16	.20	.268	.22	.18
282	sq.ft. 7-in. conc. driveway	.24	.17	.25	.20	.21	.289	.26	.20
7,503	sq.ft. 3½-in. conc. sidewalk	.16	.10	.15	.13	.15	.16	.185	.15
3,333	sq.ft. 2-in. asph. surface	.05	.05	.06	.05	.06	.07	.08	.06
22,668	ft. concrete curb	.40	.40	.50	.30	.40	.407	.43	.34
1,227	ft. 4-in. concrete pipe	.45	.40	.55	.55	.50	.67	.60	.55
78	ft. 6-in. concrete pipe	.55	.50	.60	.65	.60	.73	.65	.60
85	ft. 8-in. concrete pipe	.70	.60	.70	.90	.75	.78	.75	.75
300	ft. 12-in. concrete pipe	1.00	.75	1.00	1.30	1.25	1.18	1.08	1.00
413	ft. 18-in. concrete pipe	1.80	1.50	1.95	2.00	2.00	2.13	1.85	1.60
432	ft. 21-in. concrete pipe	2.40	2.00	2.50	2.50	2.50	2.52	2.45	2.00
50	ft. 4-in. black iron pipe	.60	1.00	.25	.50	.70	1.00	.72	1.00
4,736	sq.ft. corr. iron culvert, part circle	.964	.50	1.30	.90	.98	1.50	1.17	2.50
6	catchbasins (each)	40.00	25.00	49.00	35.00	50.00	35.00	42.75	45.00
59	water service laterals (each)	10.00	10.00	9.00	10.00	10.00	10.00	10.00	10.00
6	manholes (each)	40.00	30.00	58.00	40.00	58.00	64.00	76.30	65.00
23	city monument frames (each)	7.50	.50	3.00	1.00	6.00	5.00	4.09	5.00
4	24-in. inlets (each)	40.00	15.00	35.00	15.00	20.00	4.00	34.90	40.00
3	17-in. inlets (each)	25.00	10.00	25.00	2.00	15.00	20.00	19.65	20.00
2	tons binder course mixture	6.00	5.00	7.00	5.00	8.00	10.00	4.60	10.00
½	ton base course mixture	6.00	5.00	7.00	5.00	8.00	10.00	4.60	10.00

SACRAMENTO, CALIF.—STATE—GRADING—COLUSA COUNTY

Fredrickson & Watson, 354 Hobart St., Oakland, and Fredrickson Bros., First National Bank Bdg., Stockton, $58,269, low bid to California Division of Highways, Sacramento, for 8.3 miles grading from Williams to Maxwell, COLUSA COUNTY. Bids received from:

(1) Fredrickson & Watson and Fredrickson Bros. $58,269
(2) Utah Construction Co., San Francisco 62.297
(3) C. W. Wood, Stockton 68,650
(4) M. J. Bevanda, Stockton 69,500
(5) Kennedy-Bales Const. Co., Biggs 71,052
(6) Hemstreet & Bell, Marysville 72,735
(7) Yglesias Bros., San Diego $74,595
(8) Geo. Pollock Co., Sacramento 74,736
(9) T. M. Morgan Paving Co., L. A. 74,944
(10) A. Teichert & Son, Sacramento 78,918
(11) Lord & Bishop, Sacramento 85,504
(12) J. P. Holland, San Francisco 87,871
(13) Isbell Const. Co., Fresno 89,377

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
120,000	cu.yd. roadway excavation	.26	.28	.33	.34	.35	.30	.39	.38	.41	.44	.40	.50	.43
250,000	sta.yd. overhaul	.02	.015	.02	.01	.01	.03	.01	.01	.01	.01	.02	.01	.005
2,000	cu.yd. structure excavation	1.50	1.00	1.00	1.50	1.00	2.00	.75	1.20	.70	1.25	2.00	1.25	3.50
570	cu.yd. A concrete (structures)	18.00	23.00	20.00	22.00	22.50	25.00	24.00	18.00	20.00	20.00	28.00	20.00	27.00
63,000	lb. reinf. steel (structure)	.045	.05	.05	.05	.05	.06	.05	.05	.05	.04	.045	.0425	.05
108	ft. 12-in. corr. metal pipe	.50	.40	1.00	.50	.50	.50	.50	.60	.60	.40	.50	.50	.50
180	ft. 18-in. corr. metal pipe	.50	.50	1.00	.75	.75	.75	.70	.80	.60	.50	.80	.65	.50
220	ft. 24-in. corr. metal pipe	1.00	.60	1.00	1.00	1.00	1.00	1.00	1.00	.60	.75	1.00	1.00	.50
256	ft. 30-in. corr. metal pipe	1.00	.75	1.50	1.25	1.25	1.00	1.00	1.30	.65	1.00	2.00	1.25	1.00
28	ft. 36-in. corr. metal pipe	1.00	.90	2.00	2.00	1.50	1.25	1.50	1.60	.75	1.50	2.00	1.50	1.50
174	ft. 42-in. corr. metal pipe	1.50	1.10	2.00	2.25	2.00	1.75	2.00	2.00	1.25	1.50	2.50	2.00	2.00
92	ft. 30-in. corr. pipe (jack. in pl.)	4.00	2.50	4.00	5.00	5.00	6.00	10.00	8.00	6.00	12.50	4.00	3.00	8.00
232	ft. corr. pipe (clean and relay)	1.00	1.00	1.00	2.00	1.50	1.00	1.00	1.00	.80	1.00	2.00	1.00	1.00
3.4	mi. move & reset prop. fences	$225	$250	$350	$350	$450	$400	$250	$300	$225	$150	$400	$400	$350
3.65	mi. new standard prop. fence	$400	$400	$450	$500	$550	$550	$400	$600	$350	$400	$550	$600	$700
0.62	mi. new special property fence	$500	$700	$650	$750	$1200	$900	$850	$1500	$900	$1000	$650	$625	$1260
439	sta. finishing roadway	4.00	6.00	5.00	4.00	5.00	3.00	4.00	10.00	7.00	5.00	8.00	7.00	10.00
58	monuments	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.50

SACRAMENTO, CALIF.—STATE—GRADING AND CONCRETE PAVING—SAN DIEGO COUNTY

Matich Bros., Elsinore, $38,118, low bid in California Division of Highways, Sacramento, for 0.9 mile grading and concrete paving from San Onofre to San Clemente, SAN DIEGO COUNTY. Bids from

(1) Matich Bros., Elsinore $38,118
(2) Macco Constr. Co., Clearwater 38,675
(3) Bert Calvert, Los Angeles 40,582
(4) Sander Pearson, Santa Monica 41,255
(5) Watson & Sutton, San Diego $41,314
(6) Bruce Bros., Huntington Beach 42,125
(7) R. E. Hazard Contr. Co., San Diego 46,961
(8) Robinson, Roberts Co., L. A. 46,963

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
42	sta. clearing and grubbing	5.00	5.00	5.00	6.00	15.00	8.00	4.00	15.00
26,000	cu.yd. excavation	.34	.32	.34	.37	.39	.45	.45	.43
200,000	sta.yd. overhaul	.01	.0075	.01	.005	.01	.01	.015	.01
200	cu.yd. struc. excavation	1.50	5.50	2.00	1.00	1.00	1.00	1.50	1.25
10 000	sq.yd. subgrade (pave)	.10	.08	.12	.10	.10	.09	.12	.09
2,075	cu.yd. A conc. (pave)	8.90	9.00	10.00	8.80	9.36	9.10	11.00	11.25
75	cu.yd. A conc. (struc.)	19.00	30.00	22.50	25.00	25.00	20.00	28.50	24.00
55,000	lb. reinf. steel	.0375	.0475	.05	.045	.038	.04	.03	.05
70	ft. 24-in. rein. conc. pipe	3.00	3.25	3.50	3.00	4.00	3.25	5.00	4.25
980	ft. fur. un. doug. fir piles	.35	.40	.35	1.65	.50	.40	.40	.35
28	drive douglas fir piles	20.00	30.00	17.50	22.50	40.00	25.00	35.00	20.00
1,088	cu.yd. remove and disp. exist. pavement	1.60	1.00	.65	3.00	1.50	2.25	1.50	1.75
1.5	mi. move and reset fence	$500	$300	$500	$400	$150	$300	$250	$250
42	sta. finishing roadway	5.00	5.00	5.00	6.00	5.00	4.50	6.00	15.00

CARSON CITY, NEV.—STATE—LYON COUNTY—GRADING AND SURFACING

Contract awarded to Nevada Rock & Sand Co., Reno, who bid $85,675 for 11.73 miles grading and gravel or rock surfacing in LYON COUNTY, from Yerington to Wilson's. Bids received from:

(1) Nevada Rock & Sand Co., Reno $85,675
(2) Utah Constr. Co., San Francisco 95,607
(3) Dodge Bros., Inc., Fallon, Nev. 97,751
(4) A. D. Drumm, Jr., Fallon, Nev. $100,653
(5) Isbell Const. Co., Carson City 111,531
(6) Engineer's estimate 102,247

		(1)	(2)	(3)	(4)	(5)	(6)
17,000	cu.yd. excavation	.20	.25	.25	.30	.25	.30
86,000	cu.yd. select. borrow excavation	.48	.55	.57	.60	.70	.60
19,680	sta.yd. overhaul	.04	.05	.08	.03	.04	.04
11.73	mi. prepare subgrade and shoulders	75.00	$100	75.00	50.00	$150	$100
29	demolish siphon inlets or outlets	5.00	10.00	10.00	10.00	10.00	15.00
3	demolish rein. conc. box culverts	50.00	$100	25.00	50.00	50.00	50.00
29,400	cu.yd. cr. rock or cr. gravel (pla.)	.90	.90	.97	1.00	1.03	1.00
200	cu.yd. cr. rock or gravel (stockpile)	.75	.90	.97	1.00	1.05	1.00
131	cu.yd. A concrete	35.00	35.00	35.00	35.00	35.00	35.00
87	cu.yd. B concrete	35.00	25.00	35.00	30.00	35.00	35.00
2,226	lin.ft. 18-in. corr. pipe, install	.50	1.00	.50	.50	.50	.60
404	lin.ft. 24-in. corr. pipe, install	.50	1.25	.75	.50	.50	.60
274	lin.ft. 30-in. corr. pipe, install	.50	1.50	.75	.50	1.00	.60
380	lin.ft. 24-in. siphon pipe, inst.	.50	2.00	.75	1.00	.75	.60
2,544	ft. stand. timber guard rail	.90	.90	.90	1.00	1.00	1.00
34	corr. pipe culvert extensions	10.00	24.00	12.50	10.00	10.00	12.00
2,720	ft. remove timber guard rail	.05	.10	.10	.10	.05	.15

OAKLAND, CALIF.—COUNTY—GRADING—HAYWARD-REDWOOD CANYON ROAD

Contract awarded to Frank C. Cuffe, Box 441, San Rafael, who bid $45,205 (on Prop. B) for grading 2 miles of Hayward-Redwood Canyon Road near Pinehurst Road for County. Bids received on: (1) 120,000 cu.yd. grading; (2) 2100 ft. 12-in. corr. pipe; (3) 820 ft. 18-in. corr. pipe; (4) 40,000 sta.yd. overhaul.

