

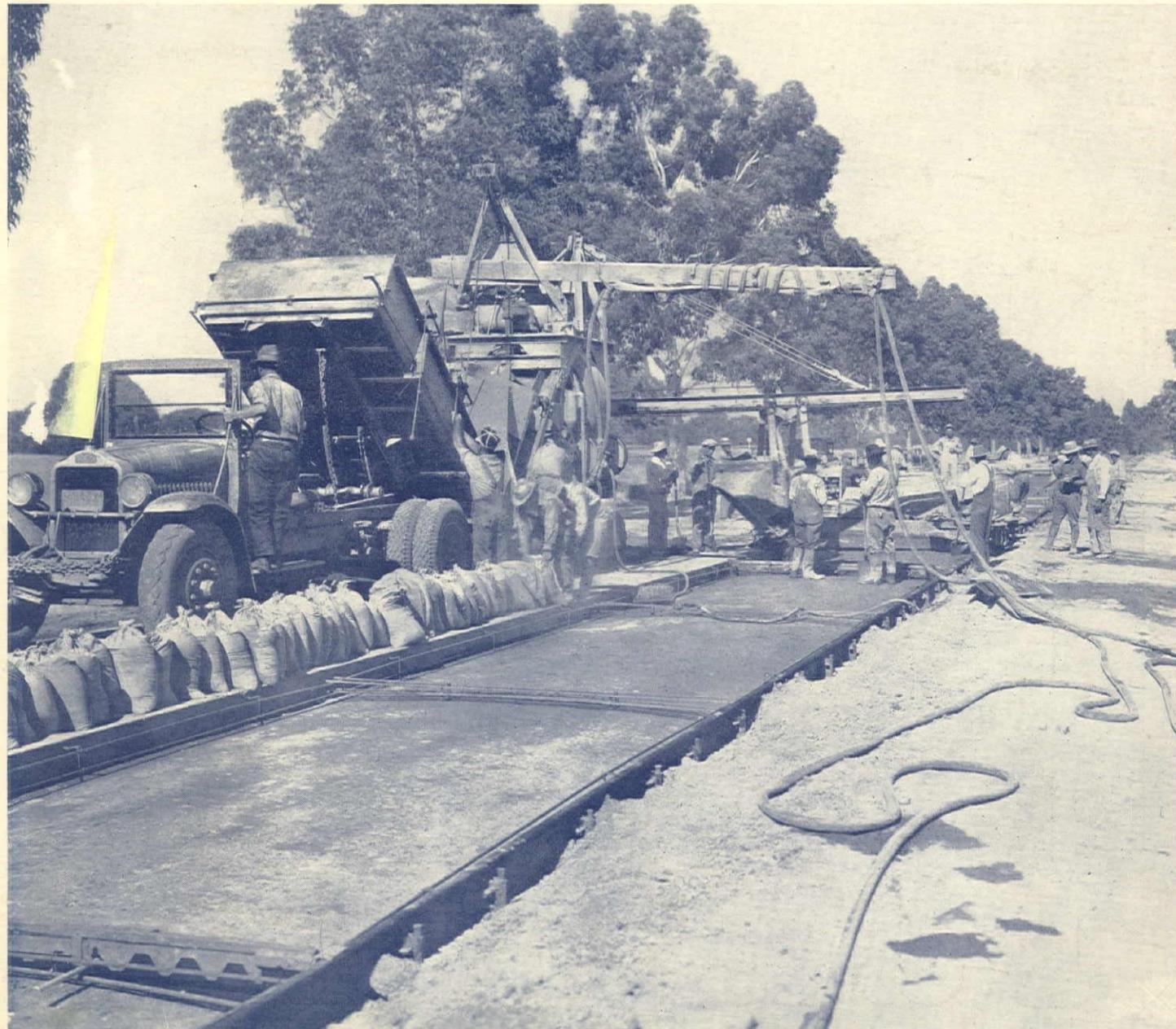
WESTERN CONSTRUCTION NEWS

CIVIL ENGINEERING AND CONSTRUCTION IN THE FAR WEST

PUBLISHED SEMI-MONTHLY
VOLUME IV NUMBER 21

SAN FRANCISCO, NOVEMBER 10, 1929

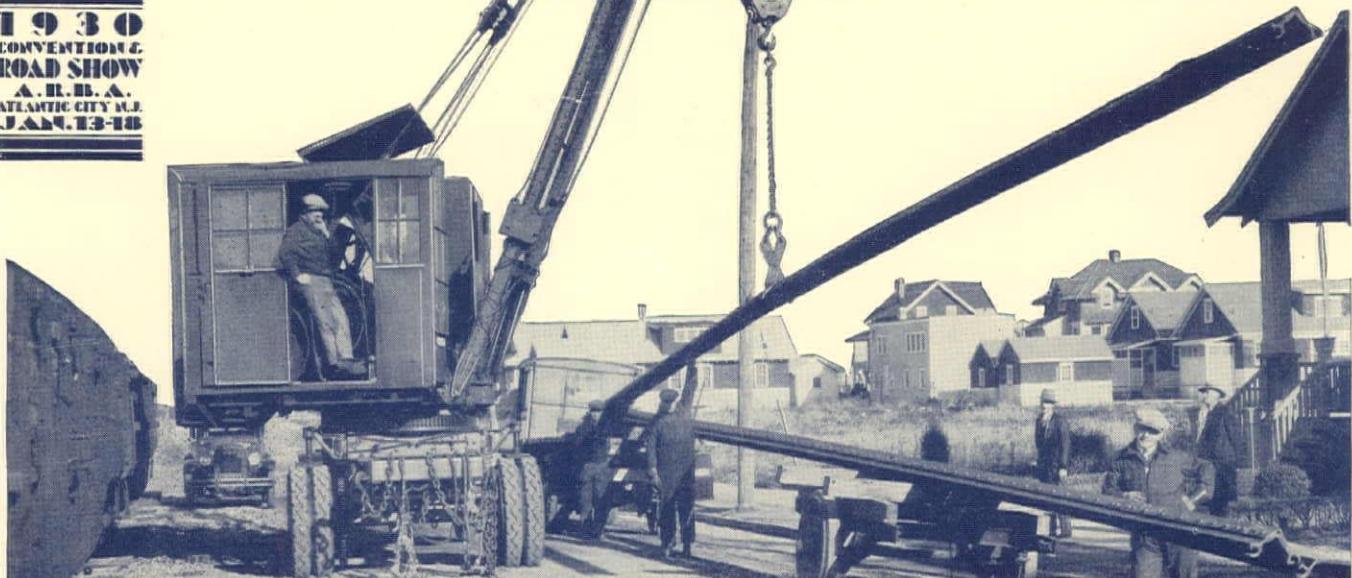
25 CENTS A COPY
\$3.00 PER YEAR



PLACING CONCRETE ON BEN ALI-SYLVAN SCHOOL SECTION OF PACIFIC HIGHWAY NEAR SACRAMENTO, CALIFORNIA. NOTE AUXILIARY BOOM ON PAVER TO SUPPORT WATER HOSE. FREDRICKSON & WATSON AND FREDRICKSON BROS., CONTRACTORS

No Fleet Is Complete *without a* Fast Traveling TRUCK CRANE

1930
CONVENTION &
ROAD SHOW
A. B. B. A.
ATLANTIC CITY N.J.
JAN. 13-18



No matter how many cranes you have, you need a fast traveling P & H Truck Crane—a crane that travels as fast as the trucks—a crane that goes out to a distant job and often completes the job before any other crane would get there.

The P & H Truck Crane is full revolving—has a line speed of 155 f.p.m. and a swing speed of 5½ r.p.m. The winch head mounted on the revolving frame

pulls in any direction regardless of truck position. It handles any load up to 5 tons at 10 ft. radius, and is equipped with travel jacks for traveling with load suspended from hook.

In short, the P & H Crane is powerful and fast enough for man-sized jobs and has many other superiorities you should know about.

Write for Bulletin No. 640-X.

HARNISCHFEGER SALES CORPORATION

Established 1884

3890 National Ave., Milwaukee, Wis.
32 Beale St., San Francisco 2036 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.*

P & H

Water Works Supply Co.

501 Howard Street
SAN FRANCISCO

2326 East Eighth Street
LOS ANGELES

SEATTLE: Water Works & Power Equipment Co., White Building

Take Air Out of Pipe Lines with SIMPLEX Air Release Valves

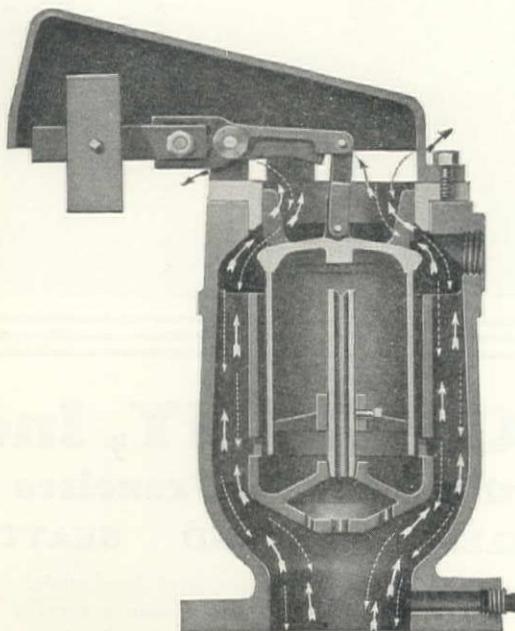


AIR in a pipe line plays many tricks. At high points it collects because of the decrease in pressure—water under lower pressure holds less air in solution than water under higher pressure.

The immediate effect of air pockets at the high points is reduced carrying capacity of the line and consequent loss of efficiency of the system. The increase in velocity of water passing air pockets, because of the reduced effective area, causes turbulence and eddy currents.

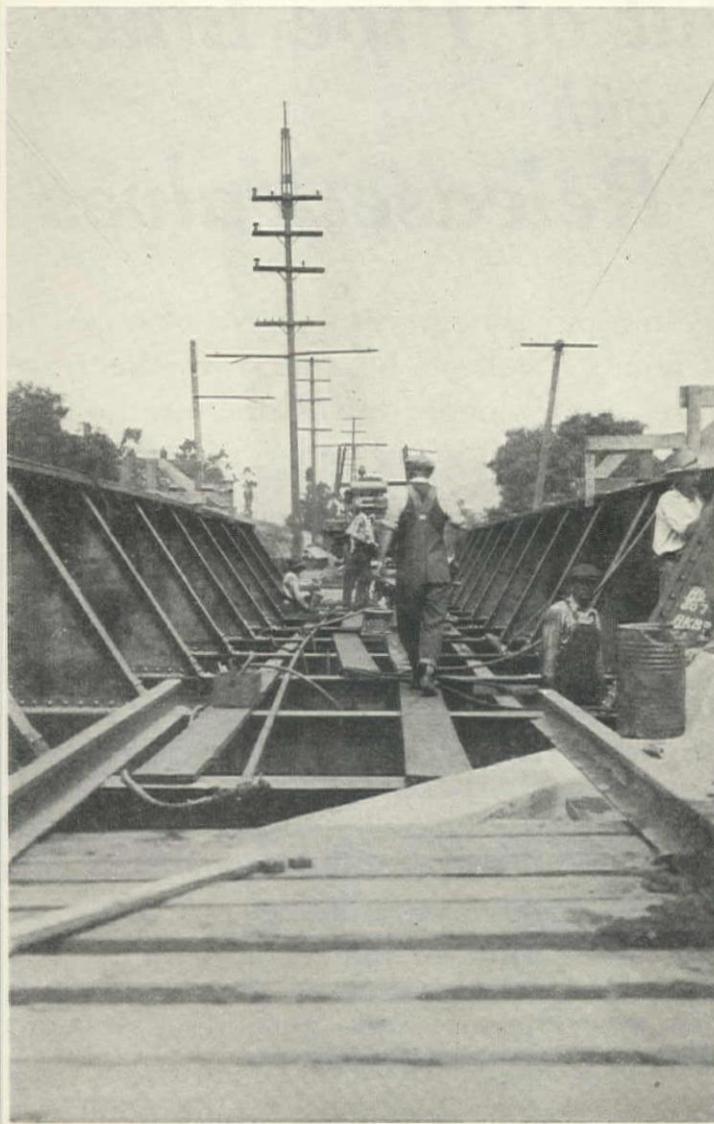
Less obvious but more dangerous conditions—water hammer and surges—are always liable because of the compressibility of the entrapped air.

The safe, sure and effective remedy is a **SIMPLEX** Air Release Valve correctly installed at each high point in the pipe line.



SIMPLEX Air Release Valves are installed singly or in combination with **SIMPLEX** Air and Vacuum Valves

Speeding Bridge Construction



If you need AIR you need RIX

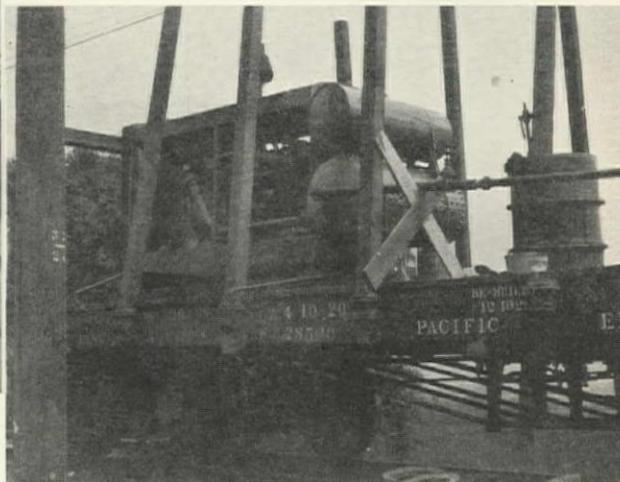


Since 1877

RAT-TAT-TAT! The clang of action. The sizzle of speed. Cutting days off the contract time. Shaving dollars off estimated costs. A RIX Compressor is on the job. *Stalwart dependable* RIX that has fought shoulder to shoulder with Western Builders since the Pioneer days of the Seventies. RIX with the mighty lung power that delivers 26% more working air, size for size. Would you increase your *profit* and *peace of mind*? There is a RIX for every job, and RIX service protects you anywhere, *always*. Write for Bulletin 8-K.

RIX

Portable Compressors



RIX COMPANY, Inc.
400 4th Street, San Francisco

LOS ANGELES PORTLAND SEATTLE

The RIX Pioneer line includes vertical and horizontal compressors in all sizes for all purposes, compressor service and supplies. Agents for COCHISE Drills, exclusive distributor for THOR Pneumatic Tools in Los Angeles and Seattle territories.

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

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

WESTERN CONSTRUCTION NEWS

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

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

DEVOTED TO CIVIL ENGINEERING AND CONSTRUCTION IN THE FAR WEST

VOLUME IV

NOVEMBER 10, 1929

NUMBER 21

CONTENTS

Editorial	569
Pacific Highway, California	570
Denver Avenue Viaduct, Portland	573
MELVILLE E. REED	
Building Code for Dams—Discussion	574
Stop Signs for Arterial Streets	577
GEORGE D. BURR	
Loop Road in Lassen Volcanic National Park	580
Symmetry of Design and General Economics in Construction	581
JAMES G. TRIPP	
Improvised Geared Stand for Gate Operation	585
W. C. BROWN	
California Water Works Men Meet at Del Monte	586
Pardee Dam	589
Hydraulic Fill in Highway Construction	590
California Sewage Works Association	591
Reminiscences of the Pioneer Engineers of California—Part III	596
OTTO VON GELDERN	
Foundation Movements at San Gabriel Damsite	598
Personal Mention	599
Associations	599
New Equipment and Trade Notes	600
Unit Bid Summary	36
Construction News Summary	42
Opportunity Page	55
Buyers' Guide	56
Professional Directory	61
Index to Advertisers	62

WESTERN CONSTRUCTION NEWS IS ON SALE AT THE FOLLOWING NEWS STANDS

LOS ANGELES, CALIF.
 CALIFORNIA NEWS AGENCY
 315 West 6th Street
 MARTINDALE & SONS, W. W.
 619 West 6th Street
 NATICK BOOT STORE
 104 W. 1st Street
 TOM HOPKINS
 466 So. Main Street
 WEST COAST NEWS CO.
 Box 314, Arcade P. O.
 AZUSA, CALIFORNIA
 C. A. RICKTER
 CRESCENT CITY, CALIF.
 GOODRICH STORE
 NEWHALL, CALIF.
 HAWLEY DRUG STORE

SAN FRANCISCO, CALIF.
 FOSTER & OREAR NEWS STAND
 Ferry Building
 KEY SYSTEM FERRY BOATS
 FITZGERALD NEWS AGENCY
 21 Fourth Street
 OAKLAND, CALIF.
 BENSON & SMITH CIGAR CO.
 1315 Franklin Street
 EUREKA, CALIF.
 EUREKA NEWS CO.
 309 F Street
 VALLEY SPRINGS, CALIF.
 B. H. PETTINGER
 News Stand
 PARDEE DAM-SITE STORE

SACRAMENTO, CALIF.
 MARTIN NEWS STAND
 9th and K Streets
 OSCAR PARISI
 9th and J Streets
 POSTOFFICE NEWS STAND
 7th and K Streets
 MARTINEZ, CALIF.
 MARTINEZ NEWSPAPER AGENCY
 614 Ferry Street
 PHOENIX, ARIZONA
 REIS, *The Old Boy Himself*
 Cor. 1st Ave. and Monroe
 SEATTLE, WASH.
 ARCHWAY BOOK STORE
 319 Pike Street
 ECKART NEWS AGENCY
 102 Washington Street

SPOKANE, WASH.
 PRINCE'S CONFECTIONERY
 Trent and Washington Sts.
 TACOMA, WASH.
 COALE'S NEWS STAND
 901 Pacific Avenue
 ROCKPORT, WASH.
 WINSTON BROS.
 PORTLAND, OREGON
 RICH'S CIGAR STORE
 6th and Washington Streets
 HARPER, OREGON
 DERBON CONSTRUCTION CO.
 LEABURG, ORE.
 A. GUTHRIE, & CO.
 Camp No. 1
 Owyhee, OREGON
 GENERAL CONSTRUCTION CO.

SUBSCRIPTION RATES

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

WESTERN CONSTRUCTION NEWS, INC.

Eastern Representatives:

Main Office:
 114 SANSCOME STREET
 SAN FRANCISCO, CALIF.

F. R. JONES, 1013 Garrick Bdg.
 Chicago, Ill.
 ROBT. P. SMITH, Guarantee Title Bdg
 Cleveland, Ohio
 H. B. KNOX, JR., 101 Park Ave.
 New York, N. Y.

Branch Office:
 422 WESTERN PACIFIC Bdg.
 LOS ANGELES, CALIF.

S. H. WADE, *President and General Manager*
 S. J. SANDERS, *Vice-President* PHILIP SCHUYLER, *Managing Editor*
 Entered as second-class matter at the postoffice at San Francisco, California, under the Act of March 3, 1879
 Copyrighted 1929 by WESTERN CONSTRUCTION NEWS, INC.

SERVICE —

to contractors, municipalities and consulting engineers in representing and servicing the following well known lines:

“Hydro-tite”

the modern pipe joint material.

“Badger Water Meters”

Pumping Machinery

for every requirement.

A. D. Cook, Inc.

Deep well plunger pumps and cylinders.

Dayton-Dowd Company

Centrifugal Pumps

Peerless Pump Company

Deep Well Turbines

Noel Pump and Manufacturing Co.

Pressure water systems.

“Turbine Sewer Machine”

and equipment for efficient cleaning of sewer pipe lines.

“Pollard Pipe Line Equipment”

all necessary tools for water, gas, and sewer lines.

“Gesner Flushing Valves”

Sewage Treatment Equipment

Pipe, Valves and Fittings

Industrial Plant Specialties

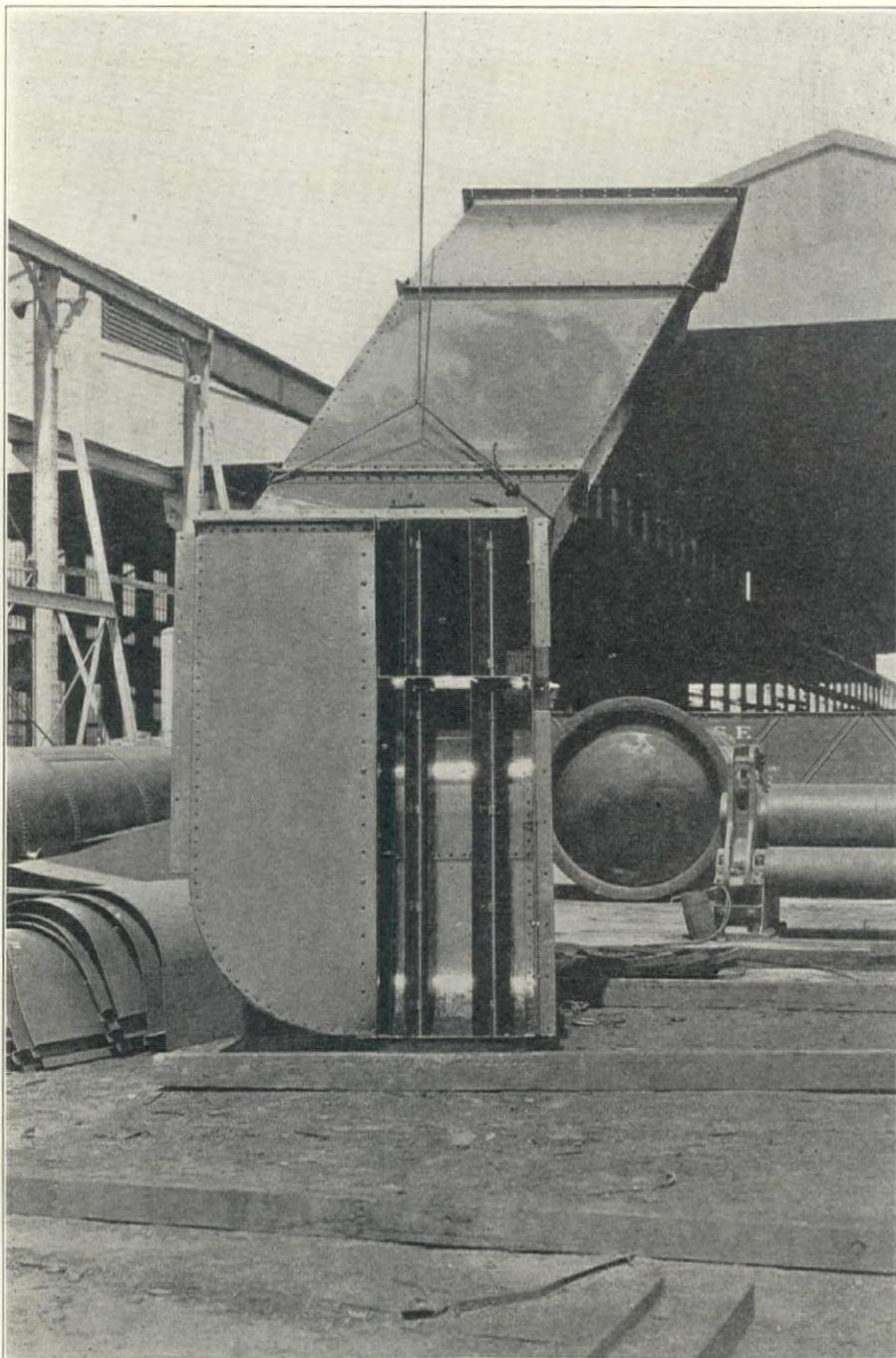
Miscellaneous Equipment for Contractors

INDUSTRIAL & MUNICIPAL SUPPLY CO., Inc.

ENGINEERING EQUIPMENT — WATER WORKS SUPPLIES

Phone DOuglas 8793 — 7 Front St., San Francisco, Calif.

Special Steel Work



Boiler breechings, smokestacks, and similar work, are specialties in our factories. The breeching above was made at our Los Angeles plant for Southern California Edison Co.'s steam plant at Long Beach. We will be glad to figure on special steel work for you.

WESTERN PIPE & STEEL CO.

OF CALIFORNIA

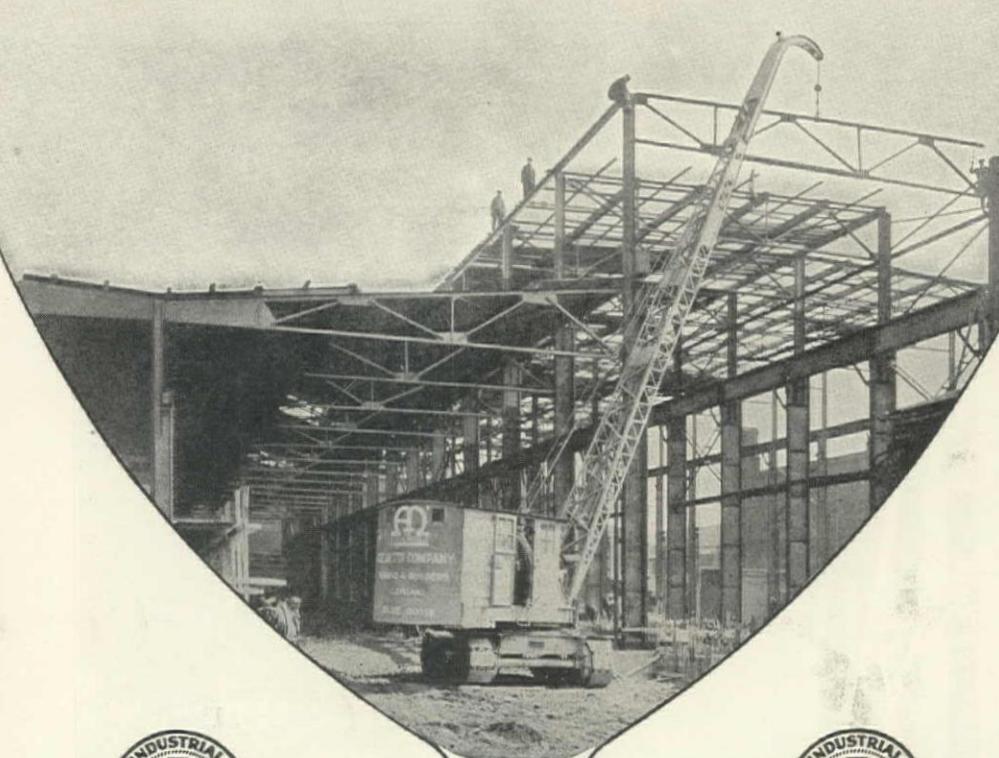
444 Market Street
San Francisco

5717 Santa Fe Avenue
Los Angeles

Factories:

South San Francisco ~ Los Angeles ~ Fresno ~ Taft ~ Phoenix

When Time Means Money



The Austin Company does not hesitate to make a contract which provides a penalty clause for the non-completion of a job within a remarkably short time. And they invariably make good because they have an efficient organization, backed up by dependable equipment.

Included in this equipment are five Industrial Brownhoists, the last of which was recently sold to The Austin Company of Texas for use on railroad terminal and hangar work. These crawler cranes are among the first units on the job and are put to work in the unloading, handling and erection of materials. When their work is done, they are easily loaded and shipped to the next job because no dismantling is necessary.

The Austin Company, and many other of the country's leading organizations, are fleet owners of Industrial Brownhoists because they have found that they pay big returns and that their better construction makes them absolutely dependable. There is a size and type that would be equally as efficient on your work.

Industrial Brownhoist Corporation, General Offices, Cleveland, Ohio
District Offices: New York, Philadelphia, Pittsburgh, Detroit, Chicago, New Orleans, San Francisco, Cleveland

Plants:

Brownhoist Division, Cleveland; Industrial Division, Bay City, Michigan; Elyria Foundry Division, Elyria, Ohio

The Choice of Leading Engineers



Believe It or Not!

BELOWE it or not," the two pipes on the display rack were cast *straight*. Screw jacks deflected them over 4 inches at the center, as visible proof to those attending the Water Works Convention at Del Monte, Calif., that *Pacific* cast iron pipe will withstand unusual strains without breaking. While no one is interested in bending cast iron pipe, in these days of increasing traffic every water works superintendent, engineer, or commissioner likes to know that he is laying pipe which *can* bend without breaking if it has to.

PACIFIC States Cast Iron Pipe is that kind of pipe. Sizes 1 $\frac{1}{4}$ through 12 inches. Standard lengths. With or without Precalked Joints. Precalked Fittings, too.

Prompt shipments of Western-made cast iron pipe. Investigate *Pacific* cast iron pipe before you buy any pipe. Catalog.

WRITE FOR ILLUSTRATED LITERATURE



MCWANE
CAST IRON PIPE

MCWANE CAST IRON PIPE CO.
BIRMINGHAM, ALA.

PACIFIC STATES CAST IRON PIPE CO.
PROVO, UTAH.

SALES OFFICES

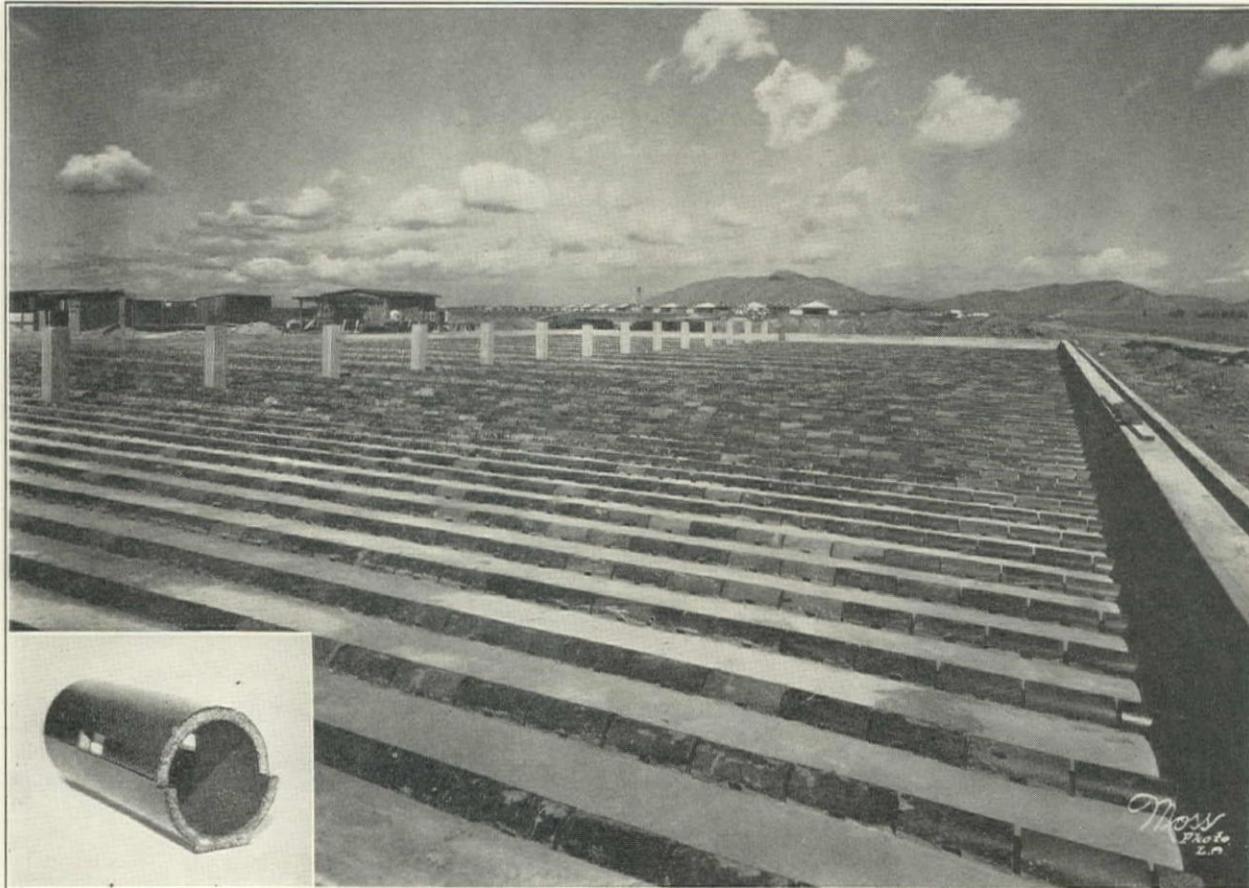
208 S. La Salle Street, Chicago
111 Sutter Street, San Francisco

1807 Sante Fe Building, Dallas
149 West 2nd, South, St., Salt Lake City

267 Washington Street, Portland
417 South Hill Street, Los Angeles

326 First Natl. Bank Bldg.
Denver

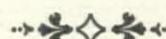
VITRIFIED CLAY—the Only Everlasting Material for Sanitary Sewers



“Plymouth” Vitrified Clay Underdrain Tile---a Pacific product---in the trickling filter beds (during construction) of the sewage treatment plant at March Field, the U. S. Army Aviation Camp near San Diego.



*The United States Government uses VITRIFIED
CLAY for all permanent improvements*



Pacific Clay Products

Suite 650
Chamber of Commerce Bldg.



1151 South Broadway
Los Angeles



for

H.W. ROHL
Los Angeles Cal.



THE completion of the Bay Shore highway by H. W. Rohl marks another big step forward for Northwest—another endorsement for the Variable Speed Motor, Accelerator Controlled.

Four of the six machines on the Bay Shore highway were Northwests; two owned by H. W. Rohl and two rented, and one was equipped with the Variable Speed Motor. The latter machine topped the list of yardage producers both in comparison with the other Northwests and the competitive machines which were of larger rated capacity.

H. W. Rohl has just bought two Model 6 Northwests!
It's the best buy on the market today.

NORTHWEST ENGINEERING COMPANY

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

1745 STEGER BLDG., 28 E. JACKSON BLVD., CHICAGO, ILL., U. S. A.
23 MAIN STREET, SAN FRANCISCO, CALIFORNIA

Brown-Bevis Company
Santa Fe Avenue, at 49th St.
Los Angeles, Calif.

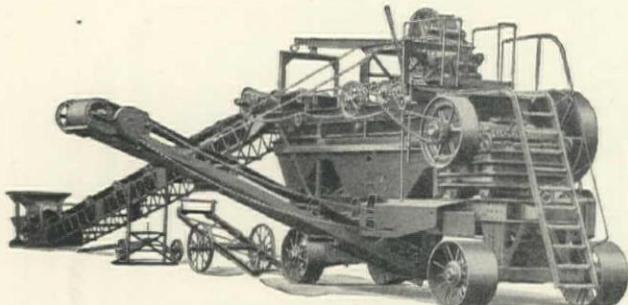
NORTHWEST

WCN 11-10-Gray

PIONEER GRAVEL EQUIPMENT

“Setups” to Fit Your Job

We have been making Screening, Crushing and Loading plants for fifteen years, perfecting every little detail and sparing no expense to give you the particular “setup” to do your job. If you need our big capacity one-unit plants, we will tell you so and show you why. If a simpler and less expensive one will do, we’ll recommend that. But whatever screening, crushing or loading problem you have, there’s a “Pioneer” setup to fit it.



Close-up view of No. 12 Plant. Crushes, screens and loads in one operation, one handling of pit-run gravel. Powered by 60 H. P. gasoline engine or by steam or electric motor. Capacity 350 to 500 cubic yards in 10 hours. Equipped with sand ejector.

Write for new
80-page
catalog with
28 blue print
setups
of Pioneer
Gravel
Equipment.

We manufacture a complete line of
11 different sizes of Crushing and
Screening Plants, also Loading Plants,
Drag Lines, Storage Bins, Conveyors,
Shakers, Revolving Screens, etc.

PIONEER GRAVEL
EQUIPMENT MFG. CO.

MINNEAPOLIS :: MINNESOTA

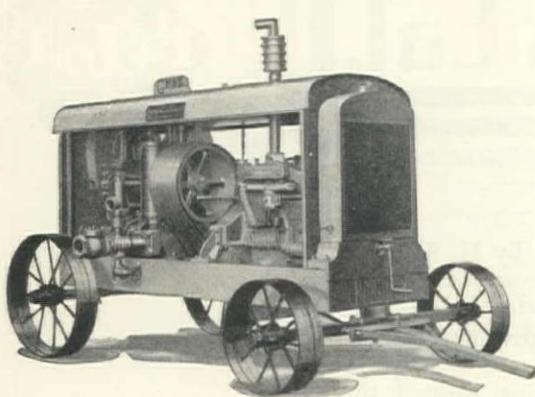
HARRON, RICKARD & McCONE CO.

1600 Bryant Street, SAN FRANCISCO

(SINCE 1875)

2205 Santa Fe Avenue, LOS ANGELES

C. H. & E.
NEW No. 11 TRIPLEX PUMP



**WHY THE C. H. & E. NEW 1929
TRIPLEX PUMP IS BETTER**

Forged Steel Crank Shaft. Texrope Drive. Crank Shaft Roller Bearings. Steel Gears. Special Metal Valves. Welded Steel Truck Frame. Silent and Smooth-Running. No Vibration or Clashing of Gears.

Capacity 80 Gallons Per Minute—
500 Pounds Pressure.

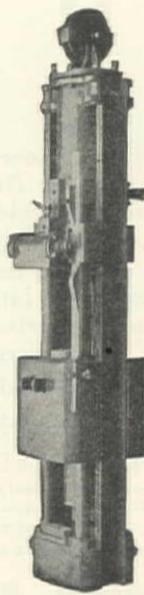
Harron, Rickard & McCone Co.

2205 Santa Fe Avenue, Los Angeles

Since 1875

1600 Bryant Street, San Francisco

**WARRINGTON
VULCAN
PILE
HAMMERS**



are designed in accordance with
the best engineering principles
to drive the most piling in the
shortest time with the least
damage to the piling and the
least wear on the machine.

Catalogue furnished
on request





KOEHRING

Speed at no loss of "feel" of the load!

GIVE us a chance to show you what Koehring Cranes are doing in this territory — and what our service means in more profitable operation of any equipment!

Crane Capacities

Quickly convertible to shovel, pull shovel or dragline.
No. 301 — 10 tons at 12' radius. 1 yd. clamshell bucket at 28' radius, 45' boom. Other sizes at proportionate radii and boom lengths.
No. 501 — 17 tons at 12' radius. 1½ yd. clamshell bucket at 35' radius, 45' boom. Other sizes at proportionate radii and boom lengths.
No. 601 — 19 tons at 12' radius. 1½ yd. clamshell bucket at 33' radius, 45' boom. Other sizes at proportionate radii and boom lengths.

Speed Begins at Control Levers

Easy-shifting levers that shift easy-shifting clutches with no loss of the "feel" of the load!

That's why the Koehring operator handles his work with speed, precision and confidence!

That's why he makes the most of high speed functioning — fast line travel and fast swing!

Koehring FingerTip control is secured from easy-shifting, self-equalizing double outside band friction clutches of great contact area — this is the simple, direct, ONLY way of securing ease of control *without loss of "feel" of the load* indispensable to precision, speed and confidence in operation.

Know the Koehring!

Send for Crane Bulletin.

CALL OR ADDRESS NEARER OF THESE TWO:
HARRON, RICKARD & McCONE CO.
 (SINCE 1875)

LOS ANGELES: 2205 Santa Fe Ave.
 Telephone: JEFFerson 4191

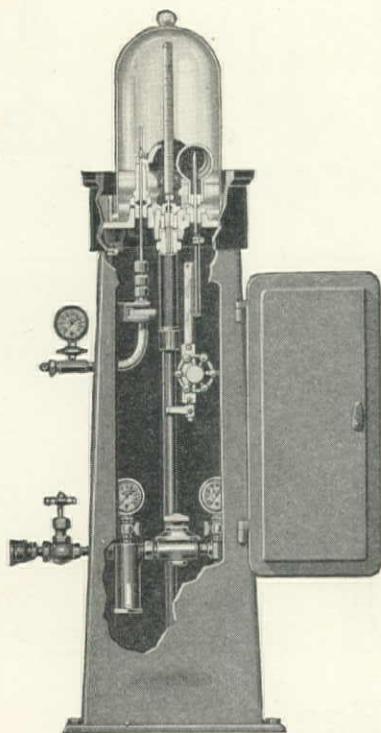
SAN FRANCISCO: 1600 Bryant Street
 Telephone: UNDERHILL 3740



A5095-I-R

IN THE HEALTHY CITIES

Chlorination of Drinking Water is Continuous



*W&T Vacuum Type MSV Solution Feed
Chlorinator*
Rugged—Reliable—Accurate

STATISTICS show that the healthy cities always have low typhoid fever rates. Their health officers know that a safe water means low typhoid. They also know that to assure a safe water supply at all times CHLORINATION MUST BE CONTINUOUS.

THAT'S WHY they insist on strict chlorination control—duplicate chlorinators, careful operating records and regular chemical and bacterial analysis of raw and chlorinated water.

THAT'S WHY over 7,000 W&T Chlorinators have been specified for installation in more than 3,500 cities and towns in North America.

THAT'S WHY practically all large American cities are installing duplicate chlorinators as a safe-guard against any possibility of interruptions in chlorination.

Is Your Chlorinating Equipment in Duplicate?

OUR STAFF OF TECHNICAL EXPERTS WILL BE GLAD TO
HELP YOU SOLVE YOUR CHLORINATION PROBLEMS

"The only safe water is a sterilized water"



WALLACE & TIERNAN

COMPANY, INCORPORATED

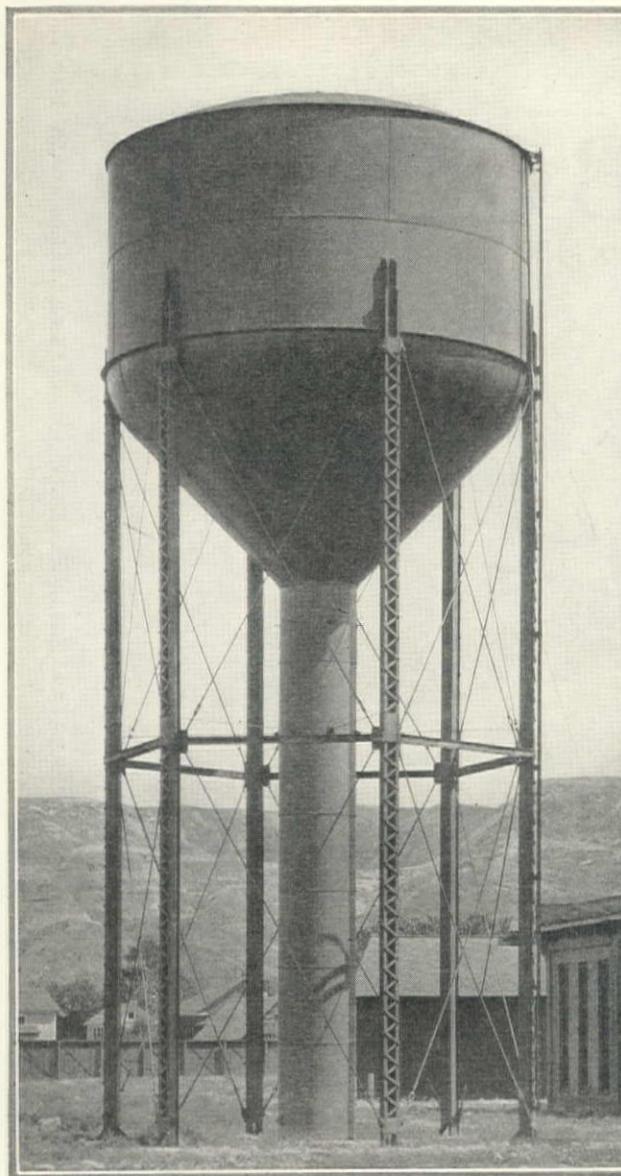
Manufacturers of Chlorine Control Apparatus

NEWARK

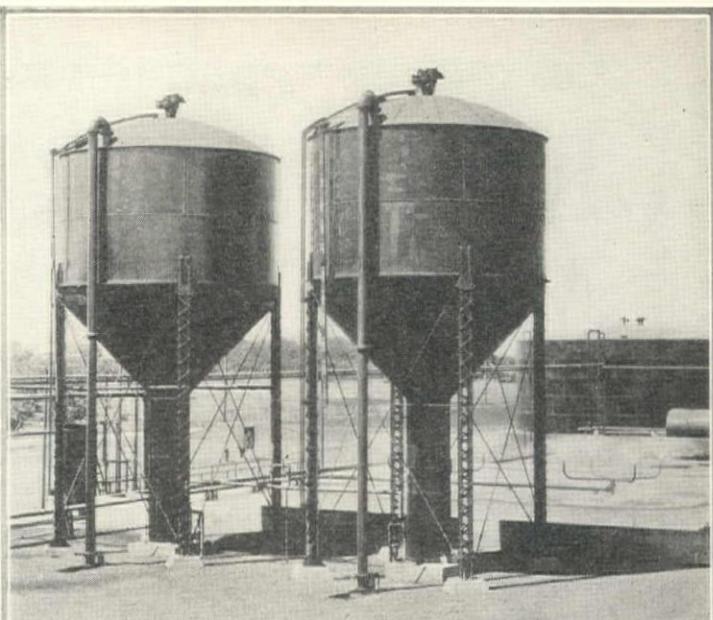
NEW JERSEY



NEW YORK CHICAGO KNOXVILLE SAN FRANCISCO MINNEAPOLIS PITTSBURGH DALLAS KANSAS CITY
LOS ANGELES SEATTLE ST. LOUIS BUFFALO INDIANAPOLIS DETROIT BOSTON JACKSONVILLE
CHATTANOOGA CHARLOTTE OKLAHOMA CITY PHILADELPHIA SPOKANE OGDEN
WALLACE & TIERNAN, LTD., TORONTO, CANADA WALLACE & TIERNAN, LTD., LONDON, ENGLAND



Left: Two panel conical-bottom tank with 150,000 gallon capacity on Northern Pacific at Glendive, Montana



Above: 2 50,000-gal. tanks at S. P. creosoting plant, Blair, Ore.
Below: Wiggins Roof on a fuel oil tank at Ashland, Ore.

STEEL Tanks for Railway Water Service—Horton tanks are constructed entirely of steel. They render dependable service at low cost. Long life decreases annual investment cost. Replacements of parts are few and painting is practically the only maintenance. Cleaning is done periodically without taking the tank out of service by opening a washout valve in the bottom of the riser.

STEEL Tanks for Creosoting Plants—Standard elevated and storage tanks are adapted to creosoting plant and other uses where liquids are handled and stored. Special piping connections and other openings are installed as required.

STEEL Tanks for Fuel Oil Storage—Flat-bottom steel tanks are used to store quantities of fuel oil at central locations and elevated tanks deliver it to locomotives. The storage tanks may be equipped with Wiggins Floating Roofs to protect them from fire. This device rides on the oil, eliminating the vapor space in the tank and making it impossible for the oil to ignite.

Ask our nearest office for information or prices on steel tanks of any kind. They are completely erected with our own experienced field erection crews. Get estimates now on contemplated installations.

CHICAGO BRIDGE & IRON WORKS
1013 Rialto Building, San Francisco

HORTON TANKS

B-102

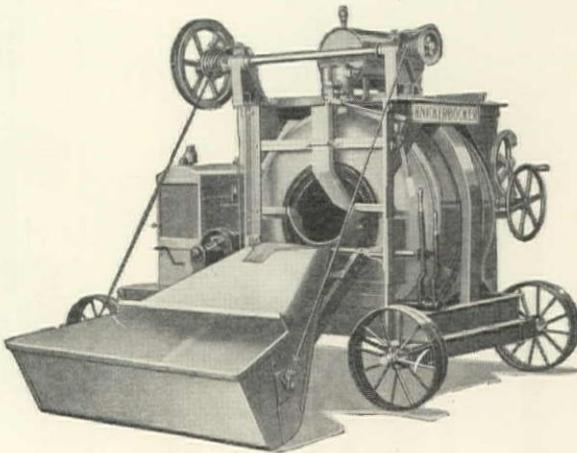
KNICKERBOCKER MIXERS

Always Reliable

Sizes 5S to 28S

Manufactured for discriminating contractors who think in terms of mixer performance.

Ask for New Catalog



E T N Y R E OIL DISTRIBUTORS

Etnyre Model "F" Distributors Prove Best

"Full width distribution" in bituminous road construction reduces costs through a saving in time and labor. All guess work eliminated in operating the Etnyre model "F"

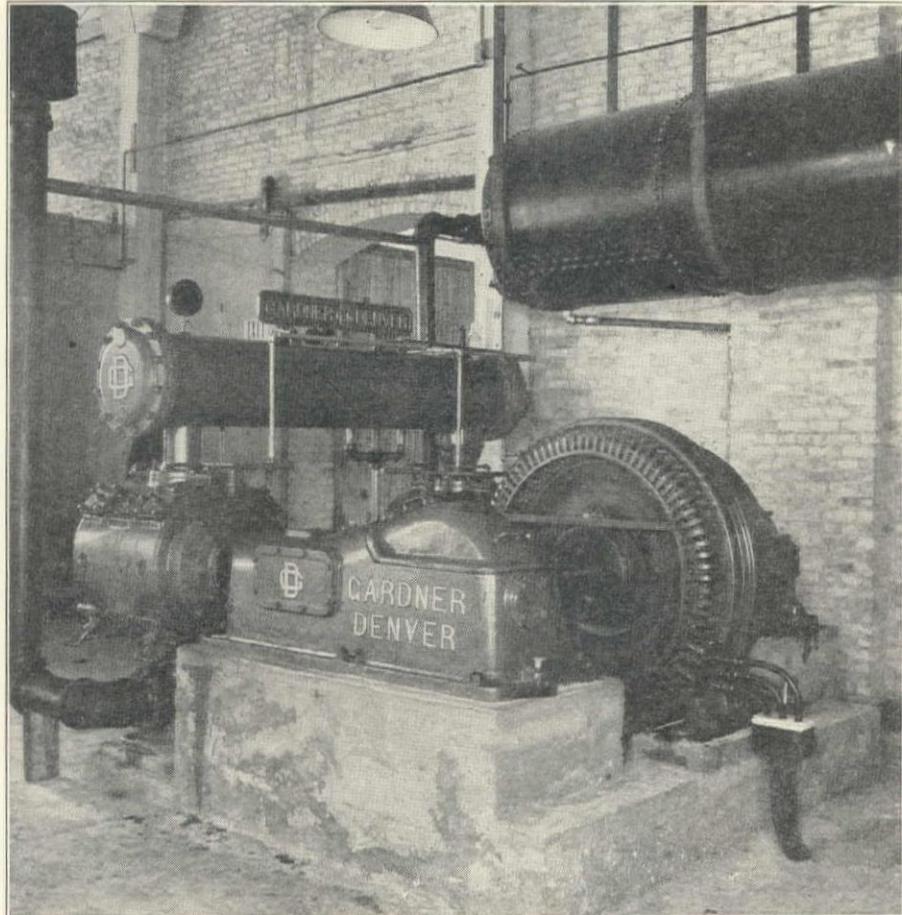
WRITE FOR FURTHER INFORMATION



A.L. Young Machinery Co.

San Francisco, California

GARDNER-DENVER *Compressors* equipped with *ROLLER BEARINGS*



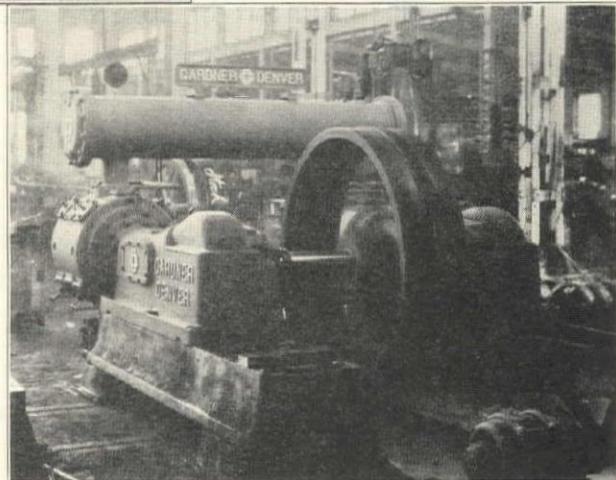
Gardner-Denver Roller Bearing
Direct Connected Synchronous
Motor Driven Compressor In-
stallation.

GARDNER-DENVER Direct Connected Synchronous Motor Driven Compressors Require Less Horsepower

Roller Bearings reduce running friction to the lowest possible amount. Roller Bearings with the well-known *Gardner-Denver Duo Air Valves* give you a compressor that is truly *more economical to operate*. Send for Bulletin HAC-36.

GARDNER-DENVER COMPANY
QUINCY, ILL.

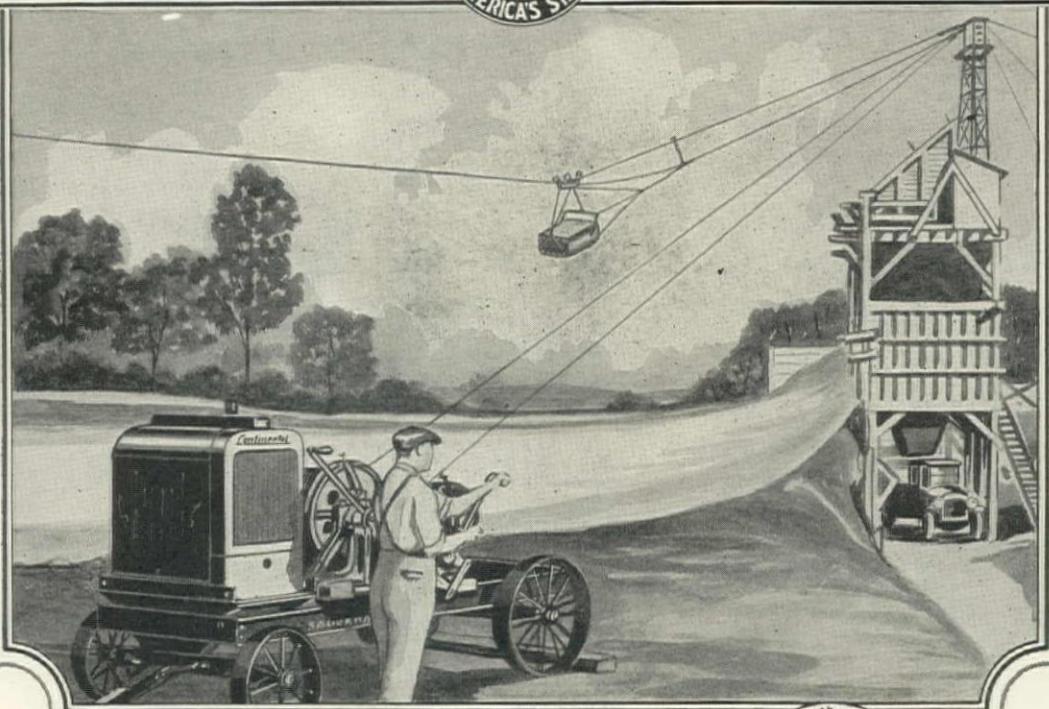
Branches in All Principal Cities



100 H. P. Gardner-Denver Roller Bearing
Compressor operating on test block
(against friction load) with 3 H. P. Motor.

GARDNER-DENVER

Dependable Power for Every Purpose



More Economies —Greater Profits

The Continental powered Sauerman Portable Scrapers, are daily proving the good judgment of hundreds of contractors who use them as standard equipment in excavating work.

In this field where power, ruggedness, long life, and economy of operation are a determining factor in the difference between profit and loss, Continental Heavy Duty Engines furnish the answer to the question of greater profits.

CONTINENTAL MOTORS CORPORATION
INDUSTRIAL EQUIPMENT DIVISION
Office and Factory: Muskegon, Michigan

The Largest Exclusive Motor Manufacturer in the World



Western Distributors

Salt Lake City	Seattle, Washington
Lund Company	A. H. Cox & Company
Mendenhall Auto Parts Co.	Colyear Motor Sales
Denver	Vancouver
Hendrie & Bolthoff	Power Equipment & Supply Company
Gall Auto Specialty Supply Company	Vancouver Parts Co., Limited
Southern California and Arizona	San Francisco
Brown-Bevis Company	Colyear Motor Sales
Northern California and Western Nevada	Jenison Machinery Company
Jenison Machinery Co.	
Los Angeles	Portland, Oregon
Brown-Bevis Company	Howard Cooper Company
Colyear Motor Sales	Colyear Motor Sales

Continental Engines

★ LOCAL STOCKS **JENISON** AND SERVICE ★

STOCKS SALES SERVICE

on Construction Equipment

Barber-Greene Conveyors, Loaders and Ditchers

Butler Bins and Hoppers

Continental Power Units

Elgin Street Sweepers and Eductors

Galion Graders and Rollers

**Lakewood Paving Equipment, Concrete Placing
Equipment, Clam Shell Buckets, Cars
and Tier Lift Trucks**

Milwaukee Gasoline Locomotives

Mundy Hoists Orton Truck Cranes

Page Buckets

Rex Mixers and Pavers Rix Compressors

Sauerman Excavators and Scrapers

Telsmith Rock Crushers and Gravel Plants

Thew-Lorain Shovels, Cranes and Drag Lines

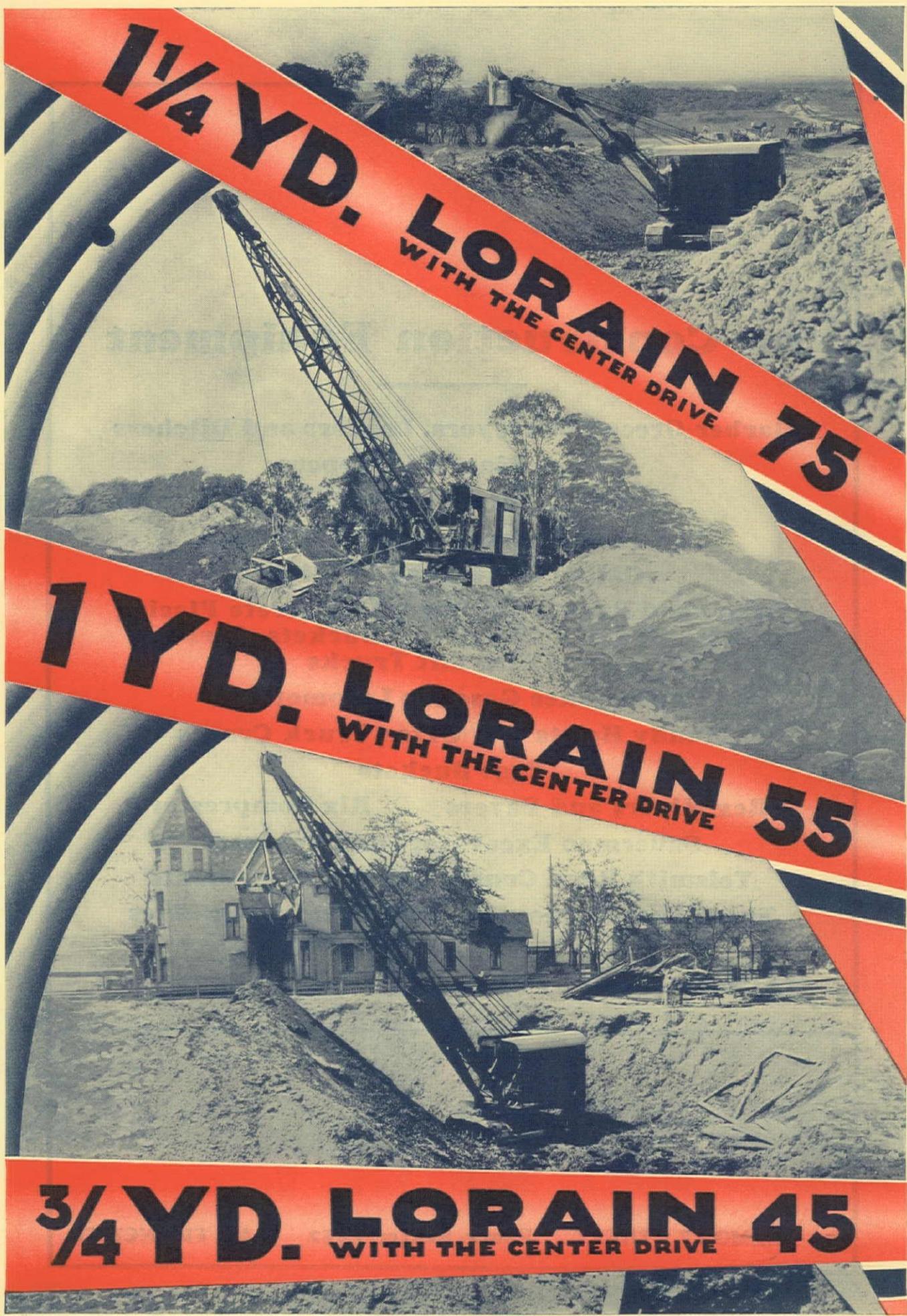
WOODWORKING EQUIPMENT

MACHINE TOOLS - PUMPS - ENGINES - WELDERS

JENSON

MACHINERY COMPANY

58 FREMONT STREET Phone SUTter 0952 SAN FRANCISCO



TODAY

the 3/4 yd.

