WESTERN CONSTRUCTION NEWS

CIVIL ENGINEERING AND CONSTRUCTION IN THE FAR WEST

PUBLISHED SEMI-MONTHLY
VOLUME V NUMBER 3

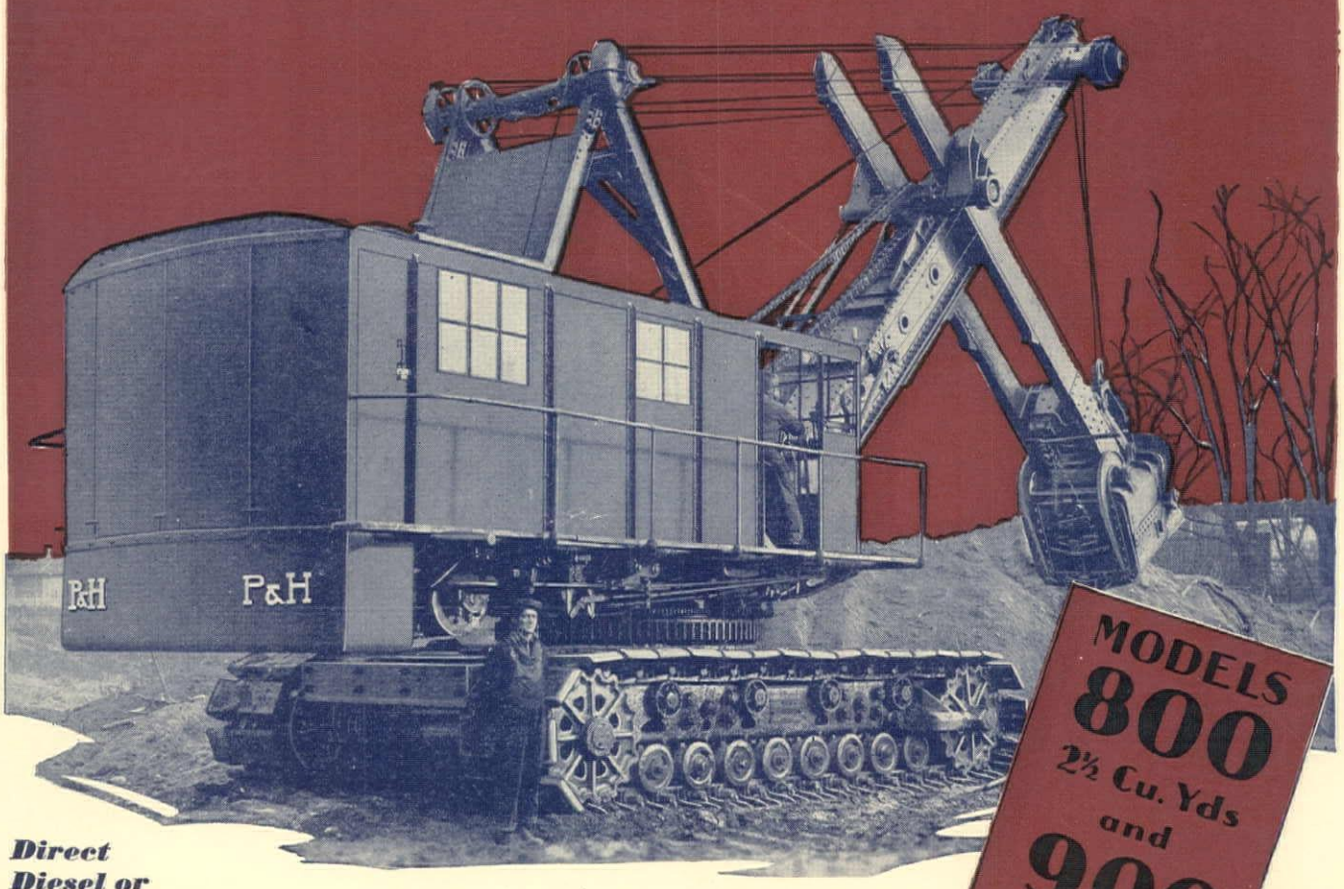
SAN FRANCISCO, FEBRUARY 10, 1930

25 CENTS A COPY
$3.00 PER YEAR

MOLASSES CREEK CONTROL WORKS, SEATTLE WATER SYSTEM. THREE DELIVERY LINES IN FOREGROUND; SMALL CHLORINATOR HOUSE IN CENTER; CONTROL TANKS IN RIGHT BACKGROUND; ELEVATED PRESSURE TANK FOR CHLORINATORS IN CENTER BACKGROUND

MOBILITY

Unheard of Before in Shovels of this Size



MODELS 800 2½ Cu. Yds and 900 3½ Cu. Yds.

Direct Diesel or Electric Drive

P&H

Diesel SHOVELS

A Complete Line

GAS • DIESEL • ELECTRIC

½ to 3½ cu. yds.

There is no need to drive blocks under the tractions of P&H machines for steering.

Models 800 and 900 have steering brakes and are steered by the operator from his cab. No man is required on the ground. These machines can be maneuvered as readily as machines of one-yard capacity—can be steered exactly where needed quickly without any lost motion.

Other Advanced Features

LOW FUEL CONSUMPTION—steam-like torque characteristics.

HYATT or TIMKEN ROLLER BEARINGS used on all important shafts above the deck. Maximum efficiency of power transmission.

SINGLE PIECE STEEL CASTINGS used for all main frames. Perfect alignment of machinery at all times. Less maintenance.

QUICKLY CONVERTIBLE into shovel, dragline or crane.

These P&H machines are going into service on the Iron Range, in quarries, gravel pits and along the Mississippi.

There are many other features that you should know about. Let us send you complete information.

HARNISCHFEGER SALES CORPORATION

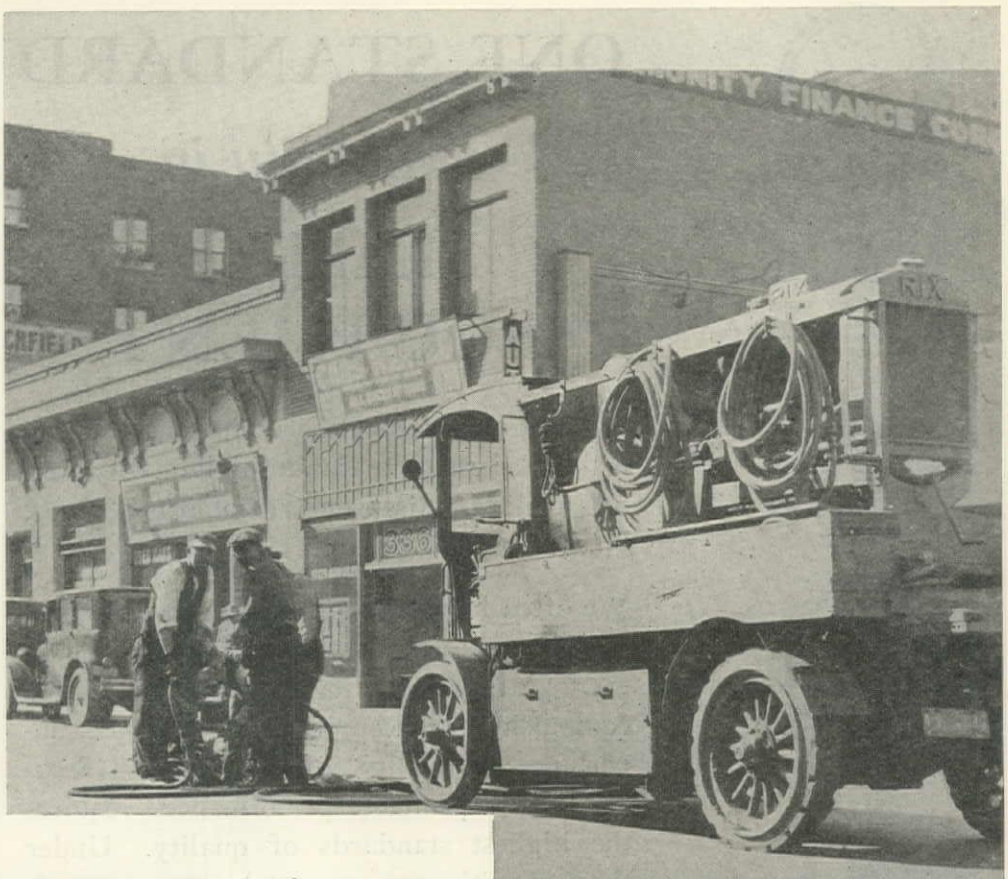
Established 1884

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, Wash.



Where you find a RIX you find ACTION. RIX gets things done. At the right, an action photo of one of several RIX Portables which are cutting costs and speeding up service for P. G. & E. Notice the special mounting.

SPECIAL

WHEN you've got to do a job in a *special* rush, when you get a *special* bonus for cutting contract time, when you've got to bid *especially* close, when you run up against *special* problems, then is when you appreciate a RIX "SIX" most. Its pioneer dependability. Its 26% higher efficiency. Its fighting spirit. Its capacity to stand the gaff and keep going until the job is done. RIX is the *only* Compressor equipped with a *Super-Charger*. Special mountings for special purposes. And RIX *"Express Service"* with every RIX Rig. Write for Bulletin 8-P.

IF you need AIR you need RIX

RIX "6"

PORTABLE AIR COMPRESSORS

The *Pioneer* RIX line includes vertical and horizontal compressors in all sizes for all purposes, compressor service and supplies, and pneumatic tools. Rix Co. are also agents for COCHISE Drills, and exclusive distributors for THOR Pneumatic Tools in Los Angeles and Seattle territories.

RIX COMPANY, Inc.

400 4th St., San Francisco

Seattle • Portland • Los Angeles

Since 1877

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DEVOTED TO CIVIL ENGINEERING AND CONSTRUCTION IN THE FAR WEST

VOLUME V FEBRUARY 10, 1930 NUMBER 3

CONTENTS

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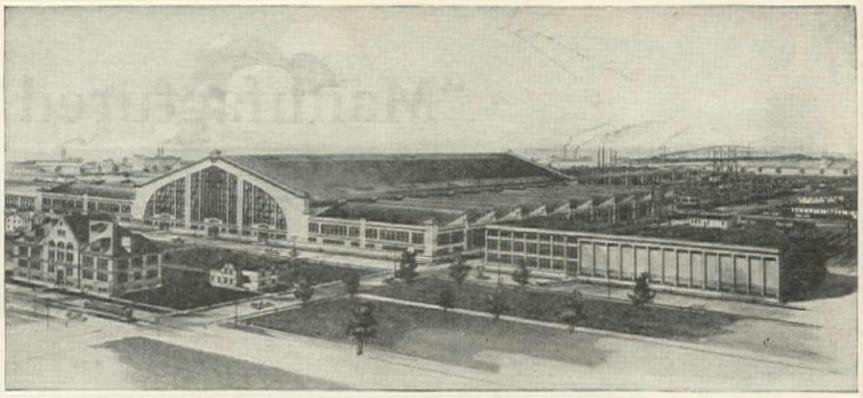

Brownhoist Division Plant, located at Cleveland, Ohio.

Crane Builders for Over 50 Years

Originators of the locomotive crane industry in this country, Industrial Brownhoist has always adhered to the belief that giving its customers the highest quality is the best way to serve them.

As a natural result of this policy, three great plants employing nearly 2,000 skilled workers are now required to produce the most complete line of this equipment that has ever been built by one company.

Industrial Brownhoist appreciates the confidence that is being shown in its products and will continue to serve each individual owner of material handling equipment to the best of its ability.

Industrial Brownhoist Products include Locomotive and Crawler Cranes of from 6 to 200 tons capacity, Crawler Shovels of ½ to 1¼ yards dipper capacity, Bridge Cranes, Dock Machinery, Clamshell Buckets, Conveyors, and Ditching Machines.

Industrial Brownhoist Corporation

General Offices: Cleveland, Ohio

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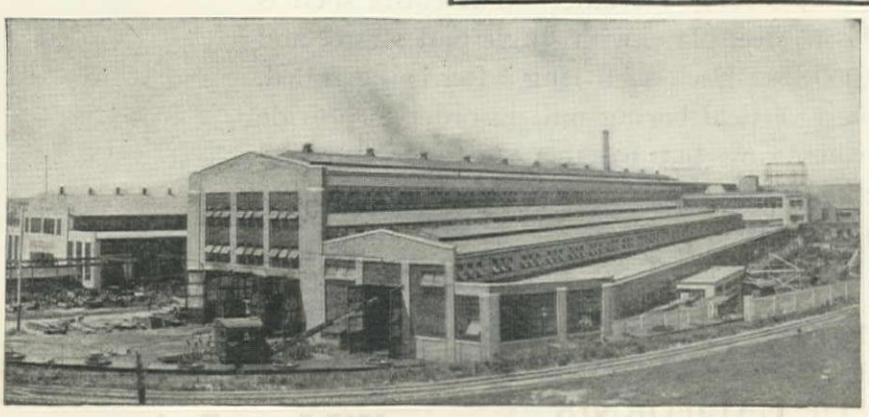
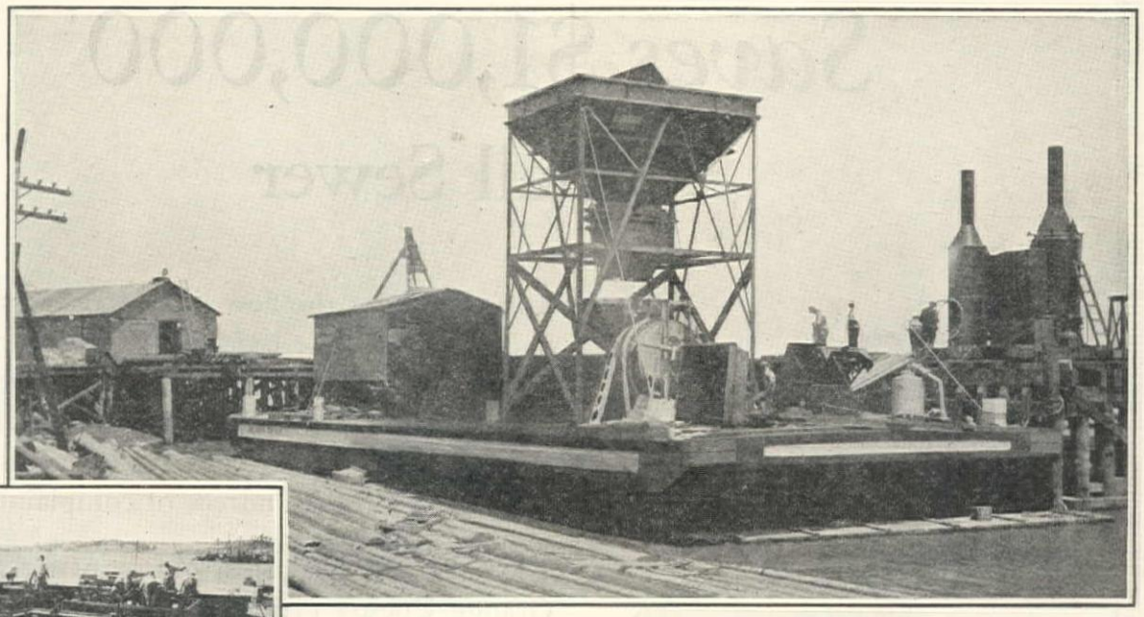


Industrial Division Plant, located at Bay City, Michigan.

INDUSTRIAL BROWNHOIST

A floating CENTRAL MIXING PLANT



Blaw-Knox Steel Cassion Forms are another feature of the Suisin Bay Bridge Job.

for Siems, Helmers & Schaffner, Inc.

The flexibility of Blaw-Knox BATCHERPLANTS has again been demonstrated on the Suisin Bay Bridge at San Francisco.

Siems, Helmers & Schaffner, Inc., are using this 150-ton Self-Cleaning BATCHERPLANT, equipped with an 8000 lb. Double Weighing Batcher. The complete plant is mounted on a barge, and can be easily shifted from pier to pier as the bridge work progresses.

The adaptability of Blaw-Knox BATCHERPLANTS has been demonstrated on hundreds of jobs in all parts of the world. When a jobs need an efficient central mixing plant,

BLAW-KNOX KNOWS HOW TO BUILD IT.

Blaw-Knox Road Building Equipment

- Steel Bins - Batcherplants, Portable, Self Cleaning
- Road Forms
- Steel Forms for Streets and Sidewalks
- Weighing Batchers
- Volume Batchers
- Cement Weighing Batchers
- Agitator Truck Bodies
- Ready Mixed Concrete Plants
- The Blaw-Knox Triplex Gate
- Sand, Gravel and Coal Gates
- Truck Turntables
- The Blaw-Knox Inundation System
- Clamshell Buckets
- Dragline Buckets
- *Electroforged* Steel Grating and Flooring
- Blaw-Knox Veergard Steel
- Standard Steel Buildings
- Steel Forms Blawforms for General Concrete Construction
- Ord Road Finishing Machine
- Nu-Method Finish Grader
- Ball Wagon Grader

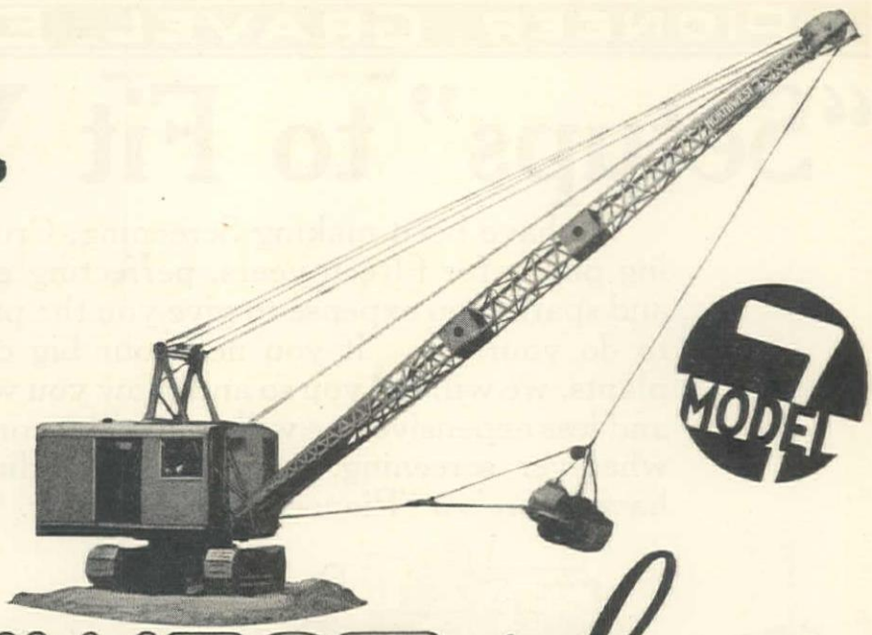
TRADE MARK REG. U.S. PAT. OFFICE BLAW-KNOX

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

Garlinghouse Bros., 16th St. and Santa Fe Ave., Los Angeles
Harron, Rickard & McCone, 1600 Bryant St., San Francisco
J. L. Latture, 312 E. Madison St., Portland, Ore.
Pacific Hoist & Derrick Co., 818 First Ave., S., Seattle, Wash.
L. A. Snow Co., 1032 Sixth Ave., S., Seattle, Wash.

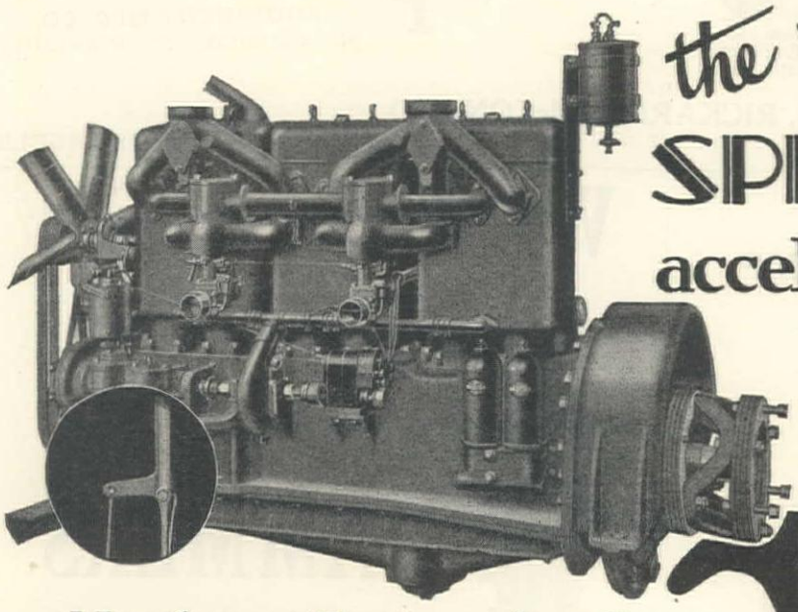
BLAW-KNOX

A 1¾ cubic yard NORTHWEST *plus*



MODEL 7

the VARIABLE SPEED MOTOR accelerator controlled *means*



2¼ cubic yard capacity

Northwest Engineering Co.

The world's largest exclusive builders of gasoline, oil burning and electric powered shovels, cranes and draglines

1736 Steger Bldg., 28 E. Jackson Blvd.
Chicago, Ill., U. S. A.

NORTHWEST ENGINEERING CO.
23 Main Street, San Francisco, Calif.

BROWN-BEVIS CO.
49th Street and Santa Fe Avenue
Los Angeles, Calif.

½ 1¼ 1 YD. 1½ ¾

NORTHWEST

When writing to NORTHWEST ENGINEERING CO., *please mention Western Construction News* WCN 2-10 Gray

THE FIRST MANUFACTURER TO BUILD DIESEL EXCAVATORS

5 *Diesel Machines Pioneered by Bucyrus-Erie*

Diesel engines have made sensational history in the past 10 years. So great are the advantages of Diesel power that it has been rapidly adapted to ships, railroads and a wide range of industrial uses.

With pioneering vision, Bucyrus-Erie saw that Diesel engines were especially suited for excavation work. Bucyrus-Erie built the first Diesel shovel, the first Diesel dragline, and was first with four other types of Diesel excavating machines. Bucyrus-Erie small shovels with Atlas-Imperial Diesel engines have been made continuously by this company for the past 8 years and are operating with complete satisfaction all over the world today.

These Diesels have the power to meet abnormal demands. Power for the toughest digging. Power that is hard to stall. Fuel cost is but a fraction of that for gasoline engines. Rugged simplicity keeps these Diesels on the job.

Every Bucyrus-Erie Diesel machine is correctly designed and built. Each part bears the proper relationship to every other part of the machine. "Built by Bucyrus-Erie" means *dependable performance!*

Power shovels, clamshells, cranes, draglines, dragshovels—½ to 16-yard capacity—electric, steam, gasoline, Diesel, gas + air, Diesel + air. Dipper, hydraulic and placer mining dredges.

We will gladly co-operate with you and help you choose the machine for your needs. World wide service goes with every sale.

A-22-2-10-30-W CN

BUCYRUS ERIE

BUCYRUS-ERIE COMPANY

Plants: South Milwaukee, Wis., Erie, Pa., Evansville, Ind. General Offices: South Milwaukee, Wis.

West Coast Branch Office: 989 Folsom Street, San Francisco.

Clyde Equipment Company, Portland, Ore., Seattle, Wash. Concrete Machinery & Supply Company, Los Angeles, Cal.

New Model 12 ~A *Wheel-Type* Service Ditcher

Thousands of satisfied owners know, from actual experience, the proven superiority of Buckeye "Wheel-Type" Ditchers in hard digging, their speed and low operating and maintenance costs.

The *New* Model 12 is offered to the construction world for all excavating requiring a compact, flexible ditcher. It eliminates or minimizes costly hand labor for cutting through lawns, between sidewalk and curb, and close to poles, trees and other side obstructions. Furthermore, it operates just as efficiently in open spaces as it does in restricted areas.

Multiplied production and service result from this dependable Buckeye's ready portability. Being light and compact, it is easily transported by truck or trailer from one job to another. With a big, over-size motor and sturdy, sure-footed traction wheels, it easily climbs steep inclines or grades. That reduces the crew and the time required for loading and unloading.

This is our assurance to you regarding Model 12's performance: It must work satisfactorily in any soil that is practical for machine digging—an ability every owner has the right to expect.

Check carefully this new Buckeye's complete specifications. Then you will know why it welcomes your rigid inspection and comparison—from motor to digging wheel. Write for free descriptive and illustrative bulletin.

Profitable Features

Cutting widths — 11½", 14½", 18", 22"

Cutting depth — 5½'

Overall Width — 61"

Overall Height — 8' 6"

Center of ditch to outside of traction — 29"

Eight digging speeds, transmission controlled, range from 27" to 123" per minute.

Twin full-length, steel-tread Alligator (crawler) wheels.

THE BUCKEYE TRACTION DITCHER COMPANY
FINDLAY, OHIO

for over thirty years

Buckeye

Representatives:

A. L. YOUNG MACHINERY CO.
SAN FRANCISCO

The BROWN-BEVIS CO.
LOS ANGELES

When writing to THE BUCKEYE TRACTION DITCHER COMPANY, *please mention Western Construction News*

ENGINES THAT FIT

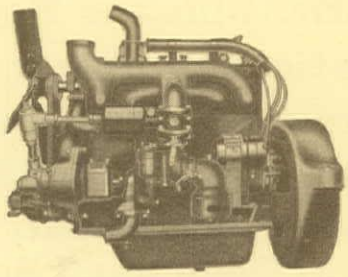
Every customer has his own specifications for a gasoline engine today. The manufacturer needs an engine that can be quickly adapted to his own individual product. While the jobber on the other hand, and the ultimate user require an engine that is more completely assembled and actually ready for use. Really, the only universal requirement among these diversified groups of customers is that the power plant be thoroughly dependable and also fit the exact need.

The series of Heavy Duty Continental Engines illustrated below prove that these varied demands have been met. Continental has carried the assembly process just far enough to meet every need with a sturdy engine that fits. Write for a complete catalog.

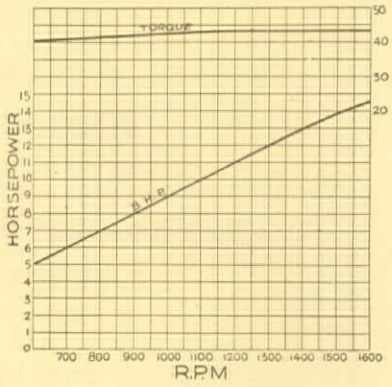
CONTINENTAL MOTORS CORPORATION
INDUSTRIAL EQUIPMENT DIVISION
Office and Factory: Muskegon, Michigan
The Largest Exclusive Gasoline Motor Manufacturer in the World

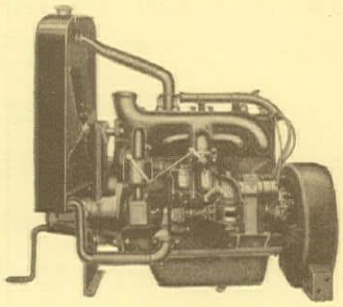
RED SEAL CONTINENTAL INDUSTRIAL ENGINES AND POWER UNITS

Engine Model	No. Cyls.	Bore and Stroke	Horsepower
Y2	2	3⅜" x 4¼"	4-11
H2	4	2½" x 4¼"	5-18
H9	4	3⅜" x 4¼"	10-35
W9	4	3⅜" x 4¼"	13-40
M3	4	4⅛" x 4¼"	20-28
S12	4	4¼" x 5"	26-34
14C	6	3⅜" x 4⅝"	27-37
29R	6	4" x 4⅜"	36-56
30R	6	4" x 4½"	41-64
31R	6	4⅛" x 4¾"	46-73
32R	6	4⅜" x 4¾"	50-80
28H	6	4½" x 5¾"	39-105
H15	4	4¾" x 6"	32-70
H16	4	5" x 6"	36-75
H17	4	5¼" x 6"	40-80
H22	4	5¼" x 6½"	47-86
H23	4	5½" x 6½"	52-91
H24	4	5¾" x 6½"	60-97
H25	4	6" x 7½"	65-120
H26	4	6¼" x 7½"	70-125
H27	4	6½" x 7½"	76-130
H28	4	6¾" x 7½"	82-136
21Z	6	4¾" x 6"	91-102
22Z	6	5" x 6"	99-109
23Z	6	5¼" x 6"	108-122
P10A	2	3⅜" x 4¼"	4-14
P11	4	2½" x 4¼"	5-18
P11A	4	2½" x 4¼"	5-18
P20	4	3⅜" x 4¼"	10-35
P20A	4	3⅜" x 4¼"	10-35
P27A	4	3⅜" x 4¼"	13-40
P39A	4	4¼" x 5"	26-34
P45A	6	3⅜" x 4⅝"	27-37
P57A	6	4" x 4⅜"	36-56
P65A	6	4" x 4½"	41-64
P73A	6	4⅛" x 4¾"	46-73
P80A	6	4⅜" x 4¾"	50-80
P96	6	4½" x 5¾"	39-105
P55	4	4¾" x 6"	32-70
P61	4	5" x 6"	36-75
P67	4	5¼" x 6"	40-80
P74	4	5¼" x 6½"	47-86
P79	4	5½" x 6½"	52-91
P88	4	5¾" x 6½"	60-97
P110	4	6" x 7½"	65-120
P120	4	6¼" x 7½"	70-125
P130	4	6½" x 7½"	76-130
P139	4	6¾" x 7½"	82-136

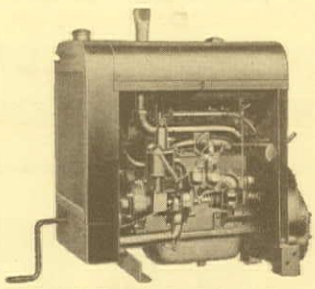


Model H2—4-cylinder Red Seal Industrial Engine with Automotive type housing





Model H2—4-cylinder Red Seal Industrial Engine with Foote type housing and radiator



Model P11A Red Seal Industrial Power Unit with model H2 Industrial Engine

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Colyear Motor Sales

Continental Engines

★ LOCAL STOCKS JENISON MACHINERY COMPANY AND SERVICE ★

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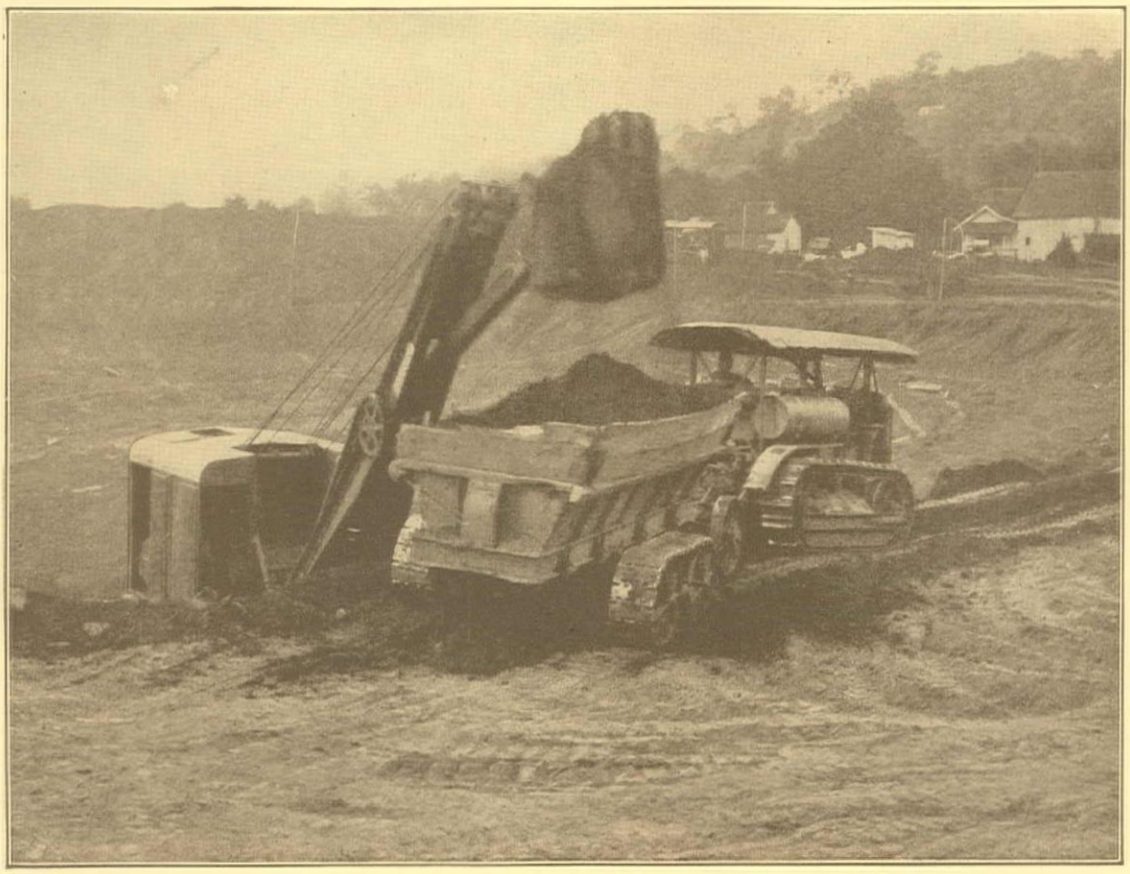
POWER

When and where You want it ◆ ◆ ◆



HERE IS A SHOVEL that needs no coaxing—a machine that steps right up to the bank and smashes through . . . . the Heavy Duty Lorain 75. ▲▲ A 97 H. P. motor is there to crowd the dipper out—and with the Center Drive all of this power can be thrown to any one operation—crowd, hoist, or swing. It gives you power when and where you want it—one powerful motor with the flexibility of three.

THE THEW SHOVEL COMPANY • LORAIN, OHIO

THEW LORAIN 75

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.

★ LOCAL STOCKS JENISON MACHINERY COMPANY AND SERVICE ★

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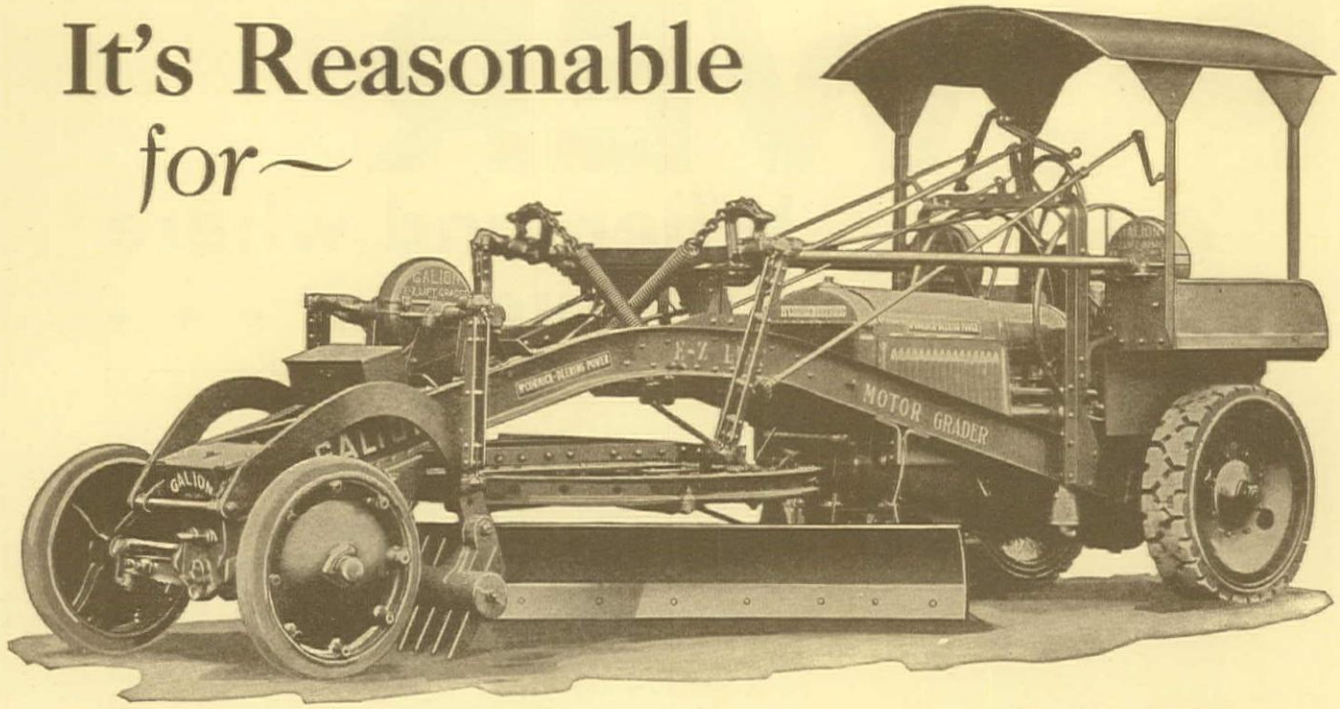
It's Reasonable for~



You to Expect More Work and Better Work

from

Galion E-Z Lift Motor Patrol Graders

Because in them will be found—

Heavy construction throughout—perfectly balanced and easy to operate.

An entirely new type "bottom" construction. Semi-circle—of railroad rail steel—the strongest material available for the purpose. Method of attaching mouldboard makes machine absolutely chatterless, resulting in *smoother cutting.*

Mouldboard has reversible blade—two cutting edges.

Patented Galion front end or "head Block"—eliminates swaying, yet has sufficient flexibility to permit easy oscillation.

Accurately machine-cut gears enclosed and operating in a bath of oil at bottom of oil tight dust proof case.

Cam and lever truck-type steering gear—enclosed and operates in oil bath.

Spring-mounted operator's platform.

All controls within easy reach of the operator, whether sitting or standing.

Send now for catalog describing this and other Galion Road Machinery.

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Smith Booth Usher Company
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THE GALION IRON WORKS & MANUFACTURING COMPANY

The World's Largest Road Machinery Plant

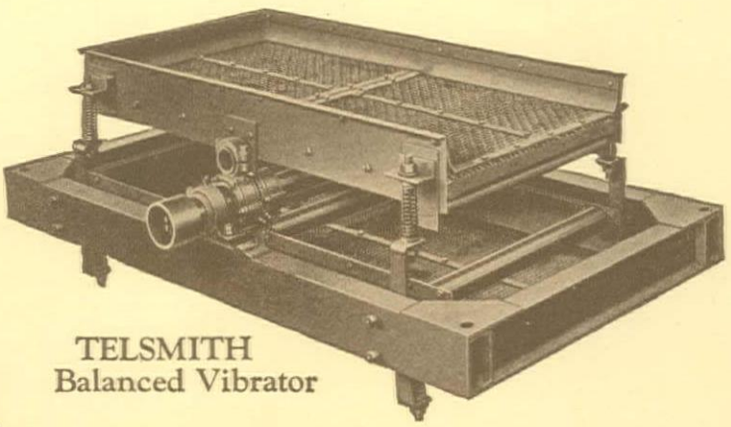
Galion, Ohio

★ LOCAL STOCKS JENISON MACHINERY COMPANY AND SERVICE ★

When writing to THE GALION IRON WORKS & MFG. CO., *please mention Western Construction News*

The Screens Vibrate—*not the Frame*

TELSMITH



TELSMITH
Balanced Vibrator

Something new in screen design

A hundred hours of continuous operation under overload! The Telsmith Balanced Vibrator stood this test and was still running smoothly, with bearings cool and all bolts tight—where other screens would have shaken themselves to pieces.

Telsmith's rate of vibration is 1200 R. P. M.—and it's *uniform,* on every inch of both decks, under any load. Yet a thimble will remain stationary on the steel skids—so slight is the vibration transmitted to the screen and so smoothly balanced is the opposite movement of the two decks. Opposed eccentrics do the work—one screen tray going up while the other is going down, and vice versa. For rapid replacements, an extra tray is furnished for each of the two decks. Even with its remarkably large capacity Telsmith uses less than two horsepower. It is built for economy and long life.

Consult the Nearest Representative or write or wire direct to

Smith Engineering Works
1826 Holton Street
Milwaukee, Wis.

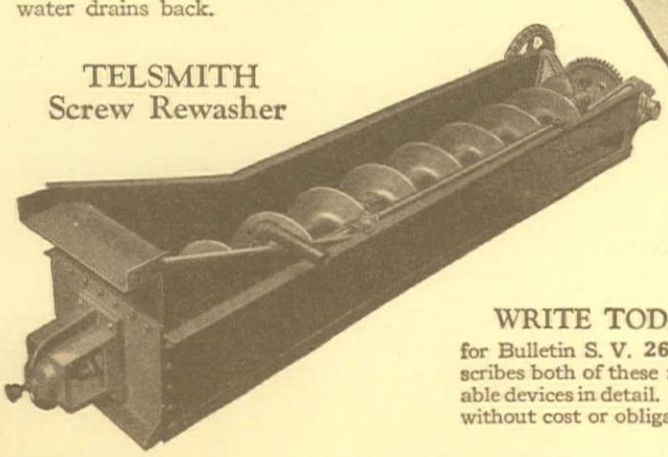
S. V. 3

No Free Water — no clay no trash

Sand from Telsmith Screw Rewasher is all sand—no dirt—no water. Reverse currents in the washing trough battle valiantly with lignite, mica, bark and trash—bringing them to the surface and pushing them back until they finally float off over the spillway. Clay balls, too, are chewed to pieces by the big screw.

When your trucks haul the sand, there'll be no complaints about drippage—there's no free water in it. Telsmith's discharge vent is *above the trough floor.* The sand piles up at the end of the screw—the dry aggregate discharges from the top of the pile while the water drains back.

TELSMITH
Screw Rewasher



WRITE TODAY
for Bulletin S. V. 26 It describes both of these remarkable devices in detail. Mailed without cost or obligation.

Jenison Machinery Co.
58 Fremont St., San Francisco

Garlinghouse Bros.
2044 Santa Fe Ave., Los Angeles

★ LOCAL STOCKS JENISON MACHINERY COMPANY AND SERVICE ★

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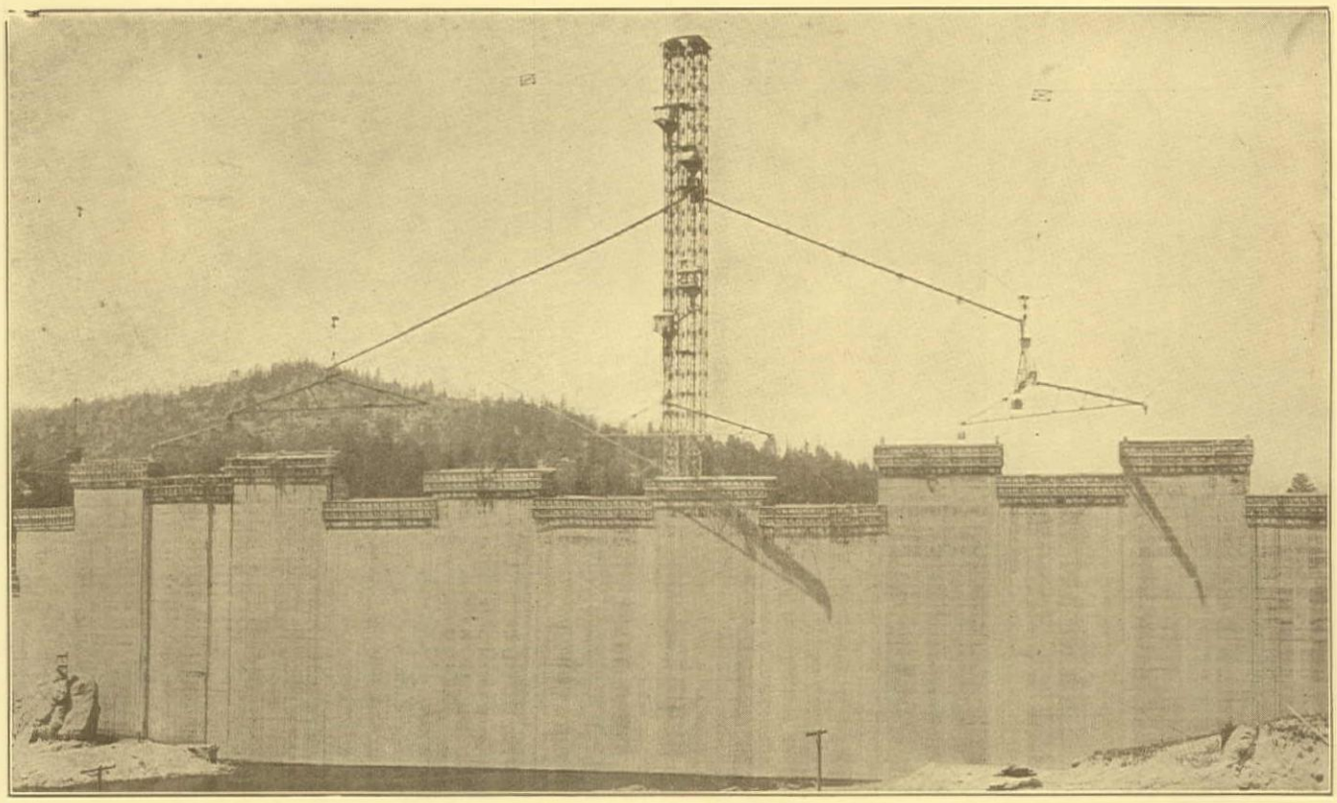


The Lakewood Double Compartment Steel Tower as shown above was 360 ft. high and each compartment handled a 2½ cu. yd. Elevator Bucket.

The Shaver Lake Dam

THE Construction Division of the Southern California Edison Co. placed 280,000 cu. yds. of concrete in the Shaver Lake Dam in 271 days with Lakewood Chuting and Steel Tower Equipment. The maximum run for an eleven-hour shift was 1808 cu. yds.

If you want capacity—If you want a chute that will handle large aggregate concrete—If you want a chute that will handle dry concrete easier—You want Lakewood Half-Round, Arch-Band Chute.