	(1)	(2)	(3)	(4)	TOTALS
Frank C. Cuffe, San Rafael	.33	1.60	2.25	.01	$45,205
Lee J. Immel, Berkeley	.33	1.65	2.50	.01	45,515
M. J. Bevanda, Stockton	.34	1.40	2.00	.01	45,780
C. A. Bruce & Son, Pleasanton	.43	1.50	2.75	.008	57,325
Casson & Lee, Hayward	.45	2.25	3.00	.02	61,985
Granfield, Farrar & Carlin, S. F.	.455	2.15	2.70	.02	62,129
J. P. Holland, Inc., S. F.	.48	1.50	2.25	.01	62,995
J. C. Lappin, Sacramento	.46	1.60	2.30	.02	61,246
Ariss Knapp Co., Oakland	.55	2.00	2.50	.04	73,850

CARSON CITY, NEV.—STATE—LYON COUNTY—GRADING AND SURFACING

Contract awarded to Dodge Bros., Fallon, Nevada, who bid $67,297 to the State for grading and rock or gravel surfacing from Towle Ranch to Fernley, LYON COUNTY. Bids received from the following:

(1) Dodge Bros., Fallon, Nev. $67,297
(2) Isbell Constr. Co., Carson City 67,591
(3) A. D. Drumm, Jr., Fallon, Nev. 71,527
(4) J. N. Tedford, Fallon, Nev. $89,065
(5) Engineer's estimate 77,894

		(1)	(2)	(3)	(4)	(5)
72,000	cu.yd. excavation	.35	.35	.39	.50	.35
44,893	sta.yd. overhaul	.05	.04	.03	.10	.04
22.46	mi. prepare subgrade and shoulders	75.00	100.00	50.00	100.00	100.00
36,500	cu.yd. cr. rock or gravel (place)	.80	.80	.90	1.00	.90
500	cu.yd. cr. rock or gravel (stockpile)	.80	.80	.90	.90	.90
68	cu.yd. 'A' concrete	40.00	35.00	35.00	35.00	35.00
5	cu.yd. 'B' concrete	35.00	35.00	30.00	35.00	35.00
1,426	ft. 18-in. corr. pipe, install	.50	.50	.50	.50	.60
446	ft. 24-in. corr. pipe, install	.50	.75	.50	.50	.60
20	cu.yd. cem. rubble masonry	12.50	15.00	15.00	20.00	15.00
100	monuments (each)	3.00	3.00	4.00	3.00	3.50
4,200	ft. construct fence	.10	.10	.10	.15	.20
36,000	lb. structural steel	.10	.11	.08	.12	.08

DENVER, COLORADO—STATE—GRADING AND SURFACING—GRAND COUNTY

C. A. Sweitzer, Arvada, Colo., $113,597 low bid to State Highway Comm., Denver, Colorado, for 4 miles grading and surfacing south of Muddy Pass, GRAND COUNTY. Three lowest bids received from:

(1) C. A. Sweitzer, Arvada $113,597
(2) F. L. Hoffman $131,950
(3) Pioneer Const. & Engr. Co. $137,500

		(1)	(2)	(3)			(1)	(2)	(3)
	Clearing and grubbing	$1000	$1500	$1400	1,500	tons surfacing detour	1.20	1.50	1.52
8,200	lin.ft. removing fence	.01	.02	.0225	900	tons replacement gravel	1.20	1.40	1.52
60,400	cu.yd. unclassified excav.	.64	.65	.68	20.6	MB ft. treated bridge timber	105.00	115.00	120.00
30,300	cu.yd. unclassified borrow	.40	.65	.68	198	cu.yd. 'A' concrete	23.00	24.00	30.00
109,000	sta.yd. overhaul	.02	.02	.02	65	cu.yd. 'B' concrete	22.00	24.00	30.00
1,000	yd.mi. special overhaul	.32	1.00	1.00	16,700	lb. reinf. steel	.07	.07	.08
13,700	tons gravel surfacing	1.20	1.50	1.52	1,700	lin.ft. wire cable guard fence	.75	.85	1.00
74,200	ton mi. overhaul surfacing	.15	.15	.15	44,300	lin.ft. galv. barbed wire	.07	.09	.09

PHOENIX, ARIZ.—STATE—OILING—PHOENIX-YUMA HIGHWAY

Contract awarded to Schmidt-Hitchcock Cont. Co., P.O. Box 296, Phoenix, Arizona, who bid $59,039 to Arizona State Highway Commission, Phoenix, for oil processing of Phoenix-Yuma Highway, F. A. Project 69, Schedule 3, work beginning at Piedra and extending westerly 10 miles, consisting of oil processing by the road mix method, approximately 10 miles of road. Bids received on:

(1) 106,127 sq.yd. prepare subgrade
(2) 15,395 cu.yd. additional mater. (surf.)
(3) 23,157 cu.yd.mi. haul additional mater. (surf.)
(4) 212 254 gal. oil applied to road
(5) 10.05 miles mix, lay, and finish

	(1)	(2)	(3)	(4)	(5)	TOTALS
Schmidt-Hitchcock Cont. Co., Phoenix, Arizona (awarded)	.01	2.18	.15	.075	$500	$59,039
N. G. Hill & Co., Phoenix	.01	2.20	.22	.07	$500	59,907
Skeels & Graham Co., Tucson	.015	3.50	.20	.08	$600	83,116

PORTLAND, ORE.—STATE—LANE COUNTY—GRADING

Contract awarded to Earl L. McNutt, Eugene, Oregon, who bid $102,985 for 3.9 miles grading Berry Creek-Sutton Lake Section of the Roosevelt Coast Highway, LANE COUNTY, for the Oregon State Highway Comm. Bids received on:

(1) Clearing and grubbing
(2) 219,000 cu.yd. common excavation
(3) 15,000 cu.yd. sand borrow
(4) 238,000 sta.yd. overhaul
(5) 15,000 yd.mi. truck haul
(6) 150 cu.yd. 'A' concrete
(7) 12,000 lb. reinf. steel
(8) 600 lin.ft. timber piling
(9) 1,100 lin.ft. 12-in. concrete pipe
(10) 1,000 lin.ft. 18-in. concrete pipe
(11) 330 lin.ft. 24-in. concrete pipe
(12) 1,600 lin.ft. 6-in. drain tile

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	TOTALS
Earl L. McNutt	$17,985	.27	.27	.02	.30	26.00	.06	1.00	1.20	2.50	3.00	.40	$102,985
Washburn & Hall	20,000	.28	.25	.03	.25	25.00	.08	1.00	1.50	2.50	4.00	.40	109,120
Liesch & Tofte	9,620	.35	.27	.025	.20	24.00	.045	.75	1.40	3.10	4.20	.40	112,221
Newport Const. Co.	12,000	.33	.33	.03	.30	30.00	.06	1.50	1.50	3.00	4.00	.30	114,775
Joplin & Eldon	14,500	.33	.30	.03	.30	30.00	.06	1.00	1.35	2.75	3.75	.35	116,432
Lidral-Wiley, Inc.	20,000	.30	.30	.02	.20	50.00	.10	2.00	1.50	3.00	4.00	.50	116,520
Clifton, Applegate & Toole	11,900	.35	.35	.025	.26	37.00	.10	1.50	2.50	3.00	4.00	.30	120,310
Fred H. Slate	16,000	.35	.30	.04	.40	40.00	.08	1.00	1.25	2.30	3.20	.25	127,143
A. C. Greenwood	15,000	.37	.37	.02	.30	40.00	.10	1.50	1.75	3.50	5.00	1.00	129,735
Guy F. Atkinson	12,000	.46	.50	.02	.33	35.00	.07	1.50	1.75	3.00	5.00	.50	146,845

SEWER CONSTRUCTION

SAN FRANCISCO, CALIF.—CITY—REINFORCED CONCRETE

Contracts awarded as follows by the Board of Public Works, City Hall, S. F., for reinforced concrete sewers:

(A) To L. J. Cohn, 1 De Haro St., S. F., $112,031 for Section B of the Fillmore St. sewer from Harrison St. to Van Ness Ave., on 10th St. and Fell St. Bids on:

(1) 3,084 ft. 6 ft. 9-in. circular reinf. concrete sewer
(2) 41 lin.ft. 2 ft. 6-in. by 3 ft. 9-in. reinf concrete sewer
(3) 30 lin.ft. 2 ft. 3-in. reinf. conc. sewer, invert, lined with vitr.
(4) 55 lin.ft. 10-in. vitrified culvert
(5) 14 manholes on new sewer
(6) 3 manholes on existing sewer
(7) 300 ft. 12-in. vitr. underdrain
(8) 400 ft. 10-in. vitr. underdrain
(9) 1,100 ft. 8-in. vitr. underdrain
(10) 1,284 ft. 6-in. vitr. underdrain

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	TOTALS
Louis J. Cohn, S. F.	34.40	18.25	11.00	1.78	$ 83	$108	1.33	1.21	1.07	.95	$112,031
MacDonald & Kahn, S. F.	36.00	19.00	17.00	2.00	80	90	1.15	1.00	.80	.65	116,272
Peter McHugh, S. F.	36.30	21.20	20.00	1.75	120	150	1.60	.80	.70	.10	117,343
Rocca & Caletti	37.50	18.37	15.00	3.50	50	100	1.60	1.25	.75	.60	120,621
C. B. Eaton, S. F.	38.00	15.00	15.00	2.00	100	100	.75	.60	.50	.40	121,595
C. C. W. & H. H. Haun	38.00	25.00	25.00	5.00	80	175	1.80	1.50	1.20	1.00	124,631
Healy-Tibbitts Co.	40.00	20.00	15.00	5.00	80	90	1.50	1.25	1.00	.80	129,372

(B) To Peter J. McHugh, 300 Va dez St., S. F., $66,751 for Geary St. and 23rd Ave. sewer system from 27th Ave. and Geary St., to 23rd Ave. and Lake St. Bids on:

(1) 48 ft. 21-in. vitr. pipe sewer
(2) 1,673 ft. 2 by 3-ft. rein. conc. sewer
(3) 276 ft. 2 ft. 6-in. by 3 ft. 9-in. reinf concrete sewer
(4) 706 lin.ft. 3 ft. 6-in. by 5 ft. 3-in. reinf. concrete sewer
(5) 1,391 ft. 4 by 6-ft. reinf. conc. sewer
(6) 1 taper connection, reinf. concrete
(7) 1 taper connection, reinf. concrete
(8) 1 junction structure, reinf. concrete
(9) 1 junction structure, reinf. concrete
(10) 1 junction structure, reinf. concrete
(11) 14 manholes

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	TOTALS
J. J. Gartland, S. F.	1.50	8.70	10.90	14.90	16.90	$200	$200	$200	$200	$ 200	$ 50	$53,362
L. J. Cohn, S. F.	8.45	10.44	12.50	18.00	22.60	254	292	381	254	950	83	68,759
Peter McHugh, S. F.	5.00	10.50	11.00	14.50	23.65	200	225	100	200	1000	75	66,751
MacDonald & Kahn, S. F.	6.50	11.50	12.50	17.00	23.00	200	250	150	275	500	80	69,491
E. J. Tracy, S. F.	4.00	12.00	14.80	17.80	22.00	160	160	150	200	950	100	70,541
C. C. W. & H. H. Haun	10.00	14.00	16.00	19.25	24.00	230	270	200	360	1000	80	78,472

BRIDGES AND CULVERTS

SACRAMENTO, CALIF.—STATE—SAN BERNARDINO COUNTY—STEEL AND CONCRETE

J. F. Knapp, Financial Center Bdg., Oakland, who bid $118,460, low bid to California Division of Highways, Sacramento, for steel and concrete bridge over Mojave River, 3 miles north of Victorville, SAN BERNARDINO COUNTY. Bids received from the following concerns:

(1) J. F. Knapp, Financial Center Bdg., Oakland $118,460
(2) Rocca & Caletti, San Rafael 126,704
(3) Carpenter Bros., Beverly Hills 131,806
(4) Whipple Eng. Co., Monrovia 132,300
(5) H. W. Rohl Co., Los Angeles 136,203
(6) Lynch-Cannon Eng. Co., L. A. $143,664
(7) Gist & Bell, Arcadia 144,908
(8) Torson Const. Co., Long Beach 149,122
(9) Lord & Bishop, Sacramento 152,698