LORAIN

45

shovel—crane—clamshell—
dragline with the famous Center
Drive applied to superstructure,
truck and shovel boom, and
backed by Thew's reputation
and 34 years experience.

THE THEW SHOVEL CO. • LORAIN, OHIO

Shovels • Cranes • Draglines • Backdiggers • Locomotive Cranes
Gasoline, Diesel, Electric or Steam Power



Distributed by:
Smith Booth Usher, Los Angeles, Calif., Jenison Machinery Co., San Francisco, Calif., Paragon Supplies, Ltd., Vancouver, B. C., Canada, Hall-Perry
Machinery Co., Butte, Mont., Feeney Machinery Co., Portland, Ore., Spokane, Wash., Seattle, Wash.

★ LOCAL STOCKS **JENISON** AND SERVICE ★



Universal Truck Cranes operating with skip boxes, digging 30 ft. pier holes on the \$10,000,000 Pennsylvania Warehouse, Jersey City.

1929 JOBS DONE ON TIME

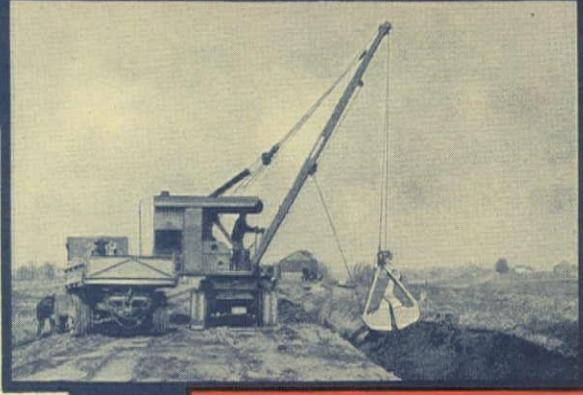
RIGHT NOW when you want to keep your big equipment going steadily, to complete this year's contracts on time, a Universal Truck Crane can save you a lot of expense and worry.

Here is a machine that can travel at motor truck speed, taking care of the cleanup work, from one end of the job to the other.

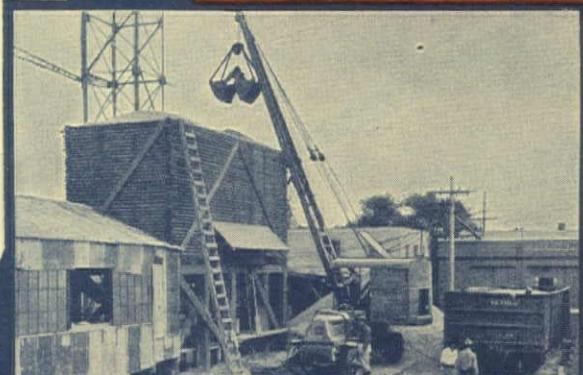
You can use it to unload a car of supplies, for road ditching and berthing, or bridge building. You can send it to pull up forms, remove a slide or slip, dig footings, or for any of the hundred and one short jobs that ordinarily slow things up.

If you haven't enough work to warrant the purchase of a machine now, you can rent a Universal Crane from your local crane service company, to tide you over until spring.

THE UNIVERSAL CRANE COMPANY
Lorain, Ohio



A quick and economical way to take care of "V" ditching and berthing.



Aggregate for 8000 cu. yds. of concrete was loaded into this bin by the Schadwell Crane Service Company's Universal Truck Crane.



Steel for this type of building is easily erected with these two Universals. 1400 tons were set in 25 crane days.



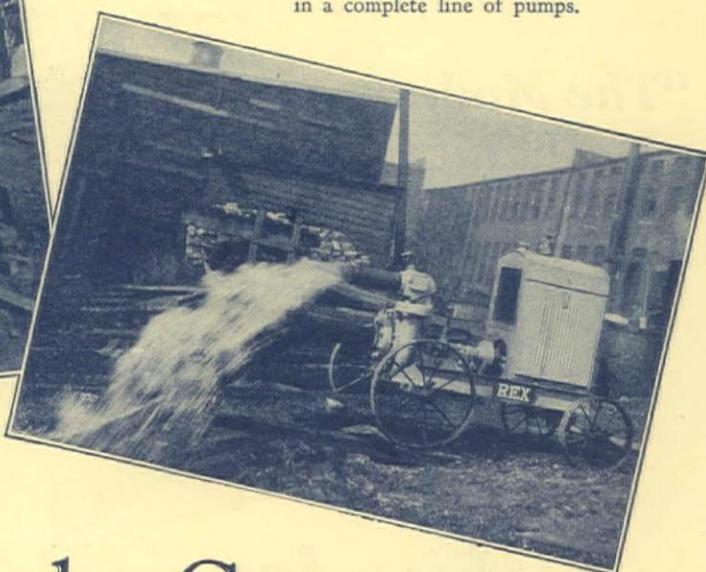
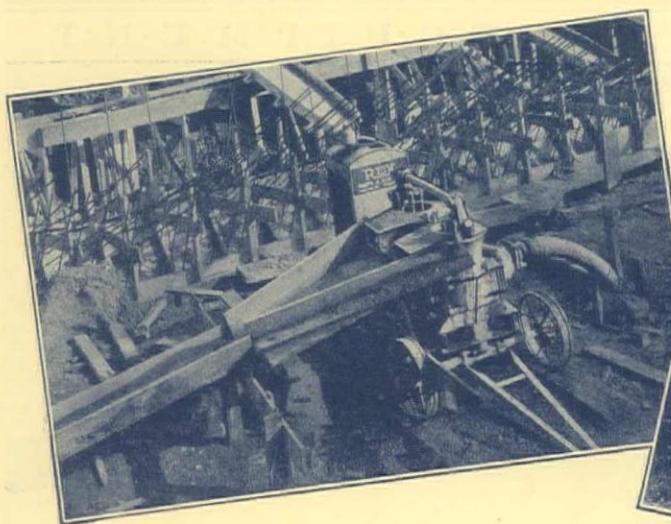
UNIVERSAL

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

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

★ LOCAL STOCKS **JENISON** MACHINERY COMPANY AND SERVICE ★

Rex has new values for contractors pumping requirements in a complete line of pumps.



Supplying the Contractor with a complete line of contractors pumps



Rex Plunger Force Pumps are ideal for trench and foundation work, well point installations, manhole pumping, cofferdam and pier dewatering.

Sweeping modern designs built on a modern standardized production basis that actually sets a new standard of value

NO matter what your demands for water are or may be there is a Rex pump to be had that will keep the water moving at a remarkably low cost. They are basically designed from the contractors point of view having up to date improvements such as automotive type engines, enclosed gear reduction running in oil, constant lubri-

cation, positive suction for fast steadier pumping. The pumps illustrated here are but a part of the Rex line which consists of diaphragm pumps, plunger pumps, centrifugal pumps and road pumps. Separate catalogs may be had on each model. We carry a full line of pumps in stock at all times ready for immediate shipment.

REX PUMPS

JENISON MACHINERY CO.

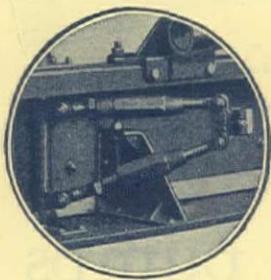
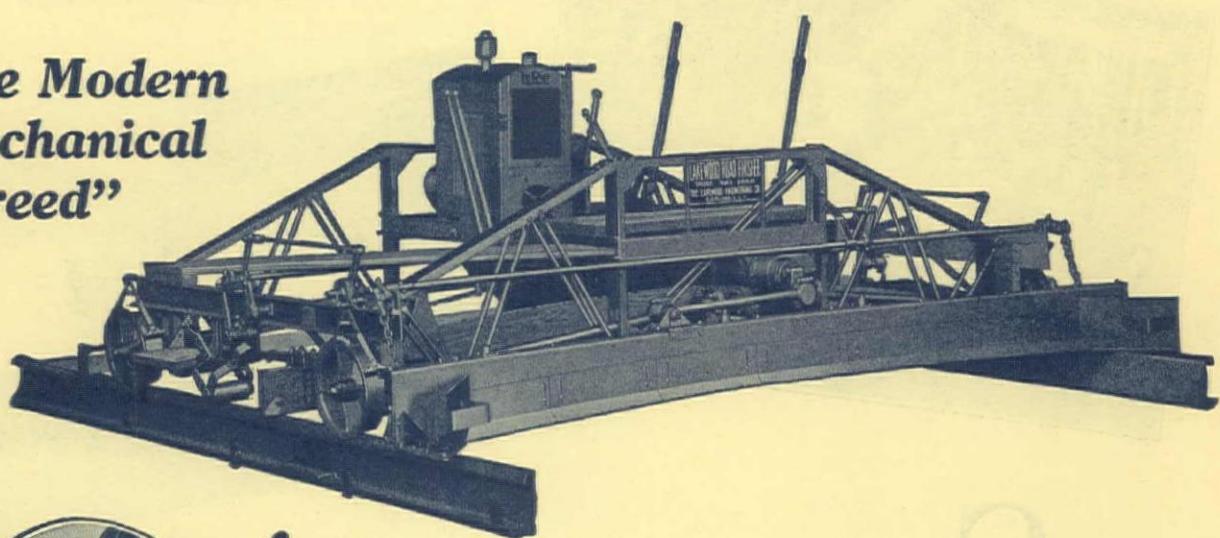
58 Fremont Street

San Francisco, Calif.

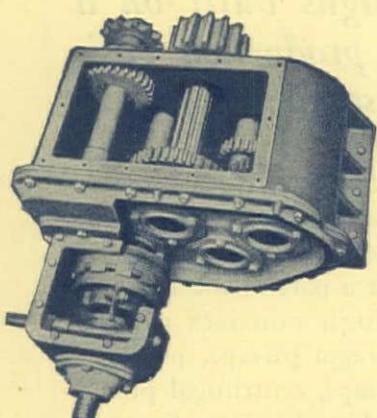
★ LOCAL STOCKS **JENISON** AND SERVICE ★

LAKEWOOD PAVING EQUIPMENT

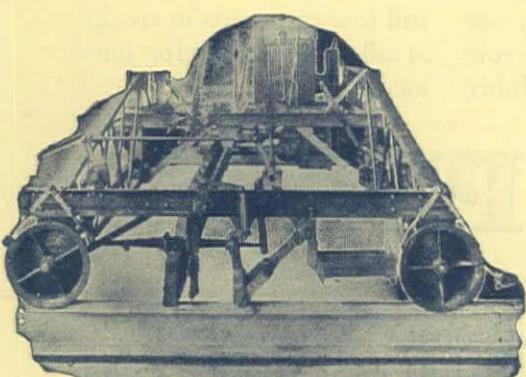
"The Modern Mechanical Screeed"



Turnbuckles on screed member for tilting



Cover removed on transmission showing automotive construction



Weight of machine equally distributed on the forms

for
Concrete or Asphalt

The ONLY Mechanical Screeed with—

Automotive type of construction. There are 22 Timken roller bearings in this machine—High grade alloy steel shafts and gears. All gears enclosed and running in oil.

Two speeds forward and two reverse with an automotive type of transmission.

A screed member which can be tilted to give the same surfacing action obtained with a hand trowel. Prevents scoring in coarse aggregate and dry concrete.

Direct shaft drive to ALL wheels. Every ounce of weight is used to the maximum advantage in "pushability".

Equal distribution of weight on the forms, minimizing form displacement.

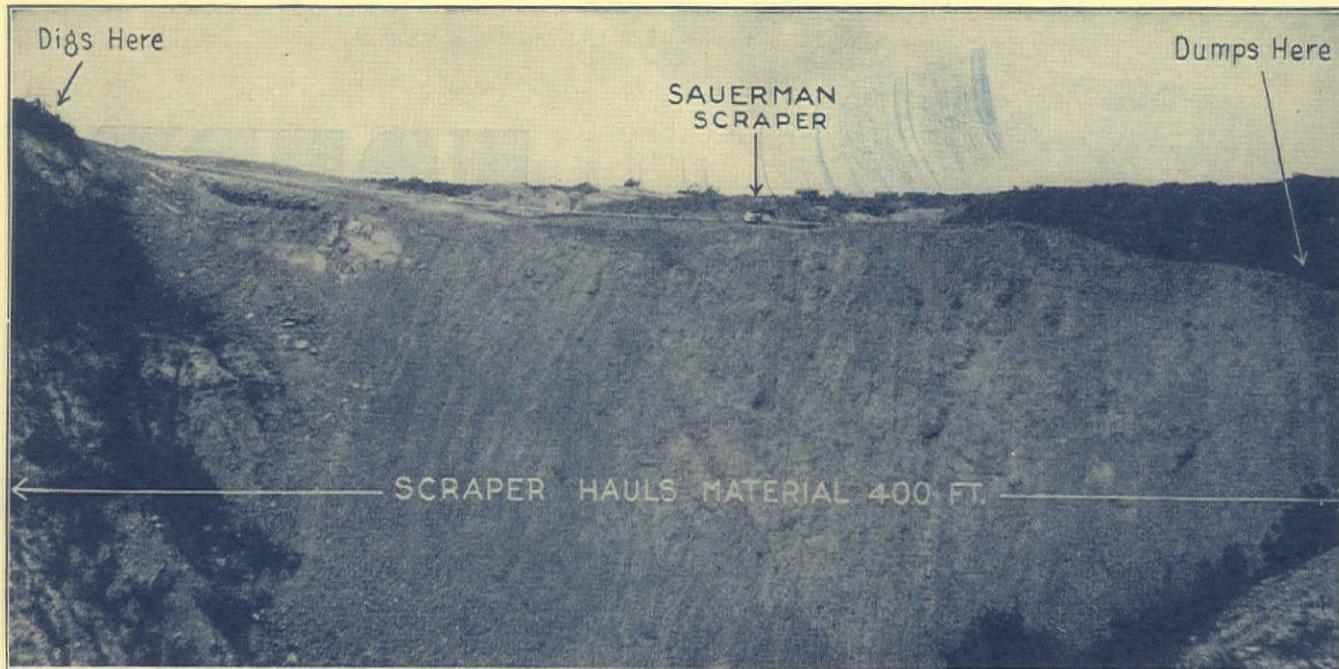
Combined screeed and tamper operation can be provided for if desired.

There are many other exclusive advantages in this improved Screeed, all of them are explained in detail in our Bulletin 47-R. There are still some copies left.

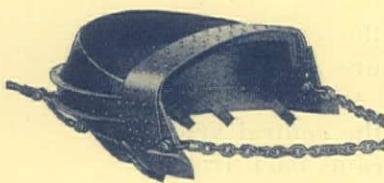
EXPORT OFFICES: 30 Church St., New York City - CABLE ADDRESS: Brosites
LAKEWOOD
 The Lakewood Engineering Co., CLEVELAND, O.

California Representatives: JENISON MACHINERY CO., 58 Fremont Street, San Francisco;
 THE BROWN-BEVIS CO., 49th Street and Santa Fe, Los Angeles

★ LOCAL STOCKS **JENISON** MACHINERY COMPANY AND SERVICE ★



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., Manufacturers, CHICAGO, ILLINOIS

Western Distributors:

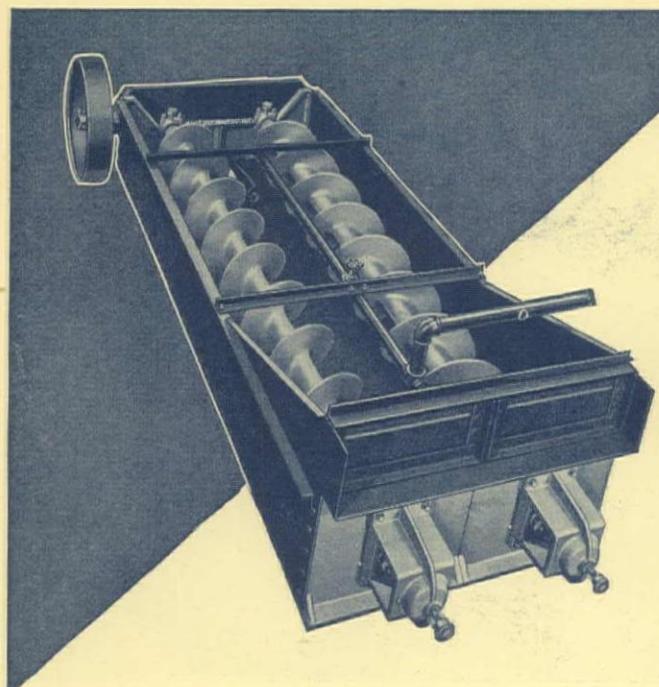
Jenison Machinery Co.
58 Fremont St., San Francisco

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

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

SAUERMAN

★ LOCAL STOCKS **JENISON** MACHINERY COMPANY AND SERVICE ★



DRY SAND

**NO FREE WATER
NO CLAY
NO TRASH**

Telsmith Twin-Screw Rewasher

Sand that's all sand . . . so dry that it doesn't drip . . . clean and clear of clay and dirt. The new Telsmith Twin-Screw Rewasher not only turns it out that way but handles large tonnage easily.

In the inclined washing trough, the counter current of wash water brings to the surface lignite, shale, mica, bark and trash. There's no chance for them to work upward along the screws . . . water sprays stop that . . . and the re-

verse currents keep these intruding substances moving until they finally float off over the spillway. As for clay, the big screws disintegrate it rapidly.

Sand piles up at the end of the screws. A low enclosure allows only the dry sand from the top of the pile to discharge through the central vent . . . while the water drains back from the bottom of the sand pile. There is no free water in the product.

Equally efficient and similar in principle, the TELSMITH SINGLE-SCREW REWASHER may be used where capacity requirements are not so strenuous.

Telsmith-Hercules Gravel Washer

A NEW Washing Screen with These Outstanding IMPROVEMENTS

Timken Roller Bearings Throughout

Ball Mill Scrubber

All Metal Construction

Chain Disintegrators

Easily Replaceable Screen Plates

Write today for BULLETIN S-H 26 describing both of these new devices in detail

SMITH ENGINEERING WORKS

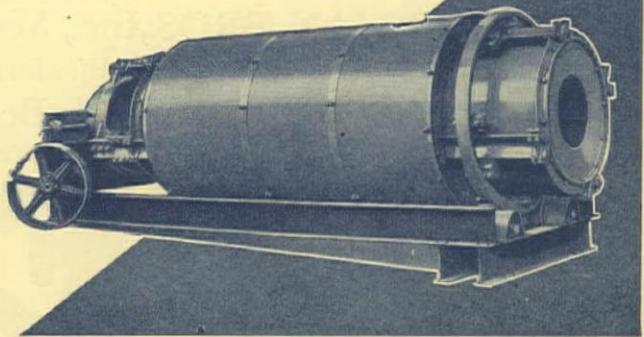
1826 Holton Street, Milwaukee, Wisconsin

JENISON MACHINERY COMPANY

58 Fremont Street, San Francisco

GARLINGHOUSE BROTHERS

2044 Santa Fe Avenue, Los Angeles



S.H. 1

★ LOCAL STOCKS **JENISON** AND SERVICE ★

EASY OPERATION



Western Distributors:



Jenison Machinery Co.
SAN FRANCISCO

Smith Booth Usher Company
LOS ANGELES

Feenaughty Machinery Co.
PORTLAND, BOISE, SPOKANE,
SEATTLE

Brown, Fraser & Co., Ltd.
VANCOUVER, B. C.

C. H. Jones Co.
SALT LAKE CITY

Hall-Perry Machinery Co.
BUTTE, MONT.

F. Ronstadt Co.
TUCSON, ARIZ.

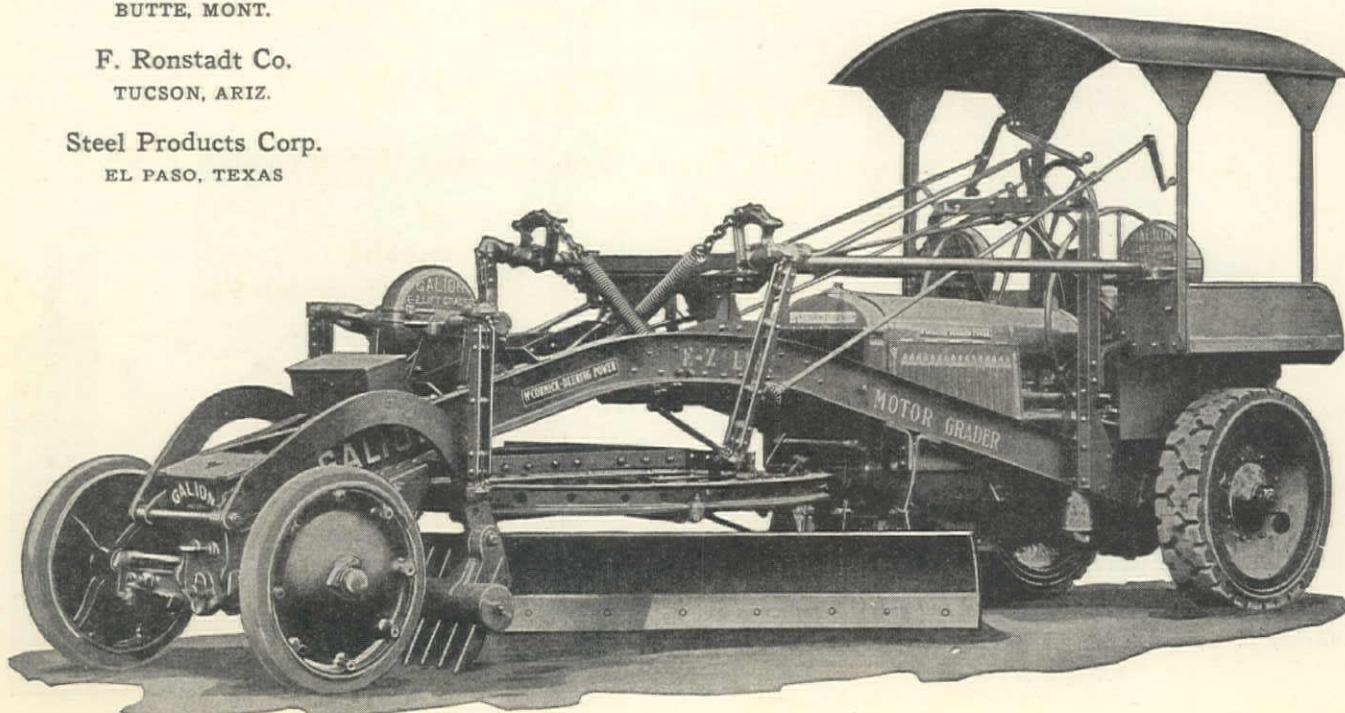
Steel Products Corp.
EL PASO, TEXAS

OF a Motor Patrol Grader means that your operator will do more work and better work with less effort. Galion E-Z Lift Motor Patrol Graders are the easiest operating Motor Graders ever designed. All controls are within reach of the operator and all adjustments are easily and quickly made from the operator's platform.

Galion E-Z Lift Motor Graders are scientifically designed and perfectly balanced, sturdy, rigid and chatterless and will give you years of satisfactory, uninterrupted service.

Write for special bulletins

The
**GALION IRON WORKS
& MANUFACTURING COMPANY**
Galion, Ohio



★ LOCAL STOCKS **JENISON** AND SERVICE ★

Read what this user accomplishes with

HYSTER Truck Crane



HODGSON, KING & MARBLE

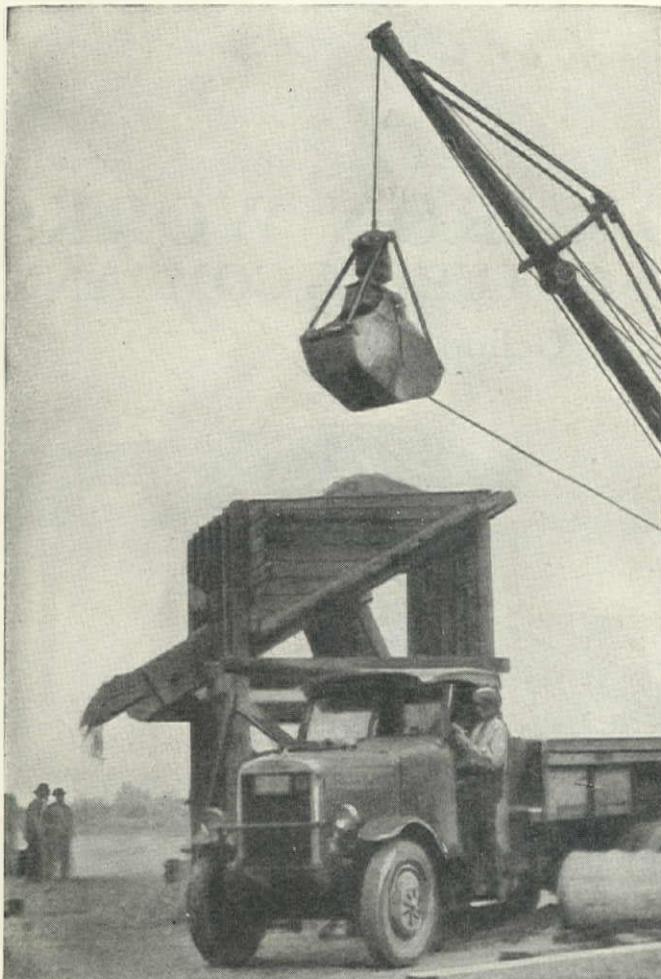
ENGINEERS AND CONTRACTORS

ROYAL TRUST BLDG.

VANCOUVER, B.C.

HODGSON, KING & MARBLE, after using a HYSTER Truck Crane more than a year, write: "The Crane is well designed and constructed, gives us little or no trouble in operation, and has been the means of saving us considerable money on several contracts.

"We have used it on the construction of foundations



HYSTER Truck Crane unloading sand and gravel from scows at Mission, B. C., on paving job recently completed by Hodgson, King & Marble.

for a three million foot Waterless Gasholder, involving the handling of over four hundred concrete piles as well as unloading sand and gravel from scows for this work, backfilling and excavating."

On many other jobs, such as loading ten to fifteen thousand tons of railway material for export, placing large concrete sewer pipes for sewer construction and unloading sand and gravel for road work, HYSTER Truck Crane has proved invaluable to Hodgson, King & Marble. What it has accomplished for them, it can also do for you.

WILLAMETTE-ERSTED CO.

PORLAND, OREGON

800 S. Adams Street,
Peoria, Illinois

126 Liberty Street,
New York, N. Y.

Ask these Dealers for full facts:

ATLANTA	EL PASO	PHILADELPHIA
Evans Implement Co.	Steel Products Co.	Service Supply Corp.
BALTIMORE	FORT WORTH	PITTSBURGH
Alban Tractor Co.	Browning Ferris Mach. Co.	Geo. W. Ziegler Mach. Co.
BOSTON	HOUSTON	PORLAND, OREGON
Clark-Wilcox Co.	Browning Ferris Mach. Co.	Industrial Equip. Co.
CHEYENNE	INDIANAPOLIS	RICHMOND, VIRGINIA
H. W. Moore Equip. Co.	W. J. Holiday Co.	Virginia Tractor Co.
CHICAGO	LOS ANGELES	SALT LAKE CITY
Tractor & Equip. Co.	Harron, Rickard & McCone Co.	Landes & Co.
CINCINNATI	MILWAUKEE	SAN ANTONIO
Queen City Supply Co.	Industrial Power Co.	Browning Ferris Mach. Co.
CLEVELAND	MINNEAPOLIS	SAN FRANCISCO
W. M. Partison Supply Co.	T. W. Rosholt Co.	Harron, Rickard & McCone Co.
DALLAS	NEW ORLEANS	SEATTLE
Browning Ferris Mach. Co.	Woodward Wight Co.	A. H. Cox & Co., Inc.
DAYTON, OHIO	DETROIT	SPOKANE
Queen City Supply Co.	NEW YORK	Hofius-Ferris Equip. Co.
DENVER	H. O. Penn Mach. Co.	ST. LOUIS
H. W. Moore Equip. Co.	OMAHA	Lincoln Equip. & Mat. Co.
DES MOINES	H. M. Brown Co.	TOLEDO
H. M. Brown Co.	PHOENIX	Contractors Mach. Co.
DETROIT	Mine & Smelter Equip. Co.	VANCOUVER, B. C.
Contractors Equip. Co.		National Mach. Co., Ltd.

2939



WORLD LEADERS

IN THE SMALL SHOVEL FIELD

1/2 to 1¹/₄ CU. YARDS

It is logical to expect that Bucyrus-Erie, world's largest exclusive manufacturers of excavating machinery, would have special facilities for the production of small equipment.

Separate factories, and a separate engineering organization of outstanding ability, are maintained for the sole manufacture of small excavating units — Gas, Diesel, Electric, Gas + Air and Diesel + Air. In addition, this small-unit division is privileged to draw on the sum-total experience of the Bucyrus-Erie organization.

Still more impressive is the fact that Bucyrus-Erie has more machines actually operating in the field than any other manufacturer of excavating machinery. Suitability for the job — and dependability in operation — are traditional features of Bucyrus-Erie shovels, large and small. And Bucyrus-Erie Service extends to every part of the civilized world!

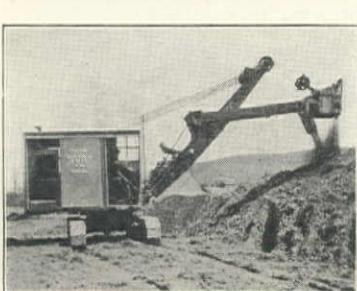
Write for bulletin on the size of equipment you need.

BUCYRUS - ERIE COMPANY

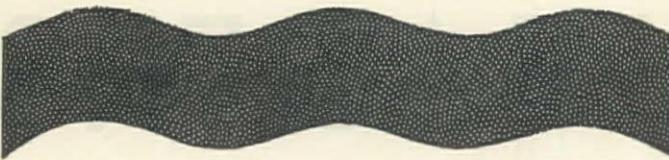
Plants: South Milwaukee, Wis., Erie, Pa., Evansville, Ind. General Offices: South Milwaukee, Wis.
Branch Offices: Boston, New York, Philadelphia, Atlanta, Birmingham, Pittsburgh, Buffalo, Detroit,
Chicago, St. Louis, Dallas, San Francisco.

Representatives throughout the U. S. A. Offices and distributors in all principal countries.

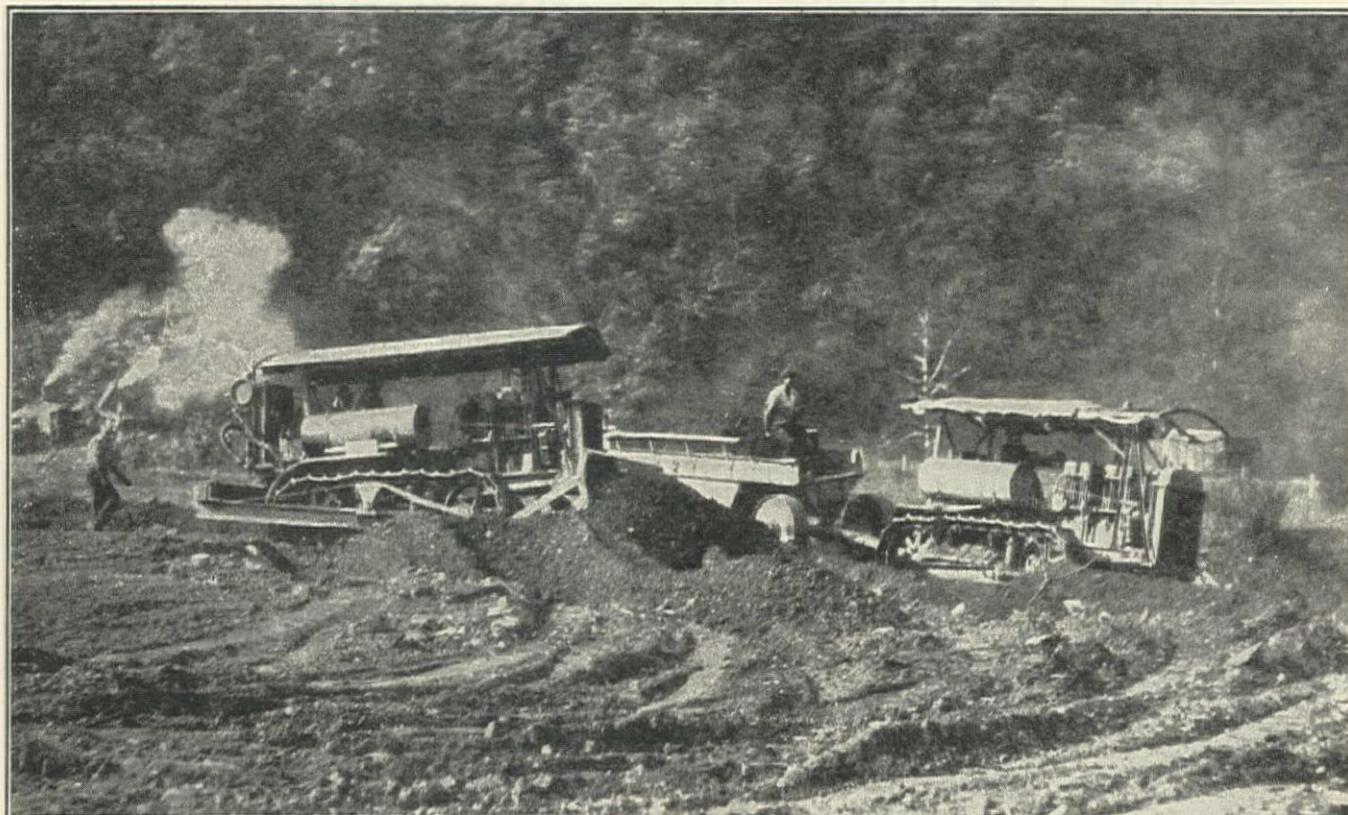
OE-11-10-29-WCN



**BUCYRUS
ERIE**



Saving men, money, minutes



These "Caterpillars" are grading and leveling for a huge industrial plant—a plant that had to be built in a hurry. Because this contracting firm* was armed with "Caterpillar" Tractors and modern equipment, it was awarded the job *at a premium*. Although working in the roughest places and ignoring bad weather the job progressed faster than the engineers could lay out the foundations! Extra power and traction mean extra profits!

*McCrady Brothers, Pittsburgh, Pennsylvania.

Prices—f. o. b. Peoria, Illinois

TEN	\$1125	TWENTY	\$1975
FIFTEEN	\$1500	THIRTY	\$2475
SIXTY	\$4300		

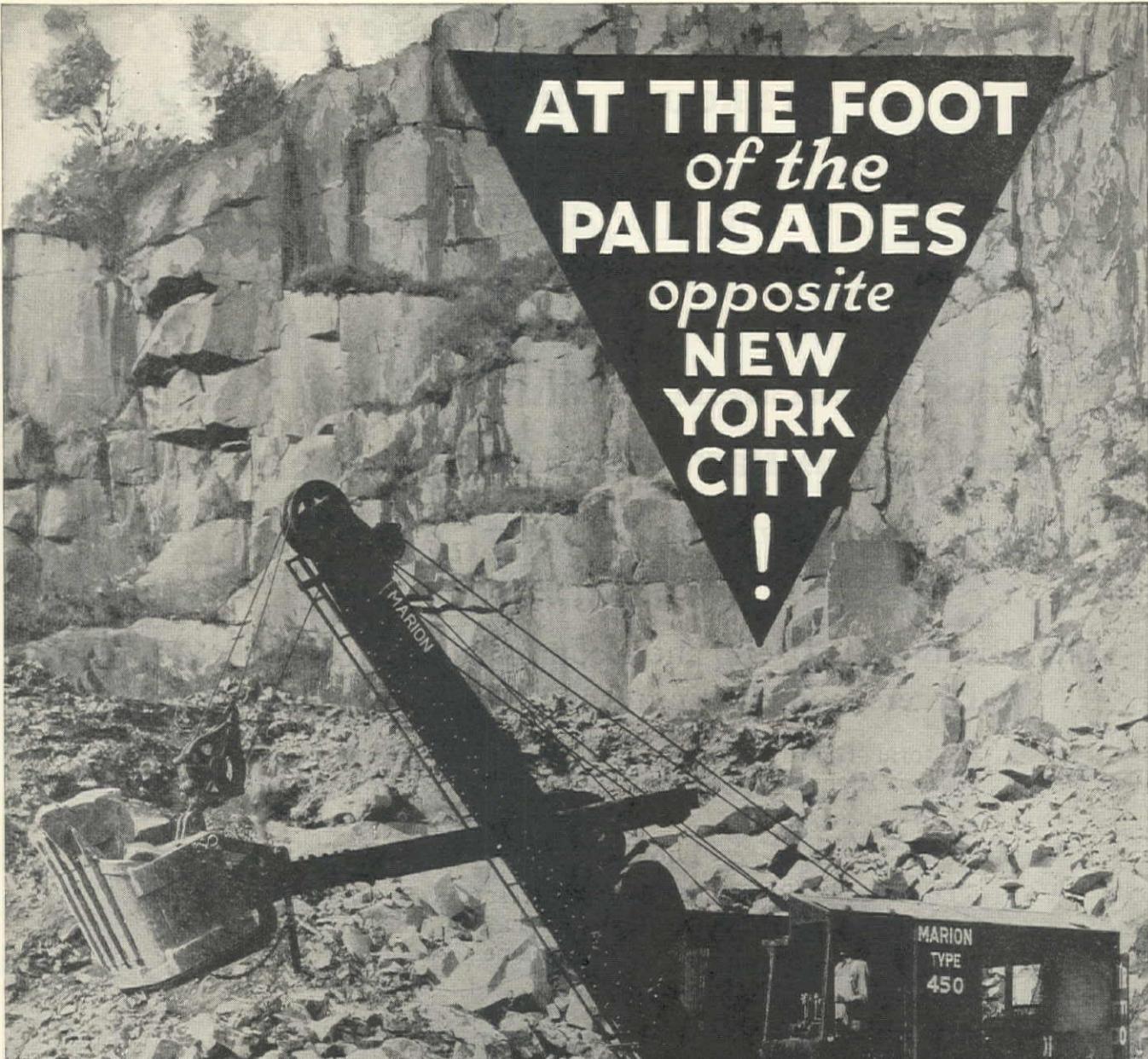
Caterpillar Tractor Co.

PEORIA, ILLINOIS and SAN LEANDRO, CALIF., U.S.A.

Track-type Tractors, Combines, Road Machinery

(There is a "Caterpillar" Dealer Near You)

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



AT THE FOOT
of the
PALISADES
opposite
NEW
YORK
CITY
!

CLEARING away the debris of centuries from the foot of the Palisades with a Marion Type 450, 1 1/4 yard, Gas-Electric. The Luckenbach Trap Rock Corporation of New York, who own and operate this shovel, are handling this typical hard New Jersey trap rock with entire satisfaction. An unusual task for so small a machine but the service rendered is typical of Marion Shovels. Your next machine should be a Gas-Electric. Ask for data.

THE MARION STEAM SHOVEL COMPANY
MARION, OHIO, U. S. A.



MARION

BETTER AND CHEAPER ASPHALT ROADS THROUGH THE USE OF



FOR

Surface Treatments, Plant and Road Mix and Penetration Pavement 2 to 8 Inches Thick

Used Without Heating—No Expensive Equipment

That Bitumuls is Useful and Economical is Proven by Repeated
Orders from Distinguished Customers Including

California Highway Department
Arizona Highway Department

Oregon Highway Department
Nevada Highway Department
National Park Service

The Counties of---

Los Angeles, Riverside, Alameda, Fresno, Kern, Contra Costa,
Marin and Santa Cruz in California.
Hood River, Lane, Coos and Josephine Counties in Oregon

FOR OUR CUSTOMERS' CONVENIENCE, BITUMULS IS NOW AVAILABLE AT
Bitumuls Plants:

Oakland, California
Inglewood, California

Bitumuls Branch Offices:

709 Couch Building
Portland, Oregon

204 South Third Street
Albuquerque, New Mexico

Bitumuls Distributing Stations:

City of Riverside
Riverside, Calif.

J. W. Huffman
Merced, California

Western Motor Transfer Co., Inc.
2 Quarantina Street, Santa Barbara, Calif.

A. Teichert & Son, Inc.
1846 37th Street, Sacramento

Cox and Nunn
Encinitas, California

V. R. Dennis Construction Co.
3911 Fifth Street, San Diego, California

Also Crescent City, Calif., and Bandon, Oregon

Bitumuls Dealers' Stations:

O. F. Fisher

Central Supply Company

418 Security Building, Phoenix, Arizona

Salinas, California

Mercer-Fraser Company

Highway Builders, Ltd.

Second and Commercial Sts., Eureka, Calif.

San Rafael, California

John R. Chace

E. M. Dearborn

Second and Jones Sts., San Jose, Calif.

Redwood City, California

Write for information regarding uses and nearest supply point.

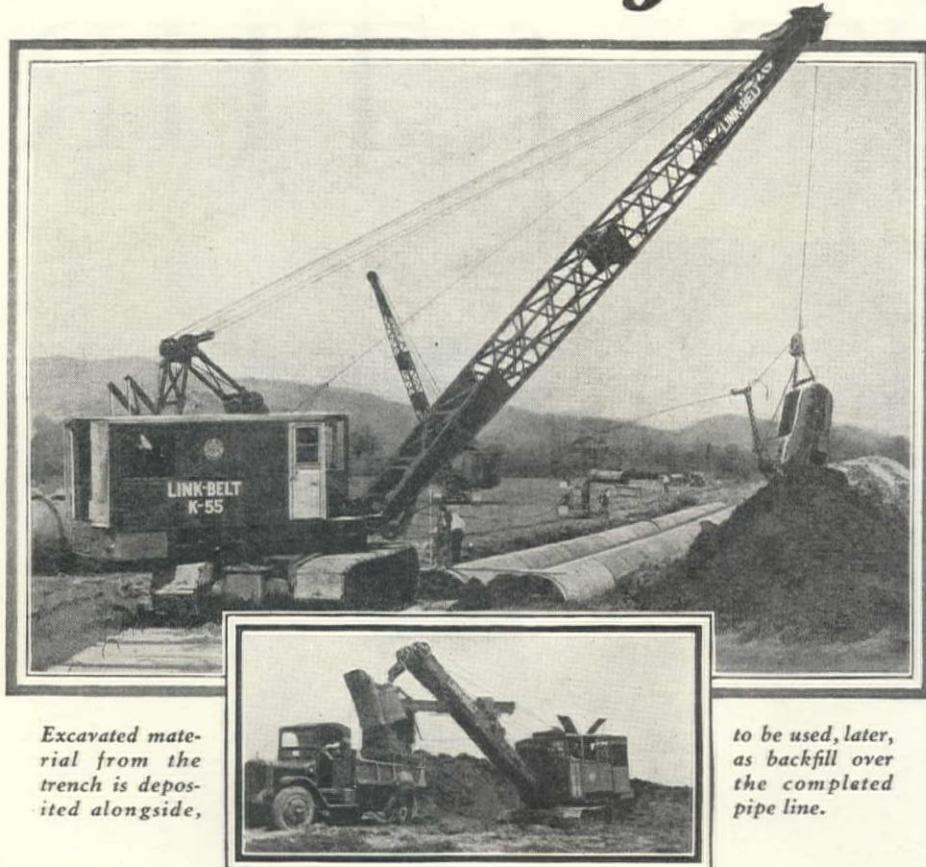
AMERICAN BITUMULS COMPANY

503 MARKET STREET

SAN FRANCISCO

CALIFORNIA

"The 'tough stretches' were 'all-in-the-day's work'"



THE Wanaque Aqueduct in Northern New Jersey, in the wide variety of soil to be excavated, is proving a good testing ground for equipment.

An engineer who saw the Link-Belt K-55 Crane-Shovel-Dragline excavating for the twin 74" pipe line there, writes: "The matter-of-fact way it encountered the tough stretches as all in the day's work, was as fine a tribute to good machinery as I know about."

The same machine placed with ease the 30 ft. long sections of pipe, weighing 7½ tons each, at an operating radius of 45 to 50 ft., as well as pipe valves weighing 14 tons, at a radius of 48 ft.

Go where you will, Link-Belts are found on the hard jobs. Performance is what counts—Link-Belts are designed and built to perform—to make the tough jobs seem easy.

Catalog No. 1095 sent on request.

3775

LINK-BELT COMPANY

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

San Francisco
GARFIELD & CO. Hearst Bldg.

Portland
J. L. LATTURE EQUIPMENT CO. 312 E. Madison St.

Seattle
A. H. COX & COMPANY, INC. 1757 First Ave., S.

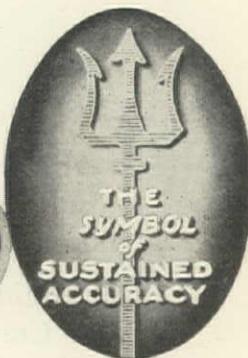
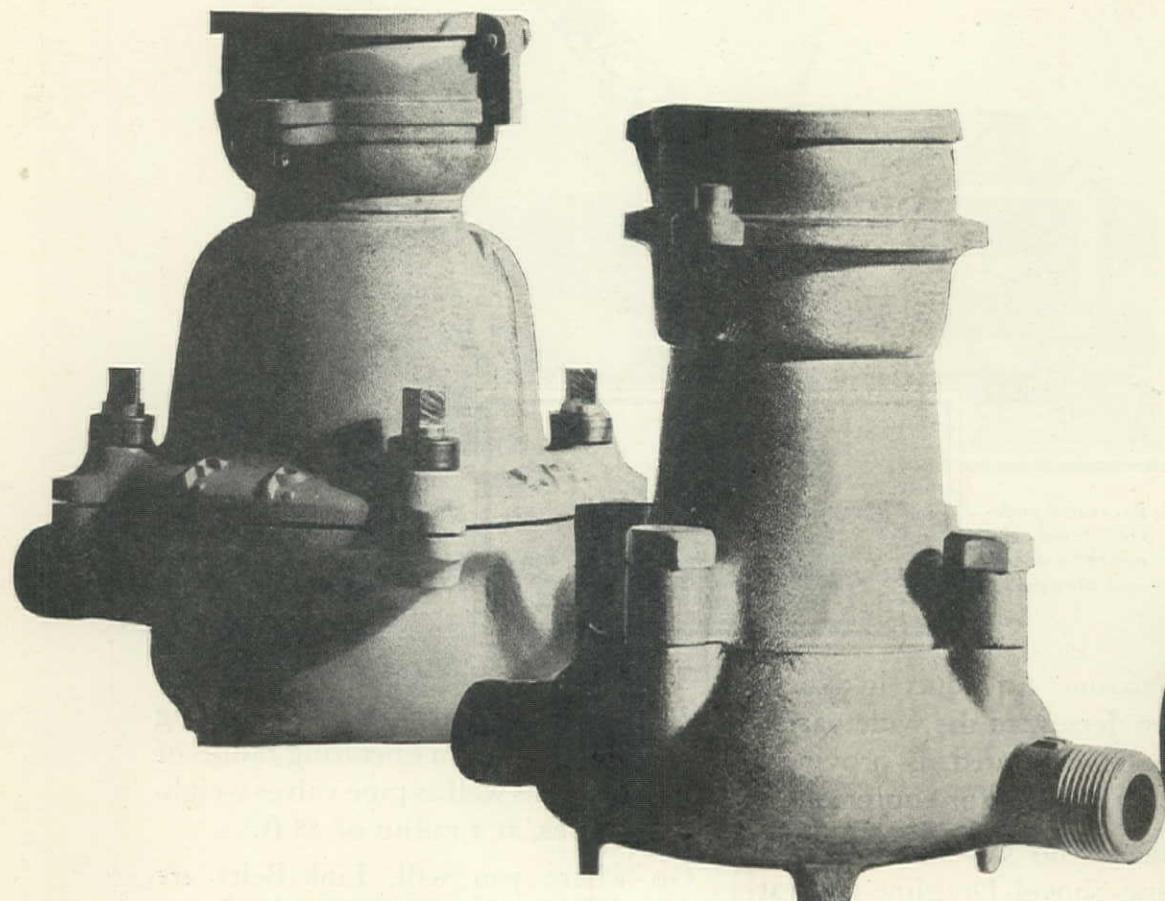
Los Angeles
HARRY C. COLLINS 2411 East 26th St.

Phoenix
MINE & SMELTER EQUIPMENT CO. Lock Box 788

LINK-BELT

SHOVELS + CRANES + DRAGLINES

ONE OUT of THREE



Of all the water meters that have been made in the United States, one out of every three has been a TRIDENT or a LAMBERT. Their record of sustained accuracy over long periods of years is but one of the many reasons for the predominance of these "Cash Registers of the Water Works Field."

NEPTUNE METER COMPANY

50 East 42nd Street, New York City

NEPTUNE METER COMPANY, Ltd., Toronto, Ont., Canada

THOMSON METER CORPORATION

PIONEERS IN METER PROGRESS • YESTERDAY • TODAY • TOMORROW

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

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

WESTERN CONSTRUCTION NEWS

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

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

VOLUME IV

NOVEMBER 10, 1929

NUMBER 21

Although most of us are motorists and in our daily drives through the city or between cities must detour one or more times, we little realize the immense amount of street and highway construction that is being done—in California totaling over \$50,000,000 per annum, and proportionately in other states.

Importance of Highway Construction One of the leading states in highway construction is Illinois, with a ten-year program of permanent type of pavement construction which will give the state 10,000 miles of arterial highways. But, as there are 100,000 miles of roads in the state, what is to be done with the 90,000 miles of connecting roads—at present mostly impassable or 'impossible' for auto travel? The same condition holds true in all other states.

The motorists will undoubtedly demand a continuation of highway construction, but only when conditions become acute. They must be shown that the driver of an average car who travels over high-type roads for an operating expense of \$1.00, pays \$1.18 to travel the same distance on intermediate-type roads and \$1.38 on low-cost roads. If to drive an auto over high-type roads costs five cents per mile, then a dollar buys 20 miles of travel. The average motorist now travels 6000 miles per year, or at a cost of \$300, \$354, and \$414 for high, intermediate, and low-type roads. Cheaper motoring can come only through more extensive highway improvements.

It is largely up to the highway engineers, equipment manufacturers, and automobile manufacturers and distributors to anticipate the great need for better highways and urge the support necessary to secure county, state, and federal appropriations.

Means for improving the relationship between engineers and contractors have been much discussed. James G. Tripp, superintendent of construction on the

Relations Between Engineer and Contractor Lake Pleasant and Coolidge dams, offers in this issue two major departures which an engineer may undertake to better that relationship. They are: construction symmetry of design, and a change in the inspection of work.

If an engineer is to achieve construction symmetry of design he must keep in perspective the method by which his structure can be economically built. He should ask himself these two questions—'What is this

design to do?' and 'How is this design of mine going to be built?' The constructor appreciates an engineering design which not only is sound but practicable. When the designer looks at his design through the constructor's eyes and the constructor will make an effort to learn what work that design is to do, a complete understanding between these two forces of construction is possible.

The inspectors—an important phase of contact between engineer and constructor—are too often undervalued by their employer. Tripp believes that the reasons for this are: first, economy, and second, the generally low grade of men that find their way into inspection forces. Usually, inspectors are of two classes: the experience-getter (young graduate engineer) and the superannuated contractor or engineer who has been forced into such employment. The well-rounded and experienced inspector, who can be safely intrusted with the delicate task of interpreting his chief's intention and wishes, in terms of construction program and necessity, is rarely found. The present condition is wrong and might be overcome by attaching dignity and emolument to the office of inspection, even by rating inspectors as assistant engineers.

We are glad to be able to publish in this issue several 'Letters to the Editor', discussing the tentative suggestions for a 'Building Code for Dams' submitted by Fred A. Noetzli in the

Building Code for Dams

Since this code was published, George W. Hawley has been appointed deputy in charge of dams under Edward Hyatt, state engineer of California. Hawley has a large and difficult task ahead of him. He must inspect every dam constructed to date in the state, and decide whether it is a safe structure or not, and at the same time pass in final review upon the plans and methods of construction of all new dams. One of his first tasks is to decide on the fate of two partly constructed dams.

As pointed out editorially in the September 10th issue, a building code for dams is necessary in order to establish certain fundamentals for each type of dam, without restricting in any way the creative genius of the designing engineer. We hope to receive additional discussions for publication.

Pacific Highway, California

*Grading and Concrete Paving on 8.7 Miles of Ben Ali-Sylvan School Section
Near Sacramento*

Motorists traveling north and east from Sacramento may now drive over a smooth and comfortable portland cement concrete pavement on the section five miles out of the city. This the contractors finished concreting on October 25. The completed pavement is a decided improvement over the original narrow macadam surface.

Location—The new pavement starts at Ben Ali and continues for 8.7 miles to Sylvan school. This is an important route to central California, carrying the

Under the standard practice of the California Highway Commission, which is to increase rights-of-way on main traveled roads along with surface improvements, dedications were secured to make the section 100 ft. wide. The former width of 60 ft. carried an 18-ft. roadway surface, but the new pavement is 30 ft. wide for 3.2 miles and 20 ft. wide for the remaining 5.5 miles.

Contract for the improvement was awarded in June, 1929, to the low bidders, Fredrickson & Watson and Fredrickson Bros., of Oakland and Stockton, for \$323,686. These contractors won two of the three concrete paving construction records on California state highways during 1928. With their Vialog measure of 6-in. roughness per mile of pavement, made on the Galt-Arno road in Sacramento county, the smoothness record was gained. Their average of 247 cu.yd. of concrete placed daily on the San Joaquin-

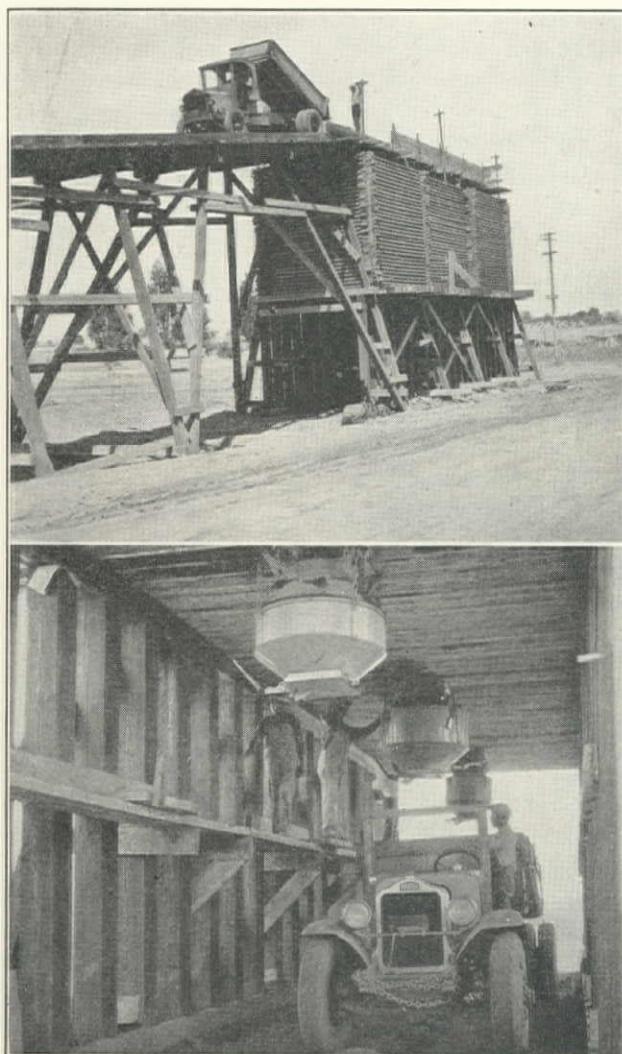


Fig. 1 (Upper) White Truck Dumping Aggregates Into Material Bunker Which Was Built From 3 by 10-in. Header Boards. Bin Said to be Easily Erected or Dismantled. Separators Provide Bins for No. 1 Rock, No. 2 Rock, and Sand. Trucking Incline Supported on Frame-Trestle Bents. (Lower) White Truck in Position Beneath Johnson Weighing Hopper, Each Size of Aggregate Being Weighed Separately. Hoppers Attached to Under Side of Bins and Held in Place by Bolts Running Through Bottom of Bunkers to Reach Steel Plates Inside Bins

Victory and Pacific highways. Travel both to eastern points over the transcontinental route and to northern points over the Pacific highway via Marysville, uses this particular stretch.



Fig. 2. Completed Section of Concrete Pavement on Ben Ali-Sylvan School Section, Pacific Highway

French Camp road in San Joaquin county, established the 1928 output record. On the Ben Ali-Sylvan school job they made a record average run of 360.4 cu.yd. of concrete per day and a maximum run of 407.9 cu.yd. per day. While the average record exceeds those of the past two years by 40%, these contractors did not exceed the standing maximum record of 421 cu.yd. per day.

