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WESTERN CONSTRUCTION NEWS

WITH WHICH IS CONSOLIDATED
WESTERN HIGHWAYS BUILDER

PUBLISHED MONTHLY
VOLUME X, No. 10

OCTOBER, 1935

25 CENTS A COPY
$2.00 PER YEAR

IN THIS ISSUE

A group of articles reviewing progress in the field of western water works engineering since 1920, when the California Section of the A.W.W.A. was founded.

Special—Description of the desilting works for the All-American Canal.

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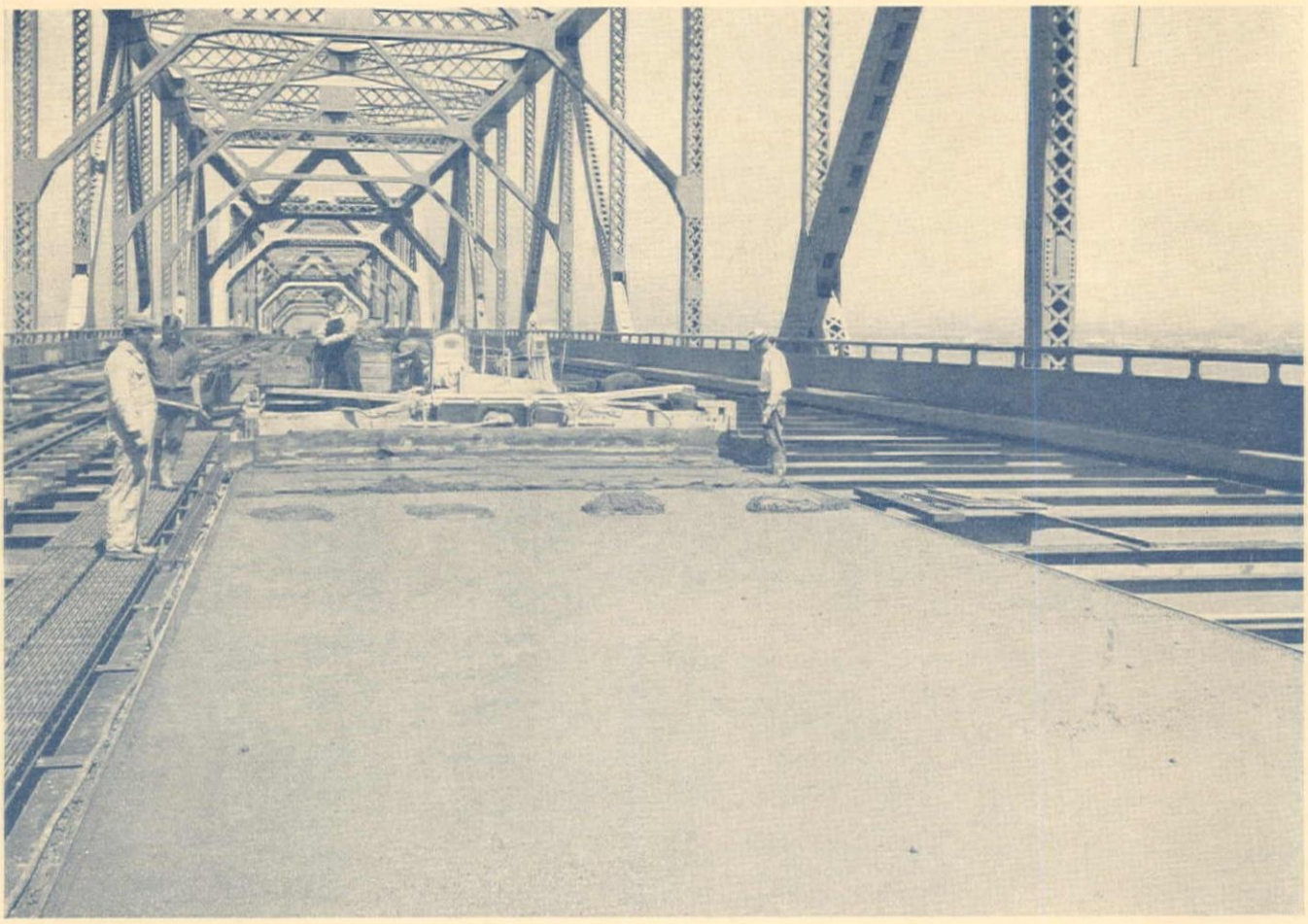
At the outlet of the Calaveras Reservoir the San Francisco Water Department has built this 80 m.g.d. aerator and screening plant.

Tenth Annual Water Works Issue

"ON DECK"



PAVING UPPER DECK SAN FRANCISCO-OAKLAND BAY BRIDGE

Golden Gate Portland Cement Being Used

Modern construction methods demand that materials be quickly available from dependable, adequate sources of supply.

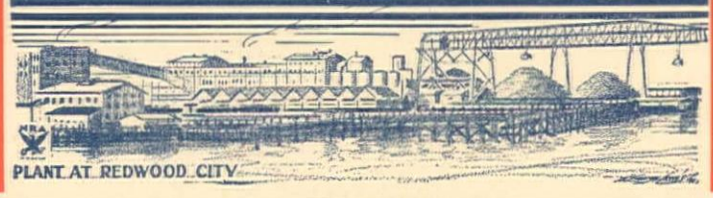
Golden Gate *True* Portland Cement is always "on deck"... when and where you want it... anywhere on the Coast.

Produced on San Francisco Bay, it is always quickly available in bulk or sack ... by rail, steamship, barge or truck.

You'll also find the men behind Golden Gate right "on deck"...always ready to serve your needs.

Ask Your Materials Dealer

PACIFIC PORTLAND CEMENT COMPANY
SAN FRANCISCO

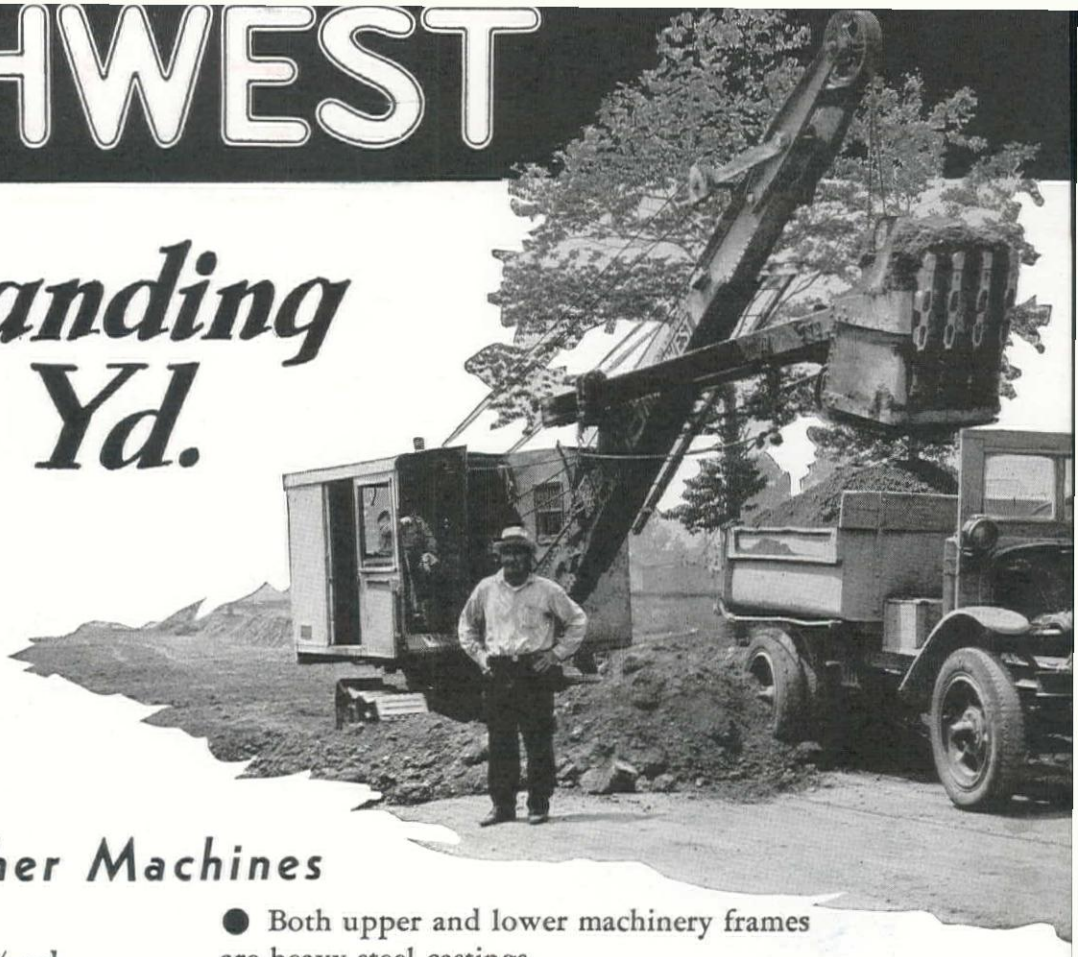


PLANT AT REDWOOD CITY

GOLDEN GATE PORTLAND CEMENT

NORTHWEST

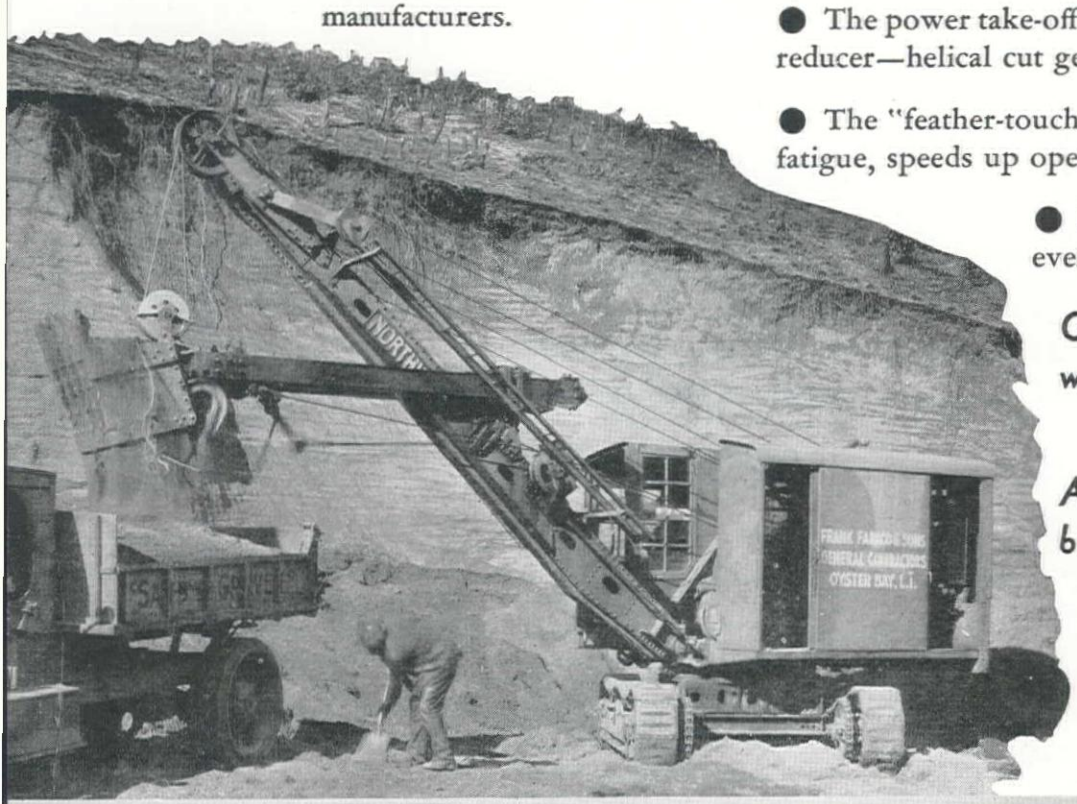
The outstanding ½ and ¾ Yd. Shovel!



Compare them Point by Point with Other Machines

Northwest ½ yd. and ¾ yd. shovels are big full sized, heavy duty machines not to be compared with the average small shovels offered by other manufacturers.

- Both upper and lower machinery frames are heavy steel castings.
- They steer with full power on both crawler belts while turning, as well as when going straight ahead.
- All high speed shafts roll on ball or roller bearings.
- The power take-off is the equivalent of the finest speed reducer—helical cut gears running in oil.
- The "feather-touch" clutch control reduces operating fatigue, speeds up operation and increases output.
- Full convertibility permits meeting every problem.



Outstanding value at a price within reach of your pocketbook!

Ask about prices before you buy!