Bulletin 23-R gives the complete details—write for copy

EXPORT OFFICES: 30 Church St., New York City · · *CABLE ADDRESS:* Brosites

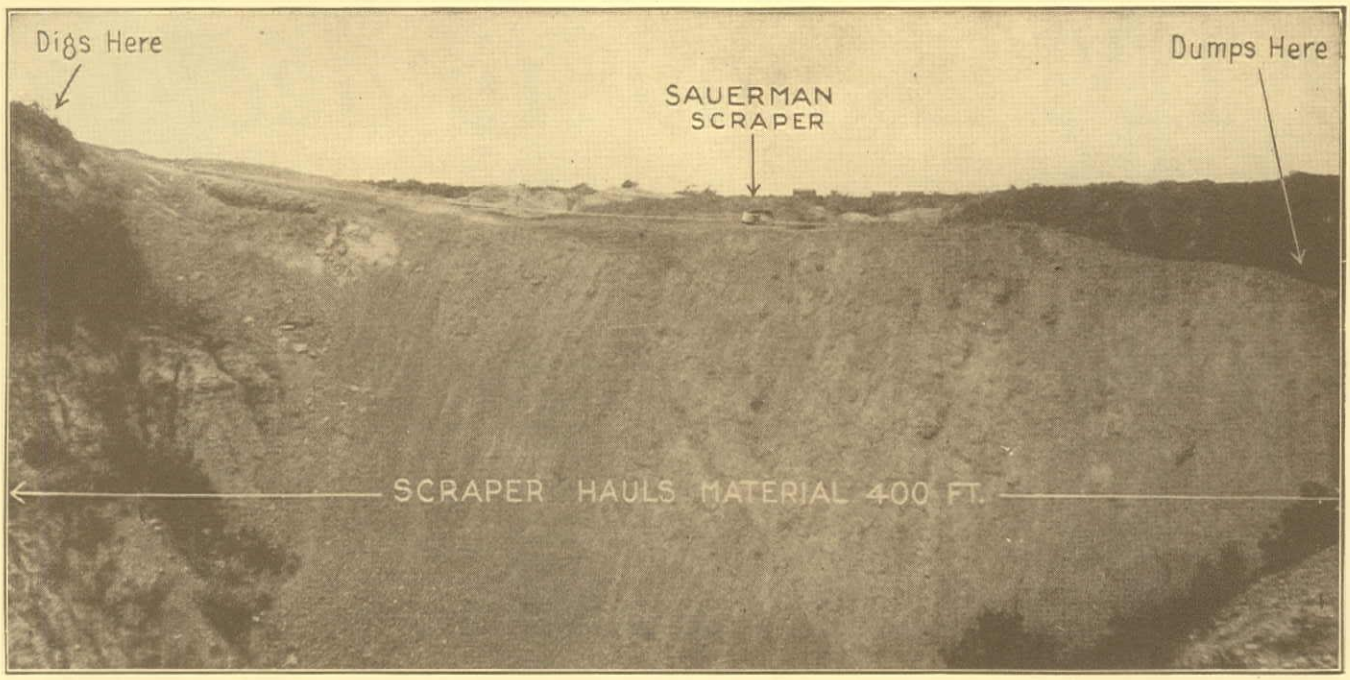
LAKEWOOD

The Lakewood Engineering Co., CLEVELAND · O.

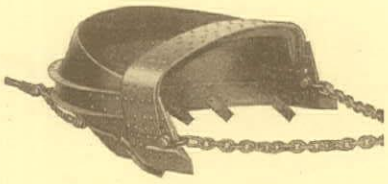
California Representatives: JENISON MACHINERY CO., 58 Fremont Street, San Francisco; SMITH BOOTH USHER CO., 1910 Santa Fe Avenue, Los Angeles

★ LOCAL STOCKS JENISON MACHINERY COMPANY AND SERVICE ★

When writing to THE LAKEWOOD ENGINEERING CO., *please mention Western Construction News*



Simplifies Cut-and-Fill Work



Sauerman Power Drag Scrapers are Cutting Costs on the Following Work:

—cleaning or deepening reservoirs
—constructing levees
—grading building sites
—cut and fill work
—excavating sand and gravel from bank or hillside
—excavating sand and gravel from shallow pits
—stripping overburden
—distributing spoil piles
—dredging out shallow streams and canals
—making earth dams
—handling all kinds of bulk materials

COST was the big problem that confronted the contractor on this job, where the side of a hill had to be cut away and the material moved into the adjacent hollow to make a fill 400 ft. long.

After figuring from all angles, the contractor finally turned to a Sauerman Power Drag Scraper, and here's what he found:

The Sauerman Scraper only required one man for operation, and the daily expense for power was small. Moreover, it eliminated the buying of a lot of excavating and hauling equipment and the erection of trestles.

The Sauerman Scraper dug the loam, clay and gravel from the side of the hill and conveyed the material to the hollow in one continuous operation—one man kept the bucket running back and forth continuously, taking a heaping load at every trip.

As a result, the contractor was able to avoid a big investment in equipment and handled the entire job at a surprisingly low cost per yard.

You'll find Sauerman Power Drag Scrapers used all over the country on such work as dam construction, levee building, cleaning reservoirs and ponds, embankment construction, grading, and many other jobs where the length of haul runs up as high as 1,000 feet, and capacity requirements as high as 400 cu.yd. per hour.

Write for the new 96-page Scraper booklet and see for yourself how Sauerman Scrapers are cutting costs for other users on all kinds of excavating work.

SAUERMAN BROS., Inc., CHICAGO, ILLINOIS

Pacific Coast Distributors:

Jenison Machinery Co.
58 Fremont St., San Francisco

Smith Booth Usher Co.
228 Central Ave., Los Angeles

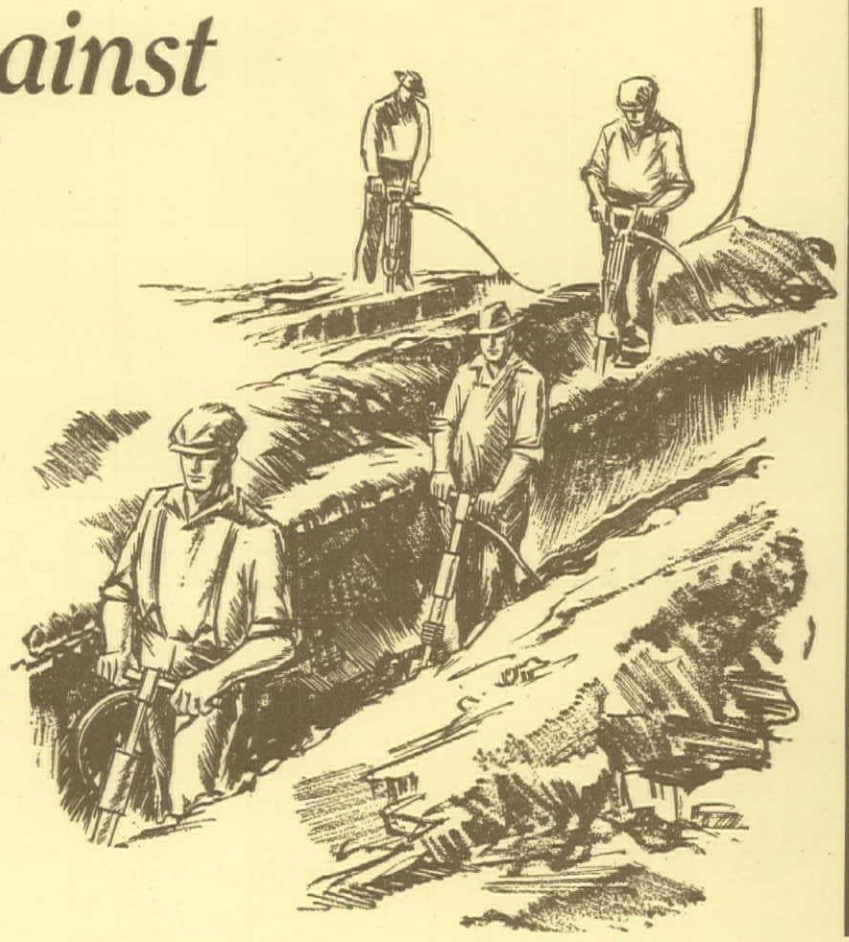
Clyde Equipment Co.
Portland, Ore., Seattle, Wn.

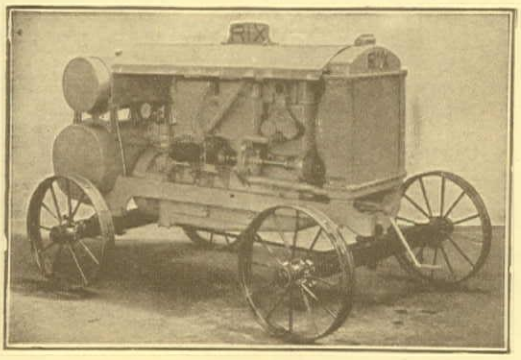
SAUERMAN

★ LOCAL STOCKS JENISON MACHINERY COMPANY AND SERVICE ★

When writing to SAUERMAN BROS., INC., *please mention Western Construction News*

TIME *now to declare* WAR *against* COST





—*you need a* RIX "SIX" *in the front line trenches*

COMPETITION will be keen in 1930. If you get the job, you've got to bid low. If you make money, you've got to cut costs. Do you operate air compressors? A size *smaller* RIX "SIX" will actually do as much work as a size *larger* compressor of any other make. That's ECONOMY—costs less to *buy*, costs less to *operate*. And think of all the jobs you can do with a RIX "SIX." There's a size and type for every purpose, and RIX *"Express"* SERVICE with every RIX rig. Time *now* to declare war against cost. Write for Bulletin 8-Q.

RIX

Since COMPRESSED AIR MACHINERY R RIX X SAN FRANCISCO LOS ANGELES *1877*

Rix Company, 400 4th Street, San Francisco

SEATTLE PORTLAND LOS ANGELES

***Sales Representative:* JENISON MACHINERY COMPANY**
58 Fremont Street, San Francisco, Calif.

Rix Co. are also agents for COCHISE Drills, and exclusive distributors for THOR Pneumatic Tools in Los Angeles and Seattle territories.

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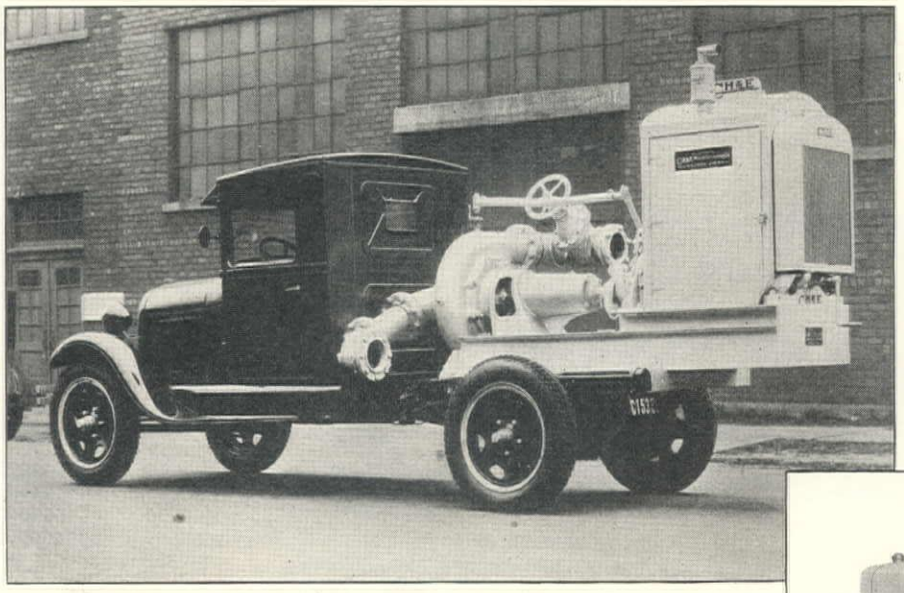
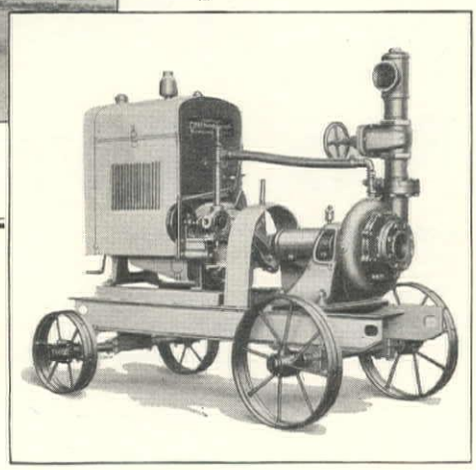
When writing to Rix Company, Inc., *please mention Western Construction News*



A 6 in. F-M Wood Trash Pump driven by a 30 hp. 4 cylinder gasoline engine and mounted on a Ford truck.

1930
begins the
SECOND CENTURY
of building
FAIRBANKS SCALES



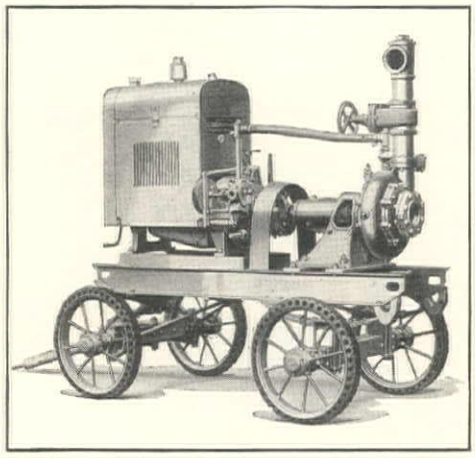
This illustration shows the pump unit mounted on a truck built of channel iron with steel wheels.

Portable trash pumps handle big solids without clogging

PORTABLE Fairbanks-Morse Wood Trash Pumps save time and money where fluids containing fibrous or stringy foreign matter and large solids must be handled. These pumps permit continuous operation without clogging. They eliminate the necessity and expense of screening.

The use of portable F-M Wood Trash Pumps speeds up work. Shutdowns to take the pump apart are avoided. Time is saved because it is unnecessary to raise the end of the suction hose during operation, as neither screen nor foot valve is used. A single bar keeps out bricks, tin cans and other refuse that might lodge crosswise. The impeller will pass anything that will enter the suction nozzle through a right angle bend.

Portable F-M Wood Trash Pump units are made in sizes 4 to 8 inches. Gasoline engine or electric motor power is optional. The illustrations show three of the four main types of mounting. The other method is to mount the pump on a steel skid. Further information will be sent promptly upon request.



F-M Wood Trash Pump and gasoline engine mounted on spring suspension, rubber tired truck.

POWER PUMPING AND WEIGHING EQUIPMENT

FAIRBANKS, MORSE & CO., Chicago

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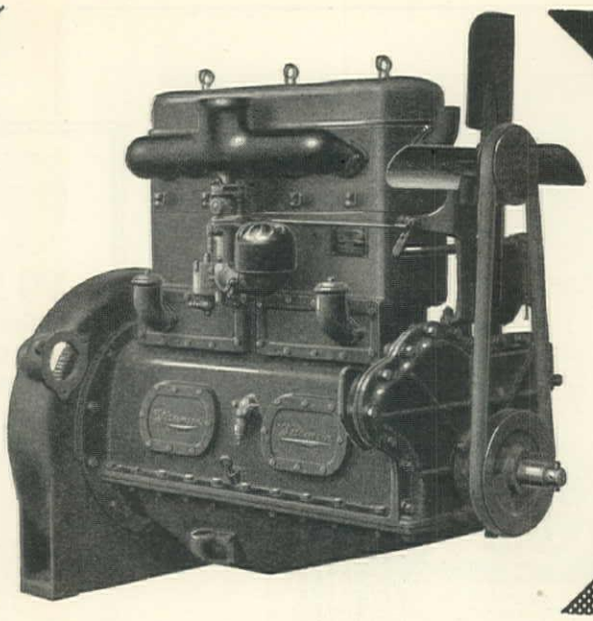
FAIRBANKS-MORSE PUMPS

PA31.3

When writing to FAIRBANKS-MORSE & CO., *please mention Western Construction News*



No Mystery About It

There is nothing mysterious about the extra power that Wisconsin Motors deliver —power that far exceeds bore-and-stroke expectancy... It is a simple matter of better design, better engineering, better workmanship . . . One of these motors on *your* test block will tell you all you wish to know. Work it hard. Run it continuously—bear down on it with overloads to parallel actual working conditions...Then make your decision.

Made in a full range of Sixes and Fours, from 20 to 150 h. p., for industrial machinery, trucks and tractors.

Wisconsin Motor Co.
Milwaukee
Wisconsin

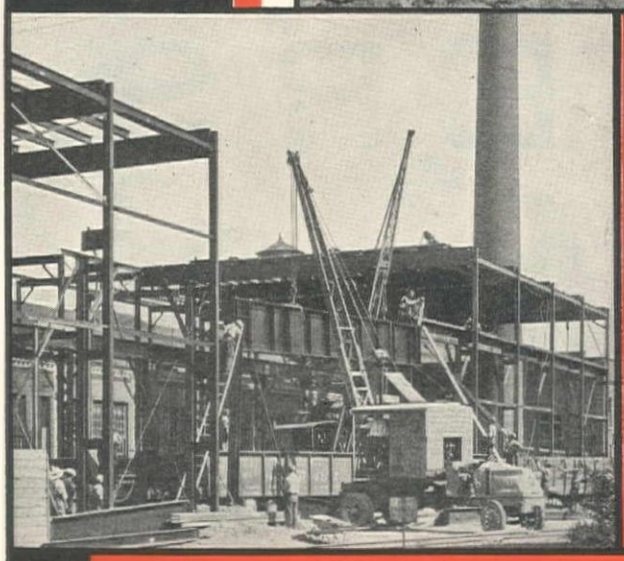
WISCONSIN ENGINES

MORE POWER per CUBIC INCH

(Left)
Thompson and Hanson's ½ yd. Universal 35 demolishing foundation walls, footings and an old reinforced concrete vault. Site of the new Delaney Bldg., Fort Worth, Texas.

(Below)
Universal 35's are transferable to motor truck mounting where quick mobility is desired.

(Below)
Spencer, White and Prentis' ½ yd. Universal 35 clamshell digging deep wall bearing footings.



THE UNIVERSAL 35 is more than a crane or shovel—it is one of the most useful excavating and material handling machines that you can own.

Booms are readily interchangeable for shovel, crane, clamshell, dragline, backdigger or skimmer scoop operations. You can unload a car of slag, dig a sewer trench, level a grade, erect steel or any of 101 similar jobs.

Sooner or later you will need this fast working, economical machine, whether it is to lick a sizable job alone, or whether it is to support your larger equipment on the big jobs. Write for bulletin describing the complete equipment.

THE UNIVERSAL CRANE COMPANY · LORAIN, OHIO

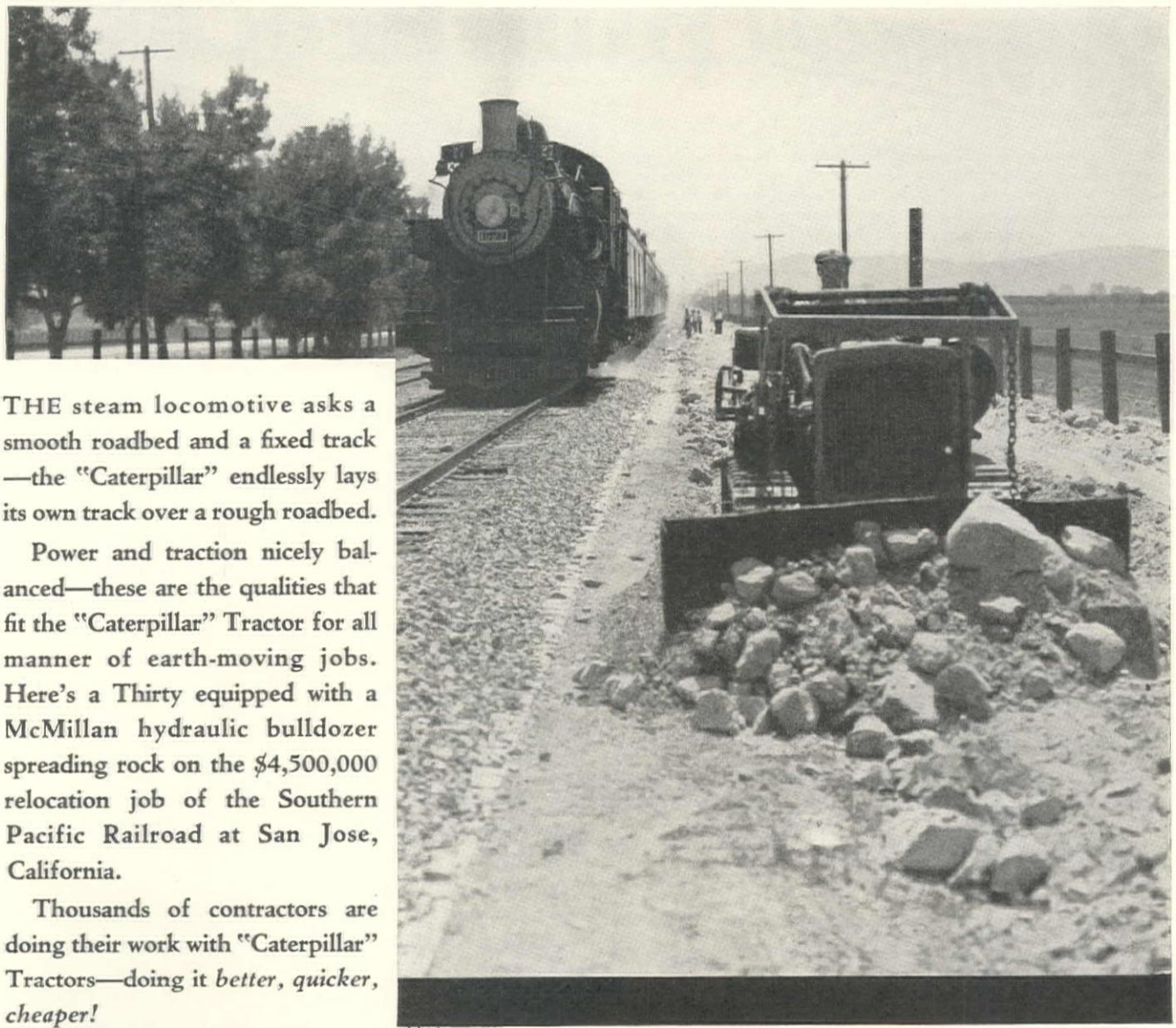
UNIVERSAL-35

Truck Crane and Universal "35" Representatives: The Universal Crane Co., Los Angeles, Calif.; The Universal Crane Co., San Francisco, Calif.; The Feenaughty Machinery Co., Portland, Seattle, Spokane.

Universal "35" Representatives only: The Smith Booth Usher Co., Los Angeles, Calif.; The Jenison Machinery Co., San Francisco, Calif.

When writing to THE UNIVERSAL CRANE COMPANY, *please mention Western Construction News*

CONQUERED by the "Caterpillar" Tractor



THE steam locomotive asks a smooth roadbed and a fixed track —the "Caterpillar" endlessly lays its own track over a rough roadbed.

Power and traction nicely balanced—these are the qualities that fit the "Caterpillar" Tractor for all manner of earth-moving jobs. Here's a Thirty equipped with a McMillan hydraulic bulldozer spreading rock on the $4,500,000 relocation job of the Southern Pacific Railroad at San Jose, California.

Thousands of contractors are doing their work with "Caterpillar" Tractors—doing it *better, quicker, cheaper!*

Prices—f. o. b. Peoria, Illinois

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

Caterpillar Tractor Co.

PEORIA, ILL. *and* SAN LEANDRO, CALIF., U. S. A.

Track-type Tractors Combines Road Machinery

(There's a "Caterpillar" Dealer Near You)

CATERPILLAR
REG U.S. PAT OFF.
TRACTOR

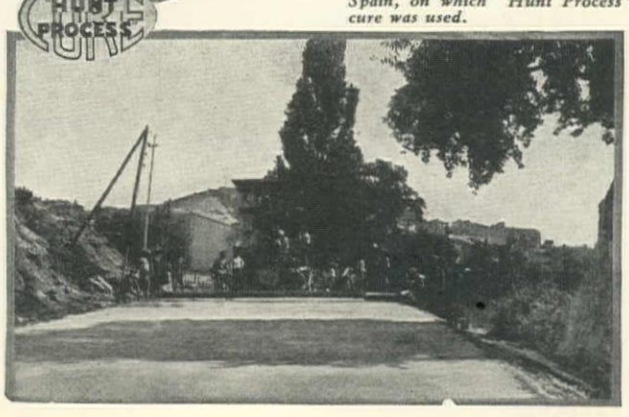
His Majesty's Engineers Recommend "Hunt Process"

Following a survey in this country by Spanish Government engineers, a report was made on the subject of American road-building practices with particular reference to suitable methods of curing concrete. Following are some pertinent excerpts, including several recommendations, reprinted from this report as made by the Engineer of Roads, Isidoro Fontana y Elvira.

BY Royal Decree of December 28, 1928, the undersigned was commissioned by the Government of your Majesty (whom may God protect), to study in the United States, the results which are being obtained in curing cement concrete by means of applying a patented product, and at the same time to collect and report to the Director of Impervious Pavements upon the latest experiences regarding the use of various impervious pavings, and particularly those of concrete.

Isidoro Fontana (right) and Carlos Mendoza, Spanish engineers, inspecting Fairfax Avenue paving job, and application of "Hunt Process" cure in Los Angeles, California.

Construction of a concrete highway through Lerida, Spain, on which "Hunt Process" cure was used.



In order to comply with such Royal Decree, we went to Los Angeles, California, where such product for curing concrete has been most used, having first visited the principal technical offices of Washington, D. C., and Chicago in order to interview the technical staff and obtain the data hereinafter set forth.

* * * * * * * *

Fourth—That there has been recognized unanimously in the United States, the enormous importance of the method which is used to secure a perfect setting and cure of concrete, whatever may be the temperature and climatic conditions.

* * * * * * * *

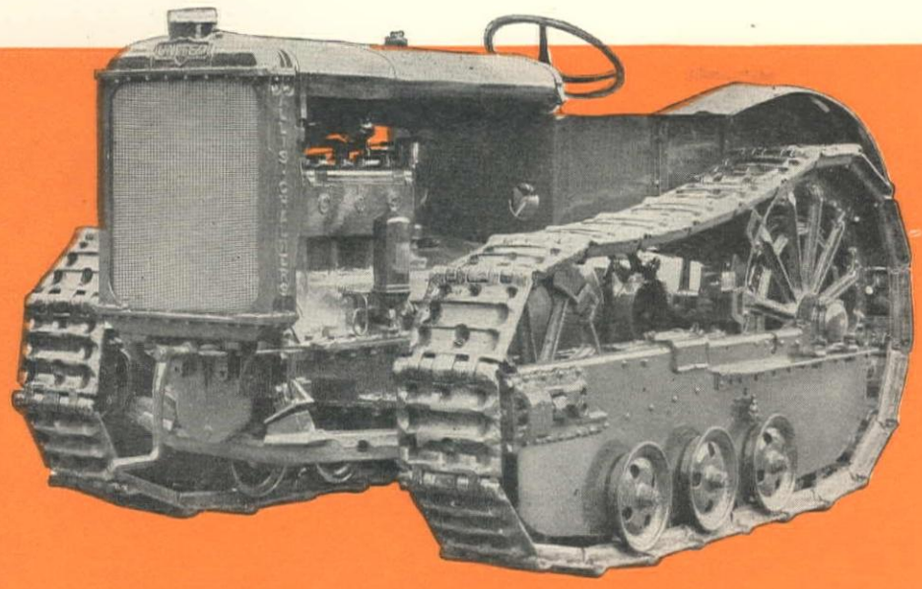
Fifth—That the so-called "HUNT PROCESS" for assuring the perfect setting and curing of concrete is giving such excellent results that, while not yet made obligatory in many specifications, it is applied in 95 per cent of the cases (in Los Angeles); that all paving cured by this system and provided with expansion joints as explained in the body of this report, are found in a magnificent state of conservation, and that it is rare to find cracks in them, or microscopic or hair checks which are due to evaporation of water from the surface and which are causes of the beginning of disintegration.

* * * * * * * *

Seventh—That in any case the "HUNT PROCESS" is recommended for the complete and satisfactory curing of concrete paving.

Madrid, July 11, 1929.

The Engineer of Roads,
ISIDORO FONTANA Y ELVIRA.

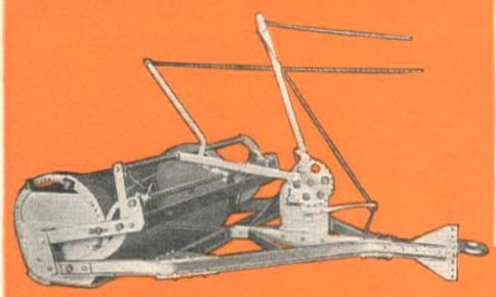


The United Crawler Tractor is the ideal combination of rugged power, speed and sure-footed traction to meet the varied requirements of contracting, road building and general industrial work. A joint product of Trackson Company and Allis-Chalmers.

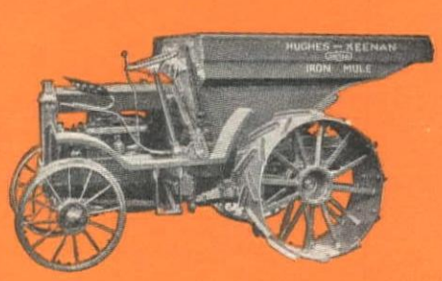
PROFIT WITH UNITED EQUIPMENT

United Equipment brings efficient, low-cost performance to every job! Powered by the United Industrial Tractor—product of Allis-Chalmers—United Equipment saves time, men and money on road building and maintenance, contracting jobs and other industrial work.

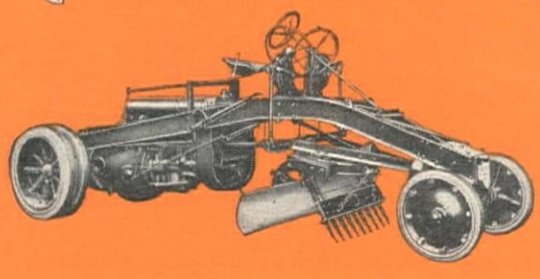
Write for details and name of your nearest United distributor.



United Power Graders, product of Wehr Company, offer all the latest features of Wehr construction plus the outstanding advantages of low-cost United Tractor power. Supplied in either Rear or Center Control models with wheel or crawler traction.



United Victory Scrapers, built by Perry Company, bring new operating ease and economy to every earth moving job where tractor-drawn scraper equipment can be used. One man operates both tractor and scraper, and has easy, positive control of the scraper at all times.



United Iron Mules, product of Hughes-Keenan Co., are dump bodies with complete dumping mechanism mounted on the United Tractor. Combined with the tractor they form a very compact, efficient and economical dumping unit for use on short-haul earth moving.

UNITED TRACTOR & EQUIPMENT CORP.

612 NO. MICHIGAN AVE. CHICAGO, ILLINOIS.

UNITED TRACTORS & EQUIPMENT

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UNIVERSAL POWER SHOVEL CO
WEHR COMPANY

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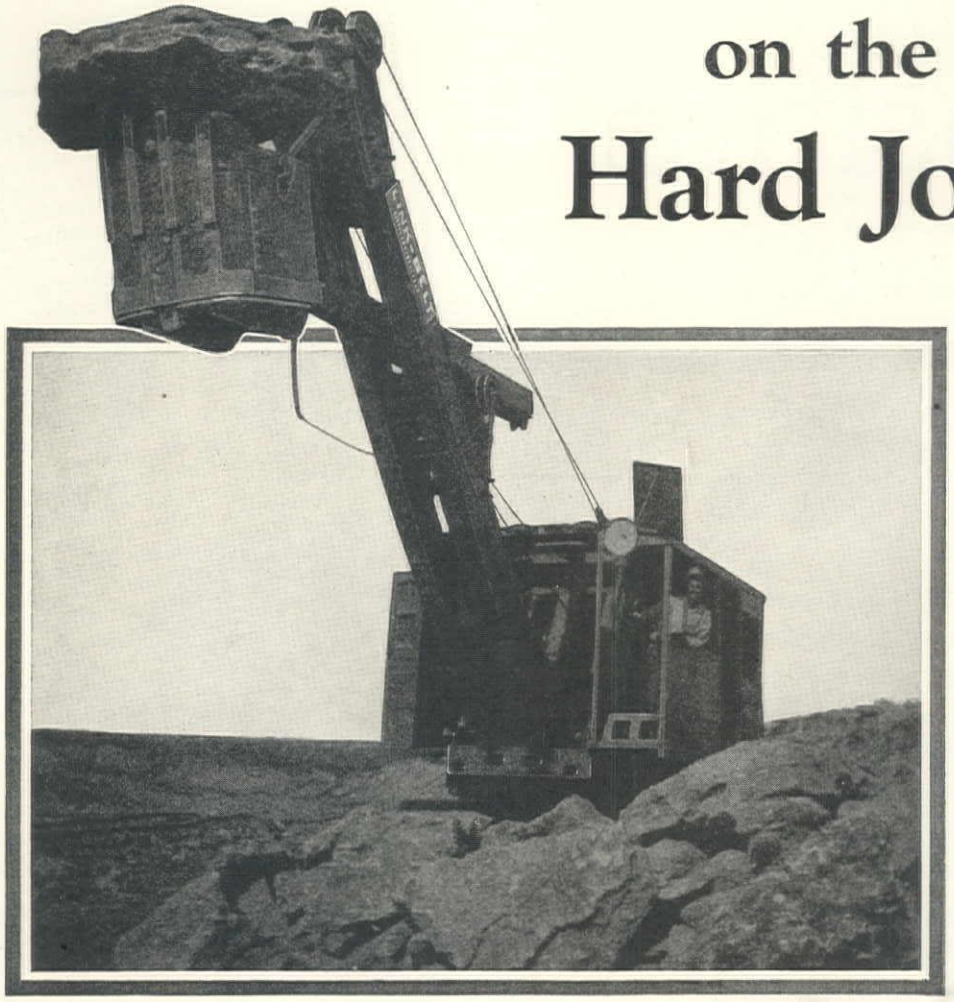
For Steady Performance on the Hard Jobs



ON the hard jobs, such as this one, Link-Belt Shovels — Cranes — Draglines prove their dependability.

This Link-Belt K-42, 1¼-yard gasoline shovel is working in the quarry of James Stone Co., Richland, Texas, where the rock lies in solid formation and is dynamited to allow for loading into quarry dump cars.

Boulders too large to be scooped into the dipper are carried on the teeth of the dipper to the cars or are laid aside for reblasting.

Both the operator and the owners are very enthusiastic over the outstanding performance of this machine under the difficult conditions. Mr. M. C. Davis, the operator, has been running Link-Belt Shovels for over four years

Link-Belt builds a complete line of shovels —cranes—draglines from ¾-yard capacity to full 2-yard capacity: all heavy duty units.

Send for Book No. 1095

LINK-BELT COMPANY

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

San Francisco	Portland	Seattle	Los Angeles	Phoenix
GARFIELD & CO. Hearst Bldg.	LOGGERS & CONTRACTORS MCHY. CO. 345 E. Madison St.	A. H. COX & CO., Inc. 1757 First Ave., S.	HARRY C. COLLINS 2411 East 26th St.	MINE & SMELTER EQUIP. CO. Lock Box 788

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SHOVELS + CRANES + DRAGLINES

When writing to LINK-BELT COMPANY, *please mention Western Construction News*

Cash Registers of the Water Works Field

Simple Positive Action

BRIEFLY, water cannot pass thru measuring chamber of Trident and Lambert Meters without causing positive movement of disc and revolution of projecting spindle. Elementally simple . . . phenomenally sensitive . . . continuously accurate.

Pioneers in Meter Progress
Yesterday TODAY Tomorrow

NEPTUNE METER CO.
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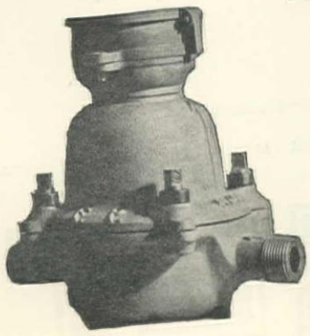
The measuring chamber of this meter is in the form of a central zone of a hollow sphere, having ends at the top and bottom, which are conical frustums, whose sides slope inward towards each other, and hence toward the center of the sphere. At the center of each of these conical ends is a spherical socket with its center of curvature in the center of the spherical chamber.

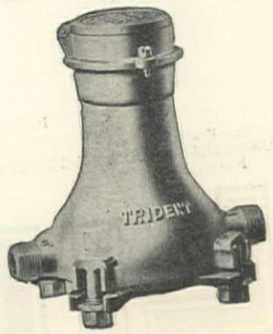
In these sockets fits a solid sphere which forms the central boss of a thin, flat, circular disc, the edge of which exactly fits the interior of the spherical chamber. This disc constitutes the piston of the chamber and has a movement of nutation or wabbling about the center of the sphere as a center of motion, the character of the movement being such that the spindle in the axis of the disc receives a conical motion, so that its end sweeps around in a circular path. The chamber is divided at one side by a vertical radial septum or partition, generally called the diaphragm, extending from the periphery of the chamber to the central sockets, and the disc is perforated with a narrow radial slit so that it may straddle the partition. The whole measuring chamber is enclosed in a case into which the water to be measured flows. From this the water enters the measuring chamber through an opening in the spherical wall on one side of the radial partition, and is discharged into the outlet pipe of the meter through an opening on the other side of the partition, the two openings in the wall of the chamber being close together, separated only by the thickness of the diaphragm.

The water cannot pass from the inlet opening to the outlet without so displacing the disc as to cause a complete mitation and a single revolution of the end of the spindle, and each of these complete movements corresponds to a quantity of water equal to the whole contents of the measuring chamber. The disc spindle engages with an arm on the end of one of the arbors of a train of gearing forming a register, and turns it with a uniform motion.

The measuring apparatus is of elemental simplicity. Functionally it consists of only two parts, the chamber and disc, for no valves are required to effect the distribution of the water in the chamber.



TRIDENT AND LAMBERT METERS



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VOLUME V | FEBRUARY 10, 1930 | NUMBER 3

"Prosperity will increase during the administration of President-elect Hoover." This was the prediction of Thomas A. Edison on the occasion of his 82nd birthday, a year ago. Since then, nothing has occurred to alter this prediction, in spite of the recent collapse of the stock market. Like all other boom-bubbles, over inflated, it had to burst. Very likely, under a different administration and different conditions, this crash would have caused a panic. It has caused some distress and there must be many financial adjustments, it is true, but business is on a sound basis and all that is needed is an optimistic viewpoint by everyone to keep it so.

Prosperity

There are some who are never grateful and never satisfied, and because the huge programs of projected construction have not immediately been set in motion—an impossibility—they are pessimistic about the future, and are inclined to hold back on the dollar—the rapid turnover of which is the keynote of prosperity. We must not overlook the fact that the financing, design, and preparation for contract of large engineering-construction projects can not be achieved in a short period of time.

Nothing has transpired so far to warrant pessimism nor to refute the curt statement of Edison. Within a few months engineering construction should be in full swing, as should also the erection of large buildings.

A portion of the outfall into San Francisco bay for Unit No. 5 of the Berkeley storm drains was constructed of precast reinforced concrete pipe, laid on concrete cradles on wooden pile bents, below low tide, and without the use of sheeting. The method used by the contractor and described by S. A. Hart in this issue was both efficient and ingenious.

Laying a Storm Drain Outfall

A double row of false piles was first driven and a gas-operated drop-hammer rig was carried out on these to drive the bent piling. The excavation for concrete caps and footings was made with a clamshell and a levee was thrown up on each side of the line of the outfall—one levee being built wide enough to carry the power shovel on mats. By damming off both ends of a leveed section, the contractor was able to dewater and excavate, place the forms, and deposit concrete for the cradles during low tide. Working practically between tides, a small crew averaged 40 ft. per day; pipe laying being done at low tide only.

The water works of Seattle, like those of most cities, has 'just growed'. An historical record of that water works in this issue, although quite lengthy, we believe will be of considerable interest to all those interested in this subject. In order that **Western Construction News** may continue to be a book of reference as well as a magazine recording engineering construction progress, we shall from time to time publish similar historical records.

Growth of a Water Works

The water works superintendent shoulders a big burden of responsibility—as he is to a large degree the guardian of all citizens in his community—and, he must unceasingly supply pure, sparkling water for domestic use as well as an abundant supply for fire protection and industry, at the same time keeping the cost down. The problem is aggravated when the water works is municipally owned and betterments are subject to the whims of the ballot and politics.

Although all harbors have had to be improved to meet the demands of modern shipping, most of them have started as a natural haven of refuge, and most of the large seaport cities of the world have been built on these natural harbors. Among the exceptions must certainly be mentioned Los Angeles and Long Beach, which are building large and safe harbors literally out of nothing. For some years San Pedro, the harbor of Los Angeles, was the joke of the country, until rival cities awoke to the huge tonnage passing through this man-made harbor. Therefore, when Long Beach started to build a harbor on her ocean front it created intense interest and a number of similarly situated cities are following suit. The article in this issue on 'Long Beach Improves Ocean Front' describes the rapid progress being made by this city toward becoming a seaport in addition to a bathing beach resort.

Making Harbors To Order

On February 15, an advance daily building report service, incorporated under the name of **'Architects Reports'**, will be started to better serve the building industry of Northern California. **'Architects Reports'** is endorsed by The State Association of California Architects, Northern Section, and the publishers of **Western Construction News.** For additional details see page 41 of the Advertising Section.

Architects Reports

Seattle's Water Supply System

History—Description—Operating Features—Program for Increased Supply for Leading City in Washington

By A. GILBERT DARWIN

General—Seattle is the closest United States port to the Orient and is at the gateway to Alaska. The city, with its excellent 5-mile salt water harbor on Puget Sound and 27-mile fresh-water harbor on Lake Washington, is not only a port but a manufacturing and railroad center as well. It is situated on a hilly peninsula in the heart of a region rich in basic resources and raw materials and enjoys a favorable climate. Seattle is the third largest city west of the Twin Cities; she has risen in three decades from 150th to 19th ranking city in the country. From an original white population of 21, the following growth has been made:

1870	1,107	1906	200,000±
1880	3,533	1927	472,428
1890	42,837	1928	506,835

The most rapid growth followed the 1897 gold rush to the Klondike. The estimated 1968 population is 1,000,000 for a total land area of 147 sq.mi.

Original Private Water Systems—To meet the several large gains in population, Seattle has had to materially change and enlarge her water supply system.

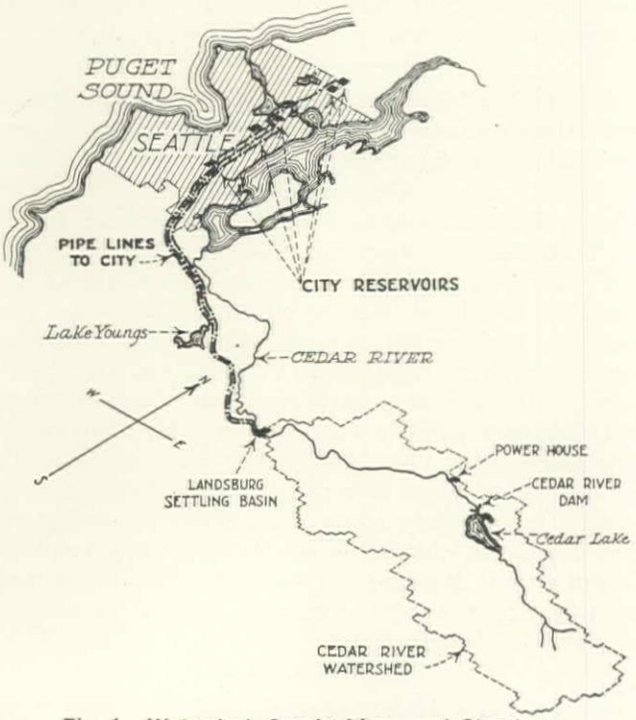


Fig. 1. Watershed, Supply Lines, and Structures, Seattle Water System

The pioneer water system of record was privately built by H. L. Yesler in 1854. This had a small tank, supplied from a stream originating on First Hill, and an open V-shaped trough for the original distribution line. The trough was later replaced with wood pipe, made by boring a 2-in. hole in 6-ft. sections of a 12-in. log and then connecting the sections by wooden spigots.

Subsequently, some 30 different private systems were put in operation on the various hills and in the valleys both within and outside the city limits. Of these, the most important were the Union Water Co. (1882), the Sturtevant, Spring Hill, and the Georgetown systems.

In 1881 the Spring Hill Water Co. was organized. This company originally took water from springs on the west side of First Hill and stored it in as many as

Fig. 2. W. B. Severyns Superintendent of Water, Seattle

12 square wooden tanks. In 1886 the company built the Lake Washington pumping station and the Beacon Hill reservoir, joining these structures by a 12-in. kalomein force main. On November 12, 1881, the city passed its first ordinance establishing rates for the sale of water. These rates under private ownership are shown on page 68 in comparison with the ones now in force under municipal ownership.

Municipal Water System—In 1890 the city established its first public utility by purchase of the Spring Hill water system for $352,266 and, in the same year, the Union Water Co. system was bought for a final cost of $28,300. Much pipe and fittings were purchased to improve and enlarge the system. Also, two high-pressure Worthington pumps, of 1,250,000 g.p.d. capacity each, were installed at the Lake Washington station and the system was brought to a total capacity of 5,000,000 g.p.d.