The contract quantities were: roadway excavation—55,500 cu.yd. at \$0.26, overhaul—630,000 sta.yd. at \$0.015, imported borrow—52,300 cu.yd. at \$0.50, structure excavation—2700 cu.yd. at \$1.00, subgrade for paving—117,500 sq.yd. at \$0.08, class A concrete in pavement—21,935 cu.yd. at \$9.50, class A concrete in

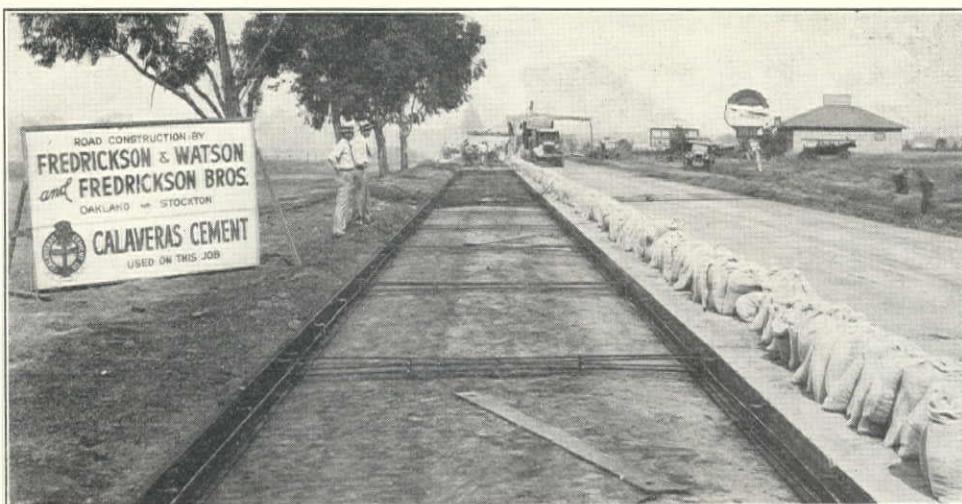


Fig. 3. Completed Subgrade on 10-ft. Strip, Showing Steel and Expansion Joints in Place. Panels Are 20 ft. Long, Provided With Weakened Plane Joints, and With Expansion Joints at 60-ft. Intervals. Concreting in Background. Sacked Calaveras Cement Stored on Finished Pavement Strip Ahead of Mixer

structures—165 cu.yd. at \$20.00, reinforcing steel—561,000 lb. at \$0.05, asphalt concrete—1100 tons at \$5.50, corrugated pipe—4046 lin.ft. of 12-in. at \$0.40 and 2450 lin.ft. of 18-in. at \$0.50, clean and relay cor-

cu.yd. at \$2.50, finishing roadway—459 sta.yd. at \$4.00, monuments—112 at \$3.00.

Due to the importance of the highway, construction was scheduled to inconvenience traffic as little as pos-

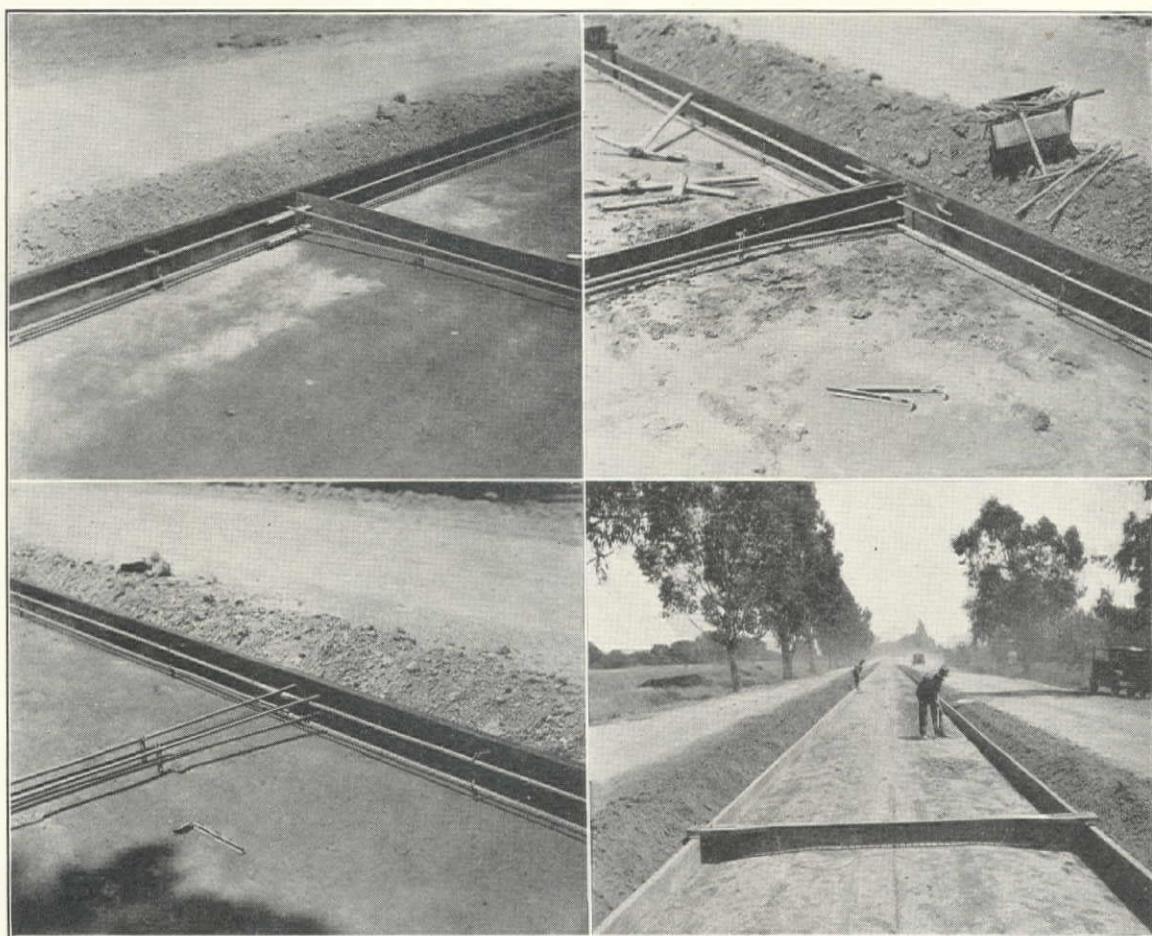


Fig. 4. (Upper Left) Reinforcing Detail at Expansion Joint, Showing Double Line of $\frac{1}{2}$ -in. Longitudinal Bars With Tin Sleeve Covering Projecting Lengths of These Bars to Break the Bond. (Upper Right) End Plate at Through Joint Makes Clean Joint Cut Through and Holds Expansion Material Vertical at Edge of Pavement. Plate Is Removed After Placing Concrete. (Lower Left) Reinforcing Detail at Weakened Plane Joint. (Lower Right) Scratch Template on Finished Subgrade

rugated pipe—155 lin.ft. at \$0.70, salvaged macadam—9500 cu.yd. at \$0.95, new property fence—1.9 miles at \$450, move and reset property fence—2.6 miles at \$200, remove and dispose of concrete and asphalt—90

sible. Both the 30-ft. and 20-ft. widths of pavement were built in 10-ft. strips, with the mixer movements so arranged as to cut the construction period to a minimum.

Design—Each 10-ft. concrete strip is of the thickened-edge design now in general use, on this project being 6 in. thick in the central portion of the strips, with edges thickened to 9 in. Joints form panels 20

ft. long, with expansion provided at 60-ft. intervals, intermediate joints being of the weakened plane type. Each 20-ft. panel is reinforced with a double line of $\frac{1}{2}$ -in. bars, one above the other, to circumscribe the

ferential bars are supported on metal chair devices which remain in the pavement. This design is now standard in California and has been developed only from the construction of test sections of highway in various localities. It has been found that the 20-ft. panel length has eliminated contraction cracking almost entirely, whereas in sections built with 25-ft. panels, the tendency to such cracking increases.

Materials—While the concrete sand was quite coarse, good concrete strengths have been recorded. The average of 28-day compressive strength tests on 41 cylinders cast between August 2 and September 19 was 4394 lb. per sq.in. The main mixes and slumps were 1:1.62:2.33 with 1½-in. slump, 1:2.16:3.02 with 2-in. slump, and 1:1.70:2.39 with 1½-in. slump. There was 137,400 sacks of Calaveras cement used in the work.

The contractor's proportioning plant was set up at a convenient point near the center of the work and was supplied with material by trucks from the producing plant. The single bunker, of a unique type



Fig. 5. Charging Foote 27-E Paver on Ben Ali-Sylvan School Section, Pacific Highway

ft. long, with expansion provided at 60-ft. intervals, intermediate joints being of the weakened plane type. Each 20-ft. panel is reinforced with a double line of $\frac{1}{2}$ -in. bars, one above the other, to circumscribe the

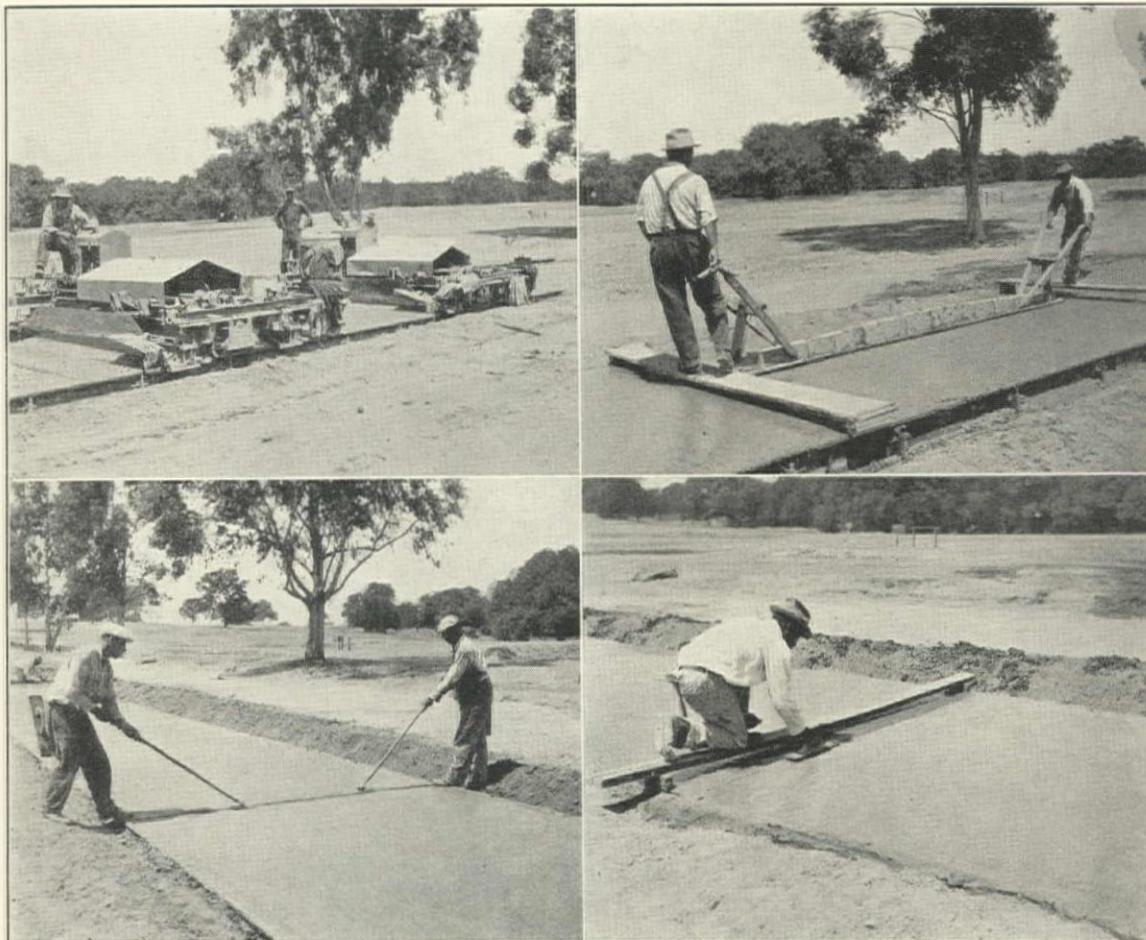


Fig. 6. (Upper Left) Two Ord Finishing Machines Working in Tandem. (Upper Right) Longitudinal Float Follows the Mechanical Finishers. (Lower Left) Edging a Weakened Plane Joint. (Lower Right) Hand Finishing an Expansion Joint, the Joint Material Being Covered With a Box Channel Strip to Hold It Straight

panel. The longitudinal bars project through the joint at one end, and the projecting length is covered with a tin sleeve to break the bond (see Fig. 4). In addition to the longitudinal steel, three dowel bars, each 24 in. long, with metal sleeves on one end, carry the load across expansion joints. All dowels and circum-

as shown in Fig. 1, was divided to provide for two sizes of coarse aggregate and for one bin of sand. All materials were weighed for the batch in Johnson weighing hoppers. A. D. Hadsell, operating manager for the Coast Rock & Gravel Co., is said to have designed the special bunker.

Equipment—The major equipment on the work included two Ord finishing machines, working in tandem; a Foote 27-E paver; a Carr subgrader; Caterpillar tractors; and a MacMillan bulldozer; a Northwest shovel; rollers; White trucks; and a scarifier. There was 13,000 lin.ft. of Blaw-Knox steel forms on the work. The macadam surfacing was torn up and the rock salvaged for borders.

Construction was standard throughout. Aggregates were combined according to their grading, and proportioned to make a mix having six sacks of cement per cubic yard of concrete. White trucks, holding the correct amount of material by weight, carried the

batches to the mixer, as in Fig. 5. Cement was dumped directly into the skip and the cement quantities computed daily against the total volume of concrete placed in the pavement. The concrete was protected with burlap covering, then by building earth dikes and curing the surface under water for 8 days. The pavement was finally opened in 14 days, or earlier if conditions were favorable for the concrete to reach its required strength.

Construction of the Ben Ali-Sylvan school section was under C. H. Whitmore, district engineer of District III, California Division of Highways, with C. A. Potter, resident engineer.

Denver Avenue Viaduct, Portland

By MELVILLE E. REED*
*Bridge Engineer, Multnomah County,
Portland, Oregon*

The interstate bridge across the Columbia river between Portland, Ore., and Vancouver, Wash., is approached on the south by two arterial ways—Union and Denver ave.

Multnomah county has recently improved the Denver ave. approach at an expense of \$350,000. This improvement consists of a concrete viaduct over Columbia blvd., 782 ft. long; a concrete and steel viaduct over Columbia slough, 775 ft. long; and an embankment approach to the north, 5600 ft. long. The roadway, as now constructed, is 30 ft. wide, with one 5-ft.

set, thus insuring a union between the deck concrete and the red traffic strips.

Concrete light posts were cast in place on the viaducts. On the fill to the north, Union Metal posts equipped with G.E.No. 12 tops were installed. All lights are in series and are connected through Sauter time clocks so that half the light may be turned off after midnight.

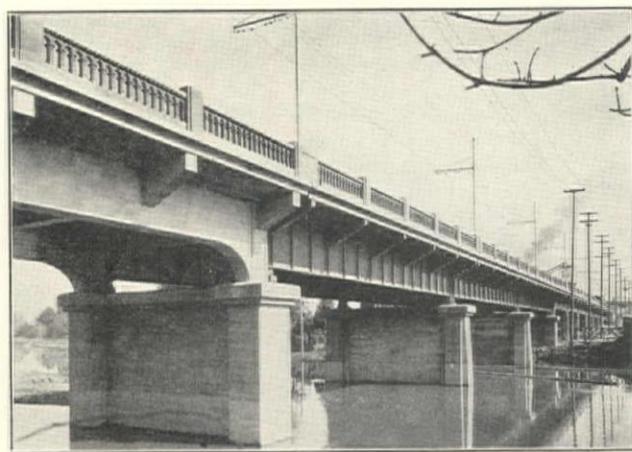
Construction was commenced on December 26, 1928, and completed June 18, 1929, five days before the contract date. The contractors thereby earned a bonus,



Denver Ave. Viaduct Showing Roadway, Car Track, Special Traffic Strip, Curb, and Handrail Details

sidewalk on the east and a street-car line on the west side. The street-car rails are laid on the deck of the concrete viaduct with the idea that later on the car track will be removed, thus providing four traffic lanes.

An innovation has been tried on the concrete deck. Permanent traffic lines have been made by placing strips of red-tinted concrete, 4 in. wide by $\frac{1}{4}$ in. thick, in the deck between each traffic lane. These strips were placed in depressions in the deck as soon as the deck concrete had its initial set and before the final



Denver Ave. Viaduct at Columbia Slough. Approach Section in Background

even though the month of January was lost on account of cold weather.

The work was under the supervision of the board of county commissioners—Grant Phegley, chairman, Clay S. Morse, and Fred W. German. Geo. W. Buck is roadmaster; M. E. Reed, bridge engineer; and W. M. Luce, assistant engineer of Multnomah county. Lindstrom & Feigensen were the general contractors for the viaduct section and the United Contracting Co. built the north approach. Jaggar Sroufe Co. installed the lighting system.

Building Code for Dams

Discussion of the Tentative Suggestions by Fred A. Noetzli for a 'Building Code for Dams,' as Published in the September 10th, 1929, Issue, Pages 461 to 465

Los Angeles, California,
October 19, 1929

THE EDITOR:

Dear Sir—The tentative building code for dams submitted for discussion by Fred A. Noetzli is a detailed and carefully prepared instruction on the design, construction, and maintenance of these structures.

Since these comprehensive regulations are published for the purpose of inviting a discussion among engineers, interested in the progress of dams, I believe that a thorough and critical examination of the fundamental ideas and assumptions, underlying the proposed code, is not only desirable, but perhaps necessary. Obviously, these suggestions involve the much pressing problem of economy combined with safety, occupying such a conspicuous place in the literature of recent years.

In the following discussion I wish to take up several of the most vital points of the proposed code, for the purpose of elucidating them further, inserting at the same time some disregarded facts of practical importance. I do not intend to make a complete analysis of the subject.

The opinions expressed herein contradict to a certain extent the views held by the author. I regret being unable to agree with all the points, advanced in this preeminently able presentation of the tentative building code for dams, and sincerely hope that my efforts to clarify and interpret some new and not commonly accepted methods of design will not be misunderstood.

Uplift—The amount and distribution of uplift in dams is, as it is well known, a controversial subject and the numerous tests and theoretical investigations made, do not yield a definite answer to this perplexing question. However, the presence of uplift in gravity dams is of great importance and the failure to take into consideration its action in the design of some high dams, is perhaps one of the main points of weakness of these structures. This probably would not happen if definite regulations were available and accordingly enforced.

The French regulations of Oct. 17, 1923,¹ for dams do not favor an uplift equal to the hydrostatic pressure at the upstream face of the dams, but, to the contrary, they leave to the judgment of the designer to decide, whether it is necessary to take into consideration the action of uplift in a given case, or not. The Italian regulations of Dec. 31, 1925,² on the other hand, assume that the amount of uplift at the upstream face of the dam depends, not only on the height of the dam but also on the natural condition of the rock. For higher dams and bad foundation conditions, a greater intensity of uplift is assumed than for lower dams, founded on good bedrock.

Owing to our present limited knowledge on the action of uplift, I believe that a more conservative assumption is to be recommended. A triangular distribution of this uplift, with two-thirds of the full hydrostatic pressure at the upstream face, diminishing to zero at the downstream face of the dam, is a more conservative assumption which, if enforced, will undoubtedly warrant a greater safety against possible unfavorable conditions met in practice. Cutoff walls and pressure grouting, although very effective, nevertheless cannot be relied upon absolutely. They should be used only as an additional safety measure against the much feared action of uplift.

Inclined Contraction Joints—There is no doubt of the necessity of contraction joints in the present-day concrete dams. The high temperature reached during the setting of the cement, is the main cause of the shrinkage stresses and, consequently, of the cracks produced in the concrete. As long as the manu-

facturers of cement cannot furnish a product generating a low chemical heat, or more probable, having a high tensile strength, contraction joints will be unavoidable in dams. There is no other alternative in this case. Noetzli deserves much credit for being instrumental in the introduction of these joints in several dams of considerable magnitude. I refer especially to the inclined joints in gravity and buttressed dams, believing, however, that the underlying principle of locating these joints, according to the theory of the trajectories of stress, is open to objection and criticism.

Statistical investigations of these types of dams are based on the law of the trapezoid, that is, on the linear distribution of the normal stresses in horizontal planes. This law presupposes that the continuity of the section is not disturbed. By arranging contraction joints, this continuity—one of the most important conditions in the theory of elasticity—is lost. The formerly continuous diagram breaks up into several independent parts, defining an entirely different stress condition not accounted for in the continuous diagram.

The trajectories of the principal normal stress fix the points where shearing stresses are absent, so that no relative displacements of the parts of the dam are possible, if cracks occur along these lines. It is, therefore, logical to arrange the contraction joints along the maximum compressive normal stresses. However, it is not permissible to locate these joints according to the theory of the principal normal stresses determined, as previously stated, by the aid of the law of the trapezoid for a continuous body without joints. This will be made clear by the following considerations:

Along the faces of the dam in contact with water or air, shearing forces cannot be developed, as neither of these substances, statically speaking, produces friction. For this reason, the trajectories will be parallel and normal to these surfaces, respectively. On the other hand, the dam being in contact with the rock at its base, there is generated a frictional resistance, so that both families of the trajectories must intersect this base under certain angles, differing from 90 deg., if not, a connection between dam and foundation is ensured. In the case contrary to the above assumption, the rock is a part of the dam, and the trajectories, therefore, are distributed similarly to those formed in the interior of the dam.

As the stress condition of a body depends not only on its shape, but also on the forces acting upon it, the distribution of the trajectories in a dam with reservoir empty will differ materially from those in a dam with reservoir full. In the first case the trajectories intersect those formed in the second case. Along the trajectories of the maximum compressive normal stresses of the second case, Noetzli suggests that the inclined contraction joints be located.

In the transitory period of rising water level, ample relative displacement of the separated parts of the dam will take place, due to the intersection of the two families of the trajectories of stress, for reservoir empty and reservoir full, thus resulting in the disturbance of its static equilibrium. These movements may be expected to produce serious stresses in the structure, endangering its safety. The above reasoning is only correct, if it is assumed as Noetzli evidently does, that the distribution of the trajectories is not affected by the presence of the inclined joints. In fact, the trajectories of stresses show an entirely different picture in the case of a dam with inclined joints, or with a continuous section.

An additional disadvantage is perhaps the fact that, during the time the chemical heat is being generated in the concrete, the dam is usually not exposed to water pressure. Consequently, the cracks due to shrinkage will not follow the trajectories of the principal compressive normal stresses, produced by the combined action of the water pressure and the

¹"Barrages de Grand Hauteur Résistant par leur Propre Poids". Reprint from Annales des Ponts et Chaussées, April, 1923, p. 321.

²"Regolamento per i Progetti, la Costruzione e l'Esercizio delle Digue di Ritenuta" in Guidi's Statica delle Digue per Laghi Artificiali, Turin, 1926, p. 123.

weight of the dam. In fact, such cracks have occurred during the construction of high dams.

This discussion does not intend to imply that dams with inclined joints are absolutely and unequivocally unsafe and dangerous, in spite of their weakened statical condition. I wish merely to point out, that the standard methods of design, used, apparently, by the author, have to be abandoned in this case and other means of attack should be sought in analysing these structures.

It is probable that the separated parts of the dam, owing to these joints, will act as inclined struts, thus preventing the dam from collapse. Noetzli claims⁴ that cracks along the trajectories of the principal compressive normal stresses were visible in the failed St. Francis dam, California. On the other hand, the German engineer, P. Ziegler, maintains⁵ that such cracks have also been observed in the buttresses of the failed Gleno multiple arch dam, Italy. He explains this phenomenon, however, in an entirely different way. He believes that, if a dam is stressed by the action of water pressure, there are formed inclined arches in its interior having one of the abutments at the upstream face of the dam. When these arches come into action, relative displacements occur between them, thus giving rise to cracks, running similarly to the trajectories of the principal compressive normal stresses in a continuous dam without inclined contraction joints.

In this conception of the stressed dam, there is perhaps some truth. At any rate, by arranging inclined joints in a dam, I believe that each of the inclined struts, thus formed, should be investigated approximately by the aid of the middle third theory as an additional safety measure.

Resistance to Earthquakes—In a seismically active country, like California, provisions should be made in a building code for safe structures against earthquake hazards.

The investigation of a dam for impact-like forces, produced during a seismic disturbance, can be considered as a matter of routine. In a given acceleration of the earthquake motion of, say, $3.0 \frac{\text{ft.}}{\text{sec}^2}$ for California, the forces acting upon a dam can be easily determined by the aid of Newton's second law of motion. This is mainly a statical problem, since the time effect does not seem to enter into play to any marked degree.

The matter is rendered more difficult, however, if resonant phenomena have to be taken into account. As resonance can take place only during a certain amount of time, the investigation of a dam in this case should be made, obviously, according to the laws of dynamics.

The high slender buttresses of the double wall type of dam and also the thin arches of the arch and multiple arch dams, can be damaged in an earthquake of long duration but lesser intensity. This is especially true, if the seismic waves are propagated in a direction parallel to the longitudinal axis of these dams. There are no methods available, which satisfactorily treat this problem from the engineering point of view. Notwithstanding this fact, it is believed that an approximate method of analysis, based on the notion of springs, can be developed for the purpose of determining stresses caused by vibrations in a dam, when subjected to an earthquake of comparatively long duration. According to this conception of the stressed dam, it is only necessary, for the various parts, to determine the spring constants, in order to know with sufficient accuracy the intensities of the field of forces, produced in the dam by prolonged seismic oscillations.

Engineers interested in vibratory movements are accustomed to judge the ability of a structure to resist the harmful effects of vibrations by the magnitude of its period. As is well known, this period is the reciprocal of the frequency. In the design of a high slender dam, therefore, its period shall not exceed a certain limit prescribed by the code. For conditions in California, an upper limit of 1.2 sec. for the period of the earthquake oscillations can be considered exceptionally safe, as high dams are commonly built on rock the seismic properties of which are exceedingly favorable.

Sliding Factor—The notion of the sliding factor is to a certain extent a remnant of the methods used, not long ago, in

⁴"Internal Stresses in Gravity Dams" by Fred A. Noetzli, Hydraulic Engineering, Dec., 1928, p. 726-729. See also *L'Energia Elettrica*, Jan., 1929.

⁵"Volle Strebenmauer und Pfeiler-Strebenmauer" by Paul Zeigler. Schweizerische Bauzeitung, June 29, 1929, p. 315-317.

the design of masonry dams, laid in lime mortar. In these structures no monolithic action could be reasonably expected. With the introduction of concrete and the refined methods applied today in practice, it is doubtful whether much attention should be paid to the sliding factor. It is gratifying, therefore, that Noetzli has gone beyond the limits usually allowed by conservative consulting boards relative to the value of this factor. If good bedrock is available, there is no serious objection against an increase of this value even up to unity. By taking into consideration a low value for the sliding factor, a substantial amount of uplift pressure and also earthquake stresses, it is difficult to keep the quantity of concrete in a gravity dam within reasonable economic limits. On the other hand, in multiple arch dams, a low value for the sliding factor doubtless causes an increase in the cost of the dam without making the structure safer.

The nine-tenths upstream slope, introduced by Noetzli in the design of multiple arch dams, is undoubtedly the direct consequence of the detrimental influence of this factor. This slope usually produces a considerable tension at the upstream face, due to the second principal stress, which can only be mitigated by making the buttresses thicker at the upstream side of the dam, and also by putting considerable steel reinforcement along this side, in the direction of the tensile stresses. An interesting example of this case is the Lake Pleasant multiple arch dam, Arizona, where these precautionary measures were overlooked, with their ensuing ill after effects⁶.

A far better design is obtained by making the upstream slope of the multiple arch dam eight-tenths, in which the tension, due to the second principal stress, is reduced automatically without the artificial means, mentioned previously. In this case, it is obvious that, by losing much weight of water, the sliding factor will be higher than in the nine-tenths slope, provided the buttresses are not designed excessively heavy.

In order to avoid this undesired tension, the Italian multiple arch dams are usually provided with a steeper upstream slope. This aim could be easily attained in that country, as most of the buttresses of these dams are of masonry. In this case, it is not difficult to keep down the value of the sliding factor, although the regulations of that country, mentioned previously, do not fix a definite value for it.

Lamination of Arch Dams—The lamination of single arch dams has obviously many advantages, but at the same time certain serious drawbacks. It is probable that the ring nearest to the water will be stressed beyond its strength, while the remaining rings will be left, practically, almost without stress. This is evident from the fact that the arches being separated from each other, no shearing stresses can be transmitted from one ring to the other. The remaining arches can only be stressed, after a considerable unelastic deformation of the first upstream ring has taken place. If arch dams were stressed mainly by bending, the matter would be different. Unfortunately, this is not the case and the safety of the laminated arch dams in their present form seems to be uncertain.

In thin arches the direct stresses predominate, so that their distribution can be defined more accurately than in a thick arch dam. Also, shrinkage stresses are kept comparatively within low limits in the thin laminated arches. However, in order to take advantage of the above favorable properties of slenderness, an arch dam with stepped water levels would be preferable in many respects.

The marked superiority of the laminated arch dam, as compared with the arch dam with stepped water levels, rests upon a decidedly different ground. The friction produced along the surfaces in contact of these laminae during a seismic oscillation, will force the dam to do work and consequently, the frequency or speed of vibration of the individual arches will be reduced appreciably, thus removing the danger of a resonance in these high slender arches.

The laminated arch dam is a new idea proposed by Noetzli which, if adequately modified and improved, could possibly solve the troublesome problem of shrinkage and stress distribution in high arch dams.

Testing of Models—The testing of proposed arch dams by

⁶"Safeguarding the Lake Pleasant Dam" by Fred A. Noetzli. Western Construction News, April 25, 1929, p. 201-202. See also "Spillway Cut Rushed to Safeguard Lake Pleasant Dam", Engineering News-Record, Feb. 14, 1929, p. 277.

the aid of models is perhaps a comparatively simple matter, provided the model is composed of the same material as the dam. In the case of concrete dams, the model must be fairly large in order to make measurements reasonably possible, a fact that increases appreciably the cost of the tests. This should not be overlooked, in proposing the use of models for the purpose of checking dams already designed.

If model and dam are of a different material, there arise in such tests serious difficulties, owing mainly to the difference of Poisson's ratio of the two materials. This is indicated by the dimensional analysis (theory of similitude) and also follows from the theory of elasticity.⁶ For this reason, small celluloid models for concrete structures are rather of a restricted usefulness in problems of three-dimensional statics. An arch dam is really stressed in three directions, thus representing a complicated elastic system in space.

Temperature Changes—As regards the temperature variation to be assumed in the design of arch and multiple arch dams, I wish to suggest a temperature drop of 20 to 30° F., depending on the climatic conditions of the damsite, with no reductions, whatsoever, for arch dams which have all contraction joints grouted. An arch dam, in which the vertical contraction joints have been left ungrouted, cannot be considered as coming into the category of an elastic arch. In these dams, the grooved keys of the contraction joints, by neglecting the restraint at the base, will probably act as hinges, thus eliminating the influence of a temperature variation upon the arch.

Although a rise of temperature in an arch dam with reservoir full, acts favorably on the stability of the structure, nevertheless there is no reason to ignore the influence of this rise when the reservoir is empty. It is true that in the last case there is ample safety against overstrain. However, under certain exceptional circumstances, tensile stresses may be developed, endangering its stability. Under these conditions, therefore, it is desirable to assume in the statical computations, that the temperature of the arch might rise up to 20 or 30° F.

Noetzli's recommendation to assume for shrinkage stresses an equivalent drop in temperature of 5° F. is logical and sound. The contraction joints are never left open for a sufficiently long period of time, so that shrinkage stresses may be developed during the cooling of the concrete. If no contraction joints are provided in the arch dam during construction, then the shrinkage temperature should be increased to 25° F.

The possibility of an unequal temperature variation between the upstream and downstream faces of an arch and multiple arch dam is commonly disregarded by American engineers. There is no justification, however, for such a neglect from the statical as well as physical points of view. Under certain unfavorable conditions, the difference of temperature between the two faces can be of such magnitude that the ensuing stresses added to those due to other causes, may exceed the allowable limits. For this reason, a proper temperature difference of, say, 10° F., with a linear variation from face to face, should be assumed in a correct design.

In closing, I wish to express my appreciation to both the editor and author for their efforts to bring into discussion a set of rules to be followed generally in the design of dams, for the purpose of their future codification. Unfortunately, there is a tendency among some quarters at present, to decide such matters behind closed doors to the detriment of progress in creative engineering.

A. FLORIS,
Civil Engineer

San Francisco, California, September 27, 1929

THE EDITOR:

Dear Sir—Constructive criticism has been invited by Fred A. Noetzli on the 'Building Code for Dams' as submitted by him and published in **Western Construction News** for September 10, 1929. I have carefully read this code, which seems quite adequate, with few exceptions or additions.

In paragraph 2 (h), the common statement is made that for gravity dams the factor of safety against sliding and incipient overturning is usually not more than two. I would

⁶"Theoretical Analysis of the Structural Action of the Stevenson Creek Test Dam" by H. M. Westergaard, in Report on Arch Dam Investigation, Vol. I, p. 232, Proceedings, American Society of Civil Engineers, May, 1928.

not like to see this statement incorporated in a code because, usually, the resultant of all forces acting on a gravity section falls but little inside of the middle third, and therefore the factor of safety of the structure acting as a gravity dam can be only a little more than one. A code should not hold out any false promises of factor of safety. Such a structure may have a factor of safety of two, but only in case the upstream face can take tension, and tension should not be permitted in the upstream face of a gravity dam. Such a structure, put on a poor foundation unable to take tension, can have only a maximum factor of safety of but little over one, and less than one if uplift has to be considered.

In a code, it should be distinctly specified that foundation excavation should be stopped only at elevations which will permit the foundation positively to resist shear action. This should in no wise eliminate paragraph 10, dealing with the factor of safety against sliding, but shear resistance should also be considered, as it is more positive than sliding resistance, provided it can be developed. On poor rock foundation, the depth of excavation would simply have to be made great enough to obtain lateral support of sufficient rock downstream from the dam.

Paragraph 8 states that 'A gravity dam shall be analyzed for a vertical element of the highest section', etc. It is, however, also necessary to analyze sections between the highest and the lowest, if the canyon has steep side slopes. The high portion deflects more at the top under load than shorter sections on the side slope, but, since horizontal beam action and shear in the vertical cantilever will tend to equalize this deflection, the shorter sections are thereby additionally loaded and the high sections proportionally unloaded by this process. The fact remains that the shorter sections have to support more than the water load upon them. I have given considerable study to this problem but have not yet solved it in a designing way. It seems that the cheapest way to strengthen the shorter section is by placing the additional material required in the shape of a buttress on the downstream side; otherwise, the shorter sections should be made heavier. The design of a gravity dam having an equal factor of safety in all its parts is not a simple matter.

In paragraph 18 (a), the water-soaking effect should be applied when analyzing the cantilever. This water-soaking effect must ordinarily be a maximum along the upstream face and a minimum along the downstream face. It would be conservative to assume that full water soaking existed along the upstream face and no water soaking along the downstream face; it is not conservative practice to leave this effect out entirely. It seems to me best to use paragraph 18 (b) for the design of arch dams, since the degree of water soaking must always remain obscure. In this respect, it is in the same class as uplift pressure and, therefore, certain assumptions must be agreed upon before proceeding with a design.

LARS JORGENSEN,
Consulting Engineer

THE EDITOR: Seattle, Washington, September 24, 1929

Dear Sir—Fred A. Noetzli's tentative suggestions for a building code for dams in your issue of September 10 contain the following relative to rock-fill dams, paragraph 53:

'The fill shall be made of reasonably durable rock fragments, resistant to deterioration, and practically free of soil admixture. It shall be sufficiently hard to prevent excessive crushing and spalling under the pressures produced in the dam.'

Suppose the available material consists of rock which deteriorates on exposure to air. Would it be safe to deposit the rock, possibly mixed with sand, with the slopes satisfactory for a rock-fill dam, and then sluice in clay to fill the voids, thus excluding air and preventing deterioration of the rock? Or, would it be safe to deposit the rock and sand with slopes satisfactory for an earth-fill dam, and then sluice in the clay?

Have any dams been constructed under the conditions similar to the above and, if so, what method has been used?

CONSTANT READER

Stop Signs for Arterial Streets

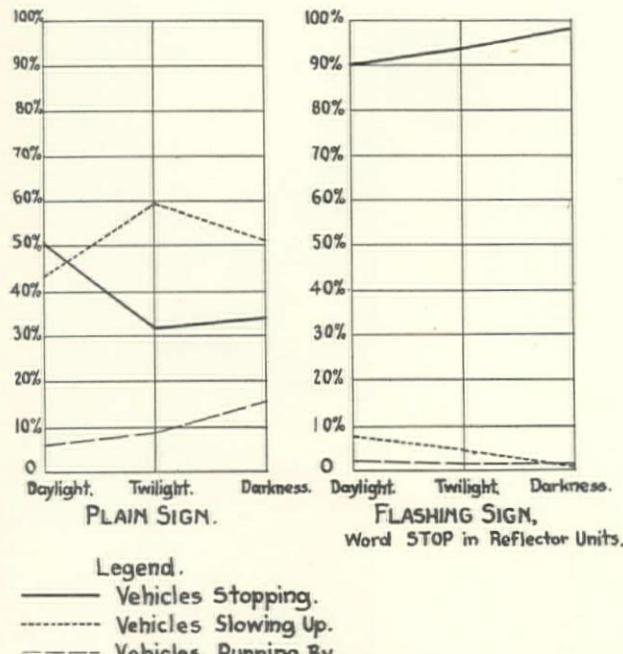
Traffic Studies—Means for Controlling Through and Side Traffic—Development, Economic Comparison, and Adoption of Stop Signs for New Boulevard System in San Francisco

By GEORGE D. BURR*
City Traffic Engineer, San Francisco

American cities have quite generally adopted arterial or 'through traffic' streets, whose normal function is to permit the rapid passage of vehicles, either along the principal highways which traverse the city or between outlying districts in the community. To allow rapid

driver of a vehicle on the arterial street anticipates that cross traffic will halt before it reaches his path. The failure of an entering vehicle to stop may cause a serious accident. To prevent accidents, therefore, the 'stop' rule must be rigidly enforced. Otherwise, it would be better to abandon the use of through streets.

Stop Signs and Markers—Approaching cross-street vehicles are usually halted by a sign, mounted on a post back of the right-hand curb at or near the property line of the arterial street, and bearing the word 'stop'. A line or other mark on the pavement is often



CHECK ON STOPS AT THRU STREET STOP SIGNS.
North and South on Franklin Street at Post Street.
February 1929.

Fig. 1

but safe movement along such arterial streets, vehicles must be stopped at, or near, the property line of the through street before they enter upon it. Four factors govern the effectiveness of rapid and safe movement along the through street. These are: ability to stop the entering traffic; the comparative volume of traffic along and across the arterial street; the selection of streets which, because of approaches, grade, alignment, and surfacing, can pass the desired volume of through traffic; and effective policing of the through street. The first-stated factor, ability to stop the entering traffic, is discussed in this article.

Arterial Stop Rule—By its very nature, the arterial stop rule introduces an element of hazard from two sources; it is not a safety measure. It encourages fast driving and increases the danger of serious accidents, as collision with a high-speed vehicle results in greater damage than would occur from impact with that same vehicle moving at a slower speed. Because of the regulation, another source of hazard is created, as the

*Associate Member, American Society of Civil Engineers.



Fig. 2. (Upper) Wired Stop Sign at Intersection of Bayshore Blvd. and Ware St. Pipe to Left of Arterial 'Stop' Will Carry Automatic Signal. (Lower) Battery-Operated 'Stop' Sign at Intersection of Bayshore Blvd. and Faith St.

extended out from the sign to designate the exact limit for bringing an approaching vehicle to a stop. The use of such a line is to be recommended. Buttons and other forms of pavement markings are sometimes used, but they are not generally to be looked for. Signing standards, to be effective, must be national in character so that their meaning will be at once clear to all tourist drivers.

Painting on a pavement surface is often obscured by glare when the pavement is wet, and is not clearly visible in night driving. Buttons on the pavement are not continuously effective in cities subject to snowfall and, therefore, can hardly be adopted as a national standard for regulating vehicle movement. San Francisco has adopted a stop sign to mark arterial streets which is the United States Standard, except for color (the state law requires a red background with white letters rather than the standard yellow background with red letters). This San Francisco sign is placed opposite the designated stopping point.

Day and Night Signs—Much experience has been had with signs for daylight use. These signs are wilfully disregarded by but 1 to 1½% of the driving public. Other violations, affecting from 10 to 35% of the drivers who run by or fail to come to a complete halt at stop signs, are caused by lack of attention and failure to see the sign and by complicated traffic situations. The reaction of the public to night signs is not so well known. Unless the sign is illuminated, ordinance provisions practically void the stop sign regula-

the face of the sign; self-luminous letters; placing the signs so they will be illuminated by street lights; reflecting letters which will be illuminated by vehicle headlights.

San Francisco Tests on Night Signs—As actual data on the relative effectiveness of these four recommended methods of illumination were not available,

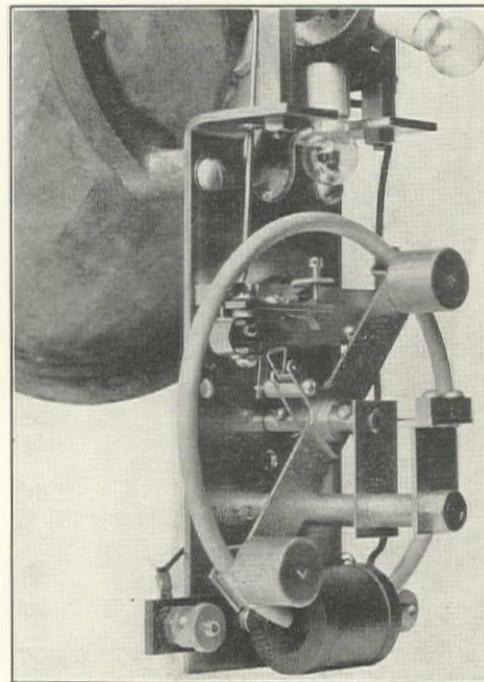


Fig. 4. Lamp-Changing Mechanism Used in Wallace & Tiernan Battery-Type Sign

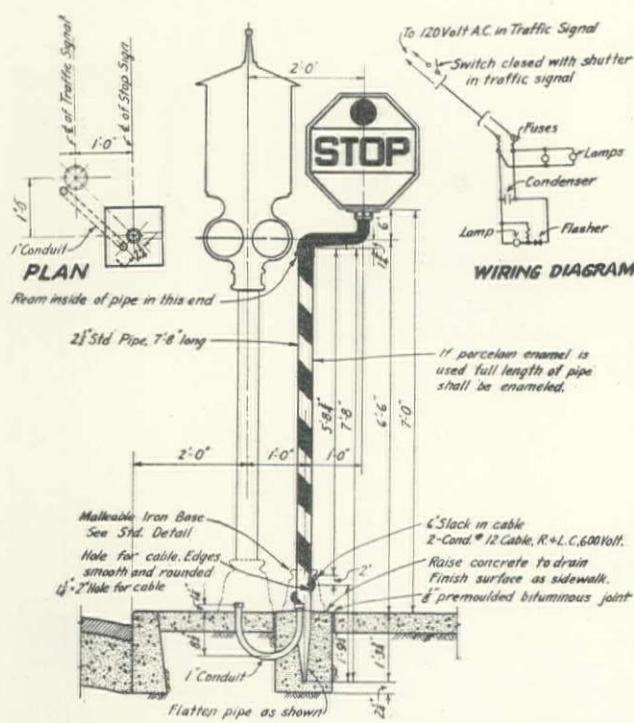


Fig. 3. Standard Details for Commercial-Powered Arterial 'Stop' Sign for Connection to Automatic Stop-and-Go Signal

tions at night. As most of the fatal street traffic accidents occur at twilight in the winter months, or during the hours of darkness, effective illumination of all important signs must be had. The American Engineering Council has recommended that illumination of stop signs be provided by one of the following means, listed in order of preference: attached lamps; floodlighting

and as the first three methods require the installation of expensive and permanent conduit and cable work, a check was made in San Francisco to determine the relative effectiveness of signs for night use. This comparison included plain, unilluminated 'stop' signs; signs with faces illuminated by street lights, effectively placed; and signs illuminated by local battery power. It was hoped to develop a system of illumination equal or superior to the best recommended practice, and yet one that would not require the inherent high cost of conduit and cable work.

For a period of over one year, unlighted arterial stop signs had been in place at the intersection of a through street and a cross street subject to comparatively heavy travel. On Monday, November 5, 1928, between the hours of 4 and 7 p.m., a check of cross traffic was made at this intersection, daylight extending from 4 to 5 p.m., twilight from 5 to 5:30 p.m., and darkness from 5:30 to 7 p.m. There were 1613 vehicles driven past the stop signs during this 3-hour checking period. These vehicles were segregated into: those coming from each direction and, further, into those which made a full stop, those which slowed down materially, and those which ran by the stop signs, apparently without heeding them. On November 9, these plain signs were removed and 24-in. octagonal signs, equipped with 8 1/8-in. red lenses, 60 flashes per minute, and with the word 'stop' outlined in Rayflector units, were installed. Power for the flasher was obtained from a local battery, set in the head of the sign. On Friday, December 7, 1928, a re-check of cross traffic

at this intersection was made between 3 and 6:30 p.m., daylight extending from 3 to 5 p.m., twilight from 5 to 5:30 p.m., and darkness from 5:30 to 6:30 p.m. During the 3½-hour period, 2638 vehicles were driven past the signs, their movement being recorded and subdivided as before. No material difference was noted in the behavior of vehicles entering the arterial street from each of the two directions.

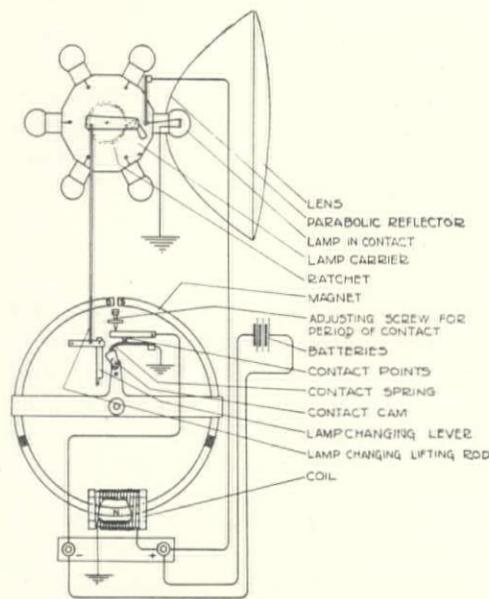


Fig. 5. Wiring Diagram of Flasher and Lamp-Changing Mechanism in Wallace & Tiernan Battery-Type 'Stop' Sign

The battery-type sign is shown (in Fig. 1) to have brought 98% of the drivers to a full stop. It was concluded from the tests that the particular flasher stop sign is more effective both by day and night than is a

flashing sign. Tests were also made on signs illuminated from commercial sources of power and so connected that the word 'stop' was formed from self-luminous, flashing, white letters.

Signals Developed—From the test results, it was decided to employ a flashing red lens which would attract attention to the sign because that color symbolizes 'stop and proceed with caution'. It was further decided that 60 flashes per minute should be given both day and night, since the cost of daylight operation is largely offset by eliminating the switching equipment needed to turn the sign on and off. In addition, it was felt that the word 'stop' should be made conspicuous by steady illumination so that, after attention had been attracted by the flasher, the message would be clear.

Two types of stop signs were next developed. One (see Fig. 3) uses 110-volt power, a 23-watt lamp back of the flashing red lens, and two steady 10-watt lamps back of the word 'stop'. The other (see Fig. 5) uses 9 dry cells for power, has a 5-volt lamp back of the flashing red lens, and employs Rayflector units for night illumination of the word 'stop' (tests had shown that the sign powered by dry cells gave nearly equal results to any others obtained). The two types of sign were constructed to similar outside appearance, as is evident from Fig. 2, with nearly the same external dimensions and with the same color, size of word, and size of red lens. The battery-powered sign head was 5 in. thick and the commercial-powered sign head was 4½ in. thick. For economical selection of type, the initial cost, cost of maintenance, and cost of moving each sign were then studied. The results are shown in Table 1.

Considerations—Sign mobility is an important fac-

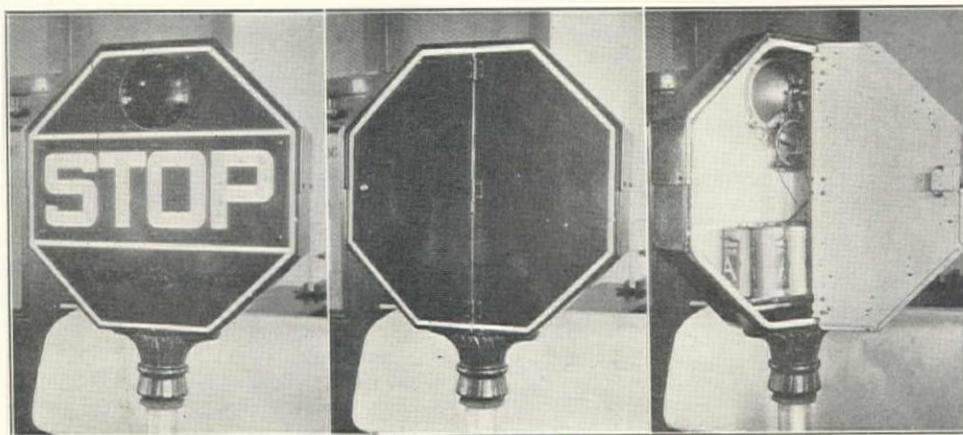


Fig. 6. (Left) Face of Wallace & Tiernan Battery-Type 'Stop' Sign. (Center) Back of Battery-Type Stop Sign. ((Right) Interior of Battery-Type 'Stop' Sign, Showing Battery Platform and Lamp-Changing Mechanism

plain, unilluminated stop sign during the day. Also, that the effectiveness of the flasher sign increases, and that of the plain stop sign decreases with darkness.

Similar checks were made on plain arterial stop signs, both before and after placing a street light 10 ft. in front of and 14 ft. above the face of the sign, with the light directed so as brilliantly to illuminate the face. This increased the number of vehicles stopping during the hours of darkness and gave an efficiency comparable with that obtained by the plain sign during the day. It was not, however, as effective as the

tor with the rapid present-day changes in traffic. If it is to be economical in first cost, a wired sign must be in place for a minimum of fifteen years—nowadays it is difficult to predict traffic circumstances fifteen years hence. For example, there were less than 20,000 vehicles in San Francisco fifteen years ago and over one-half of these were horse-drawn. A plan for arterial streets made at that time would hardly be proper today because of changes in distribution and amount of population, street improvements since undertaken, and an increase to more than 150,000 motor vehicles, with

a great decrease in horse-drawn vehicles. To meet the possibility of great changes within the next fifteen years, a sign now adopted for general use should be capable of easy and cheap moving to some other point.

Table 1

COMPARATIVE COSTS OF ILLUMINATED ARTERIAL STOP SIGNS

Division of Cost	When Wired to Commercial Power Source	With Local Battery Power
INITIAL		
1. Cost of sign head and post (including cost of furnishing and maintenance but excluding mechanism).....	\$ 22.00	\$22.00
2. Cost of equipment in sign head and its installation (local battery signs guaranteed for one year).....	12.50	44.71
3. Installation of sign and power supply.....	67.50	3.29
Sub-total	\$102.00	\$70.00
MAINTENANCE		
4. Annual depreciation due to obsolescence, wear and tear, and collision (based on 15-year amortization period and 5-year life of local battery-type mechanism)	\$ 9.50	\$ 8.00
5. Annual charge for power supply, at 3¢ per kw.hr. for power, or battery replacement 3 times yearly.....	11.68	8.70
6. Annual inspection and lamp renewal charge	3.40	2.75
7. Total annual charge per sign.....	\$ 24.58	\$19.45
MOVING		
8. Cost of moving a sign from one location to another in case the arterial street is changed.....	\$ 75.00	\$ 3.00

First cost is likewise important in San Francisco because of the 1500 locations where arterial stop signs must be placed. For example, this increased first cost of \$32.00 each for signs wired to commercial power aggregates approximately \$50,000.

Signs Adopted—Three types of signs, each one displaying 24-in. octagonal faces, have been adopted for the control of traffic on the new San Francisco boulevard system (see May 10th and September 10th, 1929, issues). These are: battery-powered signs for general use; signs wired to a commercial source of power and electrically connected to automatic stop-and-go signals; and plain stop signs for intersections of ungraded but slightly traveled streets or for blind streets extending not more than two blocks from the intersection.

The sign heads are made of sheet steel and are porcelain enameled both inside and out. A hinged door is set at the back of the sign (Fig. 6, right), through which lamps and equipment may be readily inspected. The battery-type sign has its flashing mechanism equipped with an automatic lamp changer (see Fig. 4) so that, if one lamp burns out, another will be placed in focus and continuous operation maintained. The entire mechanism of this signal can be removed and replaced with a new one, simply by the manipulation of two screws. Thus, prompt replacement can be made, if necessary, and the need of field repairs is eliminated.

Traffic control devices, arterial stop signs, signal conduit, cable and posts, traffic lanes, and pedestrian tunnels are included as original construction on the new San Francisco boulevards, over which M. M. O'Shaughnessy, city engineer, has general supervision

'LOOP ROAD' IN LASSEN VOLCANIC NATIONAL PARK

In the February 25th, 1929, issue of **Western Construction News** was an article dealing with the status of various contracts for highway construction in Lassen volcanic national park. These contracts were administered by the Bureau of Public Roads for the National Park Service in accordance with the inter-bureau agreement made in the spring of 1926. The contract of Arthur Jones for grading 2.72 miles, the west of summit section, was reported 51% completed and closed down for the winter. Mention was made of the fact that 4.5 miles, the east of summit section, had yet to be completed before the Loop Road could be of full value to traffic. The grading of this section was advertised for construction on June 4, 1929, and on June 25, bids were opened at the San Francisco district office of the U. S. Bureau of Public Roads by C. H. Sweetser, district engineer. A. J. & J. L. Fairbanks, of South San Francisco, were low bidders at \$68,273, and on July 17 were notified that their proposal had been accepted by the Secretary of the Interior and that the contract time would begin July 18.

Major items in the contract are: 53,000 cu.yd. of excavation, unclassified, at \$0.69, \$36,570; and 30,000 cu.yd. of excavation, unclassified, type 'B', at \$0.69, \$20,700. The following major equipment is being used: one P&H shovel, three 5-ton dump trucks, one air-compressor, one 30-hp. Caterpillar tractor, one revolving scraper, one scarifier.

On June 20, 1929, Arthur Jones, in company with J. L. Mathias, engineer in charge of Lassen volcanic park road construction, visited the west of summit section to determine how soon construction operations could be resumed. At this time there was several feet of snow on the roadway. The explanation for late snow is the high altitude, much of the work being above 8000-ft. elevation. A gas shovel was used to clear part of the snow and, on July 1, 1929, the contract time was resumed, grading operations being again started. The work is now 70% completed, with 50% of the contract time elapsed. The contractor will close down for the winter on about November 1.

Deny Valuation Rehearing

The California Railroad Commission has denied the petition of the Great Western Power Co. of California for rehearing on the Commission's order fixing just compensation to be paid by the City of San Francisco for those portions of the company's electric distributing system in San Francisco, which the city proposes to acquire for a distributing system for Hetch Hetchy power. In its order the commission fixed the valuation of those properties as of February 11, 1924, at \$11,815,000.

Symmetry of Design and General Economics in Construction*

*A Constructor's Viewpoint on Improvement of Relations Between Engineer and Contractor
Economic Features in Construction Plant and Methods on Coolidge Dam*

By JAMES G. TRIPP†

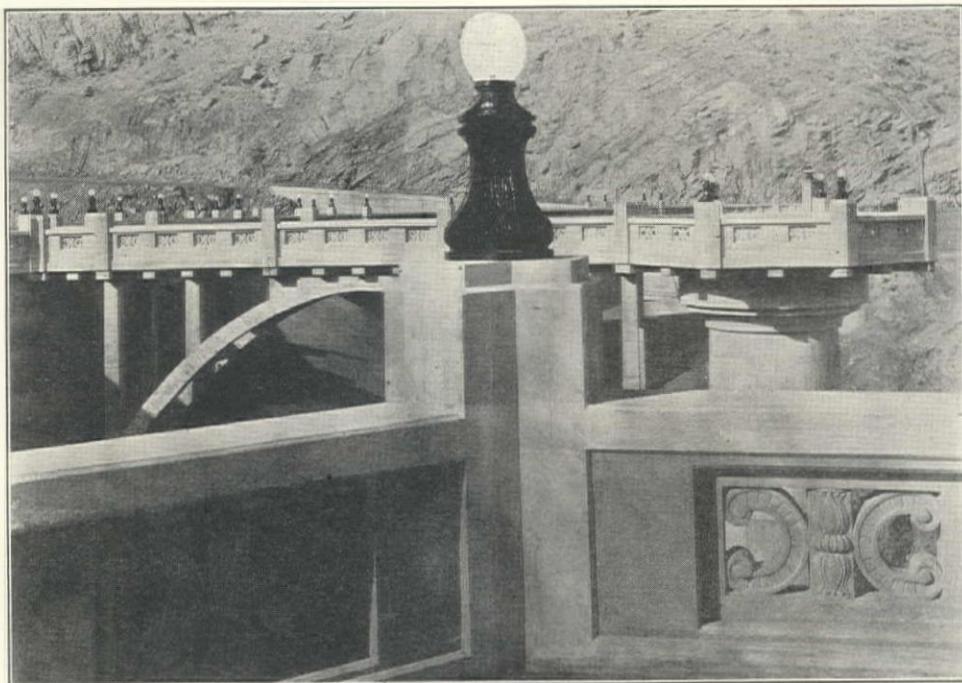
Editor's Note—James G. Tripp was born in Chicago, Illinois. He spent 2½ years as a student in civil engineering at Massachusetts Institute of Technology. From May, 1910, to April, 1918, he was a partner and engineer with the Herringbone Metal Lath Co., Los Angeles, dealers in architectural and engineering machinery and supplies. He was superintendent and engineer for Bent Bros., Los Angeles, from April, 1918, to December, 1924, on pipe-lines, oil and water storage reservoirs, and dams. Also, from February to July, 1919, he was a partner with C. S. Robinson, Los Angeles, on the Devils Gate dam spillway tunnel; from July, 1919, to March, 1920, a partner with Robinson & Tinkler on construction of the Auberry tunnel for the San Joaquin Light & Power Co.; and from March, 1920, to February, 1921, manager and partner, Pelton Concrete Tile Co., Los Angeles, on construction of houses for the Goodyear Tire & Rubber Co. Tripp was engineer for Strange & Maguire, Salt Lake City, from January to July, 1925, bidding on large western dams and storm drains and from July to November, 1925, he was superintendent of construction for Robinson-Roberts Co., Los Angeles, on storage tank No. 10 of the General Petroleum Co. He was superintendent for C. U. Heuser, Glendale, from January to April, 1926, on general construction and from April, 1926, to October, 1927, was general superintendent for Carl Pleasant, Inc., Phoenix, on construction of the Lake Pleasant dam, Beardsley project, Arizona.

the Deadwood dam, Idaho, and with Hickman as co-partner bid on the Red Butte dam, Utah.