Shovels, Cranes Draglines Pullshovels Skimmers

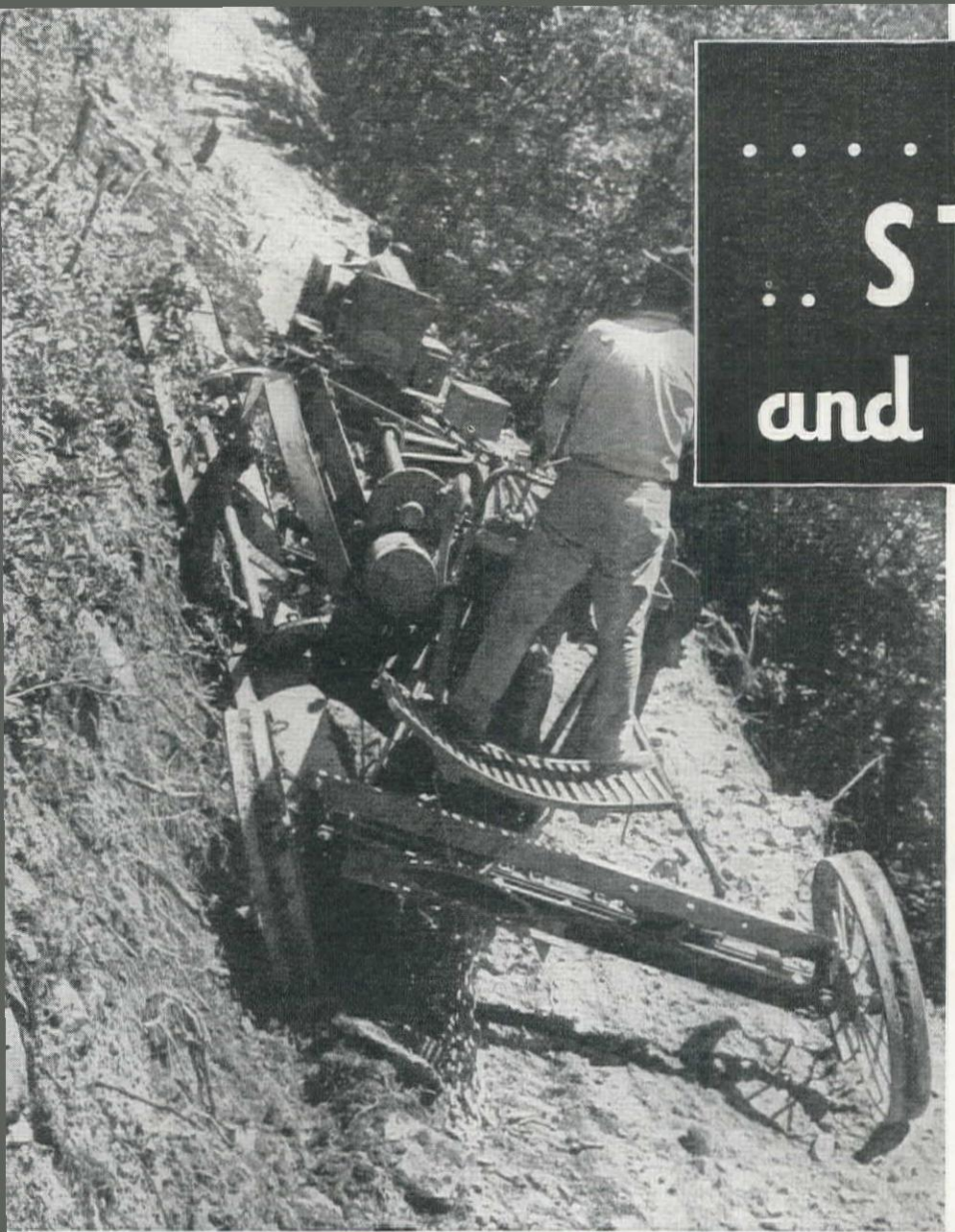
Built in a Range of 10 Sizes — 1/2 Yd. Capacity and Larger

Gasoline, Oil Deisel or Electric Powered

NORTHWEST ENGINEERING COMPANY
1736 Steger Bldg., 28 East Jackson Blvd., Chicago, Ill.
Please send me complete information on machine checked:
☐ Shovel ☐ Crane ☐ Dragline ☐ Pullshovel
☐ ½ Cu. Yd. ☐ ¾ Cu. Yd.

Name ..... *Address* .....
City ..... *State* .....

NORTHWEST ENGINEERING COMPANY—255 Tenth St., San Francisco, Calif.; 3707 Santa Fe Ave., Los Angeles, Calif. REPRESENTATIVES—Pacific Hoist & Derrick Co., 3200 Block, 4th Ave. S., Seattle; Arnold Machinery Co., Inc., 149 W. 2nd St. S., Salt Lake City; The Mine & Smelter Supply Co., 1422 17th St., Denver, Colo.; Neil B. McGinnis Co., 1401 S. Central Ave., Phoenix, Ariz.



..... Amazing .. STRENGTH and RIGIDITY

THE new box-type frame in Adams Graders has tremendous strength and ridigity to hold the blade firmly to the cut and withstand hard usage. It is a solid, one-piece all-welded unit — no rivets to work loose — nothing to give trouble.

Other outstanding features of these machines are an extremely wide range of blade working positions, quick and easy manipulation, and extraordinary visibility. New mechanical features contribute to ease of operation and long life.

Available in 12 ft. and 10 ft. blade sizes with hand or power-operated controls. Don't buy any grader until you investigate these remarkable machines.

J. D. ADAMS COMPANY

SAN FRANCISCO—LOS ANGELES—SPOKANE

Western Distributors: LUND MACHINERY CO., Salt Lake City; NIEL B. McGINNIS CO., Phoenix, Ariz.; ELTON T. FAIR CO., Denver; McCHESNEY-RAND EQUIPMENT CO., Santa Fe, N. M.; A. C. HAAG & CO., Portland, Ore.

—the New-Type ADAMS GRADERS

U.S. Forest Service machines building roads through the forests and mountains of Pennsylvania—part of an order for 217 such graders recently delivered to this department.

"Partial Estimates"

Kickoff—California won the $15,000,000 toss of federal financing and is going to start construction of the long-proposed state water development plan under the coaching of Elwood Mead and staff. The first play will probably be directed against the Friant dam site.

Yardage gained—With a yardage of 3,625,000 placed in the Fort Peck dam during the month of August, which represented a volume 22% greater than the design capacity of the dredges, a new record has been established for fill placed per month.

Second down—Passing the lowest bid which was received for steel pipe for a water supply conduit, the city of Ogden, Utah, selected the second low bid, which was concrete pipe, on this $330,000 project for a 5-mi., 36-in. conduit.

"He's Away!"—Off around Mr. Ickes' end carrying a $1,000,000,000 work relief allotment, Mr. Hopkins has apparently headed for a score, but will probably end up with about a 1-yd. gain in the shape of permanent, worthwhile improvements and return on the public's investments.

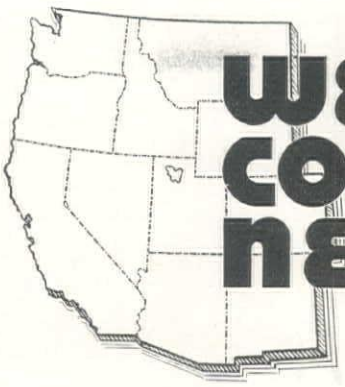
No gain—It looked as if a nice hole was opening up for the renewal of work on the Parker Dam, with the allotment of funds to start the Gila project in Arizona aimed to take out the opposition, but the play was smeared from behind, for some reason or another, when the Bureau of Reclamation allotment did not set aside funds for this structure.

Offside—We accept an offside penalty for failing to credit the spectacular picture of the diving diver, which appeared on the cover of the September issue, to the Western Pipe and Steel Co.

Huddle—From Oct. 23 to 26 the California Section of the A.W.W.A. will be in its annual huddle intent on listening to technical papers, and other forms of amusements. When the whistle blows there will undoubtedly be the usual rush for the water bucket.

SUBSCRIPTION RATES

The annual subscription rate is $2 in the United States and foreign countries where extra postage is not required. To Canada and to foreign countries where extra postage is necessary the annual rate is $3. Single copies 25 cents.



WESTERN CONSTRUCTION NEWS

WITH WHICH IS CONSOLIDATED WESTERN HIGHWAYS BUILDER

J. I. BALLARD, Editor

Contents for October, 1935

WESTERN CONSTRUCTION PUBLICATIONS, Inc.

Office of Publication: 114 Sansome Street, San Francisco, California.

Southwest Office: 206 S. Spring, Los Angeles, Newton W. Withers, Mgr.
Northwest Office: 2937 N.E. 64th Ave., Portland, Ore., G. E. Bjork, Mgr.
Chicago Office: 6100 N. Winthrop Ave., Stephen H. Babcock, Manager.

Please address correspondence to the executive offices, 114 Sansome Street, San Francisco

Entered as Second Class Matter at the Post Office at San Francisco, California, under the Act of March 3, 1879.

FOUR THOUSAND TONS FOR ONE JOB

Electrically welded steel pipe for a twelve mile line to supply water to the harbor districts of Los Angeles County was fabricated in the plant of the Southwest Welding and Manufacturing Company at Alhambra. More than two thousand lengths were required and delivery was made as wanted by the Bureau of Water and Supply.

A Quarter Century of Specialized Experience

Our experience and facilities enable us to handle any engineering specification that involves fabrication and welding. Expert workmanship is assured on every job—big or little—all alike or all different—in any weldable metal. Correct technique applied in welding corrosion resisting alloys, stainless steel, nickel-clad and duralumin. Principal products include refinery stills, reaction chambers, heat exchangers, towers, piping and fittings.

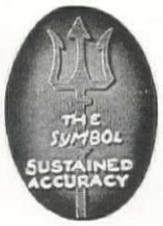
Southwest Welding and Manufacturing Co., Ltd.
Alhambra, California

Pipe Specifications

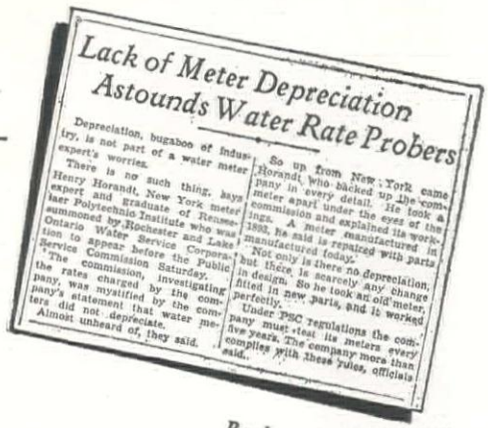
Inside diameter, 31.4 inches. Thickness, 3/8 inch. Average length of sections, 30 feet. Total weight, more than 4015 tons. Capacity of line, 30,000,000 gallons in 24 hours, with a flow of 20 cubic feet per second. Pipe tested to 572 pounds per square inch. Service pressure, 80 to 175 pounds per square inch. H. A. Van Norman, Chief Engineer and General Manager; W. W. Hurlbut, Engineer of Water Distribution; Thos. Brooks, Superintendent of Street Main Construction.

When writing to SOUTHWEST WELDING AND MANUFACTURING CO., LTD., *please mention Western Construction News*

When you know Trident Meter QUALITY



The clipping below, reproduced from the Rochester "Democrat and Chronicle," refers specifically to TRIDENT Water Meters. It tells its own story of QUALITY and interchangeability. Need we add more?



Lack of Meter Depreciation Astounds Water Rate Probers

Depreciation, bugaboo of industry, is not part of a water meter expert's worries.

There is no such thing, says Henry Horandt, New York meter expert and graduate of Rensselaer Polytechnic Institute who was summoned by Rochester and Lake Ontario Water Service Corporation to appear before the Public Service Commission, Saturday.

The commission, investigating the rates charged by the company, was mystified by the company's statement that water meters did not depreciate.

Almost unheard of, they said.

So up from New York came Horandt, who backed up the company in every detail. He took a meter apart under the eyes of the commission and explained its workings. A meter manufactured in 1893, he said is repaired with parts manufactured today.

Not only is there no depreciation, but there is scarcely any change in design. So he took an old meter, fitted in new parts, and it worked perfectly.

Under PSC regulations the company must test its meters every five years. The company more than complies with these rules, officials said.

Rochester "Democrat and Chronicle"

WHEN you know Trident (and Lambert) Water Meter QUALITY you know why Water Works men today are turning from cheap, low priced "bargains" to well designed, well built QUALITY equipment . . . equipment that, years from now, will satisfy the most critical "water rate probers" as to the value of the investment. Today men are buying QUALITY water meters . . . they are buying Trident and Lambert Water Meters, because they know that a generation of service, or any possible improvements, will not cause depreciation nor obsolescence, and that their quality design and construction insure sustained accuracy and maximum water-revenue production. A type for every service. Write Neptune Meter Company (Thomson Meter Corp.), 50 West 50th Street (Rockefeller Center), New York City . . or . . Neptune-National Meters, Ltd., Toronto, Canada.

OVER 6 Million

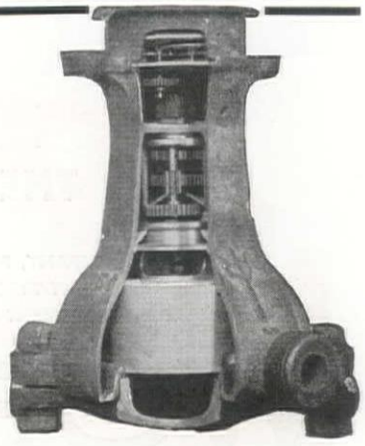
Trident and Lambert Water Meters made and sold the world over.

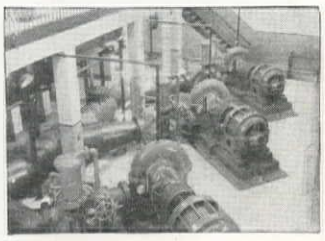
QUALITY!

TYPICAL OF TRIDENT METER QUALITY

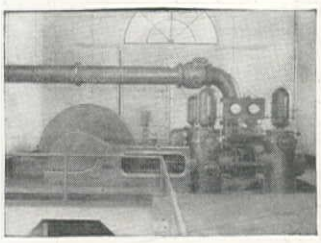
These Gauges are used in Trident Gear Trains and Registers

How truly Neptune-built meters are quality products is shown by these gauges, used to check Gear Trains and Registers. The Trident Gear Train alone is gauged some 75 times during production of its parts, and all interchangeable parts are again 100% inspected before assembling. Nothing will do but complete precision for every part of Trident or Lambert Meters. Note modern interchangeable parts inserted into (cut-away) Trident Meter casing dating back to 1899.