At this early date it was realized that the existing pumped water system would soon be inadequate and unsafe, and Benezette Williams, then chief engineer for the city water system, recommended on August 11, 1890, that a gravity supply be secured from Cedar river or that an entirely new pumping plant be built. The gravity system was selected but, as Cedar river pipeline No. 1 was not finished until 1901, an additional

5,000,000 g.p.d. pumping unit was meanwhile required at the Lake Washington station. When Cedar river water was first brought in (1901) the lake was abandoned as a source of supply and the gravity system has since been in use. This system has been successively enlarged and repaired and additional supply lines are now under contract or planned for 1930.

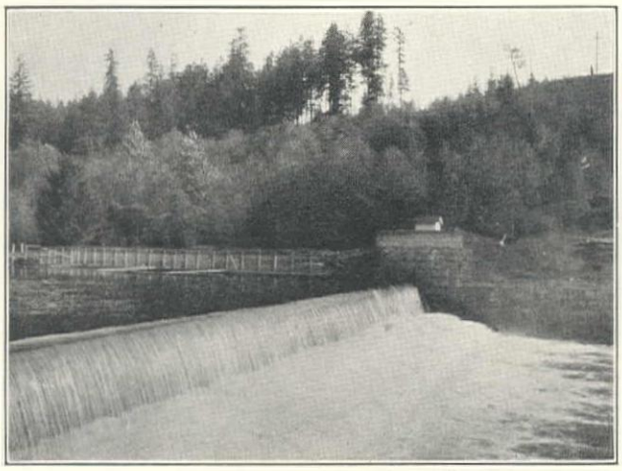


Fig. 3. Diversion Dam and Intake at Landsburg

Present System—The physical equipment of the Seattle water system (see Fig. 1) includes Cedar lake catchment basin; a gravity dam, intake, and control works at Landsburg, 28 miles from the city; 21.75 miles of 42 to 44¼-in. wood-stave pipe-line and 6.82 miles of 42-in. steel pipe; 28.72 miles of 36 to 60-in. wood-stave pipe and 5.32 miles of 36 to 51½-in. steel pipe; and 16.44 miles of 66-in. steel pipe from Molasses creek to the city; an intake at Lake Youngs; Lake Youngs impounding and settling reservoir; an 8-ft. tunnel, 11,300 ft. long, from Lake Youngs to Molasses creek; control works at Molasses creek; six concrete-lined city reservoirs with a combined capacity of 266,000,000 gal.; eight steel standpipes with a combined capacity of 6,734,000 gal.; three wooden standpipes with a combined capacity of 150,000 gal. (a total city storage of 272,884,000 gal.); and eight pumping stations with a combined capacity of 35,000,000 g.p.d. The distribution system, with its various divisions, will be described later. Four contracts were let in the fall of 1929 and additional improvements will bring the 1930 construction program to $5,000,000.

The source of supply is Cedar river in Sec. 19, T. 22 N., R. 7 E., W. M. Lines 1 and 2 are now diverted into Lake Youngs, and lines 1, 2, and 3 are supplied at the Molasses creek controlling works from Lake Youngs by way of the Lake Youngs tunnel. Provision has been made at the controlling works for a fourth line. Lake Youngs, formerly called Swan Lake, is used as an impounding reservoir to assure ample water supply if the upper 12 miles of line should go out of commission.

Cedar River Watershed—Cedar river heads in Yakima Pass (elev. 3500 ft.) on the Pacific slope of the Cascade range, and flows west and a little north for 45 miles to its junction with Lake Washington. 'Cedar river watershed' is locally interpreted as the entire area of land drained by Cedar river and its tributaries from the summit of the Cascade mountains down to the intake of the pipe-lines. The drainage basin is long and narrow and has an area of 240 sq.mi.; the watershed area is 142 sq.mi. and its length is 31 miles. The fall of the catchment basin is 4760 ft.

Twelve miles from its source and 14 miles from the summit of the range, Cedar river enters Cedar lake, which has an area of 1200 acres with water at elev. 1530 ft., the normal level. The lake is 3½ miles long, averages ½ mile in width, and is of great depth. A timber crib dam, built in 1905 at a point ½ mile below the natural outlet, raised the level to 1548 ft. In 1915 a gravity-section concrete dam was built 2 miles below the lake. By this dam the elevation can be raised to 1555 ft., giving an area of 5.23 sq.mi. at an average depth of over 100 ft. Flashboards increase the elevation to 1560.5 ft. In flood periods these flashboards have been overtopped more than 6 ft.

Floods on the upper watershed (of Cedar lake) have raised the level of the lake as much as 40 ft. in one week. While construction of the dams was primarily for water-supply to the Cedar river municipal power plant, they were effective in increasing the dry season runoff from Cedar lake. Enough seepage comes from the bed of the lake to make a considerable stream 6 miles below the masonry dam. During the dry season, this 8 sq.mi. area supplies more water to Cedar river than does the 79 sq.mi. above the dam. It thus appears that impounding water behind the dam creates

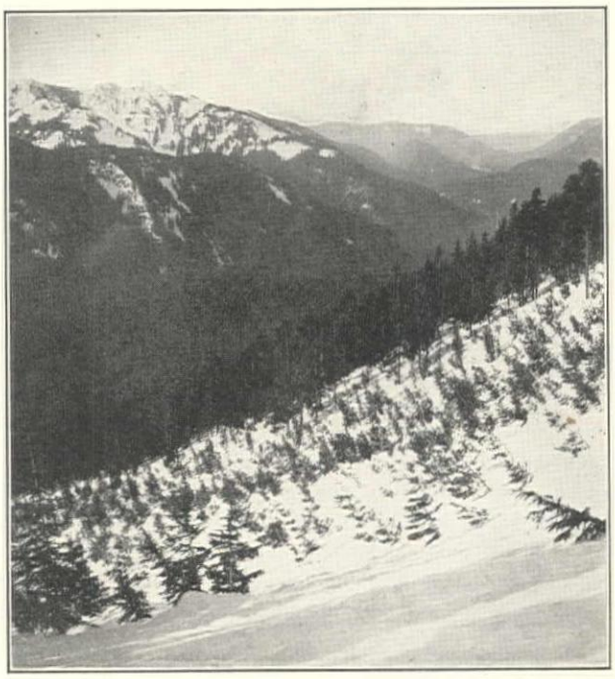


Fig. 4. Upper Cedar River Valley

an underground reservoir for the dry season, far in excess of the normal flow. This underground flow is filtered through 7 miles of morain before again entering the river at the mouth of Taylor creek.

From the dam, the river flows in a deep and narrow canyon, with a fall of 600 ft. in 3½ miles, to the Cedar river municipal power plant, elev. 920 ft. Thence it

flows through a fairly level valley for 12 miles to the settlement of Landsburg, elev. 540 ft. A dam, intake, and control works at Landsburg divert the required flow. The intake is 23 miles on an air line from the center of Seattle and 28 miles distant by the route of the supply lines. The discharge of Cedar river at Landsburg for the 10-year period, 1902-1911, averaged 678 c.f.s. The mean annual precipitation ranges from 36-in. at Seattle, to 56-in. at the intake, to 112 in., and perhaps 130 in., on the crest or headwaters of the Cedar river drainage. The only important tributary of Cedar lake other than Cedar river is Rex river, 8 miles long, which enters the lake from the southeast.

Lake Youngs, 6 miles southeast of Renton and west of the river, has an area of 548 acres at elev. 470 ft. and 800 acres at elev. 488 ft. The lake can be drawn down to elev. 445 ft. to give 22,350 ac-ft. storage, or enough to supply 500,000 people for 146 days. Its watershed, including the lake area, is 4 sq.mi. The maximum rise from winter floods does not exceed 3 ft.

Before the glacial period the watershed had a broad, deep valley with steep rocky sides, extending from above Cedar lake to far into its lower division. Since the glacial epoch, the valley has been filled with morainal material, chiefly sand and gravel. Much of the precipitation of the upper watershed on the area above Landsburg is lost through seepage into the porous, glacial drift. Most of this reappears near Landsburg as surface runoff on the lower watershed. Thus, the drift acts as a huge reservoir to regulate the flow at Landsburg.

None of the Cedar river drainage is above timber line. There is, however, a heavy snowfall in the

Fig. 5. Lake Youngs Settling Reservoir. Earth Dam in Right Foreground, Intake Control House Over Tunnel in Left Background

watershed and deep snow remains in the upper watershed of Cedar river as late as July (see Fig. 4). The drainage basin is properly divided into two parts, an upper watershed of 83 sq.mi., with steep and precipitous sides, and over one billion f.b.m. of low quality timber, and a lower watershed bounded by mountainous ridges, but of itself rolling or bench land. Much of the 59 sq.mi. of lower watershed has been logged off or burned over. The original stand of timber on the upper watershed was 1⅓ billion f.b.m.

For protecting the watershed the city has acquired considerable land and, on private lands, has enforced special sanitary provisions. Fire prevention and reforesting have been practiced, especially on the lower watershed. Reforesting not only preserves the timber supply, but also serves to remove obnoxious growths—chiefly of deciduous trees and fallen logs—around the shores of Cedar lake and on the banks of Cedar river above Landsburg. Three special type zones are described in a special reforestation study made in 1924. They are: lower (douglas fir, western hemlock, western red cedar, sitka spruce, alder); upper (hemlock and white fir); and sub-alpine above elev. 3000 ft. (white fir, hemlock, western white pine, and noble fir). When there is proper fire protection on the western slope of the Cascades, douglas fir reforests naturally in a rotation of 60 to 80 years. Alders are especially objectionable along the stream as an epidemic of leaf worms causes dropping of the leaves, with dis-

Fig. 6. A. M. Lewis
Assistant Superintendent of Distribution

coloration of the water and the introduction of colon bacteria.

During the fall of 1928, two crews began cleaning the banks of Cedar river from Cedar falls to Landsburg (see both views, Fig. 7). The estimated cost of cleaning this 13-mile stretch of alder and logs is $12,000. Two logging engines and crews began in 1929 to clear and pick up along the shores of Cedar lake. The area of this clearing has not been determined, but the average cost to date is $260 per acre. Each machine has a yearly clearing capacity of 100 acres.

As much of the logged or burned off watershed will not reforest naturally, a nursery has been established and systematic planting is done each year under the direction of a forester. The planting seasons are from the last of March to the first of May and from the first of October to the middle of November. The planting program is 500 acres annually. With replants spaced 8 by 8 ft. and an allowance of 15% for death and culling, 400,000 trees are required annually for this area. During 1928, the city replanted 405 acres and in that period the nursery was moved from Cedar lake to Walsh lake. At the end of that year 445,000 seedlings and transplants were in the nursery. The total cost of reforesting, to the close of 1928, was $41,000.

Supply Structures and Lines—The three supply lines have been briefly described. The 24-hour capacity of these lines, in gallons, is: No. 1—22,500,000, No. 2—44,250,000, and No. 3—50,000,000.

At Landsburg there is a dam on Cedar river one-half mile above the controlling works. At the south end of this dam, water is diverted into a side basin (see Fig. 3), from which it enters two wood-stave pipes, respectively 54 and 60 in. diameter. These pipes convey the water to a settling basin where it passes

through two fine screens and thence into the main pressure pipes. Connected with each of the pipes is a bypass, consisting of a 24-in. pipe for No. 1 line and a 30-in. pipe for No. 2. When it is necessary to empty the settling basin, the main gates at the east end of the basin are closed and the bypass gates are opened, so as to maintain the flow of water to the city. On the north side of the basin there are three waste gates, opening into a common sluice pipe, by which the basin can be quickly drained. Near the top of the basin and on this same side there is a 3 by 10-ft. overflow weir to care for excessive deliveries. The screens are supported by two concrete walls rising from the floor of the tank.

The Landsburg control works is connected to Lake Youngs by pipe-lines. The lake allows sedimentation of suspended matter carried in the water. By raising the level 20 ft., enough water can be accumulated during the winter months to tide over the summer period of the greatest consumption for several years to come. The development of Lake Youngs as a storage reservoir required an intake control, consisting of a sluice gate in a concrete shaft. This was placed at the upper end of the outlet conduit, 1000 ft. from the intake. There were also required an earth-fill dam at the south end of the lake and one at the northeast corner, clearing and swamp drainage around the lake (see Fig. 5), diversion of the outflow of Mud lake away from Lake Youngs and into the lower reaches of Cedar river, and relocation of a county road.

An 8-ft. diam. concrete-lined outlet tunnel, 11,300 ft. long, capacity 150,000,000 g.p.d., connects Lake Youngs to the controlling works at Molasses creek in Sec. 27, T. 23 N., R. 5 E., W. M. The tunnel was built at a cost of $1,625,000. The control works (see cover) consists of two steel tanks, with horizontal screens, connected to the 8-ft. tunnel, with gates by which the water is guided either directly into a manifold, and from there delivered to the outlet pipes, or into one or both of the two steel screening tanks. These tanks also deliver into the manifold. After passing through the screening tanks, the water is chlorinated. (The chlorinating equipment—Wallace & Tiernan—is described on p. 546 of the October 25th, 1929, issue.) To the manifold three delivery pipes, 48, 51½, and 66-in. diam., are connected, and provision has been made for a fourth line, 66-in. diam., the contract for which is to be awarded. These pipes deliver into and are part of the supply lines leading to the city. A gate is provided on each outlet pipe, by which the supply can be shut off and the pipe emptied in case of accident or needed repairs. Blowoffs are provided at Molasses creek in the ravine west of the control works. The elevated steel tank, built by the Chicago Bridge & Iron Works to supply pressure for the chlorinators, is described in the October 25th, 1929, issue, p. 546.

Cedar river pipe-line No. 1, a wood-stave and steel conduit, was installed in 1901. By 1915 part of the wood staves were in bad condition, although the bands were satisfactory. Many of the staves were renewed in 1916-1917. The cost of this line, intake and controlling works, and reservoirs, was $1,250,000. Line No. 2 was completed in 1909. In 1922 three miles of the 52-in. untreated fir pipe was replaced with creosoted douglas fir. Weakness of staves at spots along the remainder of this line required replacement of five miles with steel pipe in 1924. This line cost $2,250,000. Considerable portions of the No. 1 and No. 2 wood pipe-lines within the city have been rebuilt within the past few years and additional construction is now under contract to the J. L. Smith Construction Co. Line No. 3, built in 1922-1923, extends from Ginger creek, 2½ miles northwest of Lake Youngs, to Volunteer park reservoir. It is a 66-in. riveted steel line, 15 miles long, from $\frac{5}{16}$- to $\frac{9}{16}$-in. shell. The line cost $2,000,000. When the controlling works was constructed, this line was extended to the manifold by the same contractor.

Connections and Reservoirs—Water is delivered into Beacon hill reservoir through a 30-in. line which

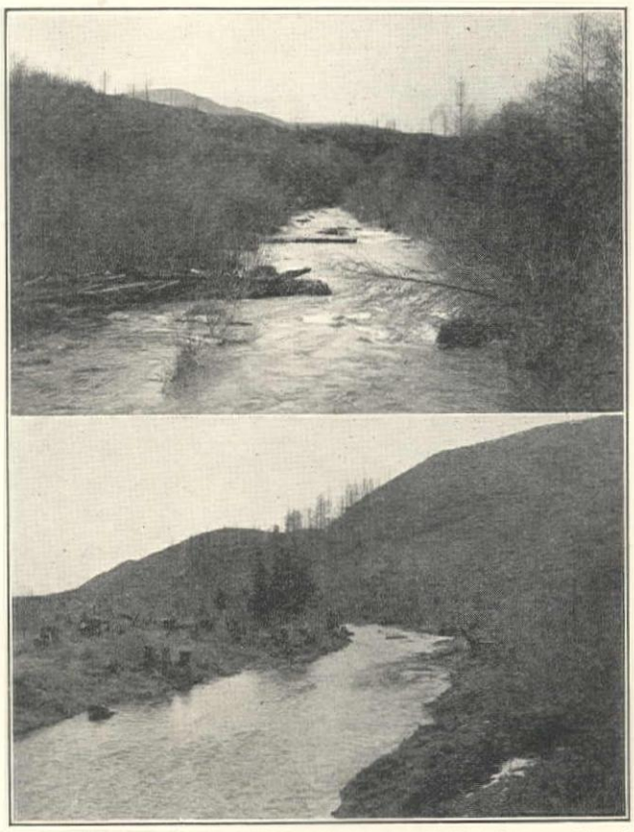


Fig. 7. (Upper) Cedar River Above Landsburg Before Clearing Banks of Alder and Debris. (Lower) Cedar River Above Landsburg After Clearing Banks

branches into two 6-in. lines and two 20-in. lines. From Cedar river pipe-line No. 1, water goes to Volunteer park reservoir (Fig. 10), passing directly into the weir chamber, thence through a pipe into the equalizing tank, and out into the reservoir. From Cedar river pipe-line No. 2, water is delivered by two branches, one going into the weir chamber of Volunteer park reservoir and the other direct into that reservoir. No. 2 line continues west as a 42-in. line along Prospect st. and north to Maple Leaf reservoir. A 24-in. bypass connects No. 2 with a 42-in. concrete pipe from Volunteer park to Lincoln park, so that the low service can be fed, if necessary, direct from the No. 2 line.

Water is delivered to Pelton wheels, driving pumps at Lincoln park reservoir, through the 42-in. concrete

pipe on 12th ave. from Volunteer park reservoir. After driving the pumps, the waste water goes into the low service reservoir and comes out through a 30-in. line to feed the downtown district. A cross-connection between No. 1 line and the feed line to the pumps at 12th and Olive st. makes it possible to supply Lincoln park direct from the headworks. The Maple leaf or Green lake intermediate reservoir is supplied directly by the 42-in. pipe passing Volunteer park reservoir, along Prospect st., and north via Federal ave., Shelby st., Howard and Eastlake ave., 7th ave. n.e., e. 47th st., and 12th ave. n.e., to the reservoir. The Green lake low service receives its supply through a 20-in. pipe, which connects the reservoir at its northwest corner with the 30 to 36-in. steel line coming south from Maple leaf reservoir. At the Maple leaf gatehouse is a 24-in. connection between the 42-in. line from the headworks and the 30-in. line coming south from

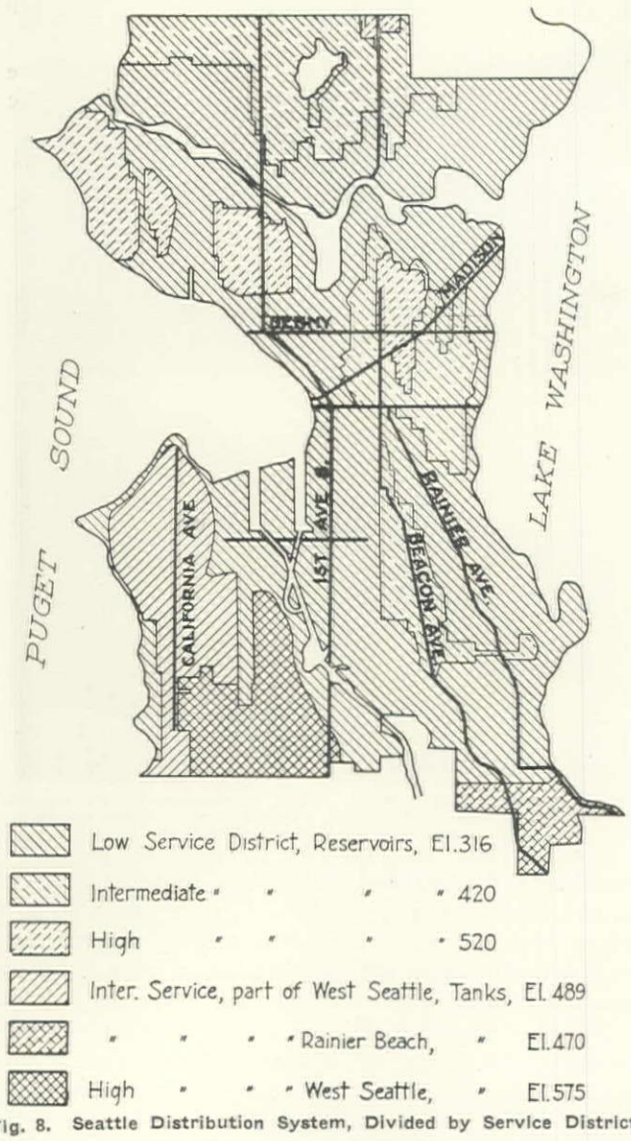


Fig. 8. Seattle Distribution System, Divided by Service Districts

Maple leaf to the 30 to 36-in. main between Maple leaf and the low service reservoir. Thus, the low service can be supplied directly from the headworks when Maple leaf reservoir is empty. There is also a 20-in. connection direct from the 42-in. line into the reservoir, so that the water can be delivered without having to go north to the Maple leaf gatehouse and then return to the Green lake low reservoir.

Volunteer park reservoir was built in 1901, with an average depth of 22 ft. It was relined in 1925-1926 at a cost of $59,416 (see October 10th, 1927, issue, p. 66). Beacon hill reservoir, built in 1904, was traversed by an underground stream until 1926, when an intercepting open-pipe drain, backfilled with gravel, was laid

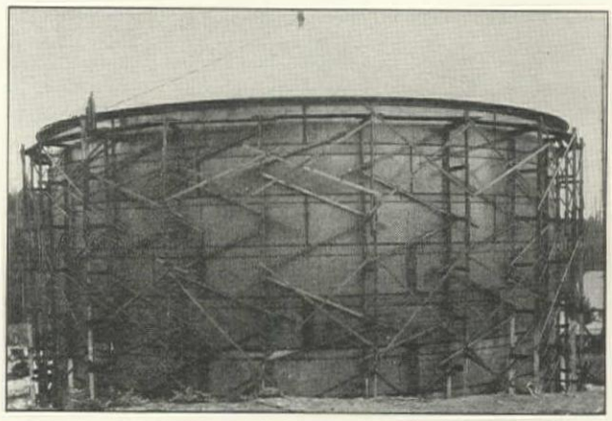


Fig. 9. Constructing W. Barton St. Standpipe, Seattle, 80 ft. Diam. and 41 ft. High

to save the floor of this structure. This drain cost $20,000. The sides of Lincoln park reservoir (23 ft. deep) were renewed in 1926-1927 for $18,000 and the grounds were beautified. Tracts of land around Maple leaf, Green lake, and Beacon hill (twin) reservoirs were beautified in 1924. In 1924 and 1926 steel standpipes were erected at Woodland park (Fig. 11), w. Barton st. (Fig. 9), and w. Charlestown st. The latter standpipe replaced a wooden structure. Standpipe sizes are as follows: Woodland park, 50 ft. diam. and 65 ft. high, unroofed, built in 1924; w. Barton st., 80 ft. diam. and 41 ft. high, roofed, built in 1926; and w. Charlestown st., 50 ft. diam., and 65 ft. high, roofed, built in 1926. (For a description of these three tanks see August 25th, 1927, issue, p. 34).

The booster pump at 7th ave. n.e. and Northlake ave. connects to a 20-in. trunk main around Woodland park to supply that high district from Cedar river line No. 2.

Part of the distribution system is supplied by large pipes through tunnels, namely: a tunnel under Duwamish waterway from 1st ave. s. to Peninsula place, built in 1923 for $200,000; a tunnel under the waterway at Montlake bridge to enlarge the service in that portion of Seattle north of Lake Washington canal (begun in 1928); a tunnel under Lake Union near 7th ave. n.e., built in 1914-1916 for $206,000.

Many of the principal wooden distribution mains laid about 1898-1905 have been replaced by 20-in. cast-iron pipe. A 1924 ordinance established the life of wooden mains in Seattle at 16 years. Residential district service mains (8-in.) had been financed by front-foot assessment of the actual cost against the abutting property owners. In 1925 this assessment was limited to $2.25 per front foot, with any excess to be paid from the water fund.

The statistics in Table I show the status of the Seattle water system as of December 31, 1928:

TABLE I

General

Estimate by Polk's directory for population of Greater Seattle, 1928	506,835
Estimate of population served by system (76,779 x 6)	460,674
Percentage of Seattle services metered	100
Total annual consumption, 1928, in gal. (est.)	17,935,722,030
Total annual consumption, 1928, in gal. (passed through meters)	15,373,722,030
Average daily consumption, in gal. (estimated)	49,004,705
Average daily consumption, in gal. (metered)	42,004,705
Average gal. per day to each consumer	106
Average gal. per day per meter, based on metered consumption	547
Cost of supplying water per million gal.	$74.72
Cost of supplying water per million gal., based on operation and maintenance costs only, omitting fixed charges, interest, and delayed losses	$57.61
Percentage of receipts from metered water to total income	81.45

Mains

Kind of pipe	cast-iron, steel, wood, and concrete
Size	2-in. to 8-ft.
Extended during year, miles	42.85
Discontinued during year, miles	22.32
Total mileage of distribution mains in use	858.08
Total mileage of supply mains in use	75.50
Mileage of supply and distribution mains	933.58
Cost of repairs per mile to mains and hydrants, including wood mains in use	$69.49
Length of pipe less than 4-in. diam., miles	98.16
Number of hydrants added during year	407
Number of hydrants now in use	8,998
Number of gate valves added during year	258
Number of gate valves now in use	7,661
Number of gate valves smaller than 1-in.	1,550
Normal range of pressure on mains	5 to 137 lb.

Services

Kind of pipe	galvanized iron, galvanized steel, and cast-iron
Size	½ to 8-in.
Number of service taps added during year	3,765
Number of meters now in use	76,779
Number of fire service meters in use, 6 and 8-in.	143

For distribution purposes (Fig. 8) the city is divided into three main zones—low, intermediate, and high. All of the section below elev. 225 ft. is supplied by gravity from the low service reservoirs at elev. 316 ft. The intermediate zone between elev. 225 ft. and 325 ft. is supplied by gravity from reservoirs having an elevation of 420 ft. The high-service zone above elev. 325 ft. is supplied by gravity from standpipes at the various elevations shown in Table II. Water for the standpipes is pumped from Lincoln park, Volunteer park, and Maple leaf reservoirs, and from all of the West Seattle, and part of the Magnolia Bluff and Queen Anne stations. The standpipe service is divided into intermediate service for part of West Seattle (elev. 489 ft.), intermediate service for Rainier Beach (elev. 470 ft.) and high service for part of West Seattle (elev. 575 ft.).

Water storage within the city at the close of 1928 was arranged as in Table II:

TABLE II

	Elev. of Overflow (Ft.)	Capacity (Gal.)	Location
Reservoirs			
Maple Leaf	420	60,000,000	12th ave. n.e. and e. 85th
Green Lake	316	50,000,000	14th ave. n.e. and e. 73rd
Volunteer Park	420	23,000,000	12th ave. n.e. and e. Prospect
Lincoln Park	316	23,000,000	10th ave. and e. Olive st.
Beacon Hill	316	110,000,000	Beacon ave. and Spokane st.
Standpipes and Tanks			
Volunteer Park	520	883,000	14th ave. n. and e. Prospect st.
Queen Anne	520	318,000	Warren ave. and Lee st.
Queen Anne	520	883,000	Warren ave. and Lee st.
Woodland Park	420	1,000,000	Near n. 53rd st. and Phinney ave.
Maple Leaf No. 1 (wood)	509	50,000	10th ave. n.e. and e. 86th
Maple Leaf No. 2 (steel)	509	100,000	10th ave. n.e. and e. 86th
Graham st. (wood)	346	50,000	Beacon ave. and Graham st.
South Park (wood)	270	50,000	Beacon ave. and Willow st.

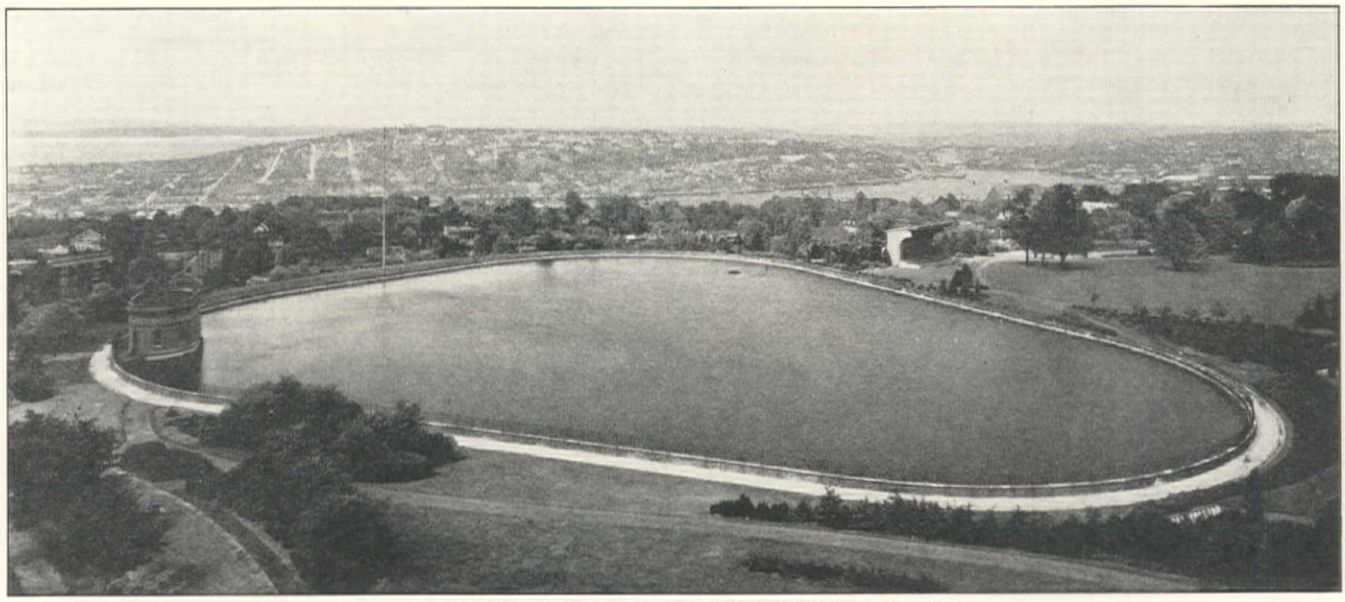


FIG. 10. VOLUNTEER PARK RESERVOIR, SEATTLE

Rainier Beach (steel)	470	500,000	Beacon ave. and Leo st.
W. Myrtle st. (steel)	575	500,000	36th ave. s.w. and w. Myrtle st.
W. Charlestown st.	489	1,000,000	40th ave. s.w. and w. Charlestown st.
Magnolia Bluff (steel)	470	250,000	38th ave. w. and w. Dravus st.
W. Barton st. (steel)		1,400,000	38th s.w. and w. Barton st.
Total		272,984,000	

These pumping stations were maintained in 1928 (Table III):

TABLE III

Pumping Station	No.	Gal. per Min. (Rated)	Location
Lincoln Park	2	1040	10th ave. n. and e. Olive st.
Queen Anne	1	1050	4th ave. n. and Ward st.
Volunteer Park	1	1050	12th ave. n. and Prospect st.
Maple Leaf	2	1000	12th ave. n.e. and e. 82nd st.
Interbay	1	1050	23rd w. and w. Dravus st.
West Seattle	1	4000	33rd s.w. and w. Spokane st.
West Kenyon st.	2	2000	5th ave. s.w. and w. Kenyon st.
Northlake (booster)	1	7000	7th ave. n.e. and Northlake ave.
36th ave. n.e. (booster)	1	800	36th n.e. and e. 55th st.

General Operating Features—The Seattle water system is built and maintained from two sources of revenue—local improvement assessments and receipts from water service directly and bond issues which are retired from revenue. The low water rates are, therefore, only possible because payments by abutting property owners for distributing mains relieve the department of an excessive bonded debt. All that portion of the expense of installing large feed mains over and above the cost of installing a main of sufficient capacity to meet the needs of services on the street where it is located, is charged against the water fund, thus distinguishing between feed and local distribution mains. All mains in residence districts over 8 in. and all mains in the business districts over 12 in. are classed as feed mains. Fig. 14 shows the maintenance shops and Fig. 12 the corporation yard.

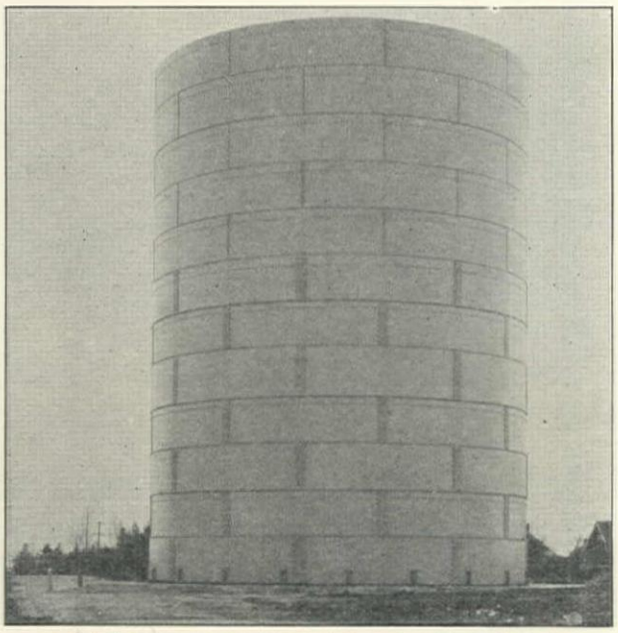


Fig. 11. Woodland Park Standpipe, Seattle, 50 ft. Diam. and 65 ft. High

Metering—The first Seattle water rates, established for the Spring Hill Water Co. in 1881, are shown in Table IV.

TABLE IV

Private families, all purposes	$1.50 per mo.
Each lot 60 by 120-ft., for irrigation	$2.00 per year
Steamers and vessels—50¢ for first 1000 gal. and 40¢ for each 1000 gal. thereafter	
Hotels of 100 rooms—$5.00 per mo. and for each additional 50 rooms or fraction thereof	$1.50 per mo.
Livery stables	$3.00 per mo.
Saloons	$1.50 per mo.
Restaurants	$2.50 per mo.
Barber shops with bath rooms—$2.50; without bath rooms	$1.00 per mo.
Stores and retail shops	$1.50 per mo.
Manufactories—30¢ for first 1000 gal. and 20¢ for each 1000 gal. thereafter	
Laundries consuming 300 gal. per day and less—$4.00 per mo. and same proportion above	
All other purposes—50¢ for first 1000 gal. and 35¢ for each 1000 gal. thereafter	

The present water rates for the municipal system have been in effect for 18 years. They are given in Table V.

TABLE V

For 500 c.f. or less—50¢ per mo. except that for two or more separate buildings on same meter the minimum is 50¢ per mo. each.	
For each c.f. over 500—6¢.	
For manufactories, laundries, elevators, school district No. 1, and the Government aviation field the rate in excess of 30,000 c.f. is 4¢ per 100 c.f.	
For premises outside of the city limits—500 c.f. or less—$1.00; all over 500 c.f.—15¢ per 100 c.f. But, where service uses not less than 80% for industrial purposes the rate is 10¢ per 100 c.f. for the first 30,000 and 8¢ per 100 c.f. additional.	
Flat rates for construction within the city are:	
For paving and laying sidewalks, concrete, per 100 sq.yd. or less for 6-in. base or less	50¢
Earthwork, for settling each 100 cu.yd. of earth	$1.40
Curing pavement, per sq.yd.	3¢
Portable engines, for first hp. (per month or less)	80¢
For each additional hp. for portable engines	20¢
For laying brick, per thousand	15¢
Service connections to mains are charged as follows:	
For ¾-in. tap on unpaved street, minimum charge	$15.00
For 1-in. tap on unpaved street, minimum charge	$18.00
For sizes larger than 1-in. and in a paved street, the actual cost of labor and materials in laying such a service and replacing the pavement is charged.	
(The water department furnishes the meter without cost to the consumer and also bears its maintenance costs.)	

By a 1921 ordinance, water bills are collected by the various local banks for the convenience of people who do not pay by check. For this service the banks make no charge.

The city is 100% metered, except for such municipal uses of water as parks, streets, sewers, and fire purposes. For these unmetered services the department is allowed $94,884 annually.

The majority of the meters are Trident, Watchdog, and Worthington. The growth of the department in the past few years is shown by the total metered services, Table VI.

TABLE VI

Year	No. Meters	Year	No. Meters
1918	47,283	1924	62,829
1919	50,593	1925	67,161
1920	52,809	1926	70,949
1921	54,956	1927	74,242
1922	57,131	1928	76,779
1923	59,463	1929*	78,638

*To December 1.

Free water service is given to about 20 relief homes and welfare organizations. For three years this service (Table VII) has aggregated:

TABLE VII

Year	Consumption (cu.ft.)	Value of Service
1926	5,186,100	$3,193
1927	4,740,900	2,943
1928	5,018,500	3,134

Operating Costs—The 1926 to 1928 water department forces numbered 390, 331, and 355. Certain 1928 salaries were: superintendent—$500, assistant superintendent—$290, utility accountant—$340, chief inspector—$200, foremen on water service and maintenance—$225, forester—$195, common labor—$4.50 to $5.25 per day.

Fig. 12. Corporation Yard, Seattle Water Department, 9th S. and Lander Streets

Some operating cost data are given in Tables VIII and IX.

TABLE VIII

Year	Average Daily Consumption gal.	Average Cost to Deliver 100 c.f.	Unit Revenue per 100 c.f.
1925	36,236,042	.....	$0.0731
1926	38,752,629	.....	0.0712
1927	39,121,383	$0.0597	0.0725
1928	42,004,705	0.05604	0.0712

TABLE IX

Year	Operating Revenue	Net Income
1926	$1,466,625	$546,889
1927	1,634,830	507,529
1928	1,808,751	493,163

Program for Increased Supply—An 8½-mile aqueduct survey was recently made for an independent, 300,000,000 g.p.d. supply line between Landsburg and Lake Youngs to increase the flow to that reservoir and also provide protection in case Cedar river pipelines 1 and 2 should be taken out by floods on Cedar river. As the two lines now supplying the lake have a maximum capacity of 74,500,000 g.p.d. (sufficient to meet only the present demand without drawing down the lake except for a short time in summer) the aqueduct is needed to meet an increase in population. With the present population and supply, the drawing down of Lake Youngs to its limit and an ensuing dry spell would cause a shortage of water in the city. Decision was reached to build this aqueduct and in October, 1929, the city received bids for Lake Youngs aqueduct, to be 96-in. diam., and for Lake Youngs aqueduct tunnel. The low bid of $351,720 for the aqueduct was submitted by Elliot, Stroud Bros. & Seabrook, of San Diego, who were awarded the contract. The contract quantities and unit prices are given in Table X.

TABLE X

Clearing and grubbing—3 acres at $600
96-in. reinforced concrete pipe—10,202 lin.ft. at $30
Earth excavation for pipe—30,000 cu.yd. at $0.60
Rock excavation for pipe—10,000 cu.yd. at $1.00
Tunnel invert excavation—600 cu.yd. at $3.00
Manholes and vent pipe—2 at $1300
Blowoff, including 30-in. gate valve—1 at $1350
Install 30-in. cast-iron pipe—160 lin.ft. at $4.40
Concrete protection for river crossing—400 cu.yd. at $15.00
Concrete blocking—200 cu.yd. at $15.00.

Other total bids were received on the aqueduct as follows: Coluccio & Arcorace, Seattle—$365,183; American Concrete Pipe Co. of Washington—$395,425; United Concrete Pipe Co., Los Angeles—$402,128; Lock-Joint Pipe Co., Denver—$430,332.

For the aqueduct tunnel, Colluccio & Arcorace, Seattle, submitted the low bid of $96,345. The contract quantities and unit prices are given in Table XI.

TABLE XI

Clearing and grubbing—8 acres at $400
Sinking shaft—55 lin.ft. at $35
Driving tunnel—2950 lin.ft. at $24
Portal excavation—5200 cu.yd. at $0.80
Timber in tunnel and shaft—542 M f.b.m. at $30.

The total bids of the two next lowest bidders were: Goetz & Brennan, Seattle—$110,442; F. N. Badolato, Seattle—$117,310.

Delivery to Volunteer park reservoir by lines 1 and 2 is 44,769,000 g.p.d. from Landsburg. The maximum possible delivery from the three lines between Lake Youngs and the city totals 117,500,000 g.p.d. A contract for constructing Cedar river pipe-line No. 4 between Landsburg and the controlling works at Molasses creek was awarded in October, 1929, to Hans Pederson, Seattle, for $780,419. This is a wood-stave line, 78-in. diam. There were only two bids and that of the Federal Tank & Pipe Co., Seattle, was $918,417. The bids were rejected but later awarded to Pederson for the contract quantities and unit prices given in Table XII.

Fig. 13. Reconstructing Cedar River Pipe-Line No. 2 from Reclaimed Staves, Looking North from Near Leo St., Seattle

TABLE XII

Clearing and grubbing—25 acres at $500
Trench excavation—70,000 cu.yd. at $1.00
Grading—15,000 cu.yd. at $0.50
Remove 44-in. wood pipe—11,500 lin.ft. at $1.00
Concrete blocking—600 cu.yd. at $20
Excavation for saddles—2500 cu.yd. at $2.00
Creosoted piling for trestle—7600 lin.ft. at $1.00
Creosoted lumber for trestle—43 M. f.b.m. at $100

Steel plate specials—118,128 lb. at $0.10
Concrete in spillway—84 cu.yd. at $30
Creosoted timber for saddles—370 M f.b.m. at $100
Wood pipe:
5/8-in. bands with 6-in. spacing—39,792 lin.ft. at $9.50
5/8-in. bands with 5 7/16-in. spacing—1919 lin.ft. at $10
5/8-in. bands with 4 1/8-in. spacing—1884 lin.ft. at $10
5/8-in. bands with 4 5/16-in. spacing—1600 lin.ft. at $10
3/4-in. bands with 6-in. spacing—2369 lin.ft. at $11
3/4-in. bands with 5 5/16-in. spacing— 803 lin.ft. at $11
3/4-in. bands with 5 1/4-in. spacing— 820 lin.ft. at $11
3/4-in. bands with 4 7/8-in. spacing—2029 lin.ft. at $11
3/4-in. bands with 4 5/8-in. spacing— 627 lin.ft. at $11
3/4-in. bands with 4 3/8-in. spacing— 242 lin.ft. at $11.50
3/4-in. bands with 4 1/8-in. spacing— 72 lin.ft. at $11.50
3/4-in. bands with 3 1/8-in. spacing— 120 lin.ft. at $11.50
3/4-in. bands with 3 3/4-in. spacing— 121 lin.ft. at $11.50
3/4-in. bands with 3 5/16-in. spacing— 119 lin.ft. at $12
3/4-in bands with 3 7/16-in. spacing— 902 lin.ft. at $12
3/4-in. bands with 3 1/4-in. spacing— 434 lin.ft. at $12
3/4-in. bands with 3 1/8-in. spacing— 82 lin.ft. at $13
3/4-in. bands with 3-in. spacing— 82 lin.ft. at $13
3/4-in. bands with 2 7/8-in. spacing— 82 lin.ft. at $14.50
3/4-in. bands with 2 1/8-in. spacing— 82 lin.ft. at $14.50
3/4-in. bands with 2 1/16-in. spacing— 82 lin.ft. at $16
3/4-in. bands with 2 5/8-in. spacing— 84 lin.ft. at $16
3/4-in. bands with 2 1/2-in. spacing— 170 lin.ft. at $17
50-lb. gate valves, 60-in. diam.—2 at $3500
150-lb. gate valves, 48-in. diam.—1 at $3300
50-lb. gate valves, 42-in. diam.—2 at $2000
150-lb. gate valves, 36-in. diam.—3 at $1700
Blowoffs and 6-in. gate valves—14 at $250
Cast-iron pipe—600 lin.ft. of 6-in. at $2.25
Standpipes—13 at $1000
Air valves—7 at $475
Steel castings—60,000 lb. at $0.15
Floor stands for 60-in. valves—2 at $1500
Floor stands for 48-in. valves—1 at $1200
Floor stands for 36-in. valves—3 at $1100

For replacement of Cedar river pipe-lines 1 and 2 at Lake Youngs, the city awarded a contract during

Fig. 14. Seattle Water Department Shops at 9th. S. and Lander Streets

1929 to Thos. Scalzo & Co., Seattle, at $164,520. The contract quantities and unit prices are given in Table XIV.

TABLE XIV

Clearing and grubbing—4.5 acres at $600
Excavation—20,000 cu.yd. at $1.00
Borrow—1000 cu.yd. at $1.00
Creosoted lumber for trestle—70 M f.b.m. at $68
Creosoted piling—18,000 lin.ft. at $1.00
Steel plates—50,000 lb. at $0.10
30-in. gate valves—1 at $600
30-in. concrete valve chambers—1 at $250
42-in. gate valves—1 at $1000
42-in. concrete valve chambers—1 at $350
48-in. gate valves—1 at $1500
48-in. concrete valve chambers—1 at $400
Standpipes—3 at $380
Lumber in wood-stave pipe—9620 lin.ft. at $7.50
Bands for pipe—16,500 at $1.20
Shoes for pipe—33,000 at $0.25
Connection with tunnel—$5000
Cement for grout—25 bbl. at $6
Sand for grout—10 cu.yd. at $5
12-in. vitrified pipe culvert—100 lin.ft. at $1.50
Reinforcing steel—8500 lb. at $0.09
Structural steel—500 lb. at $0.09
Steel castings—500 lb. at $0.15
Grey iron castings—500 lb. at $0.17
Concrete blocking—100 cu.yd. at $12
Vitrified pipe drain—100 lin.ft. of 4-in. at $1.00

Two other bids were received, as follows: J. L. Smith Construction Co., Seattle—$178,766; and C. L. Creelman, Seattle—$179,665.