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
5,900 cu.yd. road excav.	.50	.40	.40	.36	.50	.60	.48	.60	.60
50,000 sta.yd. overhaul	.01	.015	.02	.01	.01	.02	.02	.02	.015
148 ft. 36-in. corr. pipe	1.00	1.00	1.50	1.00	1.00	.50	2.00	1.00	1.00
350 ft. timber guard rail	1.00	1.20	1.00	1.10	1.00	1.00	1.00	1.25	1.25
0.294 mi. oiling detour	$3,000	$2,750	$175	$4,100	$600	$3,000	$4,000	$500	$3,168
1 bridge removed	3 000	6,000	4,300	2,750	2,500	6,500	7,000	6,000	7,700
1,400 cu.yd. struc. excav.	2.50	1.75	3.50	3.45	3.00	2.50	2.50	.90	4.00
1,430 cu.yd. 'A' concrete	16.50	16.00	18.24	18.80	20.00	23.50	22.00	17.50	20.00
400 cu.yd. 'B' concrete	15.50	16.00	14.30	14.85	18.00	16.00	18.00	16.50	19.40
265 cu.yd. 'C' concrete	14.50	16.00	12.00	11.50	17.00	12.50	14.00	15.50	19.10
260,000 lb. reinf. steel	.04	.045	.0435	.0422	.05	.05	.05	.05	.045
750,000 lb. struc. steel	.065	.067	.0681	.0695	.0725	.065	.07	.085	.079
12,900 lb. cast steel	.14	.14	.1395	.1425	.15	.13	.14	.18	.1495
6,220 lb. bronze exp. plates	.35	.50	.50	.37	.50	.50	.50	.50	.50
19,200 lb. cast-iron railing	.10	.11	.125	.138	.12	.14	.14	.15	.145
62,000 lb. struc. steel railing	.10	.11	.154	.1775	.12	.158	.17	.195	.184
870,000 cu.yd. riprap	2.00	5.00	4.50	3.50	3.00	4.00	2.00	1.50	2.00
1 lot miscel. work	$500	$100	$550	$549.85	$300	$2,000	$1,000	$2,400	$250

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 April, 1930, for Engineering Construction Projects in the Far Western States total $21,529,646, as follows:

Paving	$ 5,678,254
Grading, highways	5,327,248
Bridges	1,257,000
Sewer construction	1,347,265
Water supply systems	1,257,642
Power development	1,250,000
Lighting systems	657,000
Irrigation and reclamation	3,000,000
Tunnel construction	700,000
River and harbor work	555,237
Railroad construction	500,000
	$21,529,646

LARGE WESTERN PROJECTS

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

WORK CONTEMPLATED

Steam power plant for City of Eugene, Ore.; $400,000.

State office building on First and Spring Sts., Los Angeles, for State of California; $1,250,000.

Paving streets for City of Winslow, Ariz.; $305,000.

Sedimentation basin and improvements to filtration plant for City of Sacramento; $450,000.

BIDS BEING RECEIVED

Lake Union Bridge in City of Seattle, for Washington State Highway Comm.; bids to June 3.

BIDS RECEIVED

Warrenite Paving Union Ave. for City of Portland, Ore.. Kern & Kibbe, Portland, $351,000, low.

CONTRACTS AWARDED

Asphalt paving Sepulveda Blvd. for City of Culver City, Calif., to Braun, Bryant & Austin, $382,055.

Boilers for City of Tacoma steam power plant, to Puget Sound Machinery Depot, Seattle, $353,986.

STREET and ROAD WORK

WORK CONTEMPLATED

WINSLOW, ARIZ.—Plans by C. A. Lewis, City Engineer, for paving about 76 blocks in the City of Winslow, involving about 87,000 sq.yd. cement concrete, asphaltic concrete, or Warrenite bitulithic pavement, 49,000 lin.ft. curb. Holmquist & Maddock, 139 N. Central Ave., Phoenix, is the Consulting Engineer. $305,000. 4-28

HAYWARD, CALIF.—Plans by City Engineer, J. B. Holly, for improving Soto, Peralta, Simon Sts., etc., involving 78,000 sq.ft. 6-in. and 11,700 sq.ft. 5-in. penetration emulsified asphalt macadam paving. Bids after May 7. 4-21

LOS ANGELES, CALIF.—Plans by County Surveyor, protests May 19, for: (1) Improving Firestone Blvd. from Central Ave. to Union Pacific Ry., and portions of Manchester and Atlantic Aves., 4.04 miles, involving: SECTION L—57,601 cu.yd. excavation, 33,678 ft. 6 by 10 by 18-in. curb, 47,611 sq.ft. 6-in. gutter, 432,369 sq.ft. 3½-in. sidewalk, 843,124 sq.ft. 8-in. concrete paving, 845,552 sq.ft. 5-in. dis. rock subbase, pedestrian subway; SECTION II—1340 ft. 8-in. cement sewer, 5270 ft. 6-in. cement house sewers, 5 flushing manholes, 4 manholes; SECTION III—5550 ft. 1-in. copper water serv. exten., 4 fire hydrants reset; SECTION IV—313 Union Metal light standards; and (2) Improving 116th St. near Watts, 1.65 miles, involving 12,900 cu.yd. excavation, 244,000 sq.ft. 8-in. concrete paving, vitr. sewers, corr. culverts, etc. 4-25

SAN DIEGO, CALIF.—Plans by H. W. Jorgensen, City Engr., protests May 19, for improving Morena Blvd., etc., involving 778,779 sq.ft. 6-in. asphalt paving, 127,759 cu.yd. excavation, 18,416 ft. 6-in., 1200 ft. 10-in., and 625 ft. 6-in. cast-iron mains, 42 hydrants, reinf. conc. and concrete sewers, etc. 4-26

SAN MATEO, CALIF.—Plans by City Engineer, protests May 19, for: (1) Paving in San Mateo Homestead east of State Highway, involving 17,700 cu.yd. grading, 114,000 sq.ft. 5-7-in. and 172,000 sq.ft 6-8-in. concrete paving, concrete and vitrified sewers, concrete box culvert; and (2) Paving in eastern section of City, involving 12,500 cu.yd. grading, 156,000 sq.ft. 5-in. and 97,700 sq.ft. 6-in. asphalt base with 3-in. rock cushion, vitr. and concrete sewers, 1 pumping unit complete. 4-22

SAN RAFAEL, CALIF.—Plans by H. K. Brainerd, City Engr., for improving G and Ida Sts., involving 31,775 sq.ft. 6-in., 6035 sq.ft. 4-in., and 22,000 sq.ft. 3-in. asphalt paving, vitrified pipe, corr. culvert, etc. Bids after May 8. 4-29

BIDS BEING RECEIVED

PHOENIX, ARIZ.—Bids to 2 p.m., May 22, by Bureau of Public Roads, Dist. Engr., Phoenix, Ariz., for 2.7 miles grading Swift Trail Road in Crook National Forest, Graham County, Ariz., involving 29,288 cu.yd. excavation, corr. pipe, etc. 4-29

PHOENIX, ARIZ.—Bids to 2 p.m., May 15, by Arizona State Highway Commission, Phoenix, Arizona, for surfacing and oil processing of the Utah-Nevada Highway, F.A.P. 92, Schedules 1 and 3. The work begins at the Nevada State Line and extends north about 17 miles to the Utah State Line, and consists of surfacing and oil processing by either the plant or road mix method. Work involves: ROAD MIX—39,000 cu.yd. mineral aggregate (surf.), 72,000 cu.yd.mi. min. aggr. haul, 178,000 sq.yd. prepare subgrade, 311,000 gal. oil, 16.8 miles mix, lay, finish, and roll; PLANT MIX—178,000 sq.yd. prepare subgrade, 44,000 gal. oil for blotter coat, 16,000 cu.yd. min. agg. (bottom course), 33,000 cu.yd.mi. min. agg. (bottom) haul, 29,800 tons plant mix (top course), 129,000 ton mi. plant mix, haul, 16.8 mi. spread, finish, and roll, 3600 gal. oil for embankment slopes. 4-26

PHOENIX, ARIZ.—Bids to 10 a.m., May 27, by U. S. Bureau of Public Roads, c/o Park Supt., Grand Canyon, Ariz., for 17 miles Grand Canyon-Old Trails National Highway, COCONINO COUNTY, involving 13,000 cu.yd. excavation, 98,000 cu.yd. borrow, conc. structures, etc. 5-1

HOLLISTER, CALIF.—Bids to May 13 by City Clerk for improving streets, involving 267,705 sq.ft. 6-in. and 54,520 sq.ft. 5-in. concrete paving, vitrified sewers, culverts, etc. $81,000. 4-30

LONG BEACH, CALIF.—Bids to 2 p.m., May 20, by City for improving Industrial Ave. involving: 1311 ft. cement concrete curbs, 6634 sq.ft. cement concrete sidewalk, 240 ft. 4-in. cast-iron pipe, 845 ft. 6-in. cast-iron pipe, 520 ft. 8-in. cast-iron pipe, 2535 ft. 12-in. cast-iron pipe, 12 6-in. gate valves, 3 8-in. gate valves, 2 12-in. gate valves, 8 fire hydrants. 5-3

OAKLAND, CALIF.—Bids to 10:30 a.m., May 20, by County for 316,000 sq.ft. emulsified asphalt oiling in Niles. 4-30

REDDING, CALIF.—Bids to 2 p.m., May 19, by Dist. Engr., California Division of Highways, for 21 miles heavy oiling from Shasta River to Walker, SISKIYOU COUNTY. 5-3

REDWOOD CITY, CALIF.—Bids to 10 a.m., May 12, by County for improving streets in Menalto Park, involving 36,000 cu.yd. grading, 430,000 sq.ft. 4-in. rock macadam base with 3-in. asphalt surface, vitr. and concrete sewers, etc. 4-21

SACRAMENTO, CALIF.—Bids to 2 p.m., May 21, by California Division of Highways, Sacramento, for 5.2 miles from Loleta to 2 miles north of Beatrice, HUMBOLDT COUNTY (2.6 miles grading and 5.2 miles surfacing), involving 86,000 cu.yd. roadway excavation, 1,230,000 sta.yd. overhaul, 400 cu.yd. structure excavation, 20,500 cu.yd. river run gravel surface, corr. pipe, etc. 4-23

SACRAMENTO, CALIF.—Bids to 2 p.m., May 28, by California Division of Highways for: RIVERSIDE COUNTY—29 miles from Whitewater River Bridge to Indio, involving: 24,304 bbl. heavy fuel oil; SAN BERNARDINO COUNTY—71.8 miles from Cronese to East Boundary, involving: 7249 bbl. heavy fuel oiling; LASSEN AND MODOC COUNTIES—57.2 miles from Hillside to Alturas, involving: 5893 bbl. heavy fuel oiling; TRINITY AND SHASTA COUNTIES—Heavy fuel oiling as follows: 5.2 miles from Tower House to Greenhorn; 12.3 miles from Asjers to Montgomery Creek; 24.1 miles from Haynes Ranch to Fall River; and 17.1 miles from Grass Valley Creek to Weaverville, involving: 5020 bbl. heavy fuel oiling; SAN JOAQUIN COUNTY—1.9 miles from South Banta Road to East Banta Road, involving: 19,400 cu.yd. imported borrow, 7100 tons asphalt paving. 4-30

SALINAS, CALIF.—Bids to 10 a.m., May 14, by County Clerk for (1) Asphalt macadam surfacing on King City-Jolon, San Lucas-Lockwood Roads, etc.; and (2) Asphalt macadam surfacing Carmel Valley Road. 5-1

SAN FRANCISCO, CALIF.—Bids to 2 p.m., May 22, by Bureau of Public Roads for grading 6.7 miles Laguna National Forest Highway, SAN DIEGO COUNTY, involving 75,500 cu.yd. excavation, etc. 4-30

SAN FRANCISCO, CALIF.—Bids to 2 p.m., May 27, by Bureau of Public Roads, 461 Market St., S. F., for 2.7 miles grading Generals Highway, Sequoia National Park, TULARE COUNTY, involving 95,133 cu.yd. excavation, 19,475 cu. yd. 'B' excavation, etc. 5-2