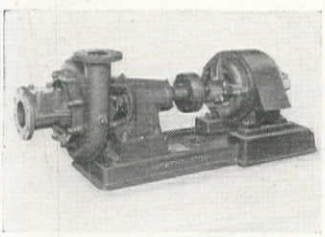




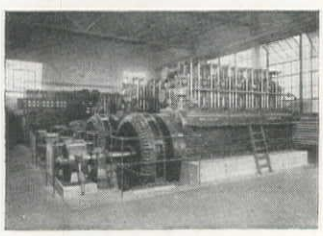
Centrifugal pumps in city water works



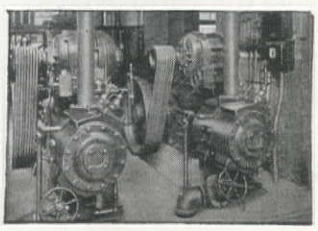
Reciprocating duplex pump in city water works



Motor-driven "Freflo" pump for unscreened sewage



Diesel engines driving electric generators



Air compressors with Multi-V-Drives

SINCE 1840 . . . when Henry R. Worthington invented his first pump, one of the most important contributions to the science of water handling . . . the name Worthington has been associated, with increasing emphasis, with every major development and forward step in the pumping and power service field.

In large and small water works systems, in huge irrigation developments, sewage and storm water disposal plants, in state-wide water conservation and construction projects . . . in every kind of water handling . . . Worthington installations are writing history with their performance records.

WORTHINGTON EQUIPMENT FOR WATER SUPPLY

CENTRIFUGAL PUMPS
•
DEEP WELL TURBINE PUMPS
•
DIESEL ENGINES
•
STEAM CONDENSERS
•
STATIONARY FEEDWATER HEATERS
•
STATIONARY AIR COMPRESSORS
•
ROCK DRILLING EQUIPMENT
•
V-BELT DRIVES

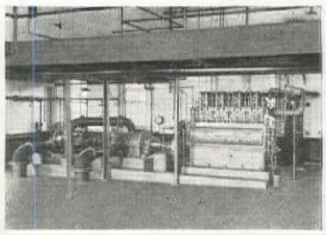
STEAM AND POWER PUMPS
•
SUMP AND DRAINAGE PUMPS
•
GAS ENGINES
•
CONDENSER AUXILIARIES
•
STEAM AIR EJECTORS
•
PORTABLE AIR COMPRESSORS
•
CONSTRUCTION AIR TOOLS
•
AIR LIFTS

•

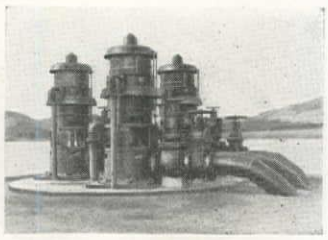
WATER METERS

A complete line of water meters of every type is manufactured by Worthington-Gamon Meter Company, a subsidiary of Worthington Pump and Machinery Corporation.

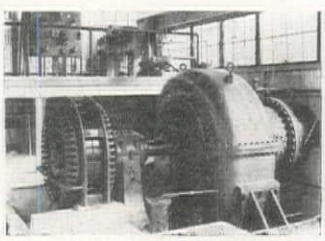
● *Complete descriptive literature available*



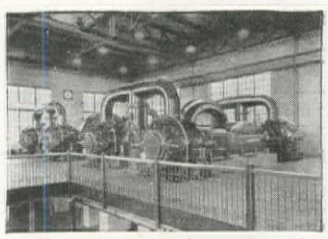
Diesel engine driving centrifugal water works pump



Deep well turbine pumps in city water works



Motor-driven centrifugal pump on drainage service



Opposed-type compressors on gas distribution

Portable air compressor operating pavement breakers

THE WORTHINGTON COMPANY, INC.

SEATTLE SAN FRANCISCO LOS ANGELES

A. C. HAAG & COMPANY, Portland STAR MACHINERY COMPANY, Seattle GENERAL MACHINERY COMPANY, Spokane
WESTMONT TRACTOR & EQUIPMENT COMPANY, Missoula GARLINGHOUSE BROTHERS, Los Angeles
CONTRACTORS EQUIPMENT & MACHINERY COMPANY, San Diego VANDERCOOK COMPANY, Sacramento

WORTHINGTON

A-35103

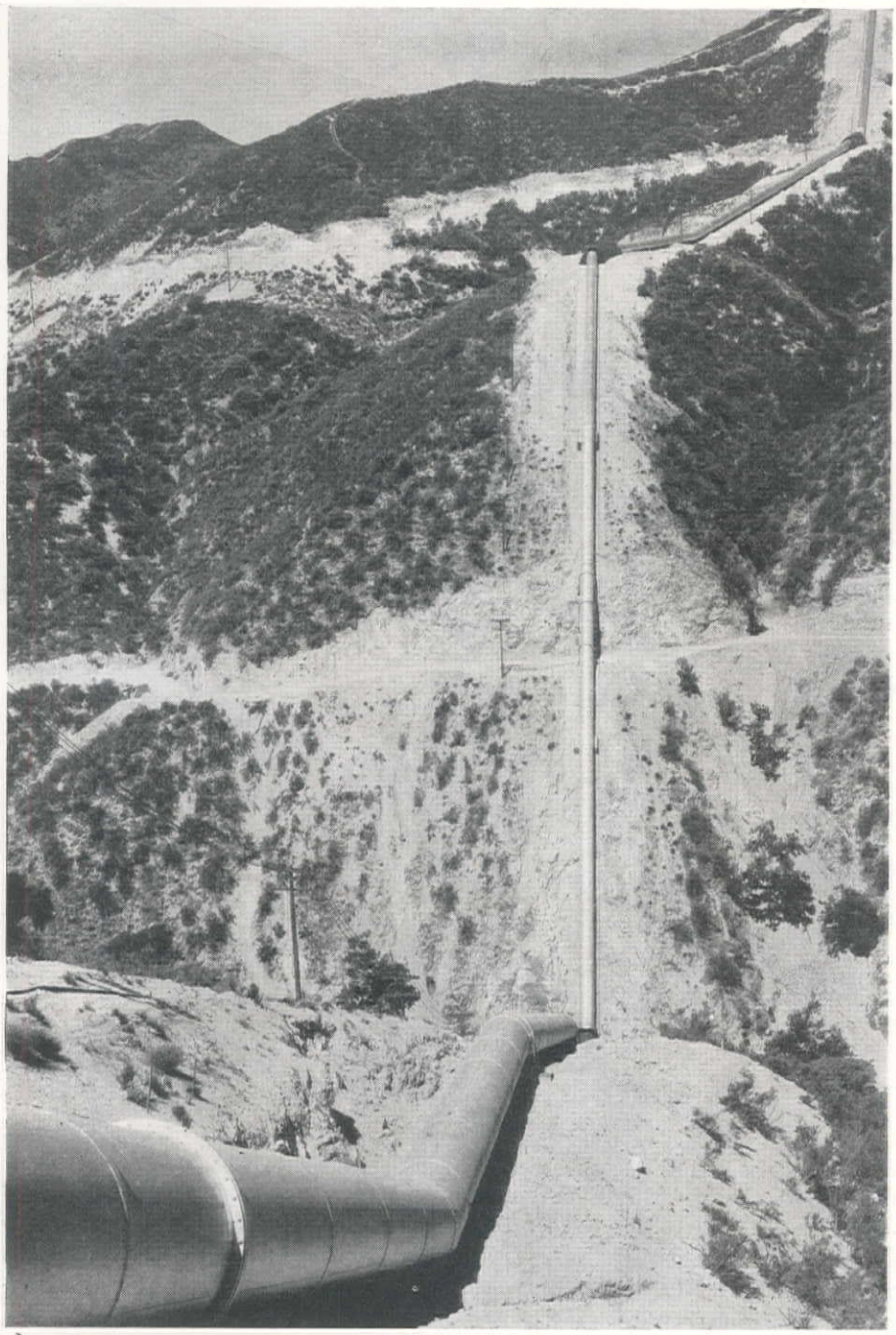


Illustration above shows electric welded steel syphon across San Francisquito Canyon. The pipe varies from 94" to 80" diameter. Manufactured at our Los Angeles plant.

WESTERN PIPE & STEEL CO.

FABRICATED

The

ELECTRIC WELDED STEEL PIPE

for

BOUQUET CANYON PROJECT

City of

LOS ANGELES

WESTERN PIPE & STEEL COMPANY

OF CALIFORNIA

LOS ANGELES SAN FRANCISCO FRESNO BAKERSFIELD PHOENIX

Affiliated: HARDINGE-WESTERN COMPANY

In service since 1847 *under historic Boston Common*

Water Works Improvements Are Sound Relief Projects

1. Water supply improvements constructed with cast iron pipe pay for themselves.
2. Approximately 75% of the cost of manufacturing, distributing and installing cast iron pipe, including raw materials, goes directly to workmen.
3. Manufacturing and installing one mile of 6-inch cast iron pipe gives approximately 1000 man days of employment.
4. For every 100 tons of cast iron pipe manufactured, the railroads handle approximately 1000 tons of material.

John Quincy Adams dug the first spadeful of earth for the excavation when this cast iron pipe line was laid 88 years ago.

THERE was a holiday celebration on Boston Common when the water was turned on in Boston's first cast iron water line and children sang an ode written for the occasion by James Russell Lowell. A section of this cast iron line which is still in service was recently uncovered and found in perfect condition.

The long life of cast iron pipe is evidenced by mains still in use in America and Europe after from one to nearly three centuries of service. It is the recognized standard material for water and gas mains. Engineers rate its useful life, in evaluating bids, at 100 years, far beyond that of other materials used for underground mains.

Cast iron pipe *costs less per service year* and *least to maintain* because it effectively resists rust. It is the one ferrous metal pipe for water and gas mains, and for sewer construction, that will not disintegrate from rust.

Communities should take advantage of the present favorable municipal bond market and Government grants to modernize, enlarge or extend water distribution systems, or to build new supply lines. With Federal aid, pipe line improvements can be secured for a fraction of their usual cost. Further information may be obtained through The Cast Iron Pipe Research Association, Thomas F. Wolfe, Research Engineer, 1015 Peoples Gas Bldg., Chicago, Illinois.

CAST IRON PIPE

METHODS OF EVALUATING BIDS NOW IN USE BY ENGINEERS RATE THE USEFUL LIFE OF CAST IRON PIPE AT 100 YEARS

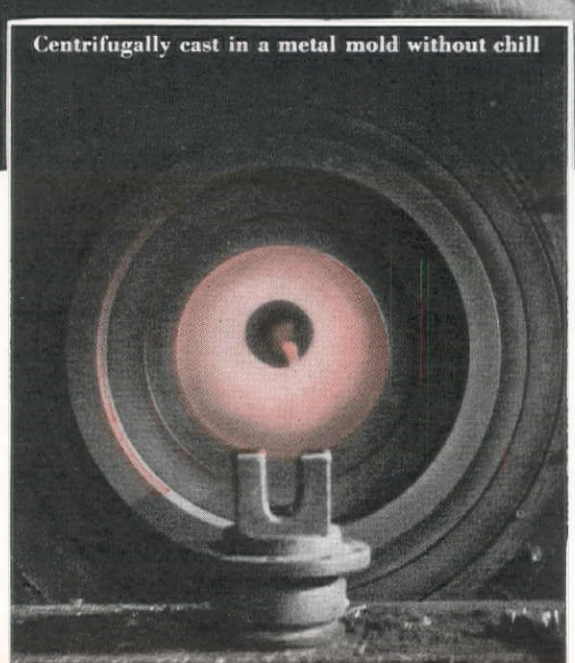
TRADEMARK REG.

When writing to THE CAST IRON PIPE RESEARCH ASSOCIATION, *please mention Western Construction News*

IMPACT RESISTANCE DOUBLED!

Unloading 5500 feet of 16" Super-de Lavaud Pipe at Water Department stockyard for installation at Washington, D. C.

Centrifugally cast in a metal mold without chill



THE full span of a cast iron water main's useful life is yet to be measured: witness the fact that the first recorded installation of cast iron water pipe is still in use after nearly three centuries of service. Certain it is that Super-de Lavaud centrifugally-cast pipe with its notably improved metal structure will more than live up to cast iron's unique reputation for long life. This is a *stronger, tougher, more ductile* cast iron pipe, made so by a patented and proved process in which gray iron is centrifugally-cast in a metal mold *without chill.* Impact resistance is *doubled* without lowering tensile or bursting strength. Send for descriptive brochure.

U.S. SUPER-de LAVAUD PIPE

CAST WITHOUT CHILL IN A METAL MOLD

UNITED STATES PIPE AND FOUNDRY CO., General Office: BURLINGTON, N. J.

Foundries and Sales Offices throughout the United States

To the WATER WORKS INDUSTRY

. . . *We Announce*

An ENGINEERING CONSOLIDATION of National Scope

● **Effective immediately, The Pelton Water Wheel Company becomes exclusive representative in the West for the complete line of Chapman Automatic Control Valves for Water Works, Sanitary and other services. This agreement combines the experience and engineering resources of the Chapman Valve Manufacturing Company with those of this company, representing an aggregate of one hundred and thirty years of pioneering leadership — East and West. Pelton automatic valve products will be engineered and serviced in the eastern states by the Chapman organization.**

● **This fortunate association places Pelton engineering and service facilities behind the well known *Automatic Cone Valve*, and enables the offering of automatic valve equipment to precisely fit every hydraulic condition, admirably supplementing the lines of Larner-Johnson (balanced plunger) and angle types developed by Pelton engineers.**

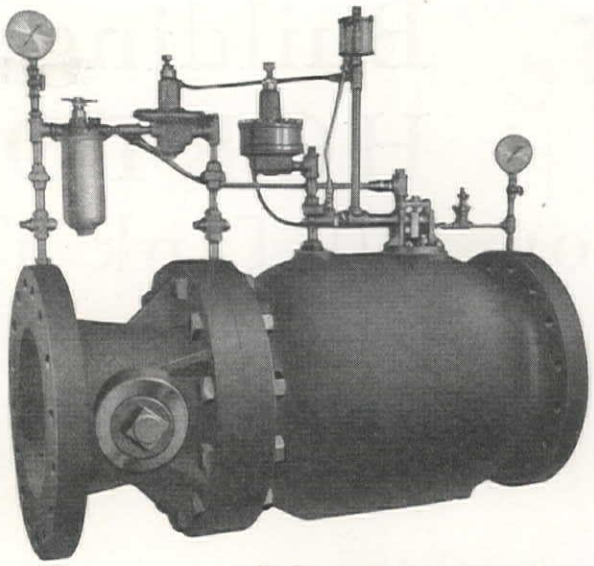
● **Thus from one source the water works industry may procure automatic valves of the three leading approved designs in the interests of best engineering for each installation. Literature, proposals and consulting service is readily available from our San Francisco offices.**

See the* PELTON *and* CHAPMAN *Exhibits at the* WATER WORKS CONVENTION, SAN DIEGO, *Oct. 23 to 26.