When asked by an officer of this Section to address you on the construction of Coolidge dam, I did not know whether to give my paper on the same subject, as read at the fall meeting of the Society in San Diego in 1928, or to go into another subject dear to my heart. I have decided to give you my views on both subjects, the one—improvement of relations between engineer and contractor; the other—construction problems of the Coolidge dam.

The details of plant selection at Coolidge dam have been well reported in the technical press. I will emphasize only the compelling reasons that brought about the plant layout.

Fundamentals—In dam construction, usually centered in a distant and inaccessible country, the builder has twelve fundamental considerations to study and appraise before he can safely embark on a construction program. In proper order they are: (1) shape of can-



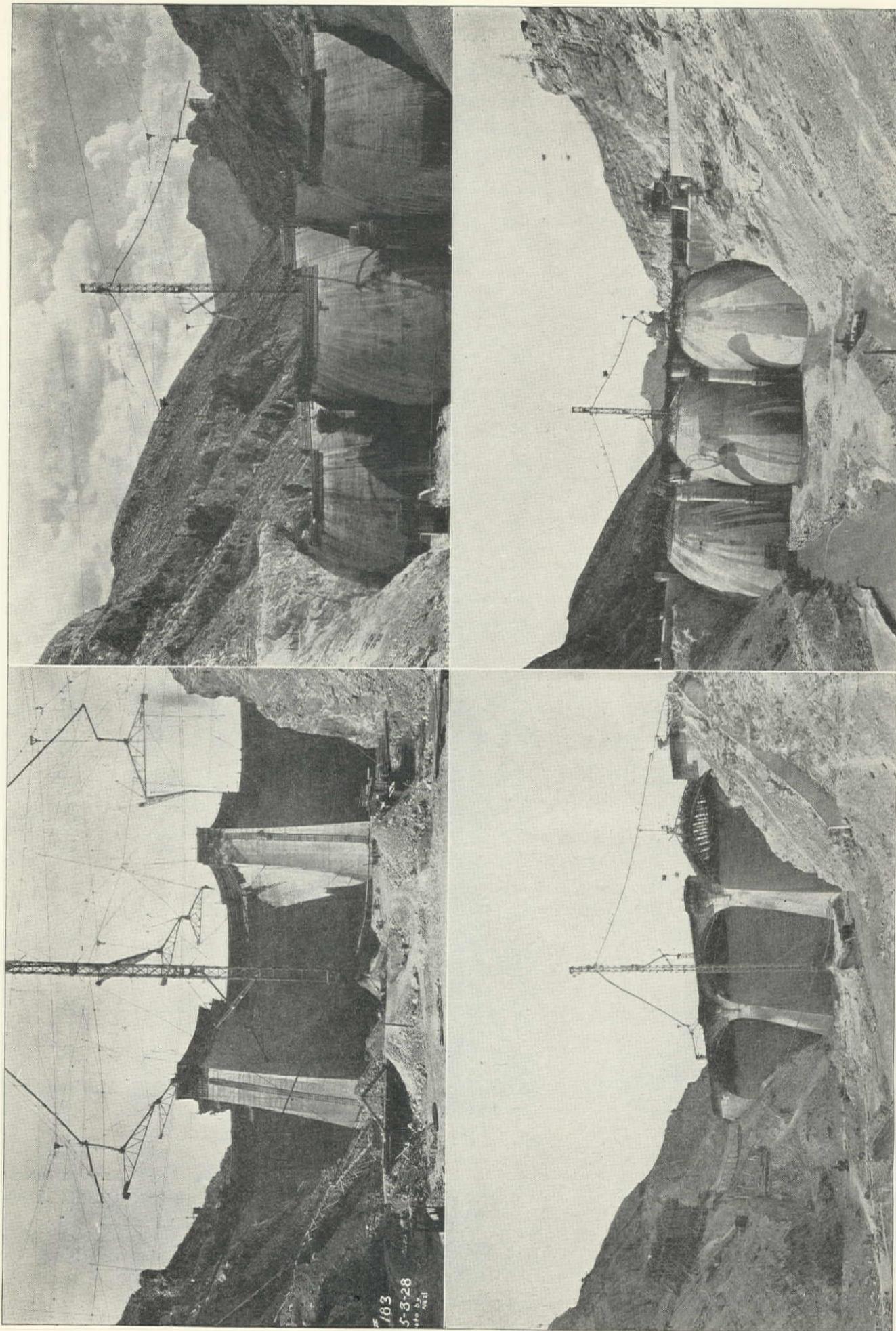
DETAIL OF LIGHT FIXTURE AND PARAPET WALL ON COOLIDGE DAM. ROADWAY ARCH IN BACKGROUND

From October, 1927, to November, 1928, Tripp was general superintendent for Atkinson, Kier Bros., Spicer Co., Los Angeles, on construction of the Coolidge dam, San Carlos project, Arizona. From then until April, 1929, he was contractor's engineer on the Pardee dam, Valley Springs, California. Since April he has been engaged in building construction and private engineering and, with Strange & Maguire as partners, bid on

yon floor and wall; (2) shape of the job; (3) quantities involved; (4) speed element; (5) specification limitations; (6) kind and price of labor available; (7) power available—steam, gas, electric; (8) economic balance and first cost; (9) operating and probable salvage value of plant; (10) flood, weather hazards, and transportation situation—roads, highways, rail lines, freight rates; (11) construction symmetry of design; and (12)

*From a paper read before the Sacramento Section, Am. Soc. C.E., April 2, 1929.

†Member, American Society of Civil Engineers.



(Upper Left) Beginning Form Work May 3, 1928, for Egg-Shaped Domes of Cooldige Dam. Note Extensive Equipment for Conveying and Placing Concrete. (Upper Right) Looking Down Stream at Dome Construction on June 3, 1928. (Lower Right) Domes Under Construction on August 15, 1928, Showing Novel and Complicated Steel Truss Centering Forms Designed by Contractors to Carry Roadway Portion of Structure. Concrete Mixing Plant and Tramway Discharge on Sidehill at Left. (Lower Left) Construction View Looking Downstream on August 15, 1928

general economic considerations. Of these twelve points I have chosen two for major illustration, namely: symmetry of design and general economic considerations.

Design Symmetry—Perhaps the subject of design symmetry is best illustrated for Coolidge dam by a somewhat detailed discussion of the intricate form work. This will be given later. The design of the structure required extensive planning and mathematical treatment and it is to the credit of Major Olberg and his designing staff that we pioneer constructors were able to build the dam. But, because the design was strictly a pioneer one and subject to the trials and vicissitudes of all things pioneer, glaring inconsistencies were encountered during construction. Their discussion should bring out the full meaning of the term, 'construction symmetry of design'.

From the constructor's viewpoint, it is not enough that the design be sound—it must also be practicable. In past years when I bent my energies to design work, I would quite often bring forth what I thought to be an intellectual nugget. But, when the field forces dissected my plan, the nugget seemed changed to 'fool's gold'. I asked myself why, and to seek the answer I became a construction man. I had discovered that a master carpenter's way of laying out work was not my way. Where I needed only a drafting board and quiet, he needed a place to stand or to tie himself to before he could set up the lines which I so easily drew and indicated. A carpenter has but a plumb and level to do the things with which I had a host of good drawing instruments to indicate. Therefore, my plans were not altogether practicable; they were not symmetrical from the constructor's viewpoint. I do not maintain that my idiosyncrasies are by any means the criterion, but I do want to emphasize that the question, 'How is this design of mine going to be built?' is quite as important as 'What is this design to do?'

We had a phase of construction symmetry of design on Coolidge dam. Here the solution of the construction problem for one dome answered for all three. Had the domes been given different curves and springings, the constructor's difficulties would have been multiplied, as would the difficulties of the designers. In this case, the designing engineers had in mind the fact that the cost of construction must, in the final analysis, justify the design.

Lack of Symmetry—When the top construction on Coolidge dam is considered, a decidedly different picture is presented. To meet a theoretical saving in design, the six 50-ft. span arch bridges over the spillway weirs were designed to be stable when finished. The design did not provide for unbalanced thrusts in the piers during construction, and the contractor had wastefully to employ centers. Had the designing engineer asked himself 'How are these arches to be built?' the owners might have saved several thousand dollars and the contractors avoided a lot of needless work.

The bridge deck across the domes and the balustrade presented another construction problem which was solved only at relatively high cost. Here again the designer would have been well repaid for asking himself the same question which was previously stated.

To illustrate: Under modern conditions, a constructor may attack his job from any angle that fits in with economical handling. Thus, in a structural frame building, curtain walls and surface treatment can be begun and left off at any floor level. From the constructor's viewpoint, it was best to build the sidewalk and balustrade for Coolidge dam first and the roadway slab last. But, the engineer had so designed the deck that this could not be done without unnecessary waste of centering. Under his design, the concrete placing plant for building the sidewalks and balustrade would have to be twice installed—once for the road slab and once for the sidewalk and balustrade. Under our desired method, but one installation would be required and only one cleanup to finish the job. Accordingly, we elected to waste the centers. Here again, had the designer investigated this feature, he would have saved on actual cost and also provided construction symmetry of design.

These general observations are not criticisms against the designers of Coolidge dam but are illustrations afforded by that structure. They are common examples and it is my idea that designers should get the construction problem in perspective when they are designing. In this way they would get the most value for the money expended and would also promote closer relations between the engineer and contractor. Construction symmetry of design must be attained to produce first-class results and to prove the adage that an engineer is a person who can do with one dollar what anyone can do with two dollars.

A complete understanding between the designing and contracting forces has more chance of fruition if the designer on his part will look at his design through the contractor's eyes and the contractor will on his part learn what a designer expects.

Inspection of Work—Before leaving this subject and discussing construction features of the Coolidge dam, I wish to dwell on a most important phase of contact between the engineer and constructor—the inspection forces.

It is common for a contractor to complain about inspectors. As there are two sides to every question, I will admit as a starting point that both sides in a construction controversy are usually wrong. However, the eyes and the hands of the chief engineer are his inspectors. A skilled pianist places high value on his hands, and properly so, but, generally, the engineer by analogy does not. From my observation, I believe there are two reasons for this undervaluation of inspection forces. The first one is economy and the second, a corollary of the first, is the generally low grade of men that find their way into inspection forces.

We have, first, the experience-getter, the young graduate, and the next the superannuated contractor or engineer who, for one reason or another, has been forced into this employment. Rarely does one find a well-rounded and experienced individual who is entrusted with the delicate task of interpreting his chief's intention and wishes in terms of construction program and necessity, which is—to judge and order work with a fine regard to the equities of law and custom. Often, unpleasant relations, extra work bills, lawsuits, and what not result from the attempts of the inexperienced

or unqualified inspector to justify his observations and reports to the chief engineer. The condition is all wrong and can, I believe, be overcome by attaching dignity and emolument to the office of inspection. I can see no valid reason why engineers cannot rate their inspectors as assistants, with assistants' dignity and salary. Let the engineering student get his training in construction organizations and designing offices, but not at the expense of the construction; let the elderly justify their experience and ability in decent pay and dignified authority.

Engineering is not a cheap profession, but we go on year by year surrounding ourselves by a cheapened contact with the constructor and the public. We should, I believe, strive to enlarge our usefulness not only to our clients but to ourselves, and thereby set a value on our services which is in keeping with that usefulness. I maintain that quickened attention to construction symmetry of design and better paid and prepared inspection will hasten the day of wider usefulness and improved relations between engineers, contractors, and the public.

Construction Features of Coolidge Dam—In describing the construction of Coolidge dam I had best dissect the physical features of the work, much as we did in our own minds before attacking the problem. The box-like shape of the canyon permitted side-hill planting of construction equipment. As the job was nearly square in its horizontal projection, careful arrangement of rigging was required in order to permit easy operation of the cableways and chuting.

For many reasons, it was decided that high-speed construction was desirable, a high rate of speed being in keeping with the specification limitations. Further, that the quantities—200,000 cu.yd. of concrete and 350,000 cu.yd. of excavation—permitted plant selection of size and kind which makes speedy construction profitable and allows a comfortable working margin between first cost and salvage and general operating economy. With the plant selected, the material was handled and placed during eleven months, elapsed time.

Form Work—It was evident that the form system must function properly; it did. Also, the form work presented another feature—that of pioneering, since Coolidge dam was built with variations of old ideas and newer methods. The job divided itself into three classes, namely: buttresses, domes, and topwork, the latter considerably ornamental.

The buttresses presented no problems except to accommodate the engineers' level layouts to sloping pours. This involved added costs in shores and wires but, otherwise, the buttresses were straight-away work.

The domes, however, were difficult to construct. They are fashioned into enormous egg-shaped affairs, rising in nearly vertical lines from bedrock to a point 50 ft. above that elevation, where they begin to curve downstream, with gradual increases in curvature, until at the top the crown is level. The total horizontal distance from the upstream bedrock contact to the downstream face at the top of the dam is 212 ft., and the total height is about 245 ft. The walls are 20 ft. thick at bedrock and taper to 4 ft. at the top. The span of the domes increases from 94 ft. at bedrock to 160 ft.

at mid-height and then gradually decreases to 126 ft. at the top. The rises vary from 30 ft. at the bottom to 50 ft. at the center to 24 ft. at the top. The top 30 ft. of the dome is a sector of a sphere and the entire dome is a very odd-shaped structure.

We divided the domes into three sections: (1) that portion from bedrock to 50 ft. above, (2) from that elevation to a point near the top where the spherical cap took shape, and (3) the top. The dome form work was set up from survey points at each 4-ft. elevation. This required pours of proper size to use up the plant capacity, and chuting flexible enough to easily reach the scattered areas provided for in the dam design.

Placing Concrete—We found it best to place the buttress concrete monolithic with the quarter-arch dome span. Shrinkage was then allowed to act and, three or four days later, the central portion of the arch was poured. This plan accomplished two things: it provided concentrated pours with small moving in the buttresses and quarter-arch, on one shift, and scattered pours in the other. The flexibility built into the plant was made usable during the time of concentrated pours, so that a balanced yardage and form area was maintained. Since the dome walls were of varying curvature, we constructed flexible form panels which were used throughout, both for buttresses and domes. The panels were made up in variable rises such as 9 by 12 and 4 by 8-ft., 4 by 6 and 5 by 6-ft.

No difficulty was experienced until the overhang of the dome intrados panels passed 35 degrees from the vertical, when we introduced reinforcing steel tie-backs, set in each successive lift of concrete to hold the form. These tie-backs enabled the domes to be carried nearly to the top of the dam and into an overhang approaching 54 degrees from the vertical. The caps of the domes were divided into two portions, namely: that part lending itself to bridge treatment and that part named 'the wart', for which a new and novel treatment was devised. The bridge, or roadway portion, of the domes was supported on structural steel centering, designed by the contractor. It is concreted in balanced blocks, thus controlling the deflections. Steel 'U' bolts were cast into the bridge barrel, as were a similar number of bolts in the last pours of the dome, where, at 54 degree overhang, the construction was stopped. Suspended from these 'U' bolts were 22 bowstring timber trusses in each dome, upon which was built the lagging to support the concrete. Loading on these trusses was distributed so that each pour became self-supporting before a new load was applied, thereby obtaining economy and providing for shrinkage in the concrete.

The depositing of concrete for each wart consumed three weeks. No construction difficulty was experienced, but the design of this centering taxed every resource we possessed. Not only had the superimposed loads to be carried safely and with controlled deflections but to avoid over-stress in the portions of the domes used for carrying the trusses, considerable cut-and-try work was required.

In looking back on Coolidge dam it is a source of satisfaction to me that the engineers and myself were in general accord and that we sat around the table together to bring our job to a successful conclusion.

Where design symmetry was lacking, the engineers showed both courtesy and alacrity in helping us to overcome that lack and we, on our part, felt that such cooperation was worthy of our best efforts. The entire contractor's organization felt that instructions to carry out the engineers' and inspectors' wishes were more than justified in the helpful attitude that the de-

signing staff maintained toward us. If jobs could generally be brought to the same basis of understanding, I believe that construction symmetry of design and economical considerations are proved as two obstacles to better relations between engineers and contractors which warrant study and thoughtful consideration looking to their solution.

Improvised Geared Stand for Gate Operation

By W. C. BROWN

Superintendent, San Dieguito Irrigation District, California

The geared stand illustrated in Fig. 1 was designed by me and manufactured in our shop to fill a need for several inexpensive geared stands. These stands were to be used in operating 24-in. gate valves under fairly high pressures. The design shown is intended for

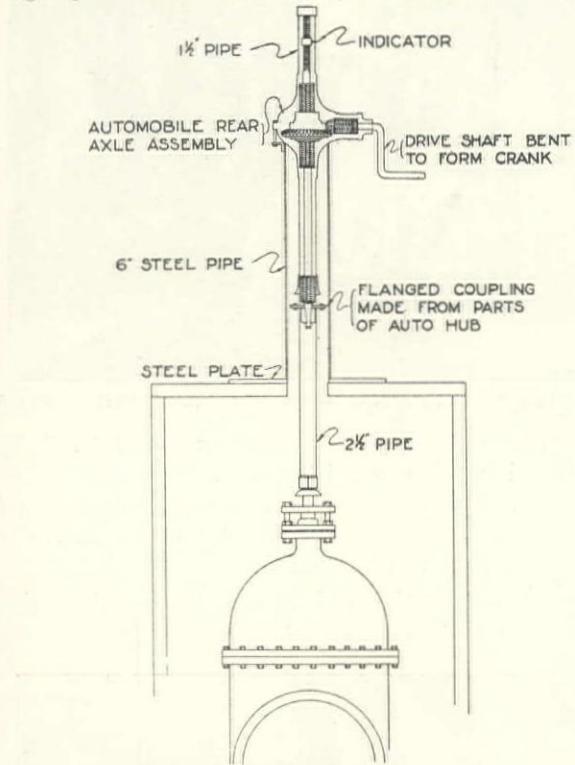


Fig. 1. Cross Section of Improvised Geared Stand for Operating 24-in. Gate Valves

permanent installations, but with slight changes it could be adapted for portable use or power drive.

The principal part of this device is a salvaged rear axle and drive shaft from a light make of automobile. The differential triple gears were jammed by melting metal into the teeth, so that the entire axle turns as one unit. One end of the axle and its housing, and the drive shaft housing, were cut off by means of an acetylene torch, and the drive shaft was bent to form a crank. A small amount of work converted one of the auto hubs into a flanged coupling. A piece of 2 1/2-in. pipe, welded to the lower flange and with a square socket welded to the lower end, connects the hub with the gate-valve stem.

The indicator consists of a short section of the axle shaft turned down and threaded to receive a 7/8-in. S.A.E. nut, which moves up and down the shaft as the gate is closed or opened. A pointer is welded to

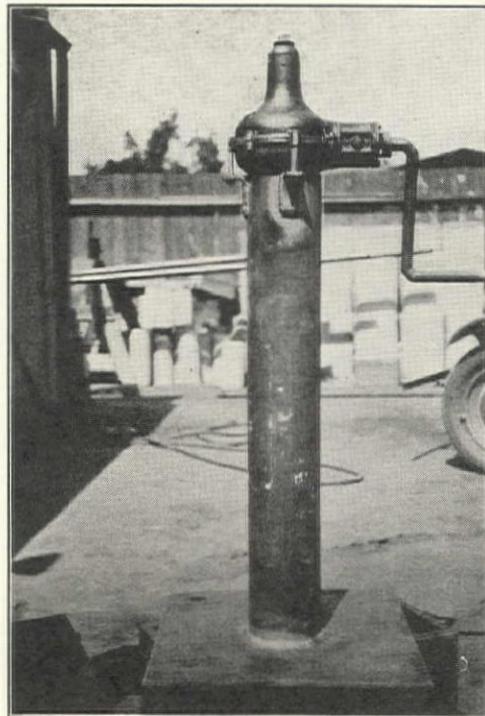


Fig. 2. Shop Assembly of Geared Stand

the nut and the nut is kept from turning by this pointer which moves in a vertical slot cut in the 1 1/2-in. pipe forming the indicator housing. The indicator may be omitted, in which case the upper shaft is cut off just above the roller bearing and a 1 1/2-in. pipe coupling is welded to the top of the gear case and supplied with a screw plug.

The device is mounted on a standard, consisting of a piece of 6-in. steel pipe welded to a steel base plate. Two brackets are welded to the pipe at its top, and are drilled to receive bolts which replace two of the regular bolts which hold the differential housing together.

Editor's Note: Descriptions of such useful developments as the one described by Brown are desired. We hope to frequently publish similar short articles on irrigation and water works operation.

California Water Works Men Meet at Del Monte

Tenth Annual Convention of California Section, American Water Works Association, October 23 to 26

Water works engineers, superintendents, and equipment manufacturers from every section of California, and some from Oregon, Washington, British Columbia, Idaho, and the far east, congregated at Del Monte for a four-day session from Wednesday to Saturday, October 23 to 26. Although the registered attendance—nearly 400—was less than at the three last conventions at San Diego, San Jose, and San Francisco, the

water works systems, could add much of value to these discussions. In the selection of papers and topics for discussion, they should be consulted.

Although the original object of conventions was to afford an opportunity to present and discuss technical and non-technical problems of the industry—it has developed that as much good, if not more, is obtained through the closer personal contacts secured under



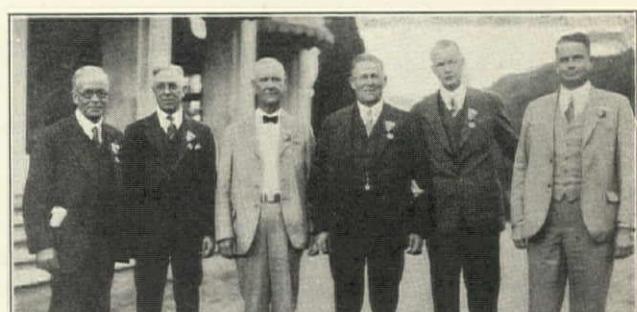
SOME OF THE '400' WHO ATTENDED THE WATER

conclave was just as successful. The Hotel Del Monte is an expensive hostelry, although fully worth the price, and also somewhat off the main arteries of travel; and those who drop in for a few hours at conventions in larger cities and thus boost the attendance, were not present at Del Monte. The selection of a suitable place for a convention is not an easy one. The ideal place is a small city, with a hotel capable of housing most of the delegates, a space suitable for the fifty or more exhibits, a dining room large enough to seat 500 for the manufacturers' dinner dance; and with moderate rates, preferably on the European plan. These are the main considerations. The manufacturers bear the brunt of the cost—in exhibits and entertainment. They should really be the ones to select the place to hold these conventions, rather than the directors of the association. It is to their interest to attract as many of the operators of water works to these meetings as possible. The exhibits involve a great deal of labor and expense, they are instructive as well as interesting, and deserve the close scrutiny of all delegates.

Although the technical discussions are considered strictly a function of the active members—the water works engineers and superintendents—there is no question but that the engineer-salesmen of the manufacturers who are in frequent contact with all the 'play'. Therefore, golf, dinner dances, and small-room

the informal and relaxed conditions engendered by gatherings have become important functions of all conventions. There should be a proper balance, and the committee on arrangements should be carefully selected with that end in view.

Coming back to the Del Monte Convention, this 'balance' was well secured under the able direction



(Left to Right) John S. Burt (Retiring President), W. W. Hurlbut, W. F. Goble, Chas. S. Olmsted, Geo. W. Pracy, and Samuel B. Morris

of the following committee chairmen: Exhibits, James R. Barker (Neptune Meter Co.); entertainment, Alexander Bell (Wallace & Tiernan Co., Inc.); local arrangements, Charles S. Olmsted (supt., Monterey County Water Works); golf, H. S. Kittredge (pres., San Jose Water Works); reception, George W. Pracy (supt., Spring Valley Water Co., San Francisco).

Golf—The first day, Wednesday, was golf day, and many entered the tournament on the Del Monte course to compete for the 18 handsome prizes. The only Canadian present—J. F. Belyea, of Vancouver, B. C.—walked away with first prize with a low gross of 176 for 36 holes. The lucky prize winners were:

1st prize—J. F. Belyea, Vancouver, B. C., leather caddy bag.
 2nd prize—Harry Reinhart, San Francisco, leather zipper bag.
 3rd prize—R. A. Stumm, Los Angeles, leather zipper bag.
 4th prize—M. C. Robinson, Ventura, leather caddy bag.
 5th prize—W. F. Goble, Alhambra, five matched iron clubs.
 6th prize—V. E. Perry, San Francisco, five matched iron clubs.
 7th prize—J. S. Peters, San Rafael, three matched wood clubs.
 8th prize—A. E. Shepperd, San Jose, three matched wood clubs.

9th prize—R. W. Martindale, San Francisco; G. F. Piersol, San Francisco (tie), cane seat. Martindale won the toss; Piersol received one doz. golf balls.



WORKS CONVENTION AT DEL MONTE, OCTOBER 23 TO 26

10th prize—Alexander Bell, San Francisco, leather jacket.
 11th prize—Tom Leahy, San Francisco, rain jacket.
 12th prize—J. F. Smith, San Francisco; Guy D. Lamp, San Francisco, rain jacket. Lamp won the toss.
 13th prize—Ben S. Morrow, Portland, Oregon, putter.
 14th prize—Claude T. Faw, Oakland, putter.
 15th prize—No winner, one doz. golf balls.
 16th prize—No winner, one doz. golf balls.
 17th prize—J. L. Tanning, Los Angeles, one doz. golf balls.
 18th prize—E. W. Green, San Jose; F. W. Schooley, San Francisco; Philip Schuyler, San Francisco, one doz. golf balls to each.
 19th prize—W. R. Blair, San Francisco, zipper bag and practice balls.

Technical Sessions—As the program of papers and authors was published in the October 10th issue, p. 526, it will not be repeated here.

Charles S. Olmsted described the Monterey county water works and Frank W. Hanna the Mokelumne project of the East Bay Municipal Utility district.

The maintenance of water meters was discussed by various authorities and some valuable points brought forth.

Cross-connections and the many unlooked for possibilities of contamination of water systems, were interestingly presented.

Pipe corrosion, a most serious problem of water works maintenance, was enlighteningly discussed.

The discussion of 'What is Adequate Pressure', and 'What are Proper Sizes for Mains and Services', de-

veloped into the relation between pressure and volume, about which there were various opinions. The net result of this discussion is that a committee might well be appointed to gather worthwhile and helpful statistics on this important subject. On one point all were agreed—the advisability of larger and more permanent types of service connections, such as 1½ and 2-in. cast-iron pipe, feeding two or more services.

Leon B. Reynolds, professor of sanitary and hydraulic engineering, Stanford University, submitted some statistics on the necessity for more financial support by the state for the Bureau of Sanitary Engineering, in order that its personnel may be increased adequately to supervise all the water works and sewage plants in the state. A resolution was passed endorsing this support.

Informal Dinner and Business Meeting—This dinner was held in the beautiful dining salon of the Hotel



'Ed' R. Prentice, Golf Wizard of the Marin Municipal Water District, with His Unique Outfit—Oak Driver with Flexible Shaft, Madrone Midiron, Manzanita Mashie, and Grease Wood Putter; In a Burlap Caddy Bag, with Lubricant Bottle and Soft Rubber Ball—and, St. Mary's 'Golf' Stockings

Del Monte, 210 ft. long and 60 ft. wide, with a high ceiling. M. M. O'Shaughnessy, city engineer, San

Francisco, outlined the Hetch Hetchy water supply project, which will be completed in less than three years and will deliver 400,000,000 gal. daily to San Francisco and the peninsula. O'Shaughnessy in his usual fearless style, 'panned' the politicians who had attempted to hinder this project.

Pasadena was selected as the convention city for 1930, and the following officers were elected: President, Charles S. Olmsted (supt., Monterey County Water Works); vice-president, William W. Hurlbut (engineer of water distribution and operation, Dept. of Water and Power, Los Angeles); secretary-treas-



In This Operating Exhibit, Water Is Pumped from Pump-Station in Lower Left-Hand Corner into Mountain Storage Reservoir and Distributed Through High-Pressure Hume Pipe

urer, Louis L. Farrell (supt. of construction and operation, East Bay Municipal Utility District, Oakland); executive committee, W. F. Goble (supt., San Gabriel Water Co., Alhambra); and George W. Travager (supt., Lindsay-Strathmore Irrigation District):



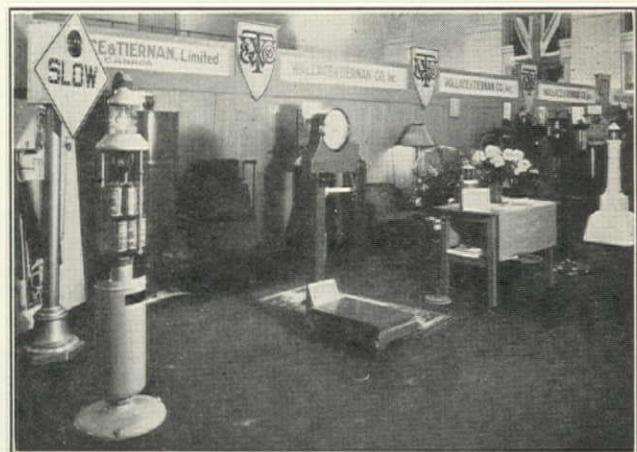
A Self-Contained and Operating Exhibit Showing the Control of Water in Canal, Calco Flume, Calco Gates of Various Types and Culverts

national director, Samuel B. Morris (chief engineer, Water Department of Pasadena) to succeed in a few months, George W. Pracy.

Manufacturers' Dinner Dance—This is always the big event of all water works conventions, especially of the California section. Excellent vaudeville numbers were interspersed between the dances, the music

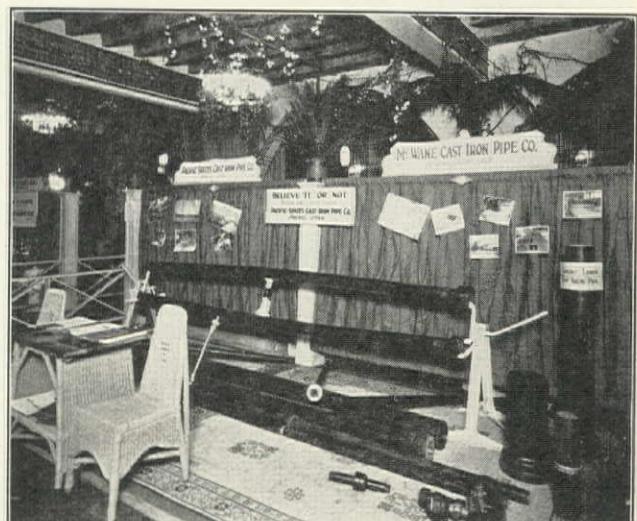
being furnished by McDonald's orchestra of San Jose. J. R. Barker acted as master of ceremonies and awarded the golf prizes.

The exhibits were displayed in the 'Garden Room' (the dance café), the artistic overhead floral decora-



Wallace & Tiernan's Elaborate Display of Chlorinators, Dry Feed Machines, and Highway Flasher Signals

tions and soft lights being retained. These, together with the booth subdivisions, made a most attractive ensemble. Much credit is due J. R. Barker and his able committee for untiring efforts to secure 52 exhibitors and have everything in spick and span shape on Wednesday morning. (See October 10th issue for list of exhibitors.) A few typical exhibits are shown in the illustrations herewith.



The 'Believe It or Not' Exhibit of McWane and Pacific States Cast-Iron Pipe—Demonstrating Flexibility

Charles S. Olmsted and Mrs. Olmsted (chairman of the ladies' entertainment committee) arranged a most delicious barbecue at the Old Indian Village in the Del Monte forest. Unfortunately, most of the delegates and visitors were more interested in the Stanford vs. University of Southern California football battle at Stanford, and less than 50 attended the barbecue.

Western Construction News had prepared and distributed on Friday morning, a roster of attendance 'as registered up to 5 p.m. Thursday'. Copies of this roster may be obtained by writing to the Editor.

Pardee Dam

Dedicated on October 19—Atkinson Construction Co. Serves 'Dam Luncheon' to 450 on Top of Dam

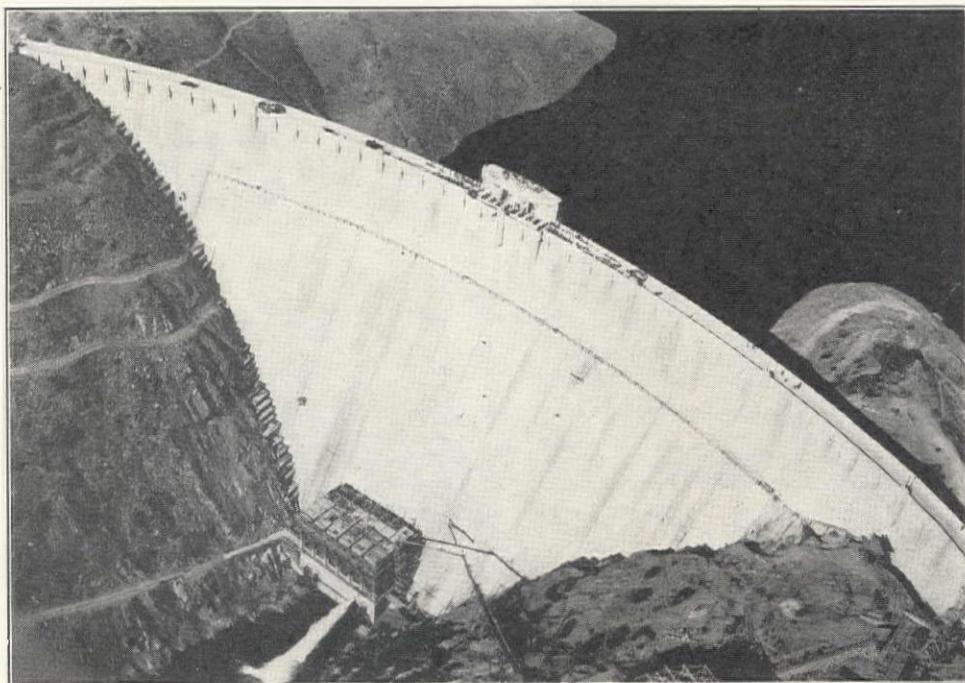
Preceding the public dedication of the Pardee dam of the East Bay Municipal Utility District near Valley Springs, California, on October 19, a 'Dam Luncheon' was served to 450 invited guests, gathered to honor the board of directors and officers of the District. This enjoyable luncheon, given by the Atkinson Construction Co. in cooperation with the Calaveras Cement Co., Pelton Water Wheel Co., Pacific Coast Steel Co., Fidelity & Deposit Co., National Surety Co., Joshua Hendy Iron Works, E. K. Wood Lumber Co., and the Standard Oil Co., was served on top of the dam, the first of its kind, as far as we know. In 1925, upon the completion of a large sewer project in Los Angeles, Lynn Atkinson served a 'Sewer Luncheon' in the sewer; and in 1926, a 'Bridge Luncheon' on top of the Macy st. bridge which he built.

Saturday, October 19, was one of those perfect, clear and warm days for which California is famous. During the luncheon and dedication, an airplane circled

present, including the wives of the contractors, engineers, and officials.

During the luncheon, Lynn Atkinson, of the contracting firm, presided as toastmaster, in a most entertaining manner, introducing his copartners, W. A. Kettlewell and Guy F. Atkinson, who made excellent responses. Charles Neumiller, well-known attorney of Stockton, then read congratulatory messages from C. E. Bressler, H. A. Van Norman, A. P. Davis, Paul Langworthy, William P. Joyce, Melville Dozier, Jr., Stewart L. Rawlings, Ray Lyman Wilbur, and President Hoover. Other speakers on the luncheon program were George C. Pardee, F. W. Hanna, T. P. Wittschen, Alfred Latham, Grant D. Miller, W. J. Locke, Frank D. Stringham, C. E. Grunsky, Jr., Henry A. Johnson, Daniel Read, and John H. Kimball, all of the East Bay Municipal Utility District.

At the dedication ceremonies, immediately following, also held on top of the dam, the program was in



AERIAL VIEW OF PARDEE DAM, SHOWING 450 PEOPLE AT THE ATKINSON 'DAM LUNCHEON' PRIOR TO DEDICATION ON OCTOBER 19. (PHOTO BY FAIRCHILD AERIAL SURVEYS)

overhead taking aerial photographs, and aerial bombs were sent up releasing American flags suspended from parachutes. The reservoir was one-third full of water, and a stream of water was shooting out of one of the Larner-Johnson valves at the base of the dam. It was an unusual setting for a luncheon. Telephone service and complete broadcasting and amplifying equipment had been installed, and was under the supervision of a Standard Oil Co. expert. There were many women

charge of Charles Neumiller, and was as follows:

'Star Spangler Banner'

Invocation by the Rev. E. F. Brown

Remarks by F. W. Hanna, chief engineer and general manager of the District

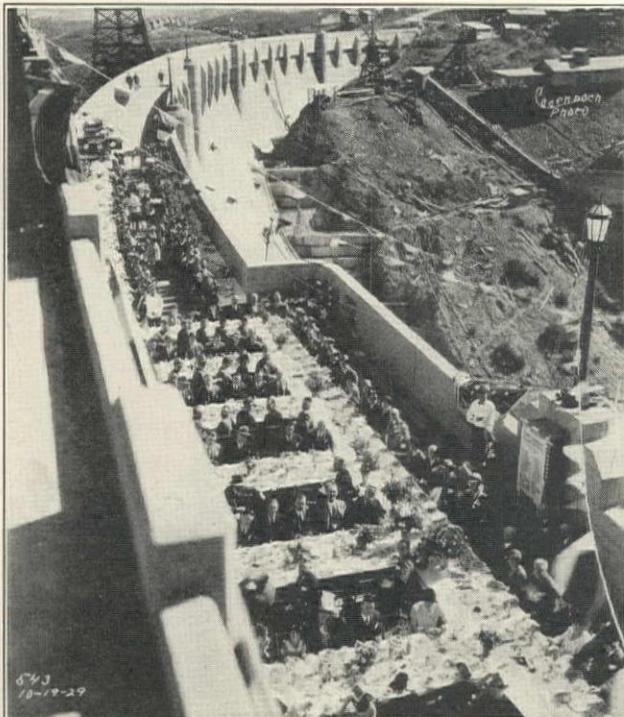
Comments by T. P. Wittschen, chief counsel of the District

Dedication by the Hon. C. C. Young, governor of California

Benediction by the Rev. James O'Flanigan
'America'

Governor Young paid high tribute to George C. Pardee, former governor of the state, and president of the East Bay Municipal Utility District, as a man (now 72 years of age) who refused to retire after serving as governor 25 years ago, but who continues to take an active interest in public affairs and undertook to carry through the Mokelumne project, in order that the East Bay Cities might have plenty of water for their expansion. Governor Young unveiled the bronze plaque on top of the dam, and christened the dam with a bottle of Mokelumne river water, being assisted by the two young daughters of Lynn Atkinson.

Construction of Pardee dam was commenced in July, 1927, the first concrete being placed in December of that year. This dam, one of the largest in the world, is a curved, gravity type structure, 1337 ft. long on the crest, 241 ft. thick at the base, and 358 ft. high above the bedrock in Mokelumne river. The base is at elevation 222 ft. and the parapet wall at elevation



'Dam Luncheon' on Top of Pardee Dam, October 19. Lynn Atkinson, Toastmaster, at Microphone

580 ft. above sea level. The dam was completed in July, 1929, one and one-half years ahead of the contract time. It provides a reservoir capacity of 222,000 acre-feet and supplies water for a 90-mile aqueduct which serves the cities of Alameda, Albany, Berkeley, El Cerrito, Emeryville, Oakland, Piedmont, Richmond, and San Leandro, California. There was 153,000 cu.yd. of foundation rock excavation and 615,000 cu.yd. of concrete in this \$6,000,000 dam. From 600 to 800 men were employed during plant construction and a peak of 1300 men was reached on the spillway construction.

E. W. Kramer, district engineer of the U. S. Forest Service, California district, will cooperate with the board of engineers and geologists on investigation of the San Gabriel damsite.

HYDRAULIC FILL IN HIGHWAY CONSTRUCTION, KERN COUNTY, CALIFORNIA

Force, Curriган & McLeod, of Oakland, will finish 11 miles of California state highway construction in Kern county from Bakersfield to Cottonwood creek about December 1. On October 22 the culverts and structures on this contract, 06XC3 Ker-57-E & F, were completed. Grading, crushed gravel base, and oil-treated top were 95% complete on this date.

The contract price, \$170,685, involves mainly 161,350 cu.yd. of roadway excavation at 30¢; 21,100 cu.yd. of crushed gravel base course at \$1.90; and 23,800 cu.yd. of oil-treated crushed gravel surface course at \$2.25. The job includes one large cut, 70 ft. deep, containing 75,000 cu.yd. of earth. About 60% of this is being moved by pumping water to the top of the cut and washing the material into an adjacent fill. This fill rests on a 5 by 5-ft. concrete box culvert which drains a small watercourse. The remainder of the cut is being excavated with shovels and the material hauled by truck.

In constructing the hydraulic fill, a combined set-



(Upper) Settling Basin and Reservoir on Hydraulic Fill at Sta. 460 to 465 of Force, Curriган & McLeod Contract, April 4, 1929.
(Lower) Same Fill on June 26. Levees Have Been Built With P&H Model 206 Dragline

ting basin and reservoir was built between sta. 460 and 465, levees being thrown up with a P&H No. 206 dragline. A float, carrying an 8-in. suction pipe, was placed in the reservoir. Water is supplied to the combined reservoir and settling basin through a 4-in. pipeline and is then pumped through the 8-in. line to the top of the cut. Here a trench has been blasted in the cut and the water returns by gravity, sluicing material down a wooden flume to the settling basin. By this method material is being successfully moved at low cost.

California Sewage Works Association

Inspection Trip, Business Meeting, and Synopsis of Papers—Second Annual Convention, Oakland, October 7 to 9, 1929

The second annual meeting of the California Sewage Works Association was held in conjunction with the 31st annual convention of the League of California Municipalities at the hotel Oakland, Oakland, on October 7 to 9. This meeting established the Association as the leading factor in the campaign to secure state-wide recognition of the fact that sewage purification and disposal is one of the most important functions of municipal government. It further demonstrated its value as a short-course for educating the sewage works operator and as a convenient time and place for the interchange of practical ideas. The third annual meeting to be held at Long Beach in October, 1930, should have an even larger attendance than the past successful meeting, and it is hoped that the one of 1931 will draw operators from every California municipality. The California Sewage Works Association now has 219 members of whom 94 registered for the second annual meeting.

Inspection Trip

The meeting was begun on October 7 with a one-day inspection trip of 200 miles to the five sewage treatment plants shown on the route map, page 592, which was printed in the program. Forty automobiles made up the caravan which left Monterey at 8 a.m. Oakland was reached about 8 p.m., the length of trip and short stop at each city allowing only a cursory examination of the several plants. The barbecue luncheon at the Gilroy golf club as guests of The Dorr Co. and the city of Gilroy proved an enjoyable break in the long trip. Although a number of processes of sewage treatment were viewed on this trip, many of the association members felt that a full day at one plant, with a detailed explanation and instruction on its operation, would be preferable for the 1930 meetings. This will probably be tested at the sectional meetings next year.

Business

Regular sessions began on October 8, with an address of welcome by William H. Parker, commissioner of streets, Oakland, and response by Leon B. Reynolds, president of the association and professor of sanitary and hydraulic engineering at Stanford University. Reports were then heard from committee chairmen, as follows: Membership—Philip Schuyler, San Francisco; program—B. J. Pardee, Visalia; standard report forms—G. A. Parkes (acting), South Pasadena; editorial—R. F. Goudey (acting) Los Angeles; industrial wastes—F. J. Rossi, Modesto; educational—A. M. Rawn, Los Angeles; state-aid sewage research—Philip Schuyler, San Francisco; nominating—Raymond Burgess, Gilroy. After a report from the nominating committee, officers were elected for the ensuing year. They are: president—F. A. Batty, engineer of sewer maintenance, city of Los Angeles; first vice-president—B. J. Pardee, city manager, Visalia; second vice-president—William A. Allen, Pasadena; secretary-treasurer—E. A. Reinke, assistant engineer, Bureau of Sanitary Engineering, California Department of Public Health, Berkeley; new member on board of directors—Alexander Bell, Pacific Coast manager, Wallace & Tiernan Co., San Francisco; new member on board of control of the Federation of Sewage Works Associations—Leon B. Reynolds, professor of sanitary and hydraulic engineering, Stanford University.

Four resolutions were introduced and passed at the meeting. The first was one of appreciation to **Western Construction News**, Wallace & Tiernan, The Dorr Co., American Concrete Pipe Co., Gladding, McBean & Co., and N. Clark & Sons; firms which helped to make the meeting a distinct success. The second resolution was in support of state-aid sewage research, the secretary being instructed to write a letter of appreciation to Governor Young and Alexander Heron, director of finance, for their interest in sewage research, and urging

that they designate a time and place for an early meeting on the subject with representatives of the association. The third was a resolution of appreciation for the fine work of the retiring officers, particularly Leon B. Reynolds, president; C. C. Kennedy, board of control member; and F. M. Lockwood, director. The fourth resolution urged increased financial support of the State Bureau of Sanitary Engineering in order that it might have adequate personnel to maintain closer contact with sewage disposal work and operation, thereby bringing the sewage plants to a higher state of efficiency.

Discussions of Plants Visited

F. V. Hammerly, Water Works Supply Co., San Francisco, the designer of the 'Watsco' aerator, described the development of this equipment which is being used at Montezuma Mountain School for Boys, Los Gatos. His aerator was designed to introduce air into sewage, treating it in a more intimate and efficient manner than is had by the present conventional activated sludge method. The three cardinal conditions to a well operated sewage aerating plant were said by him to be: a slight and continuing excess of oxygen in all places within the tank to support the growth of oxidizing bacteria; the positive mechanical mixing of activated sludge with the sewage treated; and a positive means to avoid accumulations of activated sludge within the tank. (The 'Watsco' aerator was described in the October 10th, 1929, issue.)

C. G. Gillespie, chief of the State Bureau of Sanitary Engineering, Berkeley, stated that in the operation of the Gilroy plant a ton of raw peaches produces the same amount of sludge per day as would the sewage of 120 people. Results of operation at Gilroy show that, with proper digestion, odors from sludge can be controlled.

Luncheons and Pipe Manufacturing Plant Inspections

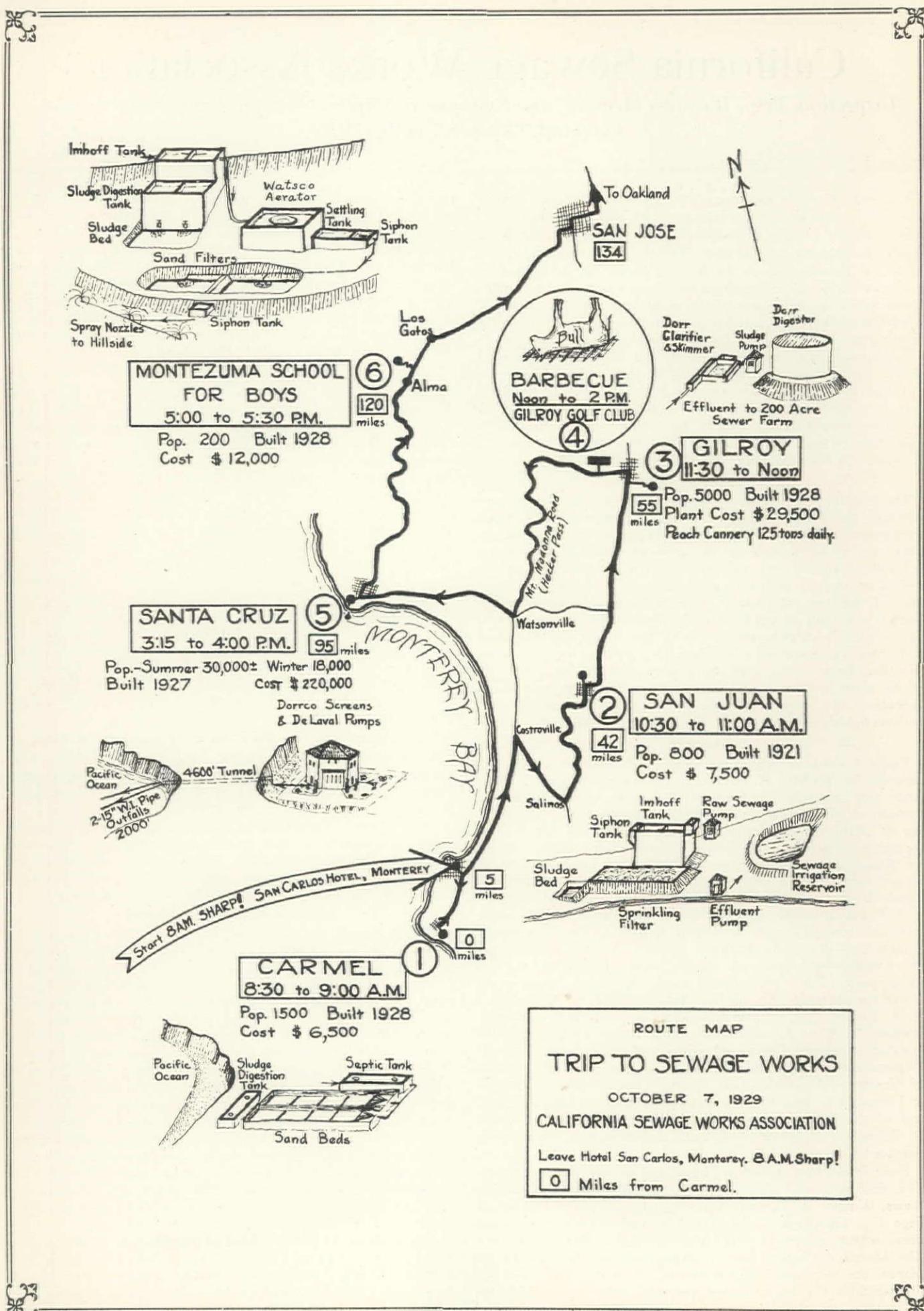
Members of the Association had luncheon on October 8 as guests of the American Concrete Pipe Co. at its Oakland plant. This was followed by an inspection of the Hume centrifugal process of concrete pipe manufacture.

The luncheon on October 9 was held at the hotel Oakland, where the members were guests of N. Clark & Sons and Gladding, McBean & Co. The luncheon was followed by inspection of vitrified clay pipe and other clay products manufactured at the west Alameda plant of N. Clark & Sons.

Synopsis of Papers Presented

'Oil Exclusion and Removal', by F. A. Batty, engineer of sewer maintenance, city of Los Angeles. Too little attention has been given to the stoppage of sewers from congealing grease or the explosion of accumulated sewer gases, having their origin in petroleum wastes. Grease can be classified into: grease from foods, soapy effluent from laundries, petroleum wastes, and garage wastes. It is estimated that the 1,000,000 people connected with the sewer system of the city of Los Angeles contribute 22 tons of grease per day, most of which enters through individual house connections. The grease problem has two distinct phases—preventing large quantities of grease from entering the sewers and thereby reducing the cost of maintenance and preventing costly damage to the conduits or treatment plants; and the removal of grease at the lower end of the sewer so as to make the disposal of the effluent more satisfactory. The paper was discussed by G. A. Parkes, sanitary engineer, City of Los Angeles, and John Spencer, of the State Fish and Game Commission.

'Digestion of Activated Sludge at Pomona', by F. H. Froehde, city engineer (read by Alva J. Smith, of Black & Veatch, consulting engineers, Pasadena). Waste sewage water can be processed, conserved, and used for agriculture, thereby conserving the available water for domestic purposes. The



Pomona effluent carries nearly 175 lb. of nitrogen per 24 hours. On the estimate that 50 lb. of horse manure is equivalent to 1 lb. of nitrogen in solution, the irrigators of Pomona are obtaining the equivalent of 8750 lb. of horse manure daily from the activated sludge plant. They are not, of course, obtaining the humus which is available from the latter fertilizer. The city has a 20-year contract and sells its sewage effluent for one-half cent per inch-hour from October to April and for one cent per inch-hour during the remainder of the year. In the last fiscal year Pomona received \$9624 from the sale of effluent, sludge, and paper mill water; for the lease of its old sewer farm; and for treating the sewage of Claremont and La Verne. The total cost of disposal plant operation was \$9112 during the same period, the net cost per million gallons of sewage treated being \$15.04. The paper was discussed by C. C. Kennedy, consulting engineer, San Francisco; R. F. Goudey, resident engineer, State Bureau of Sanitary Engineering, Los Angeles; and T. R. Haseltine, of Burns-McDonnell-Smith Engineering Co., Los Angeles.

'Separate Industrial Sewers and Chlorination at Tulare', by R. M. Berryhill, city manager. Tulare is a city of 75,000 in the heart of a large dairy section of the South San Joaquin valley. By the spring of 1928, the various milk products plants were throwing a sewage load of 800,000 g.p.d. on the plant. It became necessary to separate industrial wastes from the domestic wastes. This was accomplished by connecting the industrial wastes to the storm sewers and disposing of them by broad irrigation, without chlorination for odor control. After experiments, it was found that chlorination would retard the putrefaction of whey and other wastes, provided the land allowed an even distribution over the surface and the soil could be thoroughly cultivated within 16 hours after irrigation. Tulare is considering a sewer rental charge, and this point was discussed by D. E. Perry, manager and assessor, Marin County Sanitary District No. 1, San Anselmo; L. B. Reynolds, professor of sanitary and hydraulic engineering, Stanford University; and C. G. Gillespie, chief of the Bureau of Sanitary Engineering, Berkeley. The use of chlorination as a help in sewage treatment plant processes was discussed by Carl Beyer, Wallace & Tiernan Co., Inc., San Francisco.

'Foaming and High-Rate Land Disposal at Visalia', by L. H. Gadsby, city engineer. The operation of four Imhoff tanks at the Visalia plant, each with gas vents 4 ft. wide, was described. Although scum accumulates in these vents, active foaming seldom requires the building up of freeboard on the tanks. The thick layer of scum, evident on many Imhoff tanks, indicates an acid condition. By accumulating a large proportion of well-ripened sludge in the tank, this acid condition is markedly reduced. At Visalia, the effluent is disposed of on a 120-acre sewage farm, cropped to alfalfa and Egyptian corn. The soil is largely a sandy loam, with some heavier clayey material. In 1925 there was a 9.2-ft. depth of effluent applied per acre. When the canneries are running, a rate of 1.5 ft. depth per acre per month is reached. The normal range of disposal is 8 to 12 ft. depth of water per year on crops which ordinarily require only $\frac{1}{2}$ to $\frac{3}{4}$ ft.

'Experience with High-Rate Land Disposal at Modesto', by F. J. Rossi, city engineer. Modesto first passed its sewage through a septic tank and discharged the effluent into the river. As a different method of effluent disposal became desirable, money for experimental work was appropriated to study high-rate land disposal. Test wells were drilled to the ground-water line at 18-ft. depth and the character of the soil was studied. Tests on experimental unit No. 1, a rectangular bed in sandy loam, 147.3 by 390.75 ft., with a 3-ft. levee and 50 ft. of 6-in. open-joint tile drain laid 4 ft. deep, showed a removal of 0.77 in. per hour for a 13-hour filling period. The effluent was applied to a depth of 2 ft. After the third of ten continuous applications, the rate of disposal dropped to $\frac{1}{2}$ in. per hour. In experimental unit No. 2, a strip check 20 by 448 ft., the last 48 ft. was used as an overflow reservoir and the strip leveled to a grade of 0.1%, the effluent being admitted at the rate of 20 c.f.m. To traverse the 400-ft. strip, 2 hours and 52 minutes was required. This rate continued for 8 hours and for 3 days of experiment. Evaporation of the

thin film of effluent may have raised the rate of disposal. The disadvantages of the strip method—winter operation, grading, cultivation, and care required—caused a selection of unit No. 1 for the Modesto plant.

The paper was discussed by J. L. Mason, Water Works Supply Co., San Francisco, and C. G. Gillespie. Rates of disposal on land were said by Gillespie to vary from: 10,000 gal. per acre per day at Pasadena, 15,000 gal. at Visalia, 20,000 gal. at San Luis Obispo—in all cases crops being raised—to 60,000 gal. at Fresno (no cropping), from 360,000 to 750,000 at Modesto, 750,000 gal. at Kingsburg where the sprinkling filter effluent is disposed of on sand, and 1,500,000 gal. on the Carmel sand beds.

'Pumping and Foaming at Stockton', by W. B. Hogan, city manager. Stockton operates two Imhoff tanks, built in 1922 for a cost of \$103,000. These serve a population of 20,000 distributed over an area of $4\frac{1}{2}$ square miles. The average time required for sewage to reach the tanks is $2\frac{1}{2}$ hours. Sewage is pumped into the tanks against a total head of 35 ft. A retention period of 30 minutes is used. The direction of flow through the tanks is reversed once a week so as to more uniformly distribute the settleable solids. The effluent is discharged into San Joaquin river. The tanks are rectangular in shape, 57 ft. long and $28\frac{1}{2}$ ft. wide, with flowing-through chambers 9 ft. wide, 55 ft. long, and $14\frac{1}{2}$ ft. deep. The vent area is 26.1% of the total tank area, excluding concrete walls. The sludge digestion chambers are shaped as an inverted frustum of a cone, two interconnected chambers being provided in each tank. The present sludge capacity is 1 cu.ft. per capita.

The tanks have foamed on an average of 104 days per year during the past four years. Foaming can be controlled by hosing down with water. A greater area of vent chambers and larger capacity in the sludge digestion chambers, or else supplementary digestion, would probably remedy this trouble. During the winter, sludge is disposed of by allowing it to flow into deep borrow pits, excavated when a flood protection levee was built around the plant. During the rest of the year, sludge is dried on a bed 120 by 65 ft. in plan, and well underdrained. One week is required to dry this sludge on this bed. With an average yearly sewage flow of 482,410,000 gal., the yearly cost of handling the sewage averages \$24.84 per m.g., of which \$6.27 is spent for power. The paper was discussed by F. E. De Martini, assistant engineer, State Department of Public Health, Berkeley, and C. C. Kennedy.

'Gas Burning and Chlorination at San Bernardino', by F. S. Currie, consulting engineer, San Bernardino. Gas from the Imhoff tanks at San Bernardino is collected and stored in two 750-cu.ft. capacity, lift-type gas holders under a pressure of 6 in. of water. Some of this gas is utilized in a 40-hp. gas engine, direct-connected to an electric generator, the excess gas being burned at the rear of the plant. The power is required for use in washing around the plant, skimming the tanks, pumping sludge, and lighting. The demand for power is light and intermittent, and gas burning is not yet economical. The plant was placed in operation during February, 1929, no gas being noticed for 30 days. From then until June 1, the production gradually increased to 5000 cu.ft. per day in a one-week period and to 10,000 cu.ft. within two weeks. This increase was accompanied by foaming and considerable sludge had to be dumped. Foaming was stopped but the gas production was not decreased by this operation.