During 1929, the city awarded a contract to the J. L. Smith Construction Co., Seattle, who bid $530,349, for constructing a lockbar steel pipe-line connecting Cedar river lines 2 and 3 and the Maple leaf and Green lake reservoirs. The two other bidders were: Frank J. McHugh, Seattle—$580,478, and Puget Sound Bridge & Dredging Co., Seattle—$594,325. The contract quantities and unit prices are shown in Table XIII.

TABLE XIII

Earth excavation—60,000 cu.yd. at $1.15
Rock excavation—200 cu.yd. at $2.00
Planking—5 M f.b.m. at $30
Remove paving—6620 sq.yd. at $0.90
Restore surface—27,789 lin.ft. at $0.10
Closing-in pieces—17,000 lb. at $0.15
Lock-bar steel pipe—12,361 lin.ft. of 54-in., 5/16-in. plate at $13.80
Lock-bar steel pipe— 4,330 lin.ft. of 54-in., 3/8-in. plate at $15.70
Lock-bar steel pipe— 9,055 lin.ft. of 54-in., 7/16-in. plate at $16.70
Triple-riveted steel pipe—476 lin.ft. of 54-in., 1/2-in. plate at $26.85
Lock-bar steel pipe—1567 lin.ft. of 30-in., 5/16-in. plate at $10.25
Air valves—7 at $275
Connecting chambers for air valves—7 at $116
Pipe drain—200 lin.ft. of 4-in. at $0.40
Ventilating posts—8 at $130
'A' cast-iron pipe—120 lin.ft. of 6-in. at $1.00
6-in. blowoffs and traps—4 at $275
6-in. blowoffs without traps—1 at $175
4-in. blowoffs without traps—1 at $175
Cast-iron valve box for blowoff—1 at $25
Chambers for blowoffs—4 at $115
Brick chambers for manholes—17 at $90
Concrete blocking—120 cu.yd. at $15
Shaft houses—2 at $1800
6-in. water jet eductor—1 at $427
4-in. galvanized steel pipe—74 lin.ft. at $1.50
8-in. galvanized steel pipe—110 lin.ft. at $4.00
Structural steel—9000 lb. at $0.15
36-in. flanged check valves—2 at $1595
12-in. flanged check valves—1 at $119
48-in. flanged gate valves—1 at $1415
36-in. flanged gate valves and bypass—2 at $1274
30-in. flanged gate valves—1 at $759
12-in. flanged gate valves—1 at $99
4-in. flanged gate valves—1 at $27.50
Concrete chambers for 36-in. valves—2 at $484
Concrete chamber for 48-in. valve—1 at $450
Concrete chamber for 30-in. valve—1 at $211
Concrete chamber for 12-in. valve—1 at $150
Rebuild catchbasins—20 at $60
Rebuild gate chambers—10 at $30
Move and reset hydrants—5 at $20
Shackle rods—600 lb. at $0.15
Extra excavation—200 cu.yd. at $2.00
Lumber for blocking—1 M f.b.m. at $40
Lumber for pipe support—2 M f.b.m. at $40
Reinforcing steel—500 lb. at $0.10
Special iron castings—500 lb. at $0.15
Special steel castings—500 lb. at $0.20

Rebuild side sewer—200 lin.ft. at $1.50
Rebuild catchbasin connection—100 lin.ft. at $1.50
Remove 8-in. pipe—50 lin.ft. at $1.50
Remove 12-in. pipe—50 lin.ft. at $2.00

Distribution system improvements during 1929 included a contract for cast-iron mains in 31st ave. s. awarded to Argentieri & Colarossi, Seattle, for $46,809. The contract quantities and unit prices are given in Table XV.

TABLE XV

Cast-iron 'B' pipe—8070 lin.ft. of 8-in. at $1.42
Cast-iron 'C' pipe—2325 lin.ft. of 8-in. at $1.50
Cast-iron 'B' pipe—2875 lin.ft. of 12-in. at $2.20
Cast-iron 'C' pipe—1480 lin.ft. of 12-in. at $2.35
12-in. gate valves—3 at $60
Brick valve chambers—1 at $35
Rebuild valve chambers—27 at $20
6-in. hydrants—1 at $100
Reconnect hydrants—29 at $5
Reset hydrants—1 at $10
Hydrant drains—200 lin.ft. at $0.50
Shackle rods—850 lb. at $0.20
Special castings—1000 lb. at $0.01
Concrete blockings—5 cu.yd. at $7

The two next lowest bidders were: S. A. Moceri, Seattle—$47,054; and Badolato & Macri, Seattle—$47,156.

For 1930, Seattle is considering two water system improvements—a new 66-in. steel pipe-line from Lake Youngs controlling works at Molasses creek to the city (estimated cost $1,500,000) and a new branch pipeline from the four supply lines at the south city limits to the West Seattle section, including a new reservoir (estimated total cost $1,500,000).

Progress on Current Contracts—The order to begin work on the Lake Youngs aqueduct was issued October 18, 1929. The monthly estimate of January 1, 1930, credits the contractor, Elliott, Stroud Bros. & Seabrook, San Diego, with 2172 lin.ft. of 96-in. diam. reinforced concrete pipe ($50,130) and 380 cu.yd. of

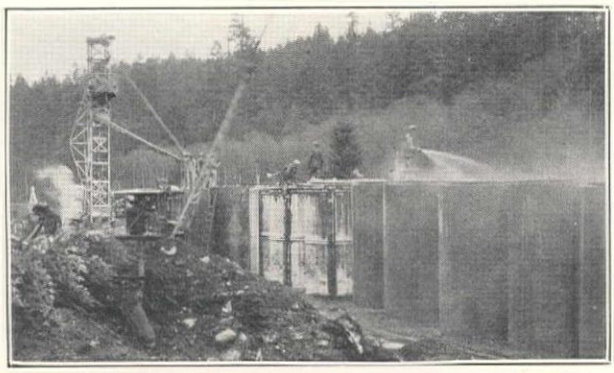


Fig. 15. Molding and Curing Sections of 96-in. Diam. Reinforced Concrete Pipe for Lake Youngs Aqueduct, Seattle

river-crossing concrete protection ($4500). On January 1 the job was 16% complete, with the contract time limit expiring June 1, 1930. In this contract, for which the units are given in Table X, p. 69, there are nearly two miles of 96-in. concrete pipe. The pipe is being manufactured on the job, as shown in Fig. 15 and 16.

On Cedar river pipe-line 4, a 78-in. diam. wood-stave pipe extending from the west portal of the Lake Youngs aqueduct tunnel to a connection with existing lines near the Molasses creek controlling works, the order to begin work was issued November 5, 1929. This project requires more than 8 miles of pipe and includes the units given in Table XII, p. 69 and 70. The monthly estimate of January 1, 1930, credits the contractor, Hans Pedersen, Seattle, with 3800 lin.ft. of 78-in. wood-stave pipe ($36,410); 17,350 cu.yd. of trench excavation ($17,350); 850 cu.yd. of concrete blocking ($17,000); and minor items. The contract time limit expires June 25, 1930.

The Maple leaf reservoir pipe-line connecting Cedar river pipe-lines 2 and 3 to Maple leaf and Green lake reservoirs, begins near Volunteer park reservoir and extends for 5 miles to these reservoirs near the northerly city limits, crossing Lake Washington canal in a previously constructed tunnel. The order to begin

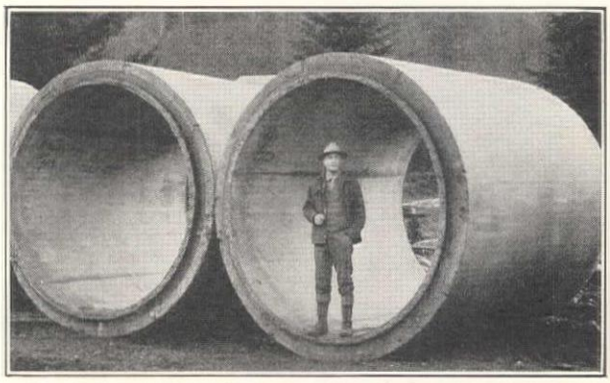


Fig. 16. Completed Sections of 96-in. Diam. Reinforced Concrete Pipe for Lake Youngs Aqueduct

work was issued August 7, 1929, to the J. L. Smith Construction Co., Seattle, and on January 1 the contract was reported 13% complete; the time limit being August 7, 1930. This is a 54-in. lock-bar steel pipe-line for which the Western Pipe & Steel Co., San Francisco, furnished the pipe. The units are given in Table XIII, p. 70 and 71. In the estimate of January 1, the following major items are credited: 32,000 cu.yd. of trench excavation ($36,800) and 1200 lin.ft. of 54-in. lock-bar pipe ($17,034).

Personnel—Present officials of the Seattle water department include: W. B. Severyns, superintendent (Fig. 2); A. M. Lewis, assistant superintendent (Fig. 6); G. B. Schunke, utility accountant. From February 11, 1895, to his death on June 10, 1923, L. B. Youngs was superintendent of water. He was followed in 1923 by G. F. Russell, in 1926 by L. Murray Grant, and in 1928 by W. B. Severyns.

Philip Tindall is chairman of the city council's public utility commission. W. D. Barkhuff is the city engineer and T. H. Carver is the water supply engineer for Seattle. Photographs for most of the illustrations in this article were taken by George Chew, city photographer.

Water Resources Investigation

The engineering personnel of the California division of water resources grew from 60 in July to 120 at the first of December, 1929. The increase was required by new activity in water resources investigation and the duties incident to the supervision of dams. With this increase, the engineering corps is still taxed to meet its duties.

Carlsbad-Lakewood Highway, New Mexico

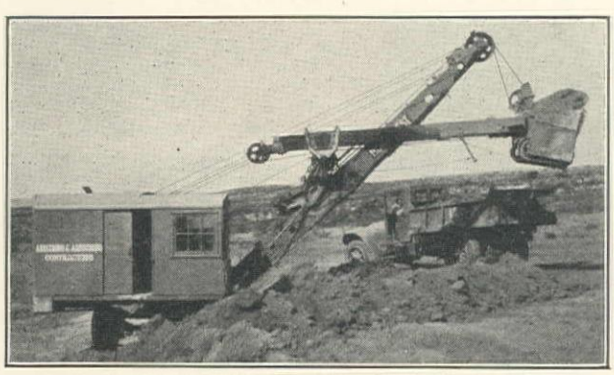
By A. M. MORRISON
Project Engineer, New Mexico State Highway Department, Carlsbad

General—Federal Aid Project 132-A is located between Carlsbad and Lakewood in Eddy county, district 2 of the New Mexico State Highway Department. It has a total length of 14.121 miles, of which 13.098 miles is Federal Aid work, and, when completed, will give a continuous, high-class all-weather road from Carlsbad to Roswell.

This project, involving grading, drainage structures, and crushed surfacing, will cost over $300,000, or about $21,000 per mile. It is one of the most expensive single projects awarded by the state in recent years and incorporates a maximum in construction methods and details.

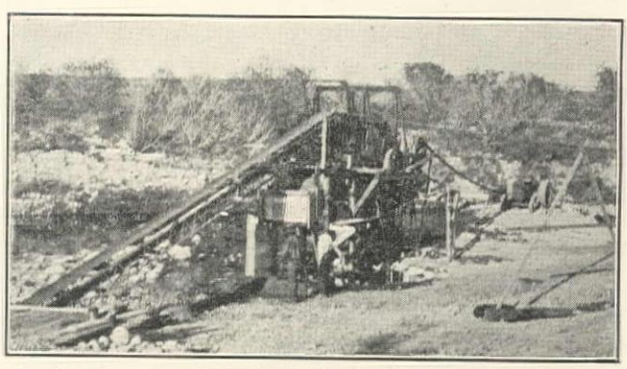
Soil Conditions—The location traverses a rough territory, in which is encountered almost every type of soil known to the southwest, including clay, gypsum, caliche, and limestone. In the face of these natural conditions, aside from the engineering problems, the contractor has problems that require considerable study and accurate planning for the work in progress, as well as considerable equipment to handle the project. The contractor on this work had various units of equipment on hand when the contract was awarded, but purchased several new units at the time he began construction.

Contract—The contract was awarded in the summer of 1929 to Armstrong & Armstrong, of Roswell, New Mexico, for $295,193. Contract quantities and unit prices follow:



Northwest 1¼-yd. Gas Shovel Loading 5-yd. Truck, F.A.P. 132-A

Unclassified excavation—49,867 cu.yd. at $0.95
Structure excavation—3694 cu.yd. at $1.40
Common borrow—168,768 cu.yd. at $0.28
Overhaul—54,140 sta.yd. at $0.03 and 1637 mi.yd. at $1.00
Approach fill for U abutment—1273 cu.yd. at $0.60
Rock fill—157 cu.yd. at $1.50
Base course for oil-processed surface—24,875 cu.yd. at $1.45
Crushed gravel base course—487 cu.yd. at $1.45
Scarify and reshape surface course—14.121 mi. at $50.
Class 'A' concrete box culvert and siphon—629 cu.yd. at $20.25
Class 'A' concrete in bridge substructure—1637 cu.yd. at $19.25
Class 'A' concrete in bridge superstructure—779 cu.yd. at $21.25
Class 'B' concrete headwalls for metal culvert pipe—21 cu.yd. at $24.
Reinforced concrete monument and marker—2 at $15.
Reinforcing steel for concrete headwalls, metal culvert pipe—600 lb. at $0.07
Reinforcing steel for concrete culvert and siphon—60,490 lb. at $0.55
Reinforcing steel for bridge concrete—299,011 lb. at $0.049
Structural steel for bridges—879,915 lb. at $0.048
Treated timber piling—1350 lin.ft. at $1.35
Treated timber in bridge substructure—16.386 M f.b.m. at $133
Treated timber in bridge superstructure—144.304 M f.b.m. at $133.
Corrugated galvanized metal culvert pipe—432 lin.ft. at $3.35
Woven wire bridge railing—1119 lin.ft. at $1.00
Woven wire guard fence—320 lin.ft. at $1.10
Galvanized barbed wire fence—111,087 lin.ft. at $0.0475
Reconstruct fence—4040 lin.ft. at $0.03
Gates—34 at $16



Sand and Gravel Screening and Washing Plant, F.A.P. 132-A

Roadway Construction—The first step in construction was to place two team-outfits on the job. These were supplemented with a large elevating grader, drawn by a 10-ton Holt tractor, used to cast in the base of the fill where suitable material was to be found. Fresnoes and a blade were used to follow-up. In one team camp, a Monarch tractor and a rooter plow were used to clear and grub the right-of-way of small greasewood and mesquite. Later, the same equipment was used to plow for several fresnoes and, when not occupied at this work, to draw a 1¼-yd. tumble bug.

A new 1¼-yd. Northwest gas shovel was purchased and set to work following up a third team outfit. This shovel is being used to make the roadway cuts, protection ditches, and to load trucks from borrow pits where sufficient side borrow could not be obtained with fresnoes. There are several fills as high as 12 ft. and the shovel, with four 5-yd. dump trucks, averages not less than 1000 cu.yd. per day on short hauls.

Contract Includes 6 Bridges—A dragline is being used successfully to make the structure excavation for five concrete and steel bridges on the project. These bridges are of recent design, using five lines of I-beam stringers, from 27 to 33 in. deep and 50, 60, and 65 ft. long. The bridges are to have concrete floors and concrete handrail, of attractive design. The 300-ft. bridge at sta. 636 has a driven pile substructure and the wooden superstructure was erected in record time. This bridge is on a 1° 38′ curve, superelevated, and has twelve 25-ft. spans.

Long Beach Improves Ocean Front

Progress on Bulkhead for Outer Harbor and Pleasure Pier

BULKHEAD FOR OUTER HARBOR

By R. G. McGLONE
Chief Engineer, Harbor Department, City of Long Beach

C. J. Kuback, Los Angeles, will complete his contract June 1, 1930, for 4892 lin.ft. of timber and concrete bulkhead and 1,160,000 cu.yd. of dredging in the outer harbor, city of Long Beach. The contract was awarded in February, 1929, for $838,034.

Progress—By January 1, the contractor had driven 95% of the 13,000 bearing piles for relieving platforms at piers A and B; had the retaining walls at pier B about 95% complete; was scheduled to begin the fill within two weeks; and was driving steel sheet piling along pier A and the relieving platform. At that time, all of the platform and 75% of the wall along the end of the slip between piers A and B was in place.

The equipment includes two scow drivers fitted with pendulum leads for driving batter piles; one skid rig with steam hammer for driving timber sheet piles; one drop-hammer skid rig for driving steel sheet piles; one barge, with a complete concrete mixing plant and conveyor, for casting the platform and wall; and a small saw plant for cutting long pile butts into form lumber.

Construction Methods—Fig. 2 shows the outer end of the temporary creosoted timber bulkhead, with the timber relieving platform and tie backs extending from shore to a connection with the permanent steel and concrete bulkhead at the rear of the slip. This temporary bulkhead defines the westerly limit of the present project. At the upper left in Fig. 2 may be seen the completed reinforced concrete retaining wall at berth 18.

Fig. 1 shows the reinforced concrete relieving platform and retaining wall at berth 12. Footings along the back of the wall are for the front columns of the transit shed. In the upper center of this figure, the concrete mixing barge is at work placing concrete at the rear of the slip between piers A and B. Dark splotches on the relieving platform are formed by marine growth.

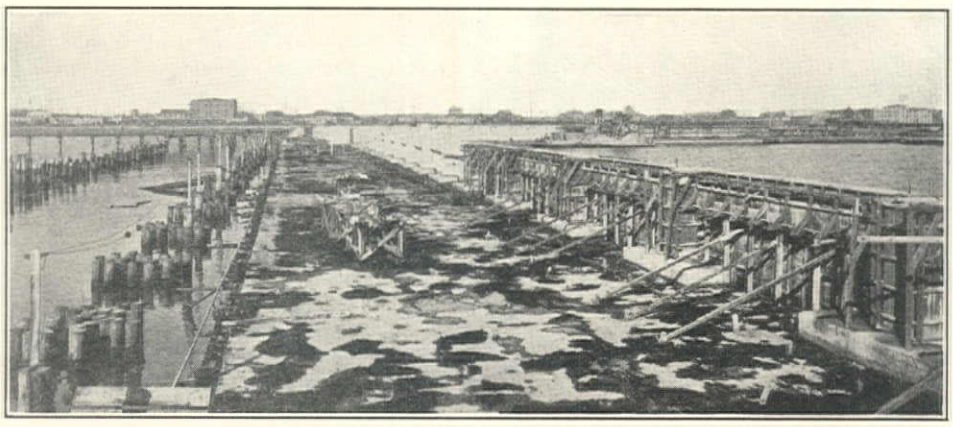


FIG. 1. REINFORCED CONCRETE RELIEVING PLATFORM AND RETAINING WALL, LONG BEACH OUTER HARBOR

PIER AUDITORIUM PROJECT

By C. M. CRAM*
Marine Construction Engineer, Public Service Department, City of Long Beach

Bonds in the amount of $2,800,000 were voted on May 1, 1928, to cover the cost of (1) constructing a pleasure pier, auditorium fill, and accessories; and (2) an auditorium building. I have charge of the first of these two sub-projects under A. H. Adams, director of public service, city of Long Beach.

Sub-Project No. 1—The preparation of a site for the auditorium includes the construction of a curved pleasure pier connecting the foot of Linden ave. with the foot of Pine ave.; inclosing about 40 acres of protected water, of which an 8-acre portion at the foot of American ave. is bulkheaded and to be filled as a site for the auditorium building.

One-half of the total bond issue, or $1,400,000, was allocated to cover the cost of the pleasure pier complete with its enrockment; the 8-acre fill with its retaining bulkhead; filling the beach within the enclosure of the pier enrockment; paving Seaside blvd. between Pine and Linden ave.; and the rearrangement of storm drains entering the inclosed water area.

Contract—Plans and specifications for construction of the pleasure pier, auditorium fill, and accessories, were prepared by the city engineering department, approved by Leeds & Barnard, consulting engineers of Los Angeles, on July 16, 1928, and were adopted by the city council on July 17.

Bids for construction of the pier auditorium project were received by the city manager on August 31, 1928, from:

*Member, American Society of Civil Engineers.

Hauser Construction Co., Long Beach—$959,960
Ross Construction Co., Los Angeles—$989,950
Twohy Bros. & J. F. Shea, San Francisco—$992,933
Butte Construction Co., San Francisco—$993,820
Kern & Kibbe, Portland—$1,115,717
C. J. Kuback, Los Angeles—$1,122,870
Mittry Bros., Los Angeles—$1,141,825.

A contract for construction of the pleasure pier, the bulkhead to retain the auditorium fill, and the deposit of hydraulic fill both within the inclosure of the bulkhead surrounding the auditorium site and along the beach within the inclosure of the enrockment, was awarded to the Hauser Construction Co. on September 4, 1928. The project will be completed about June 1, 1930. K. B. Kumpe is the general manager for the contractor.

This contract covers the principal items of the subproject, as follows:

Rock embankment—296,000 tons at $1.60
Pier trestle complete—$270,000
Retaining bulkhead—$120,000
Rock fill—219,000 cu.yd. at $0.44
Culverts in place—30 at $300.

Fig. 2. Outer End of Temporary Creosoted Timber Bulkhead, Long Beach

It excludes the items of paving along Seaside blvd., alterations to storm drains, electric lighting installations, fire and water mains, and other minor items.

Progress—For consideration of progress, the construction items were segregated into:

(1) Pier trestle substructure
(2) Pier trestle superstructure
  (a) Roadway and seaward sidewalk
  (b) Shoreward sidewalk
(3) Pier enrockment
(4) Bulkhead
(5) Hydraulic fill
  (a) Within bulkheaded inclosure
  (b) Along beach
(6) Seaside blvd. storm drain.

Pier Trestle Substructure—The driving of piles for the trestle substructure was begun on October 2, 1928, at the foot of Linden ave. Two standard skid pile drivers, each equipped with a drop hammer, were used. The forward driver placed but four piles of the seven-pile bent and the rear driver completed the bent and placed an extra pile on the landward side of the substructure to carry the contractor's track for the delivery of stone. Both drivers progressed around the pier to its completion (excepting sway braces) at the foot of Pine ave. on April 10, 1929. One locomotive crane was used on the substructure. Construction of the pier substructure is shown in Fig. 3.

Pier Trestle Superstructure—Construction of the trestle superstructure was scheduled to begin January 2 and to be completed July 1, 1930. The superstructure will consist of decking, sidewalks, and a 20-ft. asphalt paved roadway.

Pier Enrockment—The depositing of stone was begun on March 4, 1929, and carried out at a rate in excess of contract requirements, to complete the inclosure of sheltered water in which the auditorium fill is being constructed.

All stone was obtained from the contractor's granite quarry near Riverside, where two '50-B' Bucyrus-Erie and one Marion '60' steam shovels and two standard gauge locomotives were in operation. This stone was delivered on the contractor's track along the shoreward side of the pier trestle on standard gauge cars. Core stone was unloaded from flat cars to both landward and seaward of the car by an Erie type 'B' steam shovel traveling on the bed of the car, and from standard air-dump cars to shoreward. Stone forming the seaward side slope was unloaded from flat cars by a steam-powered derrick, specially constructed to skid along the capped bents of the substructure. A standard gauge locomotive was used to handle the cars.

Methods of depositing stone from the track along the shoreward side of the substructure made it necessary to deposit a sufficient quantity of stone on the crest of the enrockment to permit rehandling it with the steam shovel or derrick to 'lay up' or 'finish' the enrockment to the required lines and grades. This finishing had, to January 1, been done from shore to

Fig. 3. Substructure for Pier Auditorium Project

1900 ft. from the foot of Pine and 870 ft. from the foot of Linden ave. By that date, a total of 318,943 tons of stone had been deposited in the enrockment. It is estimated that 6000 to 12,000 tons of stone will be required to complete the enrockment. If, meanwhile, storms are so severe as to lower the enrockment, this estimated amount would be increased.

Although the pier enrockment is practically completed from the standpoint of required stone, considerable work remains to be done in finishing it to the required lines and grades.

Bulkhead—Construction of the retaining bulkhead to surround the 8-acre fill was begun August 10, 1929, at its junction with Seaside blvd. near Collins way. Two pile drivers, each equipped with a steam hammer, were used—one in advance of the other, placing guide and anchor piles and capping alternate panels, the other placing wakefield sheet piling. The structure was completed on November 30, 1929.

Hydraulic Fill—The depositing of hydraulic fill was

begun by the San Francisco Bridge Co., subcontractor, on December 16, 1929, and will be completed about February 15, 1930. The 24-in. suction dredge 'McMullen' has been operated in channel No. 3 of Long Beach inner harbor since that date on a 24-hour basis, except for Sundays and holidays. Prior to beginning the hydraulic fill, the pipe-line between the points of excavation in channel No. 3 and deposit within the auditorium bulkhead had been laid. This is a 20-in. discharge line, from 8000 to 8800 ft. long.

By January 1, there had been deposited 20% or 38,500 cu.yd. of material. Most of this material was placed within the bulkheaded inclosure, although placing of some fill along the beach had been undertaken and a portion of the required temporary retaining structures built.

Storm Drain—Plans and specifications for the Seaside blvd. storm drain were prepared by the city engineering department. This drain will prevent the entrance of storm waters into the enclosed water area formed by the enrockment, the outfalls being located on the seaward sides of the enrockment at Pine and Linden ave. Official approval of these plans on October 23, 1929, was followed by award of the contract to the Harbor Sewer Co., Wilmington, California, on November 14, 1929. Work was begun November 18 and completed December 25, 1929, at a total cost of $6881.

See previous articles on Long Beach harbor improvements in October 10th, 1926, and March 25th, 1927, issues.

Berkeley Storm Sewer System

Laying 4800 Feet of 24 to 60-Inch Reinforced Concrete Pipe for Unit No. 5

By S. A. HART*

Sanitary Engineer, City of Berkeley, California

Engineers seem to have acquired the reputation of seldom publicly admitting that a construction job has been handled by a contractor in such a manner that they have no criticism to make. For once, at least, I am going to publicly give credit where credit is due.

On September 24, 1929, Fredrickson & Watson Construction Co., Oakland, was awarded the contract for Unit No. 5 of the Berkeley storm sewer system. The contract totalled $73,000 and consisted mainly of laying 4800 lin.ft. of 24 to 60-in. reinforced concrete pipe. About 1000 lin.ft. of the 60-in. pipe, in 8-ft. lengths weighing 8.7 tons to the joint, was placed on 2-pile bents running out into the bay.

Construction Features—The job is, I think, worthy of special note for several reasons:

(1) Although the contractor lost three weeks waiting for pipe deliveries, the work was completed and accepted on December 31, 1929; a total elapsed time of 98 days from the award of contract.

(2) On the general excellence of the standard of workmanship on all parts of the work.

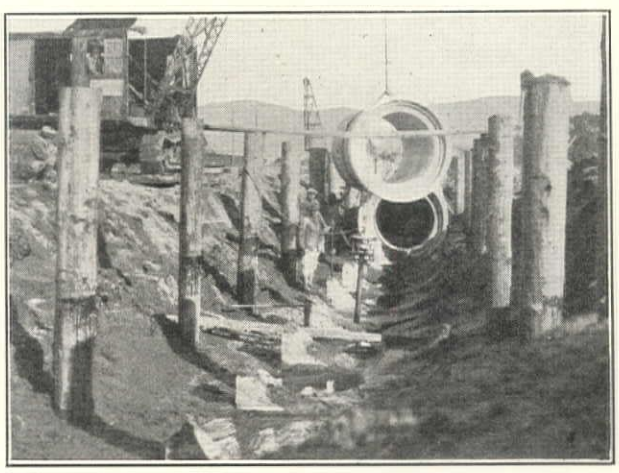
(3) Because during the entire work there was not a single hitch, objection, or complaint, either from the adjacent property owners, the city, the Southern Pacific Co., or the contractor. In other words, perfect harmony prevailed.

(4) That on this job the first 60-in. centrifugal cast concrete pipe made in this part of California was laid. The type of construction of the exposed outfall should be of particular interest to engineers.

(5) Because 600 lin.ft. of the line was laid on concrete cradles on pile bents, below low tide, without the use of any sheeting.

Pipe Manufacture—Pipe 24 in. and smaller was manufactured by the California Concrete Products Co. at Oakland on a Turk McKenzie machine. Pipe 27 to 60 in., inclusive, was manufactured by the American Concrete Pipe Co. at Oakland by the Hume centrifugal process.

Condition of Old Outfalls—As the monolithic outfall sewers at Berkeley, constructed 15 years ago, have shown serious deterioration, a different type of construction was selected for this outfall. Examination of the old outfalls showed that the sewage has had practically no effect upon the concrete, as the interior is still firm and hard. But, disintegration has set in at the outside of sections exposed to the waters of the bay, and particularly at and near the water surface line at high tide. This disintegration extends in some cases well beyond the steel, and is so complete in some sections as to preclude the possibility of repair.



Laying 60-in. Double Wall Pipe on Concrete Cradles Supported by 2-pile Bents, Unit No. 5, Berkeley Storm Sewers

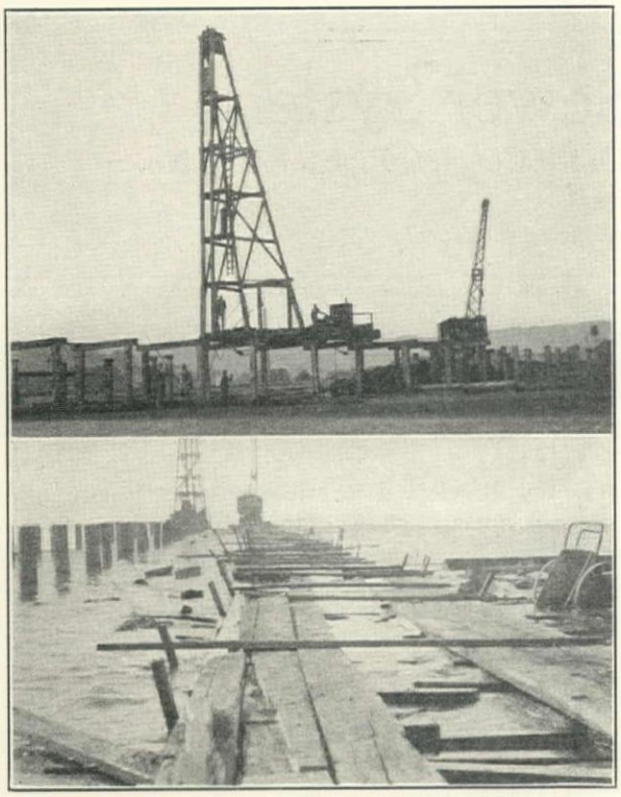
The outfall for Unit No. 5 is a 60-in. pipe, 8½-in. wall, reinforced with spiral steel, 0.25 sq.in. to the lin.ft., spaced 3 in. from the inner surface of the pipe. As the pipe was centrifugally cast, it is felt that the greater density of the concrete will prevent deterioration. To protect the joints, centrifugally cast collars

*Associate Member, American Society of Civil Engineers.

were calked on the outside and the inside was filled with mortar.

For foundation in the outfall section, 30-ft. piles were driven to 20-ton bearing. A concrete cradle placed on these bents extends to a minimum of 2 ft. below mud line to protect the piles. Bents consisting of 2 piles each were spaced on 8-ft. centers, so that the collars of the pipe would seat on bent cradles, the space around the collars being filled with concrete after laying.

This part of the work was ingeniously handled. A double row of false piles, spaced 12 ft. centers, was first driven and the gas-operated drop hammer rig carried out on these to drive bent piles. A Northwest model 105 power shovel, equipped with a ¾-yd. clamshell



Low and High Tide at End of Outfall, Unit No. 5, Berkeley Storm Sewers

at the same time threw up a levee on each side of the at the same time threw up a levee on each side of the line of the sewer. One levee was built wide enough to carry the shovel on mats, the other levee was light and temporary. By damming off both ends, the contractor could pump out a section covering six or eight bents, excavate for and place the form, and pour during low tide. Working practically between tides, Fredrickson & Watson Construction Co. made an average of six bents per day with a small crew. The Northwest was used as a crane in laying the pipe after the concrete bents had cured. Pipe laying was done only at low tide.

The remainder of the work was handled in the usual manner, but with real efficiency. Trenching for all pipe up to and including 27 in. was done with an Austin trencher, using 44-in. buckets. Trench for the 36 to 39 and the 42-in. pipe was dug with the Northwest, using a ¾-yd. hoe attachment. Trenching for 60-in. pipe, except where placed on piles, was done with the Northwest, using a 1-yd. dragline bucket.

Otto Bonnesen was superintendent for Fredrickson & Watson Construction Co., and George Turner was the resident engineer in charge of the work for the city.

CONSTRUCTION IN NIGERIA

By DANIEL R. MCFARLAND*
Civil Engineer, Azusa, California

Construction methods in Nigeria are very primitive, both because of the low-priced native labor and the fact that engineers in charge of construction have not been trained in modern methods.

Railroads—The largest single job now under construction in Nigeria is the new railroad bridge at Makurdi. This bridge is 2584 ft. long, consisting of three 240-ft. spans and ten 180-ft. spans. At the bridge site the water is 46 ft. deep and the center piers are 93 ft. below streambed. This bridge is part of the railroad line from Makurdi up the Benue river to Lake Chad, and construction of the road has just begun. Other railroad projects under construction include a line from Zania to Sakoto, one-half completed, and a line from Kano to Maidugari, one-third completed. On the railroad work, cuts and fills are made mostly by natives with headpans.

Highways—There is a rather extensive program of road construction planned, but funds are insufficient and little progress is being made. No road graders or rock crushers are used for road building. I asked the reason for this and was told that rock crushers were not used in the part of Europe that the engineer came from; also that he had never seen a road grader.

Water Works and Water Power—Water works are being planned or are under construction at Jos, Kano, Kaduna, Zaria, and Minna. There is one hydroelectric station operating in Nigeria and that is near Jos. A second one is now under construction in the same vicinity. Four years is required to construct an earth-fill dam containing 176,000 cu.yd. of material.

KAISER PAVING CO. ACHIEVES SAFETY RECORD

A real safety record was achieved by the Kaiser Paving Co. in its gravel plant at Livermore, California, during 1929.

There was not a single lost-time injury during the entire year, and this in spite of the fact that rock crushing operations are hazardous. An average of 35 men was employed at the plant throughout the year and a total of 84,000 man-hours worked. The Kaiser Paving Co., with headquarters at Oakland, is among the pioneers in the accident prevention movement.

The safety work has been under the supervision of J. J. Rosedale, consulting safety engineer.

FINANCING 1930 RESIDENCES

S. W. Straus & Co. estimates that more than $150,000,000 will be required in 1930 to finance the erection of new residential housing for Pacific Coast cities. Of this amount, 40% may be required for multi-family housing, including hotels.

*Associate Member, American Society of Civil Engineers.

River Crossings on the East Bay Aqueduct

By F. W. HANNA*

Chief Engineer and General Manager, East Bay Municipal Utility District, Oakland, California

The East Bay aqueduct of the Mokelumne river project of the East Bay Municipal Utility District crosses three branches of the San Joaquin river, known respectively as the San Joaquin river, Middle river, and Old river, all of which carry water several feet above the delta lands, and are strongly leveed. All of the crossings are alike in general design, and each consists of anchors on both the land and river sides of the levees, and two steel pipe-lines extending between the two exterior anchors and beneath the river channels.

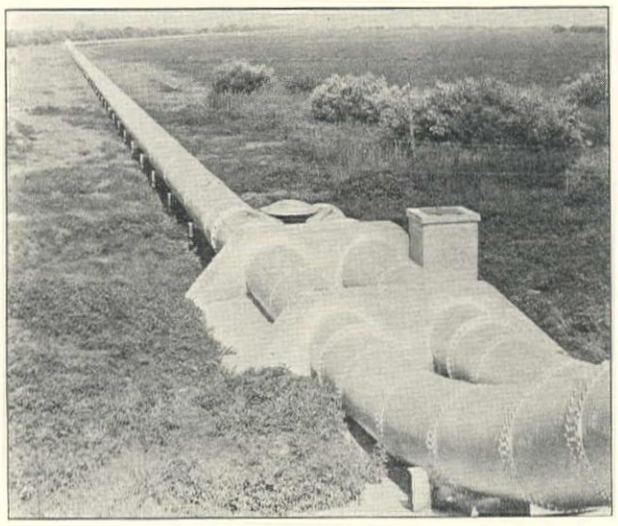


Fig. 1. Land Anchor and Transfer Connection at Middle River Crossing

Although the East Bay aqueduct across the delta lands consists of a single pipe-line at the present time, varying from 61 to 65 in. diam., it is the purpose in the future to install two additional pipe-lines to bring the capacity of the water supply system up to an ultimate of 200,000,000 g.p.d.

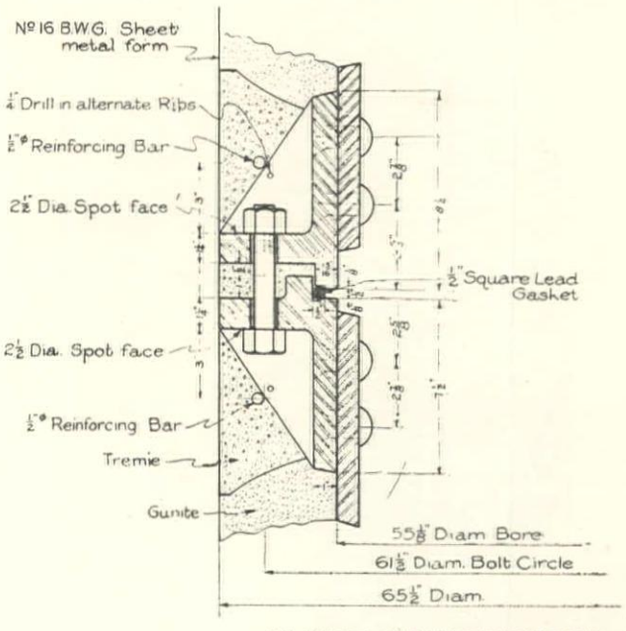
Duplicate Crossings—In order that continuous operation of the crossings may be insured, two 54-in. diam. pipe-lines on 8½-ft. centers were installed across each of the rivers. One of these lines serves as an extra unit for present needs and will be available for use with the second unit of the aqueduct when it is constructed. The duplicate lines are cross-connected at the outside anchors so that water can now be run in both pipes simultaneously or in either of the pipe-lines independently. Fig. 1 shows cross-connecting pipes and the landside anchor on the east side of Middle river.

Anchors—The anchors at the extreme ends of the double pipes of the river crossings are designed to absorb the full temperature pulls or thrusts of the pipe-line. As the anchors are founded on peat soil of considerable depth, it was necessary to use a large number of piles driven in planes parallel to the pipe at angles with the ground surface to resist the pulls or thrusts of the pipe. Each of the exterior anchors contains 121 piles driven into the ground to a depth of about 50 ft.

The anchors on the river sides of the levees are also designed to take the pulls and thrusts of the pipe due to expansion and contraction. They each rest on 77 piles driven from 40 to 50 ft. into the river banks. Half of the piles are driven vertically and the other half are given slopes downward toward the river channels.

Fabricating and Distributing Plate—The steel plates for the river crossings were rolled at Pittsburgh, Pennsylvania; transported by rail from there to Newport News, Virginia, and cut into proper lengths for use in manufacturing the pipe; shipped by steamer from there through the Panama Canal to Berkeley, where they were made up into pipe sections and tested; transported on barges to Antioch and there united into larger field sections and given a protective coat of gunite; then towed by tugboats to the sites of installation.

Making and Testing Pipe—The steel pipes of the river crossings were made in 30-ft. sections out of two plates, each ½-in. thick, joined with electrically-welded longitudinal seams. These sections were then subjected in the shop to a hydrostatic test producing a tensile stress of 20,250 lb. per sq.in. in the pipe plate, dipped in Hermastic pipe coating, and then transported to the field yard where they were joined into field sections varying from 60 to 180 ft. in length according to



FLANGE CONNECTION FOR RIVER CROSSINGS

Fig. 2

*Member, American Society of Civil Engineers.

the tangent and vertical curve requirements of the grades at the river crossings.

The joints in these lengths were of the double-riveted butt strap type; and the ends were terminated with specially designed cast steel flanges. (See Fig. 2 showing details of the plan of connection.) It will be noted that the joints were encased with tremie concrete after installation. Cast steel bulkheads were placed on the ends of the sections and they were then

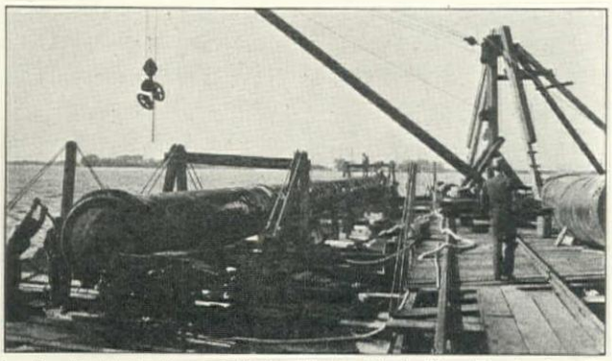


Fig. 3. Field Section of 54-in. Diam. Steel Pipe Ready for Test

tested for 24 hours under an internal pressure of 250 lb. per sq.in. (See Fig. 3 showing one of the field sections ready for testing.)

Transporting and Handling Pipe—To provide for transporting the pipes by flotation from the field yard to the sites of installation, and also for exterior protection, the pipes were given a 4-in. coat of 1 : 3 gunite,

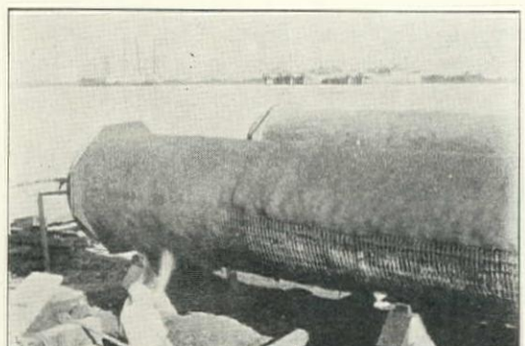


Fig. 4. Gunited Field Sections of 54-in. Steel Pipe on Barge Ready for Submergence

reinforced by two layers of 2 by 4-in. mesh No. 13 by 13 wire fabric with side laps of 2 and end laps of 4 in. (See Fig. 4 showing some of the gunited field sections.) The inner course of the wire fabric was placed ⅜ in. from the inner surface and the outer course 1½ in. from the outside surface of the coat. The plan of installation required the sections to be handled by means of slings placed at two points distant 0.21 of the length from the ends, thus producing tensile stresses in the pipe sections immediately over the slings and at the centers. To protect the gunite against cracking from these stresses, ¾-in. diam. steel reinforcing rods were placed in it. The reinforcement for taking up tensile stresses produced immediately over the slings extended from the ends of the sections 0.4 of the lengths towards the centers; and those placed for taking up stresses at the centers of sections were extended each way from the centers 0.3 of the lengths. The weight of the pipe, gunite coating, and reinforcement was just sufficient so that, when the pipe was empty and fitted with bulkheads, it would float. This furnished a means of transporting the pipe with tug boats from the point of manufacture to points of installation.

Construction Features—Each of the crossings, including outside anchors and transfer sections, is approximately 1000 ft. long, of which 500 to 600 ft. is submerged in the streambeds between the interior anchors. The pipes between the exterior and interior

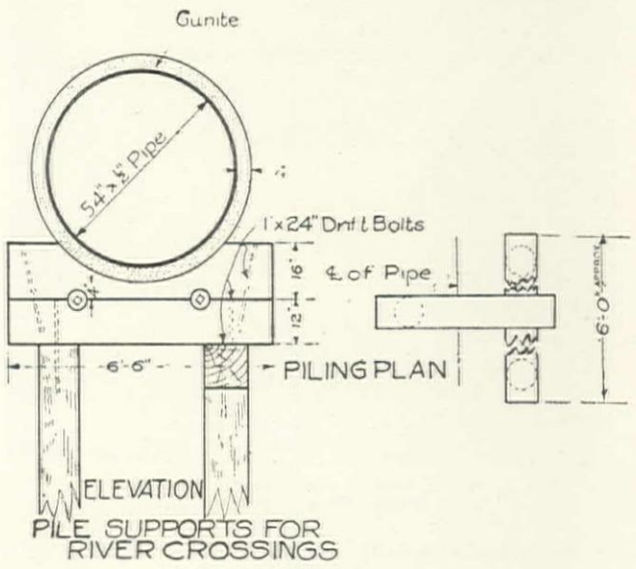


Fig. 5

anchors are supported at 30-ft. intervals on piles cut off below ground water level and capped with 12 by 12-in. redwood timbers on which are supported bents of redwood timbers of the same size. Between the interior anchors, the supports are spaced also at 30-ft. intervals and each support is carried on three piles driven in the form of a triangle, two in a line parallel with the pipe on one side of it and the third on the opposite side. The two piles on the one side are cut off 1 ft. lower than the pile on the other and capped with a 12 by 12-in. redwood timber. Then a super-cap is placed on top of the third pile and sub-cap, so that the super-cap and cradle might rest in a right-angle position with reference to the pipe-line. The trenches in which the twin pipes are installed were excavated and the piles driven to the desired grade. These grades follow well below the riverbeds, and the tops of the pipes are about 40 ft. below mean lower low water in the deepest part in order to give ample clearance for navigation. (See Fig. 5 showing pipe supports for river crossing.) The double pipes are above ground surface between the exterior and interior anchors and are provided with concrete road crossings on the tops of the levees and with manholes and air and vacuum relief valves at the highest points.

The trenches in the river beds having previously been excavated and the pile foundations driven, the floating sections were towed to position between two barges with an opening of about 20 ft. between them along the line. (See Fig. 6 showing one of the field sections in position between the installation barges at Middle river crossing.) After removal of the bulkheads they were lowered by means of block and tackle equipment supported from 'A' trusses resting on the barges and operated with hoist engines also on the barges. After lowering the pipes into the trench, wooden cradles were cut to fit between the pipe and the caps on top of the pile foundation. The placing of these cradles and joining together of the flanges were done by divers. The pipe-lines were then given another hydrostatic test of 220 lb. internal pressure and backfilled with excavated material from the pipe trenches.