SAN FRANCISCO, CALIF.—Bids to 2 p.m., May 15, by Bureau of Public Roads, 461 Market St., S. F., for: (1) Grading Sect. 2, Loop Route, Lassen Volcanic National Park, 7.7 miles, involving 90,050 cu.yd. excavation, corr. pipe, etc.; and (2) Surfacing Sect. C-3, C-4, C-1, and C-2, Loop Route, Lassen Volcanic Park, involving 14,900 cu.yd. crushed rock surfacing, etc. 4-28

CARSON CITY, NEV.—Bids to 2 p.m., May 14, by Dept. of Highways for 47 miles WHITE PINE COUNTY from Robbins Summit to Keystone, etc., involving 64,000 cu.yd. excavation, 57,600 cu.yd. gravel or stone surface, corr. pipe, etc. 5-2

RENO, NEV.—Bids to May 12 by City for sidewalks, curbs, gutters, etc., on various streets. 4-30

PORTLAND, ORE.—Bids to 10 a.m., May 15, by Bureau of Public Roads, Portland, Oregon, for improvement of Alsea River Grading Project No. 6-E2, I, within Siuslaw National Forest, Lincoln County, 1.2 mi., involving 2 acres clearing, 2 acres grubbing, 42,100 cu.yd. excavation, 1.6 mi. finishing earth-graded road, 57,000 ½-mile yd. haul, 700 ft. wood gutter, 15 M b.m. untr. timber, 200 ft. culverts, 500 ft. hand-laid riprap, 700 ft. untr. timber piling, 200 ft. porous tile underdrain. 4-29

BIDS RECEIVED

PHOENIX, ARIZ.—Low bids as follows by State Highway Comm. (1) Skeels & Graham Co., Consolidated Bank Bdg., Tucson, $55,277, low for Road Mix, and Southwest Paving Co., Washington Bdg., L. A., $69,085, low for Plant Mix for oiling 9 miles of Douglas-Rodeo Highway northeast of Douglas toward Rodeo; (2) N. G. Hill & Co., 1344 E. McKinley St., Phoenix, Ariz., $41,802, low for oil processing 6 miles from southeast of Apache Junction toward Florence Junction; and (3) Skeels & Graham, Tucson, $134,124, low for oil processing 26.5 miles Douglas-Rodeo Highway from Bernardino toward State Line. (See Unit Bid Summary.) 4-28

SACRAMENTO, CALIF.—Low bids as follows by California Division of Highways: COLUSA COUNTY—12.7 miles grading from Bear Creek to 5 miles west of Williams: R. G. LeTourneau, 122 Moss Ave., Stockon (low), $139,326; COLUSA COUNTY—8.3 miles grading from Williams to Maxwell: Fredrickson & Watson, 354 Hobart St., Oakland, and Fredrickson Bros., 1st National Bank Bdg., Stockton (low), $58,269; SAN DIEGO COUNTY—0.9 mile grading and concrete paving from San Onofre to San Clemente: Matich Bros., Elsinore (low), $38,118. 4-30

SACRAMENTO, CALIF.—Skeels & Graham, Roseville, $3264, low for 8.6 miles oiling in ALPINE COUNTY from Hangmans Bridge to Markleeville, for California Division of Highways. 4-30

SANTA CRUZ, CALIF.—Bids received by County for grading 3250 ft. of Mt. Hermon Road No. 2 have been rejected and work will be done by day labor under supervision of County Surveyor, Lloyd Bowman, Court House, Santa Cruz. Low bid was submitted by E. W. Heple, 494 Dalmas Ave., San Jose, $13,757. 4-30

PORTLAND, ORE.—Low bids as follows by State Highway Comm.: F. J. Kernan, Reedsport, Oregon, $164,565, low bid for Eugene Oiling project, Santiam, Pacific and Corvallis-Newport Highways, 31.2 miles of bituminous macadam wearing surface and 30.11 miles of non-skid wearing surface; LINCOLN COUNTY—10.1 miles regrading of Pioneer Mountain-Eddyville Section of the Corvallis-Newport Highway: S. H. Newell & Co., 1254 Reed College Place, Portland, Oregon (low), $56,270; GRANT COUNTY—29.31 miles of broken stone surfacing of Mountain Rest-Little Beech Creek Section of the Pendleton-John Day Highway, Long Creek-Hamilton Section of Market Road No. 1, and Mt. Vernon-Beggs Ranch Section of Market Road No. 2: March Constr. Co., Spokane, Wn. (low), $80,068; DESCHUTES COUNTY—18 miles surfacing of Bend-Horse Ridge Section of Central Oregon Highway: J. W. Feak Constr. Co., Tacoma, Wn. (low), $73,073. 4-28

PORTLAND, ORE.—Kern & Kibbe, 290 E. Salmon St., Portland, $351,096, low bid to City for paving with Warrenite Bit. Union Ave. from Lincoln St. to Gooding St.

CONTRACTS AWARDED

JUNEAU, ALASKA—Awards as follows by Bureau of Public Roads: (1) To Wright Const. Co., Aberdeen, Wash., $113,540 for grading Ketchikan-Wards Cove Road; and (2) To Siems-Carlson Co., Spokane, Wash., $48,715 for grading Wrangell Highway.

PHOENIX, ARIZ.—Awards as follows by State: (1) To Schmidt & Hitchcock Const. Co., P.O. Box 292, Phoenix, $149,469 for oil processing 42 miles of Yuma-Phoenix Highway west of Yuma-Maricopa County Line; and (2) To Schmidt & Hitchcock Const. Co., P.O. Box 292, Phoenix, $59,039 for 10 miles oil processing Phoenix-Yuma Highway from Piedra west. 4-21

PHOENIX, ARIZ.—To Southwest Paving Co., Washington Bdg., L. A., $22,072 for emulsified asphalt paving in town of Holbrook for State. 4-25

COLUSA, CALIF.—To Hemstreet & Bell, Marysville, who bid $1628 to Colusa County, for grading to replace long bridge on east side of river on Colusa-Butte City Road. 4-25

CULVER CITY, CALIF.—To Braun, Bryant & Austin, 8746 W. Washington Blvd., L. A., $382,055 for improving Sepulveda Blvd. from Venice Blvd. to Centinela Ave. for City, grading, paving with 6-in. asphalt base with 2-in. Warrenite Bit. surface. (See Unit Bid Summary.) 5-1

EUREKA, CALIF.—To Hemstreet & Bell, Marysville, $9750 for furnishing and stockpiling gravel or stone in MENDOCINO COUNTY at Longvale for California Division of Highways. 5-3

GLENDALE, CALIF.—To Chas. U. Heuser, 816 Allen Ave., Glendale, for improving Riverside Drive for City, asphalt paving, water system, etc. 5-1

LOS ANGELES, CALIF.—To Griffith Co., 502 L. A. Railway Bdg., L. A., $58,041 for improving Carmenita Road for County, grading, asphalt paving, etc. 4-30

OAKLAND, CALIF.—To Jones & King, Atherton and Jackson Sts., Hayward, who bid $118,904 on Proposal B (using Type B asphalt surface) for paving two miles of E. 14th St. from San Leandro to Hayward, for Alameda County. Work involves 6-in. concrete base, 2-in. 'B' asphalt surface, corr. culverts, grading, vitrified sewers, grading, etc. (See Unit Bid Summary.) 4-24

OAKLAND, CALIF.—To Frank C. Cuffe, Box 441, San Rafael, $45,205 for grading 2 miles of Hayward-Redwood Canyon Road near Pinehurst Road for County. (See Unit Bid Summary.) 4-22

REDWOOD CITY, CALIF.—Awards as follows by City: (1) To Peninsula Paving Co., Standard Oil Bdg., S. F., $13,488 for asphalt paving Oak, Sierra Sts., etc.; and (2) To W. O. Tyson, Redwood City, $3163 for curbs and sidewalks on Ebener St. 4-22

SACRAMENTO, CALIF.—To Gilmore Oil Co., 2423 E. 28th St., Vernon, L. A., who bid $22,165 to Calif. Div. of Highways, Sacramento, for oiling 35.4 mi. as follows: 2.7 mi. from La Mesa to El Cajon; 11.3 mi. from Flynn Springs to Diejas Valley; 7.9 mi. from Pine Valley Creek to Kitchen Creek; and 13.5 mi. from La Cumbra to Myers Creek. 4-25

SACRAMENTO, CALIF.—To C. W. Wood, Box 1435, Stockton, who bid $31,296 to California Division of Highways, Sacramento, for 0.9 mile grading and concrete paving through Wheatland, YUBA COUNTY. 4-22

SACRAMENTO, CALIF.—To Ben F. Dupuy, 20102 S. Vermont Ave., Los Angeles, $10,081 for 26.5 miles oiling from west boundary to Santa Monica, LOS ANGELES COUNTY, for Calif. Div. of Highways. 4-23

SALINAS, CALIF.—To Granite Const. Co., Watsonville, $10,905 for concrete paving Front and Gabilan St. for City. 4-23

SALINAS, CALIF.—Awards as follows by County to Granite Const. Co., Watsonville: (1) $20,368 for surfacing Old Toll Road; and (2) $17,888 for surfacing Salinas River Road. 4-26

SAN FRANCISCO, CALIF.—To Granfield, Farrar & Carlin, 65 Hoff Ave., San Francisco, $18,295 for improvement of Section C of the Alemany Blvd., work for City, grading and concrete structures. 4-28

SAN JOSE, CALIF.—Awards as follows for asphalt surfacing: (1) To San Jose Paving Co., San Carlos and Dupont Sts., San Jose, who bid $8400 for 8000 lin.ft. of Senter Road from Tull to Singleton Road; (2) To Union Paving Co., Call Bdg., San Francisco, who bid $14,329 for 1.3 miles of San Jose and Alviso Roads; and (3) To A. J. Raisch, Burrell Bdg., San Jose, who bid $7990 for 1900 lin.ft. of Sunnyvale Ave., from Maude to Lawrence Ave. 4-21

SAN LUIS OBISPO, CALIF.—To Gilmore Oil Co., L. A., $4185 for oiling 15 miles from Buckhorn Creek to Cuyama River, SANTA BARBARA COUNTY, for California Division of Highways. 5-1

SAN LUIS OBISPO, CALIF.—To Bradley Truck Co., Santa Maria, $4130 for 6.5 miles heavy fuel oiling from Elwood Overhead crossing to Goleta, and from Carpinteria to Rincon cutoff, SANTA BARBARA COUNTY, for California Division of Highways. 4-23

SAN RAFAEL, CALIF.—To Jack Casson, 8 St. James Court, Hayward, who bid $8287 for 4.6 miles oiling from Point Reyes to Inverness Road. 4-28

SANTA ROSA, CALIF.—Awards as follows by County for oiling: (1) First District, Petaluma to Sonoma Highway, to Geo. French, Jr., Box 675, Stockton, at $6839; (2) Second District, Alton Road (2 miles), to Highway Builders, Inc., 640 Redhill Ave., San Anselmo, at $2539; (3) Second and Fifth Districts, Graton-Occidental Road (5 miles), Molino Road (1 mile), to Highway Builders, Inc., 640 Redhill Ave., San Anselmo, at $4614; (4) Fifth District, Bodega Highway (3 miles), to A. Teichert & Sons, 1846 37th St., Sacramento, at $2814; (5) First District, El Verano to State Highway, to Geo. French, Jr., Box 675, Stockton, at $5436; and (6) Valley Forge Highway (1 mile), to Geo. French, Jr., Box 675, Stockton, at $2700. 4-22

SUNNYVALE, CALIF.—To Peninsula Paving Co., Standard Oil Bdg., S. F., $89,931, for asphalt paving, concrete sewers, corr. culverts, etc., on Washington Ave., Evelyn Ave., etc., for City. (See Unit Bid Summary.) 5-1

VISALIA, CALIF.—Awards as follows by City: (1) To J. S. Caldwell, Visalia, $2841 for curbs, sidewalks, etc., on E. Mineral King Ave.; and (2) To Central California Roads Co., 1305 28th St., Oakland, $32,424 for asphalt base with Warrenite Bit. surface on E. Mineral King Ave. 4-23

WILLOW GLEN, CALIF.—To A. J. Raisch, Burrell Bdg., San Jose, $18,039 for paving with Durite of Willow Glen Way, etc., for City. 4-22

BOISE, IDA.—Awards as follows by State: (1) To M. J. Kuney Co., Spokane, Wash., $42,204, for 4 miles grading and rock surfacing from Lewiston to Genesee, NEZ PERCE COUNTY; (2) To Wm. Hoops, Twin Falls, Ida., $49,405 for 24 miles gravel surfacing from Moreland to County Line, BINGHAM COUNTY; (3) To Roy Green, Grangeville, Ida., $18,147 for 8 miles surfacing from Lapwai to Culdesac, NEZ PERCE COUNTY; and (4) To Idaho Contracting Co., Boise, Ida., $17,241 for 2 miles grading and surfacing Treasureton Sect., BANNOCK COUNTY.