Chlorine is introduced at the upper end of a 6300 ft. inverted siphon through one 300-lb. W&T vacuum type machine, at the immediate entrance to the plant by two 200-lb. W&T machines, and at the dosing chamber through one 300-lb. machine. The chlorine is stored at the plant in one-ton containers, set horizontally. Purchase of chlorine in large quantities is found economical on account of the favorable price obtained in such lots. Although the rate of chlorination is 4 p.p.m. at the upper end of the siphon, a dosage of over 6 p.p.m. at the bottom of the riser stack in the plant showed no color with orthotolidine at the top of the stack. Final chlorination of the effluent is made at the rate of 0.1 p.p.m. in excess. In the first six months of operation over 700 m.g. of sewage was treated at the plant, the total dose of chlorine

averaging 7.2 p.p.m. The paper was discussed by A. M. Kivari, Pacific Coast manager, The Dorr Co., Los Angeles.

'Cost Keeping System of the Los Angeles County Sanitation Districts', by A. K. Warren, chief engineer (paper read by R. F. Goudey). The cost accounting of a sewage works or sewer system is essentially the same as for any manufacturing plant. Its value is in its ability to provide a reliable basis for comparing unit costs and gauging the efficiency and relative worth of different processes and machines. Records should show the cost of operation as related to flow and other conditions at the plant site and also the accompanying plant chemistry and biology.

Each function of the district's work is segregated into units. These are further divided as to each particular piece of equipment or machinery. Distribution is then made of power, labor, material and supplies, repairs, water, and transportation. Labor is divided into direct and proportional charges (the latter for overhead). The total gives purely operating costs, overhead and depreciation being added separately or collectively to summarize the total cost of each unit. By another summary, the monthly total of various charges or services, such as power, labor, and material, is given. A summary of the cost by months gives the yearly total. All of the costs are broken down into the cost per million gallons.

'Fly Control at Sewage Treatment Plants', by W. B. Hermes, professor of entomology, University of California, Berkeley. Flies of many species are attracted to sewage, partly because of food but particularly because of the excellent pabulum it furnishes for the development of fly larvae. With favorable temperatures, semi-solid sewage which remains in a relatively undisturbed condition will probably produce a maximum number of flies. The more liquid the sewage, the less likely it is to support the dangerous house-invading species of flies. Adequate screening of plants would prevent danger of contamination of food by pathogenic organisms of faecal origin. Flies can be trapped in simple, baited traps, or repelled by creosote oil.

Musca domestica, the common housefly, has been found to spread a maximum distance of 13.14 miles from the point of release; marked specimens have traveled over 6 miles in less than 24 hours. Flies tend to spread with the wind, but are known to travel against, or at right angles to it. The common species of flies breeding in sewage are: the housefly, blue bottle fly, green bottle fly, latrine fly, carrion fly, and drone fly. Of these, only two or three first named are house-invading. Much of the fly breeding in sewage works occurs in the sludge beds at the end of the treatment process. The full grown larvae have a tendency to migrate to drier regions, even outside of the beds; immature larvae will leave the pabulum when it becomes dry. Thus, by spreading the pabulum out thin to facilitate quick drying of the sludge, conditions are made more unfavorable for fly breeding. The paper was discussed by R. F. Goudey; A. M. Rawn, assistant chief engineer, Los Angeles County Sanitation Districts; W. F. Rantsma, deputy commissioner of public works, Fresno; Merle S. Foreman; F. A. Batty; and H. F. Gray, consulting engineer, Berkeley.

'Sewer Grades', by A. M. Rawn, assistant chief engineer, Los Angeles County Sanitation Districts. There is a disparity of opinion as to the defining limit for flat sewer grades. In the city and county of Los Angeles, grades producing a minimum velocity of less than 2 ft. per sec. with the pipe flowing full or half full are termed flat. Fresno, Modesto, Tulare, Lodi, Clovis, and other California cities are using standard grades which are commonly under this limit, and their designation of flat grades might apply to those producing velocities under 1 ft. per sec. In Los Angeles, the 2 ft. per sec. minimum velocity is felt necessary to prevent sedimentation in sanitary sewers.

Flat grades should be used in the upper ends of the system and in the outfall, but not between those two extremities, on account of the danger of blocking and clogging the sewer. Low velocity sewers will settle out certain solids which tend to become septic along the line and will materially influence the degree of treatment at the plant. The successful operation of sewers with flat grades is due as much to the size of

the system and relative location of conduit as to any other feature. Sharp grades are advisable for large systems. The paper was discussed by M. L. Crist, sanitary engineer, Burns-McDonnell-Smith Engineering Co., Los Angeles; W. F. Rantsma; F. A. Batty; C. C. Kennedy; G. A. Parkes; D. E. Perry; and E. L. Wright, water and sewer department, Orland.

'Relative Costs of Sewerage', by Don E. Perry, manager and assessor, Marin County Sanitary District, San Anselmo. The public does not rank the disposal of sewage in the sequence of importance to which it is entitled. In Marin county, the tax for maintaining the county hospital and poor farm is 32¢ on each \$100 of assessable property, as against only 15¢ for the maintenance and operation of the sanitary district. In 1928, the high school tax in this county was 75¢, the elementary school tax 45¢ for maintenance and 34¢ for redemption, the junior college 44¢, and the kindergarten 15¢. The 12,000 people in the district contribute less than one-half cent daily to sewage disposal.

The 15¢ tax limitation for sanitary districts was set 30 years ago, before treatment plants were in vogue. Sewers can neither be built as cheaply or maintained as they were during that era, nor can sewage be treated in plants under present conditions for any such amount. The public must be educated to the changed conditions and the present fragmentary and confused sanitary legislation should be revised and consolidated. A sewer rental bill is one logical solution for the financing of sewerage costs.

'State Supervision of Sewage Disposal', by C. G. Gillespie, chief, Bureau of Sanitary Engineering, Berkeley. The state of California has had to prepare itself by laws and an enforcing bureau to check negligence in sewage disposal and to encourage the building and use of sewage works. This bureau was put in operation in 1915. The motive of the bureau has been educational and cooperative, but not punitive, and a local and neighborly conscience has been developed in sewerage matters. California occupies a high position in sewage disposal in the Union in spite of its tail-end rank among the states in the financial support given to its Bureau of Sanitary Engineering.

'Responsibilities and Procedures of Municipalities', by B. J. Pardee, city manager, Visalia. One of the most important of the many powers, duties, and responsibilities with which a municipality is vested is the police power. This gives the city authority to protect the lives, morals, health, and prosperity of its citizens and consequently has to do with drainage, the sewer system, and sewage disposal plants. The first recorded regulation on the subject is in the old Mosaic law where proper edicts were issued to control the disposal of excrement from the human body. Courts hold that a city council can design and construct sewers and disposal plants; that it cannot be held responsible for failure to construct or for the inadequacy of either system or design; but that the city is liable for failure in design or operation resulting in damage to persons or property. A city is a vortex that brings to a common center all manner of men and things. If it is good for man and his property that the city should collect and dispose of personal wastes, then the wastes from industry should be collected and disposed of at cost to the common purse. The duty and responsibility of a city is to harmonize trade or other waste of an unusual or difficult type at the place of origin and, if the assembling is done through private but municipally regulated sewers discharging to the public sewers, to operate both the collecting system and disposal plant. The paper was discussed by C. H. Lee, consulting engineer, Berkeley; M. L. Crist; G. A. Parkes; X. X. Forsythe; W. F. Rantsma; O. E. Steward, Anaheim; and D. E. Perry.

'Float Surveys and Wrought-Iron Pipe Outfalls at Santa Cruz', by Charles Gilman Hyde, professor of sanitary engineering, University of California, Berkeley. Float surveys were made during April and May, 1925, to determine current directions and velocities prior to locating a recommended point of outfall of the fine-screened sewage of Santa Cruz. Three types of float were used, namely: shallow surface floats made from a bottle (submerged depth 9 in.) and vane (submerged depth 12 in.); deep surface floats with light vanes (submerged depth 4 ft.) and heavy vanes (submerged depth 5½ ft.); sub-surface floats to indicate the direction of deeper currents (submerged depth 20 ft.). There was a total of 178 releases made

from four different locations, of which 122 were shallow surface floats, 34 deep surface floats, and 22 sub-surface floats. Two stations gave excellent results. The one recommended was 4500 ft. from high tide-line offshore from the mouth of San Lorenzo river, where the depth at mean lower low water was 40 ft. However, disposal in Santa Cruz harbor was not acceptable to the city because of prevailing public opinion and divers were employed to examine the ocean floor west of the lighthouse. They found a single lane of smooth rock surface extending due south from the intersection of Cliff drive and Sunset ave. To reach this point, a force main in tunnel and 4400 ft. long was required.

Outfall pipes, each 2000 ft. long, were laid from a surge chamber at the end of the tunnel. The pipe is hand-puddled wrought-iron, 16 in. outside diameter, from $\frac{1}{2}$ to $\frac{3}{8}$ in. thick, the discharge ends being 200 ft. apart. It is protected by ingot-iron sheeting in a 400-ft. section subject to scour, and by paint and gunite coating throughout the remaining length.

'B. Coli Surveys at Los Angeles', by W. T. Knowlton, sanitary engineer, city of Los Angeles. After completion of the south outfall sewer and Hyperion sewage screening plant for Los Angeles, arrangements were made to record the effect of disposal on ocean bathing along the beach and vicinity. The outfall discharges 5100 ft. out in the ocean. Semi-monthly tests were begun in 1925 and continued through 1927 at points along the beach less than one-half mile apart, extending to two miles on each side of the outfall. Collections in 1928 averaged ten times monthly and those in 1929 have averaged 14 times monthly. Also, B. Coli surveys have been made semi-annually to measure the area of the ocean sewage field. The area of pollution has been shown to increase gradually, the area per unit of flow remaining fairly constant. A limit of 10 B. Coli per cubic centimeter has been set in determining the beach line available for recreational purposes.

'Settling Tanks for Bay Outlets at San Diego', by F. M. Lockwood, city manager. San Diego has eight outfalls discharging raw sewage into the bay close to shore, none of these reaching to the channel. The discharge outlets are widely separated and sludge banks have not caused much complaint. Two Cameron type sedimentation tanks have been constructed to lessen the amount of floating substance along the water front. A hopper-bottom sedimentation tank is now being constructed to further reduce the solids discharged into the ocean. This will have a hopper bottom, 1.5-ft. depth for scum, a 1-hour detention period, and a 1.5-cu.ft. sludge capacity per capita. Plans have been made for another plant. In this plant sewage will be run by gravity to a point near the bay shore and pumped to clarifying tanks 60 ft. in diam. With a detention period of 1 hour, 95% of the settleable solids will be removed. Sludge will be pumped into four covered digester tanks, each 22 ft. deep and 40 ft. diam. The gas from the plant will be collected and piped to the city incinerator. It is estimated that the plant will handle 10,000,000 g.p.d. at a cost of \$2 per m.g.

'Slough Disposal at San Anselmo', by C. C. Kennedy, consulting engineer, San Francisco. Sanitary District No. 1 of Marin county contains an area of 15 square miles, being 6 miles long. The estimated population is 9000 and is nearly entirely of a suburban residential character. An outfall line has been constructed through the length of the district and a treatment plant, consisting of pumps, Imhoff tanks, sludge beds, and chlorinating equipment has been erected. The effluent is chlorinated and discharged into San Anselmo slough. The tidal prism above the discharge points is two miles long, an average of 20 ft. wide, and 2 to 8 ft. deep. The average dry weather flow of approximately 1,000,000 g.p.d. is given a dilution of 20 to 1 in the tidal prism alone, not considering the interchange with bay waters. It was originally intended to sterilize the effluent during the bathing season, which is the season of minimum stream flow, but the great hydrogen sulphide content of the water has made this economically impracticable. Construction of the plant has eliminated all evidence of gross pollution in the length of the slough and but little sludge banking has occurred in the channel.

'Experimental Work on Outlet Structures for Los Angeles County', by A. M. Rawn, assistant chief engineer, Los Angeles County Sanitation Districts. Certain fairly well defined laws appear to control the dilution of sewage or fresh water when

discharged into a body of water which has the salinity of ordinary ocean water. These relate to depth, direction and quantity of discharge of the sewage jet, and the rapidity with which the sewage water absorbs or is absorbed by salt water.

Sewage discharged below the surface of ocean water will tend to rise rapidly to the surface. If the outlet is pointed directly upward, it will rise in the form of an inverted cone, the diameter of the base of the cone at the surface being equal to one-third the height. If discharged horizontally under sea-water, sewage will rise along a path resembling that of a stone thrown horizontally, the curve in this case being inverted. The cross-sectional area of the base of the column or cone will be one-third of the length of path traveled.

Initial dilution is obtained during the rise of sewage from the outlet to the surface. Lateral spreading in all directions then occurs. Sufficient sea-water mixes with the sewage to give it final dilution and stratification results, the thickness of the floating sewage being equal to one-twelfth of the distance from the outlet to the surface.

Horizontal multiple outlets for ocean disposal are advantageous, especially when spaced so that the rising columns will not mingle or conflict before reaching the surface. At Long Beach, a four-outlet diffuser cap reduced the 100 B. Coli per c.c. area from 342 to 127 acres. Other conditions being equal, it was shown there that the area of the sewage field varied inversely with the square of the initial dilution. The criterion for design at a given outfall site should probably be a calm sea surface at lower low tide, coupled with the peak flow of sewage and the most pronounced effective ocean current available. These will result in the maximum field or in the maximum distance of sewage travel from the outfall.

'Concrete Pipe and Pumping at San Rafael', by H. K. Brainard, city engineer. Concrete pipe was first used for sanitary sewers in San Rafael in 1875. Sewage was originally dumped into San Rafael creek close to the town limits but, in 1892, a centrifugal pump, operated by a steam engine, and a steel pressure line along the toll road to San Quentin was installed. In 1898 a contract was let for a gravity outfall discharging into San Francisco bay and 8400 ft. of 30-in. redwood stave pipe was laid on a grade of $\frac{3}{8}$ -in. per 100 ft. A flushing basin, three acres in area, was provided for daily use on account of the flat grade. After 28 years a new outfall system was required on account of failure in the gravity line due to faulty bolt metal and also because of the backing-up effect during high tides. In the new system the sewage is run by gravity to a pumping station and is then lifted to San Francisco bay. This consists of 676 ft. of 21-in. and 978 ft. of 30-in. Hume concrete pipe and three pumps with respective normal capacities of 2000 g.p.m. against 18.6-ft. head, 3500 g.p.m. against 30-ft. head, and 500 g.p.m. against 31.5-ft. head. The first two pumps are electrically driven and the third, an auxiliary pump, is run by a Sterling engine fueled with illuminating gas. The average dry weather flow is 1,375,000 g.p.d. and the wet weather flow reaches 5,000,000 g.p.d.

'Bay Disposal and Chlorination at Newport Beach', by R. L. Patterson, city engineer. Newport Beach is a residential city and summer resort on Newport bay. It has a permanent population of 4500, a week-day summer population of 10,000, and a week-end and holiday summer population of 20,000. About 60% of the area in the city is sewered, two separate systems being used. The sewage flow is 400,000 g.p.d. during normal periods and 780,000 g.p.d. during the summer.

There are two Imhoff tanks in the city system. The one serving the sandspit which lies between the bay and the ocean has 11 miles of 8 to 20-in. concrete pipe collecting sewers on flat grades. The area is 3 miles long by 700 ft. to one-half mile wide and has a range in elevation of 7 to 12 ft. above mean lower low water. At three different points, the sewage is lifted by pumps. Sewage reaching the Imhoff tank on the sandspit is in a stale condition. The effluent is discharged into the former channel of Santa Ana river and thence into the bay.

To relieve odors at the Imhoff tank chlorination is regularly practised. Chlorine is mixed with the sewage in the pump pit and was applied between 11 a.m. and midnight at a rate of 11.7 p.p.m., or 70 lb. per 24 hours. By improvements in the tank, the amount of chlorine has been reduced to 20 lb. per day during the winter and to 35 lb. per day during the summer. Chlo-

ration is not practised when the wind blows toward undeveloped lands. Beginning in 1930, the effluent will be chlorinated before discharge into the bay. The development of the region and increased use of the bay for bathing makes it imperative that a new disposal plant be built at the westerly city limits, replacing one of the Imhoff tanks.

'Sewage Disposal in California', by Leon B. Reynolds, professor of sanitary and hydraulic engineering, Stanford University. The water-carriage system of disposal of domestic sewage is hardly 80 years old in the United States. Sewage treatment is a younger art, dating in modern form from the establishment of the Lawrence Experiment Station 40 years ago. Sewage treatment in California has had its development in the past 25 years, practically all plants designed to produce an oxidized effluent being built during the past 15 years. The state now has nearly 300 sewer systems and 200 sewage treatment plants.

Sewage disposal in the state is by two methods: discharge into fresh or salt water (dilution), and discharge upon land. There are 100 systems discharging into fresh water, of which 23% discharge untreated sewage; 108 systems discharging into salt water, of which 62% discharge raw sewage; and 92 systems discharging upon land, 16% of these delivering raw sewage. On San Francisco bay 17 communities discharge mostly untreated sewage along the west side from South San Francisco to San Jose. Disposal upon land is used in California because of the lack of diluting water away from the coast and the suitable soil conditions.

The treatment of sewage varies from the removal of only the largest floating solids to removal of nearly all the suspended solids and bacteria. Some 13 major variations in type of plant are in use. There are seven fine-screening plants along the coast, one in the interior, and three used to decrease the load on other plants. There are still 87 septic tanks in use, most of them followed by no further treatment. Of the 96 Imhoff tanks, one-half are followed by no subsequent treatment. Of late, the tendency toward plain sedimentation in open or Imhoff tanks, with continuous or frequent sludge removal to separate sludge digestion tanks, has increased, 13 such plants being now in use. The effluent from sedimentation

tanks is treated by 33 trickling filters and 26 natural sand filters. Seven activated sludge plants are operating, with two non-operating. Commercial fertilizer is produced in one plant. Chlorination is practised in 19 cases for the destruction of bacteria and in 4 cases for odor control.

Following the paper, Reynolds showed slides of the Corona, Chula Vista, Davis, Dinuba, Exeter, Fresno, Hanford, Livermore, Long Beach, Los Angeles, Madera, Manteca, Modesto, Morgan Hill, Pomona, Porterville, Reedley, San Bernardino, Santa Ana, Santa Barbara, Santa Cruz, Stockton, Tracy, Ventura, Visalia, Vista, Watsonville, Whittier, Yreka, and other sewage treatment plants in California.

Further Organization for 1930

At a meeting of officers in Los Angeles on October 29, committees were named and the time and place for the 1930 spring meeting was determined.

The membership committee includes: chairman—Philip Schuyler, San Francisco; R. F. Goudey, Los Angeles; W. F. Rantsma, Fresno. The program committee will be the entire governing body. The chairman of the legislative committee is B. J. Pardee, Visalia, and other members are: Don E. Perry, San Anselmo; W. T. Knowlton, Los Angeles; A. K. Warren, Los Angeles; and (Mrs.) M. L. Christensen, Palo Alto. On the industrial wastes committee F. J. Rossi, Modesto, is chairman, with F. C. Froehde, Pomona; Herbert Patterson, Long Beach; J. F. Blakely, Lodi; and R. M. Berryhill, Tulare, as other members. The committee on standard report forms includes: chairman—A. M. Rawn, Los Angeles; L. B. Reynolds, Stanford University; A. M. Kivari, Los Angeles; G. A. Parkes, Los Angeles; and W. B. Hogan, Stockton. The publicity committee is composed of: chairman—Alexander Bell, San Francisco; A. W. Kivari, and A. K. Warren. The editorial committee includes: chairman—E. A. Reinke, Berkeley; C. G. Gillespie, Berkeley, and L. B. Reynolds.

The spring meeting of the Association will be held at San Luis Obispo on April 14 and 15, 1930. There will be an inspection trip on April 14 to plants in the vicinity, and a school will be conducted at the San Luis Obispo treatment works on April 15. Papers will also be presented on the latter date.

Reminiscences of the Pioneer Engineers of California*

By OTTO VON GELDERN †
Consulting Engineer, San Francisco

PART III

He‡ developed it from its small beginning to what it had become by the time San Francisco was destroyed by the great earthquake and fire of 1906. He was then sixty-four years old but, in spite of his age, his resourceful intellect and untiring energy provided the city with water again in a comparatively short time, although the great mains of the peninsula had collapsed in consequence of the severity of the shock in the locality where they lay. Mr. Schussler was an extraordinary man; a man of great efficiency and unequaled resourcefulness. He died about ten years ago, still active professionally to the very day of his death.

Commander Calvin Brown of the Corps of Civil Engineers, United States Navy, under whom it has been my privilege to serve as an assistant engineer in the middle seventies, was one of the earliest federal officers on duty at Mare Island. Under his direction

most of the constructive work of the Department of Yards and Docks was done. He designed and built the first stone drydock in California at the Mare Island Navy Yard. Aside from his activities at this Naval Station he was associated with many prominent engineering works in Oregon and California. Before Mr. Schussler arrived in San Francisco, Commander Brown had been the chief engineer of the Spring Valley Water Co.; he constructed one of the earth dams of the peninsular group of lakes in San Mateo county. He died in San Francisco in 1908 at the age of ninety-two.

Another eminent official of the Federal Government was the late Professor George Davidson of the United States Coast and Geodetic Survey, an honorary member of the American Society of Civil Engineers, stationed for nearly a lifetime in San Francisco. He was a true pioneer, who arrived here during the gold rush when laboring men were rare and expensive. He told me that when in charge of his scientific parties, his pay as a young Coast Survey officer was \$75 a month, while the more valuable member of the party, the cook, received \$150 a month.

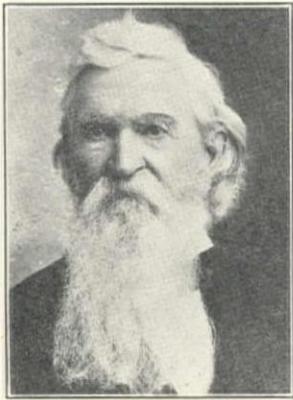
Professor Davidson did more for the safety of nav-

*Part II was published in the October 25th, issue.

†Otto von Geldern is a Life Member of the American Society of Civil Engineers; Past President of the Astronomical Society of the Pacific; a Vice-President of the California Academy of Sciences; President of the Mechanics Institute of San Francisco; and a Regent of the University of California.

‡Hermann Schussler.

igation on the Pacific Coast than any other federal official. He was an enthusiastic, tireless worker, who loved his task. He came to our coast when he was young, active, healthy, and ambitious, and he spent his life here. It was he who became responsible in a great degree for the magnificent work accomplished in



CALVIN F. BROWN

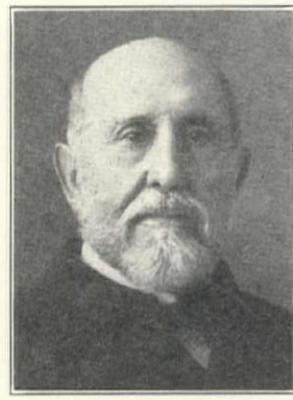
the way of harbor charts, coast charts, and more particularly by the publication of the 'Pacific Coast Pilot', of which he was the founder and director from its very inception.

With advancing years he became blind, or nearly so, from close application to astronomical work, and finally died at a ripe old age, deeply mourned by innumerable friends and admirers. I knew him well; I served with him on many occasions and knew the value of this original character who had devoted his life to the service of his country in one of its most useful technical departments. He died in 1911.

His end was a tragic one. During a change in the

Folsom. He was the state's consulting engineer in many instances.

Colonel Mendell (the first president of the Technical Society of the Pacific Coast) had in his charge the rivers and harbors of California. He was an erudite gentleman of the old school with the most formal



GEORGE H. MENDELL

manners and a precise judgment of affairs. He was a particularly good writer on engineering subjects. He had a deep theoretical knowledge, and his reports which dealt with the important problems of the rivers and harbors of the Pacific Coast are well worth reading today. They show an astuteness of mind, a thorough grasp of the subject, and an unequaled and scholarly method of expressing his thoughts in clear and concise English—a rare talent today. He died in 1902 in his seventy-first year.

In this connection Captain, then Lieutenant, A. H. Payson of the Corps of Engineers, United States Army, should not be forgotten. He was at that time.



GEORGE DAVIDSON

administration he was dismissed from the service without reasonable cause when an old man, and when pension funds were not available. Those acquainted with the circumstances thought it a most unjust and cruel treatment of a man who had faithfully devoted his whole life to the service of his country.

At about the same time the engineering branch of the Army was well represented by General Alexander, one of the earlier predecessors of the late Colonel George H. Mendell, United States Army, who was our well known harbor engineer. General Alexander was consulted in the case of many of the engineering structures and engineering problems that came up for solution. He was the engineer who worked out and recommended a design for the original State Prison at



A. H. PAYSON

now forty-nine years ago, a military assistant of Colonel Mendell. He made extensive investigations of the valleys of the southern rivers, tributary to the San Joaquin river, such as the Mokelumne, Cosumnes, Calaveras, Stanislaus, Tuolumne, and Merced. Information of this large area was gathered by means of surveys showing the condition of these streams, and the effect of hydraulic mining upon their beds. Later on Captain Payson became a prominent figure in the affairs of our state, after his resignation from the Army. At the time of the great earthquake, in 1906, he was the president of the Spring Valley Water Co. He is now the vice-president of the Santa Fe Railway Co. with offices in San Francisco.

(To be continued)

Foundation Movements At San Gabriel Damsite

A brief summary of the findings and recommendations of a consulting board employed to examine and report on the rock conditions at the San Gabriel dam was given on page 537 of the October 25th issue. The preliminary report by this board was rendered October 15. In a report dated September 19, E. C. Eaton, chief engineer of the Los Angeles County Flood Control District, reviewed the nature and amount of a slip, described the status of the work, and made certain recommendations. This slip was incidental to the work, the investigation having been under way over a week before it occurred. It therefore merely confirmed conditions as found. Portions of his report and additional data from the report of the consulting board are extracted below.

Historical—The object of the San Gabriel dam is to control the floods and conserve, so far as possible, runoff from the San Gabriel watershed. To accomplish this, it is proposed to build a gravity type concrete dam at the forks site which would give a storage of 240,000 acre-feet. The dam would be 432.5 ft. above streambed and about 500 ft. above assumed foundation. A contract for the construction of the dam was awarded to Fisher, Ross, MacDonald & Kahn, Inc., in December, 1928, and excavation was begun on March 1, 1929. Over 700,000 cu.yd. of material had been excavated from the abutments by October 15, the date work was ordered suspended.

On September 16, a movement of a portion of the ground on the west abutment occurred, the maximum slip being 10 ft. in an easterly direction. A main crack opened for a distance of 400 ft., the line of the crack running parallel to and about 250 ft. above the line of the upstream face of the dam. Several smaller cracks developed parallel to the main crack. Only a small amount of slide material dropped into the excavation. However, the slip created an unstable condition in the material which was to be excavated from the affected area.

Quantities Involved—As shown in Fig. 1, certain lines were established by specifications, calling for payment of excavation from 3 ft. outside of the concrete lines and extending from these lines on a $\frac{1}{2}:1$ slope up to the original ground surface. The affected area within the pay lines depends on the depth at which bedrock is encountered. On September 1, the upstream face of excavation was distant from the estimated bedrock 140 ft. vertically and 175 ft. horizontally. With bedrock at this assumed point and a uniform slope from the point of slip at that elevation, 100,000 cu.yd. of unstable material lay outside the pay slope. Excavation on that date was to an average distance of 85 ft. vertically and 140 ft. horizontally from the lines of anticipated bedrock, at some points being 140 ft. vertically and 160 ft. horizontally. The excavation of 385,000 cu.yd. of material from the west abutment has failed to reveal satisfactory rock with

the exception of a few exposures for the lower 40 ft. and some indications that fair rock might be reached on the upper 50 ft. of the dam.

Foundation Conditions—The consulting board reported the foundation rock to be a dense diorite-gneiss, cut by dikes of white alaskite and brown to black diabase. Bedrock is cut by fractures of various kinds, including faults, shearzones, and joint systems accompanied by a clay gouge extending below the zone of weathering. These bedrock flaws on the west abutment make the site unsound for the present contemplated structure. The bad flaws are confined to the west side and the east side of the site is fairly satisfactory. Three faults cross and intersect in the body of the west abutment and account for the many seams, with their varied directions; also for the deep weathering and soft clay gouge. These faults are: a main fault running southeast and northeast and crossing under the river at the downstream toe of the dam, a fault running northeast-southwest, and a fault run-

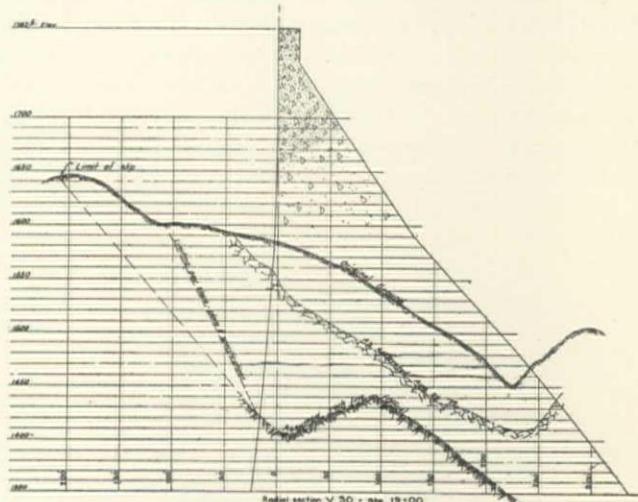


Fig. 1. Typical Section Through San Gabriel Dam. Limit of Slip Shown by Broken Line at Left

ning due north-south. The zone of maximum crushing is 100 to 150 ft. wide. The intense shearing action along the main faultzone, complicated by its intersection with the system of shear planes, does not indicate the probability of sound bedrock at reasonable depths. With the faultzone passing under or near the downstream toe and nearly parallel to the axis of the dam, a most dangerous condition exists, especially when future movement along the fault line is admitted.

Effect of Mass Shooting—The average depth of excavation on the west abutment on October 14 was 40 ft. and the maximum 105 ft. below the original ground surface. No mass shooting has been done on the west abutment since July 11, the actual black powder used, including a slightly faster relief powder in the front pockets, being 0.4 lb. per cu.yd. of material moved. Since that date, 50,000 cu.yd. has been removed with-

out shooting, except for that required to break up large rocks to dipper size. The soft and crushed condition of rock is not the result of overshooting, as steam-shovel excavation has been carried 80 ft. beyond the nearest point of mass shooting. (For a description of mass shooting on the east abutment see page 373, July 25th issue.)

Exploration work on the west abutment has been in progress since August 5, when Louis C. Hill, consulting engineer; W. A. Perkins, representing the state engineer; and Eaton made a general inspection. Thereafter three test shafts were drilled and, on September 11, C. F. Tolman, consulting geologist, began a detailed geologic study. Tolman and Eaton were present when the slip occurred. The consulting board, consisting of L. C. Hill, A. J. Wiley, R. T. Hill, and C. F. Tolman, later spent one week individually and separately in studying the physical characteristics of the site and exploring test pits. These men then spent five days in concurrent study at the damsite. The board recommended against any high dams at the site and that further exploration be made to determine if a dam of lesser height can be built at the forks site; also that a study be made of possible alternate or supplemental sites upstream on the watershed to such a dam as the exploration may prove safe for the forks location. Eaton is still engaged in this further exploration.

Other Investigations—On November 4, Edward Hyatt, state engineer, appointed a special investigating board of three engineers and three geologists to review the safety features of plans, specifications, and foundations of the San Gabriel dam. This action followed a filing by the Los Angeles County Flood Control District of formal application for approval of the dam. The application is in accordance with a law governing state supervision of dams, passed by the 1929 Legislature. None of the members of the board has heretofore been associated with the project. The engineer members are: J. L. Savage, chief designing engineer, U. S. Bureau of Reclamation, Denver; George A. Elliott, chief engineer, Spring Valley Water Co., San Francisco; and M. C. Hinderlider, state engineer of Colorado, Denver. The geologist members are: Charles P. Berkey, consulting engineer and professor of geology at Columbia University, New York; George D. Louderback, consulting geologist and professor of geology at University of California, Berkeley; and Ira P. Williams, consulting geologist, Portland. This board will convene in Los Angeles about November 11.

Some of the engineers and geologists who previously reported on the project have been retained to review the situation as it now stands and report again to the Board of Supervisors. These men are: Andrew Lawson, consulting geologist, University of California; F. H. Fowler, consulting engineer, San Francisco; Wayne Loel, consulting geologist, Los Angeles; Alan Sedgewick, consulting geologist, University of Southern California; F. J. Safely, consulting engineer, San Gabriel Protective Association; and J. W. Reagan, former chief engineer of the District. The group met with E. C. Eaton, chief engineer, on November 4 and 5, and will make its report by November 20.

PERSONAL MENTION

H. W. Dennis, of Los Angeles, national director for the southwestern states, District 11, American Society of Civil Engineers, addressed the Arizona Section of the Society, stopping off en route to Los Angeles from the fall meeting at Boston.

Ben E. Torpen, formerly with the hydraulic department of the Electric Bond & Share Co., New York, is now representative and chief engineer for Thebo, Starr & Anderton, contractors and engineers of San Francisco, on a 45,000-hp. hydroelectric development at Medellin, Colombia.

W. E. Blomgren, for the past six years project engineer of the U. S. Bureau of Reclamation in charge of engineering construction and operation on the Fort Hall project, Idaho, has been transferred to the Denver office of the Bureau. He is now a designing engineer under J. L. Savage and is engaged in studies and designs for Boulder dam.

George Pollock Co., of Sacramento, has completed its grading contract for the south approach to Suisun Bay bridge. On this contract the company moved 500,000 cu.yd. of earth onto a high fill in less than 144 working days, the average daily movement being 3500 cu.yd. with an average haul of 2000 ft. C. A. Jones was superintendent on the work.

ASSOCIATIONS

American Road Builders Association will hold its 27th annual convention and road show at Atlantic City, New Jersey, on January 11-18, 1930. This association staged an airport conference at Washington on October 24 and 25 with an attendance of over 200 engineers, contractors, and representatives from the aeronautics industry. The two outstanding construction papers were 'Airport Drainage' by C. A. Hogentogler and F. A. Robeson, and 'Airport Surfaces' by C. N. Conner.

American Institute of Steel Construction will convene for its seventh annual convention at Biloxi, Mississippi, on November 12. Speakers at the convention will include: Henry Goldmark, consulting engineer, New York, on the use of structural steel in dams; D. B. Steinman, consulting engineer, New York, on the problems of bridge engineering and their special application to structural steel; Kenneth G. Merriam, assistant professor of applied mechanics at Worcester Polytechnic Institute, presenting some new light on the design of column slabs. The Institute also will discuss and debate the relative merits of riveting and of welding. The side of rivets will be presented by the best known authorities on steel rivets. Eminent engineers will be called on to uphold the merits of gas and electric welding.

California Board of Registration for Civil Engineers

At the organization meeting of the State Board of Registration for Civil Engineers, held in Sacramento October 28 and 29, the following officers were elected: president—Donald M. Baker, consulting engineer, Los Angeles; vice-president—Henry J. Brunnier, consulting structural engineer, San Francisco; secretary—Albert Givan, general manager and chief engineer, Sacramento Utilities District, Sacramento. Pecos H. Calahan, Glendale, was appointed assistant secretary.

The Board proposes to make an intensive study of the registration laws, and particularly of procedure, in other states. This work probably will be completed and the application blanks ready to send out about January 1. At the time that blanks are ready, wide publicity will be given this fact and all engineers will be notified. If the engineers are members of engineering societies or local engineering clubs, their names will be taken from the membership lists. In other cases, corporations, cities, counties, and additional agencies will be notified. It is the hope of the president of the Board that engineers will wait to get any necessary information until they have been notified that application blanks are ready.

New Equipment and Trade Notes

HARNISCHFEGER CORP. ISSUES COMMON STOCK

The Harnischfeger Corp., of Milwaukee, manufacturers of P&H construction equipment, is offering 75,000 shares of no par value common stock at \$30.50 per share. This stock will be placed on a \$1.80 annual dividend basis, with the payment of an additional quarterly dividend of \$0.45 per share on January 1, 1930. The stock is listed on the Chicago Stock Exchange. Proceeds from the sale of this common stock will be used to retire current indebtedness, for additional working capital, and for other general corporate purposes.

The balance sheet, as of July 31, 1929, of Harnischfeger Corp. shows a strong financial condition, with current assets of \$8,609,695 and current liabilities of \$1,314,258. Net tangible assets are equivalent to \$28.68 per share of common stock to be outstanding.

The business of Harnischfeger Corp. was started as a partnership in 1884 and incorporated under the laws of Wisconsin in January, 1910, as Pawling & Harnischfeger Co., the name being changed to the present designation in 1924.

The company's business has been built around the task of supplying mechanical force and means to lift, carry, dig and convey materials. Its products include electric overhead cranes and hoists, material handling monorail systems, gasoline, diesel, and electric-powered shovels, draglines, cranes, trenching machines, backfillers, truck cranes, single-line grab buckets, and others. Harnischfeger Corp. is not only one of the leading manufacturers in its field, but has been a pioneer in developing new and improved labor-saving devices for material handling and conveying. Among these were the successful introduction of the gasoline and the diesel-powered shovel, both of which entered a field previously dominated by the steam shovel.

C. A. SPEARS JOINS CATERPILLAR TRACTOR CO.

C. A. Spears, who for 20 years has been in road engineering, 17 of these with Spears, Wells, has joined the sales engi-



C. A. SPEARS

neering staff of the Caterpillar Tractor Co., San Leandro. Spears is widely known on the Pacific Coast as an authority on roads and streets, and has a large acquaintance among contractors and engineers and governmental men. His time will be devoted to helping solve the earth-moving problems which confront this group.

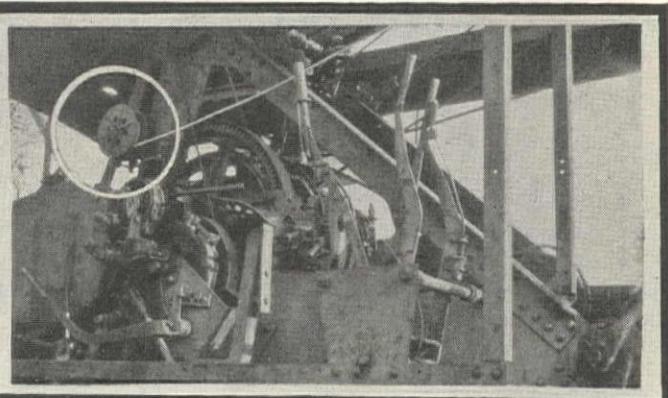
LINK-BELT SHIPS SAWMILL CONVEYOR CHAINS

The Link-Belt Co., of Chicago, recently shipped from its Indianapolis plant one of the largest single orders of conveyor chain ever made. This shipment, consisting of 76,950 ft., or 14½ miles, of sawmill conveyor chain, weighed 250,000 lb. and required three freight cars. In addition, a large quantity of Link-Belt roller and silent chain for transmission purposes was shipped to the same purchaser, the Edward L. Hines Western Pine Co., of New Burns, Oregon.

This lumber company is completing a western soft pine mill which will be one of the most up-to-date plants in operation. In addition to the sawmill and dry kilns, there are 50 miles of standard gauge railroad in the project. Construction is being done by force account with Batty & Kipp, of Chicago, in charge.

CULVER POWER TRIP

M. P. McCaffrey, of Los Angeles, who for 18 years has been handling and repairing gas and steam shovel appliances, is now manufacturing the Culver power trip. This is a com-



Culver Power Trip Installed on Northwest Shovel

plete and efficient power trip and can be adapted to any make of gasoline, electric, diesel, or gas+air shovel, being used with success on Northwest, P&H, Erie, and Osgood machines.

The Culver power trip is designed to operate the latch on the bucket door at the touch of a finger and with lightning-like speed. It weighs but 85 lb. and may, therefore, be easily and quickly installed by any shovel crew. It occupies only one cubic foot of space and can be installed so that it does not in any way interfere with shovel operation. It is entirely bolted to, and thus requires no additional drilling of the shovel forms. All working parts are protected against wear by large bronze bushings. There are no delicate parts which would require a skilled mechanic to keep the trip in adjustment. It is claimed that the device is simple and effective in operation and will increase a shovel's output as much as 20%.

HERCULES POWDER CO. LABORATORIES

The Hercules Powder Co., of Wilmington, Delaware, manufacturers of explosives, naval stores, nitrocellulose and cellulose, has announced plans for the erection of a new experimental station, containing experimental and chemical research laboratories.

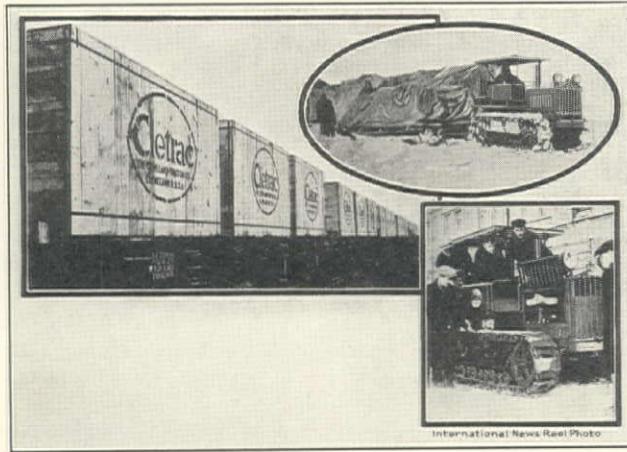
After new structures have been erected on the 300-acre laboratory site, situated about 2½ miles from the west city limits of Wilmington, the company's experimental staff and research equipment will be moved from the present labora-

tories at Kenvil, New Jersey. The new construction will include a main building with chemical laboratories, offices, and library; auxiliary buildings containing experimental plants; a power house and storerooms. The experimental staff numbers 120, of whom more than half are technically trained chemists, physicists, and engineers.

Removal of the laboratories to Wilmington will bring the experimental work into closer contact with the main office and will facilitate the technical service offered by the Hercules Powder Co. This company has carried on extensive experimental research for a number of years.

CLETRAC CRAWLER TRACTORS FOR RUSSIA

The Cleveland Tractor Co., of Cleveland, recently received another large order, one for 708 Cletrac crawler tractors, from the Russian Soviet. This order brings the total number of



(Left) Shipment of Cletrac Crawler Tractors for Russian Soviet. (Center) Cletrac Hauling Load of Russian Grain and Supplies on Sleds. (Right) Russian Students Being Instructed in Tractor Operation

Cletracs purchased by the Russian government during the past year to over 1300.

These tractors will be used for farming in the great agricultural sections of Russia, for building and maintaining highways, for construction, for logging, in oil field and mine work, and for hauling supplies across those vast regions where railroad facilities are limited.

THEW SHOVEL CO. ANNOUNCES THE LORAIN-45

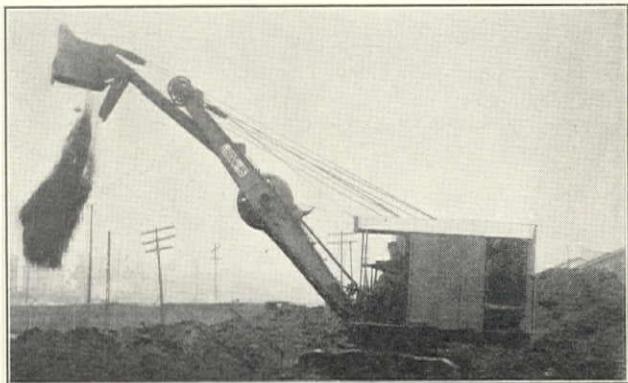
The Lorain-45, a new $\frac{3}{4}$ -yd. shovel, crane, clamshell and dragline, has been announced by the Thew Shovel Co., Lorain, Ohio. This line of equipment will supplement the company's present product, the 1- $\frac{1}{2}$ -yd. Lorain-55 and the 1- $\frac{1}{4}$ -yd. Lorain-75. The basic design and construction principles of the older lines are reflected in the new Lorain-45, which is built to the Thew 'center-drive' design in turntable, truck, and shovel boom.

The superstructure, or turntable, is powered by a Waukesha type 'H.S.' motor with $5\frac{1}{2}$ -in. bore, $6\frac{1}{2}$ -in. stroke, developing 71 hp. at 1000 r.p.m. The power transmission consists of a power take-off and a silent chain drive, carrying the power directly to the center drive pinion. This pinion meshes directly with the three power shafts, the hoist, swing and crowd, or travel shafts, and constitutes the entire power transmission of the Lorain-45. Each of the three power shafts is independently controlled through a large, internal-expanding band clutch. Each may be separately engaged with the full power of the motor applied to it; or any combination of these shafts may be effected for simultaneous operation.

This superstructure is mounted on a two-speed Thew center-drive crawler, similar to that of the Lorain-75 mounting, but modified for the smaller capacity. A vertical travel shaft and a horizontal propelling shaft comprise the major crawler drive. All the propelling gears, steering clutches, etc., run in a constant oil bath in a heavy, steel crankcase placed up high to afford generous ground clearances. The steering clutches of the crawler are mounted on splined shaft sections,

a new innovation. The crawler high-travel speed is $1\frac{1}{2}$ m.p.h., climbing a 15% grade, and the low speed is $\frac{3}{4}$ m.p.h., climbing a 30% grade. Both speeds are available for travel in either direction with equal efficiency, regardless of the length of travel. A full range of boom equipment for shovel, crane, clamshell, and dragline units is furnished for the new Lorain-45.

The Thew center-drive shovel boom is used, in which the dipper shaft is placed at the center of the boom, or further ahead and in a lower position, permitting the dipper stick to attain a greater vertical angle. This is said to enable the



New Lorain-45

Lorain-45, with an 18-ft. shovel boom and standard 14-ft. dipper stick to dig and dump higher and to reach farther out than other shovels equipped with the same length of boom and dipper stick. The shovel boom has an all-steel, full box-section of great strength. The dipper stick is an all-steel welded, rectangular section with a patented 'far-reach' greenhorn at one end.

The dipper on the Lorain-45 is tripped by an automatic power dipper trip, a small clutch device on the turntable on the end of the swing shaft. A lever, set immediately to the right of the operator's position, when engaged by a slight pressure, actuates this clutch and causes a pull on the trip rope. This automatically trips the dipper once and then returns to the 'ready' position.

The crane, clamshell, and dragline booms are all-steel, latticed, built in two sections, with interchangeable boom heads. The standard boom is 35 ft. long, although various lengths of head and middle sections can be furnished for longer booms.

For the dragline machines, the Thew patented two-sheave fairlead is used. The pivoted lower sheave automatically maintains a correct, straight lead from fairlead to bucket under all conditions of side pull and side sway. In the clamshell tagline, the lower sheave is also pivoted so that a straight lead from tagline to bucket is constantly and automatically maintained.

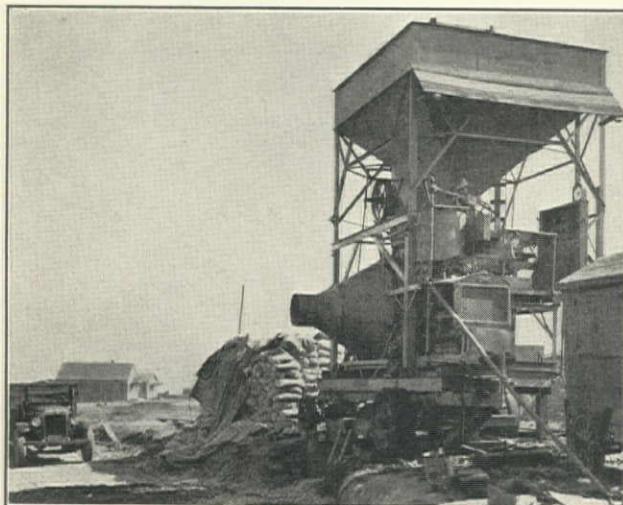
SMITH WEIGH-MIX AT SAN DIEGO

The use of central mixing plants on road work as well as in building construction is becoming more and more common. And, if the contractor is enabled to move the plant from job to job with both ease and speed, his costs are considerably reduced.

The central mixing plant owned by Bert Noble, of San Diego, is unique insofar as it is extremely compact and portable. In this plant a standard T. L. Smith 40-S tilting mixer with Weigh-mix attachment is mounted on a trailer, and a demountable steel bin of 50 tons capacity is placed above it. The bin is charged with a Koehring crane, and a cement elevator lifts the cement to a small hopper suspended under the gravel hopper. At the present time the plant is being used for street paving. It will shortly be transferred to a large causeway job.

When it is desired to move the equipment to another location, it is only necessary for the crane to pick up the bin and elevator and load on another trailer. The entire plant is then towed to the new location. After the bin and elevator are placed in position, the plant is again ready for operation. Only four hours are required to dismount and re-erect the plant.

An important feature is that the intermediate weighing hoppers are entirely done away with. The Smith Weigh-mix weighs the stone, sand, cement, and water, and then thoroughly mixes these ingredients. Such equipment greatly simplifies the plant design, and the positive control of aggregate proportions insures a resultant uniform and high-strength concrete. Four men do all the work, turning out 40 batches per hour. One man operates the Weigh-mix, two handle the



Smith Weigh-Mix in Portable Central Mixing Plant at San Diego

cement, and one runs the crane. The Smith Weigh-mix in this instance effects a saving of 9 ft. in height. The hopper is only 23 ft. high and can be loaded with a 40-ft. boom crane. The plant's simplicity is shown by the fact that the owner mounted the Weigh-mix on the trailer, built the steel hoppers and elevator leg in his own shop, and also mounted his own motor.

OHIO POWER SHOVEL COMPANY

Grant Davis, Sales Manager of the Ohio Power Shovel Co., and J. Lee Laughlin, Vice-President of the above company and comptroller of the Lima Locomotive Works, recently made an extended trip to the Pacific Coast, visiting their distributors and analyzing the business outlook of this territory. They are very much impressed with the sales progress their dealers are making and the interest shown by contractors in the "Lima 101." The distributors of the Ohio Power Shovel on the Pacific Coast that were visited include Frank T. Hickey Company, Los Angeles; Western Road Machinery, Seattle and Portland; Tyee Machinery Co., Vancouver, B. C., and The A. L. Young Machinery Co., of San Francisco.

TRACTOR-EQUIPMENT, INC.

Tractor-Equipment, Inc., has been formed to take over the business of the O. R. Peterson Co., San Francisco. Officers of the new organization are: president—Milton W. Anderson; vice-president—Arthur G. Herring; secretary-treasurer—Edith M. MacMahon. There will be four distinct departments to Tractor-Equipment, as follows: 1—Monarch tractor and equipment department, with Charles W. Manning, formerly with Caterpillar Tractor Co., as director and Gus Nesslage, former superintendent of service for the Robinson Tractor Co., and Arthur T. Jones, of Fresno. 2—United industrial department, covering United industrial tractors and equipment. 3—United agricultural department, handling the United agricultural tractors and equipment and the La Crosse line of farm implements. C. A. Epperson is the dealer contact man for this department. 4—Truck equipment department, in charge of Crocker B. Hord. The new company has recently made delivery on a number of Universal shovels. In addition to the San Francisco headquarters, branches are planned for Sacramento, Stockton, and Fresno.

At the first organization dinner meeting, held at the Clift hotel on October 28, Milton W. Anderson outlined the factory and distributing activities of the United and Monarch

tractor companies, together with their plans for future development. He reported on the performance of the new Monarch 35, which is entirely different from the stereotyped designs of the past. This model, which has great simplicity and 30% more power than the older Monarch, will be displayed in San Francisco during November. Anderson will have an active interest in the new company and will retain his presidency of the United Tractor & Equipment Co.

CHAIN BELT CO. APPOINTS ASSISTANT TO PRESIDENT

Hibbard S. Greene, formerly with the National Carbon Co., of Cleveland, and later director and vice-president of the Barber-Greene Co., of Aurora, Ill., has been appointed assistant to the president of Chain Belt Co., manufacturers of 'Rex' brand construction machinery. Greene will make his headquarters at the Milwaukee plant of the Chain Belt Co. and will correlate the marketing plans of four affiliated Milwaukee companies—the Chain Belt Co., the Sivyer Steel Casting Co., the Federal Malleable Co., and the Interstate Drop Forge Co.; also the Stearns Conveyor Co., of Cleveland, a division of the Chain Belt Co.

NEW CATALOGS

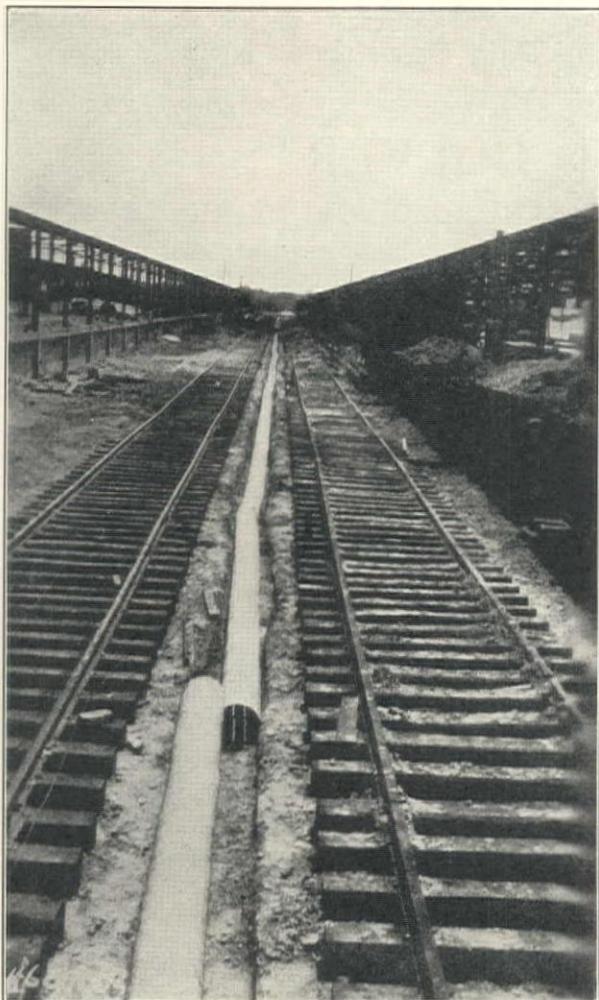
Cement—The Calaveras Cement Co., of San Francisco, has prepared 'The Story of the Pardee Dam.' This is an artistic, illustrated description of the \$6,000,000 structure recently completed near Valley Springs, California, and dedicated on October 19. On the Pardee dam, over 615,000 cu.yd. of concrete were mixed and placed in less than 24 months, more than 3,000,000 sacks of Calaveras cement being used.

Compressors, Etc.—Gardner-Denver Co., of Denver, has issued an accordion folder describing its portable compressors with standard, trailer, skid, truck, and railroad mounting; concrete breaker; sheeting driver; Waughhammers; clay and trench diggers; drill sharpeners; drill steel forge; and drifting drills.

Electrochemical Products—The Hooker Electrochemical Co., of New York and Tacoma, a large producer of electrolytic caustic soda, chlorine, and chlorine products, has released its 1929 catalog. This 78-page book is a valuable manual of information and contains the following divisions: organization history, directory, industrial relations program, technical advisors, history of the chlorine and electrolytic caustic soda industry, group photograph and flow sheet of products, technical service, transportation and traffic service, caustic soda, chlorine, bleaching powder, muriatic acid, monochlorbenzene, paradichlorbenzene, benzoate of soda, benzoic acid, benzoyl chloride, benzyl alcohol or phenyl carbinol, antimony trichloride, ferric chloride, sulfur monochloride, sulfur dichloride, sulfonyl chloride, salt, chemical equivalents and properties, atomic weights, conversion factors, temperature conversion tables.

Mine Safety Appliances—The Mine Safety Appliances Co., Pittsburgh, Pa., has issued its 160-page general catalog No. 4, covering 'everything for mine and industrial safety.' Subdivisions of the catalog are: Edison electric safety cap lamps and accessories, permissible shot firing devices, Wolf flame safety lamps, gas and air measuring devices, rock dusting equipment, oxygen breathing apparatus, gas mask respiratory protective equipment, gas detectors and recorders, resuscitation equipment, eye and head protective equipment, safety clothing, safety saws, and first-aid supplies.

Steel Bridges—The American Institute of Steel Construction has published a booklet, 'The Superiority of the Steel Bridge', in which is illustrated an extensive collection of bridges throughout the world. Beauty, strength, permanence, flexibility, movability, and economy are said to be the basic characteristics of the best practice in bridge construction. It is claimed that steel possesses the quality of beauty-potentiality because of its physical properties which permit fabrication into any desired form suitable for bridges.



Where conditions necessitate SUPER-drainage, meet the problem with

ARMCO PERFORATED PIPE

SURFACE and subsurface moisture both yield quickly to the splendid efficiency of Armco Perforated Pipe. Airports, railroad yards, stadiums and many another place where conditions necessitate *super*-drainage find that Armco Perforated Pipe sets a never-failing trap for all excessive water, insuring quick drying in the most adverse situations.

Compact, light in weight, easily handled, Armco Perforated Pipe has the added value of long life. Pure Armco Ingot Iron resists rust. And the pipe is resilient, so that the severest shocks and strains are *absorbed*.

May we tell you more about it?