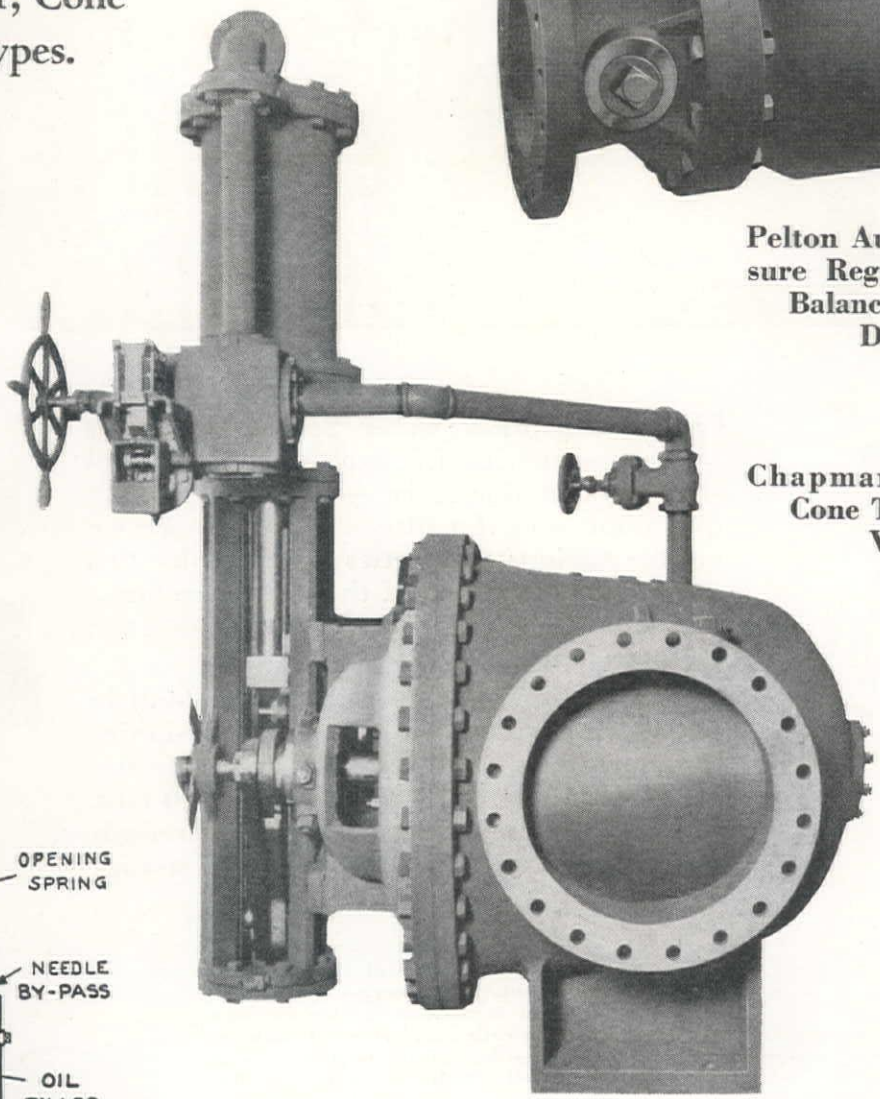
CHAPMAN

We Present . . .

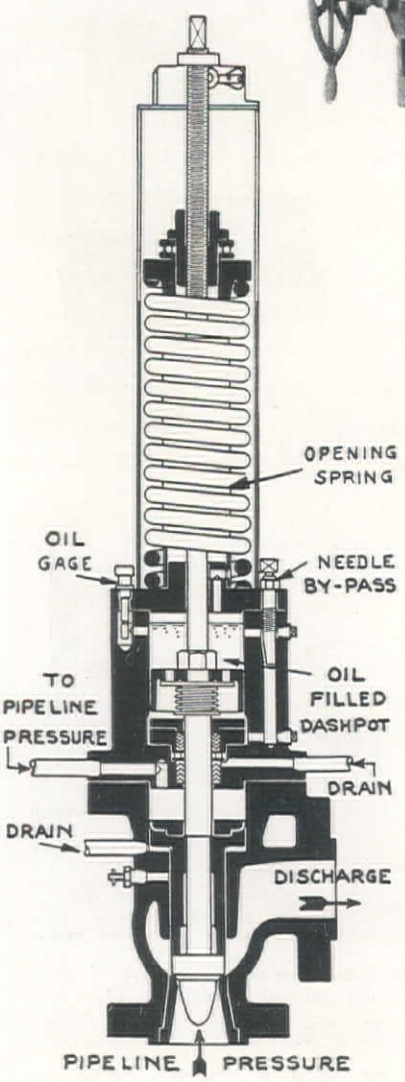
Three Distinctive Automatic Valve Designs including Balanced Plunger, Cone and Angle Types.



Pelton Automatic Pressure Regulator of the Balanced Plunger Design.



Chapman Automatic Cone Type Check Valve.



Pelton Automatic Angle Type Surge Suppressor.

Complete descriptions of all valves given in Chapman Catalog No. 3, and Pelton Bulletin No. 29. Ask for copies.

THE PELTON WATER WHEEL COMPANY

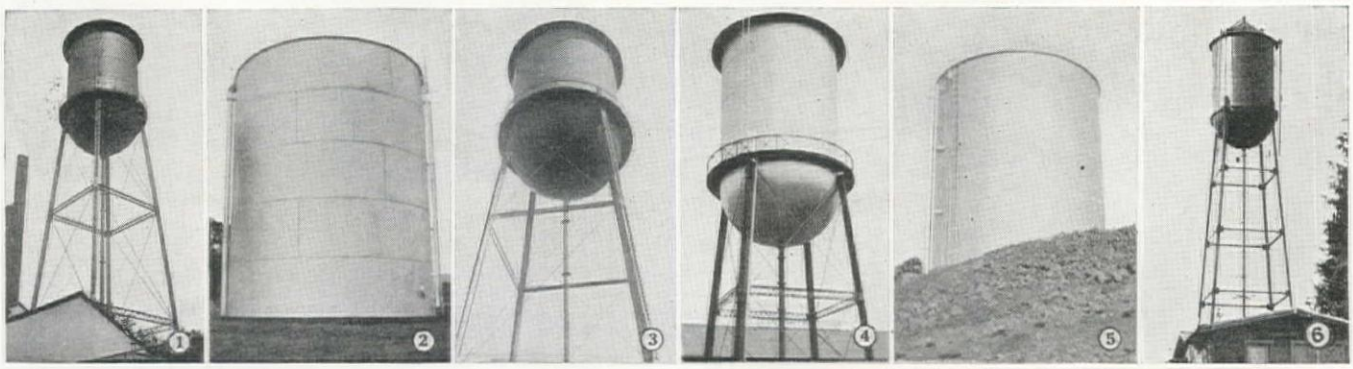
Hydraulic Engineers

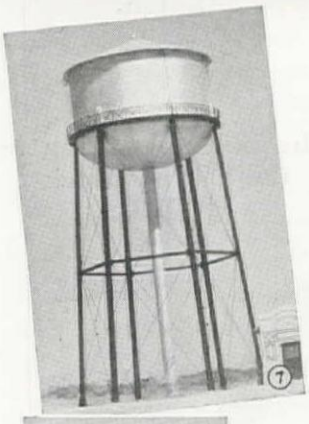
120 Broadway	2929 Nineteenth Street	Paschall Station
NEW YORK	SAN FRANCISCO	PHILADELPHIA

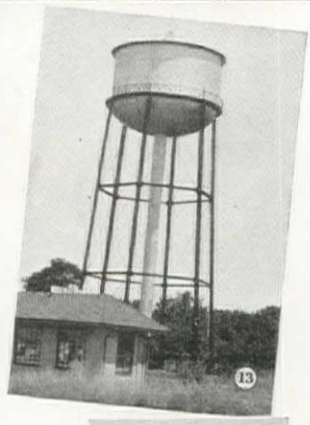
Pacific Coast Representatives for Baldwin-Southwark Corp., De LaVergne Engine Co., Cramp Brass & Iron Foundries Co., Woodward Governor Co., *and* Chapman Valve Manufacturing Co.

PELTON

Building their 15TH HORTON TANK on 170 Tank Years of Experience



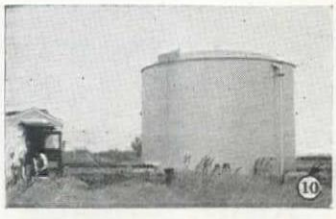




THE California Water Service Company has recently completed a Horton elevated steel tank at Belvedere—the third tank at that point and the fifteenth now in service on the various properties operated by this water company. One of the Belvedere tanks and the twelve in other communities are pictured here.

The first of the fifteen tanks was built in 1905. Three of them have been in service for more than 25 years. The aggregate life of the group amounts to a total of 170 tank years—an imposing record which represents a wealth of experience in the use of storage in waterworks distribution systems.

The increasing use of elevated storage in municipal service is a notable trend of recent years. Our facilities for fabricating and erecting tanks of all types have fully kept pace with improved practice and today we offer the latest shallow-depth designs, as well as any of the conventional types. Our nearest office will gladly furnish data on savings effected by elevated storage and cost information for estimating purposes.



1. First Chico tank, built 1905.
2. 100,000 gallon standpipe at Diablo.
3. Second Chico tank, 150,000 gal. capacity.
4. 25-year-old tank at Hanford.
5. Walnut Creek standpipe.
6. 10,000 gal. tank at Marshfield, Ore.
7. Bakersfield tank, 150,000 gal. capacity.
8. Concord elevated tank.
9. A 1921 tank at Willows.
10. San Mateo tank built in 1933.
11. 200,000 gal. tank, at Stockton.
12. First Belvedere tank, built 1925.
13. 150,000 gal. tank at Hillsboro, Ore.

50,000 gal. tank built in 1927 and 100,000 gal. tank built in 1935 at Belvedere not illustrated.

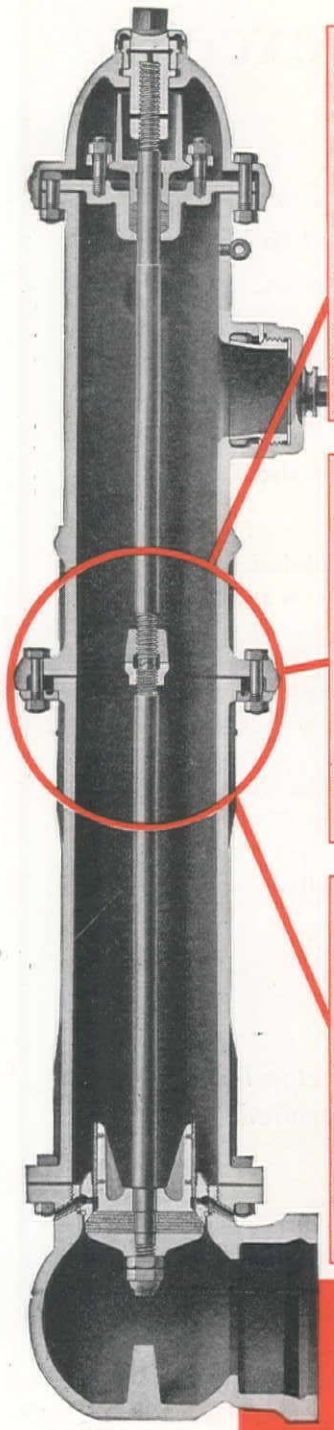
CHICAGO BRIDGE & IRON WORKS

San Francisco	1013 Rialto Bldg.	Tulsa	Thompson Bldg.	Detroit	Lafayette Bldg.
Los Angeles	1444 Wm. Fox Bldg.	New York	165 Broadway	Birmingham	1500 North Fiftieth Street
Houston	2919 Main Street	Chicago	Old Colony Bldg.	Cleveland	Rockefeller Bldg.

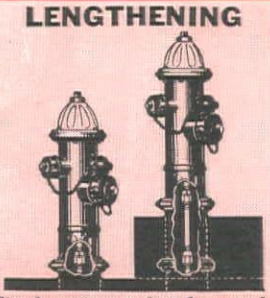
Plants at **BIRMINGHAM, CHICAGO** *and* **GREENVILLE, PA.**

We call it a "Safety Flange"

--but "safety" is only part of the story--



LENGTHENING

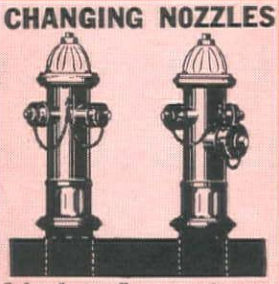


Simply remove safety flange and coupling and add section as shown. Then install solid flange and coupling at lower end of section and safety flange and coupling at upper end. No water cut-off; no digging.