HELENA, MONT.—Awards as follows by State: Grading 14.56 miles of the Jordan-Miles City highway in CUSTER COUNTY, Stanley Bros., St. Cloud, Minn., $50,539.48; grading 8.99 miles of the Lewistown-Grass Range road in FERGUS COUNTY, W. P. Roccoe & Co. of Billings, $26,142.53; grading 7.28 miles of the Shelby-Chester highway in LIBERTY COUNTY, Morrison & Kundson Co., Spokane, Wash., $22,706.95.

CARSON CITY, NEV.—Awards as follows by State Highway Comm.: (1) To Basalt Rock Co., Napa, $18,271 for oiling from Fernley to

SURETY BOND AND CASUALTY INSURANCE DIRECTORY

THE service that Surety Companies can render goes far beyond the mere signing of bonds, but what constructive advice and help on your financial, engineering and other problems can be given depends entirely upon how full is the information you give about your financial condition, the contracts under way and to be undertaken, and the various problems you are confronted with.

The relationship of principal and surety can be satisfactory to both only when complete confidence exists one in the other and nothing is withheld. Deal as frankly with your Surety Company as you would with your Banker.

Leeteville, LYON AND CHURCHILL COUNTIES; (2) To A. D. Drumm, Jr., Fallon, Nev., $37,827 for 18 miles grading and surfacing from Paradise Hill to Orovada, HUMBOLDT COUNTY; (3) To Nevada Rock and Sand Co., Reno, $85,675 for 11 miles grading and surfacing from Yerington to Wilsons, LYON COUNTY; and (4) To Dodge Bros., Inc., Fallon, $67,297 for grading and surfacing from Towle Ranch to Fernley, LYON COUNTY. (See Unit Bid Summary.) 4-30

CARSON CITY, NEV.—Awards as follows by State: (1) To Nevada Rock & Sand Co., Reno, who bid $85,675 for 11.73 miles grading and gravel or rock surfacing in LYON COUNTY from Yerington to Wilsons; and (2) To Basalt Rock Co., Napa, Calif., who bid $18,271 for 17.98 miles asphaltic fuel oiling in LYON AND CHURCHILL COUNTIES from Fernley to Leeteville. (See Unit Bid Summary.) 4-24

PORTLAND, ORE.—Awards as follows by State Highway Comm.: LANE COUNTY—To Earl L. McNutt, Eugene, Oregon, who bid $102,985 for Berry Creek-Sutton Lake Section of the Roosevelt Coast Highway, 3.9 miles grading; CURRY COUNTY—To Saxton & Looney, Port Orford, who bid $22,345 for 11 miles crushed gravel resurfacing of Gold Beach-Myers Creek Section of the Roosevelt Coast Highway; DESCHUTES COUNTY—To Johnson Bros. Co., Klamath Falls, Oregon, who bid $26,179 for 6.8 miles grading of Dry River-Millican Section of the Central Oregon Highway; SHERMAN, WASCO, AND HOOD RIVER COUNTIES—To J. F. Forbes, Olympia, Wn., at $119,011 for 16 mi. bit. mac. surface, 48.2 mi. of non-skid surface, and 23.3 mi. oiling of Dalles Oiling Project, Sherman. (See Unit Bid Summary.) 4-28

MT. VERNON, WASH.—To Bolse & McBride, Seattle, $94,644 for concrete paving Van Horn Hill Road for County.

YAKIMA, WASH.—To Moceri Bros., Seattle, $108,570 for concrete paving 4½ miles of Summit View Road for County.

BRIDGES and CULVERTS

BIDS BEING RECEIVED

EUREKA, CALIF.—Bids to May 20 by County for reinf. concrete and steel bridge over Eel River at Redway, $45,000. 5-2

SACRAMENTO, CALIF.—Bids to 2 p.m., May 21, by California Division of Highways, Sacramento, for bridge over Mokelumne River near Lodi, involving 1850 cu.yd. structure excavation, 4500 lin.ft. furnish douglas fir piles, 10,000 lin.ft. furnish redwood piles, 408 drive piles, 108 M redwood (dense select all-heart struc.), 86 M redwood (select all-heart struc.), 2100 cu.yd. concrete, 170,000 lb. reinf. steel. 4-23

SACRAMENTO, CALIF.—Bids to 10 a.m., May 19, by County for (1) Reinf. conc. bridge on Ninth St. over Arcada Creek; and (2) reinf. conc. culverts on Fulton Ave. 5-3

SACRAMENTO, CALIF.—Bids to 2 p.m., May 28, by California Division of Highways for bridge over Salinas River at Bradley, MONTEREY COUNTY, involving 12,000 ft. Douglas fir piles, 5000 ft. reinf. conc. piles, 5350 cu.yd. concrete, 700,000 lb. reinf. steel, 1,230,000 lb. structural steel, etc. 4-30

OLYMPIA, WASH.—Bids to June 3 by Washington State Highway Commission, Olympia, for constructing approaches and the piers for the flanking spans of the Lake Union Bridge on State Road No. 1 in City of Seattle, KING COUNTY, Washington, work involves: 16,300 cu.yd. excavation, 18,100 ft. reinforced concrete piling, 1350 ft. 6-in. drain and sewer pipe, 11,140 cu.yd. concrete, 1,733,000 lb. reinforcing steel, 130,800 lb. structural and castings. 5-3

BIDS RECEIVED

PHOENIX, ARIZ.—Wm. Piper, Heard Bdg., Phoenix, $20,900, low for reinf. conc. bridge at Continental for State. 5-1

SACRAMENTO, CALIF.—Dean Const. Co., 2091 California St., Berkeley, $24,246, low for timber bridge over Alder Creek, north of San Simeon, MONTEREY COUNTY, for California Division of Highways. 4-30

CONTRACTS AWARDED

SACRAMENTO, CALIF.—To Smith Bros. Co., Eureka, who bid $13,875 to California Division of Highways for two timber bridges, one over North Fork of Pit River, 3½ miles north of Alturas; and one over Shields Creek, 4 miles northeast of Alturas, MODOC COUNTY. 5-1

SACRAMENTO, CALIF.—To J. F. Knapp, Financial Center Bdg., Oakland, who bid $118,460 to California Division of Highways, Sacramento, for steel and concrete bridge over Mojave River, 3 miles north of Victorville, SAN BERNARDINO COUNTY. (See Unit Bid Summary.) 5-3

SACRAMENTO, CALIF.—To Geo. J. Ulrich Const. Co., P.O. Box 773, Modesto, who bid $18,037 to California Division of Highways, for reinforced concrete bridge over Calaveritas Creek, 3 miles south of San Andreas, CALAVERAS COUNTY. 4-23

SACRAMENTO, CALIF.—To A. T. Howe, 111 Stanford St., Santa Rosa, who bid $10,990 for construction of reinforced concrete bridge over North Fork of the Feather River at Chester, PLUMAS COUNTY, for California Division of Highways. 4-22

SAN BERNARDINO, CALIF.—To John Strona, Chino, $9900 for steel bridge on Upper Waterman Canyon for County. 4-29

SAN JOSE, CALIF.—To John D. Carlson, 1331 Sierra St., San Jose, $35,637 for constructing two reinf. concrete bridges over Guadalupe River for City. 4-29

SAN RAFAEL, CALIF.—To Geo. French, Jr., Box 675, Stockton, $1405 for reinf. conc. bridge at Morage Ranch on Cheleno Valley Road and $2648 for concrete bridge at Dolciniville on Marshall-Petaluma Road. 4-28

STOCKTON, CALIF.—To E. R. Stokes, 933 S. Sierra Nevada St., Stockton, $3300 for concrete and timber bridge on Van Allen Road over Little John Creek for County. 4-22

PORTLAND, ORE.—To E. F. Balgemann, Portland, Ore., $30,950 for 6 reinf. conc. bridges on Turner-Aumsville Market Road in Marion County for State.

SEWER CONSTRUCTION

WORK CONTEMPLATED

LOS ANGELES, CALIF.—Plans by City Engr., protests May 27, for Jefferson Street Storm Drain System, Section 3, by cement pipe house connections, reinforced concrete pipe storm drain, cement pipe storm drain. $300,000. 4-26

RENO, NEV.—City is considering installation of 63,120 ft. of sewer in various wards to cost $125,000. 5-3

KLAMATH FALLS, ORE.—Plans by City Engr., protests May 19, for 15th Sewer Unit, using vitrified or concrete pipe. $35,000. 4-26

PORTLAND, ORE.—Plans by A. Laurgaard, City Engr., for vitrified Lakeside Ave. trunk sewer, $142,000.

BIDS BEING RECEIVED

LOS ANGELES, CALIF.—Bids to 10 a.m., May 14, by Board of Public Works for Section 34A of North Outfall Sewer, involving: Type No. 1—5833 ft. 60-in. precast rein. conc. pipe, 5330 ft. 54-in. precast rein. conc. pipe, 2427 ft. 42-in. precast rein. conc. pipe, 20 ft. 24-in. vitrified sewer, 7 ft. 18-in. vitrified sewer; Type No. 2—5833 ft. 57-in. semi-ellip. conc. sewer, 5330 ft. 51-in. semi-ellip. conc. sewer, 2427 ft. 39-in. semi-ellip. conc. sewer, 20 ft. 24-in., 7 ft. 18-in. vitrified sewer. 5-3

LOS ANGELES, CALIF.—Bids to May 14 by County Sanitation District 8, Law Bdg., L. A., for (1) Main St. sewer, involving 3009 ft. 33-in. reinf. conc. sewers with vitr. liners, 17,000 ft. 12-in. to 21-in. vitrified or concrete pipe; (2) 216th St. Trunk Sewer, involving 1277 ft. 12-in. cast iron pipe and 5817 ft. 36-in. reinf. concrete pipe; and (3) Keystone Trunk Sewer, involving 3804 ft. 15-in. and 3306 ft. 12-in. vitrified or concrete pipe. 5-1

SAN MARINO, CALIF.—Bids to 8 p.m., May 14, by City for sewer in La Mirado Ave., Euclid Ave., etc., involving 14,000 ft. 8-in. to 30-in. vitrified sewer. 4-26

KLAMATH FALLS, ORE.—Bids to 8 p.m., May 19, by City for 14th Sewer Unit involving 51,000 ft. 6-in. to 10-in. vitrified or concrete pipe. 5-1

CONTRACTS AWARDED

BERKELEY, CALIF.—To Schnoor Bros., 6016 Claremont Ave., Berkeley, who bid $11.89 for 150 ft. 6½-ft. by 5-ft. Monolithic horseshoe section conduit in Codornices Creek at Airport Runway for City. 4-22