CALIFORNIA CORRUGATED CULVERT COMPANY

Los Angeles: 424 Leroy Street

Berkeley: 417 Parker Street

UNIT BID SUMMARY

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

BRIDGES AND CULVERTS

SACRAMENTO, CALIF.—STATE—SAN DIEGO COUNTY—STEEL

Gutleben Bros., 4815 Calaveras Ave., Oakland, who bid \$281,542, low bid to California Division of Highways, Sacramento, for bridge over San Luis Rey River near Oceanside, SAN DIEGO COUNTY, consisting of three 265-ft. steel deck spans and two 60-ft. steel stringer spans. Bids received from the following concerns:

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
(1) Gutleben Bros., Oakland	\$281,542									
(2) Pan-Pacific Piling & Const. Co., L. A.	287,912									
(3) Lynch-Cannon Engineering Co.	291,359									
(4) Carpenter Bros., Beverly Hills	295,240									
(5) Chas. & F. W. Steffgen, San Diego	305,062									
Clearing and grubbing	\$600	\$114	75.00	\$200	\$100	87.50	\$1000	\$240	\$200	\$290
250 cu.yd. remove pavement	2.50	2.61	3.00	1.50	3.26	2.62	5.00	3.40	3.44	3.03
3,700 cu.yd. struc. excav.	5.00	4.14	6.00	5.62	7.50	6.25	7.70	4.15	7.00	5.93
15,500 cu.yd. roadway excav.	.40	.377	.50	.30	.515	.38	.50	.35	.56	.43
3,750 sq.yd. subgrade	.16	.195	.15	.10	.22	.20	.20	.10	.32	.18
19,440 ft. douglas fir pile, fur.	.40	.54	.20	.36	.44	.44	.45	.45	.46	.42
216 douglas fir piles, drive	33.00	17.94	17.50	26.80	31.10	50.00	40.00	13.40	30.00	28.85
300 cu.yd. 'A' conc. tremie	18.00	13.36	16.50	16.17	16.66	17.50	22.00	21.00	20.00	17.90
1,700 cu.yd. 'A' conc. struc.	14.00	15.73	25.00	20.46	15.59	17.50	15.00	20.00	18.25	17.94
700 cu.yd. 'A' conc. pave	11.00	12.60	12.00	12.30	13.37	12.75	15.00	15.00	16.30	13.33
1,365 cu.yd. 'B' conc.	12.00	13.08	15.00	18.00	13.06	17.50	13.00	17.00	15.55	14.90
68 cu.yd. 'E' conc.	70.00	54.15	50.00	69.49	72.47	50.00	\$100	60.00	80.00	67.20
256,000 lb. reinf. steel	.045	.0567	.045	.04	.0477	.04	.045	.0525	.041	.046
2,675,000 lb. struc. steel	.058	.0595	.057	.0585	.06	.0611	.062	.0741	.067	.062
36,000 lb. cast steel	.12	.15	.105	.11	.15	.12	.14	.14	.112	.127
1,800 lb. phosphor bronze	.40	.89	.60	.50	.0528	.55	.50	.75	.64	.60
110 tons br. stone bit. mac.	5.00	4.25	3.50	4.00	4.54	3.25	10.00	5.00	3.79	4.81
4 tons emul. asphalt	30.00	50.75	50.00	30.00	42.93	36.00	20.00	27.50	41.75	36.50
17 sta. finish roadway	10.00	5.06	5.00	7.00	8.00	3.50	50.00	6.00	4.56	10.20
26 monuments	3.50	5.04	4.00	4.00	3.35	3.50	2.00	3.00	4.75	3.68
1 lighting equipment	\$3032	\$4105	\$2000	\$3650	\$3571	\$3500	\$1800	\$1500	\$4103	\$3030
1 bridge remove	\$6400	\$4103	\$1000	\$2500	\$6032	\$7000	\$5000	\$1800	\$7342	\$4570

SACRAMENTO, CALIF.—STATE—LOS ANGELES COUNTY—BRIDGE WIDENING

Johnson Construction Co., 2131 Barclay St., Los Angeles, \$88,054 low bid to California Division of Highways for bridge widening over San Gabriel River on Foothill Blvd., near Azusa, LOS ANGELES COUNTY. Bids on following items:

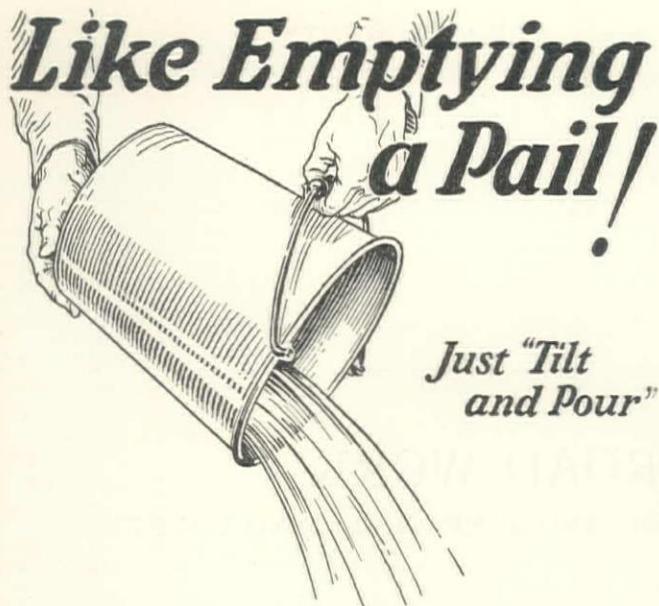
(1) 4,800 cu.yd. structure excavation	(7) 67 M ft. redwood (select all ht. structural)	
(2) 1,400 cu.yd. roadway embankment	(8) 124 M ft. redwood (dense select all ht. structural)	
(3) 1,910 cu.yd. 'C' concrete	(9) 205 cu.yd. remove concrete	
(4) 1,490 cu.yd. "A" concrete	(10) 990 sq.yd. subgrade for paving	
(5) 46 cu.yd. "E" concrete	(11) 1,080 tons asphalt concrete paving	
(6) 293,000 lb. reinforcing steel	(12) 16,000 lb. cast steel	
Johnson Construction Co.	(1) (2) (3) (4) (5) (6) (7) (8) (9) (10) (11) (12) TOTALS	
1.05 .75 9.00 14.62 35.00 .039 92.50 89.00 16.33 .90 5.75 .142	\$88,054	
Carpenter Bros.	1.00 .60 10.00 14.50 50.00 .04 89.00 89.00 8.00 .60 7.00 .16	89,718
Oberg Bros., Los Angeles	2.00 .50 13.00 13.00 13.00 .04 80.00 80.00 5.00 .20 6.00 .12	91,721
Whipple Engr. Co.	1.95 .35 12.35 16.00 41.50 .035 79.00 79.00 8.00 .13 5.50 .13	94,320
deWaard & Sons.	.90 .70 15.40 15.00 40.00 .0375 85.00 85.00 5.00 .10 4.90 .12	94,462
S. M. Kerns	2.00 1.00 13.00 15.00 50.00 .04 71.00 75.00 6.00 .10 7.00 .11	96,906
Average bid	1.48 .65 12.10 14.70 38.00 .039 82.80 82.70 8.10 .34 6.02 .13	92,500

SEATTLE, WASH.—APPROACH TO W. SPOKANE ST. BRIDGE—CITY

Contract awarded to General Const. Co., Colman Bdg., Seattle, Wash., who bid \$149,688 for constructing west approach to West Spokane Street Bridge No. 2 for City of Seattle. Three lowest bids from:

(1) General Const. Co.	\$149,688	(2) J. F. Ward, Inc., Tacoma	\$151,951	(3) W. T. Butler, Seattle	\$153,663
Clearing and grubbing	\$3500	\$3308	\$1770	475 ft. 6-in. vitr. sewer	(1) (2) (3)
3,028 cu.yd. embankment	.50	.55	.50	68 ft. 6-in. cast-iron pipe	1.00 1.75 1.75
1,605 cu.yd. excavation	3.00	3.00	1.50	50 ft. 4-in. cast-iron pipe	2.00 2.50 2.50
3,092 cu.yd. 'B' concrete	17.00	16.50	18.50	590 ft. 4-in. wrought steel pipe	1.00 1.50 1.50
578 cu.yd. 'C' concrete	17.00	15.25	10.50	600 ft. precast conc. drain covers	2.50 3.70 2.40
725,100 lb. reinf. steel	.04	.038	.042	15 bridge lamp posts	.70 .45 .65
485,900 lb. structural steel	.055	.069	.0675	15 furnishing for lamp posts	30.00 35.00 40.00
20,400 ft. timber piles	.45	.39	.40	6 lamp posts for stairs	45.00 41.00 45.00
1,152 ft. conc. railings	3.50	3.10	4.15	Lamps and furn. for stairs	12.00 11.00 10.00
624 ft. pipe railing	4.00	4.30	3.00	Conduits for light. system	60.00 59.00 56.00
5 brick catchbasins	80.00	85.00	90.00	Wiring for light. system	\$600 \$579 \$640
7 inlets, bridge type	60.00	33.00	40.00	Transformer for light. system	\$400 \$435 \$480

W. D. Barkhuff is City Engineer of Seattle.



NO one empties a pail with a scoop. It takes too long. The fastest, most practical way is to tilt the pail and pour out the contents.

Smith engineers applied this same simple reasoning when they designed the famous Smith Tilters. You simply "tilt and pour" the Smith — the easy natural way — like emptying a pail.

One quick short motion of the tilt lever and dry or wet batch comes scooting out. Clogging is impossible. In 8 seconds the drum is completely discharged — a speedy flow of concrete, easily controlled. Forms filled in double quick time.

Smith Tilters range from 2½-S to 112-S — a size for every conceivable mixing job.

You will want this BETTER and FASTER mixer for pouring the small jobs. Send the coupon for complete descriptive information.



THE T. L. SMITH COMPANY, 1111-32nd St., Milwaukee, Wis.
Division of National Equipment Corporation

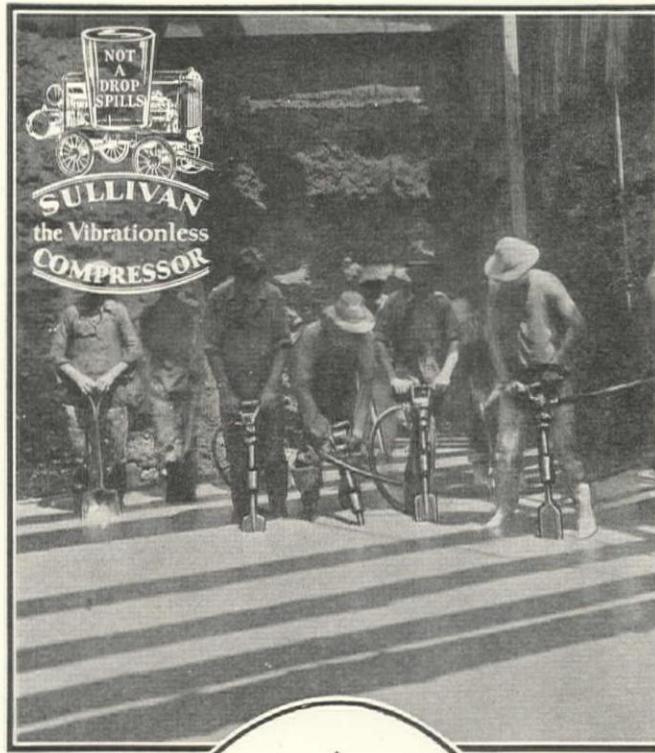
Please send me complete descriptive information on your Small Mixers.

Name.....

Address.....

City..... State.....

HARRON, RICKARD & McCONE COMPANY
1600 Bryant Street SINCE 1875 2205 Santa Fe Ave.
SAN FRANCISCO LOS ANGELES



*digging
bridge footings
with
Sullivan Spaders*

THE Miller-Taylor Construction Company of Waterloo, Iowa, is building a \$350,000 bridge across the Maumee River at Napoleon, Ohio.

Forty-six-hundred yards, or more than half of the material removed for six piers and two abutments, is blue clay, hard pan, and limestone. And twelve men with Sullivan Spaders, and two with Sullivan Rotators, complete footings 18x82x15 ft. in four 12-hour days.

The Spaders are the short-shanked models, armed with 5-in. chisels. Long-shanked tee-handled Spaders are also available for open trench work.

A 310-ft. Sullivan Vibrationless Compressor keeps men and tools stepping lively. This is the largest of the six Sullivan Compressors. They are available with gasoline engines or electric motors, and on steel wheels, trailer trucks, or skids.

Extra profits on bridge or building excavations, and on many sewer and water projects, await the contractor who adopts Sullivan Spaders.

Send for the new picture book, 87-A.

Sullivan Machinery Co.

580 Market Street
San Francisco

Los Angeles Salt Lake
El Paso Spokane
Vancouver
Seattle



DENVER, COLO.—STATE—STEEL—POWERS COUNTY

J. F. Roberts & Sons, Tramway Bdg., Denver, Colo., who bid \$140,102 low bid to State Highway Commission for 1260 ft. steel bridge north of Lamar, POWERS COUNTY. Three lowest bids from:

(1) J. F. Roberts & Sons.....	\$140,102	(3) L. F. Williams, Pueblo.....	\$142,509
(2) A. R. Mackay, Ft. Morgan.....	142,103		
	(1) (2) (3)	(1) (2) (3)	(1) (2) (3)
600 sq.yd. removing old conc. pavement.....	\$.25	\$.30	\$.50
2,800 lin.ft. removing fences.....	.01	.005	.01
100 cu.yd. unclassified excavation.....	.40	.15	.50
400 cu.yd. dry com. struct. excav.....	.50	.15	1.00
300 cu.yd. wet com. struct. excav.....	2.50	5.00	3.00
20,000 cu.yd. unclassified borrow.....	.35	.25	.25
60,000 sta.yd. overhaul on borrow excav.....	.02	.02	.02
3,140 sq.yd. conc. pavement.....	2.30	2.20	2.20
210 cu.yd. sand cushion.....	.80	.60	1.00
141.3 M ft. B M treated bridge timber.....	95.00	97.00	85.00
1,096 cu.yd. class A concrete.....	17.50	13.80	19.00
223,300 lb. reinf. steel.....	.0462	.045	.0475
1,150,000 lb. struct. steel.....	.045	.0464	.047
19,100 lin.ft. treated timber piling.....	1.15	1.50	1.20

STREET AND ROAD WORK

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

Allied Contractors, Inc., Ludlow, Calif., \$239,792 low bid to California Division of Highways for 21.3 miles grading and oil-treated gravel or stone surfacing from Coso Junction to Olancha, INYO COUNTY.

(1) Allied Contractors, Inc.....	\$239,792	(4) Hemstreet & Bell, Marysville.....	\$272,376				
(2) G. W. Ellis, Los Angeles.....	240,255	(5) Isbell Const. Co., Fresno.....	282,543				
(3) V. R. Dennis Const. Co., San Diego.....	265,083	(6) Average bid.....	260,000				
		(1) (2) (3) (4) (5) (6)					
122,000 cu.yd. roadway excavation.....		.43	.60	.45	.43	.49	.48
251,400 sta.yd. overhaul.....		.02	.02	.01	.01	.02	.016
1,200 cu.yd. structure excavation.....		1.00	.75	1.50	.75	1.50	1.10
960 cu.yd. rock backfill.....		2.30	3.00	2.50	1.25	2.00	2.21
13,700 cu.yd. binder for subgrade.....		.60	.50	.65	.60	.60	.59
6,200 M gal. water applied to surf.....		2.00	2.00	1.75	2.00	2.25	2.00
48,250 tons crusher-run base.....		1.56	1.35	1.75	1.94	1.89	1.70
35,650 tons oil-treated gravel or stone surf.....		2.00	1.80	2.40	2.49	2.47	2.23
1,100 cu.yd. gravel or stone screenings.....		2.50	2.00	2.00	2.25	2.50	2.25
1,000 bbl. fuel oil.....		2.50	2.30	3.00	2.50	2.75	2.61
40 cu.yd. 'A' concrete (structures).....		30.00	25.00	30.00	26.00	40.00	30.20
1,550 lb. reinforcing steel (struct.).....		.06	.06	.10	.06	.07	.07
16 ft. 12-in. corr. pipe, place.....		.75	.70	2.00	.40	1.00	.97
352 ft. 18-in. corr. pipe, place.....		.75	.75	2.00	.50	1.00	1.00
202 ft. 24-in. corr. pipe, place.....		.75	1.00	2.00	.75	1.00	1.30
74 ft. 30-in. corr. pipe, place.....		1.00	1.00	2.00	.90	1.50	1.28
72 ft. 42-in. corr. pipe, place.....		1.50	1.50	2.00	1.25	2.00	1.65
0.2 mile move and reset property fence.....		\$250	\$300	\$500	\$400	\$300	\$350
1,126 stations finishing roadway.....		4.00	3.00	5.00	5.00	4.00	4.20

PORTLAND, ORE.—STATE—MALHEUR COUNTY—SURFACING

Contract awarded to Willamette Contracting Co., Pilot Rock, Ore., who bid \$114,433 for 7 miles resurfacing and 15 miles surfacing, Harper-Vale Section of the Central Oregon Highway, for Oregon State Highway Commission. Bids on following main items:

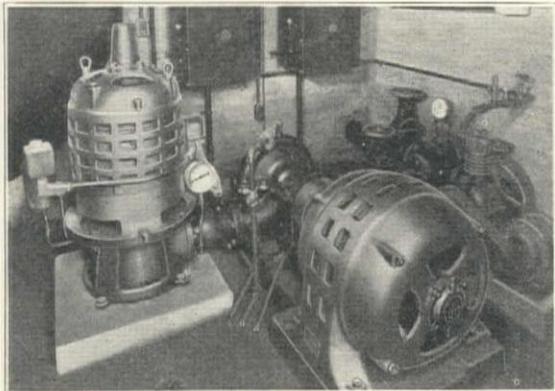
(1) 12,000 cu.yd. common embankment.....	(6) 5,500 cu.yd. grade 'A' material (stockpiles)
(2) 32,000 cu.yd. base course surfacing.....	(7) 5,500 cu.yd. grade 'B' material (stockpiles)
(3) 10,000 cu.yd. top course surfacing.....	(8) 12,000 cu.yd. earth filler
(4) 10,000 cu.yd. base course resurfacing.....	(9) 16,000 cu.yd. haul broken stone (pile measure)
(5) 4,600 cu.yd. top course resurfacing.....	(10) 24,000 yd.mi. filler haul
	(1) (2) (3) (4) (5) (6) (7) (8) (9) (10) TOTALS
Willamette Contr. Co.....	.40 1.40 1.40 1.40 1.40 1.00 1.00 .20 .16 .16 \$114,433
Joslin & McAllister.....	.60 1.30 1.30 1.30 1.30 .90 .90 .30 .30 .20 114,581
J. F. Konen.....	.30 1.49 1.49 1.49 1.49 1.01 1.01 .30 .16 .17 120,693
Wren & Greenough.....	.25 1.65 1.65 1.42 1.42 1.00 1.00 .20 .16 .16 124,172
Gerber & Doherty.....	.30 1.60 1.60 1.60 1.60 1.02 1.02 .25 .16 .16 125,699
Carl Nyberg.....	.35 1.58 1.58 1.58 1.58 1.10 1.15 .30 .18 .17 127,697
Knute Lein.....	.25 1.56 1.56 1.56 1.56 1.56 1.56 .25 .20 .20 130,067
Quinn-Robbins Co.....	.35 1.77 1.58 1.51 1.51 1.20 1.10 .35 .20 .18 134,498
Triangle Const. Co.....	.40 1.78 1.87 1.58 1.65 1.35 1.25 .25 .25 .20 142,675
Newport Const. Co.....	.30 1.80 1.80 2.20 2.20 1.35 1.35 .30 .18 .18 149,181
Milne & Dussault.....	.40 1.98 1.98 1.98 1.98 1.98 1.98 .35 .20 .18 165,032

SACRAMENTO, CALIF.—STATE—KERN COUNTY—SURFACING

Los Angeles Decomposed Granite Co., 2171 W. Washington Blvd., Los Angeles, who bid \$50,379 (as stated in our issue of Oct. 16), submitted low bid to California Division of Highways, Sacramento, for 12.2 miles surfacing with oil treated crushed gravel or stone from Pentland to San Emigdio Road, KERN COUNTY. Bids on:

(1) 22,900 tons oil treated crushed gravel or stone surface.....	(3) 566 bbl. fuel oil (seal coat)
(2) 890 tons gravel or stone screenings.....	(4) 12.2 miles finishing shoulders
	(1) (2) (3) (4) TOTALS
L. A. Decomposed Granite Co., Los Angeles.....	1.97 1.60 1.40 \$250 \$50,379
Tieslau Brothers, Berkeley.....	2.25 2.10 2.35 \$250 57,774
Hartman Const. Co., Bakersfield.....	2.35 2.50 1.75 \$211 59,607
Hemstreet & Bell, Marysville.....	2.55 2.00 2.00 \$150 63,137
V. R. Dennis Construction Co., San Diego.....	2.90 2.00 2.00 \$250 72,372
Average bid.....	2.40 2.04 1.90 \$222 60,654

"UNIT-BUILT" pumping equipment



A typical Fairbanks-Morse Price Turbine Pump installed with an F-M Centrifugal Booster Pump unit.

backed by a single responsible manufacturer

IT is wise to regard the purchase of a motor driven turbine pump as an investment in water service. How important, then, is the reputation of the manufacturer upon whose guaranty you depend . . . and how vital that permanent service facilities be available.

Your investment is protected *permanently* when you buy a Fairbanks-Morse Price Turbine Pump. The entire unit—motor and pump—is guaranteed by an organization recognized throughout the world. Complete Fairbanks-Morse service departments are maintained in all principal cities . . . prompt service is always available.

Fairbanks-Morse Price Turbine Pumps are made in sizes to suit every practical condition. Complete information will be sent upon request.

Fairbanks-Morse Price Turbine Pumps may be purchased under
CONDITIONAL
PURCHASE
AGREEMENT
FOR DEEP WELL
PUMPS
Approved as to form
by California Farm
Bureau Federation,
University of California

FAIRBANKS, MORSE & CO., Chicago

LOS ANGELES, CALIF. 423 East Third Street
SAN FRANCISCO, CALIF. Spear and Harrison Sts.
PORTLAND, ORE. East First and Taylor Streets
SEATTLE, WASH. 550 First Avenue, S.
SPOKANE, WASH. 1113 West Railroad Avenue
SALT LAKE CITY, UTAH. 14 S. West Temple
TACOMA, WASH. 432 Perkins Building

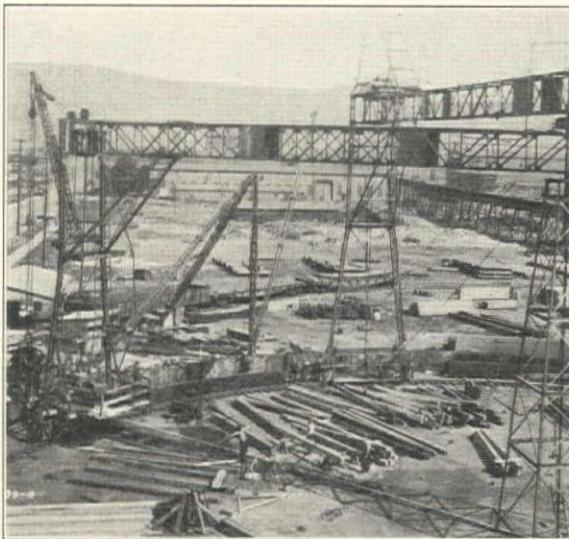
FAIRBANKS-MORSE
PUMPS — MOTORS
SCALES — DIESEL ENGINES



PA 95.8

used by thousands

FOR all kinds of work—all over the world—there are thousands of Clyde hoists being used by satisfied owners. Built for performance and service, they justify the highest expectations of the most critical operator. Below is shown a gas tank being built at Duluth, by the Stacey Mfg. Co. Three Clyde hoists are working on this job—a two drum gas hoist operates the derrick in the background—a two drum steam operates the traveling crane—and a two drum electric operates the riveter.



CLYDE IRON WORKS SALES CO. DULUTH, MINN.

Western Distributors:
Concrete Machinery & Supply Co.
777 E. Merrill Ave.
Los Angeles, Calif.
Garfield & Co.
1232 Hearst Building
San Francisco, Calif.

WATER SUPPLY SYSTEMS

EVERETT, WASH.—CITY—CONCRETE DAM—SULTAN RIVER PROJECT

Contract awarded to Parker-Schramm Co., Couch Bdg., Portland, Ore., who bid \$85,890 for constructing concrete Sultan River Dam for the City of Everett, Washington. Bids on following main items:

(1) 4,600 cu.yd. excavation, solid rock	(5) 3,200 cu.yd. Class "C" concrete	(9) 300 lin.ft. copper water stops
(2) 1,500 cu.yd. excavation, common	(6) 27,000 lb. reinforcing steel	(10) 12,000 lb. structural steel
(3) Lump sum diversion	(7) 500 lin.ft. grout holes	(11) 36,000 lb. install gates and hoists
(4) 550 cu.yd. Class "B" concrete	(8) 20 cu.yd. cement grout	(12) 200 cu.yd. hand-placed rock
	(1) (2) (3) (4) (5) (6) (7) (8) (9) (10) (11) (12)	TOTALS
Parker-Schramm Co.	4.00 1.50 \$7,000 25.00 11.25 .06 1.00 15.00 1.00 .15 .04 2.50	\$85,890
Morrison-Knudson Co.	4.00 2.00 7,500 24.00 14.00 .07 1.00 50.00 1.00 .10 .03 2.50	95,560
Coyle Construction Co.	8.00 1.50 6,000 21.00 19.50 .08 3.00 80.00 .75 .05 .07 5.00	131,293

Baar & Cunningham, Spalding Bdg., Portland, Oregon, are Consulting Engineers.

EVERETT, WASH.—STEEL PIPE-LINE—CITY—SECTION 5, SULTAN RIVER PROJECT

Contract awarded to Pacific Bridge Co., E. Water and Salmon Sts., Portland, Ore., \$345,615 for Section 5, pipe-line from Ebey Slough to Everett, Sultan River Water Project for the City of Everett, Wash. Bids on main items received from:

(1) Pacific Bridge Co., Portland..... \$345,615 (3) Chasteen & Dorsey, Bellingham, Wash..... \$359,733
 (2) Coluccio & Arcorace, Seattle..... 357,387 (4) Western Pipe & Steel Co., San Francisco..... 361,483

UNIT A

	C N T R A					C N T R A				
	(1)	(2)	(3)	(4)		(1)	(2)	(3)	(4)	
7 acres clearing	\$100	\$250	\$305	\$200	500 cu.yd. gravel backf.		3.00	2.00	2.05	4.00
2 acres grubbing	\$150	\$300	\$405	\$200	7,050 ft. 48 by 3 $\frac{1}{2}$ -in. steel pipe		10.70	10.50	10.48	10.00
300 yd. excav. struct.	2.75	.90	.10	4.00	7,050 ft. wrapping 48-in. pipe		.34	.36	.34	.55
7,600 yd. excav. common	1.10	.90	1.00	1.50	10 48-in. Dresser couplings		68.50	70.00	70.00	37.05

UNIT B

	COST B					COST B			
	(1)	(2)	(3)	(4)		(1)	(2)	(3)	(4)
500 yd. excav. rock.....	3.50	.90	.10	4.00	1,140 ft. wrapping 48-in. pipe.....	.35	.36	.34	.55
11,800 yd. excav. com.....	1.10	.90	.98	1.25	7,750 ft. 40 by $\frac{1}{4}$ -in. steel pipe.....	6.75	6.60	6.61	6.24
500 yd. gravel backf.....	2.00	2.00	2.00	2.50	7,750 ft. wrapping 40-in. steel pipe.....	.29	.30	.29	.46
520 ft. 48 by $\frac{1}{4}$ -in. steel pipe.....	10.15	10.40	10.35	9.30	930 ft. 24 by $\frac{1}{4}$ -in. steel pipe.....	3.75	3.75	3.67	3.60
1,140 ft. 48 by $\frac{1}{4}$ -in. steel pipe.....	10.90	10.70	10.67	10.00	930 ft. wrapping 24-in. pipe.....	.18	.20	.18	.30

UNIT C

	(1)	(2)	(3)	(4)		(1)	(2)	(3)	(4)
2,900 yd. excav. 'A'.....	1.05	2.00	2.35	3.50	16,000 lb. struct. steel.....	.10	.10	.20	.12
4,500 yd. excav. 'B'.....	.95	6.00	4.10	1.50	100 M ft. BM fir timber.....	40.00	45.00	34.50	50.00
2,500 yd. gravel backf.....	1.25	2.50	1.00	2.50	70 M ft. BM cedar timb.....	.50	.50	40.00	70.00
4,500 ft. fir piling, below cutoff.....	.62	.70	.66	.80	70 M ft. BM creo. fir timb.....	75.00	75.00	72.00	89.00
4,400 ft. fir piling, above cutoff.....	.12	.70	.20	.50	145 M ft. BM fir housing.....	37.00	45.00	51.00	57.00
20,000 ft. cedar piling, below cutoff.....	.70	.60	.63	.50	4,250 ft. 48 by $\frac{3}{8}$ -in. steel pipe.....	10.50	11.30	11.26	10.30
1,000 ft. cedar piling, above cutoff.....	.22	.60	.24	.22	4,250 ft. wrapping 48-in. steel pipe.....	.34	.36	.34	.55
45 cu.yd. 'A' concrete.....	40.00	35.00	35.00	35.00	1,800 ft. 36 by $\frac{1}{2}$ -in. steel pipe.....	28.30	18.50	19.30	24.50
280 cu.yd. 'B' concr.....	17.00	22.00	40.60	28.50	1,800 ft. wrapping 36-in. steel pipe.....	.27	.30	.27	.37
225 cu.yd. 'C' concr.....	22.00	20.00	36.50	25.00	130,000 lb. install valves.....	.03	.025	.02	.045

Baar & Cunningham, Spalding Bdg., Portland, Ore., are Consulting Engineers.

SEWER CONSTRUCTION

BERKELEY, CALIF.—CITY—NORTH BERKELEY STORM DRAIN—REINF. CONCRETE AND VITRIFIED

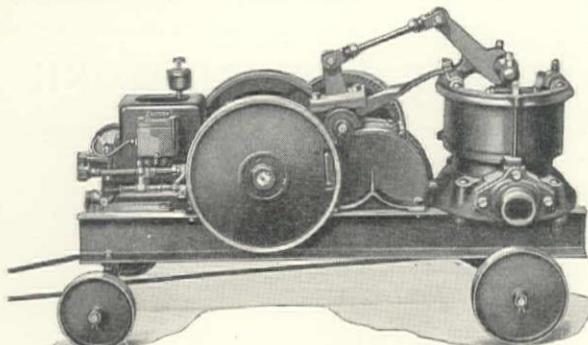
J. C. Hickey, 320 South Palm, Alhambra, \$221,666 low bid to City for North Berkeley Storm Drain system on portions of Regal Road, Spruce St., Los Angeles Ave., The Alameda, Arlington Ave., and other streets. Bids received from:

(1) J. C. Hickey, Alhambra.....	\$221,666	(3) Fredrickson & Watson Constr. Co., Oakland.....	\$249,443
(2) W. J. Tobin, Oakland.....	234,664		
		(1) (2) (3)	(1) (2) (3)
38,875 cu.yd. excavation.....	1.40	2.18	2.20
560 lin.ft. 70-in. reinf. conc. pipe.....	16.00	13.50	15.65
1,210 lin.ft. 69-in. reinf. conc. pipe.....	14.00	12.00	13.80
765 lin.ft. 66-in. reinf. conc. pipe.....	13.00	11.00	12.60
940 lin.ft. 60-in. reinf. conc. pipe.....	12.00	10.00	11.35
785 lin.ft. 57-in. reinf. conc. pipe.....	11.00	9.50	10.80
410 lin.ft. 51-in. reinf. conc. pipe.....	10.00	8.25	9.30
680 lin.ft. 48-in. reinf. conc. pipe.....	9.00	6.95	7.70
120 lin.ft. 45-in. reinf. conc. pipe.....	8.00	6.20	6.85
1,500 lin.ft. 42-in. reinf. conc. pipe.....	7.00	5.90	6.70
1,765 lin.ft. 39-in. reinf. conc. pipe.....	6.50	5.50	6.20
2,145 lin.ft. 36-in. reinf. conc. pipe.....	5.50	5.15	5.65
2,915 lin.ft. 33-in. reinf. conc. pipe.....	5.25	4.60	4.90
1,565 lin.ft. 30-in. reinf. conc. pipe.....	5.00	4.28	4.50
1,675 lin.ft. 27-in. reinf. conc. pipe.....	4.00	3.55	3.70
2,425 lin.ft. 24-in. reinf. conc. pipe.....	3.00	3.00	3.15
475 lin.ft. 21-in. reinf. conc. pipe.....	2.50	2.68	2.65
920 lin.ft. 18-in. reinf. conc. pipe.....	2.50	2.47	2.30
1,075 lin.ft. 15-in. reinf. conc. pipe.....	2.00	1.78	1.40
750 lin.ft. 12-in. vitrified pipe.....		2.00	2.00
1,260 lin.ft. 10-in. vitrified pipe.....		2.00	1.50
200 lin.ft. 8-in. vitrified pipe.....		1.00	1.50
100 lin.ft. 6-in. vitrified pipe.....		1.00	1.50
100 lin.ft. 4-in. vitrified pipe.....		1.00	1.00
69 standard manholes.....		100.00	100.00
2 water seal manholes.....		100.00	150.00
55 catchbasins, type 1.....		100.00	150.00
5 catchbasins, type 2.....		150.00	150.00
7 catchbasins, type 3.....		100.00	60.00
3 curb inlets, type 1.....		90.00	50.00
10 curb inlets, type 2.....		75.00	50.00
12 sanitary intercepts.....		25.00	10.00
50 cu.yd. class 'A' concrete.....		30.00	20.00
40 cu.yd. class 'B' concrete.....		25.00	15.00
20 cwt. reinforcing steel.....		5.00	7.00
30 cu.yd. foundation rock.....		5.00	5.00
1,000 sq.ft. asphalt paving.....		.50	.60
3,000 sq.ft. oil macadam paving.....		.25	.50

City will pay \$13,000 cash, balance under 1911 Act. Harry Goodridge is City Engineer, and Sam Hart is City Storm Drain Engineer.

PUMPS FOR EVERY SERVICE

Dewatering Trenches and Excavations,
Oil Transfer, Highway Construction
Service and All Industrial Conditions
WATER SYSTEMS FOR ALL PURPOSES



LAUSON PORTABLE PUMPER

Gas Engine or Motor Direct Connected Units

DEEP WELL TURBINES



WOODIN & LITTLE, INC. PUMPS

33-41 Fremont Street San Francisco
Phones Davenport 0670-0671

Chlorine

plays a vital part in Western Industry. Thousands of tons are used yearly in bleaching and sterilizing wood pulp and paper in the Northwest; in sterilization of water supplies; in sewage disposal plants.

Great Western Electro-Chemical Company established the pioneer electrolytic chlorine plant of the Coast in 1916; today Great Western uses sixteen of the world's largest single-unit chlorine tank cars, of 30-ton capacity; four single-unit cars of 15-ton capacity; and thirteen cars of 15 one-ton-unit capacity, for supplying its widespread chlorine customers.

BLEACH
AMMONIA
CAUSTIC
CHLORINE
XANTHATE
SULPHUR-
DIOXIDE
FERRIC-
CHLORIDE

Great Western Electro-Chemical COMPANY

9 Main Street, San Francisco, California
Works at: PITTSBURG, CALIFORNIA

FOR SALE

400 Tons used Lackawanna
Arch Web Sheet Piling
Both 14" and 15" sections
Lengths from 20' to 50'
Tees and Corners

One—75 hp. Fairbanks Morse
semi-Diesel stationary type

One—110 hp. Pacific, full Diesel
stationary type, almost new

Two—200 hp. stationary full
Diesels

Priced Low for Quick Sale

United Commercial Company, Inc.

Representing HYMAN MICHAELS COMPANY, Chicago
234 STEUART STREET 837 MERRILL AVENUE
SAN FRANCISCO LOS ANGELES



Soulé Steel Industrial Buildings

Electric
Are
Welded



Soule Steel Buildings are electric arc welded, insuring strength, safety and permanence. Note the clean cut steel construction and absence of dirt collecting gusset plates in the above photo.

Write for Information

SOULÉ STEEL COMPANY

SAN FRANCISCO

LOS ANGELES

PORTLAND

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 October, 1929, for construction projects in the Far Western States total \$68,056,775, of which \$29,456,775 was for *Building Construction, balance of \$38,600,000 for Engineering Construction, as follows:	
Paving	\$ 3,650,000
Grading, highways	2,325,000
Bridges	2,200,000
Sewers	1,660,000
Water supply systems	3,340,000
Irrigation and reclamation	925,000
Power development	8,000,000
River and harbor work	500,000
Railroad construction	500,000
Lighting systems	500,000
Oil pipe lines	15,000,000
Building construction	\$38,600,000
	\$29,456,775
	\$68,056,775

*Building permits compiled by S. W. Straus & Co.

LARGE WESTERN PROJECTS

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

WORK CONTEMPLATED

Junior high school building on 25th and Noe Sts. for City and County of San Francisco; \$650,000.
 Addition to Meier & Frank building at Portland, Ore.; \$2,000,000.
 Paving 84 blocks for City of Santa Clara, Calif., with concrete and asphalt.
 Disposal plant and sewers in Mission Valley for San Diego County, Calif.; \$400,000.
 Wells, pumps and reinforced concrete pipe-lines for Riverside County Water Works District 1, California; \$681,250.
 Pipe-line for City of San Diego, known as Lower Otay line; \$1,500,000.
 Reservoirs, pipe-lines for City of Helena, Mont.; \$400,000.
 Wells, pumps, and canals for Tranquillity Irrigation District, California.
 Store at San Jose, Calif., for Hale Bros.; \$500,000.
 Seawall for City of Seattle, Wash., from Madison St. to Bay St.; \$1,172,000.
 Hotel at San Jose for San Jose Community Hotel Co.; \$375,000.
 Normal school at Honolulu for University of Hawaii; \$500,000.
 Water, sewer, park, and other improvements for City of Phoenix, Ariz.; \$4,828,000.
 Club building for Olympic Club at San Francisco; \$14,000,000.
 Paving, sewer and water mains, bridges, piers, and lighting system on Lido Island for City of Newport Beach, Calif.; \$1,100,000.
 Aptos Junior High School on Aptos and Westgate Aves., San Francisco; \$750,000.
 Hotel at San Rafael, Calif.; \$1,000,000.
 Reservoirs and pipe-lines for City of Helena, Mont.; \$400,000.
 Engineering building for University of California at Berkeley; \$700,000.
 Marine Hospital at Presidio, San Francisco, for Government; \$1,500,000.

BIDS RECEIVED

Steel viaduct on E. 11th St. for City of Tacoma, Wash.; Lindstrom & Feigenson, Portland, \$434,596, low.

CONTRACTS AWARDED

College building for University of California at Los Angeles, to P. J. Walker Co., Los Angeles, \$500,000.
 Dam for Inland Power & Light Co. at Kelso, Wash. (first unit of \$8,000,000 project) to Phoenix Utility Co., New York, N. Y.
 Factory for Meese & Gottfried Co., on Paul and San Bruno Aves., San Francisco, to Austin Co. of California, San Francisco, \$500,000.
 Pipe-line for City of Everett, Wash., from Ebey Slough to City, Pacific Bridge Co., Portland, \$345,616.
 Hotel on Post & Leavenworth Sts., San Francisco, to E. B. DeGolia, to Cahill Bros., San Francisco, \$600,000.

STREET and ROAD WORK

WORK CONTEMPLATED

BERKELEY, CALIF.—Plans by H. Goodridge, City Engineer, for improving San Pablo Ave., involving 174,500 sq.ft. grading, 174,500 sq.ft. 6-in. rock cushion, 115,000 sq.ft. 5-in. asphalt base with 2-in. Warrenite Bit. surface, 190,000 sq.ft. Warrenite resurfacing, vitrified sewers, concrete sewers, etc. 1911-15 Acts. Bids after Nov. 19. 10-30

CULVER CITY, CALIF.—Plans by Geo. E. Lee, City Engineer, protests Nov. 18, for improving Sepulveda Blvd. from Venice Blvd. to Centinela Blvd., involving 472,000 sq.ft. 6-in. asphalt base with 2-in. Warrenite Bit. surface, 450,000 sq.ft. 6-in. concrete base with 2-in. Warrenite Bit. surface, 1,620,000 sq.ft. grading, reinforced concrete pipe, etc.; \$350,000. 10-26

FRESNO, CALIF.—Plans by City Engineer, A. M. Jensen, protests will be heard Nov. 14, for improvement of alleys as follows: Paving alley Block 36, City of Fresno, 6-in. concrete pavement. Paving alley Block 9, Central Addition, 5½-in. asphaltic concrete pavement. Work under 1911 Improvement Act. 10-28

LOS ANGELES, CALIF.—Plans by County Surveyor, protests Nov. 18, for (1) Improving Shepard Lane and La Canada Blvd., involving 5945 cu.yd. excavation, 96,977 sq.ft. 3-in. oil-macadam, curbs, gutters, reinforced concrete pipe, etc.; (2) Cerritos Ave. from Center St. to Long Beach, involving 15,697 cu.yd. excavation, 217,660 sq.ft. 8-in., 6-in. concrete paving, 228,370 sq.ft. 5-in. disintegrated rock subbase; and (3) Milton St. from Pasadena to Rosemead Blvd., involving 4055 cu.yd. excavation, curbs, gutters, sidewalks, 20,488 sq.ft. 8-in. concrete paving, 69,058 sq.ft. 3-in. asphalt base with 2-in. Warrenite Bit. surface. 10-24

NWPORT BEACH, CALIF.—Plans by R. L. Patterson, City Engineer, for improving Lido Island, involving 36,100 cu.yd. excavation, 737,509 sq.ft. 6-in. Warrenite Bit. paving, 271,755 sq.ft. 4-in. Warrenite Bit. paving, 28,000 ft. 6-in. to 15-in. vitrified sewers, 38,000 ft. 4-in. to 12-in. cast-iron pipe, 2571 ft. 8-in. cast-iron sewer, steel plate bridge, involving 150 tons structural steel, lighting system, etc. Cost \$1,100,000. 1911 Act. 10-29

PALO ALTO, CALIF.—Plans by City Engineer, J. F. Byxbee, Jr., protests Nov. 12, for improving Middlefield Road from Seale Ave. to Embarcadero Road and Lane 8 from Homer to Channing Aves., grading, concrete curbs, sidewalks, driveways, and concrete paving. 1911-15 Acts. 10-23

SACRAMENTO, CALIF.—Bids to 2 p.m., Nov. 20, by California Division of Highways for: (1) SANTA BARBARA COUNTY—5.5 miles from Eagle Creek to El Capitan Creek, involving 4390 tons broken stone and 325 bbl. heavy fuel oil; and (2) VENTURA COUNTY—2.3 miles from Conejo Creek to Camarillo, involving 6800 cu.yd. roadway embankment, 6750 tons asphalt concrete, etc. 10-23

SAN DIEGO, CALIF.—Plans by H. W. Jorgensen, City Engr., for improving 34th St., involving 55,494 sq.ft. 4-in. asphalt base with 2-in. Warrenite Bit. surface, 1207 ft. 6-in. 'B' cast-iron pipe, 1 hydrant, etc. 11-2

SAN DIEGO, CALIF.—Plans by H. W. Jorgensen, City Engineer for: (1) Improving Del Mar Ave., involving 55,417 sq.ft. 6-in. asphalt paving, 80 ft. 10-in. and 210 ft. 6-in. C cast-iron pipe, etc.; and (2) McClintock St., involving 43,473 sq.ft. 6-in. concrete paving, 1 hydrant, 1207 ft. 6-in. cast-iron mains, etc. Bids after Nov. 12. 10-19

SAN DIEGO, CALIF.—Plans by H. W. Jorgensen, City Engineer, for improving Coronado Ave., involving 51,330 sq.ft. 6-in. asphalt paving, 2 hydrants, 1267 ft. 6-in. 'C' cast-iron pipe. Bids after Nov. 18. 10-26

SAN JOSE, CALIF.—Plans by W. L. Popp, City Engr., for improving Sherwood Ave. and Portola Ave., grading, paving with 2½-in. asphalt base with 1½-in. asphalt surface, cast-iron house sewers. Bids after Nov. 12. 11-1

SANTA CLARA, CALIF.—Plans by City Engineer, Geo. Sullivan, for the paving of 84 city blocks on portions of Fremont, Benton, Liberty, Lexington, Alviso, Sherman, Madison, Jefferson, University, Bellomy streets. Work is to be divided into three districts, and three contracts will be awarded. In two of the districts the paving is to be asphalt concrete and in the other district the paving is to be concrete. 10-22

SOUTH SAN FRANCISCO, CALIF.—Plans by Geo. A. Kneese, City Engr., for improving Third St., involving 12,500 sq.ft. 6-in. waterbound macadam paving, 37,000 sq.ft. 3-in. asphalt surface, vitr. sewer, etc. 10-30

VALLEJO, CALIF.—Plans by City Engineer, T. D. Kilkenny, protests Nov. 12, for improvement of Maxwell Alley from 112 ft. east of Sutter St. to Napa St., work consisting in the main of grading, paving with 5-in. concrete, 16 ft. wide; construction of 3 by 12-in. redwood curbs, etc. Work under 1911-15 Acts. 10-28

PROVO, UTAH—Plans by City Engineer, F. W. Deming, for paving various streets to cost \$150,000.

FOR SALE

ALL MACHINERY AND EQUIPMENT USED IN CONSTRUCTION OF THE PARDEE DAM

Motors
Transformers
Compressors
Jack Hammers
Drill Steel
Crushers
Conveyors
Belts
Classifiers
Screens

Bin Gates
Pulleys
Blocks
Hoists
Cable
Lathes
Concrete Mixers
Locomotives
Dump Cars
Rails
Switches

Mine Timbers and Lumber
Blacksmith Shop Equipment
Machine Shop Equipment
Drill Sharpening Equipment
Welding and Cutting Equipment
Refrigerating Equipment
Kitchen Equipment

Ties
Dump Wagons
Telephones
Bolts and Nuts
Jacks
Pipe
Pipe Fittings
Valves
Pipe Tools
Pumps

Gravel Plant Equipment
Carpentry Equipment
Engineering Equipment
Office Equipment
Railroad Equipment
Mining Equipment

Copper Wire
Gas Engines
Tool Steel
Iron Bars
Iron Plates
Iron Drills
Derricks
Chain Blocks
Beds
Cots
Mattresses

Stoves
Tents
Tableware
Ice Machines
Desks
Doors
Windows
Pool Tables
Store Fixtures
Tanks

Draglines and Gas Shovels
Plumbing and Bathroom Fixtures
Electrical Equipment
Rigging Equipment
Concrete Placing Equipment
Cableways
Tramways

All above machinery and equipment may be inspected and purchased at the

PARDEE DAMSITE EQUIPMENT YARD

located on State Highway 30 miles east of Stockton—turn north at Valley Springs.

ATKINSON CONSTRUCTION COMPANY

P. O. Address: VALLEY SPRINGS, CALIF.

S
T
E
E
L



DETROIT, MICH., 1,500,000 GALS.

T
A
N
K
S

FOR JOINT STRENGTH

FOR DRIVING ALIGNMENT

RAYMOND COMPOSITE

WE BROKE away a section of concrete to show how the timber part of these piles keys into the concrete. This Raymond joint means a composite pile of known carrying capacity and absolutely true alignment in driving.

RAYMOND CONCRETE PILE CO.

NEW YORK: 140 Cedar Street
RAYMOND CONCRETE PILE CO., LTD.,
Montreal, Canada

CHICAGO:
111 West Monroe
Street

Branch Offices
in All Principal
Cities

Pittsburgh-Des Moines Steel Co.

358 Rialto Building
San Francisco, California

946 Tuttle Street
Des Moines, Ia.



3160 L. C. Smith Bldg.
Seattle, Wash.

Pittsburgh New York Atlanta Chicago Dallas

BIDS BEING RECEIVED

PHOENIX, ARIZ.—Bids to 2 p.m., Nov. 13, by Arizona Highway Commission for (1) 17 miles Florence-Tucson Highway from Coolidge south towards Picacho, involving 140,000 cu.yd. borrow excavation, 25,000 cu.yd. ditch excavation, 3600 cu.yd. concrete, 108,000 lb. reinforcing steel; and (2) 6 miles Ashfork-King Highway, involving 7800 cu.yd. roadway excavation, 18,000 cu.yd. borrow, 16,000 cu.yd. surfacing, 38,000 cu.yd. fill (bridge), 920 cu.yd. concrete, and 96,000 lb. reinforcing steel. 10-19

BURBANK, CALIF.—Bids to 7:30 p.m., Nov. 19, by City Clerk for improving: (1) Sunset Canyon Drive from Olive Ave. to Walnut Ave., grading, concrete paving, curbs, curtain walls, fire hydrants, and cast-iron mains; (2) Glenoaks Blvd. from Providencia Ave. to east city limits, grading, 8-in. concrete paving, cast-iron water mains, curbs, gutters, etc., and culverts; and (3) Flower St. from Olive St. to Alameda Ave., grading, 5-in. asphalt paving, curbs, cast-iron mains. 11-1

LONG BEACH, CALIF.—Bids to 2 p.m., Nov. 18, by City Clerk for: (1) 53rd St. from Long Beach Blvd. to Linden Ave., by construction of curbs, sidewalks, and water mains. (2) 31st St. from Cedar to Main Aves., Cedar St., and other streets by curbs, sidewalks, and water mains. (3) To alleys, near Rose Ave. and near Magnolia Ave., by 6-in. concrete paving, etc. 10-26

LOS ANGELES, CALIF.—Bids to 2 p.m., Nov. 18, by County for improving 2000 ft. Third St. in Belvedere, involving 25,008 cu.yd. excavation, 71,394 sq.ft. 1½-in. oil macadam paving, conc. and corr. pipe. 11-1

MARYSVILLE, CALIF.—Bids to 8 p.m., Nov. 18, by City Clerk for sidewalks on B St., F St., G St., etc., involving 28,593 sq.ft. cement sidewalk. 1911-15 Acts. 10-30

SACRAMENTO, CALIF.—Bids to 2 p.m., Nov. 13, by California Division of Highways for: (1) HUMBOLDT COUNTY—1.2 miles from Garberville to Bluff Creek, involving 119,600 cu.yd. roadway excavation, 1,096,200 sq.yd. overwash, concrete structures, corrugated pipe and 3200 cu.yd. gravel or stone surfacing; and (2) ORANGE COUNTY—6.4 miles from Sunset Beach to Newport Beach, involving 204,000 cu.yd. roadway excavation, 7400 cu.yd. concrete paving, 172,000 lb. reinforcing steel, reinforced concrete headers, etc. 10-16

SAN BERNARDINO, CALIF.—Bids to 7:30 p.m., Nov. 12, by City Clerk for: (1) Improvement of E St., Mill St., Valley St., Livingstone St., etc., work consisting of constructing concrete curbs, concrete sidewalks, concrete gutters, concrete driveways, culverts, pipe drains, 5-in. asphalt concrete paving, 8-in. vitrified pipe sewer, and reinforced concrete drains; and (2) Improvement of portions of 28th and other streets, work consisting of constructing concrete curbs, concrete sidewalks, 5-in. macadam paving, and 8-in. vitrified pipe sewers. 11-1

SAN DIEGO, CALIF.—Bids to Nov. 18 by City Clerk for: (1) Improving 40th St., involving 287,293 sq.ft. 6-in. concrete paving, 7708 ft. 6-in. 'C' cast-iron pipe, 9 hydrants, etc.; (2) Florida St., involving 98,192 sq.ft. 6-in. concrete paving, 2421 ft. 6-in. cast-iron pipe, 3 hydrants; and (3) Santa Cruz Ave., involving 75,648 sq.ft. 6-in. concrete paving, 299 ft. 6-in. and 80 ft. 10-in. 'C' cast-iron pipe, 2 hydrants. 11-2

SAN DIEGO, CALIF.—Bids to 11 a.m., Nov. 21, by Public Works Office, 11th Naval District, for paving extension of seaplane runway on North Beach, Naval Operating Base, Air Station, San Diego, work consisting of a reinforced concrete runway extension, concrete piles, granite block and plain concrete surfacing of present runway, and a cofferdam. 11-4

SAN FRANCISCO, CALIF.—Bids to 2 p.m., Nov. 26, by U. S. Bureau of Public Roads, 461 Market St., San Francisco, for 2.19 miles Project 2A4 from Grouse Creek to Turtleback Dome, Wawona Road, Yosemite National Park, involving 85,000 cu.yd. excavation, etc. 11-4

VENTURA, CALIF.—Bids to 11 a.m., Nov. 13, by Joint Highway District 6, for 6 miles grading Maricopa-Carpinteria Road, from Cuyama 650,000 yd. excavation, corrugated pipe, etc. 10-18

MISSOULA, MONT.—Bids to 3 p.m., Nov. 14, by U. S. Treasury Department, Washington, D. C., for the construction of a new concrete driveway and other work at the U. S. Postoffice and courthouse at Missoula, Mont. 10-31

OLYMPIA, WASH.—Bids to Nov. 19 by State Highway Commission for: PACIFIC COUNTY—2.2 miles of Ilwaco-North Head Road, involving 9.3 acres clearing, 59,950 cu.yd. excavation, 6540 cu.yd. crushed stone surfacing, 336 lin.ft. pipe culverts, etc. CLALLAM and JEFFERSON COUNTIES—19.3 miles of State Road No. 9, Tyee to Hoh River, involving 40,340 cu.yd. crushed stone surfacing. 10-25

BIDS RECEIVED

HOLBROOK, ARIZ.—Western Roads Co., 1305 28th St., Oakland, \$81,808, low for 6-in. Warrenite-bitulithic paving Porter, S. Central and other streets for City.

PHOENIX, ARIZ.—Yglesias Bros., Spreckels Bdg., San Diego, who bid \$10,361, submitted low bid for surfacing of the Mesa-Florence Highway for the Arizona State Highway Commission, Phoenix. The project begins at a point 1.8 miles west of Apache Junction and extends 1.8 miles east to Apache Junction. 10-23

PHOENIX, ARIZ.—F. D. Shuffelbarger, Albuquerque, N. M., \$174,003, low for 22.5 miles grading and steel bridge on Holbrook-Lupton Highway from west of Sanders to Arizona-New Mexico Line for State Highway Commission. 11-5

PHOENIX, ARIZ.—Dudley & Amesbury, Box 108, El Paso, Tex., \$16,196 low bid to State for surfacing Globe-Safford Highway west of Bylas. 11-1

PHOENIX, ARIZ.—Phoenix-Tempe Stone Co., Phoenix, Ariz., \$29,763, low for improving Willetta St., Culver St., etc., paving with 5-in. bitulithic paving.

LOS ANGELES, CALIF.—Low bids as follows to City: (1) Geo. R. Curtis Paving Co., 2440 E. 26th St., Los Angeles, \$120,524 low for grading, paving, etc., on Riverside Drive, between Los Feliz Blvd. and

north city boundary, by asph. conc. pave., wooden guard rail, traffic markers, etc. Next lowest bidder was Gibbons & Reed Co., \$120,635. (2) J. L. McClain, 3052 W. Slauson Ave., Los Angeles, low at \$67,464 for improvement of streets in Mansfield Ave. and First Improvement District, by grading, conc. paving, water system, etc. 11-1

OAKLAND, CALIF.—Oakland Paving Co., 5000 Broadway, Oakland, \$36,792 low bid to City for improving Camden St., Courtland Ave., etc., paving with 3-in. asphalt base with 2-in. National surface, vitrified conduit, concrete box culvert. 10-23

OAKLAND, CALIF.—L. J. Cohn, 117 Montgomery St., San Francisco, \$14,558, low bid to City for improving Steel St. from Buell St. north, filling, concrete culvert, vitrified conduit. 10-23

SACRAMENTO, CALIF.—Bids received as follows by California Division of Highways: (1) LOS ANGELES AND VENTURA COUNTIES—Southwest Paving Co., Washington Bdg., L. A., \$51,361 low for oil-treated rock borders from Calabasas to Conejo; (2) INYO COUNTY—Allied Contractors, Inc., Ludlow, Calif., \$239,792 low for 21.3 miles grading and oil-treated gravel or stone surfacing from Coso Junction to Olancha; (3) Hemstreet & Bell, Marysville, \$37,330 low for 8.7 miles surfacing MENDOCINO COUNTY from Arnold to Sherwood-Laytonville Road; and (4) HUMBOLDT COUNTY—Englehart Paving & Const. Co., Eureka, \$27,050 low for 7.3 miles gravel or stone surfacing from Bean Creek to Fish Creek. (See Unit Bid Summary.) 10-31

SACRAMENTO, CALIF.—Los Angeles Decomposed Granite Co., 2171 W. Washington Blvd., L. A., \$50,379 low for 12.2 miles surfacing with oil-treated crusher gravel or stone from Pentland to San Emigdio Road, KERN COUNTY, for California Division of Highways. 10-17

SACRAMENTO, CALIF.—Grier & Taylor, 480 Chetwood St., Oakland, \$59,941 low for 26 miles gravel or stone surfacing from Bayha to La Moine, SHASTA COUNTY, for California Division of Highways. 10-24

BOISE, IDA.—C. H. Robinson, Twin Falls, Ida., \$103,692, low bid to State for 23.42 miles grading and 9.9 miles gravel surfacing Old Oregon Trail Highway from Regina to Mt. Home, ADA and ELMORE COUNTIES. 11-2

PORTLAND, ORE.—Morrison Trucking Co., foot of E. Salmon St., Portland, Ore., \$174,480, low for 10.2 miles resurfacing Rhododendron-Government Camp Section, Mt. Hood Highway, CLACKAMAS COUNTY, for State. 11-2

PORTLAND, ORE.—Jas. Tobin & Son, Clarkston, Wash., \$75,118, low to Bureau of Public Roads for 2.7 miles grading Mt. Hood Loop Highway, CLACKAMAS COUNTY, ORE. Bids rejected as too high. 10-25

CONTRACTS AWARDED

NOGALES, ARIZ.—To Schmidt & Hitchcock, Phoenix, Ariz., who bid as follows for the improvement of the Arroyo and Arroyo Blvd: 773 lin.ft. concrete curb, Det. 8..... .80 78 lin.ft. concrete curb, Det. 9..... .80 4,774 sq.ft. 4-in. concrete sidewalk..... .22 126 sq.ft. 10-in. monolithic concrete sidewalk and curb..... .40 5,223 sq.ft. 6-in. monolithic concrete sidewalk and curb..... .30 65 sq.yd. 5-in. concrete driveway..... 2.75 2,406 sq.yd. 6-in. concrete paving..... 2.60 2,600 sq.yd. 4-in. concrete paving..... 2.60 428 cu.yd. reinforced concrete in walls and abutments..... 22.00 4 cu.yd. concrete (cutoff wall)..... 22.00 1,537 cu.yd. reinforced concrete in Arroyo covering, reinforced with steel rails..... 23.00 1 manhole, adjusted..... 20.00 1 manhole and steps in Arroyo..... 30.00

ALHAMBRA, CALIF.—To Hall-Johnson Co., Alhambra, \$14,235 for improving Seventh St., paving with asphalt, vitrified sewers, etc., for City. 10-22

BERKELEY, CALIF.—To Perez & Gatto, 475 Tenth St., Richmond, \$2478 for macadam paving Rose St. for City. 10-22

DAVIS, CALIF.—To A. Teichert & Sons, 1846 37th St., Sacramento, who bid about \$48,000 to the University of California, Berkeley, for constructing asphalt roads at the University Farm, Davis, Yolo County. 10-28

LONG BEACH, CALIF.—To Griffith Co., Los Angeles Railway Bdg., Los Angeles, \$12,024 for improving Pleasant Ave., curbs, walks and water mains for City.

LONG BEACH, CALIF.—Awards as follows to Griffith Co., Los Angeles Railway Bdg., Los Angeles, for curbs, walks, and water mains: \$12,024 for Pleasant Ave., 49th St., etc.; and \$5389 for Pleasant St. from Virginia Ave. to Long Beach Blvd.