SWIVELING

Simply loosen the eight bolts that hold the safety flange in place and swivel hydrant to any degree of a circle. No digging. No water cut-off.

CHANGING NOZZLES



Safety flange offers convenient way of removing barrel section having only hose nozzles, and replacing it with section having both hose and steamer nozzles. No water cut-off. No digging.

OF course the primary purpose of the safety flange of the Columbian Fire Hydrant is to confine breakage by trucks or automobiles to a few inexpensive parts. But do not overlook the fact that it also offers three other important advantages:

(1) An inexpensive way of lengthening the hydrant to conform to new grade levels.

(2) A simple means of swiveling the barrel so that the nozzles can be faced to any degree of a circle.

(3) A simple, quick way of adding steamer connections to hydrants as conditions call for steamer nozzles.

All of these changes are made, as illustrated, without digging, without cutting off water, and at minimum cost. Cities grow, grade levels change; conditions change. Therefore even if the greater feature of protecting vital parts were forgotten, these three features of lengthening, swiveling and changing connections would make Columbians a sound investment.

In addition to these features the Columbian offers the unduplicated self oiling feature, positive protection against freezing, easy main valve removal, cut-resistant, double-life main valve, and many other features that are found in no other hydrant.

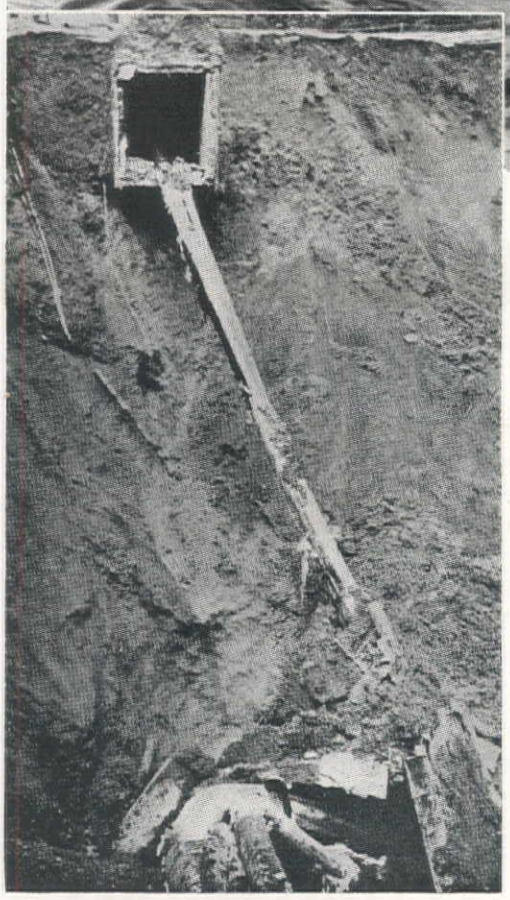
Write today for detailed description of your *future* fire hydrant.

COLUMBIAN IRON WORKS
Chattanooga, Tennessee
Division of MUELLER CO.
Decatur, Illinois

COLUMBIAN

FIRE HYDRANTS AND GATE VALVES

Nature's test of AIRCOWELDING



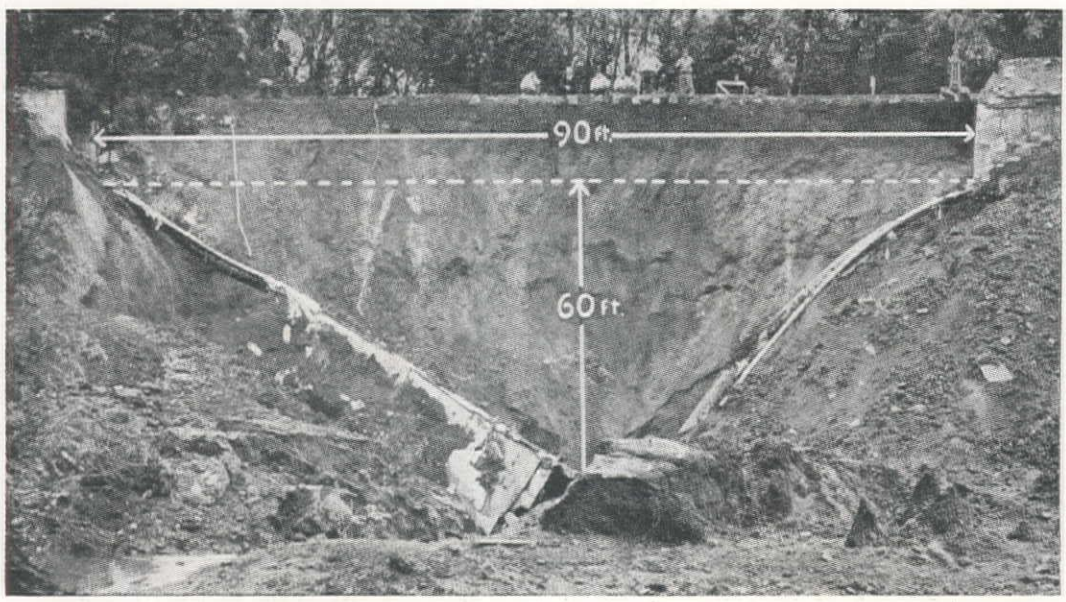
Above: A view looking across the gap from one broken end of the tunnel to the other. Below: A photo which gives a clearer idea of what happened to the tunnel and pipe lines.

Right in the path of the flood which recently ravaged a large section of Northern New York, is the State Hospital at Willard. When this modern hospital was built a comparatively short while ago, the heating and power piping was AIRCOWELDED throughout. The contractor was John W. Danforth Company, Buffalo, N. Y.

Part of this piping ran through a tunnel. With devastating force the flood washed out a section underneath the tunnel 90 feet wide and 60 feet deep. The tunnel collapsed, forcing the pipe line to support the entire weight of the concrete tunnel, which hung upon it in sections like an enormous string of beads.

Yet not a single weld parted. In fact the drag of this tremendous weight, sagging the pipe line 60 feet below normal, threatened equipment to which it was connected, and the line was cut for safety's sake, on both sides of the wash-out.

The welds in those lines must have been subjected to tremendous strains and stresses. Yet not a single weld broke or cracked. Nature has proved, beyond the possibility of doubt, the STRENGTH OF AIRCOWELDED piping. Furthermore, a 500-ft. emergency line for temporary laundry and kitchen service was AIRCOWELDED and operating within twelve hours. Speed as well as strength is a feature of AIRCO-WELDING.



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Get the facts about AIRCO-WELDING

AIR REDUCTION SALES CO.,

General Offices:
60 East 42nd Street, New York, N. Y.

DISTRICT OFFICES and DISTRIBUTING STATIONS in PRINCIPAL CITIES

facts NO MANU CAN AFFORD TO

More construction work is now being conducted in the eleven western states than in all of the thirty-seven eastern states. More than a *Billion Dollar Market* exists today. But, to reach this market effectively, you must, first of all, reach those men who specify or actually buy your product. To do this economically, the medium to carry your advertising message should be chosen with care. The only logical medium is *Western Construction News*—if you are equipped to serve all of the West, or even a major portion of it.

Why *Western Construction News?* Because it benefits all of your western outlets alike. It is the only construction publication in the West that does a complete selling job for you. It not only reaches those vitally interested in your product, but is read by them reli-

Compare THE CIRCULATION FIGURES OF WESTERN CONSTRUCTION NEWS WITH THOSE OF ANY CONSTRUCTION PAPER FOR COVERAGE OF THE WEST

The circulation of *Western Construction News* is well over 8,000 copies each month—this issue 8,500. This total is more than double the circulation of any other publication for complete coverage of the West's civil engineering industries. We base our case on these three points:

QUANTITY—We refer to actual circulation . . . and not the mythical figures you sometimes see.

QUALITY—Compare the editorial pages of *Western Construction News* with those of any other publication. It will be apparent at once that *Western Construction News* is written for the operating men whose decisions affect buying of equipment and materials. They are the ones who count.

SPREAD—An all-western coverage that means your simplest, surest way of doing a promotional job most economically. It's the only publication with adequate coverage in each of the eleven western states.

Make these comparisons yourself. We'll open our circulation files to you. We can, for our figures are real!

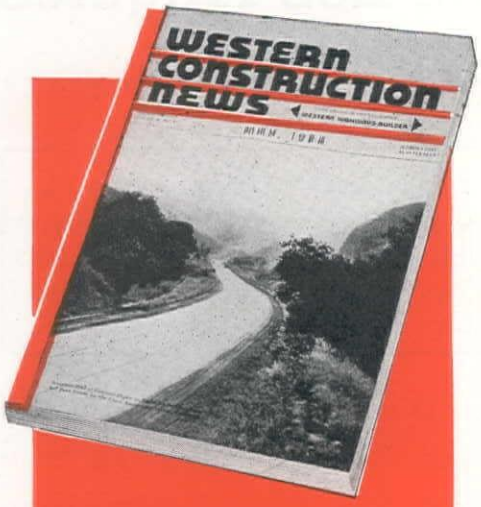
FACTURER OVERLOOK!

giously, right on the job. Because it is neither a Washington nor Arizona paper — Colorado nor California — Oregon nor Utah — but, regional in every sense of the word. *Western Construction News* offers manufacturers *complete* western coverage at one cost.

Get in touch with the nearest representative for further details. Conveniently located district offices in *San Francisco*, 114 Sansome Street; *Los Angeles*, 206 So. Spring Street; *Portland*, 2937 N. E. Sixty-fourth Avenue. In the East: *Chicago*, 6100 No. Winthrop Avenue; *New York*, R. H. Flynn.

In the meantime, may we send you the booklet, "Selling the West"? It's packed with information about this Billion Dollar market, and your most economical means of reaching the buying power.

● Send for your copy of "Selling the West." No obligation. It's filled with information about the West's Billion Dollar Market in the civil engineering industries. Send your request to *Western Construction News*, 114 Sansome Street, San Francisco.



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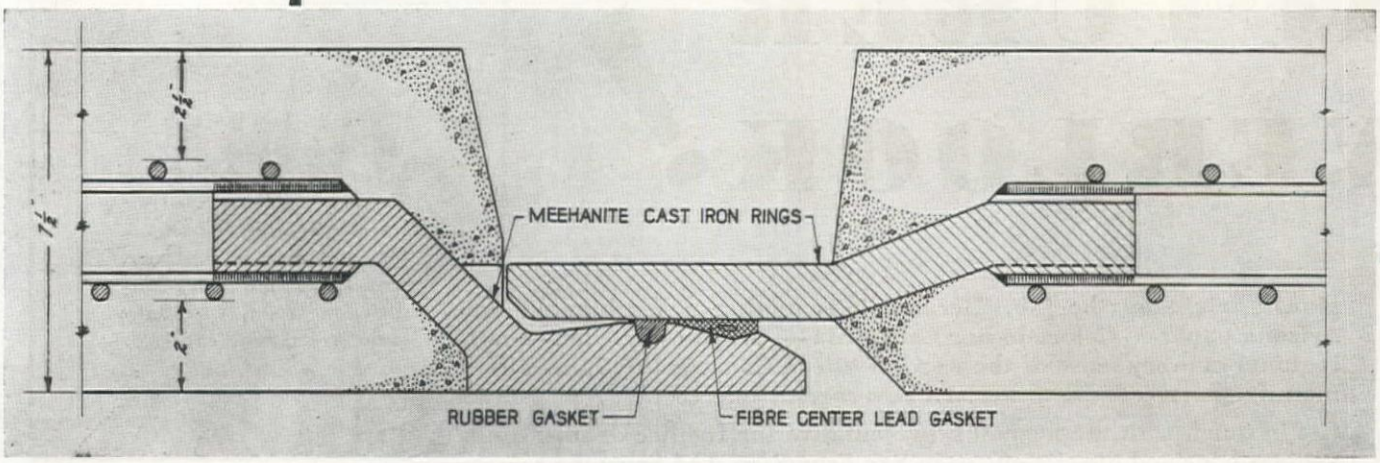
AND MANY OTHERS

Because they are sold on WESTERN CONSTRUCTION NEWS through the splendid support it continues to give them.

Another Reinforced Concrete Pipe of Special Design



The White Point *Subaqueous* Outfall Sewer for the Los Angeles County Sanitation District . . . . .

Permanence, water tightness, flexibility and strength were essential requirements in this subaqueous pipe. Pipe sections 12 and 18 feet in length. Approximately 5,000 feet of 60-inch subaqueous reinforced concrete pipe with flexible lead caulked joints for use in Los Angeles County Sanitation District's White Point Outfall Sewer. Merritt-Chapman & Scott Corporation, General Contractors.

This type of joint used on 2,646 feet of line. Ball and socket flexible joint used on remainder. All joint castings are of Meehanite Cast Iron.