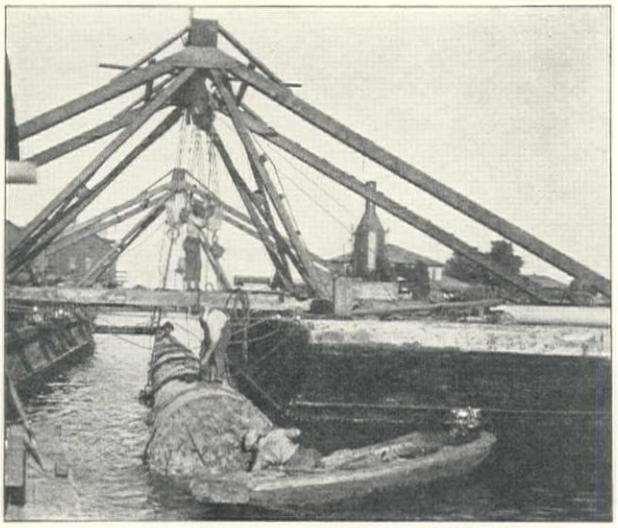


Fig. 6. Field Section Ready for Installation at Middle River Crossing

Editor's Note—For further details on design and construction of the river crossings see 'The Mokelumne River Water Supply Project for the East Bay Municipal Utility District, California' by Philip Schuyler, January 10th, 1928, issue, p. 11-14, and 'East Bay Aqueduct' by F. W. Hanna, December 25th, 1928, issue, p. 795-797.

Highway Construction Between Pueblo and Colorado Springs

Federal Aid Projects on 26 Miles of Colorado State Highway No. 1

By P. C. THURMOND
Resident Engineer, Colorado State Highway Department, Pueblo

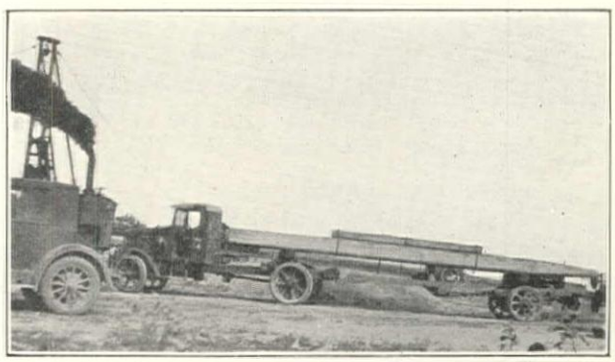
Location—F.A.P. 277-D and 277-E cover 26 miles of Colorado state highway No. 1 between Pueblo and Colorado Springs, the only portion between Denver and Pueblo which remains unpaved. F.A.P. 277-E begins 12 miles south of Colorado Springs where the pavement from the north now ends, and extends in a southerly direction 9½ miles, ending 2 miles south of Fountain river and just west of Buttes station. F.A.P. 277-D begins at this point and extends 15½ miles south, connecting with existing pavement 5 miles north of Pueblo.

The primary purpose of these two projects is to eliminate five railroad grade crossings between Pueblo and Colorado Springs. One of these is eliminated by a subway under the A.T.& S.F., 7 miles north of Pueblo, and the remaining four are effected by holding the new location beyond the subway on the west side of the railroad tracks to the north end of F.A.P. 277-E; a complete re-location for this project.

Detours for F.A.P. 277-D—About five miles of the survey for this project coincides with that of the old road. The remainder is new location and over 10 miles of the old road is being used as a detour during construction. Ten new detours had to be built. These are from 400 ft. to 1½ miles long, have a total length of 5 miles, and cost $4000 per mile. They were graded 20 ft. wide, of which 18 ft. was surfaced with 6 in. of gravel.

The gravel was crushed to meet standard specifications for gravel-surfaced roads, but was not wet and rolled. The surface was kept smooth with a blade until it had been compacted by traffic. Drainage on detours was handled by relaying salvaged corrugated metal pipe from the old road, or by timber bridges. Two of these bridges were built from salvaged lumber and one from new lumber and piling.

Divisions of F.A.P. 227-D—This project consists of two divisions. In division 1 is included all bridges, culverts, right-of-way fence, removal of old structures, and grading the road to the subgrade of the pavement in the center and to a point 1 ft. below the finished shoulders on the edges. Construction of all diversion ditches, side ditches, and channel changes, together with the required slope pavement and road approaches, is also included in this division, as is the railroad structure at the subway. However, railroad forces are

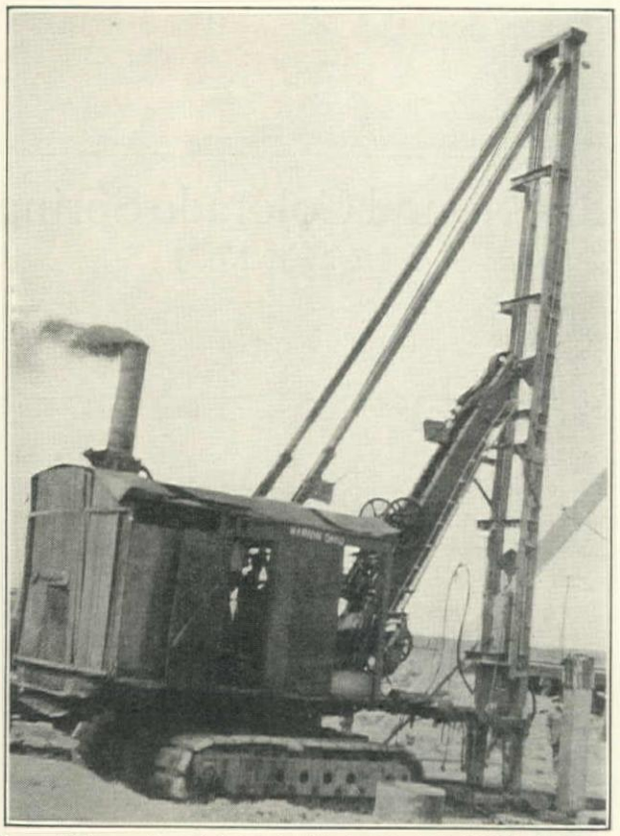


International Truck and Trailer Transporting Reinforced Concrete Pile to Bridge Site, F.A.P. 277-D

building the latter structure. In division 2 is included the removal of structures in that portion of the old road which is to serve as a detour until the new road is opened for traffic, furnishing and placing the sand cushion, 4 miles of sand subgrade treatment, laying pavement, constructing paving drains, headers, and wire-cable guard fence.

Work under division 1 is included in the present contract. When this contract has been completed and the grade has settled, a contract will be awarded for work under division 2.

Design of Roadway—When division 2 has been completed, the roadway will be 30 ft. wide, consisting of 18 ft. of portland cement concrete pavement with a 6-ft. earth shoulder on each side. At the railroad subway, the pavement will be widened for several hundred feet to 30 ft., with 6-ft. shoulders, to accommodate approach curves. Side ditches will be 2¼ ft. deep, with



Osgood Steam Shovel Rigged with Leads and 6800-lb. Hammer for Pile Driv.ng on F.A.P. 277-D

a 2:1 slope on the highway and a 1½:1 slope on the back side. All fill slopes will be 2:1.

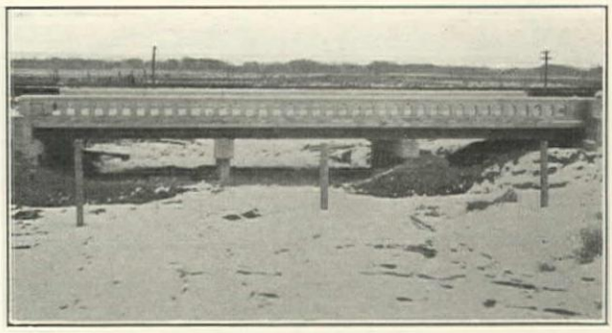
The pavement will consist of two 9-ft. concrete strips. Each strip will be 9 in. thick at the outer edge, tapering to 6½ in. at 3 ft. from the edge, and retaining this thickness to the center. There will be transverse expansion joints at 60-ft. intervals. The pavement will be laid on a 2-in. sand cushion and, where necessary, sand subgrade treatment will be used.

Since division 1 is being graded to 1 ft. below the finished shoulders, the grade is 34 ft. wide except in the vicinity of the subway, where it is widened to 46 ft.

The maximum curvature is 4 deg.; only two such curves being used on the project. These are required on the subway approaches in order that the desired crossing angle with the railroad may be obtained. There are no other curves sharper than 2 deg. The maximum grade is –4.6% approaching the subway from the north; the grade leaving the subway to the south is –0.12%. Few grades are more than 2%; they are generally less than 1%.

Drainage is carried south from the subway in an open ditch.

Bridges, Subway, and Culverts—All bridges are of concrete and steel, with a minimum roadway width of



63-ft. Reinforced Concrete Pile Bridge on F.A.P. 277-D

20 ft. There are 11 bridges on the project, ranging in length from 19 to 118 ft. Three of these are 80-ft. girder bridges on gravity-type piers, with 30-ft. approach spans on concrete piling. Their superstructures consist of reinforced concrete slabs with reinforced concrete guard rails. The remaining eight bridges are constructed on concrete piling, with reinforced slab and guard rail superstructures.

The railroad structure is a 43-ft. girder span on gravity-type abutments, with 16-ft. clear height from the bottom of the girders to the pavement crown.

All culverts are of reinforced concrete.

Quantities and Unit Prices on F.A.P. 277-E—J. L. Busselle, of Colorado Springs, was awarded the contract for F.A.P. 277-E, with a low bid of $221,389, on the following quantities and unit prices (information following the list refers to F.A.P. 277-D only):

Common excavation—53,600 cu.yd. at $0.19
Rock excavation—4400 cu.yd. at $0.19
Borrow excavation—104,800 cu.yd. at $0.18
Detour excavation—4000 cu.yd. at $0.19
Detour surfacing—3700 cu.yd. at $1.10
Overhaul—94,100 sta.yd. at $0.02
Corrugated pipe culvert—522 lin.ft. of 18-in. at $1.60 and 180 lin.ft. of 24-in. at $2.50
Corrugated pipe siphon—133 lin.ft. of 18-in. at $1.10; 207 lin.ft. of 24-in. at $1.60; and 371 lin.ft. of 30-in. at $2.00
Concrete—3288 cu.yd. of class 'A' and 402 cu.yd. of class 'B' at $16.50
Steel—444,450 lb. of reinforcing and 852,800 lb. of structural at $0.05.

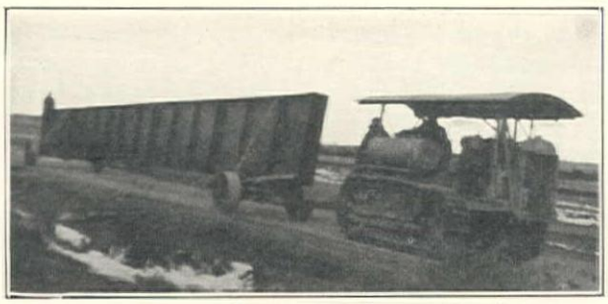
Quantities and Unit Prices on F.A.P. 277-D—M. E. Carlson, Denver, was awarded the contract for division 1 of F.A.P. 277-D with the low bid of $218,277. The estimated quantities and unit prices follow:

Remove 38 structures from old road—$800 (lump sum)
Remove wire fence—20,800 lin.ft. at $0.02
Common excavation—154,000 cu.yd. at $0.20
Rock excavation—100 cu.yd. at $1.50
Borrow excavation—75,750 cu.yd. at $0.20
Detour excavation—7800 cu.yd. at $0.20
Overhaul—598,200 sta.yd. at $0.02
Dry common structure excavation—3880 cu.yd. at $0.75
Wet common structure excavation—1490 cu.yd. at $1.00
Dry rock structure excavation—210 cu.yd. at $1.50
Wet rock structure excavation—145 cu.yd. at $2.50

Corrugated metal culvert pipe—926 lin.ft. of 18-in. at $1.80; 90 lin.ft. of 24-in. at $2.50
Corrugated metal siphon—65 lin.ft. of 24-in. at $1.50
Detour surfacing—7800 cu.yd. at $1.75
Concrete—3039 cu.yd. of class 'A' and 212 cu.yd. of class 'B' at $16.
Reinforcing steel—350,000 lb. at $0.0475
Structural steel—512,400 lb. at $0.06
Untreated timber—20.9 M f.b.m. at $60.
Untreated piling—912 lin.ft. at $1.00
Precast concrete piling—5150 lin.ft. at $4.00
Barbed wire fence—150,900 lin.ft. at $0.06
Grouted rock-slope paving—1000 sq.yd. at $4.00
Sheet copper—730 lb. at $0.50
Trash guards—3 at $20.00 and 2 at $12.50
Project markers—2 at $20
Manhole ring and cover—1 at $10
Place salvaged culvert pipe—600 lin.ft. at $0.50
Drain pipes—108 at $2.00

There was a small amount of clearing and grubbing which was let for a lump sum of $500.

Excavation quantities were found to differ considerably from the contract estimate because of classification. The class 'A' concrete overran 300 cu.yd. due to extra culverts and one extra siphon.



Caterpillar '60' Hauling Steel Girder to Site of Bridge Structure on F.A.P. 277-D

Constructing F.A.P. 277-D—Work was started May 10, 1929, with a contract time of 250 working days. At present (January 20, 1930) 164 working days have been used and the grading is 98% complete, while the remainder of the work is 90% complete. The contractor has done all of the work except wire fencing, and his subcontractor has completed the bridges and culverts. It is expected that the contract will be completed well within the time limit.

Camps—There have been two camps on the project. One, belonging to M. E. Carlson, was first established near the south end of the project and then moved from time to time to accommodate the grading crews. There were usually 50 men and 50 teams in the grading crews kept at this camp. The other camp, belonging to the J. H. Miller Construction Co., subcontractor on bridges and culverts, was established at Pinion station. Although that was not the center of the project, it was a convenient point from which to operate, as most of the large bridges were in the vicinity. There was also a satisfactory supply of spring water at this place. The J. H. Miller camp, maintained at Pinion since the work started, has accommodated an average force of 30 men employed on bridges and culverts.

Equipment—During the summer of 1929, M. E. Carlson used the following equipment:

2 Osgood steam shovels (one with a 1-yd. dipper and the other equipped with leads and a hammer for pile driving)
1 Galion gravel screening plant, operated by gasoline engine
1 Western elevating grader
1 Caterpillar '60' tractor
2 4-yd. dump trucks (1 White and 1 International)
2 5-yd. dump trucks (1 International and 1 Mack)
8 small trucks (4 Chevrolet and 4 Ford)
3 concrete mixers (1 Jaeger model 75, 1 Marsh-Capron No. 7, and 1 Lansing No. 5)
2 blades (10-ft. Russell and 6-ft. Galion)
3 water tank trucks (10-bbl. pressed steel Hardesty tanks on Chevrolet trucks)
10 Western dump wagons
9 plows (Western and John Deere)
22 fresnoes
2 concrete carts
18 wheelbarrows
2 blacksmith shops
Small tools.

Source of Materials—The sand for all concrete work was obtained from the Fountain river, in the valley of which the road is located. Two pits were opened at convenient points. The sand was washed and screened at the pits and hauled to the sites of the various structures or conveniently stockpiled for future use. The coarse aggregate for concrete was crushed limestone and was shipped to the project from Cripple Creek, Colorado. 'Ideal' brand portland cement was used in all the concrete work.

Gravel for surfacing detours was found at several points along the line. It was crushed at the various pits, screened, and hauled with trucks.

Structural steel was bought from the American Bridge Co., and reinforcing steel from the Colorado Builders Supply Co. The Hardesty Manufacturing Co., Denver, supplied the corrugated metal culvert pipe.

Culvert Construction—The construction of culverts was started well ahead of the grading and was so carried out that in few instances was the grading held up to permit the building of these structures. Most of the culvert excavations were made with teams, enough teams being used to keep the excavation well ahead of the form setters. Two form-setting crews and two concreting crews worked nearly all of the time until the culverts were completed.

Constructing 140-ft. Steel Girder Bridge on F.A.P. 277-D. Note Temporary Trestle from which Steel is Jacked Into Position

Detour Construction—Work was also begun on detours about the time that the culverts were started, so that detours were ready to be opened as soon as it was necessary to disturb portions of the old road.

Casting and Driving Piles—When the culvert work was started, a pile yard was established at Pinion, near

the camp, and all precast concrete piling was made at this yard. It was specified that piling should be cured 30 days before moving it from the yard. At the expiration of this time, the piling was hauled by truck to the various bridge sites and immediately driven.

The Osgood shovel used for pile driving was fitted with leads and a double-acting hammer while the first piling was being made. The hammer weighed 6800 lb. and developed a blow of 8200 lb. under the steam pressure generally obtained. This rig was used for driving all of the piling on the north half of the project. It was then turned over to J. L. Busselle, contractor on F.A.P. 277-E, and a shovel which had completed excavation for the subway near the south end of the job was similarly rigged and used to drive the remaining piling of F.A.P. 277-D.

Handling Steel—All steel was hauled to the bridge sites with trucks and tractors. The 80-ft. girders were placed across the gulches by building temporary bridges, hauling the steel into position, and lowering it onto the piers with jacks.

Concreting—The only central mixing plant was for precast piling. All other concrete was mixed at the sites of the various structures.

Grading was first started at the subway near the south end of the project. This cut was 2000 ft. long and contained 54,000 cu.yd. of material, or about one-third of all roadway excavation in the contract. By starting here, ample time was given for constructing drainage structures at other points. Excavation in the subway cut was begun with an elevating grader and 10 dump wagons. The grader was operated with a Caterpillar '60' tractor and three-horse teams were used on the dump wagons.

The contractor moved 750 cu.yd. per day with this outfit, making an average haul of 1000 ft. After moving 18,000 cu.yd. in this manner, shale was encountered in the cut and no further progress could be made with the equipment in use. The contractor then moved his elevating grader, dump wagons, and teams to the various cuts and borrow pits from which considerable hauls were to be made. The remainder of the subway cut was drilled and shot and the material loaded by steam shovel into trucks. With this equipment, Carlson moved 250 cu.yd. per day for an average haul of 750 ft. at about the same cost as he had moved 750 cu.yd. with the grader and wagons.

All materials were moved with teams and fresnoes where hauls were of short length. Temporary corrals and feed yards were made near the points where team work was being done, so that little time was consumed in going to and from the work.

Driving Piling—One construction feature was the pile driving and manner in which the Osgood steam shovel was equipped for this purpose. Soundings had been taken at all structure sites prior to the completion of the plans. From reports of the driller, it was thought that there would be no trouble in driving the piling. However, in most instances driving to any considerable depth proved to be impossible without first drilling and shooting the holes. Where piles were driven without this drilling and shooting, the work was done at considerable extra cost to the contractor as well as damage to the piles.

Personnel—L. D. Blauvelt is state highway engineer at Denver; James D. Bell, division engineer of division 4, Colorado State Highway Department, is in general charge of the work; I am resident engineer on F.A.P. 277-D, and Harry Littlefield is resident engineer on F.A.P. 277-E. Drexel Lacey located F.A.P. 277-D and drew all plans except for bridges and culverts, which were designed at the Denver office. As it was some time before construction started on the project, Lacey was transferred to F.A.P. 272-D. Chas. Funk was superintendent for M. E. Carlson. For the J. H. Miller Co., Hart Voss was superintendent of bridges, and George Pancake superintendent of culverts.

SACRAMENTO NORTHERN CONNECTS VACA VALLEY TO MAIN LINE

Construction of 7½ miles of railroad in Solano county, California, to connect the main line of the Sacramento Northern Railway with its detached Vaca Valley branch is to be expedited so that the line will be completed and placed in operation in time to handle the 1930 fruit crop.

The connecting line will be constructed between Creed, a station 32 miles west of Sacramento on the Sacramento Northern's main line between Sacramento and Oakland and San Francisco, and Vacaville Junction, a station on the Vaca Valley branch. The Vaca Valley branch, 15 miles long, now operates between Vacaville and Suisun-Fairfield, and also to Willotta. The branch was constructed as part of the projected Vallejo Northern, which was planned to operate between Vallejo and Sacramento, and is now isolated from the other lines of the Sacramento Northern system.

Work of building the connecting line was begun in September, 1929, and as the remainder of the right-of-way is now being acquired, the contract has been awarded to the Utah Construction Co. which put a force of men and construction equipment at work at Creed during January.

Operation of the connecting line, to cost $400,000, will be of great advantage to shippers located on the Vaca Valley branch which serves an important fruit and agricultural section. It will give the fruit shippers a much later closing hour than is now possible for the loading of cars and still enable the Sacramento Northern to transport them to Sacramento in time to connect with the fast fruit blocks of the Western Pacific and make the same arrival at eastern markets as is now made.

It will also give the territory served by the Vaca Valley branch and the connecting line a new outlet to the San Francisco Bay region, as well as to Sacramento and other points served by the Sacramento Northern and its connections.

INCREASED FEDERAL AID FUNDS

On January 29, the Senate adopted a House resolution increasing the yearly Federal Aid highway appropriation for the next three fiscal years to $125,000,000, or $50,000,000 beyond the regular amount. The maximum Federal Aid to be expended on each mile of designated highway construction was raised from $15,000 to $25,000.

Handling Large Construction by Contract*

By F. A. BANKS†
Construction Engineer, Owyhee Project, Bureau of Reclamation, Vale, Oregon

Of the $13,000,000 appropriated by Congress from the reclamation fund for expenditure during the past fiscal year, over $10,000,000 was for construction to be handled by contract, the remainder being for surveys, construction by government forces, operation, maintenance, and miscellaneous work.

Also, the unexpended balances of previous appropriations were, in some instances, made available for expenditure. In the administration of this work, involving the expenditure of 75% of the bureau's funds, certain problems were bound to arise.

The construction of public works involves a service to the general public, and in many instances the acceptance of a vital responsibility by those to whom the work is entrusted. The work must be worth what it costs to those against whom the cost is assessed, and it must perform the service for which it was intended.

Construction by Contract—One of the methods of handling public work is by contract through competitive bidding. It is with this method that I shall deal.

The policy of constructing public works by contract is predicated upon the proper correlation of the ability, training, experience, and other necessary qualifications of those two groups of professional and business men ordinarily referred to as engineers and contractors. Upon the engineer rests the responsibility for the preparation of the plans and specifications for the work, and the execution of the work by the contractor in accordance therewith. Upon the contractor rests the responsibility of so organizing his forces, developing his methods, and utilizing his resources, that he can perform the work at a rate and cost and in a manner that will justify awarding the work to him. Under this plan, when properly administered, every item or phase of public interest is properly served and safeguarded. The great public works of this country that have been constructed by the contract method are monuments to its success.

Organization and Administration—Whenever a task exceeds the capabilities of one individual, its accomplishment becomes a problem in organization and administration, and this, in my opinion, is the greatest problem in handling any large work. In administering the civil-service rules and the regulations governing appointments in the field service, I presume that most of us have discovered some problems for solution. It is sometimes just as important to the efficiency of an organization to effect a separation as to secure an appointment; but the process is liable to be even more difficult. If it so happens that the desire for the separation of an undesirable is coincidental with a general reduction in forces, it is easily gratified. But, during the period of expansion of an organization the weeding out process becomes a real problem so far as it affects classified employees and emphasizes the necessity for a careful survey of employees during their probationary period.

In developing an organization it is not merely essential to fit the round pegs into the round holes; there must be teamwork and a spirit of cooperation and loyalty if the best results are to be obtained.

Too little attention is frequently paid to personnel matters, yet this is a most important factor in developing an efficient organization. In adjusting salaries, a graph can be used to good advantage to indicate at a glance the compensation of each employee and the dates of changes. Every effort should be made to secure the proper relationship between the capabilities of the men and their compensation.

Selecting the Contractor—The multiplicity of the problems of construction and their seriousness from the standpoint of the engineer are closely associated with the selection of the contractor, and in this matter the engineer engaged in public work has little or no voice. It is common practice among private corporations when advertising for construction to invite proposals from a half dozen or so contractors who they are satisfied are well qualified to handle the proposed work. Ample competition is secured and satisfactory results are obtained. Many of the difficulties encountered in the construction of public works by contract could be avoided if some such plan could be followed by the Government. A recent decision, however, by the comptroller (A-24906) forestalls any limitation of bidders on Government work and is of interest to Government officers in charge of construction which is being handled by contract. In this case, the Treasury Department attempted to limit the bidders on the new Internal Revenue bdg. at Washington, D. C., to contractors who had, within the past four years, constructed a building costing $2,500,000 or more. The comptroller ruled that "there may be no exclusion of bidders for the performance of Government work; but in awarding contracts for such work, there may be taken into consideration, when specified in the advertisement for bids, the business and technical organization or nucleus thereof of a contractor available for Government construction, his experience in building, and the financial resources of the contractor sufficient to enable him to finance such part of the work as is not financed by the United States." The comptroller also, in this decision, drafted a paragraph which, with some modification, might be inserted to advantage in future notifications to prospective bidders. Without some such paragraph, it

*Reprinted from 'New Reclamation Era', December, 1929.
†Associate Member, American Society of Civil Engineers.

has been difficult in the past to justify the rejection of the lowest bid, even though there was ample evidence to support such action. In the future, upon proper showing, such action may be possible.

Superintendent of Construction—The selection to be made by the contractor of the superintendent to represent him on the job is a most important factor in the success of the undertaking. A superintendent who is experienced in the particular class of work covered by the contract, not only has a large personal advantage over others not so experienced; but what is fully as important, he usually has a following of experienced men in the minor positions who are ready to undertake their respective duties with a minimum of instruction. It does not take a crew of this kind long to get under way. Plans and programs are worked out well in advance and reviewed by the engineering staff, with the result that errors, if any, are detected and corrected before they become of consequence, and the work progresses with the smoothness of a well-operated machine. Obstacles mean little to an organization of this kind and there is some satisfaction in working with it. A superintendent of my acquaintance always introduced the principal inspector to each new foreman or subforeman in some such manner as this: "This is the Government inspector. He will tell you how he wants this work done. I want you to do it just that way and get it done to the best interest of the company". This, I believe, represents the attitude of many of the most reliable and experienced contractors and promotes a spirit of mutuality that goes a long way in solving the problems that arise.

With an inexperienced superintendent, the problems are too numerous to mention. His own subordinates are quick to notice the mistakes, their support is lost, inefficiency develops, attempts are made to shift the responsibility, losses occur, the contract is suspended, litigation and delay result. Perhaps the bondsmen undertake the contract or it is readvertised, all of which add to the problems of the engineer.

Reducing the Contractor's Risk—In handling large construction by contract, a saving to the Government generally results when the risk to be taken by the contractor and the contractor's investment is reduced to a minimum consistent with protection of the Government's interest. This is usually accomplished through: furnishing by the Government of materials becoming a part of the completed work; a thorough exploration of the site of the work to develop subsurface conditions as to bedrock and materials to be excavated; a proper preparation of the schedule of quantities and classification of materials; the location of sources of such material as concrete aggregates, riprap, earth borrow; the furnishing of power and transportation facilities; and the submission of plans and specifications in sufficient detail to permit the contractor to prepare an intelligent bid. Best results are more liable to be obtained in cases where the contractor has been furnished with complete information with respect to the work. Most of the contractor's difficulties have developed from a lack of information furnished him, or his inability to interpret such as he had.

Exploration of Dam Foundation—The exploration of the foundation for a large dam is one of the interesting and important functions of the engineer and is usually accomplished in cooperation with the geologist. The value of the geologist's advice in laying out exploration programs and in interpreting their results has long been recognized by the Bureau of Reclamation in the selection of sites for dams and reservoirs.

At Arrowrock dam (Southern Idaho) the foundation consisted of massive granite to unknown depths, with a relatively small cap of lava plainly exposed to view on the left abutment. The exploration in this case merely served to determine the depth of alluvium over the bedrock and confirm previous impressions as to the quality and extent of bedrock. This was done by wash boring and diamond drilling.

At American Falls dam (Southern Idaho) the geology of the damsite could be determined with reasonable accuracy from exposures in the canyon below the falls, and a study of faulting in the immediate vicinity. Prior to exploration, it was suspected that the site was crossed by a fault, that the sequence of strata from the surface down was basalt, spherulitic obsidian, and tuff overlain by volcanic ash on either side of the riverbed. The exploration, which was done with an ordinary well-drilling rig, determined the depth of soil over bedrock or either side of the river, the thickness of the basalt and obsidian strata, and not only located the fault but determined the amount of its displacement at different points, and permitted the location of the dam at a point where the displacement and resulting shattering were negligible.

At the Owyhee damsite, the height and magnitude of the structure and the resulting high pressures and stresses justified a most searching examination of the damsite, involving over 3000 lin.ft. of wash boring and 4000 lin.ft. of core drilling, in connection with which the riverbed was penetrated to a depth of 264 ft. and the right and left abutments 435 ft. and 140 ft., respectively. The drilling confirmed the early impressions of the geologist that the canyon comprising the damsite was formed by the river cutting through a tongue of felsite or ryolite enveloped in pitchstone agglomerate, all of which was extruded over tufaceous conglomerate or tuff. The topography indicated that the thickness of the ryolite at the damsite was 325 ft. above low water and that its width corresponding to the length of the box canyon was 2000 ft. The borings developed the additional information that the ryolite extended for 200 ft. below low water with an average of 20 ft. of pitchstone agglomerate and an indeterminate amount of tuff below it, and that it extended in a horizontal direction normal to the canyon beyond the limits possible of exploration with the available equipment. One of the important facts developed by the borings and one that played a large part in the location of the dam was that there was a material increase in the thickness of the ryolite below low water, as the testing progressed downstream from the upper end of the box. This led to the selection of the present site, which is 600 ft. downstream from the upper edge of the ryolite or about a third of the distance through the canyon.

Another important development as a result of drilling was the discovery of a fault through the damsite that undoubtedly started the formation of the canyon.

The fault zone is about 10 ft. wide and is filled with crushed ryolite that indicates little movement in the mass. It was located while attempting to determine the lowest point in the foundation which is so essential in computing quantities and planning cofferdams. Its location was subsequently verified by cross-cutting the base of the canyon with inclined holes. The discovery of this fault, of course, promptly raised the question as to the probable amount of movement and the chance of its recurrence. What seems to be an extension of the fault into the canyon walls was explored, from which it appears that the movement was slight and in a horizontal direction. Although assurance that future movement will not take place can not be given, the probability of it is more or less remote. The presence of the fault was an important factor in influencing the change in the design from a light to a heavy arch section and in embodying a provision for the treatment of the fault zone in the plans and specifications and emphasizes the necessity for thorough exploration.

Location of Concrete Aggregates—The location of a sufficient volume of suitable concrete aggregates is of major importance in the production of large volumes of concrete. Prior to the construction of the American Falls dam, a large part of the concrete aggregates used in that vicinity was hauled by train for 65 miles. A careful search of the adjacent territory revealed an almost unlimited supply of most excellent material adjacent to the railroad with a haul of only 15 miles. When examined by the Bureau of Standards at Denver it developed to be one of the heaviest aggregates ever tested there and to produce concrete of the highest strength. The sand, however, had a fineness modulus of about 4, which was too coarse, and grinding was attempted. The material was so hard that grinding proved to be impractical, and the problem was solved by introducing sufficient sand with a fineness modulus of about 2 to make a workable mix. The finer sand was located within a mile of the dam, hauled on trucks, and blended on the belt running from the stockpile to the mixing plant. It so happened that a shortage of sand developed in the main pit, so that all material taken from this pit could be used in the concrete without wasting any aggregates.

Preliminary plans for the construction of the Owyhee dam, which was originally planned as a thin arch structure, provided for the use of local sand, gravel, and crushed rock. Suitable materials in sufficient quantities could not be located nearer than Adrian, 22 miles away, and a railroad was consequently located to connect the Owyhee damsite with a branch line of the Oregon Short Line at that point. Subsequently, a large body of sand, gravel, and cobbles of excellent quality and of sufficient volume to satisfy the requirements of the entire project was found near Dunaway siding, 24 miles from Owyhee damsite and 7 miles from Adrian, and the location of the lower 10 miles of the railroad was changed to connect with the same branch line at this pit. The superiority of these aggregates for the production of a strong, impervious concrete with a minimum amount of cement has been verified by numerous tests in the laboratory of the Bureau of Standards at Denver and in the field laboratory at the Owyhee damsite.

Concrete Mixes—The importance of design and field control of concrete mixes to produce required uniformity, workability, impermeability, and strength in the construction of dams and other structures of magnitude is quite generally recognized. The problems involved emphasize the necessity for the establishment of a field laboratory equipped not only for the testing of cement, but, what is of much greater importance, for the mechanical analysis of aggregates and the compressive testing of concrete.

Inspection—The matter of inspection is one concerning which much might be said without covering any new ground. That it is of major importance on construction being handled by contract is well understood. A contractor on important construction is entitled to the services of a high-grade inspector with training, experience, and ability commensurate with his duties. The inspector should be the point of contact between the engineer and the contractor, and it is important that all orders and instructions to the contractor be given through him in order that he may have first-hand knowledge as to all details and be at all times sure of his ground. An inspector who is merely a critic has not sensed his real function in the organization. His work should be constructive. By frequent conferences with the contractor's representatives, he should make sure that a satisfactory program is outlined and have his engineering far enough in advance to prevent delay to the contractor. It is his duty to see that the contractor has been furnished with the latest drawings, that the old ones have been plainly marked 'superseded', and that all work is laid out, checked from every angle, and performed in accordance with the plans and specifications.

Classification of Material—Although the classification of material does not usually develop to be a matter of great importance in the construction of large dams, particularly masonry dams, it does constitute one of the principal problems in handling large excavation projects by contract. This is due partly to the fact that our specifications for classification have not kept pace with progress made in excavation methods. An attempt is still being made to classify dragline and shovel work with a team specification.

Plans and Specifications—The essence of success in handling construction by contract is embodied in the plans and specifications. No phase of engineering requires such keen vision and forethought or such a thorough knowledge of engineering principles and their application to construction in the field as must be utilized in taking a mass of data in the form of topographic maps, diamond-drilling and test-pit records, hydrometric studies, and reports on geology and preparing from them a set of plans and specifications in which are illustrated and described the most intimate details of the work and just how it should be performed. The engineers of the Bureau responsible for this type of engineering are to be commended in the highest terms for the excellency of their work. The recent act of Congress intrusting to this Bureau the design and construction of one of the world's largest structures (Boulder dam) is ample testimony of the public's appraisal of its ability.

Reminiscences of the Pioneer Engineers of California*

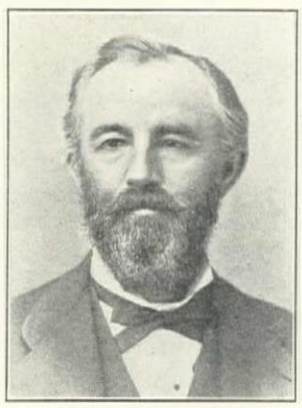
By OTTO VON GELDERN †
Consulting Engineer, San Francisco

Part V

There were many speakers who lauded to the sky the little, shy recipient of the honors, who sat at the right hand of Scott. While most of the speakers referred to Hesse's professional achievements in mechanical science, others touched upon his inventions, and still others upon his genial character and the human side of his life. I remember one of the

E. C. BURR

speakers, the late Albin Putzker, the head of the College of German in the University of California. He spoke of Hesse's character as that of a typical German student, and he made this Teutonic characteristic responsible for the thoroughness with which Hesse had been able to impart knowledge to students. To amplify



GEORGE F. ALLARDT§

this statement, Putzker referred to himself, and told the assemblage that in order to get a thorough knowledge of the modern Greek language and its relation to classical Greek, he had worked seven years in Greece to accomplish his object.

When the presiding chairman, Irving M. Scott, replied to Putzker, he said that he, too, appreciated

JOHN HOFFMAN

thoroughness, and particularly stick-to-itiveness, and that he, in order to obtain a thorough knowledge of things modern and classical in engines and boilers, had worked twenty-five years in grease—and in grease up to his elbows. Naturally, he brought down the house

CHARLES D. HOFFMAN

to Hesse's great delight, whom I had not heard laugh so heartily before.

One of our early technical writers was the late George J. Specht, who took up the subject of restraining debris and sediment of mountain streams at a time when the controversy between miner and farmer, in the great Sacramento valley, had become the all ab-

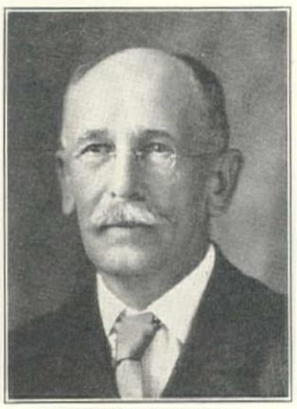
J. C. HENKENIUS

*Part I was published in the September 25th; Part II in the October 25th; Part III in the November 10th; and Part IV in the December 10th, 1929, issue.

†Member, American Society of Civil Engineers.

§Father of C. F. Allardt, mechanical engineer with C. C. Moore & Co., San Francisco.

sorbing topic, not only of the engineers of California but of the general public as well. He concluded that this was possible within limits only. His aim was this: that a commission be created to permit the building of dams for storing mining debris, where this could be done without injury to the rivers. This resulted subsequently in the establishment of the



CARL UHLIG‡

United States Debris Commission, which has done so much good work for our state and which is still active.

In other industries several names were quite prominent in the earlier history of the state's development. In the beet sugar industry of California, E. C. Burr, a native of San Francisco and a graduate of the best known technical and chemical colleges of Germany, stood out prominently for many years as a theoretical and practical expert, who had achieved great success

JAMES SPIERS

in the application of chemical science to the practical problems of manufacture.

Another industry which has become extensive on the Pacific Coast was first agitated by an engineer of the post pioneer period, F. Gutzkow. It is salt making from seawater and also the manufacture of magnesia. Gutzkow was a well trained metallurgist, and a son of the famous German poet and dramatist, Karl Ferdinand Gutzkow, whose well known master dramas 'Richard Savage', 'Zopf und Schwert', 'Uriel Acosta', and his great novels 'Ritter vom Geist' and 'Der Zauberer von Rom' had placed him in the front ranks of the literary geniuses of his time. His son Frederick came to California from Germany in the earlier days. He married into a well-known pioneer family, the Russ' of Russ House fame, and became prominently identified with the business interests of the Pacific Coast.

Ross E. Browne, one of my old friends, a mining and hydraulic engineer whom I mentioned before, lives in retirement in Oakland. It is one of my pleasures to visit him from time to time. He is a representative of that old guard of pioneer engineers typically Californian, who by his contributions to technical literature, called the attention of the outer world to the activities of our isolated Golden State. One of his most valuable contributions to hydraulic engineering, entitled 'Economic Head for Long Pipes', was pub-

A. T. HERRMANN

lished by the Technical Society of the Pacific Coast in 1889.

Other engineers of his day and time were the Hoffman brothers, John and Charles D., Major A. S. Bender, the ever genial and delightful George F. Allardt, Prof. Frank Soulé‡, Monsieur de Rougemont, C. J. Stut, F. von Leicht, E. J. Molera, J. C. Henkenius, Lewis Tasheira, Carl Uhlig‡, James Spiers, Arthur F.

L. J. LE CONTE‡

Price, Luther Wagoner‡, Hubert Vischer, A. T. Herrmann†, L. J. Le Conte‡, and last but not least, Charles G. Yale; everyone knew Charlie Yale, a Bohemian of the most generous and attractive personality, of whom we were all very fond. He was the soul of good humor and a delightful entertainer.

Another one of the old-timers who died several years ago, was the late Howard C. Holmes, for many years the chief engineer of the State Harbor Commission, who became well known in connection with our cable railway and dry dock construction.

(To be continued)

‡Member, American Society of Civil Engineers.
†Father of F. C. Herrmann, M. Am. Soc. C.E., and consulting engineer, San Francisco.

PERSONAL MENTION

A. M. McCray was appointed city engineer of Hollister, California, on November 17.

J. F. Pollard, formerly general manager of the Coast Valleys Gas & Electric Co., California, has become vice-president and general manager of the Seattle (Washington) Lighting Corp., the central gas utility of that city.

Albert C. White, formerly in the city engineer's office, Oakland, has been appointed office engineer in the Department of Public Works, city of Fresno, California, succeeding M. C. Poulsen, who recently resigned to become engineer for the Clay Products Institute of California.

Clyde L. Seavey was elected president of the California State Railroad Commission, succeeding Thomas S. Louttit. Seavey was for two years city manager of Sacramento. He was appointed to the Commission in 1923, serving as president from 1923 to 1924, and was reappointed in 1929.

James S. Dean, Sacramento architect, has been appointed city manager of Sacramento effective February 28, succeeding Harry A. Kluegel, who was removed from office by the city council. Ordinances recently introduced would raise the city manager's salary from $9000 to $10,000 and fix the city engineer's salary at $6000 a year.

Baar & Cunningham, consulting engineers, of Portland, have been retained by the city of Grants Pass to survey Grove, Evans, and Williams creeks for possible storage damsites and pipe-lines and study the possibility of securing an adequate municipal water supply from wells north of the city. The firm had previously submitted a tentative report on these projects.

Lenox R. Lohr, former major in the Corps of Engineers, U.S. Army, who resigned several years ago to take charge of the organization and other planning activities of Chicago's 1933 Centennial exposition, for which Charles H. Dawes, ambassador to England, has the main responsibility, recently arrived on the Pacific coast to coordinate local activities with those of this exposition. Lohr will be remembered by all military engineers as the man largely responsible for the successful organization of the Society of American Military Engineers and as the first editor of 'The Military Engineer'.

Charles Gilman Hyde, consulting engineer, Berkeley, lost his suit for $5717 extra services against the city of Santa Cruz, California. Hyde was retained for a fee of 8½ per cent of the contract price to design and supervise construction of a sewage treatment plant and ocean outfall sewer. The contractor, J. H. Tillman, of Portland, Oregon, was under a penalty clause, but the city allowed him 100 extra days to complete the work when he guaranteed not to charge against the city several items which might be held to be outside of the contract. Hyde's suit was for engineering services performed during this extra period.

OBITUARY

Stephen T. Mather, 62, director of national parks in the U. S. Department of the Interior from 1917 to 1928, died at Brookline, Massachusetts, on January 23.

Joseph Geiger, president of the Geiger Iron Works, Stockton, California, died January 14 after a long illness. Geiger was born in Wisconsin April 27, 1874, and moved to Stockton in 1902, forming the Geiger Iron Works in 1904. He is survived by his widow and one son.

H. H. Noble, 85, a pioneer in the hydroelectric and electric smelting field in California, founder of Cypress Lawn cemetery, San Francisco, and a Civil War veteran, died of bronchial pneumonia at San Francisco on December 19, 1929.

In 1900 Noble organized the Keswick Electrical Power Co., Shasta county, the first large attempt at hydroelectric development in the state. With two associates he later formed the Northern California Power Co., which finally consolidated with the Pacific Gas & Electric Co. His iron-ore smelting plant at Heroult, Shasta county, was the first western smelter to use electricity on this metal. The plant was operated by the government during the World War to produce ferromanganese for munitions.

Noble is survived by three daughters.

Albert Henry Payson, 82, assistant to the president of the Santa Fe railroad, died at San Francisco January 26. Payson was born in Salem, Massachusetts; graduated as a second lieutenant of engineers from West Point in 1868; and was commissioned a captain in 1882. He came to California in 1877 in charge of Pacific coast lighthouses and rivers and harbors, resigning in 1887 to help build the San Francisco and San Joaquin railroad, of which he was vice-president when it consolidated with the Santa Fe. For thirty years he was an officer of the Spring Valley Water Co., with successive offices as vice-president and president. He was mayor of San Mateo following its incorporation in 1894, and for many years was a director of the Wells Fargo Bank in San Francisco and president of the Parrott Investment Co.

A paragraph on, and cut of Payson, was published in Otto von Geldern's 'Reminiscences of the Pioneer Engineers of California', Part III, November 10th, 1929, issue, p. 597.

ASSOCIATIONS

Pacific Northwest Section, American Water Works Association—The third annual meeting of this section will be held at Portland, Oregon, April 24 to 26. (See November 25th, 1929, issue, p. 620.)

Rocky Mountain Section, American Water Works Association—The 1930 annual meeting of this section will be held at Denver, Colorado, February 13 to 14. (See December 25th, 1929, issue, p. 678.)

San Diego Engineers Club—Officers elected for 1930 include: William H. Talbott, president; R. E. Jenson, secretary; Ernest H. Smith, treasurer; and E. L. Freeland, Zalorus Rungie, J. R. Haylor, Richard V. Dodge, Jr., and C. B. Ireland, directors.

Pacific Coast Section, American Society of Agricultural Engineers—The annual business meeting and election of officers for this section was held at Davis, California, on January 27. The program also included subjects on soil tillage, moisture movement, and drainage.

Western Washington Section (Seattle), American Society of Civil Engineers—The annual dinner meeting of the section was held at the Engineers Club on January 27, with election of officers. The principal speaker at the meeting was W. Dixon Hopcraft, commander (retired) British Navy, who described his sea adventures.

Sacramento Section, American Society of Civil Engineers—This section will be host to the spring meeting of the national society on April 23 to 26.