SAN FRANCISCO, CALIF.—Awards as follows by City for vitrified and reinf. conc. sewers: (1) To L. J. Cohn, 1 DeHaro St., San Francisco, at $112,031 for Section B of the Fillmore St. sewer from Harrison St. to Van Ness Ave. on 10th and Fell Sts.; (2) To Peter J. McHugh, 300 Valdez St., San Francisco, who bid $66,751 for Geary St. and 23rd Ave. sewer system from 27th Ave. and Geary St. to Lake St. and 23rd Ave.; (3) To J. Varano, 1648 Grant Ave., San Francisco, who bid $20,105 for sewers on Ingalls St. from Carroll to Bancroft Ave., and Bancroft Ave. from Jennings to Ingalls. 4-30

WATER SUPPLY SYSTEMS

WORK CONTEMPLATED

SACRAMENTO, CALIF.—Bond election June 13 by City to vote $450,000 for new shallow type sedimentation basin and other improvements to filtration plant. 4-26

SAN FRANCISCO, CALIF.—City has authorized the following: UPPER ALAMEDA TUNNEL—To divert water from Alameda Creek to Calaveras Reservoir. Diversion dam (to be constructed later); and 6x7-ft. (horseshoe) concrete lined tunnel, 9850 ft. long. This tunnel was started from one portal several years ago by Spring Valley Water Co., and about one-half has been completed. Present appropriation of $80,000 is for construction up to July 1. It will cost $470,000 to complete tunnel and diversion dam. Alameda Creek will furnish 13,000,000 m.g.d. additional supply. SUNSET WELLS—An appropriation of $235,000 to complete wells, pumping plant, and pipe-line, commenced before acquisition of S. V. W. Co. There will be eventually 20 wells, 14-16-in. diam., 250-275 ft. deep; including two old wells, 14 about completed, and four to be drilled later. Each well is to be equipped with a vertical deep well pump, and all will discharge into a 500,000 gal. sump, from which the waste will be pumped through 10,300 ft. of 20-in. steel pipe (to be constructed) to a connection with the distribution system. PLEASANTON WELLS—An appropriation of $12,000 for lowering the wells and pumps, for pumping from lower water-bearing strata. After July 1 more wells will probably be drilled. 5-1

EUGENE, ORE.—Bids soon by City for new water filtration and pumping plant for the Eugene Water Board of Eugene, Oregon. The proposed plant will have an initial capacity of 9,000,000 gallons daily with provisions for economical expansion to a future capacity of 24 to 30 million gallons. Stevens & Koon, Spalding Bdg., Portland, Oregon, are the Consulting Engineers. $250,000. 5-3

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*

LONGVIEW, WASH.—Plans by Stevens & Koon, Engrs., Spalding Bdg., Portland, Oregon, for water works improvements to be built during the coming season, for the Washington Gas & Electric Co., owners of the water works system at Longview, Washington. The work will consist of a modern gravity type filtration plant, additional reservoir, steel pumping main, intake, pumps, motors, and auxiliary equipment for a complete new water supply. The work to be done will consist of three million-gallon units of a plant which may be expanded to a total capacity of 12,000,000 gallons per day. The cost of the work to be done this year will exceed $200,000. It is expected that proposals for reservoir construction will be taken shortly, and plans and specifications are being prepared for other units. 4-25

BIDS BEING RECEIVED

FT. BLISS, TEX.—Bids to 11 a.m., May 22, by Col. R. E. Smyser, Constructing Quartermaster, William Beaumont General Hospital, Ft. Bliss, Texas, for construction of 600,000-gallon steel stand pipe. 5-3

BIDS RECEIVED

KENT, WASH.—J. Paduano, 7301 Dibble St., NW, Seattle, $81,995, low for wood pipe lines for City. 5-2

SEATTLE, WASH.—Bids as follows by City for elevated steel tank at Landsburg, near Lake Youngs Aqueduct Intake:

Chicago Bridge & Iron Works, Seattle and S. F. (low bidder)....$12,090
Pittsburgh-Des Moines Steel Co..... 12,974
4-28

CONTRACTS AWARDED

LOS ANGELES, CALIF.—To American Cast Iron Pipe Co., $8600 to County for furnishing cast-iron pipe and fittings under Spec. No. 160, for County Water Works District No. 10, Springdale Addition. 4-23

PALO ALTO, CALIF.—To The Minton Co., Palo Alto, $3264 for reinf. conc. reservoir at Oregon and Alma Sts. for City. 5-2

RIVERBANK, CALIF.—To Pittsburgh-Des Moines Steel Co., Rialto Bdg., S. F., $6500 for 75,000-gallon steel tank for Riverbank Water Co. 5-1

SAN BRUNO, CALIF.—To J. P. Lawlor, 372 7th Ave., S. F., $8512 for cast-iron mains, hydrants, and gate valves in Belle-Air Park for City. 4-24

TULARE, CALIF.—To R. E. Rounsaville, Tulare, $5168 to City for replacing present 4 and 6-in. water mains with 6 and 8-in. cast-iron water mains on Bush, Cross, Kern, East Ave., and D St., Tulare. 4-19

IRRIGATION and RECLAMATION

BIDS BEING RECEIVED

DENVER, COLO.—Bids to 3 p.m., June 3, by Bureau of Reclamation, Denver, Colorado, for furnishing two 42-in. internal differential needle valves for the Yakima River Crossing-Wasteway, Kittitas Division, Yakima Project, Washington. 4-29

BIDS RECEIVED

FAIRFIELD, MONT.—Hall & Booth, Stanley, N. D., $83,540, low for dikes for Pishkun Reservoir enlargement, Sun River Project, for Bureau of Reclamation. (See Unit Bid Summary.)

CONTRACTS AWARDED

TURLOCK, CALIF.—To E. Erickson, Turlock, $17,791 for concrete lining Dist. 36 for Turlock Irrigation District. 5-1

ELLENSBURG, WASH.—To General Const. Co., Central Bdg., Seattle, $201,945 for tunnels, structures, etc., on North Branch Canal, Yakima Project, for Bureau of Reclamation. (See Unit Bid Summary.) 4-30

RIVER and HARBOR WORK

BIDS RECEIVED

LOS ANGELES, CALIF.—Shanahan Bros., 406 S. Main St., L. A., $21,000, low for repairing jetty at Terminal Island. 5-2

MACHINERY and SUPPLIES

BIDS BEING RECEIVED

SANTA ANA, CALIF.—Bids to 5 p.m., May 19, by City for air-compressor to have capacity of 200 cu.ft. of air. 5-3

TACOMA, WASH.—Bids to 2 p.m., May 12, by Board of Contracts and Awards, 307 City Hall, Tacoma, for three power transformers, single phase, 60 cycles, high efficiency, 1000 kva. with 55 deg. C. temperature rise. Voltage rating: 13,200 to 2300/4000-volt. 4-28

CONTRACTS AWARDED

HUNTINGTON PARK, CALIF.—To Water Works Supply Co., Los Angeles, who bid $800 for one cast-iron venturi tube and recording meter for use in a 12-in. cast-iron water main for City. 4-25

LOS ANGELES, CALIF.—To National Cast Iron Pipe Co., who bid as follows to Water & Power Bureau for furnishing cast-iron pipe under Adv. 1318: 5472 ft. 16-in. cast-iron pipe, $2.96 ft.; 2591 ft. 18-in. cast-iron pipe, $3.26 ft. 4-28

OAKLAND, CALIF.—To Pacific Coast Engineering Co., Foot of 14th St., Oakland, who bid as follows for furnishing 20-in. steel shore pipe to Oakland Port Commission: 3200 ft. 20-in. steel shore pipe, $2.35 ft.; 800 ft. 20-in. steel shore pipe, $2.30 ft. 4-29

LIGHTING SYSTEMS

WORK CONTEMPLATED

SALINAS, CALIF.—Plans by H. F. Cozzens, City Engr., for 56 Union Metal electroliers, conduit system, etc., on S. Main and Main St. Bids after May 8. 4-25

BIDS BEING RECEIVED

OAKLAND, CALIF.—Bids to 12 m., May 15, by City for 15 lighting standards on 17th St., etc. 5-3

CONTRACTS AWARDED

BAKERSFIELD, CALIF.—To Sam Fingerhut, Bakersfield, $13,975 for electroliers on 17th St. 5-1

FRESNO, CALIF.—To Robinson Electric Co., Fresno, $29,072 for electroliers on various streets. 5-3

FLOOD CONTROL WORK

BIDS BEING RECEIVED

LOS ANGELES, CALIF.—Bids to 2 p.m., May 19, by County for 550,000 sq.ft. guniting on San Gabriel Wash. 5-1

POWER DEVELOPMENT

WORK CONTEMPLATED

EUGENE, ORE.—Stevens & Koon, Consulting Engineers, Spalding Bdg., Portland, have been commissioned by the Eugene Water Board to prepare plans for an auxiliary steam power plant of 6000-kw. capacity. This plant will be built in the City of Eugene on a site adjacent to the existing water plant and electric substation. The Leaburg hydroelectric project was recently completed under direction of the engineers, and the new plant will serve as a standby and auxiliary for the two hydro plants which the City now operates on McKenzie river. The new plant is expected to be ready for service by the end of this year, and will cost approximately $400,000. It is expected that oil will be used for fuel, but arrangement of the boiler room will be such that hog fuel may be substituted if it appears desirable when the plant is required to deliver auxiliary power as a regular demand of the system. 4-19

CONTRACTS AWARDED

CENTRALIA, WASH.—To Puget Sound Bridge & Dredging Co., Central Bdg., Seattle, $477,538 for power improvements for City, including turbines, forebay, transmission lines, penstocks, power house, flume, transformers, electric equipment. 5-1

TACOMA, WASH.—Contract awarded to Puget Sound Mchy. Dept., 322 First Ave. South, Seattle, $353,986 for furnishing and installing two boilers for the steam plant auxiliary No. 2 to be constructed for the City. 4-24

MISCELLANEOUS

WORK CONTEMPLATED

INVERNESS, CALIF.—Plans are being made by Architect, Austin Moore, c/o Willis Polk & Co., 227 Pine St., San Francisco, for the construction of a frame and stucco club house for the Wauhilla Aviation Country Club, DeWitt Markham, Managing Director, 426 Russ Bdg., San Francisco, to be located near Inverness, Marin County. Work also includes the construction of swimming pool to be 50 by 150 ft., an 18-hole golf course, tennis courts, landing field, barns, etc. The golf course is being designed by Wm. P. Bell, of Los Angeles. 4-19

BIDS BEING RECEIVED

HAWTHORNE, NEV.—Bids to 11 a.m., May 21, by Bureau of Yards and Docks, Navy Dept., Washington, D. C., for buildings, beach development, and fences at the Naval Ammunition Depot, Hawthorne, Nevada. Work includes concrete and hollow tile; built-up and asbestos shingle roofing; steel and iron work; steel doors and windows; lath and plaster; wood framing and finish; plumbing, heating, and electrical systems; development to a lake beach; and about 16½ lin. miles of wire fencing. 4-21

OPPORTUNITY PAGE

CONTINUED

FOR SALE—FOR RENT

USED EQUIPMENT

AIR COMPRESSORS
(Portable and Stationary)

CRANES
(Locomotive and Caterpillar types)

HOISTS
(Gas, Electric and Steam)

SHOVELS
(Gasoline-Diesel-Steam)

LOCOMOTIVES
(Gas, Electric and Steam)

BUCKETS
(Clamshell, Dragline, and Orange Peel)

RAIL
PILE HAMMERS
PIPE
DERRICKS

MISCELLANEOUS EQUIPMENT

Road Rollers
Arc Welders
Cars :: Cableways :: Crushers
Concrete Mixers
Dragline Machines :: Engines
Pumps :: Trucks
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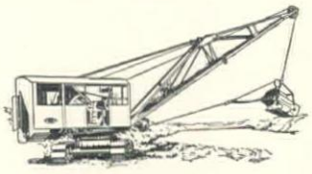

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Johnson Scarifier No. 2, $120
Rubottom Tractor Plow, $60
Dietzgen Light Transit, $100
McDaniel, Mills Building
Phone GArfield 6861

POSITION WANTED

POSITION WANTED—Young man desires position with construction company doing street or highway work. Four years' experience on street, sewer, etc., as surveyor and inspector. Three years highway. At present employed on highway survey. Experienced in handling men and had some bookkeeping. Would like to make connection where there is chance for advancement and permanent employment. Would like to start as timekeeper, cost clerk, foreman, or in similar capacity. Single, sober, and will accept any location offering desired opportunity. Field, office, or both. Box 350, W. C. News.