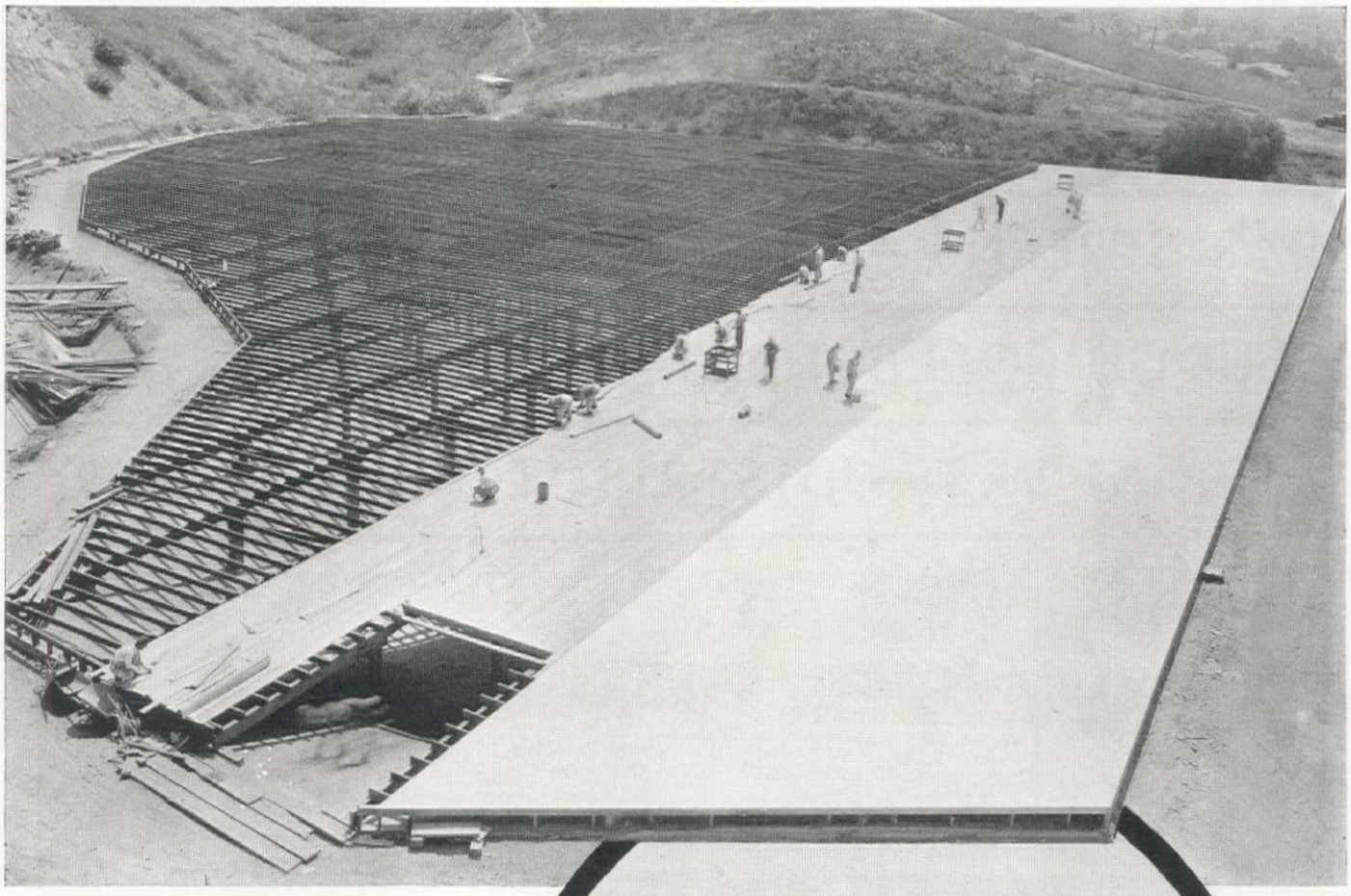
A. K. WARREN, *Chief Engineer and Gen. Mgr.* A. M. RAWN, *Asst. Chief Engineer*
Los Angeles County Sanitation District

Pipe Manufactured by

American Concrete & Steel Pipe Company

LOS ANGELES SAN DIEGO OAKLAND, CALIFORNIA
TACOMA, WASHINGTON

When writing to AMERICAN CONCRETE & STEEL PIPE COMPANY, *please mention Western Construction News*



Whittier Reservoir roof, built in 1934; M. R. Bowen, City Engineer. Columns, framing and sheathing are Redwood.

Use Redwood

. . . an old Friend

Specify Redwood for
WATER WORKS CONSTRUCTION

Reservoir roofs	Diversion boxes
Dam facing	Canal lining
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Pipe line trestles	Syphons
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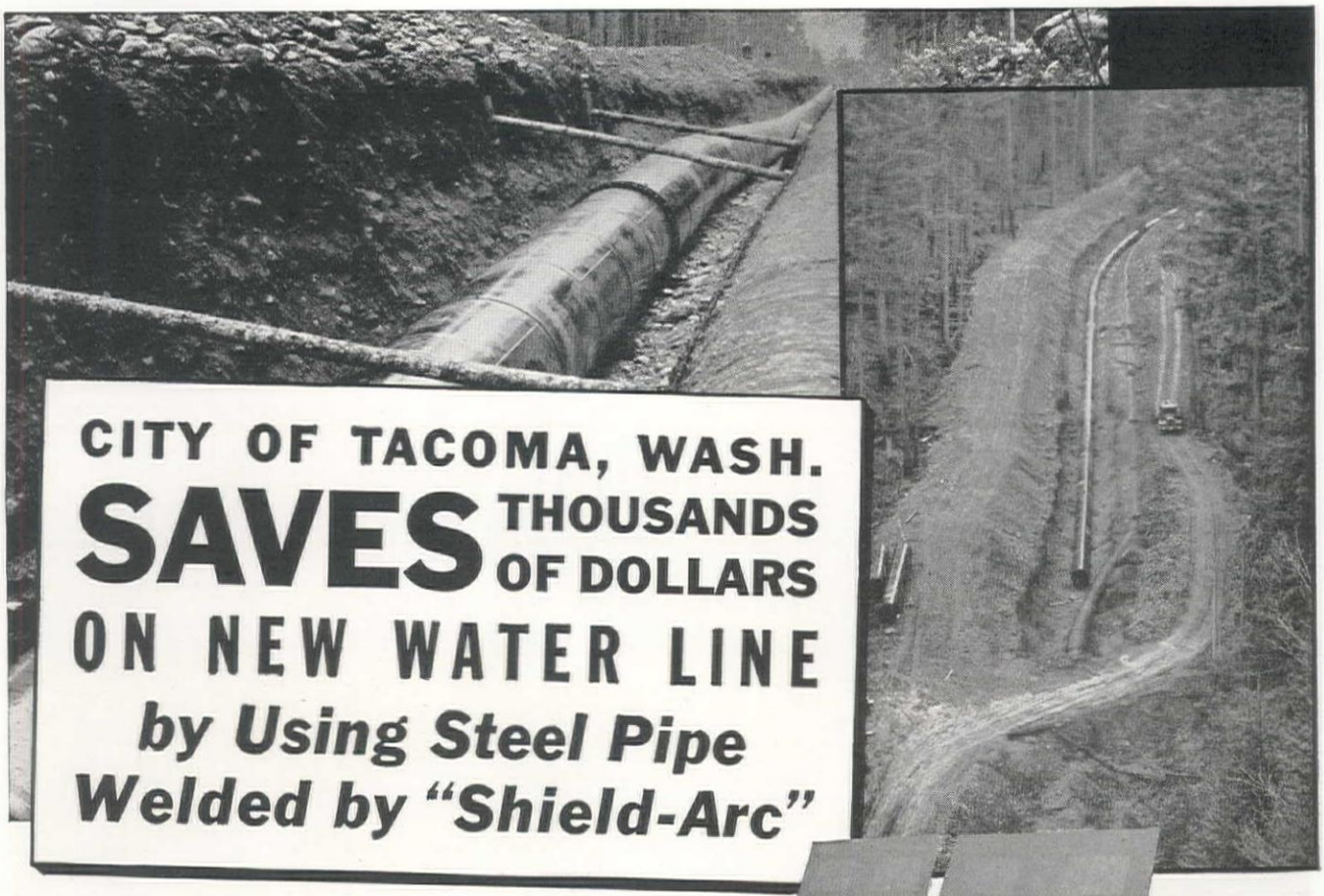
Because of its proven resistance to decay and insect attacks, its ease of working, low factor of shrinkage, comparative freedom from warping and checking, together with its sustained strength, Redwood has played an important part in water storage and distribution. Moreover, Redwood contains no harmful chemicals to contaminate the water. Today the use of the dependable structural and irrigation grades of Redwood gives added satisfaction to waterworks engineers.

CALIFORNIA REDWOOD ASSOCIATION 405 Montgomery Street San Francisco

NATURALLY DURABLE CALIFORNIA REDWOOD



CITY OF TACOMA, WASH. SAVES THOUSANDS OF DOLLARS ON NEW WATER LINE by Using Steel Pipe Welded by "Shield-Arc"

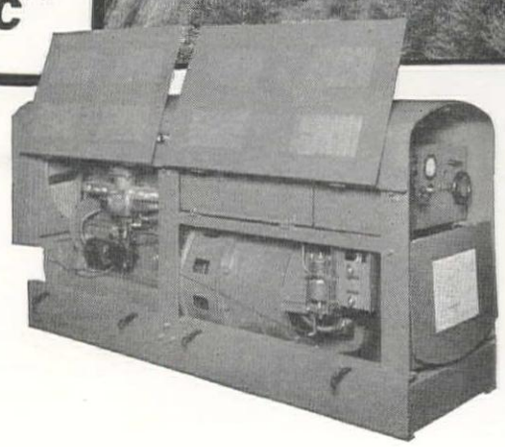
Now the City of Tacoma proves that dollars go much farther when water supply lines are built of steel pipe welded by the "*Shield-Arc*." For its new line, constructed of 52-inch, 58-inch and 63-inch diameter steel pipe, cost far less than would have been the case with ordinary methods of water line construction.

And "*Shield-Arc*" welded joints will go right on saving money—as long as the pipe lasts . . . because they are forever leak-proof and trouble-free. Never will they need attention. For they are stronger than the pipe, equal to it in ductility and density, and greater in resistance to corrosion.

And to be sure of these advantages in the pipe itself, see to it that it is fabricated by automatic shielded arc welding with the "Electronic Tornado."

Contractors also save when they weld with a "*Shield-Arc*." "*Shield-Arc's*" uniform current, high capacity, increased efficiency and eight other features give faster welding speeds, higher quality welds and more welding per dollar.

We suggest—if you want all the big savings arc welding offers—that you get all the facts on the "*Shield-Arc*" welder now. Ask THE LINCOLN ELECTRIC COMPANY, Dept. K-171, CLEVELAND, OHIO. Mail the coupon today.



LINCOLN "SHIELD-ARC" WELDER

A single, complete and compact unit powered by heavy duty gasoline engine. Users claim this "*Shield-Arc*" welder 20% to 35% more economical. Amazing economy is due to many features not found in any other welder.

POP: "It isn't the size of the dog in the fight that counts—it's the size of the fight in the dog."

LAD: "Righto, Pop—and let that be a lesson to you. It isn't the welding machines in life that save money—it's the life in the welding machines. Since we started using Lincoln '*Shield-Arcs*' our water main welding costs have dropped 25%."

THE LINCOLN ELECTRIC COMPANY
Department K-171, Cleveland, Ohio

Gentlemen: Why will the "*Shield-Arc*" give me the most savings in welding steel water mains?

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Your Name _____ Title _____

Address _____

City _____ State _____

PROGRESS VIEWS, MINNEAPOLIS-ST. PAUL $15,500,000 PROGRAM

For years the Mississippi River at the Twin Cities was highly polluted, sewage representing up to one-fifth the entire flow at low water stages. In 1933 the Minneapolis-St. Paul Sanitary District was created and a sewerage program undertaken. Today, contracts for more than $5,000,000 have been awarded. The remainder will be placed under contract in 1935-36. The 50,000 ft. main trunk sewer shown (35,000 ft. in tunnel) is to be *reinforced concrete,* sections varying from 6′ 6″ to 13′ 10″ in diameter. 204 ft. maximum cut to invert. Approximately 53 *miles of concrete sewers,* including two river crossings of *triple reinforced concrete pipe* are or will be built.

WHERE MILLIONS ARE AT STAKE SEWERS ARE BUILT OF CONCRETE

ON big sewerage projects such as those of the Sanitary District of Chicago, Louisville, Detroit, Baltimore, New Orleans, and other large cities—why is concrete chosen?

Where sewage pours from miles of collecting sewers into intercepters and outfalls bigger than railroad tunnels—why the universal reliance on concrete?

The answer is—concrete combines the necessary strength and durability at the most favorable cost. On its record this statement cannot be disputed.

Obviously concrete was chosen on these projects only after investigation proved its suitability. Whether *your* sewer is to be 12 feet in diameter—or only 12 inches—you play safe when you specify concrete.

Satisfactory sewer performance demands not only good materials but also proper design, construction and operation. Sewerage is a highly specialized field, and every project should be in the hands of an experienced sanitary engineer. Considering the investment his service is low cost insurance.

Facts on the use of concrete in sewers are available in booklets, *"Monolithic Concrete Sewers,"* and *"Concrete Pipe Sewers,"* free on request.

PORTLAND CEMENT ASSOCIATION

Dept. 1010, 816 W. Fifth St., Los Angeles, Calif. • 564 Market St., San Francisco, Calif.

Streamlined PERFORMANCE SPEEDS UP PRODUCTION

STREAMLINING can be had in an excavator. Not in the same sense that we use it in connection with the modern automobile, plane or high speed train. LIMA--the modern excavator--carries the idea beyond the appearance and into the performance of the shovel, dragline or crane.

Roller bearings and helical gears throughout, large diameter drums and clutches, splined shafts and square lever shafts make for smooth, quiet, easy performance. Ample power is always available for hoisting, swinging, propelling, and raising or lowering the boom simultaneously, if necessary.

These advantages, and innumerable others, speed up production and give streamline performance in every kind of digging. The modern excavator in line with the times.

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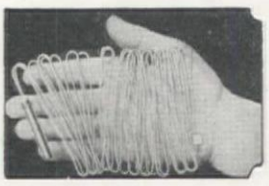
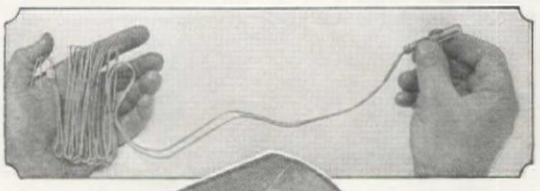
LIMAS ARE BUILT IN 3/4 YARD CAPACITY AND LARGER

LIMA Type 601 on levee work. It is one of two LIMA draglines owned by Jones and Rodgers, Memphis Tenn.