At the eighth annual meeting on January 14, the following were elected to office: Thomas E. Stanton, president; S. H. Searancke, first vice-president; Harlowe M. Stafford, second vice-president; Joseph W. Gross, junior past president; Norwood Silsbee, secretary-treasurer. For the public relations committee, Joseph W. Gross was appointed chairman with Emery Oliver, Harold Conkling, C. S. Pope, and A. D. Edmonston as members. The entertainment committee is composed of T. B. Waddell, W. E. Stoddard, and G. E. Goodall. The officers were installed on January 24 at the Hotel Senator, the meeting being followed by a program and dancing. During 1929, the section had a net gain in membership of 35, raising the present membership to 112. The average attendance for the 53 last meetings was 37.

BOOK REVIEWS

All books reviewed in these columns are stocked by the book department of **Western Construction News.**

SEWERAGE

By A. PRESCOTT FOLWELL, ScD.

John Wiley & Sons, Inc.—399 pages—6 x 9—Boards—$4.00

The design, construction, and maintenance of sewerage systems and sewage treatment plants is well covered in this standard text, the first edition of which was published in 1898 and the tenth edition (rewritten and reset) in 1929. As the book has now been entirely rewritten for the fourth time, little of the first edition remains except the general principles and plan of treatment in part I, sewerage systems. The aim of the author has been to keep the book up to date, but without optimism in the discussion of new developments that are not endorsed by recognized authorities and actual service test; to be unbiased in the presentation of controversial subjects; and to present fully what is generally recognized as the best practice in the designing and constructing of sewerage and sewage treatment systems.

The chapter headings of part I (sewerage systems) are: general outline; amount of sanitary sewage; amount of storm sewage; flow in sewers; flushing and ventilating; sewer appurtenances; collecting the data; designing; detail plans; supervision of construction; construction; maintenance; and part II (sewage disposal): principles and definitions; composition of sewage; disposal by dilution; removing suspended matter; oxidizing methods; sludge digestion and gas utilization; final disposal of sewage solids; other treatment methods; selecting disposal methods.

OUR CITIES TODAY AND TOMORROW

By THEODORA K. and HENRY V. HUBBARD

Harvard University Press—389 pages—7¼ x 10—Boards

This highly interesting survey of the theory and practice of the art of city planning, as far as developed up to the spring of 1929, will be a most valuable item in the working library of every fore-thinking civil engineer and municipal official. It covers the ground thoroughly, if briefly, from the beginning of the movement in the present United States in colonial days, at Philadelphia and Savannah; its formal inception in the L'Enfant plan for the National Capital; the reaching out and groping for better things in many of our larger cities throughout the latter part of the nineteenth and beginning of the twentieth centuries; and the extraordinary impetus given and progress made since the close of the World War. What the future may bring, no man should venture to prophesy, but every important factor in the past development and knowledge of city planning, as so far understood, has here received logical, adequate, but most concise, treatment and record.

In every case, the experience of each city is synoptically recorded and compared, weak points indicated and discussed, and elements of strength analyzed. The individual problems of any city may easily find their solution in these pages. And, in the 94 pages of appendices will be found a record and compilation of the fruits of the field survey made preparatory to this publication. In few words, the actions and results in each city or region visited are set down, giving an illuminating cross-section of the present field. A most careful and comprehensive index closes the volume.

If any particular factors are especially stressed in this work, they are: (1) the rapidly growing list of favorable court decisions in support of city planning and its numerous adjuncts, whereby newly discovered but unquestionable public rights receive the sanction and protection of interpreted law, and (2) the proven money value to any community of a comprehensive, scientific city plan. Many instances are cited, showing where planning of this character has induced more rapid and sustained growth, stability of values, comfort, health, convenience, and economy of operation. It is, however, axiomatic that such a plan shall be conceived in community honesty, designed and carried out with a fair degree of skill, and backed by an enlightened and determined public consciousness.

While, in the majority of cases, present planning activities are confined to the larger and more congested communities, where the need of immediate relief is obvious and the demand more insistent (as well as funds more abundant), several cases are noted, outside of special developments fostered by private wealth, where gratifying success has followed in the wake of planning studies of relatively small cities. The authors show an evident trend of mind toward extending the effort into minor cities, but, if any criticism is due this admirable work, it is in respect to lack of space given to the special problems of the small community. The proper and definite planning of the small city is just as needful, and just as advantageous —if not more so—as for the large city. In the small city, it is probable that hazardous municipal habits and conditions have not yet become serious or fixed, and may be remedied in time; also, there is a better opportunity to more closely approximate ideals without the penalty of excessive cost. It is hoped that the authors will soon find it possible to compile a similar epitome, covering especially cities of under 10,000 population.

HARRY G. DARWIN.

HANDBOOK OF HYDRAULICS

By HORACE WILLIAMS KING, B.S.

McGraw-Hill Book Co.—523 pages—4 x 7—Flexible—$4.00

'In applied hydraulics, rational theory must give place to experimental knowledge. Though every particle of flowing water moves in accordance with definite fixed laws, such laws are intricate and imperfectly understood. In many instances, the basic formulas used in hydraulic computations are derived from theoretical consideration, but they must invariably be corrected by experimental coefficients and frequently they become thereby so transformed as to bear but a slight resemblance to the original formulas.' With this statement, the author prefaced his first edition (1918) of a handbook for the solution of hydraulic formulas. This statement equally applies to the second edition (1929) wherein the entire text has been rewritten and revised to include new data.

The handbook is divided into the following sections: hydraulic units; hydrostatics; orifices, gates, and tubes; sharp-crested weirs; weirs not sharp crested; pipes; open channels; critical depth and hydraulic jump; measurement of flowing water; natural streams; tables (of which there are 129). The theory of the various sections is concisely stated with the assistance of simple illustrations; all the tables are in readily accessible form. The author has made available not only all the tables and data commonly required in the solution of hydraulic engineering problems, but illustrative examples of many special problems as well.

ELEMENTARY STRUCTURAL PROBLEMS IN STEEL AND TIMBER

By C. R. YOUNG, C.E.

John Wiley & Sons, Inc.—230 pages—6 x 9—Boards—$3.50

Assuming a sound basic knowledge of statics and mechanics of materials, the author presents the typical elementary problems in the design of characteristic steel and timber structures, members, and details, by the aid of illustrative examples. The various formulas are stated, together with definitions of the terms involved. However, no derivations are given, as the book is intended to supplement standard texts on the problem side.

Divisions of the book devoted to steel structures are: tension members; tension member details; compression members; compression member details; beams; box girders; plate girders; steel roof trusses; cranes. On timber structures the divisions are: tension members and tension member details; compression members and compression member details; beams; timber bent for a flume trestle; wooden roof panels; answers to exercise problems.

New Equipment and Trade Notes

DIAMOND ELECTRICAL MFG. CO.

Christmas street decorations erected in 1929 by the Downtown Christmas Festival Association, Los Angeles, at a cost of $125,000, provided the downtown crowds with considerable

'Castle Tower' Christmas Decoration at Los Angeles, Using Diamond Electrical Mfg. Co. Externally-Operated Switches

pleasure and enjoyment. There were 124 large red, white, and green towers, designed as castle towers and elaborately covered with imitation snow and ice, provided for the principal decorations. Each tower was provided with a special lighting system, controlled from the base by Diamond Electrical Mfg. Co. externally-operated switches. It is said that this is the first instance where Christmas street decorations have called for such an extensive electrical switch equipment. All materials used in the construction, wiring, and lighting of these towers could be salvaged. Decorations built along similar lines in future years can be erected at a decided saving over the 1929 cost.

Each tower was equipped with a dynamic loud speaker and radio broadcasting from a private broadcasting station maintained by the association entertained the downtown crowds at all hours of the day.

The tower lighting was controlled by a special force of workmen, provided with keys to fit the externally-operated switches which were kept locked in an 'off' position during the day and 'on' at night.

INGERSOLL-RAND CO.

Ingersoll-Rand Co. announces a new line of air-cooled, two-stage air compressors, type 30, employing a V-type belt drive. Both motor and compressor have ball bearings.

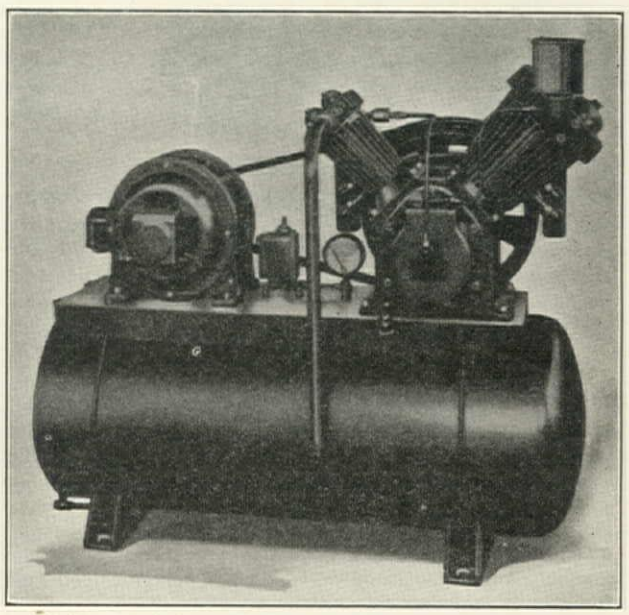
The units are self-contained, the motor and compressor being mounted on a steel base which is attached to the top of the air receiver. The latter, made of heavy pressed steel, is built to withstand a continuous duty working pressure of 200 lb. With this arrangement, no special foundation is required for correct alignment of the compressor and motor. The compressor is ready to operate as soon as the electrical connections to the motor have been made and the crankcase filled with oil.

The intercooler is located behind the fan-type flywheel, and a constant current of circulating air is driven directly across the cooling coils. This reduces the temperature of the discharge air.

Automatic start and stop control, furnished as standard equipment, operates independently, but in conjunction with the unloader. When the pressure in the air receiver reaches a point at which the regulator is set to unload, the motor is automatically shut off. A centrifugal governor allows the air in the high-pressure cylinder and intercooler to exhaust through the crankcase. This prevents the compressor from starting against a load.

Honed cylinders and two oil control rings reduce the oil in discharge air to a minimum. Each piston is run into its respective cylinder, insuring a perfect oil seal. The base of the compressor unit forms a reservoir for the oil, and no oil pump is required. A bayonet gauge gives positive indication of the amount of oil in the reservoir.

A self-cleaning air cleaner keeps dirt out of the compressor and requires no attention. The compressor is entirely enclosed, and no dirt can get into it to wear out the working parts. A balanced crankshaft eliminates destructive vibration.



Ingersoll-Rand 5 & 3 by 3½-in. Type 30 Automatic Start and Stop Compressor

This improved two-stage design reduces power from 10 to 30% and, at the same time, less floor space is required. It is built in four sizes: ¾, 1½, 3, and 5 hp. All sizes are built for a working pressure up to 200 lb. continuous-duty.

The compressor is described in bulletin 3060, which can be obtained by addressing the Ingersoll-Rand Co., 11 Broadway, New York.

HOWELL DITCH BURNER

A machine which is attracting much attention on irrigation projects is a weed and stubble burner produced by the Howell Mfg. Co., Crosby, N. D. The burner is used for destroying vegetation in canals and ditches, and has been tested by the U.S. Bureau of Reclamation, Denver office. Most of the northern projects of the Bureau have already purchased one or more of these machines.

The initial tests were made by H. A. Parker, superintendent of the Lower Yellowstone Project, and H. H. Johnson, super-

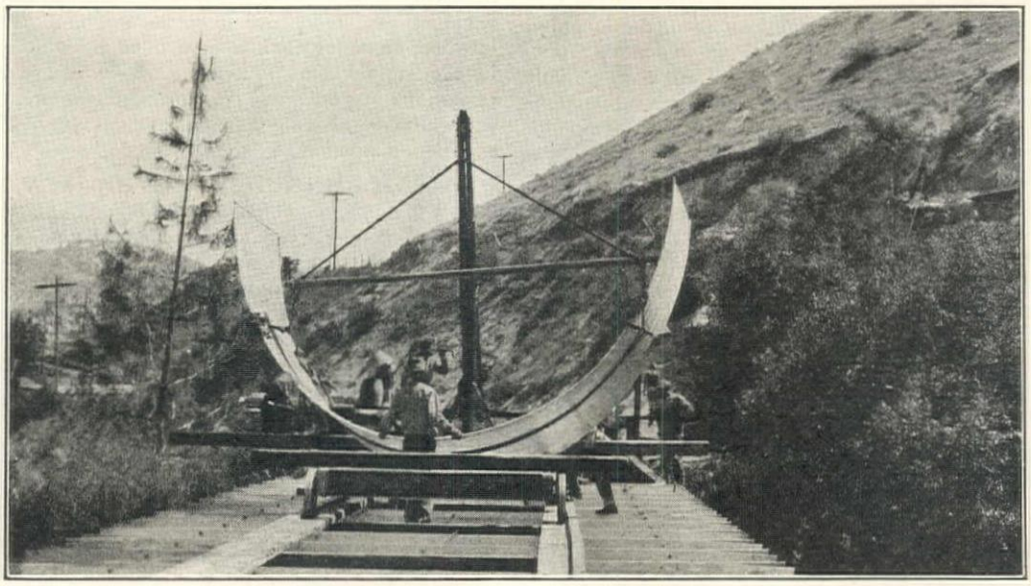


Photo of section of Armco Flume being lowered into position from hand made car

"Turn the crank, Bill, and this sheet is yours"

BILL: *"You said it, John. We are certainly making time on this section."*

JOHN: *"We sure are, but we never have any trouble—either hauling or erecting."*

BILL: *"No wonder they use Armco Flumes on all these jobs."*

No special equipment is needed for transporting and installing Armco Flumes (Lennon type). Saving in time and labor has made Armco Flumes popular with engineers and contractors, as they can be installed at a very low cost.

Made from sheets of galvanized Armco Ingot Iron, Armco Flumes are rust-resisting, durable and water-tight. They are used for conveying water around hills and mountain sides or over any kind of depression. Smooth interiors insure greatest carrying capacity.

Write for detailed information on prices and sizes of Armco Flumes (Lennon type).

California Corrugated Culvert Company

LOS ANGELES:
424 Leroy Street

BERKELEY:
417 Parker Street

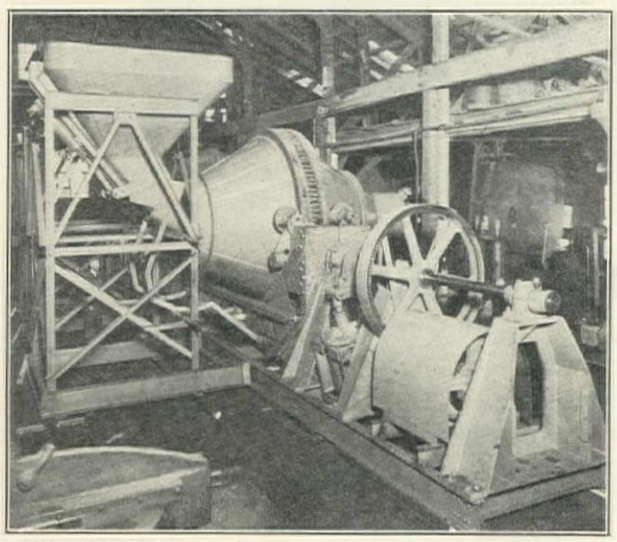
calco products

10

intendent of the Milk River Project, Montana. In the test report, several changes in construction were suggested, although the work done by the machine was highly approved. These changes have been made by the manufacturer. On one test, willows were entirely killed by the heat from the machine and the new growth was found to be lacking in vigor; in another test tules were completely killed and all new growth stopped. The machine is said to be much cheaper in cleaning out dead vegetation than hand methods now in use; its results are also more effective. There is believed to be a need for a machine of this type on every irrigation project where weeds constitute a major problem.

DAVIS BUILDS LARGE CONCRETE MIXERS

Norris K. Davis, San Francisco, has completed construction of the two largest concrete mixers believed ever to have been built. All operations of these machines are automatic. They are air-cooled and are each one-man controlled. Aggregates and cement are all accurately weighed and so controlled that,



Norris K. Davis 4-yd. Concrete Mixers for Owyhee Dam

regardless of moisture in the materials, concrete delivered each batch will be identical. The mixers are to be used by the General Construction Co., Seattle, Washington, in constructing the Owyhee dam in southeastern Oregon for the U. S. Bureau of Reclamation.

A special feature of the machine is the Davis process with which the mixing drums have been coated. This insures that the drums will last throughout the entire job, which requires 600,000 cu.yd. of concrete. Without special processing, the drums would have to be relined with ⅜-in. steel plate for every 45,000 cu.yd.

The mixers each weigh 66,000 lb. They are 19 ft. high, 27 ft. long, and the mixing drums are 10 ft. in diam. by 13 ft. long. Each machine delivers 4 cu.yd. of mixed concrete per batch, or 8 tons. The two Davis mixers will produce 3000 cu.yd. of concrete per day, using 12,800 sacks of cement and 4000 tons of rock and sand in this period. A fleet of 118 forty-ton railroad cars will be required to supply the mixers.

MULTIFOOTE PAVERS

The Foote Co., Inc., Nunda, N. Y., exhibited in Booth 211 at the Atlantic City Road Show, the 1930 Model MultiFoote Paver.

The 1930 MultiFoote holds to those same general features of construction which have proven so dependable in the past, but introduces several new refinements and improvements designed to make it a still faster and more dependable machine.

Principal among these new features are the simple device for automatically closing the discharge chute when the loading skip is raised to charge the machine; a change in the design of the loading skip which further increases the charging speed, and the change from a 'low pressure' to a 'no pressure' water measuring tank.

On the 1930 MultiFoote, all pressure is removed from the water measuring tank which is filled by gravity from an open-top auxiliary tank mounted above it on the machine. The flow of water into the auxiliary tank is controlled by a disc type float valve in the supply line. Accurate water measurement under all conditions of grade and regardless of line pressure or air in the supply line is thereby assured and no damage can result from excessive pressure.

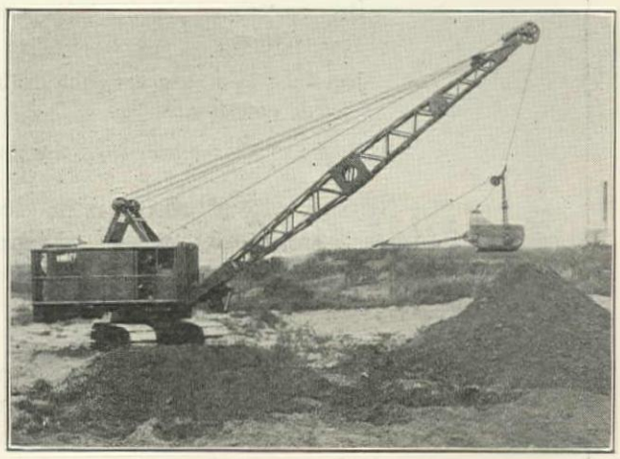
P&H ANNOUNCES SEVEN NEW MODELS

Harnischfeger Corp., Milwaukee, Wisconsin, has announced the addition of seven new models to its present line of excavators. With these new machines there is now a size to meet every requirement, from ½ to 3½ cu.yd. capacity.

The new models are known as the 600-A (1-yd.), 650 (1¼-yd.), 700-A (1¼-yd. rock shovel), 750 (1½-yd.), 775 (1½-yd. long corduroy model), 800 (2½-yd.), and 900 (3½-yd.). All of these excavators are fully convertible with the exception of the model 775, which has especially long crawlers for low ground pressure requirements. For this reason, it can be used only as a dragline, clamshell-crane or trench-hoe.

On the new P&H's will be found a number of valuable improvements, which were adopted only after months of actual field tests. These include: new internal expanding swing clutches; longer lived clutch and brake bands; a stronger 'fish-belly' type of shovel boom, with larger cable sheaves; an easy operating dipper trip; shock absorbing springs on the power clutch to insure smoother operation; all machines can be equipped with the newest type, fully enclosed, dust-proof full Diesel motors.

All the new models embody the time-proven features of P&H construction, such as unit cast steel main frames; fool-



New P&H Dragline

proof, non-clogging crawlers; positive independent chain crowd, and the use of a great number of alloy steel parts.

The P&H model 300-A, 400, and 206-B are still built, which makes the complete line-up as follows:

Model 300-A—½-yd., gasoline or electric. Model 400—¾-yd., gasoline, diesel or electric. Model 206-B—⅞-yd., gasoline or electric shovel; 1-yd. gasoline or electric crane. Model 600-A—1-yd. gasoline, diesel, or electric. Model 650—1¼-yd., gasoline, diesel, or electric. Model 700-A—1¼-yd., gasoline, diesel, or electric (extra-heavy-duty machine for rock excavation). Model 750—1½-yd., gasoline, diesel, or electric. Model 775—1½-yd., gasoline, diesel, or electric (dragline, clamshell-crane, and trench-hoe only). Model 800—2½-yd., diesel or electric. Model 900—3½-yd., diesel or electric.

Models 300-A, 400, 206-B, 600-A, 650, 700-A, and 750 may be equipped as shovel, dragline, crane, clamshell, trench-hoe, skimmer-scoop, or pile driver. Because of its long corduroy tractions, the model 775 is equipped for dragline, clamshell-crane or trench-hoe only. Models 800 and 900 are equipped as shovel, dragline or clamshell-crane. In addition to these models, P&H also builds the model 203-A truck crane, 10-30 and 15-36 trenchers, 35 backfiller, and the new T-2 tamper.

THE STATE ASSOCIATION OF CALIFORNIA ARCHITECTS

NORTHERN SECTION
557 MARKET STREET
SAN FRANCISCO

February 6, 1930.

To the Building Industry:

Subject - 'ARCHITECTS REPORTS'

Gentlemen:

The Executive Board of The State Association of California Architects, Northern Section, with the approval of the Advisory Council, has endorsed and is lending its support to an advance building report service incorporated under the title of 'ARCHITECTS REPORTS'.

We believe that this will provide a prompt, accurate, and efficient advance building news service and prove beneficial to the Building Industry. The policy of this reports service is subject to the supervision and approval of an Advisory Board of Architects representing the Association, with this purpose in view, namely, that the service will be properly conducted, that it will be economical to the subscribers, and that the reports will be authentic.

This service will start on February 15, 1930,and will consist of a daily distribution to subscribers of individual 3" x 5" slips. All reports will be verified and thereby authentic. Each subscriber will receive only those slips which contain information pertaining to his particular business. This will conserve time and effort.

We firmly believe that the establishment of this 'ARCHITECTS REPORTS' and its structure is a forward step for the benefit of the Building Industry.

Detailed information will be gladly furnished by the 'ARCHITECTS REPORTS', 114 Sansome Street, San Francisco. Telephones - Sutter 4307 and 4308.

Respectfully,

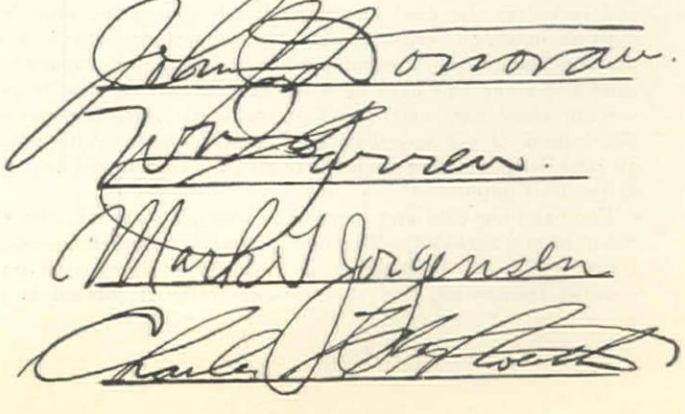
STATE ASSOCIATION OF CALIFORNIA ARCHITECTS

John J. Donovan, Chairman

Wm. I. Garren

Mark T. Jorgensen

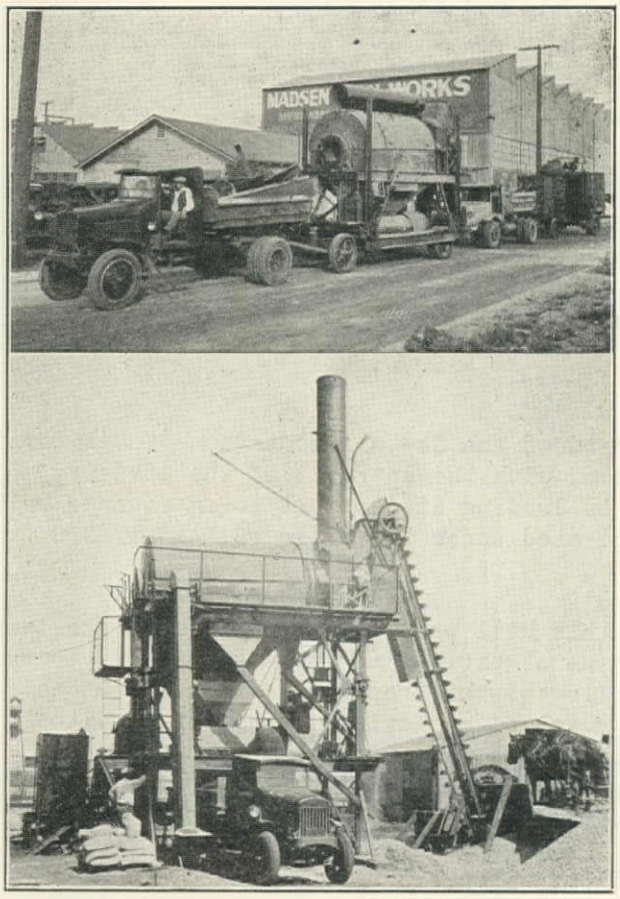
Chas. F. B. Roeth



MADSEN MOBILE ASPHALT PAVING PLANT

A mobile asphalt paving plant designed to handle 1000-lb. batches at 1¼-minute intervals, but capable of mixing batches up to 1500 lb. each, is announced by the Madsen Iron Works of Huntington Park, California.

The plant is the 1000-lb. size which this company has been



(Upper) The New Madsen Mobile Paving Plant in Transit. (Lower) The Plant in Operation, Batch Being Loaded Into International Truck

building for 10 years, re-designed to secure complete portability. This is said to have been accomplished to a degree where contractors may now profitably set up the plant for a 10 or 15 day run. The plant is built in two units. To avoid loading the main plant chassis beyond legal load limits, a separate trailer unit has been provided, on which are mounted a 20-hp. steam boiler, 10-ton steam-heated asphalt tank, 200-gal. water tank, 400-gal. fuel tank, and asphalt, fuel and boiler feed pump. This division of weight and bulk permits the individual units to be larger and of greater capacity than if all were mounted on the main plant. At the same time, the units are made more accessible for operation and maintenance.

Provision has been made for driving the plant either by electric motor, or with gas, gasoline, or oil engine. A 50-hp. motor is standard equipment, but the outer end of the main shaft is extended to accommodate a belt pulley for a 75-hp. engine drive when electricity is not available.

High efficiency is secured in drying and heating sand and stone by mounting the screen directly upon the dryer periphery and including the dual unit immediately above the sand bins with an insulated screen cover. Radiation and convection are thereby reduced to a minimum. The shape and capacity of sand and stone bins have been worked out with a view to conserving space and weight and, at the same time, to provide a bin volume of not less than seven mixer loads. With proper elevator feeding, there is plenty of all sizes of material available at the four gates.

For handling cold and more-or-less moist materials, the elevator is not enclosed. The unit is a self-contained assembly, transportable as a whole or in two parts. It is built on a channel framework, and the elevator frame is jointed in the middle half, thus requiring removal of the lower half only when moving.

The mixer is designed for a 1000-lb. mix, or an 8-hour production of 200 tons. But, it will handle a 1500-lb. mix making possible a daily production of 300 tons. The interior proportions of the mixer insure an efficient, quick mix, and the large gate opening provides a complete discharge in six or seven seconds.

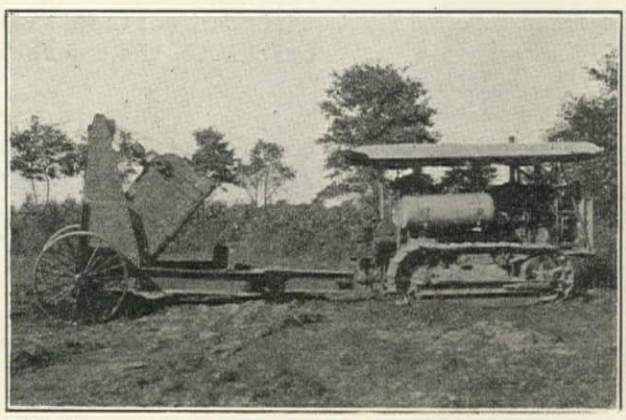
With all tanks empty for transport, the total weights are well within the road requirements of practically every state, as are the length, width, and height of the assembly.

A Madsen 1000-lb. 2-unit mobile paving plant mixing 1500-lb. batches, operated by C. O. Sparks, Los Angeles, on a job totaling 6673 tons, averaged for the entire run 266 tons per 8-hour day. Fuel oil costs averaged $0.04 per ton of material dried, this including the operation of a 20-hp. boiler for heating asphalt. The total labor costs per ton of material mixed on this contract averaged $0.2584 per ton, this cost including two fresno teams for handling aggregate to the elevator hopper. Costs of dismantling and re-erecting the plant, including a 20-mile haul, amounted to $234.00 complete. Adding the cost of dismantling, moving and re-erection, to the actual plant labor costs, gives a total cost of $0.2938 per ton of finished material delivered into trucks.

THE SHAW 'TRUE-CUT' SCRAPER

Among the new exhibitors at the recent Road Show was the Shaw Excavator & Tool Co., Worthington, Ohio, who featured in space 661 the Shaw 'True-Cut' scraper—a two-wheeled design which may be coupled to any tractor of the 'caterpillar' or crawler type. Its exceptionally rugged construction and simplicity of design, together with the unique method of operation, received much favorable comment.

On the 4-yd. display model, 13-in. ship channel steel comprises the frame construction, and two heavy wheels with 14-in. tread provide ample traction. Among the construction fea-



Side View of Dumping Position, Shaw 'True-Cut' Scraper and Caterpillar '60' Tractor

tures is the absence of gears, sprockets, rope connections, or small moving parts. The cutting edge of the bucket is a detachable, reversible, and adjustable high carbon steel knife.

The scraper is controlled entirely by one man from his driving position on the tractor. Operation of the bucket from digging to carrying to dumping and spreading positions is controlled from the tractor by means of a winch mounted on the rear end of the tractor. The bucket may be adjusted to cutting depths up to 8 in. The Shaw 'True-Cut' digs, loads, hauls, dumps, and spreads in a continuous operation.

CORRECTION ON STERLING PERSONNEL

Changes of personnel of the Sterling Motor Co. of California were announced in the January 10th issue, p. 26. The name of William Sleddon, who continues as manager of the San Francisco branch, was inadvertently omitted from the notice. Sleddon has been in active charge of the branch for several years and has been most successful in making a sales record with Sterlings in this territory.

UNIT BID SUMMARY

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

WATER SUPPLY SYSTEMS

SEATTLE, WASH.—CONCRETE INTAKE, VALVES, ETC.—CITY

Following are the three lowest bids received by the Board of Public Works, Seattle, for intake to Lake Youngs Aqueduct at the Diversion Dam of the City of Seattle's Water Supply on the Cedar River at Landsburg:

(1) J. F. Ward, Inc., Lyon Bdg., Seattle $89,196
(2) D. Nygren 98,515
(3) Lydral Constr. Co. $98,789

	(1)	(2)	(3)
14,000 cu.yd. excavation	.80	1.00	1.50
6 each 6x8-in. sluice valves	$1149	$2500	$1800
6 each floor stands	$1345	$1250	$ 800
6 each traveling screens	$3476	$3650	$2900
740 cu.yd. concrete in retaining walls, parapet, and weir	14.00	14.00	16.00
1,400 lb. copper water stops	.70	.50	.50
4,000 lb. asphalt in contrac. joints	.10	.10	.10
550 cu.yd. concrete in linings	18.00	16.00	16.00
5,000 lb. reinforcing steel, including galv. ladder irons	.05	.06	.10
6 each trash racks	$281	$300	$300
30 lin.ft. steel pipe railings	2.50	3.00	1.50
100 lin.ft. 8-in. cast-iron pipe drain	2.50	3.50	2.00
1 manhole on drain	60.00	85.00	50.00
Cleaning up site, lump sum	$500	$500	$500
Pressure water system in screen house	$213	$350	$150
Screen house, lump sum	$17,252	$16,080	$19,404
25 cu.yd. concrete filling	12.00	12.00	16.00

RIVER AND HARBOR WORK

NEWPORT BEACH, CALIF.—DREDGING AND ROCK GROINS—CITY

Contract awarded to Standard Dredging Co., Central Bdg., Los Angeles, $136,490 for constructing two rubble mound groins, and dredging the entrance channel to Newport Harbor, work for the City of Newport Beach, Orange County. Bids received on:

(1) 275,000 cu.yd. dredging (inner harbor)
(2) 125,000 cu.yd. dredging (outer harbor)
(3) 14,000 tons quarry stone in place
(4) 4,000 tons stone, remove from existing revetment

	(1)	(2)	(3)	(4)	TOTALS
Standard Dredging Co., Los Angeles	.15	.375	2.65	2.75	$136,490
San Francisco Bridge Co., San Francisco	.20	.44	3.50	3.50	173,350

R. L. Patterson is City Engineer and Chas. T. Leeds and A. L. Sonderreger of Los Angeles are Consulting Engineers.

BRIDGES AND CULVERTS

PHOENIX, ARIZ.—STATE—REINFORCED CONCRETE—SALT RIVER AT TEMPE

Contract awarded to Lynch-Cannon Engineering Co., 1027 Chapman Bdg., Los Angeles, who bid $397,608 to Arizona State Highway Commission, Phoenix, for reinforced concrete bridge over Salt River at Tempe, on Phoenix-Tempe Highway. Bids on:

(1) 12,252 cu.yd. excavation
(2) 241 cu.yd. 'A-A' conc. (above curbs)
(3) 299 cu.yd. 'A-A' conc. (sidewalks)
(4) 10,274 cu.yd. 'A' conc. (bridge)
(5) 6,584 cu.yd. 'B' conc. (bridge)
(6) 426 cu.yd. sand fill in Abt. piers
(7) 1,791,083 lb. rein. steel (inc. Exp. plates)
(8) Lighting system

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	TOTALS
Lynch Cannon Eng. Co.	3.00	60.00	30.00	18.55	10.00	2.50	.041	$6,500	$397,608
Rex B Mesney, Phoenix	7.50	46.00	23.00	17.00	10.00	1.00	.0385½	7,600	427,423
Koss Constr. Co., Des Moines	5.00	50.00	25.00	18.00	16.00	1.00	.04	6,000	449,130
Heuser, Tripp & Packard	7.00	50.00	33.00	17.00	15.70	1.00	.036	6,400	457,012
Fisher, Ross, MacDonald & Kahn, Los Angeles	7.00	55.00	25.00	19.00	12.50	1.00	.04	5,500	461,569
Stein Const. Co., Milwaukee	3.00	60.00	45.00	22.60	11.20	3.20	.05	6,600	468,121
Mulligan & Martin	7.75	45.00	23.00	18.00	15.00	.35	.045	6,449	483,564
Strong & Grant	5.00	65.00	30.00	20.00	17.00	3.00	.045	8,000	493,179
Torson Constr. Co.	5.00	58.00	48.00	20.00	17.00	3.00	.05	8,500	506,330
Lee Moor Contr. Co.	7.25	47.00	22.00	21.50	18.00	1.00	.0375	5,700	519,426

PORTLAND, ORE.—GOVERNMENT—MONTANA—STEEL AND CONCRETE

Award of contract recommended to Stevens Bros., St. Paul, Minn., who bid $57,385 for Gardiner Bridge over Yellowstone Canyon Highway at Gardiner, PARK COUNTY, Montana, work for the Bureau of Public Roads. Bids received on:

(1) 300 cu.yd. structure excavation
(2) 430 cu.yd. 'A' concrete
(3) 40 cu.yd. 'B' concrete
(4) 180 cu.yd. 'C' concrete
(5) 489,500 lb. structural steel
(6) 77,500 lb. reinforcing steel

	(1)	(2)	(3)	(4)	(5)	(6)	TOTALS
Stevens Bros., St. Paul, Minn.	7.00	22.00	30.00	34.00	.07	.05	$57,385
Portland Bridge Co., Portland	4.00	25.00	25.00	25.00	.08	.06	61,620
W. P. Roscoe, Billings, Mont.	8.00	26.00	24.00	24.00	.078	.063	61,984
Sam Boudrye, Clarkston, Wn.	7.00	28.00	28.00	28.00	.076	.06	62,314
Illinois Steel Bridge Co.	3.00	30.00	30.00	30.00	.08	.058	64,115

STREET AND ROAD WORK

SACRAMENTO, CALIF.—STATE—GRADING AND CONCRETE PAVING—IMPERIAL COUNTY

A. M. Peck Co., 2966 Allesandro, Los Angeles, who bid $264,955, submitted low bid to California Division of Highways, for 9 miles grading and paving between El Centro and Holtville, IMPERIAL COUNTY. Bids from:

(1) A. M. Peck Co., Los Angeles $264,955
(2) Sander Pearson 285,506
(3) Basich Bros., Los Angeles 286,391
(4) Jahn & Bressi, L. A. 291,815
(5) J. F. Knapp, Oakland 296,254
(6) Watson & Sutton, San Diego $317,013
(7) T. M. Morgan Paving Co. 313,456
(8) Wells & Bressler, Santa Ana 322,785
(9) Average Bid 297,000

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
30,000 cu.yd. road. excav.	.25	.24	.25	.30	.30	.35	.40	.25	.29
44,000 cu.yd. imp. borrow	.35	.37	.23	.30	.45	.35	.50	.45	.375
181,500 sta.yd. overhaul	.01	.01	.01	.0075	.01	.01	.01	.015	.01
2,690 cu.yd. struct. exc.	1.00	.70	.60	.50	.75	.85	.60	1.00	.75
12,650 sq.yd. subgrade	.09	.10	.045	.10	.09	.09	.08	.10	.088
500 cu.yd. gravel surf.	4.00	3.80	2.40	3.00	4.00	3.00	3.50	5.00	3.59
14,800 cu.yd. sand cush.	1.10	.97	.60	.70	.65	1.00	1.00	.96	.87
20,200 cu.yd. 'A' concrete (paving)	9.00	10.27	11.22	10.96	10.75	11.65	10.65	11.86	10.80
170 cu.yd. conc. (struct.)	22.00	23.00	20.00	20.00	20.00	25.00	20.00	20.00	21.25
508,200 lb. rein. steel	.045	.04	.035	.04	.0425	.0425	.055	.04	.042
10 ft. 8-in. corr. pipe	.50	.50	.20	.25	.30	.30	.30	.50	.356
1,262 ft. 12-in. corr. pipe	.50	.50	.20	.25	.40	.50	.50	.50	.42
698 ft. 18-in. corr. pipe	.50	.50	.25	.40	.50	.50	.65	.60	.49
396 ft. 24-in. corr. pipe	.60	.60	.25	.75	.60	.60	1.00	1.00	.675
24 ft. 42-in. corr. pipe	1.50	.75	.50	1.00	1.00	1.00	1.50	2.00	1.16
903 ft. corr. pipe, clean	.75	.60	.35	.50	1.00	.50	.60	.60	.61
1,410 ft. 4-in. drain tile	.20	.25	.17	.12	.20	.20	.30	.30	.22
150 tons gravel blank.	3.00	3.00	3.00	2.90	3.00	3.00	3.00	4.00	3.11
96 ft. timb. guard rail	1.00	1.00	1.00	1.50	1.00	1.50	1.50	1.00	1.19
88 cu.yd. remove conc.	4.00	4.00	1.25	3.00	3.00	3.00	4.00	3.00	3.15
52,400 sq.yd. asph. memb.	.08	.07	.07	.065	.07	.06	.09	.07	.073
471 sta. finish roadway	5.00	5.00	3.00	6.00	4.00	5.00	8.00	3.50	4.93
20 monuments	3.00	3.00	1.50	2.50	2.50	3.00	3.50	3.00	2.75

SACRAMENTO, CALIF.—STATE—SANTA BARBARA COUNTY—GRADING AND CONCRETE PAVING

Contract awarded to Cornwall Construction Co., 219 E. Mason St., Santa Barbara, who bid $153,239 to California Division of Highways for 4 miles concrete paving and grading from Zaca to Wigmore, SANTA BARBARA COUNTY. Bids from:

(1) Cornwall Const. Co., Santa Barbara $153,239
(2) J. F. Knapp, Oakland 157,239
(3) T. M. Morgan Paving Co., L. A. 164,154
(4) Basich Bros. Constr. Co., L. A. 165,470
(5) C. W. Wood, Stockton 170,659
(6) McCray Co., Los Angeles 172,592
(7) C. R. Johnson, Portland 172,664
(8) Sander Pearson $131,929
(9) A. J. Raisch, San Jose 184,082
(10) W. A. Dontanville, Salinas 184,147
(11) Matich Bros., Elsinore 189,472
(12) Central Const. Co., Oakland 220,309
(13) M. J. Bevanda, Stockton 221,090
(14) Average bid 181,000

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
38 sta. clearing and grubbing	25.00	5.00	12.00	20.00	25.00	30.00	$100	20.00	50.00	35.00	50.00	25.50	25.00	32.50
100,000 cu.yd. roadway excavation	.28	.30	.30	.43	.35	.40	.28	.37	.36	.34	.37	.50	.40	.36
234,000 sta.yd. overhaul	.01	.01	.007	.01	.01	.01	.01	.01	.01	.015	.01	.02	.015	.011
2,550 cu.yd. structure excavation	1.00	.75	.90	1.60	.80	1.00	1.00	.80	1.00	1.25	.75	1.50	1.00	1.03
44,500 sq.yd. subgrade	.08	.09	.08	.09	.07	.10	.08	.10	.10	.10	.09	.10	.09	.09
1,100 cu.yd. cushion course	1.25	2.00	1.20	2.00	2.00	2.00	2.00	2.43	1.50	2.50	3.75	3.00	2.00	2.13
9,650 cu.yd. A concrete (pavement)	9.00	9.50	9.85	8.35	10.00	9.50	10.85	10.55	10.20	11.25	11.10	12.53	11.00	10.28
150 cu.yd. A concrete (struct.)	20.00	18.50	24.00	30.00	19.00	20.00	22.00	25.00	25.00	22.50	22.00	25.00	20.00	22.50
237,500 lb. reinforcing steel	.035	.04	.045	.037	.05	.045	.04	.045	.05	.04	.04	.05	.045	.043
876 lin.ft. 18-in. corr. metal pipe	1.00	.50	.70	.50	.50	.60	.50	.60	.50	.50	.50	.50	.50	.57
498 lin.ft. 24-in. corr. metal pipe	1.25	.60	.85	.60	.50	.80	.50	.70	.60	.75	.75	.75	.60	.71
202 lin.ft. 30-in. corr. metal pipe	1.50	.70	1.00	.80	1.00	1.00	1.00	.80	1.00	1.00	1.00	1.00	1.00	.985
352 lin.ft. corr. pipe (clean and relay)	2.00	1.00	1.25	1.20	1.00	.60	2.00	.80	2.00	1.00	1.00	1.00	2.00	1.30
4.8 mi. new property fence	$500	$450	$375	$500	$500	$500	$350	$500	$500	$650	$500	$700	$475	$500
3,200 ft. solid timber guard rail	1.25	1.00	1.25	1.00	1.00	1.00	.95	1.00	2.00	.90	1.50	1.00	.90	1.14
2,050 cu.yd. remove conc.	1.25	1.50	2.00	2.75	1.50	1.50	1.00	2.40	3.00	1.00	2.50	2.00	2.00	1.88
1,000 bbl. fuel oil (shoulders)	3.50	2.00	2.00	1.75	2.75	3.25	2.50	3.25	3.00	2.10	3.25	3.00	4.00	2.80
211 sta. finishing roadway	5.00	4.00	8.00	3.00	4.00	5.00	7.00	5.00	6.00	8.00	5.00	5.00	6.00	5.47
93 monuments	3.00	2.00	3.00	3.00	3.00	2.50	4.00	3.00	3.00	3.00	3.00	5.00	3.00	3.12

SANTA CLARA, CALIF.—CITY—ASPHALT

Contract awarded to Peninsula Paving Co., Standard Oil Bdg., San Francisco, who bid $110,363 for improvement of Sherman, Lexington, Fremont, Alviso, Liberty, Lafayette, and Benton Sts. for City. Bids received on:

(1) 390,000 sq.ft. 1½-in. "B" asphalt surface.
(2) 390,000 sq.ft. 3½-in. asphalt base, including grading, and 3-in. quarry waste.
(3) 283,500 sq.ft. 2-in. asphalt surface.
(4) 283,500 sq.ft. 4-in. asphalt base, including grading, and 3-in. quarry waste.
(5) 20,500 sq.ft. cement sidewalk.
(6) 6,370 ft. concrete curb.
(7) 10,500 sq.ft. concrete gutter.
(8) 5,500 sq.ft. concrete driveway approach.
(9) 3,800 ft. 4-in. vitr. sewer.
(10) 4,200 ft. 6-in. vitr. sewer.
(11) 13 brick manholes.
(12) 81 4-in. by 6-in. Y branches.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	TOTALS
Peninsula Paving Co.	.04	.093	.05	.11	.15	.40	.20	.20	.40	.50	50.00	.50	$110,363
Union Paving Co.	.0675	.07	.0775	.08	.15	.42	.22	.22	.50	.60	30.00	.40	112,472
A. J. Raisch	.04	.104	.05	.114	.15	.50	.21	.21	.50	.60	40.00	.40	117,246

1911-15 Acts. Geo. Sullivan is City Engineer of Santa Clara.