CIVIL ENGINEER—12 years' experience as engineer, foreman and superintendent in road construction. Desires new connection. Box 400, W. C. News.

THE BUYERS' GUIDE

Refer to advertisements for addresses of companies listed. Advertisers index on page 74

Acetylene Generating Apparatus
Oxweld Acetylene Co.

Air Compressors
Bacon Co., Edward R.
Gardner-Denver Co.
Garfield & Co.
Hackley Equipment Co., P. B.
Harron, Rickard & McCone Co.
Ingersoll-Rand Co.
Jenison Machinery Co.
Leitch & Co.
Rix Company, Inc., The
Schramm, Inc.
Sullivan Machinery Co.
West Coast Tractor Co.

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

Asphalt, Emulsified
American Bitumuls Co.

Asphalt Plants and Equipment
Bacon Co., Edward R.
Harron, Rickard & McCone Co.
Jenison Machinery Co.
Link-Belt Co.
Madsen Iron Works
Peerless Mchy. & Mfg. 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.
Bacon Co., Edward R.
Bucyrus-Erie Co.
Caterpillar Tractor Co.
Cleveland Tractor Co., The
Garfield & Co.
Harnischfeger Sales Corp.
Harron, Rickard & McCone Co.
Industrial Brownhoist 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
United Tractor & Equipment Corp.
Universal Crane Co., The
West Coast Tractor Co.
W-K-M Company, Inc.

Bars, Steel
Pacific Coast Steel Co.

Beams, Channels, and Angles
Pacific Coast Steel Co.

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

Blacksmithing—Drop Forgings
Payne's Bolt Works

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

Boilers
Harron, Rickard & McCone Co.
Industrial Brownhoist Corp.
Montague Pipe & Steel Co.
Peerless Mchy. & Mfg. Co.
Water Works Supply Co.

Bolts, Nuts and Rods
Claussen & Co., C. G.
Kortick Mfg. Co.
Payne's Bolt Works

Bonds, Surety
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.

Bonds, Surety (Continued)
Globe 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

Brick, Common
Kartschoke Clay Products Co.

Bridge Plates, Bronze Expansion
Greenberg's Sons, M.
Western Iron Works, S. F.

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

Buckets, Dredging
Haiss Mfgr. Co., Geo.
Harnischfeger Sales Corp.
Slick, R. R.

Buckets, Excavating
Bacon Co., Edward R.
Bucyrus-Erie Co.
Garfield & Co.
Haiss Mfgr. Co., Geo.
Harnischfeger Sales Corp.
Harron, Rickard & McCone Co.
Industrial Brownhoist Corp.
Jenison Machinery Co.
Marion Steam Shovel Co.
Orton Crane & Shovel Co.
Owen Bucket Co.
Slick, R. R.
Williams Co., G. H.

Buckets, Rehandling
Bacon Co., Edward R.
Garfield & Co.
Harron, Rickard & McCone Co.
Industrial Brownhoist Corp.
Jenison Machinery Co.
Lakewood Engr. Co.
Orton Crane & Shovel Co.
Owen Bucket Co.
Slick, R. R.
Williams Co., G. H.

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

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.

Castings, Brass and Bronze
Greenberg's Sons, M.

Castings, Iron and Steel
American Cast Iron Pipe Co.
Industrial Brownhoist Corp.
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.
Garfield & Co.
Haiss Mfgr. Co., Geo.
Harron, Rickard & McCone Co.
Jenison Machinery Co.
Lakewood Engr. Co.

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

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

Concrete Buckets
Harron, Rickard & McCone Co.
Jenison Machinery Co.
Young Machy. Co., A. L.

Concrete Curing
Concrete Curing Co.
McEverlast, Inc.

Concrete Forms
Harron, Rickard & McCone Co.

Concrete Roads
Portland Cement Association

Conveyors, Portable
Diamond Iron Works, Inc.
Haiss Mfgr. Co., Geo.
Harron, Rickard & McCone Co.
Jenison Machinery Co.

Conveyors, Elevating and Conveying
Bacon Co., Edward R.
Bodinson Mfg. Co.
Harron, Rickard & McCone 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.
Garfield & Co
Hackley Equipment Co., P. B.
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
West Coast Tractor Co.

Cranes, Traveling
Harnischfeger Sales Corp.
Harron, Rickard & McCone Co.
Industrial Brownhoist Corp.
Jenison Machinery Co.
Thew Shovel Co., The

Crushers
Bacon Co., Edward R.
Diamond Iron Works, Inc.
Garfield & Co.
Harron, Rickard & McCone Co.
Jenison Machinery Co.
Smith Engineering Works
W-K-M Company, Inc.
Young Machy. Co., A. L.

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.
McEverlast, Inc.

Cutting Apparatus
Oxweld Acetylene Co.

Dams
Ambursen Dam Co., Inc.
Victor Welding Equipment Co.

Derricks
Bacon Co., Edward R.
Garfield & Co.
Harron, Rickard & McCone Co.
Industrial Brownhoist Corp.
Jenison Machinery Co.
Young Machy. Co., A. L.

Ditch Machinery
Bacon Co., Edward R.
Bucyrus-Erie Co.
Cleveland Trencher Co.
Garfield & Co.
General Excavator 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.
Osgood Co., The
Thew Shovel Co., The

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

Drain Tile
Gladding, McBean & Co.
Kartschoke Clay Products Co.
Pacific Clay Products

Drills, Rock
Bacon Co., Edward R.
GardnerDenver Co.
Harron, Rickard & McCone Co
Ingersoll-Rand Co.
Rix Company, Inc., The
Schramm, Inc.
Sullivan Machinery Co.

Drill Sharpening
Compressor Service & Tool Co.

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

Engineering Instruments
American Paulin System, Inc., The

Engines, Gasoline and Steam
Bacon Co., Edward R.
Continental Motors Corp.
Clyde Iron Works Sales Co.
Harron, Rickard & McCone Co.
Hercules Motors Corp.
Ingersoll-Rand Co.
International Harvester Co.
Jenison Machinery Co.
Le Roi Co.
Novo Engine Co.
Wisconsin Motor Co.

Excavating Machinery
Bacon Co., Edward R.
Bodinson Mfg. Co.
Bucyrus-Erie Co.
Caterpillar Tractor Co.
Cleveland Tractor Co., The
Excavating Equipment Dealers, Inc.
Garfield & Co.
General Excavator Co.
Haiss Mfgr. Co., Geo.
Harnischfeger Sales Corp.
Harron, Rickard & McCone Co.
Industrial Brownhoist Corp.
Jenison Machinery Co.
Link-Belt Co.
Marion Steam Shovel Co.
National Equipment Corp.
Northwest Engineering Co.

(Continued on page 70)

OPPORTUNITY PAGE

CONTINUED

OFFICIAL BIDS

UNITED STATES DEPARTMENT OF THE INTERIOR

BUREAU OF RECLAMATION

Valves

Washington, D. C., April 12, 1930

Sealed bids (Specifications No. 511) will be received at the office of the Bureau of Reclamation, Denver, Colorado, until 3 o'clock p. m., June 3, 1930, and will at that hour be opened, for furnishing two 42-inch internal differential needle valves for the Yakima River Crossing-Wasteway, Kittitas division, Yakima project, Washington. The valves will be installed by the Government. For particulars, address the Bureau of Reclamation, Ellensburg, Washington; Denver, Colorado; or Washington, D. C.

P. W. DENT, Acting Commissioner.

UNITED STATES DEPARTMENT OF AGRICULTURE

BUREAU OF PUBLIC ROADS

Grading

Standard Government Form of Invitation for Bids

San Francisco, California, April 30, 1930

Sealed bids, in single copy only subject to the conditions contained herein, will be received until 2 o'clock p.m. on the 22nd day of May, 1930, and then publicly opened, for furnishing all labor and materials and performing all work for grading a portion of Section "A" of Route 73, Laguna National Forest Highway, in Cleveland National Forest, San Diego County, California.

The length of the project to be graded is 6.76 miles and the principal items of work are approximately as follows:

Unclassified excavation, 75,500 cu.yd.
Structural excavation, 610 cu.yd.
Overhaul, 15,000 sta.yd.
Finishing earth graded road, 6.76 miles.
Cement rubble masonry, 39 cu.yd.
Corr. metal pipe in place, 2244 lin.ft.
Maint. of existing road and sections accepted for traffic (extra work est. $500).
Removing, hauling and piling existing 12-in. pipe culverts, 588 lin.ft.
Removing, hauling and placing existing 18-in, 24-in. and 36-in. pipe culverts, 308 lin.ft.
Right of way monuments in place, 180 each.

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 one hundred eighty (180) 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 payment 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., May 22, 1930.
Portion Section-A, Laguna National Forest Highway, 807 Sheldon Bldg., 461 Market Street, San Francisco, California.

C. H. SWEETSER, District Engineer.

UNITED STATES DEPARTMENT OF AGRICULTURE

BUREAU OF PUBLIC ROADS

Surfacing

Standard Government Form of Invitation for Bids

Phoenix, Arizona, April 29, 1930

Sealed bids, in single copy only subject to the conditions contained herein, will be received until 2 o'clock p.m. on the 22nd day of May, 1930, and then publicly opened, for furnishing all labor and materials and performing all work for grading Section 2B of the Swift Trail Forest Development Road in Crook National Forest, Graham County, Arizona.

The length of the project to be graded is 2.717 miles and the principal items of work are approximately as follows:

Clearing, 12 acres.
Unclassified excavation, 29,288 cu.yd.
Unclassified excavation for structures, 660 cu.yd.
Unclassified excavation for borrow, 300 cu.yd.
Finishing earth graded roads, 2.717 miles.
Cement rubble masonry, 80 cu.yd.
Corrugated metal pipe in place, 1600 lin.ft.
Hand laid rock embankment, 140 cu.yd.
Protection ditch, 10,000 lin.ft.

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 one hundred fifty (150) 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.

Award of contract will not be made until and unless the necessary funds therefor have been appropriated by Congress.

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

Bid for ROAD CONSTRUCTION. To be opened 2:00 p.m., May 22, 1930.
Section 2B, Swift Trail Forest Development Road, 508 Ellis Bldg., Phoenix, Arizona.

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

UNITED STATES DEPARTMENT OF INTERIOR

Grading

NATIONAL PARK SERVICE

Standard Government Form of Invitation for Bids

San Francisco, California, May 1, 1930

Sealed bids, in single copy only subject to the conditions contained herein, will be received until 2 o'clock p.m. on the 27th day of May, 1930, and then publicly opened, for furnishing all labor and materials and performing all work for grading section D-2 of route No. 1, Generals Highway, in Sequoia National Park, California.

The length of the project to be graded is 2.70 miles and the principal items of work are approximately as follows:

Clearing, 19.9 acres.
Unclassified excavation, 95,133 cu.yd.
Type "B" excavation, 19,475 cu.yd.
Unclassified excavation for structures, 694 cu.yd.
Overhaul, 20,917 sta.yd.
Finishing, 2.70 miles.
Cement rubble masonry, 415 cu.yd.
Corr. metal pipe (in place), 1456 lin.ft.
Hauling backfill material, 4500 c.y.mi.

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 two hundred sixty (260) 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.