Handy to carry. Easy to open. Wires folded accordion wise, and supported by the tube, enclose and cushion the detonator. When tube is removed wires extend naturally into position. Permits priming without disturbing the rest of the Accordion Fold.



Accepted!

The use of Atlas Electric Blasting Caps in the Handy Accordion Fold is standard practice. Such nation-wide acceptance was readily predicted by those who first saw this new package development in 1933.

Its advantages, in safety and convenience, were so obvious that standardization was merely a matter of time. And—as has been proven—a very short time!

The acceptance of Atlas Accordion Fold Electric Blasting Caps demonstrates the fact that blasters are always receptive to new ideas of sound, practical value.

If you have overlooked this important Atlas "First" ask the Atlas Representative to show it to you. To see it is to accept it!

ATLAS POWDER COMPANY

THE DANT DIVISION

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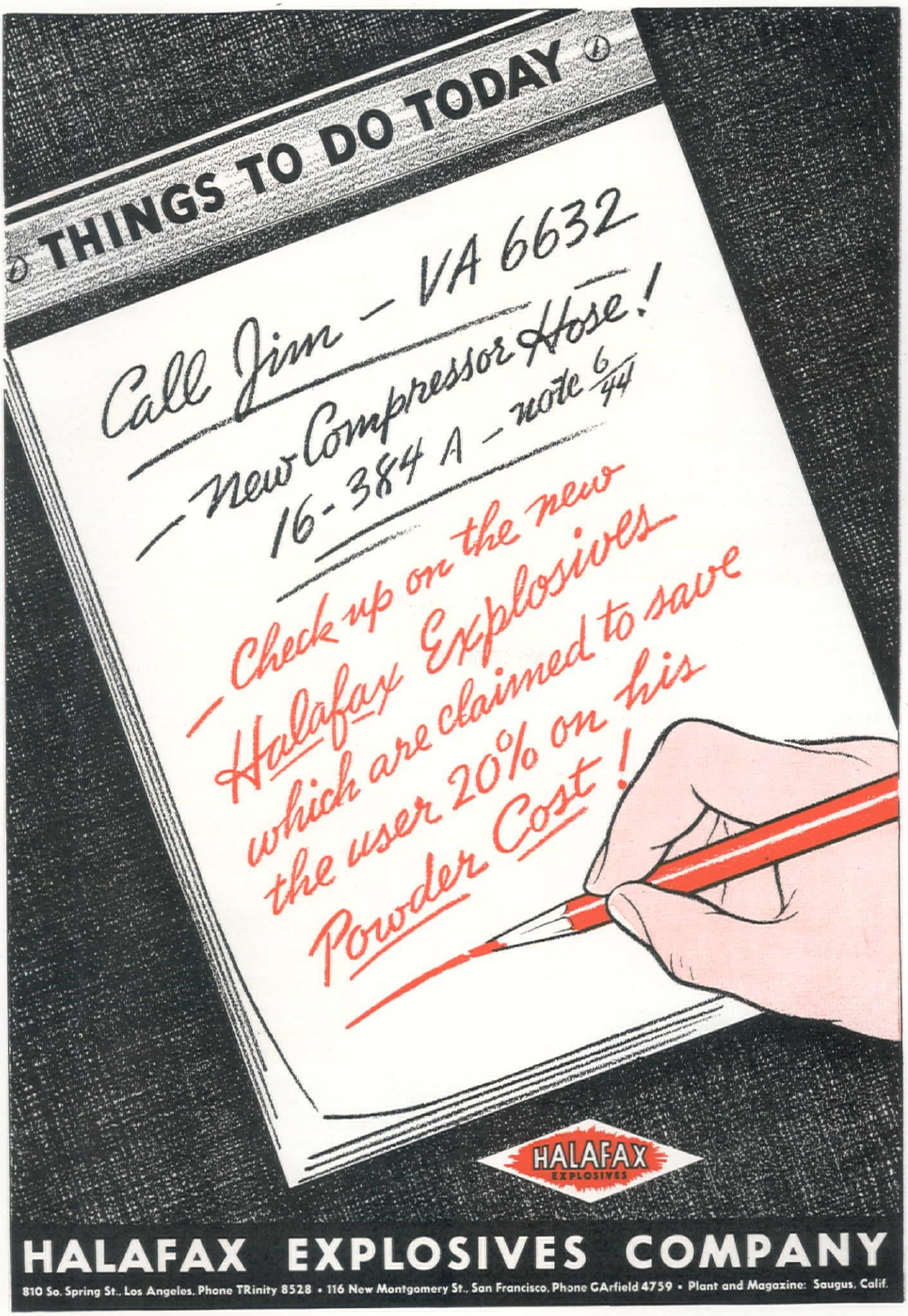
ATLAS EXPLOSIVES

ATLAS EXPLOSIVES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which are claimed to save
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Seawall of Bethlehem Piling

protects this Pacific highway

WIDENING of the coast highway between Ventura and Santa Barbara, Cal., has afforded an interesting example of the economy and adaptability of Bethlehem Steel Sheet Piling.

More than 700 tons of Bethlehem Piling were used in three seawalls, nearly ¾ mile in total length, which protect this highway.

The use of steel-sheet piling for this project brought about important savings. The cost of the seawalls, built with Bethlehem Piling, of about $83,000, compares with a cost of $200,000 which engineers estimated for the alternate method of construction that was considered.

Before the piling was driven, each pile was given a protective coating of asphalt. A heavier sand-and-asphalt mastic was then applied over this coating at the scour line, as protection against pebbles hurled against the piling by the waves. State highway engineers believe that this coating will last for many years.

Because of the substantial saving in cost of construction and the promise of long life that Bethlehem Piling has afforded in this installation, engineers of the California Department of Public Works, Division of Highways, are making further use of the steel-sheet piling type of shore-protection structure.

There are similar projects in many localities in which Bethlehem Steel Sheet Piling offers an equally simple, economical solution of the problem involved.

Other products for the construction industry supplied by Pacific Coast Steel Corporation include:

H-PILING; REINFORCING BARS; STRUCTURAL SHAPES; GALVANIZED STEEL SHEETS; DRILL STEEL; BOLTS, NUTS AND RELATED PRODUCTS; WELDED STEEL PIPE

C. H. Purcell, *Highway Engineer*, California Department of Public Works; Basich Bros., Torrance, Cal., *General Contractors*.

PACIFIC COAST STEEL CORPORATION

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BETHLEHEM STEEL

Sales Offices: San Francisco, *20th and Illinois Streets;* Los Angeles, *Slauson Avenue;* Seattle, *West Andover Street;* Portland, *American Bank Building;* Salt Lake City, *Kearns Building;* Honolulu, T. H., *Schuman Building.*

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Give 'em the works"

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THEY'LL GIVE YOU THE BREAKS ON PROFITS

URE, you can grade a road with *any* shovel. But 1935 contracts won't be let at just *any* price! Bids are low- this year. That's why you should inves- ate the P&H features that make heavy ad grading go faster and cost less. st, look at the P&H close-cutting ain crowd. It enables you to dig at gh speed within one inch of grade. requires one-tenth the maintenance other types.

en, examine the "Sure Feel" power tch that gives you more accurate dip- r control . . . that protects frame and chanism from the terrific jolts that up other shovels. Watch the action of the heavy duty Super Smooth Swing Clutches that shorten the time between bites and maintain high speed production.

Rapid Reversing Crowd Planetaries, Power Dipper Trip, Full Vision Cab . . . these are some of the other features that make P&H performance so outstanding on the big road jobs. You can give 'em the works . . . they can take it!

Obsolete equipment can't match the low cost production of these new P&Hs with Split Second Control. Investigate them now. There's one on a job somewhere near you. We'll be glad to tell you where so that you can see it at work.

Write for Bulletins on various models.

BANTAM WEIGHT (Model 100, 3/8-yd.)

e new machine that is breaking sales and performance records! Fully convertible for all ndard types of service at the lowest cost the industry has ever known. It's powered by the ooth Ford V-8 motor, renewable on the Ford Replacement Plan. Bulletin No. 100 has complete specifications. Write for your copy.

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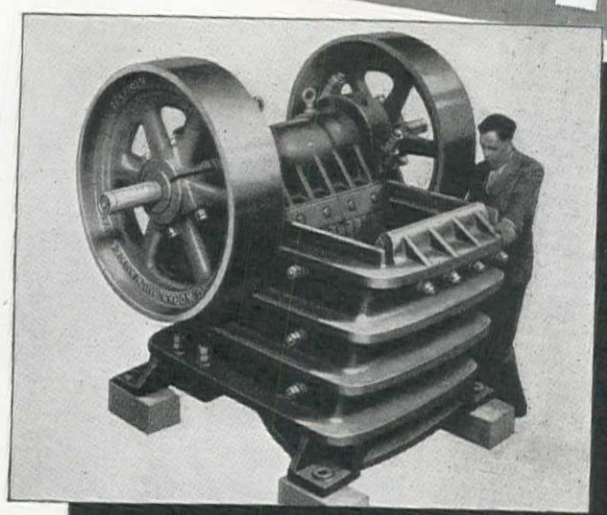


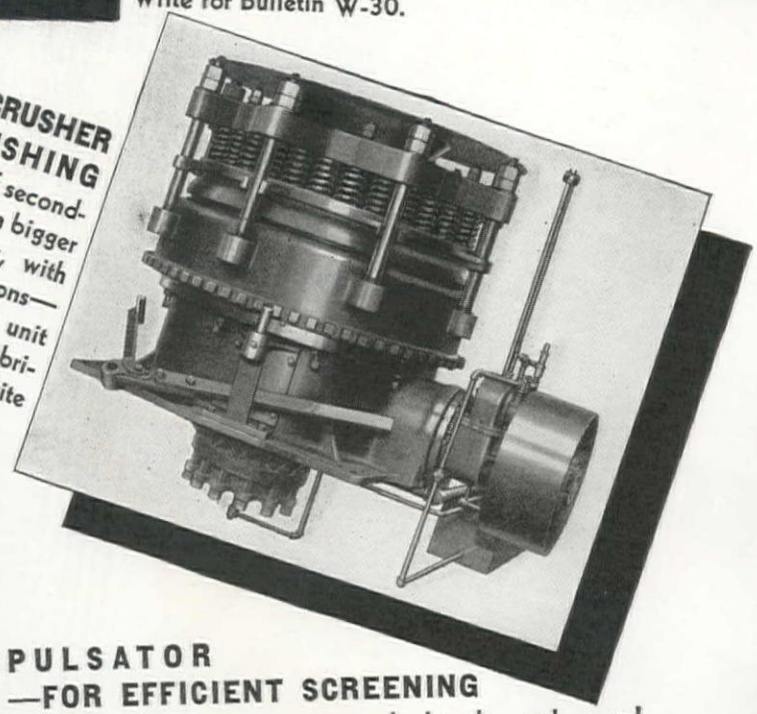
This 3-piece combination of Telsmith equipment is a striking example of group efficiency. Modern in every sense of the word . . . each piece is designed and built to better the product and cut operating costs.

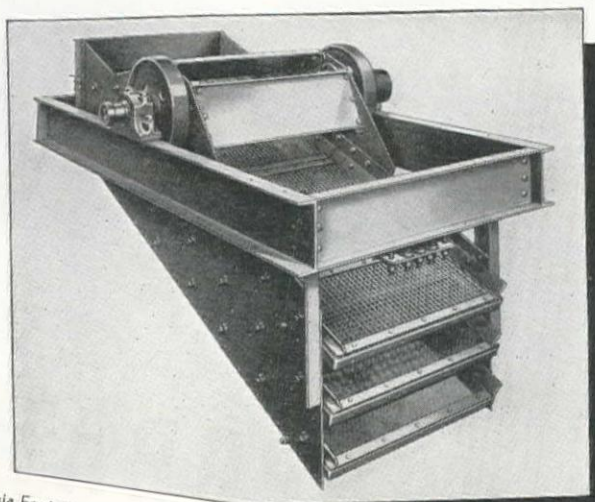
WHEELING JAW CRUSHER —FOR COARSE CRUSHING

With its compact, rugged steel structure and cylindrical roller bearings, the Telsmith-Wheeling Jaw Crusher is ideal for coarse crushing. The roller bearings, force feed and higher speed almost double the capacity without any greater expenditure for power. Simple adjustment allows wide sizing range. Up-keep is reduced to a minimum. Write for Bulletin W-30.

GYRASPHERE CRUSHER —FOR FINER CRUSHING

The Telsmith Gyrasphere takes the trouble out of secondary crushing. Working at choke feed, it turns out a bigger tonnage and more cubical product—crushes finer, with low power consumption and up-keep. The reasons—spring relief, rotary head support, spherical head, unit spring design, anti-friction thrust bearings, pressure lubrication, improved distribution of crusher pressures. Write for Bulletin Y-30.





PULSATOR —FOR EFFICIENT SCREENING

The Telsmith Pulsator screens crushed rock, sand, gravel, ore or coal . . . wet or dry. Its circular movement produces a maximum screening action, uniform on every inch of the wire, on every deck, under any load. The toughest alloy steels, the finest anti-friction bearings and special labyrinth and piston ring steels (to protect working parts) give longer life and lower up-keep. Write for Bulletin V-30.