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

Contract awarded to J. F. Knapp, 5301 Horton Ave., Oakland, who bid $272,648 to the California Division of Highways, Sacramento, for 7.2 miles concrete paving and grading from Santa Maria River to Los Berros Creek, SAN LUIS OBISPO COUNTY. Bids from:

(1) J. F. Knapp, Oakland $272,648
(2) C. W. Wood, Stockton 288,371
(3) Peninsula Paving Co., S. F. 289,732
(4) Basich Bros. Const. Co., L. A. 292,861
(5) Cornwall Const. Co., Santa Barbara 293,599
(6) Jahn & Bressi, Los Angeles 299,791
(7) T. M. Morgan Paving Co., L. A. 303,692
(8) McCray Co., Los Angeles 309,078
(9) A. J. Raisch, San Jose $312,011
(10) M. J. Bevanda, Stockton 317,084
(11) C. R. Johnson, Portland 319,431
(12) Matich Bros., Elsinore 325,020
(13) Sander Pearson, Santa Monica 325,908
(14) Valley Paving & Const. Co., Visalia 358,448
(15) V. R. Dennis Const. Co., San Diego 371,205
(16) Average bid 312,000

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
157,250	cu.yd. roadway excavation	.30	.25	.28	.43	.34	.35	.35	.40	.35	.37	.37	.38	.39	.55	.50	.37
700,000	sta.yd. overhaul	.005	.01	.005	.01	.01	.005	.01	.009	.01	.017	.01	.01	.01	.01	.01	.009
3,000	cu.yd. structure excavation	.75	.80	.73	1.00	1.00	1.00	.90	1.00	1.00	.90	1.25	.75	.90	1.00	1.50	.965
64,500	sq.yd. subgrade for paving	.09	.07	.08	.05	.08	.08	.07	.12	.09	.08	.08	.09	.10	.08	.10	.08
3,900	cu.yd. cushion course	1.75	2.00	1.85	1.15	1.25	1.25	.80	1.50	1.50	1.25	1.75	3.50	2.33	2.50	1.65	1.73
17,250	cu.yd. 'A' concrete (paving)	9.00	9.80	9.85	8.27	9.50	9.90	9.85	9.50	9.60	10.00	10.60	10.45	10.15	10.50	12.00	9.94
885	cu.yd. 'A' concrete (structures)	18.00	19.00	20.00	30.00	20.00	20.00	22.00	19.00	25.00	18.75	22.00	19.00	23.00	25.00	25.00	21.70
500,000	lb. reinf. steel	.04	.048	.045	.037	.035	.04	.045	.045	.05	.048	.04	.0385	.045	.05	.04	.043
425	tons crusher run base	2.75	2.50	3.00	3.50	3.50	3.00	2.75	3.00	1.50	4.00	2.50	3.00	2.80	2.00	3.50	2.89
716	lin.ft. 18-in. corr. iron pipe	.50	.50	.50	.50	1.00	.50	.70	.60	.50	.60	.50	.50	.50	.50	1.00	.59
684	lin.ft. 24-in. corr. pipe	.60	.50	.60	.60	1.25	.75	.85	.75	.60	.75	.60	.65	.70	.75	1.00	.73
208	lin.ft. 36-in. corr. pipe	.80	1.00	.80	1.00	1.50	1.00	1.00	.90	1.00	1.25	.70	1.00	.80	1.00	1.00	.985
62	lin.ft. 42-in. corr. pipe	1.00	1.00	1.00	1.20	2.00	1.25	1.25	1.00	1.50	1.50	.80	1.50	1.00	1.00	1.50	1.23
47	lin.ft. corr. pipe, clean and relay	1.00	1.00	.60	1.20	2.00	1.00	.80	.70	2.00	2.50	2.00	1.00	1.50	1.00	1.00	1.29
12.3	mi. new property fence	$425	$500	$510	$500	$500	$450	$400	$500	$500	$450	$350	$475	$500	$500	$450	$467
2,215	cu.yd. remove concrete	1.50	1.50	1.25	3.00	1.25	2.00	2.25	1.75	3.00	1.75	1.00	2.00	2.40	2.00	2.00	1.91
1,815	bbl. fuel oil (shoulders)	1.90	2.50	2.00	2.00	3.50	2.85	2.00	3.00	3.00	4.00	2.50	3.00	3.00	2.00	2.00	2.62
388	sta. finishing roadway	4.00	3.00	6.00	1.50	5.00	5.00	8.00	5.00	6.00	3.00	7.00	5.00	5.00	6.00	5.00	4.97
75	monuments	2.00	3.00	3.00	3.00	3.00	2.50	3.00	2.50	3.00	3.00	4.00	2.00	3.00	3.00	4.00	2.93

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

V. R. Dennis Construction Co., PO Box 183, Station A, San Diego, $126,455, low bid to California Division of Highways for 9.7 miles grading and surfacing from San Emigdio Road to Route 4, KERN COUNTY. Bids received from:

(1) V. R. Dennis Construction Co., San Diego $126,455
(2) Tieslau Bros., Berkeley 127,439
(3) C. R. Johnson, San Francisco 131,764
(4) G. W. Ellis, Los Angeles 130,943
(5) Hartman Construction Co., Bakersfield 134,127
(6) S. J. Hales, Santa Ana $140,134
(7) A. Teichert & Sons, Sacramento 144,189
(8) Isbell Construction Co., Fresno 153,964
(9) J. E. Johnson, Stockton 161,275
(10) Average bid 139,000

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
72,300	cu.yd. road. excav.	.25	.30	.27	.40	.28	.30	.25	.28	.45	.31
302,100	sta.yd. overhaul	.02	.01	.015	.02	.02	.01	.015	.01	.015	.015
1,800	cu.yd. struct. exc.	.75	.75	1.50	.50	1.00	.50	1.00	1.00	1.00	.89
23,900	tons untreated gravel or stone (base)	1.48	1.53	1.70	1.55	1.70	1.98	1.77	1.87	1.90	1.72
21,000	tons oil-treated gravel or stone (surf.)	2.10	2.00	1.90	1.72	2.00	2.12	2.47	2.80	2.60	2.19
700	tons screenings	2.50	1.50	2.25	1.50	2.00	2.12	2.15	2.50	2.50	2.11
460	bbl. fuel oil	1.85	2.00	1.75	1.50	1.70	2.04	1.50	2.50	1.50	1.82
2,700	bbl. pipe-line oil	1.75	1.40	2.15	1.50	1.40	1.80	1.85	1.75	1.25	1.65
110	cu.yd. concr. (struct.)	25.00	25.00	30.00	25.00	25.00	22.50	27.50	30.00	30.00	26.70
4,400	lb. reinf. steel	.10	.06	.06	.06	.05	.05	.05	.065	.05	.061
48	ft. 12-in. corr. pipe	.50	.90	.50	.50	.50	.50	.50	.50	.50	.54
3,606	ft. 18-in. corr. pipe	.50	1.00	.60	.70	.60	.50	.50	.50	.60	.61
336	ft. 24-in. corr. pipe	.50	1.15	.70	.75	.70	1.00	.75	.75	.75	.78
144	ft. 30-in. corr. pipe	.50	1.40	1.00	1.00	.80	1.00	1.25	1.00	1.00	1.00
19.5	mi. new pr. fence	$350	$375	$360	$400	$450	$400	$500	$500	$350	$410
12	gates in fence	25.00	15.00	20.00	50.00	25.00	20.00	25.00	15.00	20.00	23.90
549	sta. finish roadw.	3.00	4.00	5.00	3.00	5.00	4.00	5.00	3.50	6.00	4.28
40	monuments	4.00	3.00	4.00	3.00	3.00	4.00	3.00	3.00	3.00	3.33

SACRAMENTO, CALIF.—STATE—LOS ANGELES COUNTY—GRADING

T. M. Morgan Paving Co., 800 Corporation Bdg., Los Angeles, and Gazelle, Calif., $272,790 low bid to California Division of Highways, for 1.5 miles grading from 2½ miles to 4 miles northerly of La Canada, LOS ANGELES COUNTY. Bids from:

(1) T. M. Morgan Paving Co., Los Angeles (low) $272,790
(2) H. W. Rohl Co., Los Angeles 275,177
(3) M. S. Ross, Los Angeles 290,653
(4) Nevada Contracting Co., Fallon, Nev. 293,266
(5) Gist & Bell, Arcadia 319,276
(6) W. H. Hauser, Oakland 321,519
(7) J. J. Donovan & Sons, Los Angeles 331,975
(8) Geo. Pollock Co., Sacramento $350,987
(9) Marco Construction Co., Clearwater 376,840
(10) Jahn & Bressi, Los Angeles 379,746
(11) Utah Const. Co., S. F. 386,478
(12) Sharp & Fellows, Los Angeles 407,868
(13) Average bid 333,000

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
78	stations clearing and grubbing	25.00	25.00	25.00	20.00	60.00	25.00	74.00	60.00	50.00	15.00	25.00	50.00	37.80
460,000	cu.yd. roadway excavation	.35	.38	.395	.41	.46	.40	.41	.51	.51	.56	.57	.585	.46
3,000,000	sta.yd. overhaul	.007	.005	.0075	.006	.005	.01	.01	.005	.01	.005	.01	.01	.008
5,220	cu.yd. structure excavation	1.25	1.00	1.20	1.00	1.75	1.25	1.50	1.50	3.00	2.50	2.00	3.50	1.79
950	cu.yd. "A" concrete (structures)	24.00	20.00	19.00	23.00	19.00	30.00	30.00	25.00	24.00	30.00	22.00	27.50	24.50
15	cu.yd. "E" concrete (structures)	65.00	60.00	40.00	60.00	70.00	60.00	35.00	70.00	70.00	75.00	50.00	65.00	60.00
175	cu.yd. "F" concrete (structures)	25.00	30.00	25.00	24.00	40.00	70.00	35.00	55.00	30.00	45.00	28.00	39.00	37.10
170,000	lb. reinf. steel (structures)	.04	.04	.04	.05	.04	.05	.05	.05	.05	.045	.045	.037	.045
1,790	lin.ft. 24-in. corr. pipe	.75	1.00	.50	.60	1.00	1.25	1.00	1.50	1.00	1.50	.75	1.25	1.01
360	lin.ft. 36-in. corr. pipe	1.00	1.50	1.00	1.25	1.50	2.00	1.50	2.00	2.00	1.75	1.10	1.75	1.53
1,430	6-in. reinf. conc. headers (cribbing)	3.45	3.75	3.91	3.40	3.50	3.50	4.20	3.50	4.30	3.75	3.80	3.46	3.71
2,680	10-in. reinf. conc. headers (cribbing)	4.80	4.75	5.20	4.70	4.60	4.90	6.00	4.50	5.70	4.75	5.15	4.70	4.98
2,110	6-in. reinf. conc. stretchers (cribbing)	3.15	3.00	3.28	2.85	3.00	3.20	3.50	3.00	3.70	3.00	3.00	2.95	3.14
2,740	8-in. reinf. conc. stretchers (cribbing)	3.75	3.50	3.55	3.40	3.50	3.60	4.25	3.25	4.20	3.50	3.60	3.45	3.63
2,050	10-in. reinf. conc. stretchers (cribbing)	4.60	4.30	4.69	4.35	4.40	4.75	5.50	4.25	5.00	4.50	4.60	4.40	4.61
440	concrete filler blocks (cribbing)	.85	1.00	.88	.80	.70	.90	.80	1.00	1.00	.75	.80	.75	.85
78	stations finishing roadway	10.00	5.00	10.00	7.50	10.00	10.00	10.00	10.00	10.00	8.00	6.00	7.50	8.67
90	monuments	4.00	3.00	2.25	3.00	3.00	3.00	3.00	3.50	4.00	3.00	3.00	4.00	3.23

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 January, 1929, for Engineering Construction projects in the Far Western States total $30,034,000, as follows:

Paving	$ 5,260,000
Grading, highways	5,013,000
Bridges	1,720,000
Sewer construction	750,000
Water supply systems	3,341,000
Irrigation	2,050,000
Power development	6,750,000
Railroad construction	675,000
River and harbor work	1,050,000
Lighting systems	425,000
Oil pipe-lines	3,000,000
	$30,034,000

LARGE WESTERN PROJECTS

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

WORK CONTEMPLATED

College buildings at Mills College, Oakland, $2,000,000.

Department store for Meyer-Frank Co. at Portland, Ore., $1,000,000.

BIDS BEING RECEIVED

Auditorium for City of Long Beach, Calif., $1,400,000, bids to Feb. 25.

Pier, quay and bulkhead for Bureau of Yards & Docks at Pearl Harbor, T. H., $575,000, bids to Mar. 19.

Tunnels, 50,000 lin.ft., for Bureau of Reclamation, Nyssa, Ore., bids to Mar. 11.

Disposal plant, roads, etc., at Naval Ammunition Depot, Hawthorne, Nev., $300,000, bids to March 5.

Quarters for officers at Fort Douglas, Utah, bids to Mar. 3.

Dredging and excavation, first unit of Stockton Deep Water Channel, involving 1,600,000 cu.yd., being received by U. S. Engineer's Office, Sacramento.

Coliseum addition for City of Los Angeles, bids to Feb. 21.

BIDS RECEIVED

Veterans' Unit at Essondale for Minister of Mines & Public Works, Victoria, B. C., Pacific Engineers, Ltd., Vancouver, B. C., $679,000 low.

Postoffice at Honolulu, T. H., for Government, N. P. Severin Co., Chicago, Ill., $308,000 low.

CONTRACTS AWARDED

Grading Siuslaw National Forest Highway, Ore., for U. S. Bureau of Public Roads, to Morrison-Knudsen Co., Boise, Ida., $517,472.

Conc. bridge over Salt River at Tempe for State of Arizona, to Lynch-Cannon Engineering Co., Los Angeles, $397,608.

Hospital for Southern Pacific Co. at San Francisco, to Barrett & Hilp, San Francisco, $450,000.

Hospital for King County at Seattle, Wash., General Contract to Western Const. Co., Seattle, $1,245,237.

Concrete paving in San Luis Obispo County for California Division of Highways, to J. F. Knapp, Oakland, $272,648.

Bank building on S. Spring St. for Spring Realty Co., Los Angeles, to P. J. Walker Co., Los Angeles, $1,000,000.

Gainsborough apartments at Seattle, to H. S. Wright & Co., Seattle, $600,000.

STREET and ROAD WORK

WORK CONTEMPLATED

ALAMEDA, CALIF.—Plans by City Engr. for improving Park St. from San Antonio Estuary to San Jose Ave., involving 48,620 sq.ft. 5-in. asphalt paving, corr. culvert, etc. Bids after Feb. 18. 1-28

BERKELEY, CALIF.—Plans by City Engr. for improving Boynton Ave., involving 8100 sq.ft. macadam surfacing, 4000 sq.ft. macadam paving, conc. work, etc. Bids after Feb. 11. 1-27

COMPTON, CALIF.—Plans by City Engr., G. Rood, for improving streets west of Compton Ave., between Compton Ave. and west city limits, work involving 400,000 sq.ft. grading, 301,144 sq.ft. 5-in. concrete paving, 6215 ft. 6-in. and 9310 ft. 4-in. cast-iron water mains, 4890 ft. 1-in. copper services. 1911 Act. 1-21

EMERYVILLE, CALIF.—Plans by City Engr., bids to be called for about April 1 and opened about May 1, for improvement of Powell St. from Oakland city line to Tide Lands, work involving 3966 lin.ft. conc. curb and gutter, 100,000 sq.ft. 5-in. Willite asph. paving, 100,000 sq.ft. grading, 12 inverted siphons. 1911 Act. 1-28

LOS ANGELES, CALIF.—Plans by County for improving Washington Blvd. from Soto St. to Atlantic Ave., involving 21,900 cu.yd. excavation, 330,240 sq.ft. 6-in. asphalt base with 2-in. asphalt surface, 56,480 sq.ft. 8-in. concrete paving, 1165 ft. 24-in. reinf. conc. pipe, etc. $120,000. Bids after Feb. 24. 1-30

LOS ANGELES, CALIF.—Plans by J. E. Rockhold, County Surveyor, protests Feb. 24, for improving three-quarters of a mile of McCloud Ave. in Montrose, involving 6235 cu.yd. excavation, 96,380 sq.ft. 4-in. Bitumels paving, curbs, sidewalks, etc. $29,000. 1-31

LOS ANGELES, CALIF.—Plans by County Surveyor, protests Feb. 3, for improving 1.38 miles of Castle Road, near La Canada, involving 11,317 cu.yd. excavation, 204,191 sq.ft. 3-in. oil macadam, corr. pipe, etc. $44,000. 1-25

SAN DIEGO, CALIF.—Plans by City Engr., H. W. Jorgensen, protests Feb. 17, for improving Palermo Drive, involving 111,143 sq.ft. 6-in. asphalt paving, 90 ft. 4-in. cast-iron pipe, conc. sewers, etc. 1-25

SAN DIEGO, CALIF.—Plans by H. W. Jorgensen, City Engr., for (1) Improving Venice St., involving 64,688 sq.ft. 6-in. concrete paving, 1814 ft. 6-in. cast iron water mains, 3 hydrants; and (2) Collier Ave., involving 28,919 sq.ft. 6-in. asphalt paving, 664 ft. 6-in. "B" cast iron pipe. Bids after Feb. 24. 2-1

SAN RAFAEL, CALIF.—Plans by J. B. Piatt, Engr., Daugherty-Shea Bdg., Santa Rosa, protests Feb. 10 by County, for improving streets in Cascades Impr. Dist. 1, grading, Durite paving, corr. culverts. 1-31

SANTA CRUZ, CALIF.—Plans by City Engr., protests Feb. 17, for improving Walnut Ave. from Chestnut Ave. to Pacific Ave., consisting of concrete paving, curbs, sidewalks, vitr. pipe, sewers, 28 double-light electroliers, etc. 1-31

BIDS BEING RECEIVED

BURBANK, CALIF.—Bids to 7:30 p.m., Feb. 25, by City Clerk for improvement of Glenoaks Blvd. from Eton Drive to City limits, by asph. conc. pavement, 6-in. conc. pavement, curb, culverts, headwalls, cast-iron water mains, fire hydrants, etc. 1-24

BURBANK, CALIF.—Bids to 7:30 p.m., Feb. 25, by City for improving Brighton St. from Olive to Verdugo Aves., involving 63,730 sq.ft. grading, 48,270 sq.ft. 4-in. asphalt paving, water mains, curbs, sidewalks, etc. 2-4

FORT MASON, CALIF.—Bids to 11 a.m., Feb. 13, by Constructing Quartermaster, Fort Mason, San Francisco, for installing cement floors in basement of Psychopathic Ward No. 62 at Letterman General Hospital. 2-1

LOS ANGELES, CALIF.—Bids to 10 a.m., Feb. 19, by Board of Public Works for (1) Improving Oakden Drive from Tract 2021 to Ridpath Drive, work consisting of concrete paving, concrete curb, reinforced concrete retaining wall, wooden guard rail, concrete guard rail, galv. iron pipe rail, cement concrete storm drain, corr. iron storm drain, fire hydrants. (2) Improvement of Sycamore Trail, and other streets, work consisting of concrete paving, concrete curbs, walks, reinf. concrete stairway, gutter, iron and chain railing, cement pipe sewers, cast iron house sewer. screw pipe water mains, etc. 1-31

MILL VALLEY, CALIF.—Bids to 8 p.m., Feb. 13, by City Clerk for improving Circle Ave., involving 13,970 sq.ft. concrete paving, vitr. sewers. $7000. 2-1

OAKLAND, CALIF.—Bids to 12 m., Feb. 13, by City Clerk for improving Sunnyside St. from 100th Ave. southerly, involving 58,459 sq.ft. grading, 34,634 sq.ft. 5-in. macadam foundation, asphalt binder and 2-in. National surface, vitr. conduits. 2-1

SAN DIEGO, CALIF.—Bids to Feb. 17, by City Clerk, for (1) Improving Upas St., involving 39,959 sq.ft. 6-in. asphalt paving, 1845 ft. 4-in. cast iron pipe, etc.; and (2) Improving 54th and other streets, involving 316,586 sq.ft. hexagonal concrete slab paving, 46,823 sq.ft., 6-in. plain concrete paving, 43,802 cu.yd. excavation, 15,000 ft. 8-in. and 6-in. vitrified sewers, 1798 ft. 8-in., 7754 ft. 6-in., 321 ft. 4-in., and 489 ft. 2-in. "C" cast iron pipe, 13 hydrants, corr. culvert, etc. 2-1

BURLINGAME, CALIF.—Bids to 8 p.m., Mar. 3, by City Clerk for improving Primrose Road, involving 619 ft. 18-in., 75 ft. 15-in., 1195 ft. 12-in. concrete storm sewer, 6400 sq.ft. 7-in. concrete paving, 40 tons asphalt. $9000. 2-4

MARTINEZ, CALIF.—Bids to 11 a.m., Feb. 17, by County Clerk for streets in Dist. 3, San Pablo, involving 1957 cu.yd. excavation, 26,669 sq.ft. 3-in. Durite surface on 4-in. broken rock cushion, 845 ft. 6-in. vitr. sewer, etc. 1-27

OAKLAND, CALIF.—Bids to 10:30 a.m., Feb. 18, by County Clerk for improving Skyline Blvd. Alternative bids follow: ALTERNATIVE A (for 1½ miles): 75,000 cu.yd. roadway excavation, 850 lin.ft. 12-in. corr. pipe, 83,000 sta.yd. overhaul (500 ft. free haul); ALTERNATIVE B (for 2¼ miles): 90,000 cu.yd. roadway excavation, 1200 lin.ft. 12-in. corr. pipe, 83,000 sta.yd. overhaul (500 ft. free haul). 1-29

SACRAMENTO, CALIF.—Bids to 2 p.m., Feb. 26, by California Division of Highways, for 2.8 miles in CALAVERAS COUNTY from 1½ miles north to 1½ miles south of Calaveritos Creek, involving 42,000 cu.yd. roadway excavation, 3300 cu.yd. gravel or stone surface, 3670 cu.yd. crusher run base, corr. pipe, fencing, redwood timber, etc. 1-29

SACRAMENTO, CALIF.—Bids to 2 p.m., February 19, by the California Division of Highways for 15.5 miles untreated gravel or stone surfacing from Murphy to Big Trees, CALAVERAS COUNTY. Work involves 15,200 cu.yd. untreated gravel or stone surfacing, 6000 cu.yd. rock and screenings (stockpiles). 1-22

CARSON CITY, NEV.—Bids to 2 p.m., Feb. 19, by Nevada State Highway Comm. for 22 miles in PERSHING COUNTY from Woolsey to 2 miles south of Humboldt House, involving 128,000 cu.yd. excavation, 58,500 cu.yd. crushed rock or gravel surfacing, corr. culverts, etc. 2-3

SANTA FE, N. M.—Bids to 10 a.m., Feb. 12, by State Highway Comm. for: (1) COLFAX COUNTY—from Raton and Springer, 13.8 miles grading, one 100-ft. steel bridge and five treated timber bridges; (2) SANTA FE COUNTY—5.7 miles grading and surfacing from Santa Fe to Canoncito; (3) SANDOVAL COUNTY—7.5 miles grading and 1050 ft. steel bridges from Algodones to Domingo; (4) DONA ANA COUNTY—10 miles grading and surfacing, 858 ft. timber bridges; (5) VALENCIA COUNTY—9 miles grading and surfacing from Los Lunas to Belen; (5) QUAY COUNTY—10 miles hauling, crushing and placing selected material from Tucumcari to Glenrio; (6) ROOSEVELT COUNTY—15 miles grading and surfacing from Portales to Roswell; (7) UNION COUNTY—18 miles grading and surfacing from Des Moines to Grenville; and (8) LUNA COUNTY—2.8 miles crushing, hauling and placing gravel (oil processed) from Deming to Lordsburg.

BIDS RECEIVED

HUNTINGTON PARK, CALIF.—V. R. Dennis Const. Co., 3911 5th Ave., San Diego, $54,635 low for 1,000,000 sq.ft. 1-in. to 6-in. asphalt resurfacing on Main St., etc., for City. 1-29

LOS ANGELES, CALIF.—Geo. H. Oswald, 366 E. 58th St., Los Angeles, $55,597 low for County for improving Cerritos Ave., involving grading, concrete paving, etc. 1-31

CONTRACTS AWARDED

PHOENIX, ARIZ.—To Schmidt & Hitchcock, Phoenix, Ariz., $18,550 for improving Pierce St., paving with 3-in. bituminous concrete base with 2-in. Warrenite Bit. surface for City.

TUCSON, ARIZ.—Awards as follows by City: (1) To White & Miller, Yuma, $9642 for paving Pennington St.; and (2) To White & Miller, Yuma, Ariz., $30,631 for improving Church St., Court St., etc.

YUMA, ARIZ.—To R. E. Hazard Contr. Co., 2548 Kettner Blvd., San Diego, $8390 for grading and gravel surfacing Ave. C for County.

BERKELEY, CALIF.—To Hutchinson Co., 1450 Harrison St., Oakland, $1381 for surfacing tennis courts at San Pablo and James Kennedy Playgrounds for City. 1-28

BURBANK, CALIF.—Gibbons & Reed Co., 221 E. San Fernando Road, Burbank, $49,285 for improving Riverside Drive, involving grading, paving with 4-in. asphalt base with 2-in. asphalt surface, corr. pipe, water mains, etc., for City. 1-31

HERMOSA BEACH, CALIF.—To Geo. H. Oswald, 366 E. 58th St., Los Angeles, $40,195 to City for improvement of Camino Real, excavation, curbs, gutters, Permanite resurfacing, cement sewers, vitrified sewers, asphalt concrete pavement, etc. 1-24

LONG BEACH, CALIF.—Awards as follows by City: (1) To Sully Miller Contr. Co., 1500 7th St., Long Beach, $29,469 for concrete paving, sewer system on 36th St., etc.; (2) To Griffith Co., L. A. Railway Bdg., L. A., $10,754 for improving 56th St., Lester St., curbs, walks, and water mains; and (3) To D. P. Durham, 900 Raymond Ave., Los Angeles, who bid $11,395 for improving Harbor Ave., etc., curbs, walks, and water mains, etc. 2-4

LONG BEACH, CALIF.—To Griffith Co., 502 Los Angeles Railway Bdg., Los Angeles, $7404 to City for improvement of Locust Ave. between Seventh and Tenth Sts., asphalt paving, storm drain, etc. 1-23

LOS ANGELES, CALIF.—To Lewis Construction Co., 300 South Juanita, Los Angeles, who bid $97,972 to County for grading 2.9 miles of Topanga Canyon Road from summit south. (See Unit Bid Summary, January 25th issue.) 1-22

LOS ANGELES, CALIF.—Awards as follows by City: (1) To Raasch & Pursche Co., 303 N. Commercial St., Inglewood, $25,675 for improving Cherokee Ave., grading, concrete paving, storm drain, water and lighting systems; (2) To Tyron & Brain, California Bdg., L. A., $13,395 for improving Zelzah Ave., concrete paving, water system, etc.; and (3) To Geo. H. Oswald, 366 E. 58th St., L. A., $55,693 for improving 112th St. from Avalon Blvd. to Figueroa St., grading, concrete paving, sanitary sewer and water system.

LOS ANGELES, CALIF.—Awards as follows by County: (1) To Kovacevich & Price, 1553 Loma Ave., Long Beach, $29,763 for improving Santa Fe Ave. near Huntington Park, grading, concrete paving, lighting system; and (2) To P. Cristich, 1209 Federal Reserve Bdg., L. A., $13,557 for improving Floral Drive in Belvedere Gardens, grading, concrete paving, cement sewers, etc.

MARTINEZ, CALIF.—To California Const. Co., Standard Oil Bdg., S. F., $12,986 for Durite asphalt paving streets in San Pablo Dist. for County. 2-3

REDWOOD CITY, CALIF.—To Frank Bryant, 2911 23rd St., San Francisco, $27,848 for grading 3¼ miles Memorial Park Road for County. 2-3

SACRAMENTO, CALIF.—Awards as follows by California Division of Highways: (1) To Valley Paving & Construction Co., Visalia, who bid $264,664 for 15.9 miles grading and bituminized macadam paving from west boundary to Junction Pumping Station, KERN COUNTY; and (2) To Basich Bros. Construction Co., 433 South Spring St., Los Angeles, who bid $121,148 for 2.9 miles grading and concrete paving from Coyote Wells to Meyers Creek Bridge, IMPERIAL COUNTY. (See Unit Bid Summary, Jan. 25th issue.) 1-23

SACRAMENTO, CALIF.—Awards as follows by California Division of Highways: SAN LUIS OBISPO COUNTY to J. F. Knapp, 5301 Horton Ave., Oakland, $272,648, for 7.2 miles concrete paving and grading from Santa Maria River to Los Berros Creek. SANTA BARBARA COUNTY to Cornwall Construction Co., Santa Barbara, who bid $153,239 for 4 miles concrete paving and grading from Zaca to Wigmore. (See Unit Bid Summary). 2-1

SACRAMENTO, CALIF.—To Larsen Bros., Galt, Sacramento County, who bid $2664 for grading 400 lin.ft. of the Redding Cut on the Orangevale Road for Sacramento County. 2-4

SACRAMENTO, CALIF.—To Geo. Herz Co., San Bernardino, at $247,768 to California Division of Highways, Sacramento, for 15 miles grading and surfacing with oil-treated crushed gravel or stone from Cinco to 7 miles north of Ricardo, KERN COUNTY. (See Unit Bid Summary, Jan. 25th issue.) 2-3

SACRAMENTO, CALIF.—Awards as follows by California Division of Highways: (1) To T. M. Morgan Paving Co., Corporation Bdg., L. A., $272,880 for 1.5 miles grading from 2½ miles to 4 miles northerly of La Canada, LOS ANGELES COUNTY; (2) To Matich Bros., Elsinore, $42,592 for 0.5 mile concrete paving at Wineville, RIVERSIDE COUNTY; (3) To V. R. Dennis Const. Co., P.O. Box 183, Station A, San Diego, $126,455 for grading and surfacing 9.7 miles from San Emigdio Road to Route 4, KERN COUNTY; and (4) To A. M. Peck Co., 2966 Allesandro, Los Angeles, $264,955 for 9 miles grading and concrete paving from El Centro to Holtville, IMPERIAL COUNTY. (See Unit Bid Summary.) 1-28

SALINAS, CALIF.—Awards as follows by City to W. A. Dontanville, Salinas, for concrete paving streets: $34,968 for improving California, Pajaro, Acacia, etc.; and $15,963 for Villia St., Park St., etc. 1-21

SAN DIEGO, CALIF.—Awards as follows by City: (1) To Daley Corp., 4430 Boundary St., San Diego, $7342 for improvement of Alexia Place, excavation, 6-in. asphalt pavement, concrete sewer, cast-iron water main; and (2) To Griffith Co., 2104 Main St., San Diego, $33,184 for improving Cooper Ave., excavation, 6-in. asphalt paving, cast-iron pipe, fire hydrants, concrete sewer, corrugated and concrete culvert, concrete piers. 1-25

SAN DIEGO, CALIF.—To Watson & Sutton, Noell St., San Diego, who bid $48,459 as follows for improvement of Escondido-Valley Center Road for County, 3 miles, using concrete paving. 2-4

SANTA CLARA, CALIF.—To Peninsula Paving Co., Standard Oil Bdg., S. F., $110,363 for asphalt paving Sherman, Lexington, Fremont, Alviso Sts., etc., for City. (See Unit Bid Summary.) 2-4

SANTA CRUZ, CALIF.—To Thompson Bros., Santa Cruz, $7171 for concrete paving Easterly Ave. for City. 1-21

SOUTHGATE, CALIF.—To Ed. Johnson & Sons, 4183 S. Normandie Ave., Los Angeles, $72,905 for improving streets in Dist. 23, consisting of Permanite surface, sewers, cast iron mains, etc., for City. 2-1

SOUTH SAN FRANCISCO, CALIF.—To Fay Improvement Co., Phelan Bdg., S. F., $51,082 for improving Linden Ave. for City, paving with 6-in. concrete base with asphalt surface, concrete and vitr. sewers, lighting system. 1-21

STOCKTON, CALIF.—To Lilly, Willard & Biasotti, 40 W. Clay St., Stockton, $7152 for improving Jack Tone Road, grading, rock and oil surfacing for County. 1-28

CARSON CITY, NEV.—To Nevada Rock & Sand Co., Reno, Nev., $69,147 for grading and surfacing in LYON and CHURCHILL COUNTIES for State. (See Unit Bid Summary). 2-1

PORTLAND, ORE.—To Morrison-Knudsen Co., Boise, Idaho, who bid $517,472 to Bureau of Public Roads, Post Office Bdg., Portland, Oregon, for 7.7 miles grading Siuslaw National Forest Highway in LANE COUNTY, Oregon. (See Unit Bid Summary, Jan. 25th issue.) 1-22

PROSSER, WASH.—To Mathieson Const. Co., Sunnyside, Wash., $34,200 for grading 11 miles road for County, Lateral No. 1.

BRIDGES and CULVERTS

BIDS BEING RECEIVED

SACRAMENTO, CALIF.—Bids to 2 p.m., February 19, by California Division of Highways, Sacramento, for undergrade crossing under tracks of the Northwestern Pacific Railroad at Loleta, HUMBOLDT COUNTY, involving 190 cu.yd. concerte, 15,000 lb. reinf. steel, 80,000 lb. structural steel, etc. 1-22

SAN DIEGO, CALIF.—Bids to 11 a.m., Feb. 17, by County Clerk for storm drain at Fallbrook, involving 144 cu.yd. 5 by 10-ft. rein. conc. box culvert, including 19,000 lb. steel; 256 cu.yd. 6 by 9-ft. rein. conc. box conduit, including 29,000 lb. steel; 540 lin.ft. galvanized wire fencing; and 1210 cu.yd. excavation. 2-3

STOCKTON, CALIF.—Bids to 11 a.m., Feb. 17, by County Clerk for reflooring the Old River bridge over Old River on the Borden Highway, involving 81,600 ft. B.M. redwood timber. $8000. 1-23

VALLEJO, CALIF.—Bids to 11 a.m., Feb. 14, by City Clerk for reinf. concrete culvert with wooden pile foundation on Sonoma St. 2-1

SANTA FE, N. M.—Bids to 10 a.m., Feb. 12, by State Highway Comm. for bridge over the Rio Puerco in SOCORRO COUNTY, consisting of two 140-ft. steel truss spans, one 54-ft. steel stringer approach, and one 17-ft. treated timber approach.

CONTRACTS AWARDED

PHOENIX, ARIZ.—To Lynch-Cannon Engineering Co., 1027 Chapman Bdg., Los Angeles, who bid $397,608 for reinforced concrete bridge over Salt River at Tempe, on Phoenix-Yuma Highway, for Arizona State Highway Commission. (See Unit Bid Summary.) 1-24

BAKERSFIELD, CALIF.—To Stroud Bros., Bakersfield, $5864 for vitrified sewers in Dist. 600 for City. 2-4

SANTA CRUZ, CALIF.—To C. C. Gildersleeve, Felton, $6753 for reinf. conc. and timber bridge over Branciforte Creek for City. 1-29

STOCKTON, CALIF.—Awards as follows by County: (1) To E. R. Stokes, 933 So. Sierra Nevada St., Stockton, who bid $7218 for refloooring the Middle River Bridge over Middle River on the Borden Highway using redwood timber; and (2) To Carl Nelson, 1421 E. Channel St., Stockton, who bid $2495 for reflooring the Jacobs Bridge No. 2 over Burns Cutoff on the Borden Highway, using Douglas fir timber. 1-21

MONTESANO, WASH.—To Puget Sound Bridge & Dredging Co., Seattle, $28,727 for constructing Panhandle bridge over East Hoquiam River for County.

SEWER CONSTRUCTION

WORK CONTEMPLATED

FRESNO, CALIF.—Plans by City Engr. for 6-in. vitrified sewer on Weber Ave. Bids after Feb. 13. 1-28

GUSTINE, CALIF.—Bond election Feb. 25 by City to vote $20,000 for sewer extensions. W. E. Bedesen, Merced, is Engr. 1-25

OCEANSIDE, CALIF.—Plans by R. L. Loucks, City Engr., for improving portions of the Strand, involving 534 lin.ft. 6-in. cast-iron sewer pump main, 1962 lin.ft. 8-in. and 663 lin.ft. 6-in. vitrified pipe sewer, 2 concrete flushtanks, 7 concrete manholes, 1 reinforced concrete pump station, 100 cu.yd., with two 4-in. sewer pumps, 10-hp. motors. $12,000. 1911 Act. Bids after Feb. 12. 2-4

LOS ANGELES, CALIF.—Plans by County Surveyor for sewers in Eastmont Ave., Brady Ave., etc., involving 34,500 lin.ft. 8-in. vitr. sewer, 7050 lin.ft. 8-in. vitr. sewer with concrete cradle, 2900 lin.ft. 10-in. vitrified sewer with concrete cradle, 1540 lin.ft. 12-in. vitr. sewer, 2330 ft. 12-in. vitr. sewer with concrete cradle, 26,000 lin.ft. 6-in. vitr. sewer, 62 flushing manholes, 79 manholes, junction chambers, etc. $113,250. 1-25

REDWOOD CITY, CALIF.—Plans by Geo. A. Kneese, County Surveyor, protests Feb. 17, for sewer system in portions of towns of Atherton and North Fairoaks. Work involves 7 miles of 6-in., 8-in., 10-in., 12-in., 15-in., 18-in., and 30-in. pipe sewer, part vitrified and part concrete. Work under 1921 and 1911 Acts. $278,000. 1-21

SAN MARINO, CALIF.—Plans by Wm. Chalmers, City Engr., protests Feb. 13, for sewers in westerly section of City, involving 9750 lin.ft. 8-in., 390 lin.ft. 15-in., 3,020 lin.ft. 18-in., 1050 lin.ft. 21-in., 650 lin.ft. 27-in., and 40 lin.ft. 30-in. vitrified sewer pipe. $30,000. 1911 Act. 2-4

BIDS BEING RECEIVED

LOS ANGELES, CALIF.—Bids to 2 p.m., Feb. 27, by County for sewers in Belvedere Unit 2, involving 90,000 ft. 8-in. to 15-in. cement pipe, etc. 1-25

HAWTHORNE, NEV.—Bids to 11 a.m., March 5, by Bureau of Yards & Docks, Navy Department, Washington, D. C., for steam, oil, and electrical distributing systems, and sewage disposal plant, and concrete and bituminous macadam roads at the Naval Ammunition Depot, Hawthorne, Nevada. $300,000. 1-27

BIDS RECEIVED

AVALON, CALIF.—Santa Catalina Island Co., P. E. Bdg., L. A., $79,086 for vitrified sewer, reinf. conc. well, cast-iron gas main, cast-iron outfall sewer on Crescent Ave., Hiawatha Ave., for City. 1-29

CONTRACTS AWARDED

OAKLAND, CALIF.—To Hutchinson Co., 1450 Harrison St., Oakland, $63,510 for vitrified sewers on Foothill Blvd., Country Club Manor Tract, etc., for City. 1-22

LOS ANGELES, CALIF.—To Chutuk, Kordich & Vukojevich, 3518 Percy St., Los Angeles, who bid $31,555 for constructing cement pipe sewers in Belvedere Gardens Unit No. 3 for the Board of Supervisors of Los Angeles County. 1-30

PASADENA, CALIF.—To Hardinge Co., Inc., York, Pa., who bid $18,900 for furnishing and delivering one cylindrical, revolving, double shell dryer and appurtenant apparatus for drying sewage sludge at the Pasadena Sewage Disposal Plant, near Alhambra, work for the City of Pasadena. 1-30

SAN JOSE, CALIF.—To W. J. Tobin, 527 Balfour Ave., Oakland, who bid $2300 for reinf. conc. culvert to be 51 ft. long, 45 in. diameter, on oregon pine cradle under the South Pacific Coast Railroad track at Sta. 178-60 on line of San Jose Outfall Sewer, for City. 1-21

WATER SUPPLY SYSTEMS

WORK CONTEMPLATED

MESA, ARIZ.—Plans by G. I. McFarland, General Supt. of City Utilities, Mesa, Arizona, and bids will be called for at once for one 200,000-gallon elevated steel water tank, 138 ft. from foundation to top of tank, hemispherical bottom, 12-in. flanged cast-iron riser, 12-in. base elbow, conical steel roof with revolving ladder on roof and side of tank, ladder inside of tank and from balcony to ground, walk-way to expansion joint, with one coat of Kromate primer and one coat of aluminum paint, to be erected complete on foundations furnished by the City. Funds are on hand to pay the cost of above. Plans and specifications obtainable from above. 1-30

TUCSON, ARIZ.—City is considering water system improvements, surveys being made by Black & Veatch, Engineers, Ferguson Bdg., Los Angeles. 1-25

WATSONVILLE, CALIF.—Plans by City Engr., H. B. Kitchen, and Consulting Engineer, Chas. G. Hyde, University of California, Berkeley, bids soon for water improvements: Improving Ford St. wells, including two deep well pumping plants, pump house, piping, water measuring and recording device, $5000. Improving the main reservoir, grading, concrete work, wooden roof with concrete piers, installing venturi meter, etc., $32,300. Filter plant at Corralitos, including grading, filter plant structures, underdrains and sand, piping and equipment, bypass, water measuring and recording devices, $69,900. Filtered water reservoir at Corralitos, $12,000. Elevated reservoir at Corralitos, including necessary excavation and structures, main pipe and pressure control, $7800. Bonds voted, $125,000. 1-24

MARYSVILLE, WASH.—Bids soon by the City of Marysville, Washington, for furnishing and erecting a 100,000-gallon steel tank and tower. W. C. Morse Co., Smith Tower, Seattle, Washington, are the Consulting Engineers. 1-30

WENATCHEE, WASH.—Plans by City Engr. for cast-iron mains on various streets. $100,000. 2-4

BIDS BEING RECEIVED

BEVERLY HILLS, CALIF.—Bids to 8 p.m., Feb. 18, by City for furnishing and installing centrifugal pump. 2-4

MODESTO, CALIF.—Bids to 7:30 p.m., Feb. 13, by City Clerk for: (1) Drilling well, furnishing and installing casing, sand pumping, etc.; and (2) Furnishing 2000 ft. 10-in. and 120 ft. 14-in. cast-iron pipe. 1-27

SALEM, ORE.—Bids to 5 p.m., Feb. 14, by Public Works Engr. Corp., Hunter-Dulin Bdg., San Francisco, for furnishing and installing complete of a rapid sand type water filtration plant of 6,000,000 gallons daily normal capacity, together with ground improvements and miscellaneous construction work. 1-29

ABERDEEN, WASH.—Bids to 5 p.m., Feb. 19, by City for 7800 lin.ft. 8-in., 3000 lin.ft. 6-in., 1400 lin.ft. 4-in., 1200 lin.ft. 2-in., and 420 lin.ft. 12-in. cast-iron pipe, cast-iron fittings, 5000 lin.ft. ¾-in., 3000 lin.ft. 1-in., 4000 lin.ft. 1½-in., and 8000 lin.ft. 2-in. galv. steel pipe, one elevated steel tank, 15,000-gallon capacity, and tower for same. 2-4

PORT TOWNSEND, WASH.—Bids to 5 p.m., Feb. 11, by City for Water St. improvements, involving 3520 cu.yd. excavation, 4107 ft. 12-in. cast-iron pipe, valves, hydrants, galv. pipe, lead pipe, 1300 ft. 4-in. vitrified sewer, and 7500 lb. cast-iron fittings. 1-27

BIDS RECEIVED

DOWNEY, CALIF.—Low bids as follows by Downey County Water District: (1) Edgley Co., 800 E. 61st St., L. A., $28,495 for laying cast-iron pipe; (2) American Cast Iron Pipe Co., L. A., $60,639 low for furnishing cast-iron pipe; (3) Minneapolis-Moline Power Implement Co., Los Angeles, $12,733 low for one 150,000-gallon steel tank and tower; (4) Pacific Pipe & Supply Co., L. A., $3229 low for fire hydrants; (5) Ducommon Corp., L. A., $7329 low for gate valves. Burns-McDonnell-Smith Engr. Co., Western Pacific Bdg., L. A., are Engineers. 1-29

SIERRA MADRE, CALIF.—A. L. Gabrielson, P.O. Box 104, Arlington, $36,453 low for trenching, backfilling, and laying 49,700 ft. 5-in. to 16-in. lap-welded steel pipe for City. 1-30

SEATTLE, WASH.—J. F. Ward, Inc., Lyon Bdg., Seattle, $89,196 low for intake, valves, etc., to Lake Youngs Aqueduct for City. (See Unit Bid Summary.) 2-3

CONTRACTS AWARDED

ALHAMBRA, CALIF.—Awards as follows by City: (1) Contract awarded to National Cast Iron Pipe Co., Los Angeles, as follows: 1650 ft. 24-in. cast-iron pipe, B, $5.25 ft.; 16,300 ft. 20-in. centr. cast-iron pipe, $3.25 ft.; 1200 ft. 18-in. centr. cast-iron pipe, $2.785 ft.; and (2) Contract awarded to U. S. Pipe & Fdy. Co., Los Angeles, for cement-lined cast-iron pipe as follows: 900 ft. 12-in. cast-iron pipe, $1.601 ft.; 7000 ft. 6-in. cast-iron pipe, .704¢ ft.; 1000 ft. 4-in. cast-iron pipe, .479¢ ft. 1-25

OAKLAND, CALIF.—Awards as follows by East Bay Municipal Utility District for cast-iron pipe: (1) SCHEDULE NO. 1—To U. S. Pipe & Fdy. Co., Monadnock Bdg., San Francisco, who bid $24,272; (2) SCHEDULE NO. 2—To U. S. Pipe & Fdy. Co., Monadnock Bdg., San Francisco, who bid $30,659; and (3) SCHEDULE NO. 3—To U. S. Pipe & Fdy. Co., Monadnock Bdg., San Francisco, who bid $80,427. 1-23