LOS ANGELES, CALIF.—Awards as follows to Griffith Co., L. A. Railway Bdg., Los Angeles, \$61,695 for Walnut St. from Spring St. to city limits, grading, sidewalks, curbs, gutters, and asphalt paving; and \$87,820 for Soto St. from city limits to 37th St., asphalt paving, reinforced concrete culverts, etc. 10-24

LOS ANGELES, CALIF.—To P. P. Janich, 406 Pacific Southwest Bank Bdg., Long Beach, who bid \$88,327 to County for improvements in C. I. No. 872, Olive St., between east city limits of Compton and Ocean Ave., 1.91 miles, involving in the main: 17,076 cu.yd. excavation, 4652 ft. curb, 328,345 sq.ft. 8-6-in. concrete pavement, 378,733 sq.ft. 5-in. disintegrated rock subbase, 2340 ft. 8-in. vitrified sewer, 2390 ft. 4-in. cast-iron water mains, 640 ft. 6-in. cast-iron water mains, 2550 ft. 10-in. cast-iron water mains, 6 fire hydrants. 10-30

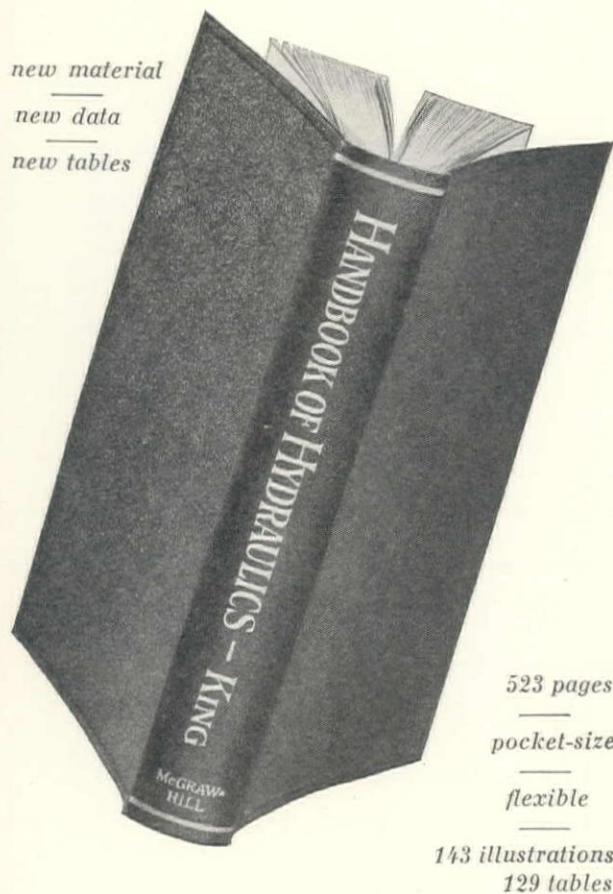
LOS ANGELES, CALIF.—Awards as follows by County: (1) To J. E. Haddock, 357 N. Chester Ave., Pasadena, \$37,544 for improving 1 mile of Garvey Ave. and Mountain View Road, grading, concrete paving; and (2) To Griffith Co., L. A. Railway Bdg., Los Angeles, \$53,649 for improving Stewart and Gray Road, grading, concrete paving, etc.

LOS ANGELES, CALIF.—To Griffith Co., L. A. Railway Bdg., Los Angeles, \$96,605 for improving streets in M St. and Machado Ave. District, grading, concrete paving, storm drain, sanitary sewer and water mains, etc., for City. 10-18

LOS ANGELES, CALIF.—To J. Tomei, 559 Madison Ave., Culver City,

Up-to-date information for the solution of hydraulic problems—

The new second edition of a well-known reference book—a real time and trouble saver for the hydraulic engineer. This book covers every phase of common practice and many special problems.



JUST OUT

Handbook of Hydraulics

For the Solution of Hydraulic Problems

BY HORACE E. KING

Professor of Hydraulic Engineering
University of Michigan

The information presented is derived from actual experiment and experience. This second edition has been edited and improved in the light of eleven years of wide and constant use by engineers everywhere.

A new chapter on critical depth and hydraulic jump, including tables for solving the more important formulas has been added. The section treating of natural streams has been enlarged and more extensive discussion given to the methods of measuring flowing water.

Contents

I. Hydraulic Units.	VIII. Critical Depth and Hydraulic Jump.
II. Hydrostatics.	IX. Measurement of Flowing Water.
III. Orifices, Gates and Tubes.	X. Natural Streams.
IV. Sharp-crested Weirs.	XI. Tables.
V. Weirs Not Sharp-crested.	
VI. Pipes	
VII. Open Channels.	

\$4.00 postpaid

FOR SALE BY:

WESTERN CONSTRUCTION NEWS, INC.
BOOK DEPARTMENT
114 SAN SOME STREET
SAN FRANCISCO :: :: CALIFORNIA

RAILROAD TIES FOR SALE

In connection with the completion of the Pardee Dam the Atkinson Construction Company will dismantle and remove during November approximately five miles of Standard Gauge Railroad previously operated by them at Valley Springs, California, 35 miles east of Stockton, California.

These ties have been down less than two years. Quantity approximately 14,000. Size 6 inches by 8 inches. Length 8 feet.

All ties used on this branch line, including switch ties, are now offered for sale at the following bargain prices for delivery after November 1st, and parties contemplating railroad construction in the near future should particularly note the especially low prices quoted for delivery during November at the time of railroad removal.

Quantity discounts and prices for orders	For delivery in ballast after rail removal in November	For delivery F.O.B. cars Valley Springs at time of rail removal	For delivery F.O.B. cars Valley Springs from storage after Dec. 1st
Less than 1,000 ties	30c	35c	40c
Less than 2,500 ties	25c	30c	35c
Less than 5,000 ties	20c	25c	30c
More than 5,000 ties	15c	20c	25c

Switch Ties at \$10.00 per 1,000 Feet, Board Measure

The above material and other equipment may be inspected by visiting the Pardee Damsite, located on the State Highway to San Andreas, near Valley Springs, California, about 35 miles east of Stockton, Calif. Address inquiries to:

ATKINSON CONSTRUCTION
COMPANY

VALLEY SPRINGS :: :: :: CALIFORNIA

Attention: C. L. BRAINERD, Equipment Manager

KARTSCHOKE CLAY PRODUCTS CO.

MANUFACTURERS OF:

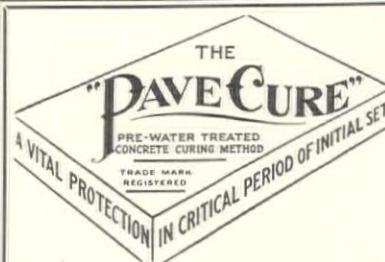
VITRIFIED CLAY SEWER PIPE
COMMON BRICK CHIMNEY PIPE
FLUE LININGS and DRAIN TILE

Plant and Offices:

FOURTH AND KEYES STREETS

PHONE BAllard 7570

SAN JOSE, CALIF.



Finished
Concrete
Colors

DARK (Killglare)
WHITE (Natural Cement)
Process Patents Pending

The Modern Scientific Concrete Curing Method
Attracting the attention of Engineers and Contractors because of its simplicity, cleanliness, effectiveness and low cost.

Write today for full particulars and printed data

CONCRETE CURING Inc.
760 Market St., San Francisco
Phone: SUtter 8849

\$13,293 for improving 89th St. from Normandie Ave. to Halldale Ave., grading, concrete paving, etc. for City.

MARTINEZ, CALIF.—To Central Construction Co., Oakland Bank building, Oakland, \$43,282 for improving Colusa St., El Cerrito, paving with 4-in. asphalt base with 2-in. Warrenite Bit. surface for County. 11-4

OAKLAND, CALIF.—To Heafey-Moore Co., 344 High St., Oakland, who bid \$8132 to City of Oakland for improvement of Elmar Ave. between Warner Ave. and 99th Ave., by excavation, 2-in. asphalt concrete base, 3-in. macadam foundation and 2-in. Willite surfacing, vitrified pipe sewers, etc. 10-30

OAKLAND, CALIF.—To W. H. Hauser, 3129 E. Seventh St., Oakland, who bid \$1.90 per ft., or \$17,081 total bid, to City of Oakland, for grading and macadam paving of Hegenberger Road. 10-26

PACIFIC GROVE, CALIF.—Awards as follows by City: (1) To Clark & Henery, Chancery Bdg., San Francisco, who bid \$3767 for improvement of 17th St., from Gibson to Siney Aves., by concrete curb, gutter, sidewalk, 3-in. cracked rock base, 2-in. asphalt surface, grading, 3 Union metal electroliners, etc. (2) To Clark & Henery, at \$4934, for 14th St., by concrete curb, gutter, grading, 4-in. asphalt pavement, 4-in. laterals, etc. 10-28

PLACERVILLE, CALIF.—To F. Schmershal, Placerville, \$3030 for concrete paving Main St. for City. 10-24

REDDING, CALIF.—To Hemstreet & Bell, Marysville, \$11,137 for producing, hauling, and placing gravel or stone from Butte county line to Red Bluff, TEHAMA COUNTY, for District Engineer, California Division of Highways. 10-23

SACRAMENTO, CALIF.—To Hemstreet & Bell, Marysville, who bid \$11,750 to Division of Highways, District Engineer, 502 State Office Bdg., Sacramento, for surfacing with crushed untreated gravel or stone, EL DORADO COUNTY, between Logtown and 4 miles southerly, about 3.8 miles. 10-28

SACRAMENTO, CALIF.—To C. R. Merrill, Williams, who bid \$11,251, only bid to California Division of Highways, District Engineer, Sacramento, for 6.9 miles widening existing roadbed to 26 ft. from Colusa to Meridian, COLUSA COUNTY. 10-23

SALINAS, CALIF.—To Granite Construction Co., Watsonville, \$24,594 for rock surfacing Old Toll Road from Castroville to Werner Hill for County. 10-26

SALINAS, CALIF.—Awards as follows by County for gravel and rock surfacing: (1) To J. L. Conner, Monterey, \$5916 for Lonoak Road at King City east; (2) To Karsted & Karstedt, 668 Morse St., San Jose, \$11,122 for Carmel Valley Road from Hatton Corner to Laureles Grade; (3) To Granite Construction Co., Watsonville, \$6235 for Salinas River Road and \$5572 for streets in Gonzales. 11-4

SAN DIEGO, CALIF.—To R. E. Hazard Contracting Co., 2548 Kettner Blvd., San Diego, who bid \$87,922 to City of San Diego, for improvement of Estelle and other streets by excavation, embankment, 4-in. asphalt base with 2-in. Durite top, sidewalks, curb, concrete sewer main, cast-iron water main, water services, fire hydrants. 10-30

SAN FRANCISCO, CALIF.—Awards as follows by City: (1) To J. F. Dowling, 251 Kearny St., San Francisco, who bid \$6975 for improvement of Ortega St., between 45th and 46th Aves., etc., by 6-in. concrete base and 1½-in. asphalt surface. (2) To Chas. L. Harney, Call Bdg., San Francisco, who bid \$4053 for improvement of Joost Ave., between Detroit and Edna Sts., by curbs, sidewalks, vitrified pipe culvert, concrete pavement, 6-in. concrete base with 1½-in. asphalt surfacing. (3) To Chas. L. Harney, Call Bdg., San Francisco, who bid \$5411 for portions of 28th Ave., by paving with 6-in. concrete base and 1½-in. asphalt surface, and side sewers. (4) To E. J. Treacy, Call Bdg., San Francisco, who bid \$10,103 for improvement of Holladay Ave., between Peralta Ave. and York St., by concrete curb, sidewalk, 4 by 4-in. precast 'A' concrete fence rail, 6-in. concrete pavement, etc. 10-25

SAN JOSE, CALIF.—To San Jose Paving Co., San Carlos and Dupont Sts., San Jose, who bid \$38,584 for improvement of Myrtle St., between Villa Ave. and Newhall St., work consisting of grading, paving with 2½-in. asphalt base and 1½-in. asphalt concrete surface, construction of cement concrete curbs, gutters, sidewalks, 6-in. vitrified sewer, 4-in. vitrified laterals, etc. 10-22

SAN MATEO, CALIF.—To Malott & Peterson, 20th and Harrison Sts., San Francisco, \$1254 for surfacing two tennis courts for San Mateo Junior College. 11-2

SANTA ROSA, CALIF.—Awards as follows by County: (1) Contract awarded to W. C. Colley, Navarro, Mendocino County, who bid 46½¢ per cu.yd. for grading 2½ miles of the Mark West Road, work involving 20,000 cu.yd. roadway excavation. (2) Contract awarded to R. Press Smith, Santa Rosa, who bid as follows for the improvement of Sonoma Ave. at Penngrove, involving 2200 cu.yd. roadway excavation at 55¢, and 540 cu.yd. rock surfacing at \$1.00. 10-19

SAN RAFAEL, CALIF.—Awards as follows by County: (1) To Pacific States Construction Co., Call Bdg., San Francisco, \$25,962 for improving streets in town of Bolinas, involving grading, corrugated pipe, reinforced steel, redwood timber, asphalt penetration macadam, etc. (2) To P. S. Harless, PO Box 594, San Rafael, \$8995 for 0.3 miles paving in town of Tiburon, involving grading, vitrified pipe, asphalt paving. 10-16

SOUTHGATE, CALIF.—To Kovacevich & Price, Inc., 4379 Tweedy Blvd., Los Angeles, \$163,833 to the City for improvement of streets in the Tweedy Homesites Tract, work consisting of concrete paving, grading. 10-19

TRACY, CALIF.—To Heafey-Moore Co., 344 High St., Oakland, who bid \$51,952 for improvement of portions of Highland Ave., Twelfth St., Bessie Ave., Wall St., Parker Ave., Walnut St., Adam St., etc., for City, concrete paving etc. 10-30

DENVER, COLO.—Award recommended to Lee Moor Contracting Co., El Paso, Tex., who bid \$80,651 for grading and surfacing 3.7 miles of Hondo-Mescalero Project, in LINCOLN COUNTY, N. M., for Bureau of Public Roads. 10-28

BOISE, IDA.—To Wm. Hoops, Twin Falls, Id., \$11,962 for gravel surfacing from St. Anthony to Ashton for State.

BOISE, IDA.—Awards as follows by State Highway Commission: (1) To Wm. Hoops, Twin Falls, Id., \$11,720 for gravel surfacing 2 miles of Sawtooth Park Highway from Picabo to Richfield, LINCOLN COUNTY; and (2) To Triangle Construction Co., Spokane, Wash., \$34,053 for 2.9 miles grading and rock surfacing North and South Highway from Weiser to Midvale, WASHINGTON COUNTY.

HELENA, MONT.—Awards as follows by State Highway Commission: (1) To Power Const. Co., Helena, Mont., \$31,898 for 9 miles grading Grass Range-Jordan Road; (2) To Crick & Kuney, Spokane, Wn., \$55,195 for 8 miles grading Missoula-Florence Road; and (3) To Stevens Bros., St. Paul, Minn., \$42,960 for grading 8 miles of Malta-Vandalia Road.

CARSON CITY, NEV.—To A. D. Drumm, Fallon, Nev., \$59,488 for 33.91 miles grading and surfacing from north of Springdale to south of Goldfield for State. (See Unit Bid Summary.) 10-31

PORTLAND, ORE.—Awards as follows by State: (1) To H. C. Boyer, Ontario, Ore., \$57,729 for grading 8.4 miles Horse Ridge-Dry River Section, Central Oregon Highway, DESCHUTES COUNTY; and (2) To Willamette Contract. Co., Pilot Rock, Ore., \$114,433 for 22 miles surfacing and 6½ miles widening Harper-Vale Section of Central Oregon Highway, MALHEUR COUNTY. (See Unit Bid Summary.) 11-2

OGDEN, UTAH—Award of contract recommended to Ora Bundy, Ogden, Utah, \$20,955 for 3.6 miles surfacing Zion National Park Highway, WASHINGTON COUNTY, for Bureau of Public Roads.

OLYMPIA, WASH.—Awards as follows by State Highway Commission: (1) To Frank McHugh, 1450 Elliott Ave. West, Seattle, who bid \$103,573 on Schedule A, and \$103,434 on Schedule B, for clearing, grading, and draining about 2.3 miles of State Road No. 2, Renton, West section of the Sunset Highway in King County. (2) To Graham Bros. & Medley, Chehalis, who bid \$68,117 for clearing, grading, and draining about 0.19 mile of State Road No. 8, Summit Creek section, Klickitat County. 10-25

ROSWELL, N. M.—To New Mexico Construction Co., Albuquerque, N. M., \$85,831 for paving Second, Third Sts., etc., for City.

SEATTLE, WASH.—To Northwest Construction Co., Seattle, \$46,074 for grading W. 75th St., etc., for City.

SEATTLE, WASH.—To Moceri Bros., Seattle, \$73,165 for concrete paving Glenn Way, etc., for City.

BRIDGES and CULVERTS

WORK CONTEMPLATED

SANTA ROSA, CALIF.—Plans by County Surveyor, E. A. Peugh, for the construction of reinforced concrete pile trestle over main fork of Green Valley Creek on the Sebastopol-Guerneville Highway to be about 150 ft. in length. 11-5

BIDS BEING RECEIVED

LOS ANGELES, CALIF.—Bids to 2 p.m., Nov. 12, by County for wooden trestle on Sepulveda Blvd., over Ballona Creek. 10-17

LOS ANGELES, CALIF.—Bids to 2 p.m., November 13, by District Engineer, Division of Highways, Associated Realty Bdg., Los Angeles, for cleaning and painting the steel bridge over the Santa Ana river, south of Huntington Beach, in ORANGE COUNTY. 10-30

MARTINEZ, CALIF.—Bids to 11 a.m., Nov. 18, by County Clerk for wooden bridge over Hastings Slough near Avon, \$600. 10-22

MERCED, CALIF.—Bids to 2 p.m., Nov. 13, by County Clerk for concrete bridge over Mustang Creek on Montpelier and Ryer Road. 10-26

SACRAMENTO, CALIF.—Bids to 2 p.m., Nov. 27, by California Division of Highways, for: MARIN COUNTY—Bridge over Corte Madera Creek at Greenbrae, involving 7300 ft. douglas fir, 27,500 ft. redwood piles, 2100 cu.yd. concrete, 140,000 lb. reinforcing steel, 355,000 lb. structural steel, 161 M ft. BM redwood timber; (2) SHASTA COUNTY—6 timber bridges on Redding-Altruras Lateral, involving 187 M ft. redwood, 175 cu.yd. 'B' concrete; and (3) LOS ANGELES COUNTY—Bridge over La Canada Canyon, involving 1400 cu.yd. concrete, 173,000 lb. reinforcing steel. 10-30

SACRAMENTO, CALIF.—Bids to 2 p.m., Nov. 13, by California Division of Highways for reinforced concrete bridge near Tejon Station, SAN BERNARDINO COUNTY, involving 366 cu.yd. concrete, 32,500 lb. reinforcing steel, 11,000 cu.yd. roadway excavation. 10-16

SACRAMENTO, CALIF.—Bids to 2 p.m., Nov. 20, by California Division of Highways, for: PLACER AND EL DORADO COUNTIES—A 322-ft. suspension bridge across north fork of American River, 2½ miles east of Auburn, work involving 125 cu.yd. 'B' concrete, 3800 lin.ft. galvanized steel bridge rope, 800 lin.ft. galvanized iron guy rope, 72,000 lb. structural metal, 75 MBM douglas fir. IMPERIAL COUNTY—Undergrade crossing under tracks of San Diego & Arizona RR near Coyote Wells, work involving 5100 cu.yd. roadway excavation, 490 cu.yd. 'B' concrete, 28 cu.yd. 'A' concrete, 46,000 lb. structural steel, 4 MBM creosoted douglas fir timber. 10-23

BIDS RECEIVED

PHOENIX, ARIZ.—Cotey & Bowman, Clifton, Arizona, who bid \$16,117, as follows, only bid submitted to Arizona State Highway Commission for bridge work on the Rice-Springerville Highway: \$5980 for Mining Canyon Bridge, one 80-ft. steel span, dismantling, hauling, re-erecting, cleaning, and painting, new timber deck and handrail, etc.; \$10,937 for Post Office Canyon Bridge, one 138-ft. steel span, dismantling, hauling, re-erecting, cleaning and painting, new timber deck and handrail, etc. 11-1

PHOENIX, ARIZ.—General Const. Co., 602 So. 7th St., Phoenix, \$40,633 low bid to State for overpass on Phoenix-Prescott Highway. 10-30

Riveted Steel Water and Well Pipe



Pressure, Irrigation and Domestic Water Mains—Non-Corrosive Covering
OIL, WATER AND TRUCK TANKS, GENERAL SHEET METAL WORK
LACY MANUFACTURING COMPANY

601 Washington Building

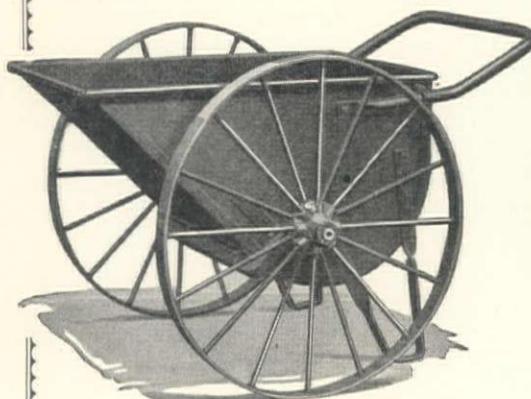
Phone TRinity 1661

ADDRESS DEPT. C

LOS ANGELES, CALIF.

Sterling Carts and Barrows

Sterling Carts are made with either oval or flat tired wheels. All wheels have 16 spokes.

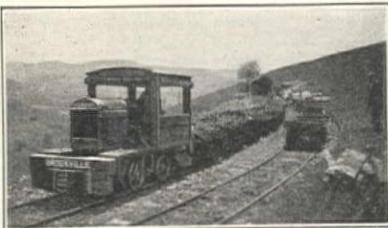


Sterling Cart Trays have unusual strength due to the rolled rod rim and special handle construction. Carts that will stand the hardest use. Wheels have replaceable bushings.

Harron, Rickard & McCone Co.

SAN FRANCISCO
1600 Bryant Street

LOS ANGELES
2205 Santa Fe Avenue



6-Ton Model "IBY"

BROOKVILLE LOCOMOTIVES

OFFERS the McCormick-Deering Model 20 and new 15/30 Industrial Tractor Power Units. The simplest, most satisfactory power units ever used on construction or maintenance equipment where hard usage and unfavorable conditions predominate. These power units used in locomotives in models 4 to 12 tons.

Also 2, 3, and 3½-ton models with the new "AA" Ford truck power unit, offering speed, pulling power, etc., that is a revelation in the light locomotive world. Combined with Brookville reliability on locomotive parts, and local service on Ford "AA" mechanism, used intact barring six machined parts in Ford truck differential.

For full data, write direct to

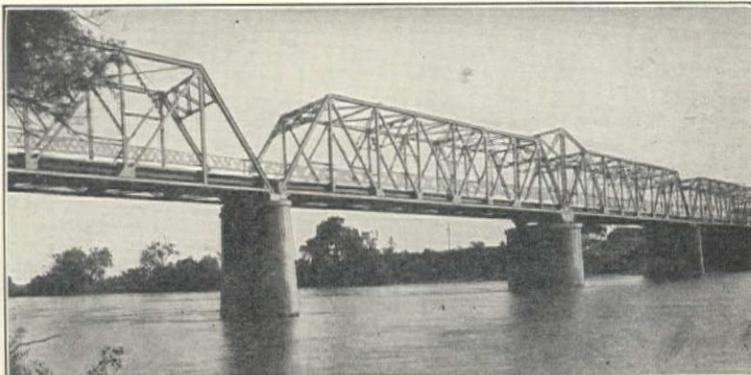
BROOKVILLE LOCOMOTIVE COMPANY

BROOKVILLE, PENNSYLVANIA

or Pacific Coast Distributors

B. HAYMAN & COMPANY, Inc.—Since 1876
118 No. Los Angeles Street, Los Angeles, Calif.

CONSTRUCTION EQUIPMENT AGENCY
83 Fourth Street :: :: :: San Francisco, Calif.



Woodson Bridge Tehama County, Bordwell & Zimmerman, General Contractors, J. B. Leonard, Engineer

STEEL and MACHINERY
furnished by

Western Iron Works

Structural Steel Contractors
BRIDGES • **BUILDINGS**

141-147 Beale Street and 132-148 Main Street
 Telephone Davenport 2575
 San Francisco, California

PHOENIX, ARIZ.—General Const. Co., Box 1813, Phoenix, Ariz., \$40,633 low for reinf. concrete overpass and grading roadway on Phoenix-Prescott Highway for State. 11-1

LOS ANGELES, CALIF.—E. S. Johnson, 401 S. Parkwood Blvd., Pasadena, \$14,948 low bid to City for steel, concrete and timber bridge over Los Angeles River on Chester Ave. 10-25

SACRAMENTO, CALIF.—Low bids as follows by California Division of Highways: (1) LOS ANGELES COUNTY—Johnson Const. Co., 2131 Barclay St., L. A., \$88,054 low for widening concrete and timber bridge over San Gabriel River on Foothill Blvd.; and (2) MARIN COUNTY—Siemer, Kendall & F. J. Main, San Anselmo, \$17,190 low for overhead, crossing over N.W. Pacific RR. near Greenbrae. (See Unit Bid Summary.) 10-31

SACRAMENTO, CALIF.—Gutleben Bros., 4815 Calaveras Ave., Oakland, \$281,542 low bid to California Division of Highways for steel bridge over San Luis Rey River near Oceanside, SAN DIEGO COUNTY. (See Unit Bid Summary.) 10-17

SAN FRANCISCO, CALIF.—E. J. Longyear, Minneapolis, Minn., \$29,950 low bid to Golden Gate Bridge & Highway District, Room 1514, Claus Spreckels Bdg., 703 Market St., San Francisco, for land and water test borings in the sites of the main piers and anchorages of the Golden Gate Bridge between Fort Point and Lime Point, San Francisco Harbor. Healy-Tibbets Const. Co., San Francisco, \$79,200, only other bidder. 10-29

DENVER, COLO.—J. F. Roberts & Sons, Tramway Bdg., Denver, Colo., \$140,102, low for 1260 ft. steel bridge in POWERS COUNTY north of Lamar for State. (See Unit Bid Summary.)

SEATTLE, WASH.—Puget Sound Bridge & Dredging Co., Central Bdg., Seattle, \$482,181 low for 1356-ft. steel and concrete bridge on 14th Ave. south over Duwamish waterway for County. 10-22

CONTRACTS AWARDED

MODESTO, CALIF.—To Geo. J. Ulrich Construction Co., Modesto, \$11,000 for 3 reinforced concrete bridges for County. 10-16

SACRAMENTO, CALIF.—To McDonald & Maggiora, 236 Second St., Sausalito, who bid \$20,035 to California Division of Highways, Sacramento, for reinforced concrete bridge over San Antonio Creek, 6 miles south of Petaluma, in SONOMA and MARIN COUNTIES. 10-23

SACRAMENTO, CALIF.—Awards as follows by California Division of Highways, Sacramento: (1) To M. B. McGowan, Call Bdg., San Francisco, who bid \$23,543 for two timber bridges near French Camp at Sta. 685 and 698, SAN JOAQUIN COUNTY. (2) To H. C. Whitty, Sanger, who bid \$11,644 for timber bridge over Villa Creek, 23 miles north of San Simeon, MONTEREY COUNTY. 10-23

SALINAS, CALIF.—To Oakland Harbor Construction Co., First National Bank Bdg., Oakland, \$27,689 for two steel trestle bridges, one over San Lorenzo Creek near Lonoak, and one over Panchorico Creek near San Ardo for County. 10-26

SAN RAFAEL, CALIF.—To W. L. Proctor, Santa Rosa, \$1162 for concrete culvert on Upper Black Point Road near Novato. 10-16

SANTA CRUZ, CALIF.—To Rocca & Caletti, PO Box 243, San Rafael, \$48,493 for reinforced concrete bridge on Riverside Ave. over San Lorenzo River for City. (See Unit Bid Summary, Oct. 25th issue.) 10-22

BOISE, IDA.—Awards as follows by State Highway Commission: (1) To J. H. Forbes, Caldwell, Ida., \$8952 for concrete bridge over Sage Creek and Dry Creek, WASHINGTON COUNTY; and (2) To C. F. Dinsmore & Co., Ogden, Utah, \$23,975 for steel and concrete bridge over Wood River near Kethum, BLAINE COUNTY.

HELENA, MONT.—Awards as follows by State Highway Comm.: (1) To L. V. Lockwood, \$21,973 for timber bridges on Malta-Vandalia Road; and (2) To Stevens Bros., St. Paul, Minn., \$16,015 for bridges on Red Trail Road.

OLYMPIA, WASH.—To R. A. Geary, Yakima, Wash., \$40,314 for 3 reinforced concrete bridges in KITTITAS COUNTY for State. 10-25

SEATTLE, WASH.—To General Construction Co., Colman Bdg., Seattle, who bid \$149,688 for construction of steel and concrete west approach to the West Spokane St. Bridge, for Board of Public Works, Seattle. (See Unit Bid Summary.) 10-21

SEATTLE, WASH.—To Union Bridge Co., Burke Bdg., Seattle, who bid \$381,000 for construction of East Bremerton Bridge to span Port Washington Narrows, for the Bremerton Bridge Co., D. Hartman, Secretary, 306 Burke Bdg., Seattle. 10-23

TACOMA, WASH.—To Lindstrom & Feigenson, Worcester Bdg., Portland, Ore., who bid \$434,596 for construction of steel viaduct on E. 11th St. for the City of Tacoma, Wash. Work involves: 6000 cu.yd. concrete, 532,000 lb. reinforcing steel, 4,677,500 lb. structural steel, 48,000 lin.ft. douglas fir piling. 10-28

SEWER CONSTRUCTION

WORK CONTEMPLATED

ALHAMBRA, CALIF.—Plans by City Engineer, O. N. Rugen, for construction of 45-in. to 70-in. reinforced concrete storm drain system from Alhambra Road to south city limits. Bids will be called for in about one month; \$155,000. 10-21

HAYWARD, CALIF.—Plans by J. B. Holly, City Engineer, for vitrified sewer on Sayre St. Bids after Nov. 6, 1911-15 Acts. 10-21

OJAI, CALIF.—Bond election Nov. 20, by City of Ojai, Ventura County, to vote on issuing bonds in amount of \$20,000 for enlargement of present sewage disposal plant, including construction of sludge tanks, sprinkling filter beds, chlorination plant, and sludge drying beds. 11-4

REDWOOD CITY, CALIF.—Plans by County Engineer, Geo. A. Kneese, resolution of intention will be adopted by County about Nov. 4 for sewers in portions of town of Atherton and North Fair Oaks, work in-

volving 200,000 lin.ft. 6-in., 8-in., 10-in., 12-in., 15-in., 18-in., and 30-in. part vitrified and part concrete sewer. Work under 1911 and 1921 Acts. 10-24

SAN DIEGO, CALIF.—Plans being made, protests Nov. 18, by County for constructing sewer system in portions of Camino Del Rio and other streets. Work consists of vitrified clay, cement concrete, cast-iron, and centrifugal reinforced cement concrete pipe sewer mains, connections, fittings and appurtenances, cement concrete manholes, fittings and appurtenances, cement concrete piers, cement concrete cradles, cement concrete yokes, cement concrete thrust blocks, cement concrete and vitrified clay pipe wye branches, cast-iron water mains, connections, fittings and appurtenances, cast-iron gate valves, valve boxes and covers. Sewage pump station consisting of pump-house, pumps, motors, switches, piping, electrical wiring, stairways together with air connections, fittings and appurtenances; and Sewage Treatment Plant consisting of heater, pumps, motors, switchboard, switches, clarifier equipment and tanks, digester equipment and tanks, chlorinating equipment, chlorine handling equipment, sludge beds, sludge handling equipment, hot water meters, gas meters, condensate trap, thermometers, gas collectors, gas holder, gas pressure relief trap, hydrogen ion and chlorine comparator sets, scales, expansion tank, weirs and ports, screen chamber and equipment, fire place, gas check valves, piping, electrical wiring, stairway, building over clarifiers and control room, together with all other connections, fittings and appurtenances. Work is to be done under the 1921 Act. E. R. Childs is County Surveyor. 11-4

SAN DIEGO, CALIF.—Plans by Engineer, Wm. Rumsey, 3035 C St., San Diego, protests will be heard Nov. 18 by San Diego County with reference to Mission Valley sewer system and treatment plant and paving of Camino Del Rio; \$400,000. Work is to be done under 1921 Act. 10-24

SEBASTOPOL, CALIF.—Bond election soon by City to vote \$22,000 for sewage disposal plant. C. E. Mueller is City Engr. 10-28

MT. VERNON, WASH.—Plans by Engineer, A. H. Dimock, Empire Bdg., Seattle, Wash., for sewer improvements to cost \$100,000, consisting of 14,000 ft. 8-in. to 36-in. vitrified or concrete sewer, installation of two pumping stations. Work is for City of Mt. Vernon, Wash. 10-23

BIDS BEING RECEIVED

SAN MARIO, CALIF.—Bids to 8 p.m., Nov. 13, by City Clerk for 7330 ft. 8-in. vitrified sewer in Fleur Drive. 11-4

BIDS RECEIVED

LOS ANGELES, CALIF.—Following are 4 low bids received by Board of Public Works, Los Angeles, for constructing Jefferson Storm Drain, Sec. No. 5, 9.38 miles of reinforced concrete pipe:

M. Miller, 208 West Second St., Los Angeles (low).....	\$298,158
M. N. Guho.....	332,714
Radich & Trancich.....	349,747
John Artukovich	350,747

OAKLAND, CALIF.—W. J. Tobin, 527 Balfour St., Oakland, \$7787 low for vitrified sewer in Estates Drive, Bullard Drive, for City. 10-31

OAKLAND, CALIF.—M. Murphy, 1321 Milvia St., Berkeley, \$35,897 low for reinf. concrete box culvert on 50th Ave. from Clement to E. 8th Sts. for City. 10-23

CONTRACTS AWARDED

BERKELEY, CALIF.—To J. C. Hickey, 320 South Palim, Alhambra, who bid \$221,666 to City for North Berkeley Storm Drain system on portions of Regal Road, Spruce St., Los Angeles Ave., The Alameda, Arlington Ave., and other streets in the City of Berkeley and Town of Albany, work consisting in the main of 70-in. to 15-in. machine-made reinforced concrete pipe and 12-in. to 4-in. vitrified pipe. (See Unit Bid Summary.) 10-29

SAN FRANCISCO, CALIF.—Awards as follows by City: (1) To Clinton Construction Co., 923 Folsom St., San Francisco, \$126,581 for Section A reinforced concrete Alemany Blvd. storm drain system from Mission St. west. (2) To Eaton & Smith, 715 Ocean Ave., San Francisco, \$271,255 for Section B, Alemany Blvd., reinforced concrete storm drain system from Bayshore Blvd. west. (See Unit Bid Summary, Oct. 25 issue.) 10-17

SANTA BARBARA, CALIF.—To Robinson-Roberts Co., 112 W. Ninth St., Los Angeles, who bid \$9780 for activated sludge type Sewage Treatment Plant to serve County Hospital. Burns-McDonnell-Smith Co., Western Pacific Bdg., Los Angeles, are the Engineers. 10-16

SANTA CRUZ, CALIF.—To Thompson Bros., Santa Cruz, \$1498 for vitr. sewer on Park Way. 10-29

WATER SUPPLY SYSTEMS

WORK CONTEMPLATED

RIVERSIDE, CALIF.—Petition will be heard by County on Nov. 18 with reference to the formation of Riverside County Water Works District No. 1, which plans the construction of the following improvements: 24 deep wells of which 22 are to be equipped with motors, pumps, casings, valves, etc.; 3300 lin.ft. 20-in. reinforced, double-strength concrete pipe, installed, and valves, etc.; 7900 lin.ft. 16-in. reinforced, double-strength concrete pipe, valves etc., in place; 39,000 lin.ft. 14-in. reinforced, concrete, double-strength pipe, valves, etc., in place; 29,000 lin.ft. 12-in. reinforced concrete, double-strength pipe, valves, etc., in place; 3000 lin.ft. 10-in. reinforced concrete, double-strength pipe, valves, etc., in place; 105,000 lin.ft. high-pressure, reinforced, double-strength concrete pipe, valves, in place; 210,000 lin.ft. low-pressure, concrete pipe in place, also 75 miles of right-of-way. Estimated cost of above work is \$681,250. 10-25

*PONT-A-MOUSSON

CAST IRON PIPE AND FITTINGS

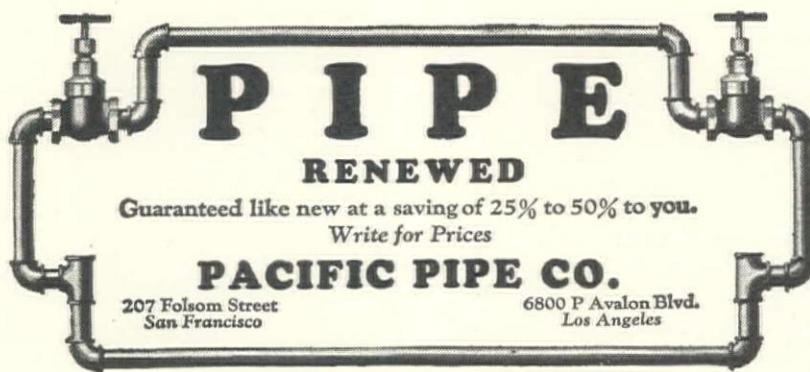
Made in France for America by the famous Societe Anonyme Des Hauts Fourneaux et Fonderies de-Pont-a-Mousson, at Nancy, one of the largest manufacturers of cast iron pipe in the world

C. G. Claussen & Company, Inc.

825 FOLSOM STREET
SAN FRANCISCO

W. M. GARLAND BUILDING
LOS ANGELES

Jobbers for
Youngstown
New
Standard Pipe
Screw Casing
Plain and
Light Weight
Pipe



Jobbers for
Dayton
Couplings
Chapman
Valves
Stockham
Fittings

The Steel Tank and Pipe Co.

of California

DESIGNERS and FABRICATORS

General Plate Work

Gas Holders, Generator Sets, Oil Storage Tanks, Elevated Tanks and Towers, Pressure
Stills, Air Receivers, Grain Elevators, Penstocks and Pipe Lines

Specialists in Both Electric and Gas Welding on Pipe Lines, Stills and Tanks

Factories and Offices:

BERKELEY, CALIFORNIA

PORTLAND, OREGON

The
POWDER GIANT COMPANY

CONSOLIDATED

“Everything for Blasting”

SAN FRANCISCO, CAL.—No. 1 Montgomery Street

Butte, Mont. Los Angeles, Cal. Portland, Ore. Salt Lake City, Utah Seattle, Wash. Spokane, Wash.

SAN DIEGO, CALIF.—City Hydraulic Engineer, H. N. Savage, 524 F St., San Diego, has been instructed to revise plans for the construction of the Second Otay pipe-line, allowing for alternative bids on concrete, steel, and cast-iron pipe. Work involves 89,000 lin.ft. trenching, 43,150 lin.ft. 40-in. pipe-line, 43,000 lin.ft. 36-in. pipe-line, 15,270 lin.ft. 36-in. pipe-line (cast-iron), 7200 lin.ft. tunnel. 10-22

SHOSHONE, IDA.—City is considering \$50,000 bond election to replace various water mains. 10-21

HELENA, MONT.—Bond election soon by the City of Helena, Montana, to vote \$400,000 for: (1) Enlarge distributing reservoir from 850,000 to 6,000,000 gallons capacity, to cost \$40,000 if unlined and \$70,000 if lined; (2) 26-in. continuous wood-stave pipe-line from the reservoir to the City, about 50,000 ft. in length, to cost \$250,000; and (3) New 6,000,000-gallon capacity reservoir, concrete lined, near Holter St., to cost \$75,000. T. Bogy is City Engineer. 11-5

HELENA, MONT.—City is considering following improvements: (1) Enlarge distributing reservoir from 850,000 to 6,000,000-gal. capacity to cost \$40,000, if unlined, and \$70,000 if lined; (2) 26-in. continuous wood-stave pipe-line from the reservoir to City, about 50,000 ft. in length to cost \$250,000; (3) New 6,000,000-gallon capacity reservoir, concrete lined, near Holter St. to cost \$75,000. T. Bogy is City Engineer of Helena, Mont. 10-22

ROOSEVELT, UTAH—Bond election soon by City to vote \$30,000 for water system extensions. 11-5

TREMONTON, UTAH—Plans by City for water supply improvements to cost \$75,000. 11-5

SEATTLE, WASH.—Plans by W. D. Barkhuff, City Engr., for reconstructing Cedar River Pipe Line No. 2 near Renton, involving 3300 ft. 51½-in. steel pipe. 11-4

STEVENSON, WASH.—Plans by Engrs., Miller Engineering Co., Burke Bdg., Seattle, Washington, and bids will be called for shortly by the City of Stevenson, for water system improvements as follows: (1) 200,000-gallon concrete-lined reservoir; and (2) 2 miles of 6-in. pipe. 10-18

SUNNYSIDE, WASH.—Bond election Nov. 22 by City to vote \$60,000 for cast-iron mains and pump house and equipment. 10-18

BIDS BEING RECEIVED

OAKLAND, CALIF.—Bids to 8 p.m., Nov. 13, by East Bay Municipal Utility District, 512 Sixteenth St., Oakland, for furnishing approximately 119 tons of Class B cast-iron pipe of 16-in. diam. and 28½ tons of Class B or 1200 lin.ft. alternate cast-iron pipe of 8-in. diam. 10-26

OAKLAND, CALIF.—Bids to 8 p.m., Nov. 27, by the East Bay Municipal Utility District, 512 16th St., Oakland, Alameda County, for covering 3000 lin.ft. of 16-in. welded steel pipe with a protective reinforced gunite coating. 11-5

MODESTO, CALIF.—Bids to 10:30 a.m., Nov. 13, by County Clerk, Modesto, Stanislaus County, for Unit No. 2, ward building and power house, for the County Hospital. Russell Guerne deLappe and Vladimir Oglou, 1710 Franklin St., Oakland, are the Architects. 10-24

SAN FRANCISCO, CALIF.—Bids to 2 p.m., Nov. 13, by State Harbor Commission, Ferry Bdg., San Francisco, for construction of cold storage plant at Pier No. 48, involving additions and construction of present reinforced concrete building, equipment, etc. 10-25

YOUNTVILLE, CALIF.—Bids to 2 p.m., Nov. 19, by Geo. B. McDougal, State Architect, Sacramento, for two barracks buildings at Veterans' Home, Yountville, Napa County. The buildings will have 45,000 sq.ft. floor area each, plastered concrete exterior walls, concrete floors, wood roof, and concrete and tile partitions. 10-23

SEATTLE, WASH.—Bids to 10 a.m., November 22, by W. D. Freeman, Purchasing Agent, 231 County-City Bdg., Seattle, for furnishing 100,000 board feet wood staves for 78-in. pipe, delivered f.o.b. cars, N.P. Railroad, Selleck, Wash. 11-4

CONTRACTS AWARDED

OAKLAND, CALIF.—Awards as follows by the East Bay Municipal Utility District, 512 16th St., Oakland, for furnishing and delivering equipment for the San Pablo filter plant: (1) Pacific Coast Engineering Co., Oakland, \$4160 for sixteen 18-in. flanged, double-disc, rising stem gate valves with 6-in. hydraulic cylinders. (2) To Rensselaer Valve Co., San Francisco, who bid \$584 for eight 8-in. flanged, double-disc, rising stem gate valves with 6-in. hydraulic cylinders. (3) To Pacific Coast Engineering Co., Oakland, \$180 for four 6-in. flanged, double-disc, rising stem gate valves, 5-in. hydraulic cylinders. (4) To Water Works Supply Co., San Francisco, \$1880 for four 30 by 30-in. bronze mounted sluice gates. (5) To American Cast Iron Pipe Co., San Francisco, \$783 for 24-in. cast-iron pipe and fittings. (6) To American Cast Iron Pipe Co., San Francisco, \$161 for 24-in. cast-iron pipe and fittings. (7) To Richmond Sanitary Co., \$541 for 20-in. cast-iron, flanged, pipe and fittings. (8) To American Cast Iron Pipe Co., \$1807 for 18-in. standard cast-iron, flanged, pipe and fittings. (9) To American Cast Iron Pipe Co., \$99 for 10-in. standard cast-iron, flanged, pipe and fittings. (10) To Lally Co., San Francisco, \$3450 for 768 2½-in. standard wrought-iron pipe, 10 ft. long. (11) To Water Works Supply Co., San Francisco, \$560 for four structural steel operating tables; \$896 for four 4-way cock manifolds; \$600 for 100 4-in. cast-iron, rifled spray, nozzles; and \$360 for four 18-in. cast-steel, flanged, saddle nozzles. (12) To Pacific Coast Engineering Co., Oakland, \$70 for one 10-in. standard check valve with aluminum flap. 10-24

ONTARIO, CALIF.—To Campbell Const. Co., 228 E. Transit St., Ontario, who bid \$9496 for constructing reinforced concrete reservoir for the Monte Vista County Water District. Reservoir is to be 20 ft. high and 80 feet diameter. 10-18

PLACERVILLE, CALIF.—To California Filter Co., 981 Folsom St., San Francisco, \$10,400 for furnishing and installing filtration plant for El Dorado Irrigation District. 10-25

SAN FRANCISCO, CALIF.—To Ajax Construction Co., 635 Mission St., San Francisco, who bid \$827 for auxiliary water system on Rankin St., from Islais St. to Custer Ave., San Francisco, for the Board of Public Works. 10-22

EVERETT, WASH.—Awards as follows by City: (1) To Parker-Schramm Co., Couch Bdg., Portland, Ore., \$85,890 for Sultan River concrete dam; and (2) To Pacific Bridge Co., E. Water and Salmon Sts., Portland, Ore., \$345,616 for steel pipe-line from Ebey Slough to Everett. Baar & Cunningham, Portland, are Engineers. 10-28

SEATTLE, WASH.—Hans Pederson, 1105 Second Ave., Seattle, will sign contract at once and proceed with the construction of Cedar River Pipe-Line No. 4, for the City of Seattle, using wood-stave pipe at a contract price of \$780,419. (See Unit Bid Summary, Oct. 25th issue.) 10-26

IRRIGATION and RECLAMATION

WORK CONTEMPLATED

PHOENIX, ARIZ.—Camelback Water Conservation District has been formed. Pumping system will supply water for the District, which covers approximately 3200 acres of land east of Arcadia and Camelback Mountain. Plans for the work are being prepared by Consulting Engineers, Reed & Baker, Fleming Bdg., Phoenix, Arizona. 11-4

LADERA, CALIF.—Bond election Nov. 13 by Ladera Irrigation District, Ladera, Riverside County, to vote on issuing bonds in the amount of \$200,000, to be used for acquisition of lands, construction of irrigation canals, pipe-lines, flumes, ditches, conduits, reservoirs, pumps, etc. H. Hawgood, H. W. Hellman Bdg., L. A., is Cons. Engineer. 11-4

TRANQUILLITY, CALIF.—Plans by Engineer, Max W. Enderlein, 517 Brix Bdg., Fresno, for construction of works for the Tranquillity Irrigation District, Tranquillity, Fresno County, as follows: 21 wells about 300 ft. in depth, equipped with deep-well turbine pumps; 190,000 cu.yd. earth canal and ditches. 10-24

TURLOCK, CALIF.—Plans by R. V. Meikle, Engr., Turlock Irrigation District, for concrete lining to cost \$40,000. 11-2

BIDS BEING RECEIVED

FRESNO, CALIF.—Bids to 10 a.m., Nov. 21, by Murphy Slough Assn., Pacific Southwest Bdg., Fresno, for cleaning Murphy Slough, involving 15,000 cu.yd. earth excavation. H. M. Crocker, Pacific Southwest Bdg., Fresno, is Engr. 10-29

CONTRACTS AWARDED

BUTTONWILLOW, CALIF.—To A. J. Peterson, Chowchilla Hotel, Chowchilla, who bid 8½¢ per cu.yd. for portion of Alejandro Canal for Buena Vista Water Storage District, Kern County, 14 ft. bottom width, 7 ft. depth, 8 ft. top width of banks, 2:1 inside slopes, 1½:1 outside slopes and 4-ft. average depth of cut, work involving 110,000 cu.yd. excavation. 10-18

MERCED, CALIF.—Awards as follows by Merced Irrigation District: (1) Contract awarded to Carlson Bros., Turlock, who bid \$31,590 for concrete lining on various schedules. (2) Contract awarded to California Corrugated Culvert Co., Berkeley, who bid \$10,74 lin.ft. for furnishing and delivering 858 ft. galvanized metal flume. 10-23

SACRAMENTO, CALIF.—To L. Hecht, 340 Pine St., San Francisco, \$18,102 for 1½ mile reinforced concrete-lined canal near Sutter City for U. S. Engineer's Office, Sacramento. 10-24

SACRAMENTO, CALIF.—Awards as follows by State Division of Water Resources, Sacramento: (1) To P. D. Maritsas, 207 J St., Sacramento, \$1998 for removing obstructions in channel of American River near Sacramento, involving removing piles; and (2) To A. Mitchell, 128 J St., Sacramento, \$875 only bid for clearing in Sacramento Bypass in Yolo County. 10-19

TURLOCK, CALIF.—Awards as follows by Turlock Irrigation District for concrete lining: (1) To Joe Alldrin, Turlock, \$15,208 for concrete lining under Schedules 1 to 5 inclusive; and (2) To Lloyd Terrell, Turlock, who bid \$1552 for concrete lining on Schedule 6. 10-16

VALE, ORE.—Awards as follows by Bureau of Reclamation for earth-work and structures on Bull Creek-West Bench lateral system, Vale project, Oregon: Schedules to 7—To W. H. Puckett Co., Boise, Idaho, \$44,880; Schedules 8 to 15—To Gabby & McNeil, Boise, Idaho, \$36,516. 10-25

COALVILLE, UTAH—To S. H. Newell & Co., 1254 Reed College place, Portland, Ore., who bid \$141,214 on Schedules 1 to 3, inclusive, for earth diversion dam, canals, and structures on the Weber-Provo diversion canal, Salt Lake Basin project, Coalville, Utah, for Bureau of Reclamation. (See Unit Bid Summary, Oct. 25th issue.) 10-25

RIVER AND HARBOR WORK

WORK CONTEMPLATED

NEWPORT BEACH, CALIF.—Bonds voted \$200,000 as follows, were voted by City of Newport Beach, Orange County, for harbor improvements: \$150,000 for dredging entrance to harbor; \$50,000 for building two rock groins. 10-24

BITUMASTIC
REG. U.S. PAT. OFF.

HERMASTIC
REG. U.S. PAT. OFF.

STEEL PROTECTIVE COATINGS

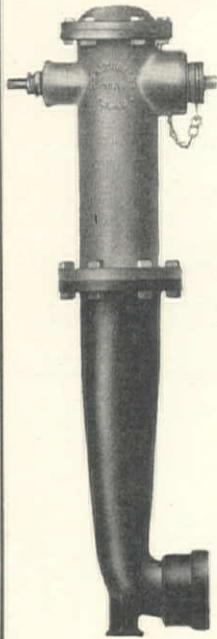
Wailes Dove-Hermiston Corp.

2464 Enterprise Street
LOS ANGELES

345 Vermont Street
SAN FRANCISCO

71 Columbia Street
SEATTLE

FIRE HYDRANTS "CALIFORNIA TYPE"



No. 101

MANUFACTURED AND DISTRIBUTED BY

M. GREENBERG'S SONSBRASS FOUNDRY and MACHINE WORKS
765 Folsom Street
San Francisco

No. 104

Our new
Fire Protection
Catalog "K"
just out.
Send for it.

Bond Issues Bought in Entirety

As Specialists in Municipal
Bonds, we are interested
in the purchase of entire
issues of

CALIFORNIA City, School and Improvement BONDS

Inquiries Invited



R.H. MOULTON & COMPANY

SAN FRANCISCO
405 MONTGOMERY STREET

NEW YORK LOS ANGELES

AMBURSEN DAM COMPANY

INCORPORATED

ENGINEER-CONSTRUCTORS

AMBURSEN DAMS

Hydroelectric Developments—Water Supply
and Irrigation Dams

DAMS ON DIFFICULT FOUNDATIONS

Alexander Building, San Francisco

NEW YORK ATLANTA CHICAGO MONTREAL



WILLIAMS
FAST-DIGGING BUCKETS

GLOBE INDEMNITY COMPANY

Phone D'Avenport 6460 SAN FRANCISCO 444 California Street

DAVID DUNCAN

Resident Manager

FRANK M. HALL

Resident Vice-President

CONTRACT BONDS

"Specify the Globe"

SEATTLE, WASH.—Plans by W. D. Barkhuff, City Engineer for 6000 ft. concrete seawall from foot of Madison St. north to foot of Bay St.; \$1,172,000. 10-28

BIDS BEING RECEIVED

SAN DIEGO, CALIF.—Bids to 11 a.m., Nov. 21, by Public Works Office, 11th Naval Dist., for dredging Area D, involving 35,000 cu.yd., and dredging Area C, involving 35,000 cu.yd.

SEATTLE, WASH.—Bids to 12 m., November 18, by U. S. Engineer Office, 602 Burke Bdg., Seattle, for dredging from the waterway connecting Port Townsend Bay and Oak Bay. 10-18

BIDS RECEIVED

OAKLAND, CALIF.—American Dredging Co., 255 California St., S. F., \$12,440 low for 25,000 to 35,000 cu.yd. dredging in yacht harbor at foot of 19th Ave. for Oakland Port Comm. 11-5

CONTRACTS AWARDED

LONG BEACH, CALIF.—To R. R. Bishop, 334 Prospect Ave., Long Beach, \$97,000 for wharves, bulkhead and fill at Berths 42 and 43, Pier 1, involving 1237 ft. berthing, including creosoted timber wharf, for City. 10-28

SAN FRANCISCO, CALIF.—By Board of State Harbor Commissioners, Ferry Bdg., San Francisco, to Duncanson-Harrelson Co., DeYoung Bdg., San Francisco, who bid \$9332 for the repairs to concrete beams and girders at Pier 26, at the foot of Harrison St., San Francisco. 10-30

FLOOD CONTROL WORK

CONTRACTS AWARDED

LOS ANGELES, CALIF.—To J. D. Harms, 111 Mesnager St., L. A., \$24,150 for guniting levees in San Gabriel Wash from Center St. in Artesia to P.E. Railway tracks for Los Angeles County Flood Control District. 10-30

POWER DEVELOPMENT

CONTRACTS AWARDED

KELSO, WASH.—To Phoenix Utility Co., New York, N. Y., for 200-ft. high concrete dam on Lewis River, to be known as Ariel Dam, near Kelso, Wash., for Inland Power & Light Co., a subsidiary of the Northwestern Electric Co., Portland. Above is in connection with first unit of hydroelectric project for company to cost \$8,000,000. Total cost of the completed project to develop about 54,000 hp., \$12,000,000. 10-24

LIGHTING SYSTEMS

WORK CONTEMPLATED

PACIFIC GROVE, CALIF.—Plans by City Engr., E. Dames, for 45 Union Metal Mfg. Co. electroliers, conduit system, etc., in Central Ave. and Fountain Ave. 1911-15 Acts. 11-5

SACRAMENTO, CALIF.—Plans by B. Clark, City Engr., for 54 single lamp electroliers on Fremont Way, Sutter Way, Third Ave., etc. Bids after Nov. 14. 10-29

SAN JOSE, CALIF.—Plans by Wm. Popp, City Engr., for 18 single lamp electroliers on San Carlos St. from 4th to 7th Sts. Bids after Nov. 12. 10-29

BIDS BEING RECEIVED

LODI, CALIF.—Bids to 5 p.m., Nov. 18, by City Clerk for furnishing, f.o.b. cars, Lodi: Nine metal poles; three mast arms 40 ft. long; six mast arms 25 ft. long; two 24-in. lamp brackets; 16 deep bowl reflectors, 12 reflecting skirts; 500 ft. galv. steel chain; 2000 ft. wire, etc., to be used on a tennis court. 11-1

CONTRACTS AWARDED

BERKELEY, CALIF.—To City Improvement Co., 2055 Center St., Berkeley, who bid \$61,620 for electric lighting system consisting of 166 heavy duty, fluted steel poles, and brackets supporting twin lamps, together with the necessary conductors and appurtenances, installed on both sides of San Pablo Ave., from north side of Virginia St. to south boundary of the City. 10-29

SAN LEANDRO, CALIF.—To Globe Electric Works, 1899 Mission St., San Francisco, who bid \$6114 for 29 Union Metal Mfg. Co. electroliers on Victoria Ave. from Warwick Ave. to Hollywood Ave. for City. 10-17

MACHINERY and SUPPLIES

BIDS BEING RECEIVED

LODI, CALIF.—Bids to Nov. 18 by City Clerk for furnishing one motor-driven pick-up street sweeper. 10-23

MONROVIA, CALIF.—Bids to 7:30 p.m., Nov. 18, by City for 2200 ft. 6-in. Class 150 cast-iron pipe. 11-1

RIVERSIDE, CALIF.—Bids to 12 m., Nov. 18, by C. Thorburn, Purchasing Agent of the Pacific Electric Railway, 636 Pacific Electric Bdg., Los Angeles, for furnishing 5000 lin.ft. 90-lb. A.R.A. f.o.b. Pacific Electric tracks, relaying rail with joints. 11-2

SACRAMENTO, CALIF.—Bids to 5 p.m., Nov. 14, by City Clerk for 50 hydrants and 150 brass gate valves. 10-26

SAN FRANCISCO, CALIF.—Bids to 11 a.m., Nov. 18, by Board of Supervisors, City Hall, San Francisco, for: (1) 60,000 pedestrian lane markers; and (2) 1000 traffic turning buttons, 1000 plain safety zone buttons, 200 reflector type safety zone buttons, 200 reflectors, 3-in. diam. lens, 2000 lag screws and expansion shields. 10-24

WATSONVILLE, CALIF.—Bids to 8:30 p.m., Nov. 14, by Watsonville School Dist. for lawn sprinkling system for M. White School and J. W. Linscott School. 11-1

CONTRACTS AWARDED

EUREKA, CALIF.—To American Cast Iron Pipe Co., Balboa Bdg., San Francisco, who bid \$4972 for furnishing and delivering 4500 lin.ft. 10-in. cast-iron pipe to City. 10-17

LOS ANGELES, CALIF.—To Santa Fe Pipe & Supply Co., 2451 E. 15th St., Los Angeles, who bid \$28,090 to Los Angeles Water & Power Bureau for furnishing wrought-steel pipe. 10-31

LOS ANGELES, CALIF.—To Grinnell Co., 520 Mateo St., Los Angeles, who bid \$3125 to Water & Power Bureau, for furnishing under Adv. 1217, (1) 750 2-in. galv. malleable iron crosses and (2) 2500 2-in. iron tees. 10-31

LOS ANGELES, CALIF.—To Chas. R. McCormick Lumber Co., 208 W. 8th St., Los Angeles, who bid \$16,965 for furnishing creosoted douglas fir piling, under Spec. No. 840, to the Los Angeles Harbor Commission. 11-1

RAILROAD CONSTRUCTION

CONTRACTS AWARDED

HARTE, CALIF.—To Morrison-Knudsen Co., Boise, Idaho, for 2.8 miles of light grading of railroad for the Western Pacific Company, Mills Bdg., San Francisco, work running from Harte Station, San Joaquin County, to Disappointment Slough. 10-21

PIPE LINE CONSTRUCTION

CONTRACTS AWARDED

LOS ANGELES, CALIF.—Awards as follows by Southern California Gas Company, Los Angeles, for the construction of 70 miles 20-in. diameter natural gas pipe-line from Kettleman Hills to Buena Vista Hills terminal of the Southern California Gas Company system near Taft, Kern County: (1) To Macco Construction Co., Clearwater, Los Angeles County, for general contract exclusive of hauling and welding; (2) To Asbury Transportation Co., 4908 S. Alameda St., Los Angeles, for unloading, hauling and stringing pipe; and (3) To A. O. Smith Co., Milwaukee, for furnishing and welding pipe. Cost of the above is \$2,250,000. 10-18

SAN FRANCISCO, CALIF.—Awards as follows by Pacific Gas & Electric Co., Pacific Gas & Electric Bdg., San Francisco, for construction of 312 miles of natural gas pipe-line (second line) from the Kettleman Hills to San Francisco Bay area via Richmond, also branch lines from the main line to serve Modesto, Stockton, Sacramento, Roseville, Woodland, and other towns: (1) To A. O. Smith Co., Milwaukee, Wisconsin, for furnishing and welding pipe (about 55,000 tons); (2) To Robt. A. Conyes, 5619 San Pablo Ave., Oakland, for hauling; and (3) Excavation will be done by the forces of the Pacific Gas & Electric Company, Pacific Gas & Electric Bdg., San Francisco. 10-21

MUNICIPAL DEVELOPMENTS

WORK CONTEMPLATED

PHOENIX, ARIZ.—Bond election soon by City to vote on issuing bonds in amount of \$4,828,000 for municipal improvements as follows: \$2,986,700 for water system improvements, including pipe-lines, meters, pumping stations, reservoir, etc.; \$817,000 for sewer improvements; \$300,000 for city library; \$375,000 for parks, playgrounds, and municipal golf course; miscellaneous items \$350,000. W. J. Jamieson is City Engineer. 10-21

BUILDING CONSTRUCTION

WORK CONTEMPLATED

ANCHORAGE, ALASKA.—Plans by S. Heiman, Architect, Santa Fe Bdg., San Francisco, for school building for the Anchorage School District; \$60,000. 10-26

PAYNE'S BOLT WORKS
Est. 1871

PHONE DAVENPORT 3700

Manufacturers of all kinds of BOLTS & NUTS
201 MAIN STREET SAN FRANCISCO

Columbia Wood and Metal Preservative Co.