Award of contract will not be made until and unless the necessary funds therefor are appropriated by Congress.

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

Bid for ROAD CONSTRUCTION. To be opened 2 p.m., May 27, 1930.
Project 1-D2 (grading), HALSTEAD MEADOW, GENERALS HIGHWAY, SEQUOIA NATIONAL PARK, 807 Sheldon Bldg., 461 Market Street, San Francisco, California.

C. H. SWEETSER, District Engineer.

THE BUYERS' GUIDE—*Continued from Page 68*

Excavating Mchy. (Continued)
Ohio Power Shovel Co.
Orton Crane & Shovel Co.
Osgood Co., The
Owen Bucket Co.
Sauerman Bros., Inc.
Speeder Machinery Corp., The
Thew Shovel Co., The
United Tractor & Equipment Corp.
Universal Crane Co., The

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
Hackley Equipment Co., P. B.
Tieslau Bros.

Filters—Water
California Filter Co., Inc.

Fire Hydrants
Greenberg's Sons, M.
Industrial & Municipal Supply Co.
Rensselaer Valve Co.
United Iron Works
Water Works Supply Co.

Floating Roofs
Chicago Bridge & Iron Works

Flood Lights
Oxweld Acetylene Co.

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
Oxweld Acetylene Co.
Victor Welding Equipment Co.

Forms, Steel
Harron, Rickard & McCone Co.
Jenison Machinery Co.
Lakewood Engr. Co.

Freight, Water
American-Hawaiian Steamship Co.

Frogs and Switches
Bacon Co., Edward R.
United Commercial Co.

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

Gates, Cast-Iron
California Corrugated Culvert Co.

Gates, Irrigation
Great Western Meter 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

Gravel Plant Equipment
Bacon Co., Edward R.
Bodinson Mfg. Co.
Bucyrus-Erie Co.
Diamond Iron Works, Inc.
Harron, Rickard & McCone Co.
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.
Industrial Brownhoist Corp.

Hoists, Hand and Power
Bacon Co., Edward R.
Gardner-Denver Co.
Garfield & Co.
Harnischfeger Sales Corp.
Harron, Rickard & McCone Co.
Industrial Brownhoist Corp.

Hoists, Hand and Power (Continued)
Ingersoll-Rand Co.
Jaeger Machine Works, The
Jenison Machinery Co.
Link-Belt Co.
Novo Engine Co.
Sullivan Machinery Co.
West Coast Tractor Co.
Young Machy. Co., A. L.

Hoppers, Steel
Bacon Co., Edward R.
Haiss Mfgr. Co., Geo.
Harron, Rickard & McCone Co.
Jenison Machinery Co.
Lakewood Engr. Co.
Link-Belt Co.
Madsen Iron Works

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
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.
Harron, Rickard & McCone Co.
Montague Pipe & Steel Co.
Peerless Mchy. & Mfg. Co.
Spears-Wells Machy. Co.
Young Machy. Co., A. L.

Leadite
Water Works Supply Co.

Loaders, Power, Truck and Wagon
Haiss Mfgr. 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)
Bacon Co., Edward R.
Garfield & Co.
Hackley Equipment Co., P. B.
Harron, Rickard & McCone Co.
Jenison Machinery Co.
United Commercial Co.

Lumber
McCormick Lumber Co.

Metal Lath
Truscon Steel Company

Meters, Irrigation
Great Western Meter Co.

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.
Young Machy. Co., A. L.

Mixers, Plaster
Harron, Rickard & McCone Co.
Jaeger Machine Works, The
Jenison Machinery Co.
Young Machy. Co., A. L.

Motors, Gasoline
Continental Motors Corp.

Motors, Gasoline (Continued)
Hercules Motors Corp.
Harron, Rickard & McCone Co.
Jenison Machinery Co.
Le Roi Co.
Wisconsin Motor Co.

Oxy-Acetylene Apparatus
Oxweld Acetylene Co.

Paints, Acid Resisting
Paraffine Companies, Inc., The
Wailes Dove-Hermiston Corp.

Paints, Metal Protective
McEverlast, Inc.
Paraffine Companies, Inc., The
Wailes Dove-Hermiston Corp.

Paints, Technical
American Bitumuls Co.
Paraffine Companies, Inc., The
Wailes Dove-Hermiston Corp.

Paints, Waterproofing
McEverlast, Inc.
Paraffine Companies, Inc., The
Wailes Dove-Hermiston Corp.

Pavers, Concrete
Foote Company, Inc.
Harron, Rickard & McCone Co.
National Equipment Corp.

Paving Breakers
Gardner-Denver Co.
Harron, Rickard & McCone 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.
Madsen Iron Works
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.
Northwest Engineering Co.
Orton Crane & Shovel Co.
Thew Shovel Co., The

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

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
McEverlast, Inc.
Paraffine Companies, Inc., The
Wailes Dove-Hermiston Corp.

Pipe, Concrete
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.
Harron, Rickard & McCone Co.
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 Company

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.
Weissbaum & Co., G.

Pipe, Vitrified
Gladding, McBean & Co.
Kartschoke Clay Products 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
Bacon Co., Edward R.
Galion Iron Works & Mfg. Co.
Hackley Equipment Co., P. B.
Jenison Machinery Co.
Spears-Wells Machy. Co.

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

Portable Lights
Oxweld Acetylene Co.

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

Power Units
Continental Motors Corp.
Harron, Rickard & McCone Co.
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
Woodin & Little

(Continued on page 72)

OPPORTUNITY PAGE

OFFICIAL BIDS

UNITED STATES DEPARTMENT OF INTERIOR

NATIONAL PARK SERVICE

Grading

Grand Canyon, Arizona, May 1, 1930.

Sealed bids, in single copy only subject to the conditions contained herein, will be received until 10 o'clock a.m. on the 27th day of May, 1930, and then publicly opened, for furnishing all labor and materials and performing all work for grading Section "D" of route No. 2, Grand Canyon-Old Trails National Forest Highway, in Tusayan National Forest, Coconino County, Ariz.

The length of the project to be graded is 17.57 miles and the principal items of work are approximately as follows:

Unclassified excavation, 13,000 cu.yd.
Structural excavation, 600 cu.yd.
Borrow, 98,000 cu.yd. Overhaul, 12,400 sta.yd.
Class B concrete, 67 cu.yd.
Class C concrete, 30 cu.yd.
Reinforcing steel, 6800 lbs.
Cement rubble masonry, 100 cu.yd.
Corr. metal pipe in place, 2104 lin.ft.
Right of way monuments, 136 each.
Subbase for gravel dips, 330 cu.yd.
Selected material for gravel dips, 170 cu.yd.
Protection ditch, 15,500 lin.ft.
Cattle guards, 9 each.

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.

Plans and specifications for the work are available at the office of the Bureau of Public Roads, 508 Ellis building, Phoenix, Arizona, for distribution to prospective bidders. 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 one hundred fifty 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.

Award of contract will not be made until and unless the necessary funds therefor are appropriated by Congress. Envelopes containing bids must be sealed, marked, and addressed as follows:

Bid for Road Construction. To be opened 10 a.m., May 27, 1930. Red Lake Section D, Grand Canyon-Old Trails National Forest Highway Route 2, Office of Park Superintendent, Grand Canyon, Arizona.

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

UNITED STATES DEPARTMENT OF THE INTERIOR

NATIONAL PARK SERVICE

Grading

San Francisco, Calif., April 26, 1930

Sealed bids, in single copy only subject to the conditions contained herein, will be received until 2 o'clock p.m. on the 15th day of May, 1930, and then publicly opened, for furnishing all labor and materials and performing all work for grading Section "E" of Route No. 1, Loop Route, in Lassen Volcanic National Park, California.

The length of the project to be graded is 7.71 miles and the principal items of work are approximately as follows:

Clearing, 46 acres.
Unclassified excavation, 90,050 cu.yd.
Unclassified excavation for structures, 530 cu.yd.
Unclassified excavation for borrow, 6250 cu.yd.
Overhaul, 25,000 sta.yd.
Finishing, 7.71 miles.
Cement rubble masonry, 63 cu.yd.
Corrugated metal pipe (in place), 2126 lin.ft.
Maintenance of existing road, extra work est. $500.
Hauling borrow, 7200 cu.yd.mi.

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 notice to proceed and shall be completed within two hundred fifteen (215) 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.

Award of contract will not be made unless and until the necessary funds therefor have been appropriated by Congress.

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

Bid for Road Construction. To be opened 2 p.m., May 15, 1930.

Project 1-E, Northwest Entrance Extension Section, Loop Route, Lassen Volcanic National Park, 807 Sheldon Bldg., 461 Market St., San Francisco, California.

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

UNITED STATES DEPARTMENT OF THE INTERIOR

NATIONAL PARK SERVICE

Surfacing

San Francisco, Calif., April 26, 1930

Sealed bids, in single copy only subject to the conditions contained herein, will be received until 2 o'clock p.m. on the 15th day of May, 1930, and then publicly opened, for furnishing all labor and materials and performing all work for surfacing Sections C-3 and C-4, and portions of Sections C-1 and C-2 of Route No. 1, Loop Route, in Lassen Volcanic National Park, California.

The length of the project to be surfaced is 7.52 miles and the principal items of work are approximately as follows:

Unclassified excavation (borrow and slide removal), 3000 cu.yd.
Fine grading subgrade and shoulders, 7.52 miles.
Crushed rock surfacing, 14,900 cu.yd.
Supplemental crushed rock, 1750 cu.yd.
Additional binder, 2100 cu.yd.
Hauling binder, 6000 cu.yd.mi.
Watering, 900 M gal.
6-in. vitrified tile underdrain (in place), 341 lin.ft.

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 bid 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 notice to proceed and shall be completed within one hundred (100) 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 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.

Award of contract will not be made until and unless the necessary funds therefor have been appropriated by Congress.

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

Bid for Road Construction. To be opened 2 p.m., May 15, 1930.

Project 1-C3, 1-C4, and portion of 1-C1 and 1-C2, Loop Route, Lassen Volcanic National Park, 807 Sheldon Bldg., 461 Market Street, San Francisco, California.

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

THE BUYERS' GUIDE—*Continued from Page 70*

Pumps, Deep Well
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
Jenison Machinery Co.

Pumps, Hydraulic
Jenison Machinery Co.

Pumps, Power
Gardner-Denver Co.
Jaeger Machine Works, The

Pumps, Road
Bacon Co., Edward R.
Harron, Rickard & McCone Co.
Jaeger Machine Works, The
Jenison Machinery Co.
Novo Engine Co.
Woodin & Little

Pumps, Sewage
Dorr Co., The
Fairbanks, Morse & Co.
Industrial & Municipal Supply Co.

Pumps, Sewage Ejector
Industrial & Municipal Supply Co.

Pumps, Sludge
Dorr Co., The

Pumps, Water Works
Fairbanks, Morse & Co.
Industrial & Municipal Supply Co.
Jenison Machinery Co.
Pelton Water Wheel Co., The
Pomona Pump Co.

Rails
Bacon Co., Edward R.
Claussen & Co., C. G.
United Commercial Co.

Reinforcing Bars
Pacific Coast Steel Co.
Soulé Steel Co.

Reinforcing Wire Fabric
Soulé Steel Co.

Reservoirs, Steel
Chicago Bridge & Iron Works
Western Pipe & Steel Company

Riveting Machines
Ingersoll-Rand Co.
Rix Company, Inc., The

Road Finishers
Bacon Co., Edward R.
Blaw-Knox Co.
Jenison Machinery Co.
Lakewood Engr. Co.

Road Forms
Bacon Co., Edward R.
Harron, Rickard & McCone Co.
Heltzel Steel Form and Iron Co.
Jenison Machinery Co.
Lakewood Engr. Co.

Road Graders and Scrapers
Austin-Western Road Machy. Co.
Bacon Co., Edward R.
Caterpillar Tractor Co.
Jenison Machinery Co.
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