SAN FRANCISCO, CALIF.—Awards as follows by Public Works Engineering Corp.: (1) To Ben C. Gerwick, Inc., 112 Market St., San Francisco, for the construction of a reinforced concrete Mallard Pumping Station, including construction of a cofferdam. Pumping plant involves about 400 cu.yd. reinforced concrete, is located two miles west of Pittsburg, Contra Costa County, located on intake channel at the end

of the pipe-line, and is a unit of Chenery Project. (2) To American Concrete Pipe Co., 41 Sutter St., San Francisco, for furnishing and installing 18-in. diameter centrifugally spun reinforced concrete pipe-line to be 10,850 ft. in length. The pipe-line begins at the south building line of the Chenery Filter plant and ends in the connection into the clear water basin of the Galindo Pumping Station, all located in Contra Costa County, between Clyde and Galindo. 1-30

SANTA ANA, CALIF.—To Lee R. Weber, 603 20th St., Santa Monica, who bid $38,195 for the construction of cast-iron pipe system, gate valves, hydrants, etc., in Villa Park, for Board of Supervisors for County. 1-30

SIERRA MADRE, CALIF.—Bids submitted for trenching, backfilling and laying 49,700 ft. 5-in. to 16-in. lap-welded steel pipe, low bid from A. L. Gabrielson, Arlington, $36,453. Bids rejected and work will be done by the City. 2-1

OMAK, WASH.—To Steel Tank & Pipe Co., Portland, Ore., who bid $42,970 for furnishing and installing water pipe-lines as follows for Omak Pump Co., Omak, Washington: 1381 ft. 22-in. steel pipe, ¼-in. plate; 832 ft. 22-in. steel pipe, $\frac{3}{16}$-in. plate; 817 ft. 22-in. steel pipe, No. 10 ga.; 12,550 ft. 22-in. steel pipe, No. 12 ga. 1-25

SEATTLE, WASH.—To DeLaval Steam Turbine Co., Seattle, who bid $3630 for furnishing one pumping unit of 5200 gallons per minute for the Volunteer Park Pumping Station, for City. 1-27

IRRIGATION and RECLAMATION

BIDS BEING RECEIVED

TURLOCK, CALIF.—Bids to 3 p.m., Feb. 17, by Turlock Irrigation District for: SCHEDULE NO. 1, 63,250 sq.ft. 2-in. concrete canal lining; SCHEDULE NO. 2, 15 concrete structures, involving 20 cu.yd. concrete; and SCHEDULE NO. 3, two wooden bridges, involving 1664 ft. board measure. 1-27

DENVER, COLO.—Bids to 3 p.m., March 10, by Bureau of Reclamation, Denver, Colorado, for furnishing gate hoists, gears sets, cast-iron gates, and accessories for structures on the Main Canal, Minidoka Project, Gravity Extension division, Idaho. All gates and hoists will be installed by the Government. 1-30

NYSSA, ORE.—Bids to 10 a.m., March 11, by Bureau of Reclamation, at the office of the Owyhee Irrigation District, Nyssa, Oregon, for construction of concrete-lined tunnels and roads for the distribution system of the Owyhee Project, Oregon and Idaho. The work is located near Nyssa, Oregon, on the Oregon Short Line Railroad. The work will consist of construction of a 14-ft. diameter tunnel, 18,722 ft. long, and a 9-ft. 4-in. diameter tunnel, 33,307 ft. long; or a 16-ft. 7-in. diameter tunnel, 18,722 ft. long, and a 9-ft. 3-in. diameter tunnel, 21,920 ft. long; and appurtenant roads and structures. Work involves the following approximate quantities: 280,000 cu.yd. tunnel excavation, 114,000 cu.yd. excavation other than tunnel excavation, 23,000 sta.yd. overhaul, 74,000 cu.yd. concrete in tunnel lining, 1600 cu.ft. pressure grouting, 600 ft. 12-in. and 18-in. corrugated metal pipe (laying), 53,000 ft. tunnel and outlet closed drains, 330 M b.m. timbering in tunnels (furnish and erect), 209,000 lb. structural steel in tunnels (furnish and erect). 1-30

NEWELL, S. D.—Bids to 2 p.m., March 18, by Bureau of Reclamation, Newell, South Dakota, for furnishing labor and materials, and performing all work for construction of about 67 miles of open drains, and drainage structures incidental thereto, on the Belle Fourche project, South Dakota. The work is located near Newell, South Dakota. Work involves: 1,385,000 cu.yd. drain excavation, 2350 cu.yd. excavation for struct., 16,000 cu.yd. backfill about struct., 170 cu.yd. concrete, 7200 lb. reinforcement bars (placing), 2750 lin.ft. piling (driving), 115 M b.m. timber in structures (erect), 10,300 ft. corr. metal pipe (laying), 400 ft. semi-circular metal flume (erect). 1-30

BIDS RECEIVED

LOS ANGELES, CALIF.—Baash-Ross Tool Co., 5512 Boyle Ave., L. A., $11,300 low bid to U. S. Indian Service, Federal Bdg., L. A., for two emergency outlet gates and motors for Coolidge Dam, San Carlos, Arizona. 1-29

CONTRACTS AWARDED

OCEANSIDE, CALIF.—To U. S. Pipe & Fdy. Co., Los Angeles, who bid $1.39 per ft. for furnishing cast-iron pipe to Santa Fe Irrigation District. 1-27

RIVER AND HARBOR WORK

BIDS BEING RECEIVED

RICHMOND, CALIF.—Bids to 3 p.m., Mar. 5, by U. S. Engineer's Office, Custom House, San Francisco, for dredging in Richmond Harbor, work involving 193,000 cu.yd. of dredging. 2-4

SACRAMENTO, CALIF.—Bids being received by U. S. Engineer's Office, California Fruit Bdg., Sacramento, for first units of Stockton Deep Water Channel, involving: Unit No. 1—1,000,000 cu.yd. suction dredging in New York Slough, Pittsburg; Unit No. 2—600,000 cu.yd. clamshell dredging and dragline work from Criminal Point to Stockton Channel. Separate bids on above. 2-4

PEARL HARBOR, T. H.—Bids to 11 a.m., March 19, by the Bureau of Yards and Docks, Navy Department, Washington, D. C., for the construction of reinforced concrete pier, quay, and bulkhead including piping and electrical work at the Naval Operating Base (Naval Station and Submarine Base), Pearl Harbor, T. H. $575,000. 1-30

SEATTLE, WASH.—Bids to 10 a.m., Feb. 14, by Port of Willapa Harbor, Lumber Exchange Bdg., Seattle, for 106,732 cu.yd. dredging, constructing dock, bulkhead, railroad spurs, transit shed 120 by 60 ft. 1-21

BIDS RECEIVED

FORT MASON, CALIF.—Clinton Const. Co., 923 Folsom St., San Francisco, $1100 low for repairs to Torpedo wharf at Fort Winfield Scott for Constructing Quartermaster. 1-27

SEATTLE, WASH.—Scherer & Carlson, Terminal Sales Bdg., Seattle, $171,680 low to Port of Seattle for four transit sheds at Pier 40.

LIGHTING SYSTEMS

WORK CONTEMPLATED

GUSTINE, CALIF.—Bond election Feb. 25 by City to vote bonds $5000 for the installation of a street lighting system. 1-28

PACIFIC GROVE, CALIF.—Plans by City Engr., protests Feb. 20, for: (1) Lighting system on Central Ave., work consisting of 17 single light Union Metal Mfg. Co. electroliers, conduit system, etc.; and (2) Installation of street lighting system on portions of Central Ave. and Fountain Ave., work involving the installation of 46 single light Union Metal Manufacturing Co. electroliers, conduit system, etc. 1-28

CONTRACTS AWARDED

HANFORD, CALIF.—To R. A. Wattson, 1026 No. McCadden Place, L. A., $18,994 for electrolier system on Seventh St., etc., for City. 1-28

SAN JOSE, CALIF.—To R. Flatland, 1899 Mission St., San Francisco, who bid $8184 for furnishing and installing lighting system in Second St., between San Salvador and Reed Sts., involving 20 Duplex electrolier posts, for City. 1-21

POWER DEVELOPMENT

VANCOUVER, B. C.—Bids to Feb. 10 by B. C. Electric Railway Co., Publicity Department, 303 B. C. Electric Bdg., Vancouver, B. C., for steel towers which will carry the projected high tension transmission line from the projected Ruskin power plant at Burnaby substation. Eight suspension towers and eight anchor towers will be erected to cross and recross the Fraser river at five points. It is estimated that 180 miles of wire will be used to carry the power for the 38 miles, as well as 5000 high tension insulators. The total cost of this transmission line is expected to exceed $750,000. 1-21

MACHINERY and SUPPLIES

BIDS RECEIVED

OAKLAND, CALIF.—Low bids as follows by Oakland Port Comm.: (1) U. S. Steel Products Co., Rialto Bdg., S. F., $30,926 low for track materials for 9th Ave. pier; and (2) Pacific Coast Engr. Co., Ft. of 14th St., Oakland, $8498 low for dredging pipe. 2-4

STOCKTON, CALIF.—Kennedy Valve Co., S. F., $1549 low for 20 fire hydrants for City. 1-29

CONTRACTS AWARDED

COALINGA, CALIF.—To Boiler Tank & Pipe Co., 75th Ave. and Russett St., Oakland, $1085 to City for furnishing and erecting one gas receiver tank, 8-ft. diameter, by 40 ft. long. 1-30

LOS ANGELES, CALIF.—To Dorr Co., Central Bdg., Los Angeles, by the Los Angeles Water and Power Commission, who bid $6797 for water treatment mechanisms of Dorr manufacture under Adv. 1291. 2-3

LOS ANGELES, CALIF.—Awards as follows by Water & Power Comm., Adv. 1287: To National Cast Iron Pipe Co., who bid 63¢ per ft. for 25,000 ft. pipe. To Pacific States Cast Iron Pipe Co., who bid 65.5¢ per ft. for 25,000 ft. pipe. 2-3

MUNICIPAL DEVELOPMENTS

WORK CONTEMPLATED

REDWOOD CITY, CALIF.—Bond election Apr. 14 by City to vote $55,000 for street extensions, bridges, and storm sewers. 1-22

SURETY BOND AND CASUALTY INSURANCE DIRECTORY

SURETY BONDS
AMERICAN SURETY COMPANY
R. D. WELDON, Manager
340 PINE STREET SAN FRANCISCO
Phone DAvenport 5770

Great American Indemnity Company
New York
241 SANSOME STREET SAN FRANCISCO
Phone DAvenport 3680
548 S. SPRING STREET LOS ANGELES
Phone MUtual 1271

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Manager
206 SANSOME STREET SAN FRANCISCO
San Francisco Branch Office: 204 Sansome Street
R. L. HOLBROOK, *Manager*
Los Angeles Branch Office: E. F. HOLMES, *Manager*
SERVICE IN ALL PARTS OF THE COUNTRY

DETROIT FIDELITY AND SURETY CO.
Pacific Coast Department:
FIFTH FLOOR, 360 PINE STREET, SAN FRANCISCO
ERNEST W. SWINGLEY, *Manager*
JOHN BURNHAM & Co.
Spreckels Building
SAN DIEGO
JAYNE-PURDUM-RIDDELL
Corporation Building
LOS ANGELES
JEWETT, BARTON & LEAVY
Lewis Building
PORTLAND

MARYLAND CASUALTY COMPANY
AGENTS EVERYWHERE
San Francisco Branch:
Insurance Center Building
Los Angeles Branch:
Corporation Building
San Diego Agency:
V. WANKOWSKI & Co., Inc.
121 Broadway
Oakland Branch: Central Bank Building

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.

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GUY LEROY STEVICK
Vice-President
LELAND W. CUTLER
Vice-President
VERNON G. PEIRSON
Pacific Manager
Eighth Floor, Financial Center Building, San Francisco

James Rolph, Jr., Landis & Ellis
General Agents
INSURANCE—SURETY BONDS
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SAN FRANCISCO
Phone KEarny 1020
536 SOUTH HILL STREET
LOS ANGELES
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Phone DAvenport 6460 SAN FRANCISCO 444 California Street
DAVID DUNCAN
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CONTRACT BONDS
"Specify the Globe"

SURETY BONDS
The companies represented on this page can help you. Consult them on your surety bonds and casualty insurance.

SOUTH SAN FRANCISCO, CALIF.—Bond election Feb. 25 by City to vote $185,000 for: (1) $20,000 for the paving of Orange Ave.; (2) $100,000 for the improvement of parks; (3) $15,000 for the purchase of necessary land; and (4) $50,000 for the construction of a municipal swimming pool for the City. Plans being prepared by Architects, Edwards & Schary, 605 Market St., San Francisco. 1-28

MISCELLANEOUS

WORK CONTEMPLATED

HAWTHORNE, NEV.—Bureau of Yards & Docks, Washington, D. C., for chimney at Naval Ammunition Depot, Hawthorne, Nevada. The work consists of a chimney that shall be 4 ft. inside diameter at the top by 100 ft. high, of reinforced concrete, and shall have a fire brick lining in the lower 70-ft. portion, openings for flues, ladder on the outside, cleaning door, and lightning protection. 2-4

BUILDING CONSTRUCTION

WORK CONTEMPLATED

TUCSON, ARIZ.—Plans by A. I. Coffey & Martin J. Rist, Architects, Phelan Bdg., San Francisco, for a one-story reinforced concrete, tile, and stucco hospital at Tucson, for Southern Pacific Co. Cost $250,000. 1-21

LONG BEACH, CALIF.—Plans by W. H. Austin, Architect, Pacific Southwest Bank Bdg., Long Beach, for an auditorium building on the Polytechnic High School site, concrete and steel. $185,000. 2-4

LOS ANGELES, CALIF.—Plans by C. Beelman, Architect, Union Bank Bdg., Los Angeles, for a 12-story and basement class 'A' store and office building at 629 South Hill St. for the Sun Realty & Finance Corp. Building will be of steel frame structure, 60 by 158 ft., with terra cotta facing, plate glass, ornamental iron work, electric elevators, etc. Steel contract has been awarded to Consolidated Steel Corp. 1-29

MERCED, CALIF.—Plans by Reid Bros., Architects, 105 Montgomery St., San Francisco, for two-story class 'C' theatre, store and office building at Merced, for Golden State Theatres, Inc. Cost $200,000. 1-30

OAKLAND, CALIF.—Plans by W. H. Ratcliff, Jr., Architect, Chamber of Commerce Bdg., Berkeley, for a group of concrete education buildings at Mills College, Oakland, for Mills College. $2,000,000. 1-21

PORTLAND, ORE.—Plans by DeYoung, Moskowitz & Rosenberg, Architects, Portland, for an 18-story steel frame addition to department store building at Portland, for Meyer-Frank Co. T. Ronneberg, Crocker Bdg., San Francisco, is the Structural Engineer. $1,000,000. About 1800 tons of structural steel will be required. 1-23

BIDS BEING RECEIVED

KELSEYVILLE, CALIF.—Bids to Feb. 27 by the Kelseyville Union High School District, Kelseyville, Lake County, for concrete school building. $35,000. Wm. Herbert, Rosenberg Bdg., Santa Rosa, is the Architect. 1-30

LONG BEACH, CALIF.—Bids to 2:30 p.m., February 25, by City Manager of Long Beach, for construction of a Municipal Auditorium at Long Beach. Separate bids will be received for general contract, plumbing, heating, and ventilating, electric wiring, and fixtures. J. H. MacDowell, New York, is the Architect, and W. H. Austin, Pacific Southwest Bank Building, West Long Beach, is the Resident Architect. Building will be 400 by 185 ft., of steel frame construction, reinforced concrete walls and floors. $1,400,000. 1-27

LOS ANGELES, CALIF.—Bids to 10 a.m., February 21, by Board of Public Works, Los Angeles, for removal of upper half of Coliseum, and reconstructing of reinforced concrete, involving extensions at each end of peristyle, extending concrete girders, columns, foundation work, and stairs below the upper surface of the concourse floor and underpinning of all tunnels, foundations, etc. J. and D. B. Parkinson, 808 Title Insurance Bdg., Los Angeles, are the Architects. 2-3

OAKLAND, CALIF.—Bids to 10:30 p.m., Feb. 18, by County for alterations to County Court House. $12,000. 1-30

SACRAMENTO, CALIF.—Bids to 2 p.m., February 25, by Geo. B. McDougall, State Architect, Public Works Bdg., 11th and P Sts., Sacramento, for Live Stock Unit, State Agricultural Park, Sacramento. The building is a one-story steel frame structure with brick and concrete walls, concrete floor, and tile and composition roof. Separate bids will be received on General Contract and Mechanical Work. $250,000. 1-29

COCO SOLO, CANAL ZONE—Bids to 11 a.m., March 5, by Bureau of Yards and Docks, Navy Department, Washington, D. C., for construction of storehouse and engine overhaul shop at Naval Air Station, Coco Solo, Canal Zone. 1-27

FORT DOUGLAS, UTAH—Bids to 11 a.m., March 3, by Office of Constructing Quartermaster, Fort Douglas, Utah, for construction of six Company Officers' Quarters and four double sets quarters for Non-Commissioned Officers at Fort Douglas. 1-31

SEATTLE, WASH.—Bids to 11 a.m., February 26, by Bureau of Yards and Docks, Navy Department, Washington, D. C., for construction of a shop building, about 260 by 100 ft., and one-story storehouse, about 200 by 100 ft., having concrete foundations and floors, steel framing, brick and hollow tile walls, and built-up roofing, and a concrete seaplane runway at the Naval Air Station, Seattle, Wash. 1-30

BIDS RECEIVED

VICTORIA, B. C.—Pacific Engr., Ltd., Vancouver, B. C., $679,000 low for veterans' unit at Essondale for Minister of Mines and Public Works.

BAKERSFIELD, CALIF.—H. I. Beller Const. Co., 6513 Hollywood Blvd., Hollywood, $261,430 low for 'A' theatre for Fox West Coast Theatres. S. C. Lee, Petroleum Securities Bdg., L. A., is the Architect. 2-3

BERKELEY, CALIF.—Low bids as follows by City: (1) K. E. Parker, 135 So. Park, S. F., $210,000 low for frame and concrete library on Kittredge and Shattuck Aves.; and (2) S. O. McDonald & Sons, 2912 Deakin St., Berkeley, $12,703 low for recreation building at San Pablo Park. 2-4

BERKELEY, CALIF.—Dyer Const. Co., 1924 Broadway, Oakland, $31,000 low bid to University of California for brick and Stucco "C" garage on Oxford and Addison Sts., Berkeley. 1-23

SALINAS, CALIF.—H. H. Larsen Co., 60 So. Park, San Francisco, $258,000 low for "A" bank and office building on Main St. for Salinas National Bank. Swartz & Ryland, 373 Main St., Salinas, are Architects. 1-31

SAN FRANCISCO, CALIF.—Dyer Const. Co., 1924 Broadway, Oakland, $65,400 low to Supt. of Lighthouses, Custom House, for reinf. concrete warehouse and shop building at Goat Island. 1-28

HONOLULU, T. H.—Three lowest bids received by the Supervising Architect, U. S. Treasury Department, Washington, D. C., for construction of a post office building at Honolulu, Hawaii: N. P. Severin Co., Chicago, Ill., $308,000; Bithulithic Painting & Concrete Co., Honolulu, $310,236; Ralph E. Woolley, Honolulu, $314,000. 1-29

CONTRACTS AWARDED

YUMA, ARIZ.—To Edwards, Wildey & Dixon, Edwards & Wildey Bdg., Los Angeles, for 'A' apartment building on the corner of Main and First Sts., Yuma, Arizona, for the San Carlos Hotel Co. Building will be of reinforced concrete 90 by 100 ft. Louis Dorr and Dwight Gibbs, 1110 Fine Arts Bdg., Los Angeles, are the Architects. $250,000. 1-23

LOS ANGELES, CALIF.—To Consolidated Steel Corp., 1200 N. Main St., and McClintic-Marshall Co., Pacific Electric Bdg., Los Angeles, for fabrication and erection of 26,000 tons of steel to be used in connection with construction of airport terminal and industrial building at 3300 S. Main St., for El Travia Company, 6600 Lexington Ave., O. R. Angelillo, Chief Engineer. $11,500,000. Sumner-Sollitt Co., 810 W. Sixth St., Los Angeles, are the Contractors. 1-23

LOS ANGELES, CALIF.—To P. J. Walker Co., 1111 W. M. Garland Bdg., Los Angeles, for 12-story "A" bank and office building at 621 S. Spring St., Los Angeles, for Spring Street Realty Co. The Consolidated Steel Corp. will furnish and erect the structural steel. J. & D. B. Parkinson, 808 Title Insurance Bdg., Los Angeles, are the Architects. $1,000,000. 1-27

SACRAMENTO, CALIF.—To Industrial Const. Co., 815 Bryant St., San Francisco, $75,000 for store building on Seventh and K Sts., for L. R. Lurie Co. O'Brien & Peugh, 315 Montgomery St., San Francisco, are Architects. 1-31

SAN FRANCISCO, CALIF.—Awards as follows by City for Ward Building F at Relief Home: (1) GENERAL CONTRACT—To Spivock & Spivock, Hobart Bdg., San Francisco, $95,900; (2) ELECTRICAL WORK—To Knut Smith, San Francisco, $2137; (3) PLUMBING AND GAS FITTING CONTRACT—To Scott Co., 243 Minna St., San Francisco, $11,537; and (4) MECHANICAL EQUIPMENT to Scott Co., 243 Minna St., San Francisco, $8160. 1-25

SAN FRANCISCO, CALIF.—To Barrett & Hilp, 918 Harrison St., San Francisco, who bid $450,000 for 'A' addition to the Southern Pacific Hospital, and alterations to the present building on Fell and Baker Sts., San Francisco. M. J. Rist and A. I. Coffey, Phelan Bdg., San Francisco, are the Architects. 1-23

SAN JOSE, CALIF.—To B. J. Smith, 1376 Mariposa St., San Jose, $30,300 for reinf. conc. and frame building at County Almshouse at Milpitas for County. 2-4

SAN RAFAEL, CALIF.—To Young & Horstmeyer, 461 Market St., San Francisco, who bid $55,050 for constructing (General Contract) gymnasium, reinforced concrete construction, at the San Rafael High School for Board of Education. 1-22

FORT LYON, COLO.—To C. S. Lambie & Co., Amarillo, Tex., $299,511 for acute building at Fort Lyon for U. S. Govt.

SEATTLE, WASH.—Awards as follows by King County Commissioners, Seattle, for Webster Hospital for King County: General Contract to Western Construction Co., Seaboard Bdg., Seattle, who bid $1,245,237. Plumbing to Rautman Plumbing & Heating Co., 109 Jackson St., Seattle, who bid $158,779. Heating and Ventilating, to Rautman Plumbing & Heating Co., 109 Jackson St., Seattle, who bid $161,967; Electric Wiring to NePage-McKenny Co., 804 Sixth South, Seattle, who bid $106,775. Sprinkler System to Rautman Plumbing & Heating Co., 109 Jackson St., Seattle, who bid $8853. 1-24

SEATTLE, WASH.—To H. S. Wright & Co., 2410 First Ave., Seattle, $600,000 for 13-story apartment building on Spring St. and Minor Ave. to be known as Gainsborough Apartments. E. W. Morrison, Seattle, is Architect.

OPPORTUNITY PAGE

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

THE BUYERS' GUIDE

Refer to advertisements for addresses of companies listed. Advertisers index on page 66

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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.

Asphalt
Gilmore Oil Co.
Seaside 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 Meese & Gottfried 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
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 Meese & Gottfried Co.
Northwest Engineering Co.
Orton Crane & Shovel Co.
Spears-Wells Machy. Co., Inc.
Speeder Machinery Corp.
Thew Shovel Co., The
Universal Crane Co., The
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.
Harron, Rickard & McCone Co.
Jenison Machinery Co.
Link-Belt Meese & Gottfried 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
American Surety Co.
Associated Indemnity Corp.
Commerce Casualty Co.
Detroit Fidelity & Surety Co.
Fidelity & Casualty Co. of N. Y., The
Fidelity & Deposit Co. of Maryland
Glens Falls Indemnity Co.
Globe Indemnity Co.
Great American Indemnity Co.
Indemnity Insurance Co. of North America

Bonds, Surety (Continued)
Maryland Casualty 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 Meese & Gottfried Co.

Buckets, Dredging
Harnischfeger Sales Corp.
Slick, R. R.

Buckets, Excavating
Bacon Co., Edward R.
Bucyrus-Erie Co.
Garfield & Co.
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 Meese & Gottfried Co.
U. S. Cast Iron Pipe & Fdy. Co.

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

Cement
Portland Cement Association

Cement Guns
Cement Gun Const. Co.

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.
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
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 Meese & Gottfried Co.

Cranes (Electric, Gasoline Locomotive)
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 Meese & Gottfried 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, Traveling
Harnischfeger Sales Corp.
Harron, Rickard & McCone Co.
Industrial Brownhoist Corp.
Jenison Machinery Co.
Thew Shovel Co., The

Crushers
Bacon Co., Edward R.
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.

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 Meese & Gottfried 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
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 Meese & Gottfried Co.
Marion Steam Shovel Co.
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.

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

Dump Wagons
Le Tourneau Mfg. 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.
Jenison Machinery Co.
Le Roi Co.
Wisconsin Motor Co.

Excavating Machinery
Bacon Co., Edward R.
Bodinson Mfg. Co.
Bucyrus-Erie Co.
Caterpillar Tractor Co.
Cleveland Tractor Co., The
Garfield & Co.
General Excavator Co.
Harnischfeger Sales Corp.
Harron, Rickard & McCone Co.
Industrial Brownhoist Corp.
Jenison Machinery Co.
Link-Belt Meese & Gottfried Co.
Marion Steam Shovel Co.
Northwest Engineering Co.
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
Universal Crane Co., The

(Continued on page 62)

OPPORTUNITY PAGE

CONTINUED

OFFICIAL BIDS

NOTICE TO CONTRACTORS

Steel or Cast Iron Pipe

Sealed proposals will be received at the office of the East Bay Municipal Utility District, 512 Sixteenth Street, Oakland, California, until 5:30 p.m. Wednesday, February 19, 1930, and will at that hour be opened, for constructing and furnishing 4000 lin.ft. of ¼-in. thickness 20-in. diameter electric welded sheet steel pipe or 4000 lin.ft. of Class 'B' cast-iron pipe, and 5700 lin.ft. of ¼-in. thickness 24-in. diameter electric welded sheet steel pipe, for the Distribution System, East Bay Municipal Utility District.

Plans and specifications for this work may be obtained by application to the office of the District, Oakland, California.

JOHN H. KIMBALL, Secretary.
Oakland, California, February 5, 1930.

NOTICE TO CONTRACTORS

Grading

Sealed proposals will be received at the office of the State Highway Engineer, Public Works Building, Sacramento, California, until 2 o'clock p.m. on March 5, 1930, at which time they will be publicly opened and read, for construction in accordance with the specifications therefor, to which special reference is made, of portions of State Highway, as follows:

Humboldt County, between southerly boundary and Richardson's Grove (I-Hum-1-A), about one and four-tenths (1.4) miles in length, to be graded and surfaced with untreated crushed gravel or stone.

Proposal forms will be issued to only those Contractors who have furnished verified statement of experience and financial condition in accordance with the provisions of Chapter 644, Statutes 1929, and whose statements so furnished are satisfactory to the Department of Public Works. Bids will not be accepted from a Contractor to whom a proposal form has not been issued by the Department of Public Works.

Plans may be seen, and forms of proposal, bonds, contract and specifications may be obtained at the said office, and they may be seen at the offices of the District Engineers at Los Angeles and San Francisco, and at the office of the District Engineer of the district in which the work is situated. The District Engineers' offices are located at Eureka, Redding, Sacramento, San Francisco, San Luis Obispo, Fresno, Los Angeles, San Bernardino and Bishop.

A representative from the district office will be available to accompany prospective bidders for an inspection of the work herein contemplated, and Contractors are urged to investigate the location, character and quantity of work to be done, with a representative of the Division of Highways. It is requested that arrangements for joint field inspection be made as far in advance as possible. Detailed information concerning the proposed work may be obtained from the district office.

No bid will be received unless it is made on a blank form furnished by the State Highway Engineer. The special attention of prospective bidders is called to the "Proposal Requirements and Conditions" annexed to the blank form of proposal, for full directions as to bidding, etc.

The Department of Public Works reserves the right to reject any or all bids or to accept the bid deemed for the best interests of the State.

DEPARTMENT OF PUBLIC WORKS.
DIVISION OF HIGHWAYS.
C. H. PURCELL, State Highway Engineer.
Dated February 5, 1930.

HELP WANTED

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

ENGINEER, with architectural and construction experience including extensive use of stone as building material, to plan, estimate and detail for sales department of stone company. Apply by letter. Location, San Francisco. R-2960-S.

ENGINEER, highly specialized on production of tin out of the ores and tin containing slimes. Apply by letter with record in duplicate. Location, Europe. K-260-W-376-C-S.

ENGINEER, with theoretical training in aeronautics and some experience in airplane construction, for executive position with manufacturing company. This is a rare opportunity to connect with aviation industry and an investment of $5000-25,000 is expected from the qualified applicant. Headquarters, San Francisco. R-2955-S.

FIELD ENGINEERS AND TOPOGRAPHICAL DRAFTSMEN, for employment in Cuba, Central and South America. Starting salaries $125-175 per mo. plus living quarters. Apply by letter; if for drafting send samples of work. Headquarters, East. R-2931-S.

THE BUYERS' GUIDE—*Continued from Page 60*

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.

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.

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
Bishop-Jacobsen & 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.
Harron, Rickard & McCone Co.
Jenison Machinery Co.
Link-Belt Meese & Gottfried Co.
Smith Engineering Works
Young Mach. Co., A. L.

Gunite Lining
Cement Gun Const. Co.

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.
Ingersoll-Rand Co.
Jaeger Machine Works, The
Jenison Machinery Co.

Hoists, Hand and Power (Continued)
Link-Belt Meese & Gottfried Co.
Sullivan Machinery Co.
Young Machy. Co., A. L.

Hoppers, Steel
Bacon Co., Edward R.
Harron, Rickard & McCone Co.
Jenison Machinery Co.
Lakewood Engr. Co.
Link-Belt Meese & Gottfried 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.
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.
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 Meese & Gottfried 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.

Metal Lath
Truscon Steel Company

Meters, Irrigation
Bishop-Jacobsen & 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.
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
Wailes Dove-Hermiston Corp.

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

Paints, Technical
American Bitumuls Co.
Wailes Dove-Hermiston Corp.

Paints, Waterproofing
McEverlast, Inc.
Wailes Dove-Hermiston Corp.

Pavers, Concrete
Foote Company, Inc.
Harron, Rickard & McCone Co.
Koehring Company
Smith Co., T. L.

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, 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.
Wailes Dove-Hermiston Corp.

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

Pipe, Culvert
American Concrete Pipe Co.
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
American Concrete Pipe Co.
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
American Concrete Pipe Co.
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.
Jenison Machinery Co.

Preservative—Wood, Metal, etc.
Columbia Wood & Metal Preservative Co.

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

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

(Continued on page 64)

OPPORTUNITY PAGE

CONTINUED

OFFICIAL BIDS

NOTICE TO CONTRACTORS
STATE OF CALIFORNIA, DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

In accordance with the provisions of Chapter 644, Statutes of 1929, prospective bidders on State highway work, before being furnished with plans and specifications, will be required to file a statement of their experience and financial condition.

Prospective bidders are requested to file their statements, or to supplement previous statements, for qualifying to bid on a job at least 14 days before they desire to take out plans and specifications, in order to allow sufficient time to review and pass on the statement or supplemental data.

No plans and specifications will be furnished to prospective bidders until their statement of experience and financial condition has been examined and approved.

DEPARTMENT OF PUBLIC WORKS,
DIVISION OF HIGHWAYS
C. H. PURCELL, State Highway Engineer.
Dated: January 15, 1930.

Officers' Quarters

Sealed proposals will be received in the office of the Constructing Quartermaster, Fort Douglas, Utah, until 11 a. m., on March 3, 1930, and publicly opened at that time, for the construction of six (6) Company Officers' Quarters and four (4) double sets quarters for Non-Commissioned Officers at Fort Douglas. Plans and specifications may be obtained from the Constructing Quartermaster, Fort Douglas, Utah, upon deposit of $25.00 for their safe return.

UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

Canal Excavations and Structures

Washington, D. C., January 24, 1930

Sealed bids (Specifications No. 507) will be received at the office of the Bureau of Reclamation, Newell, South Dakota, until 2 o'clock p.m., March 18, 1930, and then publicly opened, for furnishing labor and materials and performing all work for the construction of about 67 miles of open drains, and drainage structures incidental thereto, on the Belle Fourche project, South Dakota. The work is located near Newell, South Dakota. The principal items and the estimated quantities involved are as follows: 1,385,000 cubic yards of drain excavation; 2,350 cubic yards of excavation for structures; 16,000 cubic yards of backfill about structures; 170 cubic yards of concrete; placing 7,200 pounds of reinforcement bars; driving 2,750 linear feet of piling; erecting 115 M ft. b.m. of timber in structures; laying 10,300 linear feet of corrugated metal pipe; and erecting 480 linear feet of semi-circular metal flume. This invitation for bids does not cover the purchase of materials which are to be furnished by the Government. Materials to be furnished by the contractor and those furnished by the Government are described in the specifications which will be a part of the contract. For particulars, address the Bureau of Reclamation at Newell, South Dakota; Denver, Colorado; or Washington, D. C.

ELWOOD MEAD, Commissioner.

UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

Tunnels

Washington, D. C., January 14, 1930

Sealed bids (Specifications No. 505) will be received by the Bureau of Reclamation at the office of the Owyhee Irrigation District, Nyssa, Oregon, until 10 o'clock a.m., March 11, 1930, and then publicly opened, for furnishing labor and materials and performing all work for the construction of concrete-lined tunnels and roads for the distribution system of the Owyhee project, Oregon and Idaho. The work is located near Nyssa, Oregon, on the Oregon Short Line Railroad. The work will consist of the construction of a 14 ft. diameter tunnel, 18,722 ft. long, and a 9 ft. 4 in. diameter tunnel, 33,307 ft. long; or a 16 ft. 7 in. diameter tunnel, 18,722 ft. long, and a 9 ft. 3 in. diameter tunnel, 21,920 ft. long; and appurtenant roads and structures. The principal items and the maximum estimated quantities involved are as follows: 280,000 cu.yd. of all classes of tunnel excavation; 114,000 cu.yd. of all classes of excavation other than tunnel excavation; 23,000 station cu.yd. of overhaul; 74,000 cu.yd. concrete in tunnel lining; 1,600 cu.ft. of pressure grouting; laying 600 lin.ft. of 12-in. and 18-in. corrugated metal pipe; constructing 53,000 lin.ft. of tunnel and outlet closed drains; furnishing and erecting 330 M ft. b.m. timbering in tunnels; and furnishing and erecting 209,000 pounds structural steel in tunnels. This invitation for bids does not cover the purchase of materials which are to be furnished by the Government. Materials to be furnished by the contractor and those furnished by the Government are described in the specifications which will be a part of the contract. For particulars, address the Bureau of Reclamation, Owyhee, Oregon; Denver, Colorado; or Washington, D. C.

ELWOOD MEAD, Commissioner.

UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

Gate Hoists and Gates

Washington, D. C., January 17, 1930

Sealed bids (Specifications No. 506) will be received at the office of the Bureau of Reclamation, Denver, Colorado, until 3 o'clock p.m., March 10, 1930, and will at that hour be opened, for furnishing gate hoists, gear sets, cast iron gates and accessories for structures on the Main Canal, Minidoka project, Gravity Extension division, Idaho. All gates and hoists will be installed by the Government. For particulars, address the Bureau of Reclamation, Burley, Idaho; Denver, Colorado; or Washington, D. C.

ELWOOD MEAD, Commissioner.

NOTICE TO CONTRACTORS

Bridge and Surfacing

Sealed proposals will be received at the office of the State Highway Engineer, Public Works Building, Sacramento, California, until 2 o'clock p.m. on February 19, 1930, at which time they will be publicly opened and read, for construction in accordance with the specifications therefor, to which special reference is made, of portions of State Highway, as follows:

Humboldt County, an undergrade crossing under the tracks of the Northwestern Pacific Railroad at Loleta (I-Hum-1-G), consisting of a 60-foot deck plate girder span on concrete piers with pile foundations.

Calaveras County, between Murphy's and Big Trees (X-Cal-24-E), about fifteen and five-tenths (15.5) miles in length, to be surfaced with untreated crushed gravel or stone.

Proposal forms will be issued to only those Contractors who have furnished verified statement of experience and financial condition in accordance with the provisions of Chapter 644, Statutes 1929, and whose statements so furnished are satisfactory to the Department of Public Works. Bids will not be accepted from a Contractor to whom a proposal form has not been issued by the Department of Public Works.

Plans may be seen, and forms of proposal, bonds, contract and specifications may be obtained at the said office, and they may be seen at the offices of the District Engineers at Los Angeles and San Francisco, and at the office of the District Engineer of the district in which the work is situated. The District Engineers' offices are located at Eureka, Redding, Sacramento, San Francisco, San Luis Obispo, Fresno, Los Angeles, San Bernardino and Bishop.

A representative from the district office will be available to accompany prospective bidders for an inspection of the work herein contemplated, and Contractors are urged to investigate the location, character and quantity of work to be done, with a representative of the Division of Highways. It is requested that arrangements for joint field inspection be made as far in advance as possible. Detailed information concerning the proposed work may be obtained from the district office.

No bid will be received unless it is made on a blank form furnished by the State Highway Engineer. The special attention of prospective bidders is called to the "Proposal Requirements and Conditions" annexed to the blank form of proposal, for full directions as to bidding, etc.

The Department of Public Works reserves the right to reject any or all bids or to accept the bid deemed for the best interests of the State.

DEPARTMENT OF PUBLIC WORKS,
DIVISION OF HIGHWAYS.
C. H. PURCELL, State Highway Engineer.
Dated January 22, 1930.

NOTICE TO CONTRACTORS

Grading and Surfacing

Sealed proposals will be received at the office of the State Highway Engineer, Public Works Building, Sacramento, California, until 2 o'clock p.m. on February 26, 1930, at which time they will be publicly opened and read, for construction, in accordance with the specifications therefor, to which special reference is made, of portions of State Highway, as follows:

Calaveras County, between 1½ miles north and 1½ miles south of Calaveritas Creek (X-Cal-65-B), about two and eight-tenths (2.8) miles in length, to be graded and surfaced with crusher run base and untreated crushed gravel or stone surfacing.

Proposal forms will be issued to only those Contractors who have furnished verified statements of experience and financial condition in accordance with the provisions of Chapter 644, Statutes 1929, and whose statements so furnished are satisfactory to the Department of Public Works. Bids will not be accepted from a Contractor to whom a proposal form has not been issued by the Department of Public Works.

Plans may be seen, and forms of proposal, bonds, contract and specifications may be obtained at the said office, and they may be seen at the offices of the District Engineers at Los Angeles and San Francisco, and at the office of the District Engineer of the district in which the work is situated. The District Engineers' offices are located at Eureka, Redding, Sacramento, San Francisco, San Luis Obispo, Fresno, Los Angeles, San Bernardino and Bishop.

A representative from the district office will be available to accompany prospective bidders for an inspection of the work herein contemplated, and Contractors are urged to investigate the location, character and quantity of work to be done, with a representative of the Division of Highways. It is requested that arrangements for joint field inspection be made as far in advance as possible. Detailed information concerning the proposed work may be obtained from the district office.

No bid will be received unless it is made on a blank form furnished by the State Highway Engineer. The special attention of prospective bidders is called to the "Proposal Requirements and Conditions" annexed to the blank form of proposal, for full directions as to bidding, etc.

The Department of Public Works reserves the right to reject any or all bids or to accept the bid deemed for the best interests of the State.

DEPARTMENT OF PUBLIC WORKS,
DIVISION OF HIGHWAYS.
C. H. PURCELL, State Highway Engineer.
Dated January 29, 1930.

THE BUYERS' GUIDE—*Continued from Page 62*

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.
Woodin & Little

Pumps, Sewage
American Well Works, The
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.
French & Co., A. W.
Jenison Machinery Co.
Lakewood Engr. Co.

Road Forms
Bacon Co., Edward R.
Harron, Rickard & McCone Co.
Jenison Machinery Co.
Lakewood Engr. Co.

Road Graders and Scrapers
Bacon Co., Edward R.
Brown-Bevis Company
Caterpillar Tractor Co.
Galion Iron Works & Mfg. Co.
Jenison Machinery Co.
Spears-Wells Machinery Co.
West Coast Tractor Co.
Young Machinery Co.,A. L.

Road Oil
Gilmore Oil Co.
Seaside Oil Co.
Standard Oil Co.
Union Oil Co.

Road Oil, Emulsified
American Bitumuls Co.

Road Rollers
Bacon Co., Edward R.
Brown-Bevis Co., The
Galion Iron Works & Mfg. C.
Hackley Equipment Co., P. B.
Huber Manufacturing Co.
Jenison Machinery Co.
Spears-Wells Machinery Co.

Rules, Steel, Wood and Aluminum
Lufkin Rule Co., The

Saws, Portable
Harron, Rickard & McCone Co.
Ingersoll-Rand Co.
Jenison Machinery Co.
Young Machinery Co., A. L.

Scarifiers
Bacon Co., Edward R.
Jenison Machinery Co.
Le Tourneau Mfg. Co.
Spears-Wells Machinery Co.

Scrapers (Dragline, Fresno, Wheeled)
Bacon Co., Edward R.
Galion Iron Works & Mfg. C.
Harron, Rickard & McCone Co.
Jenison Machinery Co.
Killefer Manufacturing Co.
Sauerman Bros., Inc.

Screens, Sand and Gravel
Bacon Co., Edward R.
Bodinson Manufacturing Co.
Harron, Rickard & McCone Co.
Jenison Machinery Co.
Link-Belt Meese & Gottfried Co.
Smith Engineering Co.
Young Machinery Co., A. L.

Screens, Sewage
Dorr Co., The
Link-Belt Meese & Gottfried Co.

Screens, Vibrating
Harron, Rickard & McCone Co.
Link-Belt Meese & Gottfried Co.
Smith Engineering Co.

Second-Hand Equipment
Contractors Mchy. Exchange
Excavating Equipment Dealers, Inc.
Hackley Equipment Co., P. B.
Harron, Rickard & McCone Co.
Tieslau Bros.

Sewage Disposal Apparatus
Dorr Co., The
Industrial & Municipal Supply Co
Link-Belt Meese & Gottfried Co.
Wallace & Tiernan
Water Works Supply Co.

Sharpeners, Rock Drill Steel
Gardner-Denver Co.
Ingersoll-Rand Co.

Shovels (Electric, Gasoline, Steam)
Bacon Co., Edward R.
Bucyrus-Erie Co.
Garfield & Co.
General Excavator Co.
Hackley Equipment Co., P. B.
Harnischfeger Sales Corp.
Harron, Rickard & McCone Co.
Industrial Brownhoist Corp.
Jenison Machinery Co.
Link-Belt Meese & Gottfried Co.
Marion Steam Shovel Co.
Northwest Engineering Co.
Ohio Power Shovel Co.
Orton Crane & Shovel Co.
Osgood Co., The
Spears-Wells Machinery Co.
Speeder Machinery Corp., The
Thew Shovel Co., The
Young Machy. Co., A. L.

Shovels, Hand
Harron, Rickard & McCone Co.
Jenison Machinery Co.

Sluice Gates
California Corrugated Culvert Co
Water Works Supply Co.

Spreaders, Gravel and Rock and Asphalt
Bacon Co., Edward R.
Galion Iron Works & Mfg. Co.
Jenison Machinery Co.

Standpipes
Chicago Bridge & Iron Works
Montague Pipe & Steel Co.
Pittsburgh-Des Moines Steel Co.
Western Pipe & Steel Co.

Steel Bands
Pacific Coast Steel Co.

Steel, Drill
Gardner-Denver Co.
Ingersoll-Rand Co.
Leitch & Co.
Rix Company, Inc., The

Steel Plates
Pacific Coast Steel Co.

Steel Plate Construction
Chicago Bridge & Iron Works
Lacy Manufacturing Co.
Montague Pipe & Steel Co.
Pittsburgh-Des Moines Steel Co.
Western Pipe & Steel Co.

Steel, Structural
Pacific Coast Steel Co.
Western Iron Works
Western Pipe & Steel Co.

Street Sweepers, Sprinklers, Flushers
Jenison Machinery Co.

Steel Joists
Truscon Steel Co.

Steel Windows
Truscon Steel Co.

Subgraders
Bacon Co., Edward R.
Blaw-Knox Co.
Harron, Rickard & McCone Co.
Lakewood Engineering Co.

Swimming Pool Equipment
California Filter Co., Inc.

Tanks, Air Compressor
Ingersoll-Rand Co.
Lacy Manufacturing Co.
Peerless Mchy. & Mfg. Co.
Rix Company, Inc., The
Western Pipe & Steel Co.

Tanks, Corrugated
California Corrugated Culvert Co.
Western Pipe & Steel Co.

Tanks, Elevated Steel
Chicago Bridge & Iron Works
Lacy Manufacturing Co.
Montague Pipe & Steel Co.
Pittsburgh-Des Moines Steel Co.
Western Pipe & Steel Co.

Tanks, Oil Storage
Chicago Bridge & Iron Works
Lacy Manufacturing Co.
Steel Tank & Pipe Co.
Western Pipe & Steel Co.

Tapes, Measuring, Steel and Fabric
Lufkin Rule Co., The

Testing Laboratories
Hunt Co., R. W.

Tie Plates
Pacific Coast Steel Co.

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