WOOD PRESERVATIVE
METAL PRESERVATIVE
PILE PRESERVATIVE
DAMP-PROOFING

SHINGLE AND FELT PRESERVATIVE

1465 Fourth St. Berkeley, Calif.
PHONE BERKELEY 1043

The Thomson-Diggs Company
SACRAMENTO, CALIFORNIA

General Hardware : Iron Pipe,
Steel, Housewares, Camp Supplies,
Electrical Supplies, Fencing

WE MANUFACTURE and STOCK



Quality and Service Guaranteed

Kortick Manufacturing Co.

Office, Factory and Warehouse: 333-355 First Street
Telephones Sutter 516-517-518 SAN FRANCISCO



The Brown-Bevis Company

Machinery and Equipment
for Construction - Municipal - Industrial
Mines - Quarries - Road Building

49th St., and Santa Fe Los Angeles, Calif.
Telephone JEFFerson 5221

PIPE

STANDARD Water Pipe and Screw Casing for every purpose; also Valves and Fittings. Both new and used (remanufactured). All material tested under pressure and guaranteed. Immediate delivery. Money saving prices.

WE RENT PIPE

G. WEISSBAUM & CO.

130 11th Street, San Francisco; Phone Market 272

The PACIFIC CO.

FORMERLY THE ELLIOTT-HORNE CO.
INVESTMENT SECURITIES

LOS ANGELES
OAKLAND

1011 Financial Center Building SAN DIEGO
OAKLAND, CALIF. LONG BEACH

PHONE GLENCOURT 4137

...will buy your WARRANTS and BONDS
...will advance you money when necessary
...will help you plan your work

[Specialists for over twenty-five years in the proper handling of Street and Road Improvement Bonds.]

**CEMENT GUN CONSTRUCTION CO.
OF CALIFORNIA**

E. F. HALLORAN, General Manager

We Do High Class Cement Gun
Work and Supply Necessary
Expert Engineering Supervision

HOLBROOK BUILDING, SAN FRANCISCO
PHONE: SUTTER 3988

6769 ROMAINE ST., LOS ANGELES
PHONE: GLADstone 9278

BERKELEY, CALIF.—Plans by Geo. W. Kelham, Architect, 315 Montgomery St., San Francisco, for a Class A Engineering Building on the University of California Campus, Berkeley, for the University of California. \$700,000. 11-5

CHOWCHILLA, CALIF.—Plans by Swartz & Ryland, Architects, Bridge Bdg., Fresno, for a brick and stucco high school gymnasium. \$35,000. 10-17

CLOAREMONT, CALIF.—Plans by Webb & Spaulding, Architects, 627 S. Carondelet St., Los Angeles, for the second unit of the boys' dormitory building at Pomona College, concrete construction with plaster exterior, tile roofing, steel sash, etc. \$250,000. 11-2

LONG BEACH, CALIF.—Plans by J. H. MacDowell, Architect, New York, and W. H. Austin, Resident Architect, Pacific Southwest Bdg., Long Beach, for reinf. concrete municipal auditorium for City. \$1,400,000. 11-2

MILLBRAE, CALIF.—Plans by Willis Polk & Co., Architects, 277 Pine St., San Francisco, for a frame and stucco club building for Union League Country Club; \$60,000. 10-26

OAKLAND, CALIF.—Plans by Albert I. Roller, Architect, Crocker First National Bank Bdg., San Francisco, for a two-story and basement Class C office and loft building on Broadway and 14th Sts. for Pacific States Auxiliary Corp. \$45,000. 10-30

OAKLAND, CALIF.—Plans by Casebolt Dakin, Architect, 319 13th St., Oakland, for steel and concrete C apartment on Park Blvd. and Emerson St. for Dakin and Harry Schuster. \$200,000. 10-18

OAKLAND, CALIF.—Plans by J. J. Donovan, Architect, Tapscott Bdg., Oakland, for two-story steel and brick school building on Fleming and Monticello Aves. \$120,000. 10-17

OAKLAND, CALIF.—Plans by C. W. McCall, Architect, 1404 Franklin St., Oakland, for 'A' service and display building on Broadway and 30th for Firestone Tire & Rubber Co.; \$100,000. 10-21

OAKLAND, CALIF.—Plans by R. G. DeLappe, Architect, 1710 Franklin St., Oakland, for steel and brick 'C' parcel delivery depot at 306 24th St., Oakland, for the United Parcel Delivery Co.; \$35,000. 10-28

RIVERSIDE, CALIF.—Bond election Nov. 19 by City of Riverside, to vote on issuing bonds in amount of \$150,000 for improvement and acquisition of a municipal airport. About \$100,000 will be for the purchase of the site, and \$50,000 for improvements, including construction and maintenance of hangars, mooring masts, flying field. 10-29

SACRAMENTO, CALIF.—Plans by Geo. B. McDougall, State Architect, Public Works Bdg., Sacramento, for concrete live stock building at the State Fair Grounds, Sacramento. \$200,000. 10-18

SAN DIEGO, CALIF.—Plans by J. J. Frauenfelder, Architect, 1116 Story Bdg., Los Angeles, for a 7-story apartment on Ash St., San Diego, for C. E. Rees & Associates, concrete, with stucco and cast stone exterior. \$325,000. 10-18

SAN FRANCISCO, CALIF.—Plans by Shea & Shea, Architects, 454 Montgomery St., San Francisco, and bids will be called for shortly for construction of a Class A Junior High School building, to be known as the Aptos Junior High School, on Aptos and Westgate Avenues, San Francisco, for the City and County of San Francisco. \$750,000. 10-29

SAN FRANCISCO, CALIF.—Plans by Albert Roller, Architect, First National Bank Bdg., San Francisco, for a four-story and basement, Class C office building, on Stevenson St., to be of reinforced concrete construction, for the Pacific States Auxiliary Corporation. \$45,000. 10-29

SAN FRANCISCO, CALIF.—Plans by Wm. H. Crim, Jr., Architect, 488 Pine St., San Francisco, for a junior high school building on 25th and Noe Sts. for City. \$650,000. 10-21

SAN FRANCISCO, CALIF.—Plans by J. Baur, Arthur Brown, Jr., and John Bakewell, Jr., Architects, 251 Kearny St., San Francisco, for a 22-story class A club building on Post and Mason Sts., for Olympic Club. \$4,000,000. 11-1

SAN FRANCISCO, CALIF.—Plans by Jas. A. Wetmore, Architect, Washington, D. C., for a six-story and basement, Class A steel frame, concrete, and brick marine hospital at the Presidio of San Francisco, for the United States Government. \$1,500,000. 11-5

SAN JOSE, CALIF.—Plans by Geo. De Colmesnil, Architect, Nevada Bank Bdg., San Francisco, for reinforced concrete department store building on South First St., for Hale Bros.; \$500,000. 10-24

SAN JOSE, CALIF.—Plans by F. H. Slocum, Architect, 85 Cambridge Way, Oakland, for a three-story frame and stucco apartment building on First St., San Jose, for Louis Saroni, 362 17th St., Oakland. \$100,000. 10-29

SAN JOSE, CALIF.—Plans by Wm. H. Weeks, Architect, Hunter-Dulin Bdg., San Francisco, for 10-story steel frame and concrete hotel building on West Santa Clara St. and Notre Dame Ave., for San Jose Community Hotel Co., Inc.; \$375,000. 10-26

SAN RAFAEL, CALIF.—Plans by Wm. H. Weeks, Architect, Hunter-Dulin Bdg., San Francisco, for a five-story structural steel and concrete hotel at San Rafael. \$1,000,000. 10-30

SANTA ANA, CALIF.—Plans by Allen Ruoff, Architect, 2024 W. Sixth St., Los Angeles, for mausoleum, chapel, and crematory building of concrete construction, at Santa Ana for the Fairhaven Cemetery; \$200,000. 10-22

ST. HELENA, CALIF.—Plans by E. E. Young, Architect, 2002 California St., San Francisco, for a Class B Tuberculosis Sanitarium, Calistoga Sanitarium Co. \$150,000. 10-18

WATSONVILLE, CALIF.—Plans by H. A. Minton, Architect, 525 Market St., San Francisco, for concrete store building for Resetar Bros. \$20,000. 11-5

HONOLULU, T. H.—Plans by C. W. Dickey, Architect, 405 Damon Bdg., Honolulu, Hawaii, for a territorial normal school at Honolulu, Hawaii, for University of Hawaii; \$500,000. 10-26

PORTLAND, ORE.—Plans by H. Bidwell, Architect, Portland, Ore., for addition to Meier & Frank building at Portland. \$2,000,000.

BIDS BEING RECEIVED

BENICIA, CALIF.—Bids to 10 a.m., November 12, by Constructing Quar-

termaster, Benicia Arsenal, Benicia, for construction of five magazine buildings, Type No. 34, and about 3700 ft. connecting roads, and four magazine buildings with barricade in front. 10-31

LONG BEACH, CALIF.—Bids to Nov. 18 by Board of Education, Long Beach, for construction of a school at Harding Park school site. Derrick & Bobbe, Heartwell Bdg., Long Beach, are the Architects. \$175,000. 10-30

OAKLAND, CALIF.—Bids to 2 p.m., November 26, by Geo. B. McDougall, State Architect, Public Works Bdg., 11th and P Sts., Sacramento, for construction and completion of the Sales Building and Office, Broom Factory, and Addition to Warehouse at the Industrial Home for Adult Blind, Oakland. 10-31

SAN FRANCISCO, CALIF.—Bids to 2:30 p.m., Nov. 13, by Board of Public Works for electrical work for Francisco Jr. High School. 11-4

SAN JOSE, CALIF.—Bids to Nov. 25 by Architect, W. H. Weeks, Burwell Bdg., San Jose, for 10-story steel and concrete hotel on W. Santa Clara St. and Notre Dame Ave. for San Jose Community Hotel Co. \$375,000. 11-4

HONOLULU, T. H.—Bids to 3 p.m., December 20, by Supervising Architect, Treasury Department, Washington, D. C., for constructing an extension and remodeling of the U. S. Post Office, Court House, and Custom House at Honolulu. 10-31

BIDS RECEIVED

OAKLAND, CALIF.—Pacific Coast Engr. Co., Ft. of 14th St., Oakland, \$9732 only bid to Oakland Port Comm. for steel frame for addition to Transitt Shed 2 at 14th St. Wharf. 11-5

STOCKTON, CALIF.—Following low bids by P. Sala, Architect, 2130 N. Commerce St., Stockton, in connection with construction of a one-story brick and concrete dyeing and cleaning plant at Stockton, for Hess Dyeing & Cleaning Co., 338 N. California St., Stockton: General Construction, John Cavanaugh, Stockton, \$22,300 low; Mechanical Equipment, E. H. Grogan, Stockton, \$18,080 low. 11-4

TALMAGE, CALIF.—Low bids as follows by State Architect, Sacramento, for brick and concrete main building and dormitory buildings at Mendocino State Hospital: GENERAL—Sorenson & Haggmark, 2652 Harrison St., S. F., \$98,900 low; HEATING AND PLUMBING—Pemberton Heating & Ventilating Co., 105 Macy St., L. A., \$16,200 low; and ELECTRICAL WORK—Eddy Electric Co., 309 W. Weber Ave., Stockton, \$2390 low. 10-16

OAKLAND, CALIF.—Steel Tank & Pipe Co., 1100 4th St., Berkeley, who bid \$8418, low bid submitted to the East Bay Municipal Utility District, 512 16th St., Oakland, for furnishing 2300 lin. ft. 3/4-in. plate, 24-in. diameter welded sheet steel pipe for the distribution system of the District. 11-5

SAN LUIS OBISPO, CALIF.—Oakland Const. Co., Box 43, Fresno, \$51,059 low bid to County for vitr. sewers, cast-iron mains, and 25,000-gal. redwood tank in Ocean Heights Dist. 1 for County. Bids rejected. 11-5

YOUNTVILLE, CALIF.—To Minton Co., Mountain View, \$10,829 low for frame cottages at Veterans Home, Yountville, Napa County, for State. 10-23

CONTRACTS AWARDED

BAKERSFIELD, CALIF.—To MacDonald & Kahn, Spring-Arcade Bdg., Los Angeles, for A addition to Telephone Exchange Building for Pacific Telephone & Telegraph Co., to be of steel and concrete. \$300,000. 11-2

BERKELEY, CALIF.—To A. T. Lane, Byrne Bdg., Los Angeles, for alterations to Fox-California Theatre, Berkeley. Balch & Stanberry, Film Exchange Bdg., Los Angeles, are Architects. \$60,000. 10-18

LOS ANGELES, CALIF.—To P. J. Walker Co., Garland Bdg., Los Angeles, for concrete and brick college building on Westwood Campus for University of California at Los Angeles. \$500,000. 10-18

SAN FRANCISCO, CALIF.—To Cahill Bros., Sansome St., San Francisco, for a 16-story class A hotel, on the south side of Post St., east of Leavenworth St., San Francisco, for E. B. DeGolia. Weeks & Day, Financial Center Bdg., San Francisco, are the Architects. \$600,000. 10-31

SAN FRANCISCO, CALIF.—To J. A. Nelson Co., 10th and Howard Sts., San Francisco, at \$250,000 for heating and ventilating of the 28-story building being erected on the northwest corner of Battery and Bush Sts., for the Shell Oil Company. P. J. Walker Co. are the General Contractors. 10-31

SAN FRANCISCO, CALIF.—Awards as follows by City for concrete and steel addition to the Francisco Junior High School on Francisco and Powell Sts.: General Contract to F. C. Amaro & Sons, Wallace and Keith Sts., San Francisco, \$139,987; Plumbing to Scott Co., 243 Minna St., San Francisco, \$12,537; Mechanical Equipment to Latourrette-Fical Co., 699 Fourth St., Oakland, \$26,977. 11-2

SAN FRANCISCO, CALIF.—Awards as follows by Board of Public Works for addition to Sunshine School, Dolores and Dorland Sts., San Francisco: General Construction to Meyer Bros., 727 Portola Drive, San Francisco, at \$8753; Mechanical Equipment to Scott Co., 243 Minna St., San Francisco, who bid \$3717. 10-22

SAN FRANCISCO, CALIF.—To The Austin Co., Russ Bdg., San Francisco, for concrete factory buildings on Paul Ave., near San Bruno Ave., San Francisco, for Meese & Gottfried Co.; \$500,000. 10-23

SAN FRANCISCO, CALIF.—To Industrial Const. Co., 815 Bryant St., S. F., \$160,000 for 'B' office building on Montgomery and Sutter Sts. for Lurie Co. O'Brien & Peugh, 315 Montgomery St., S. F., are Architects. 10-23

SAN JOSE, CALIF.—To Robt. O. Summers, 17 N. First St., San Jose, for concrete store and loft building on South First St., for P. C. Hale. Geo. DeColmesnil, Nevada Bank Bdg., San Francisco, is the Architect; \$85,000. Sears Roebuck Co. are the Lessees. 11-28

MISSOULA, MONT.—To J. Hightower, Missoula, \$100,000 for high school building for Missoula School Dist. 10-23

RENO, NEV.—To K. E. Parker Co., 135 South Park, San Francisco, \$169,700 for 'C' building to be known as the South Side Junior High School for Reno School District No. 1. Low bid submitted by C. N. Swenson, San Jose, \$158,926, was withdrawn. 10-28

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*

CONTRACTORS BONDS

And All Lines of
Surety Protection

COMMERCE
Casualty Company

GLENS FALLS, NEW YORK

Pacific Coast Department
R. H. Griffith, Vice-President

C. H. Desky, Fidelity and Surety Sup't.
R. Lynn Colomb, Agency Supt.
354 Pine Street San Francisco

811 Garfield Building Los Angeles
Ben C. Sturges, Manager

FOR SALE OR RENT

Complete line of used and rebuilt construction
machinery consisting of

**Power Shovels, Pavers, Mixers, Air Compressors, Tower Equipment, Pumps,
Buckets, Graders, Pile Hammers, Hoists, Crushers, Rollers**

*Every machine rebuilt in our own modern shop. A high-class service department maintained to service
equipment working on the job. We can turn your inactive equipment into cash.*

Telephone us for particulars.

CONTRACTORS MACHINERY EXCHANGE

1135 57th Avenue, South of East 14th St., Near KGO Broadcasting Station

Phone FRuitvale 0715 :: :: OAKLAND, CALIF.

FOR RENT OR SALE
Portable Air Compressors
Concrete-Breakers

W. H. COWEN
1114 Sutter Street Phone ORdway 0173

RENT OR SALE
Air Compressors
Paint Spray Units
Climax Gas Engines

**Coast Machinery
Corporation**
Ed. CROWLEY, President
829 Folsom Street, San Francisco
931-33 Santa Fe Ave., Los Angeles

USED EQUIPMENT

For Sale and Rent

AIR COMPRESSORS (Portable and Stationary)	HOISTS (Gas, Electric and Steam)
DERRICKS (Steel and Wood)	LOCOMOTIVES (Gas, Electric and Steam)
CRANES (Locomotive and Caterpillar)	SHOVELS (Steam and Gasoline)
RAIL	PIPE

CONCRETE MIXERS	MISCELLANEOUS EQUIPMENT
Buckets (Clamshell and Orange-peel), Cars, Cableways, Crushers, Dragline Machines, Drills, Drill Sharpeners, Engines, Pile Hammers, Pumps, Road Rollers, Trucks, Tractors, Etc., Etc.	
MANUFACTURERS OF	

HACKLEY-RUBOTTOM  REVERSIBLE PLOWS

P. B. HACKLEY EQUIPMENT COMPANY
625 MARKET STREET Phone SUTter 0978 SAN FRANCISCO

BONDS *Glens Falls*

811 Garfield Building, Los Angeles
Ben C. Sturges, Manager

INDEMNITY COMPANY
of Glens Falls, New York

Pacific Coast Department
R. H. Griffith, Vice-President
354 Pine Street, San Francisco
C. H. Desky, Fidelity and Surety Sup't.
R. Lynn Colomb, Agency Supt.

**Contractors
Surety
Fidelity**

311-13 Alaska Building, Seattle
R. G. Clark, Manager

THE BUYERS' GUIDE

Refer to advertisements for addresses of companies listed. Advertisers index on page 62

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.
 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.

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 Mchy. Co., Inc.
 Speeder Machinery Corp.
 Thew Shovel Co., The
 Universal Crane Co., The

Bars, Steel
 Pacific Coast Steel Co.

Beams, Channels, and Angles
 Pacific Coast Steel Co.

Bins, Storage and Hopper
 Bacon Co., Edward R.
 Butler Bin Co.
 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, Street and Road Improvement
 Elliott-Horne Co., The

Bonds, Surety
 American Surety Co.
 Globe Indemnity Co.

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.
 Jacobs Co., Murry
 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
 Bacon Co., Edward R.
 Jenison Machinery Co.
 Leschen & Sons Rope Co., A.
 Young Machy. Co., A. L.

Camp Supplies
 Thomson-Diggs Company

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
 United Iron Works
 U. S. Cast Iron Pipe & Fdy. Co.

Cement
 Portland Cement Association

Cement Guns
 Cement Gun Const. Co.

Chemicals
 Great Western Electro-Chemical Co.

Chlorinators
 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.
 Osgood Co., The
 Sauerman Bros., Inc.
 Spears-Wells Mchy. Co.
 Speeder Machinery Corp.
 Thew Shovel Co., The
 Universal Crane Co., The
 Young Machy. Co., A. L.

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
 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.

Dams
 Amburson Dam Co., Inc.

Derricks
 Bacon Co., Edward R.
 Clyde Iron Works Sales Co.
 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.
 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.
 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 Mchy. Co.
 Speeder Machinery Corp.
 Thew Shovel Co., The
 Universal Crane Co., The
 Young Machy. Co., A. L.

Drain Tile
 Gladding, McBean & Co.

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

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

Dump Wagons
 Le Tourneau Mfg. Co.

Engineers
 Amburson Dam Co., Inc.
 Burns-McDonnell-Smith Engr. Co.
 Hunt, R. W., Co.

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.

Excavating Machinery
 Bacon Co., Edward R.
 Bodinson Mfg. Co.
 Bucyrus-Erie Co.
 Caterpillar Tractor Co., The
 Garfield & 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
 Parsons Co., The
 Sauerman Bros., Inc.
 Speeder Machinery Corp., The
 Thew Shovel Co., The
 Universal Crane Co., The

(Continued on page 58)

OPPORTUNITY PAGE

CONTINUED

AERIAL PHOTOGRAPHY

Aero Surveys and Aero Photo Maps
Most Complete File of Aerial Bird's Eyes
in Northern and Central California

GEORGE E. RUSSELL

Aero
Photographic
Specialist



112 Kearny
St., S. F.
Phone
SUTter 3049

FOR SALE

New and Second-Hand Boilers—Pipes
and Rails—Hoisting, Gas and Steam En-
gines—Steam and Centrifugal Pumps
and All Kinds of Machinery and Equip-
ment, at the Right Price.

COUTTS MACHINERY CO.
1740 Folsom Street, San Francisco
Phone MARKet 7431

FOR SALE or RENT

50-B Bucyrus Diesel Shovel and Dragline Equipment

This equipment is on caterpillars and can
be operated as a 1 1/2 cu. yd. dragline
or a 2 cu. yd. shovel

Also

MONIGHAN DIESEL 3 1/2 cu. yd. DRAGLINE

The above equipment may be inspected
at Pardee Damsite Equipment Yard locat-
ed on State Highway 30 miles east of
Stockton, turn north at Valley Springs.

Atkinson Construction Company

P.O. Address: Valley Springs, Cal.

GERMAN BOSCH

MAGNETOES—SPARK PLUGS—
GENERATORS
OFFICIAL SALES AND SERVICE
Transportation Instruments
Corp.

699 Van Ness Avenue, San Francisco
Phone ORDway 4633

Mail Orders
Solicited

FOR SALE OR RENT

7/8-yard Revolving Steam Shovel—Steel Caterpillar

W. H. COWEN
1114 Sutter Street Phone ORDway 0173

Magneto Repairs

Parts for All Standard Electrical Units.
Magnetas, Starters, Generators, Igniters.
Mail Orders Solicited. One-Day Repair
Service. All Work Guaranteed. Twenty
Years in Business.

Auto Electric Supply Co.
543 Van Ness Ave. San Francisco
Phone UNDERhill 6626

WESTERN CONSTRUCTION NEWS

CONTINUED

RECONDITIONED EQUIPMENT

FOR SALE OR RENT

Gasoline Shovels, Draglines, Clamshells, Cranes,
Trenchers, Backfillers, Kohler Light Units

All Sizes Dragline and Clamshell Buckets

EXCAVATING EQUIPMENT DEALERS, Inc.

2657 Ninth Street, Berkeley
THornwall 3367

2248 East 37th Street, L. A.
LAfayette 1787

CATERPILLAR

For Sale—Reconditioned
1-60 CATERPILLAR TRACTOR
1-30 CATERPILLAR TRACTOR
West Coast Tractor Co.
1175 HOWARD ST., SAN FRANCISCO
Telephone MArket 8020

FOR SALE OR RENT
Barber-Greene Ditcher
W. H. COWEN
1114 Sutter Street, San Francisco
Phone ORDway 0173

Rosenberg Portable Car Unloader and Truck Loader

The New "All Steel Full Revolving" Model
It Minimizes—Time-Labor-Cost

Dealers wanted in all large cities. Write for further details.

We also specialize on repairing and rebuilding of
Bunkers, Hoppers, Gravel Washers, Chuting, Con-
veyors, Rollers, Mixers, Hoists, Shovels, Tractors,
Pavers, Crushers, Draglines, Elevators, Unloaders,
and other Road and Construction Equipment.

BLACKSMITHING and WELDING

CREAR & BATES

57 Zoe Street, Between 3rd and 4th, off Brannan
Phone KEarny 1885

San Francisco, Cal.

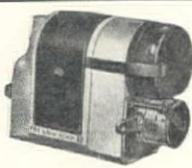
MAGNETO REPAIR COMPANY

H. G. MAKELIM

Official

BOSCH ~ EISEMAN ~ SPLITDORF

1480 Howard Street, San Francisco :: MArket 3848
1291 Fallon Street, Oakland :: GLencourt 1734



FOR SALE

Parsons No. 21 trencher,
complete with 2 sets buckets
and arranged to dig 10 ft.
deep. Just been overhauled.

AJAX CONSTRUCTION CO.
320 Market Street San Francisco

For Rent or Will Contract

1 1/4-cu.yd. Gas Shovel, Crane
Dragline or Clamshell

E. SMARIO

836 Bayshore Blvd., San Francisco
Phone DElaware 3778

THE BUYERS' GUIDE—Continued from Page 56

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 Mchly. Exchange
Hackley Equipment Co., P. B.

Filters

Water Works Supply Co.

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

Floors, Mastic

Wailes Dove-Hermiston Corp.

Flumes, Concrete

Portland Cement Association

Flumes, Metal

California Corrugated Culvert Co.
Montague Pipe & Steel 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, 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.

Hardware, Shelf and Heavy

Thomson-Diggs Company

Hoists, Hand and Power

Bacon Co., Edward R.
Clyde Iron Works Sales Co.
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.
Link-Belt Meese & Gottfried Co.
Sullivan Machinery Co.
Willamette-Ersted 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.

Jacks, Lifting

Jenison Machinery Co.

Kettles, Tar and Asphalt

Bacon Co., Edward R.
Harron, Rickard & McCone Co.
Littleford Bros. Co.
Montague Pipe & Steel Co.
Peerless Machy. & Mfg. Co.
Spears-Wells Machy. Co.
Young Machy. Co., A. L.

Leadite

Water Works Supply Co.

Lighting Standards

United Iron Works

Loaders, Power, Truck and Wagon

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.
Brookville Locomotive Co.
Garfield & 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.
Chain Belt Co.
Foot Company, Inc.
Garfield & Co.
Harron, Rickard & McCone Co.
Jaeger Machine Works, The
Jenison Machinery Co.
Lakewood Engr. Co.
Young Machy. Co., A. L.

Mixes, Plaster

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

Motors, Gasoline

Continental Motors Corp.
Hercules Motors Corp.
Harron, Rickard & McCone Co.
Jenison Machinery Co.

Paints, Acid Resisting

General Paint Corp.
Wailes Dove-Hermiston Corp.

Paints, Metal Protective

General Paint Corp.
McEverlast, Inc.
Wailes Dove-Hermiston Corp.

Paints, Technical

American Bitumuls Co.
General Paint Corp.
Wailes Dove-Hermiston Corp.

Paints, Waterproofing

General Paint Corp.
McEverlast, Inc.
Wailes Dove-Hermiston Corp.

Pavers, Concrete

Chain Belt Co.
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
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

Paving Tools

Bacon Co., Edward R.
Harron, Rickard & McCone Co.
Littleford Bros. 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.
The Shovel Co., The

Piles, Concrete

Raymond Concrete Pile Co.

Pipe, Cast-Iron

American Cast Iron Pipe Co.
Claussen & Co., C. G.
Industrial & Municipal Supply 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.
U. S. Cast Iron Pipe & Fdy. Co.

Pipe Clamps and Hangers

Kortick Mfg. Co.

Pipe Coatings

McEverlast, Inc.
Wailes Dove-Hermiston Corp.

Pipe, Concrete

Lock Joint Pipe Co.
Portland Cement Association

Pipe, Culvert

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

Pipe Fittings

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

Pipe Line Machinery

Bacon Co., Edward R.
Harnischfeger Sales Corp.
Harron, Rickard & McCone Co.
Jenison Machinery Co.

Pipe, Lock-Bar

Western Pipe & Steel Co.

Pipe, Preservative

Columbia Wood & Metal Preservative Co.

Pipe, Pressure Line

Lacy Manufacturing Co.
Lock Joint Pipe Co.
Western Pipe & Steel Company

Pipe, Riveted Steel

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

Pipe, Sewer

Gladding, McBean & Co.
Pacific Clay Products

Pipe, Standard

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

Pipe, Vitrified

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

Pipe, Welded Steel

California Corrugated Culvert Co.
Lacy Manufacturing Co.
Montague Pipe & Steel Co.
Steel 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.

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
Pacific Pumping Co.
Pelton Water Wheel Co., The
Rix Company, Inc., The
United Iron Works
Woodin & Little

Pumps, Deep Well

American Well Works, The
Byron Jackson Pump Mfg. Co.
Industrial & Municipal Supply Co.
Jenison Machinery Co.
Pacific Pumping Co.
Pelton Water Wheel Co., The
Woodin & Little

(Continued on page 60)

OPPORTUNITY PAGE

CONTINUED

OFFICIAL BIDS

NOTICE TO CONTRACTORS

Cast-Iron Pipe

Sealed proposals will be received at the office of the East Bay Municipal Utility District, 512 Sixteenth Street, Oakland, California, until 8:00 p.m., November 13, 1929, and will at that hour be opened, for furnishing approximately 119 tons of Class "B" cast-iron pipe of 16 inches diameter and 28½ tons of Class "B" or 1200 linear feet of alternate cast-iron pipe of 8 inches diameter.

Specifications may be obtained upon application to the office of the District.

JOHN H. KIMBALL, Secretary, Oakland, California, October 24, 1929.

NOTICE TO CONTRACTORS

Bridges

Sealed proposals will be received at the office of the State Highway Engineer, Public Works Building, Sacramento, until 2 o'clock p.m. on November 27, 1929, 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:

Shasta County (II-Sha-28-C and D), six timber bridges on the Redding to Alturas lateral at points approximately 40 to 60 miles east of Redding, varying in length from one to seven 19-foot spans on frame bents with concrete pedestals.

Marin County, a bridge across Corte Madera Creek at Greenbrae (IV-Mrn-1-C), consisting of a bascule span over a clear channel of 40 feet and approximately 855 feet of timber trestle approach on pile bents.

Los Angeles County, a reinforced concrete arch bridge across La Canada Canyon, about one and one-half miles northeast of La Canada (VII-LA-61-A), consisting of one 96-foot reinforced concrete arch span and two 25-foot 6-inch reinforced concrete approach spans on concrete abutments with wing walls.

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 October 30, 1929.

NOTICE TO CONTRACTORS

Welded Steel Pipe

Sealed proposals will be received at the office of the East Bay Municipal Utility District, 512 Sixteenth Street, Oakland, California, until 8:00 p.m., November 27, 1929, and will at that hour be opened, for furnishing all material and performing all necessary work to cover approximately 3000 linear feet of 16-inch welded steel pipe with a protective reinforced Gunite coating.

Specifications may be obtained upon application to the office of the District.

JOHN H. KIMBALL, Secretary, Oakland, California, November 5, 1929.

OFFICIAL BIDS

UNITED STATES DEPARTMENT OF THE INTERIOR

NATIONAL PARK SERVICE

Grading

San Francisco, Calif., November 2, 1929
Sealed bids, in single copy only subject to the conditions contained herein, will be received until 2:00 p.m. on the 26th day of November, 1929, and then publicly opened, for furnishing all labor and materials and performing all work for grading project 2-A-4, from Grouse Creek to Turtleback Dome on the Valley to South Boundary section of the Wawona road, route No. 2, Yosemite National Park, California.

The length of the project to be graded is 2.19 miles and the principal items of work are approximately as follows:

Excavation, unclassified, 57,640 cu.yd.
Excavation, unclassified, Type B, 27,360 cu.yd.
Excavation, unclassified, for structures, 100 cu.yd.

Overhaul, 38,000 sta.yd.
Finishing earth-graded roads, 2.19 miles.
Cement rubble masonry, 65 cu.yd.
Pipe culvert in place, 1514 lin.ft.

Hand-laid rock embankment, 1200 cu.yd.

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

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

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

Performance bond will be required as follows: In the amount of one hundred (100) per cent of the total contract price. Performance shall begin within ten (10) calendar days after date of receipt of notice to proceed and shall be completed within one hundred and seventy-five (175) calendar days from that date, exclusive of any time that may intervene between the effective date of orders of the Government to suspend operations on account of weather conditions and the effective date of orders to resume work.

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

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

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

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

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

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

Bid for Road Construction. To be opened 2:00 p.m., November 26, 1929.

Yosemite National Park Project 2-A4, 807 Sheldon Bldg., 461 Market St., San Francisco, California.

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

NOTICE TO CONTRACTORS

Grading and Paving

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 December 4, 1929, 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:

Tehama and Plumas Counties, between Morgan Springs and Lake Almanor (II-Teh, PI-29-C.A), about twenty-one and seven-tenths (21.7) miles in length, to be graded and surfaced with untrited crushed gravel or stone.

OFFICIAL BIDS

Imperial County, between Brawley and four miles west of Westmorland (VIII-Imp-26-H & A), about ten and four-tenths (10.4) miles in length, to be graded and paved with portland cement concrete.

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 Engineer's 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 November 6, 1929.

HELP WANTED

WANTED—Construction engineers for building work. Man 21 to 50 years old with technical training and practical building construction experience preferred. Apply State Civil Service Commission, 115 State Building, San Francisco, or 319 Capitol Building, Sacramento.

ELECTRICAL DRAFTSMAN, experienced on layout of electrical equipment for sub-stations and power plants. Must be good draftsman. Salary depends upon experience. Location, San Francisco. R-2819-S.

DRAFTSMAN, experienced on highway work, for right of way calculations, traverse work, preparation of property descriptions for condemnation proceedings, etc. Must be citizen. Salary \$200-220 mo. Apply by letter. Location, California. R-2845-S.

DRAFTSMAN, with highway or RR experience, for plotting cross sections from field books, plotting topography, traverse work, planimetering roadbed sections and earthwork calculations. Salary \$135-150 per mo. About 2 mos. work, but may be permanent. Must be citizen. Apply by letter with sample of lettering. Location, No. California. R-2795-S.

FOREMAN, with open pit experience and capable of taking charge of steam, gas and electric power shovels, or young mining graduate, who is willing to start on operating end. Apply by letter with photo, experience record and references. Location, Eastern Canada. R-2822-S.

ENGINEER, for field service work on hydraulic machinery. Pref. E.E. or M.E. graduate, single, 28-35 years. Must have considerable mechanical skill, agreeable personality and willing to travel. Salary \$175-250 mo. Apply by letter with photo. Hdqtrs. S. F. R-2726-S.

ATTENTION

CONTRACTORS and MATERIALMEN
Car unloading and batching work our specialty. Steel bunkers, scale or measuring hoppers, cranes and clamshell for any size sand or gravel job, day or contract. We also do grading and excavating.

HARRISON AND HARRISON
2415 64th Avenue, Oakland, Calif.
Phone TRinidad 1348

THE BUYERS' GUIDE—Continued from Page 58

Pumps, Dredging and Sand
Jenison Machinery Co.
United Iron Works

Pumps, Hydraulic
Jenison Machinery Co.

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

Pumps, Rented
Pacific Pumping Co., Inc.

Pumps, Road
Bacon Co., Edward R.
Chain Belt Co.
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.
United Iron Works

Pumps, Sludge
Dorr Co., The

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

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.
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. Co.
Hackley Equipment Co., P. B.
Huber Manufacturing Co.
Jenison 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. Co.
Harron, Rickard & McCone Co.
Jenison Machinery Co.
Killefer Manufacturing Co.
Le Clair, S. D.
Sauer 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 Mch. Exchange
Excavating Equipment
Dealers, Inc.
Hackley Equipment Co., P. B.
Harron, Rickard & McCone Co.

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.
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
Peterson Co., O. R.
Spears-Wells Machinery Co.
Speeder Machinery Corp., The
The 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 and Road Improvement Bonds
Elliott-Horne Co., The

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.

Tanks, Air Compressor

Ingersoll-Rand Co.
Lacy Manufacturing Co.
Peerless Mch. & 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, R. W., Co.

Tie Plates

Pacific Coast Steel Co.

Towers, Transmission

Pacific Coast Steel Co.
Water Works Supply Co.

Tractors

Allis-Chalmers Mfgs. Co.
(Monarch Tractors Division)
Caterpillar Tractor Co.
Cleveland Tractor Co.
Peterson Co., O. R.
West Coast Tractor Co.

Tramways

American Steel & Wire Co.
Bacon Co., Edward R.
Leschen & Sons Rope Co., A.

Transmission Machinery, Power

Bodinson Mfg. Co.
Link-Belt Meese & Gottfried Co.
United Iron Works

Transportation, Water

American-Hawaiian Steamship Co.

Trench Excavators

Cleveland Trencher Co., The
Garfield & Co.
Harnischfeger Sales Corp.
Harron, Rickard & McCone Co.
Jenison Machinery Co.
Link-Belt Meese & Gottfried Co.
The Shovel Co., The

Truck Cranes

Harnischfeger Sales Corp.
Harron, Rickard & McCone Co.
Jenison Machinery Co.
Universal Crane Co., The

Trucks

Fageol Motors Co.

Tunnel Shovels

Bucyrus-Erie Co.
Jenison Machinery Co.
Marion Steam Shovel Co.

Turbines, Hydraulic

Pelton Water Wheel Co., The

Water Works Supply Co.

Turntables

Bacon Co., Edward R.
Harron, Rickard & McCone Co.
Jenison Machinery Co.

Unloaders, Car and Wagon

Bacon Co., Edward R.
Crear and Bates
Jenison Machinery Co.
Link-Belt Meese & Gottfried Co.

Valves

California Corrugated Culvert Co.
Claussen & Co., C. G.
Industrial & Municipal Supply Co.
Pacific Pipe Co.

Water Works Supply Co.

Valves, Gate

California Corrugated Culvert Co.
Claussen & Co., C. G.
Pelton Water Wheel Co., The
Water Works Supply Co.

Valves, Hose Gate

Greenberg's Sons, M.
United Iron Works

Valves, Hydraulic

California Corrugated Culvert Co.
Pelton Water Wheel Co.
Water Works Supply Co.

Washers, Sand and Gravel

Jenison Machinery Co.

Smith Engineering Co.

Water Purification

Industrial & Municipal Supply Co.
Wallace & Tiernan
Water Works Supply Co.

Water Supply Installations

Industrial & Municipal Supply Co.
Wallace & Tiernan
Water Works Supply Co.

Water Transportation

American-Hawaiian Steamship Co.

Water Wheels

Pelton Water Wheel Co., The
United Iron Works
Water Works Supply Co.

Water-Works Supplies

American Cast Iron Pipe Co.
Industrial & Municipal Supply Co.
Wallace & Tiernan
Water Works Supply Co.

Well Casing

Montague Pipe & Steel Co.

Wheelbarrows

Harron, Rickard & McCone Co.
Jenison Machinery Co.

Wire Rope

American Steel & Wire Co.
Edwards Co., E. H.
Jenison Machinery Co.
Leschen & Sons Rope Co., A.

PROFESSIONAL DIRECTORY

A. A. Brown

Consulting Engineer

MATSON BUILDING

215 MARKET STREET, SAN FRANCISCO

Abbot A. Hanks, Inc.

Engineers and Chemists

CONSULTING—TESTING—INSPECTING
CONCRETE—STEEL—MATERIALS

624 SACRAMENTO STREET
SAN FRANCISCO

Black & Veatch

Consulting Engineers

Sewerage, Sewage Disposal, Water Supply, Water Purification, Electric Lighting, Power Plants, Valuations, Special Investigations and Reports.

LOS ANGELES, CALIF., 307 South Hill Street.
NEW YORK CITY, 230 Park Avenue. KANSAS
CITY, Mo., Mutual Building.

Brandt & Simmons

Drafting Service

Specializing in Illustrating Engineering Reports, Maps, Charts, Graphs, Color Work on Photostats

485 CALIFORNIA STREET
SAN FRANCISCO

Burns-McDonnell-Smith

Engineering Company

CONSULTING
ENGINEERS

Water Supply, Waterworks, Sewerage and Sewage Disposal, Power Plants, Valuations and Rate Investigations of Municipal Utilities

LOS ANGELES:
WESTERN PACIFIC BUILDING

KANSAS CITY, Mo.:
INTERSTATE BUILDING

A. J. Cleary

Consulting Civil Engineer

Water and Power Projects
Valuations

439 MILLS BUILDING, SAN FRANCISCO
Phone DOurglas 0482

H. W. Crozier

Consulting Engineer

58 SUTTER STREET, SAN FRANCISCO
Cable: CROZIENG, SAN FRANCISCO

Engineering Societies Employment Service

For Employers of Chemists
and Engineers

57 POST STREET, SAN FRANCISCO
Phone SUTter 1684

Hyde Forbes

Engineering Geologist

Geological investigations in re-foundations for dams, buildings, and engineering structures; reservoir sites and tunnels :: Underground water investigations, water supply developments and drainage.

HUMBOLDT BANK BUILDING
SAN FRANCISCO

Harold F. Gray

Sanitary and Hydraulic Engineer

2540 BENVENUE AVENUE
BERKELEY, CALIF.

Robert W. Hunt Company

251 Kearny Street, San Francisco

Testing and Inspecting Engineers

Bureau of Inspection, Tests
and Consultation

LOS ANGELES SEATTLE PORTLAND
And all large manufacturing centers

Clyde C. Kennedy

Consulting Engineer

Municipal Engineering and
Public Improvements

543 CALL BUILDING
SAN FRANCISCO

Stephen E. Kieffer

Consulting Hydraulic Engineer

57 POST STREET, SAN FRANCISCO
Phone SUTter 2585

Charles H. Lee

Consulting Sanitary

— and —

Hydraulic Engineer

58 SUTTER STREET, SAN FRANCISCO
Phone KEarny 5670

Leeds & Barnard

Consulting Engineers

INVESTIGATIONS, REPORTS, APPRAISALS, DESIGN
AND SUPERVISION OF CONSTRUCTION

CENTRAL BUILDING :: LOS ANGELES

Louis F. Leurey

Consulting Electrical Engineer

58 SUTTER STREET, SAN FRANCISCO
Telephone SUTter 6931

Are you represented in this
Directory?

The proper medium to cover the
Far West

ENGINEERING OFFICES

J. B. Lippincott

Consulting Engineer

WATER SUPPLY :: IRRIGATION :: SEWAGE
AND SEWAGE DISPOSAL
VALUATION AND RATE INVESTIGATIONS
543 PETROLEUM SECURITIES BUILDING
LOS ANGELES

Charles A. Newhall

Member: American Institute Chemical Engineers; American Chemical Society, A.A.E.; Etc.

Consulting Chemist

Specializing in . . .

Technical evidence in cases involving the selection and proper use of materials of construction; concrete disintegration—cause and prevention; technical control systems for industrial processes.

2705 SMITH TOWER SEATTLE, Wn.

J. R. Pennington

Consulting Engineer

Specialist in Underground Water,
Surveys, Investigations
and Development

CARSON CITY :: :: NEVADA

Edward G. Sheibley

Consulting Civil Engineer

Engineering Construction :: Industrial
Development :: Safety
and Sanitation
593 MARKET STREET, SAN FRANCISCO

Christopher Henry Snyder

Designing and Consulting Engineer
STRUCTURAL

251 KEARNY STREET, SAN FRANCISCO
Phone SUTter 4284

Stevens & Koon

Consulting Engineers

POWER, IRRIGATION, MUNICIPAL WATER
SUPPLY, FILTRATION, SEWERAGE,
SEWAGE DISPOSAL, APPRAISALS
SPALDING BUILDING, PORTLAND, OREGON

Waddell & Hardesty

Consulting Engineers

Steel and Reinforced Concrete Structures,
Vertical Lift and Bascule Bridges, Difficult
Foundations, Reports, Checking of Designs,
Advisory Services, and Appraisals
150 BROADWAY :: NEW YORK

AERIAL MAPPING
for Engineers by an Engineer

George S. Young

AERIAL MAPPING—GEOLOGICAL
MAPPING

579 TWENTY-FIFTH STREET, OAKLAND
Phone OAKland 1471

INDEX TO ADVERTISERS

Dash Indicates Advertisement Appears in Every Other Issue

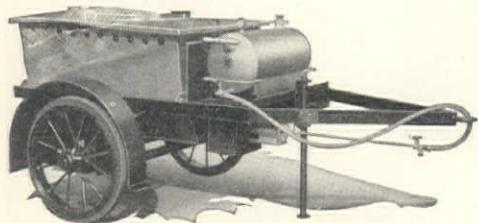
	Page		Page
Ambursen Dam Co., Inc.	51	Leschen & Sons Rope Co., A.	—
American Bitumuls Co.	32	Le Tourneau Manufacturing Co.	—
American Cast Iron Pipe Co.	—	Link-Belt Co.	33
American-Hawaiian Steamship Co.	—	Littleford Bros. Co.	63
American Paulin System, Inc.	—	Lock Joint Pipe Co.	—
American Steel & Wire Co.	—	Lufkin Rule Co., The	—
American Surety Co.	59	Madsen Iron Works	—
American Well Works, The	—	Marion Steam Shovel Co.	31
Aquatite Co.	—	McEverlast, Inc.	—
Atkinson Construction Co.	43-45	McWane Cast Iron Pipe Co.	9
Bacon Co., Edward R.	—	Mohawk Asphalt Heater Co.	—
Beebe Bros.	—	Monarch Tractor Co.	—
Blaw-Knox Company	—	Montague Pipe & Steel Co.	—
Bodinson Manufacturing Co.	—	Moulten, R. H. Co.	51
Brookville Locomotive Co.	47	Neptune Meter Co.	34
Brown-Bevis Co.	53	Northern Conveyor Co.	—
Buckeye Tractor Ditcher Co.	—	Northwest Engineering Co.	11
Bucyrus-Erie Company	29	Ohio Power Shovel Co.	—
Byron Jackson Pump Mfg. Co.	—	Opportunity Page	55-57-59
California Corrugated Culvert Co.	35	Orton Crane & Shovel Co.	—
Caterpillar Tractor Co.	30	Owen Bucket Co.	—
Cement Gun Const. Co.	53	Pacific Clay Products	10
Chain Belt Co.	23	Pacific Co.	53
C. H. & E. Manufacturing Co.	12	Pacific Coast Steel Co.	64
Chicago Bridge & Iron Works	15	Pacific Pipe Co.	49
Claussen & Co., C. G.	49	Pacific States Cast Iron Pipe Co.	9
Cleveland Tractor Co.	—	Payne's Bolt Works	53
Cleveland Trencher Co., The	—	Peerless Machinery Manufacturing Co.	—
Clyde Iron Works	39	Pelton Water Wheel Co., The	—
Columbia Wood & Metal Preservative Co.	53	Peterson & Co., O. R.	—
Continental Motors Corp.	18	Pioneer Gravel Equipment Mfg. Co.	12
Contractors Machinery Exchange	55	Pittsburgh-Des Moines Steel Co.	43
Concrete Curing, Inc.	45	Plymouth Locomotive Works	—
Dorr Co., The	—	Portland Cement Association	Back Cover
Drake, Sir Francis, Hotel	64	Professional Directory	61
Edwards Co., E. H.	—	Raymond Concrete Pile Co.	43
Fageol Motors Co.	—	Rix Company, Inc., The	4
Fairbanks, Morse & Co.	39	Sauerman Bros., Inc.	25
Foote Company, Inc.	—	Schramm, Inc.	63
French & Co., A. W.	—	Smith Co., The T. L.	37
Galion Iron Works & Mfg. Co.	27	Smith Engineering Works	26
Gardner-Denver Co., The	17	Soule Steel Co.	41
Garfield & Co.	—	Spears-Wells Machinery Co., Inc.	—
General Paint Corp.	—	Speeder Machinery Corp.	—
Giant Powder Co., Cons., The	49	Standard Oil Company	—
Gilmore Oil Company	—	Steel Tank & Pipe Co., The	49
Gladding, McBean & Co.	—	Sterling Wheelbarrow Co.	47
Globe Indemnity Co.	51	St. Louis Power Shovel Co.	—
Great Western Electro-Chemical Co.	41	Sullivan Machinery Co.	37
Greenberg's Sons, M.	51	Thew Shovel Co., The	20-21
Hackley Equipment Co., P. B.	55	Thomson-Diggs Co.	53
Harnischfeger Sales Corp.	Inside Front Cover	Toledo Pressed Steel Co.	—
Harron, Rickard & McCone Co.	12	Truscon Steel Co.	—
Hercules Motors Corp.	—	Union Oil Co.	—
Hercules Powder Co.	—	United Commercial Co., Inc.	41
Huber Manufacturing Co.	—	United Iron Works	—
Hunt Co., R. W.	—	U. S. Cast Iron Pipe & Fdy. Co.	Inside Back Cover
Industrial & Municipal Supply Co.	6	Universal Crane Co., The	22
Industrial Brownhoist Corp.	8	Vulcan Iron Works	12
Iowa Manufacturing Co.	—	Wailes Dove-Hermiston Corp.	51
Ingersoll-Rand Co.	—	Wallace & Tiernan Co., Inc.	14
Jaeger Machine Co., The	—	Warren Brothers Road Co.	—
Jenison Machinery Co.	18-27	Water Works Supply Co.	3
Jones Superior Machine Co., The	—	Weissbaum & Co., G.	53
Kartschok Clay Products Co.	45	West Coast Tractor Co.	—
Killefer Manufacturing Co.	—	Western Iron Works	47
Koehring Company	13	Western Pipe & Steel Co.	7
Kortick Manufacturing Co.	53	Willamette-Ersted Co.	28
Lacy Manufacturing Co.	47	Williams Co., G. H.	51
Lakewood Engineering Co.	24	Woodin & Little	41
Leitch & Company	—	Young Machinery Co., A. L.	16

Sturdy?

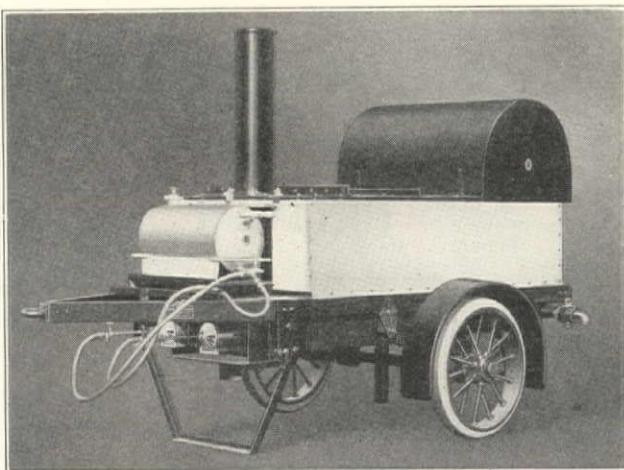
THE TRAIL-O-HEATER, 300-gallon maintenance kettle, is made to stand the hardest trailing and the most severe use that a highway maintenance gang can give it!

Chassis made of 5" channels—low slung and cushioned on semi-elliptical springs, 32" x 5" rubber tired wheels with Timken roller bearings.

It's the ideal kettle for highway maintenance over wide areas—carries 300 gallons of asphalt and can be trailed at high speed with absolutely no danger of surging or splashing. Write to the Littleford distributor in your territory—he will be glad to send complete information.



No. 84W—an oil burning tar and asphalt kettle made in 110 and 165 gallon sizes. Used by many State, county and city highway departments for highway maintenance. Has strong running gear with spring cushioned axle. Steel tired roller bearing wheels standard—rubber tired wheels optional.



No. 78-OB Trail-O-Heater is one outfit of the complete line of Littleford Road and Street Maintenance Equipment which includes melting kettles from 10 to 1500 gallons capacity, surface heaters, sand and gravel dryers, squeegee machines, etc. Ask the Littleford distributor to send you our complete catalog.

LITTLEFORD BROS.

Cincinnati, Ohio

WESTERN DISTRIBUTORS:

THE BROWN-BEVIS CO., INC.
Los Angeles, Calif.

ARIZONA TRACTOR & EQUIPMENT CO.
Phoenix, Ariz.

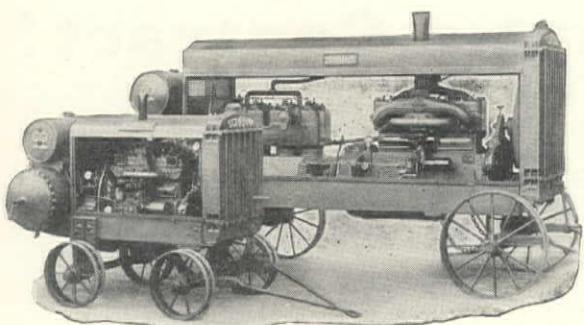
FEENAUGHTY MACHINERY CO.
Portland, Ore.

HARRON, RICKARD & McCONE CO.
San Francisco, Calif.

LUND & CO.
Salt Lake City, Utah

WILSON MACHINERY CO.
Denver, Colo.

LITTLEFORD
ROAD & STREET MAINTENANCE
EQUIPMENT



Pioneering
again!

The new heavy weight Champ

COMBINING all the power and stamina of three husky 120 cu.ft. compressors into one efficient, powerful, easily-portable unit. Only one motor to take care of—only one unit to move. This compressor in direct competition with other large makes, has proved its superior efficiency.

If you want power in abundance in maximum pressure; if you want fewer troubles and less expense—get a Schramm Compressor. We have the largest variety of standard models—one of which will prove just right for you. We show (above) the largest and smallest portable jobs. Compare them! Let us send you the data and prices.

DISTRIBUTORS

CONSTRUCTION MACHINERY CO.....	Los Angeles, Calif.	Denver, Colo.
HOWARD-COOPER CORPORATION.....	Portland, Ore.	El Paso, Texas
HOWARD-COOPER CORPORATION.....	Seattle, Wash.	Butte, Mont.
HOWARD-COOPER CORPORATION.....	Spokane, Wash.	Phoenix, Ariz.
		New Mexico Road Machy. Co.....
		Albuquerque, N. Mex.

Schramm

Inc., Manufacturers

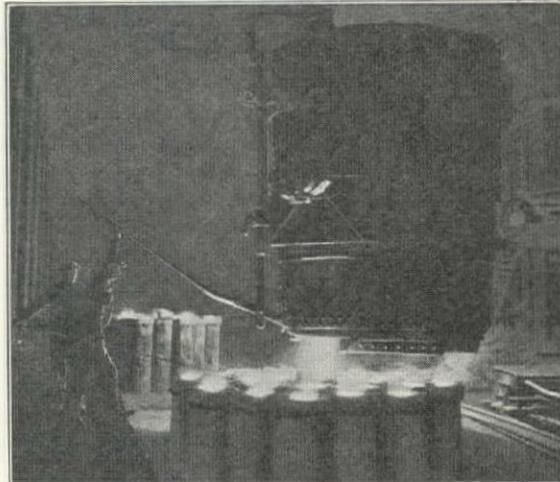
West Chester, Penna.
Representatives and Branches in all important cities

PACIFIC COAST STEEL COMPANY

Manufacturers of Open Hearth Steel Products

PROMPT AND COURTEOUS SERVICE

Forging Ingots
and Billets
Merchant
and
Reinforcing
Bars
Structural
Shapes and
Universal
Mill Plates



BOTTOM POURING INTO MOLDS

Track Bolts
Spikes
and
Tie Plates
Bolts, Nuts,
Rivets and
Specialties
Transmission
Towers
and Structures

WORKS: PORTLAND • SAN FRANCISCO • SEATTLE

Sales Offices:

SAN FRANCISCO
Hunter-Dulin Bldg.

SEATTLE
Alaska Building

PORTLAND
Failing Building

LOS ANGELES
A. G. Bartlett Building



What a Contract!

Bids Now Being Made by

HOTEL **Sir Francis Drake**
POWELL AT SUTTER
SAN FRANCISCO

FOR COMFORTABLE AND HAPPY GUESTS

Deep Carpets pave the way to the
"sleepiest" beds on the coast. Each
room an entrenchment of grandeur
designed for comfort through its
circulating Ice Water, Radio, Vita-
Glass Windows, and Servidor.

600 Guest Rooms Distinctive Dining Rooms
600 Baths Coffee Shop
600 Showers Garage in Hotel Building.

RATES: From \$3.50

L. W. HUCKINS, President

GIVE IT A PHYSICAL TEST