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M-3

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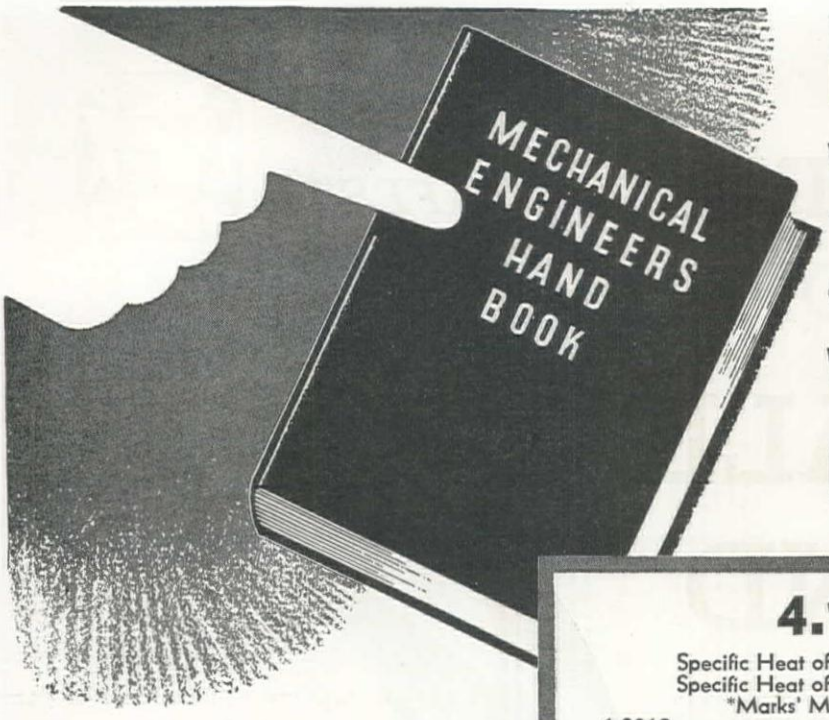


LOOK IT UP IN YOUR HANDBOOK

and see why you save with a

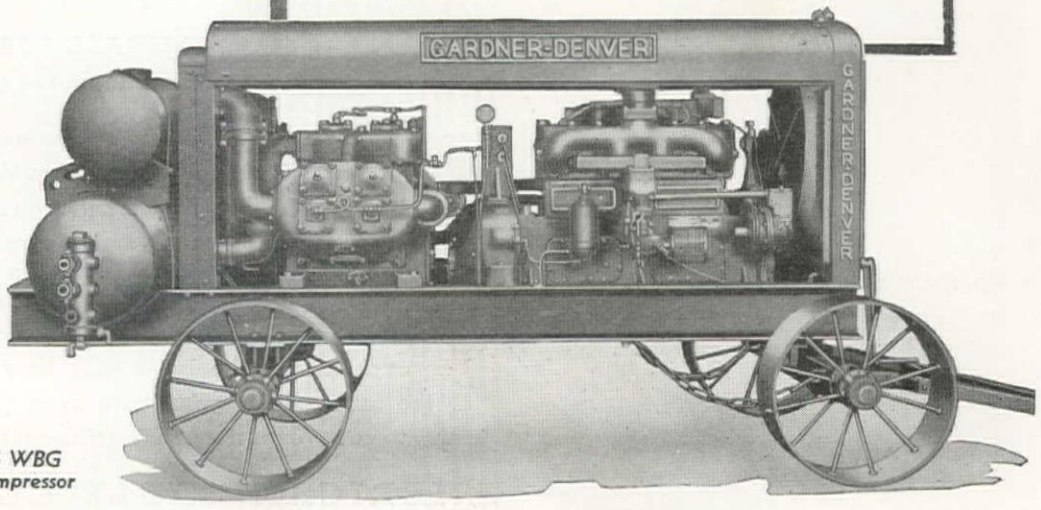
WATER-COOLED COMPRESSOR

4.13 to 1

Specific Heat of Water at 180° F = 1.0019*
Specific Heat of Air at 100° F = 0.2420*
*Marks' Mech. Eng'rs. Handbook

$\frac{1.0019}{0.2420}$ = 4.13 to 1 Ratio of heat-dissipating ability, Water over Air.

Specific Heat bears a direct relation to HEAT-CARRYING ABILITY. Radiator Water at 180° operating temperature has over FOUR TIMES the heat-carrying ability of Air at 100°, which is the average temperature of air coming from the inter-cooler fan against the cylinders of an air-cooled compressor.



Gardner-Denver No. 315 WBG Water-Cooled Portable Compressor

● Any good mechanical engineer's handbook will show you that under average operating conditions, radiator water has more than FOUR TIMES the heat-dissipating ability of air!

● That's why Gardner-Denver WATER-COOLED Compressors have lower discharge temperature . . . run cooler . . . use less oil . . . maintain higher pressure . . . and last longer.

● That's also why Gardner-Denver WATER-COOLED Compressors are UNIFORMLY COOLED in hot weather —UNIFORMLY WARMED for effective lubrication in cold weather.

● Water-jackets *completely surround* water-cooled cylinders and heads. Water is forced to every point that needs cooling—while the heated air from an intercooler fan, used to cool air-cooled cylinders, *cannot get between or behind them,* and cools only one side.

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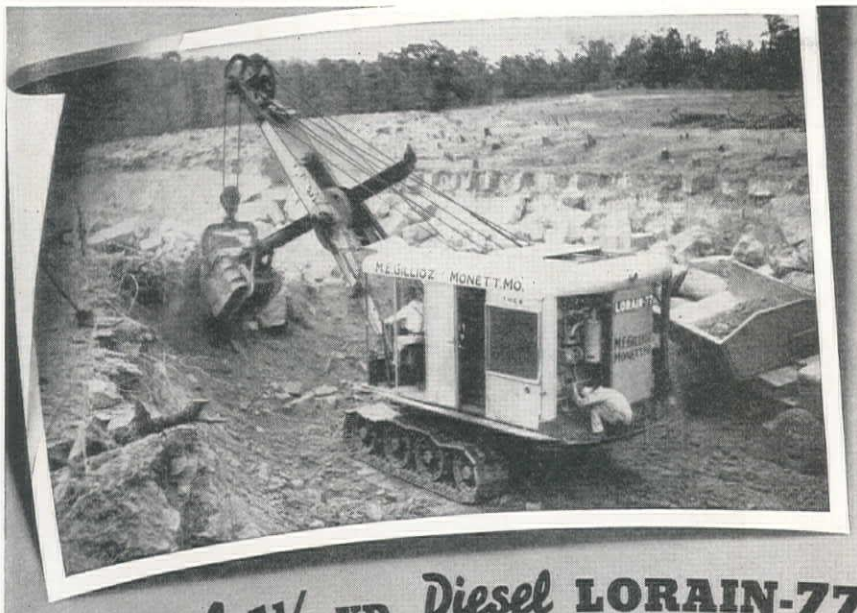
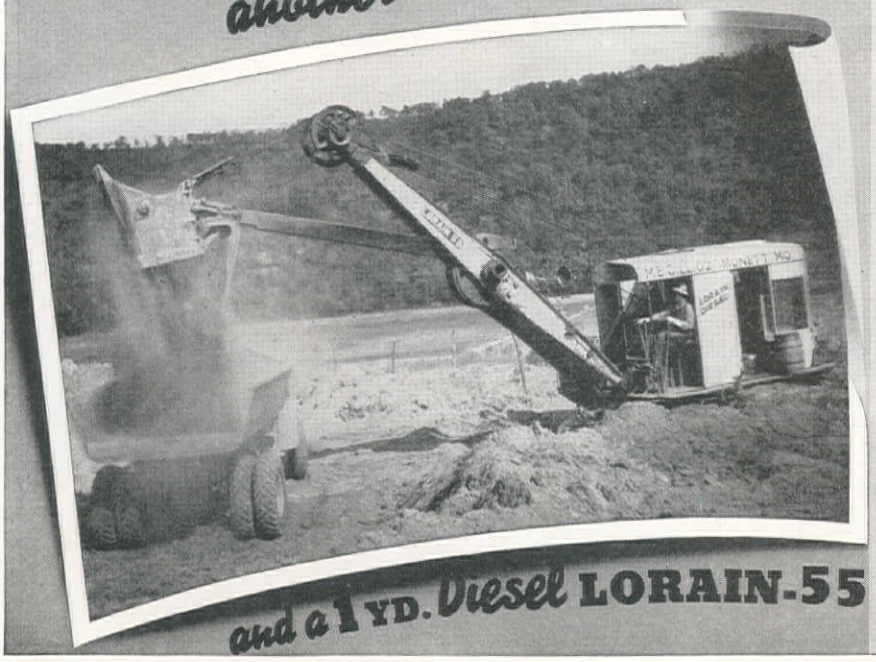
MORE AND COOLER AIR BY GARDNER-DENVER



A 1½ YD. Diesel LORAIN-77

another Diesel LORAIN-77



and a 1 YD. Diesel LORAIN-55

M. E. Gillioz uses 3 DIESEL LORAINS to move 1,100,000 yards

to build the 1600′ long, 90′ high dam on the Clear Creek Water Project for the water supply of Fort Smith, Arkansas . . . Speedy, reliable equipment is essential to finish the job in the specified 10 months.

A Lorain user for years, M. E. Gillioz knows Lorains possess these qualities and consequently purchased these 3 for this job . . . where again they're proving their ability to move more dirt, faster and cheaper.

THE THEW SHOVEL COMPANY
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THE THEW SHOVEL CO., 355 Fremont St., San Francisco. Distributors: THE RIX COMPANY, Los Angeles; HALL PERRY MACHINERY CO., Butte; FEENAUGHTY MACHINERY CO., Portland, Seattle, Spokane; ASSOCIATED EQUIPMENT CO., LTD., San Francisco, Calif.; McCHESNEY-RAND EQUIPMENT CO., Santa Fe, N. Mex.; AMBLER-RITTER, Salt Lake City; H. W. MOORE EQUIPMENT CO., Denver.

On this job of building dams in Santa Clara County, Calif., "Caterpillar" Diesel Tractors are slashing earth-moving costs. Before this job is done, they will have moved nearly a half-million yards of dirt.

THEY'RE PARTIAL TO SHOW-DOWN ECONOMY!

Nine **out of** ***ten*** **tractors at work on the biggest construction projects in the United States are "Caterpillars." Over half of these are "Caterpillar" Diesels and the figures are shifting in favor of the Diesel model every day. . . . The contractors say it's *economy*, above all else, that puts the "Caterpillar" Diesel in their equipment. And the "Caterpillar" SHOW-DOWN proves it! Caterpillar Tractor Co., Peoria, Illinois, U. S. A.**

CATERPILLAR

REG. U. S. PAT. OFF.

DIESEL

WESTERN CONSTRUCTION NEWS
WITH WHICH IS CONSOLIDATED WESTERN HIGHWAYS BUILDER

October, 1935 Vol. 10, No. 10

J. I. BALLARD, Editor
G. E. BJORK, Northwest Editor
H. W. PYERITZ, News Editor

Public Works and WPA Must Not Be Confused

THE time has come when the construction industry should insist that the Administration and the general public admit the marked distinction between the program of "public works" and the procedure known as "work relief." From the start of the $4,800,000,000 program last spring the Administration has emphasized the feature of public works, and to the average citizen PWA and WPA look and sound very much alike; possibly the similarity was intentional. Now, with the sudden switch to the work-relief idea, the construction industry, as such, must protect itself from the reaction which will inevitably follow the frantic squandering of these WPA funds.

On the one hand, a public works program, as carried out by the PWA plan, utilizes the established agencies of the construction industry—second largest in the country; it tends to select projects which result in permanent improvements; existing municipal and private engineering staffs are employed in making plans; calling for bids stimulates private contracting organizations to exercise the ingenuity and skill resulting from years of experience; award of contract insures the city or other agency that the work will be done at the lowest possible cost, within a definite period and completed in accordance with the engineer's plans; materials and equipment are required which in turn stimulate the heavy industries; conclusion of the work finds the municipality with an improvement completed within minimum cost and maximum stimulation of private enterprise and existing industry.

On the other hand, the work-relief program, now getting under way will include countless projects which have no remote connection with "works," although their cost will be finally charged against the visible results of the work-relief operations, in the public's appraisal of results; the remainder of the funds will be rushed into work where the emphasis involves getting labor, which is unfamiliar with the operations, to go through motions to earn their relief stipend; organization and coördination of effort will be almost non-existent in the urge to get the greatest possible number of men to go through the necessary motions; the waste of funds compared with the tangible results will be pitiful.

This comparison does not involve the problem of unemployment or the admitted need for relief activity. It simply calls attention to the fact that the construction industry must not let relief effort, in the disguise of legitimate "public works," go unchallenged and then reap the undeserved harvest of public disapproval. The construction industry can only acknowledge its connection with that part of the works program which is carried out in accordance with the long established practice of using the existing agencies of engineering, materials and equipment producers and the contract system of construction.

●

So It's Boulder Dam

IT APPEARS that the greatest engineering structure in the world is to be known by the simple name of Boulder Dam. There is ample precedent for retaining the local designation for these structures—Diablo dam, Owyhee dam and Shoshone dam, for example—but there is also a growing tendency to recognize engineering genius and effort in the naming of publicly built dams. In the long history of this project there were three outstanding engineers whose names would be appropriate: Arthur P. Davis, Herbert Hoover and Elwood Mead. However, if recognition of one of these engineers is to be denied, there are more inappropriate names than Boulder Dam.

●

Licensing of Operators

LOOKING forward to the raising of standards for operators in the water and sewage treatment plants of the West, the subject of licensing was recently discussed and the principle tacitly accepted by the Rocky Mountain Section, A. W. W. A. and the California Sewage Works Association. The enacting of state laws to govern the qualifications and registration of operators could well be preceded by a period in which the technical organizations in the various states would work out the necessary requirements and procedure. Experience with previous licensing laws indicates that time spent in studying the problems involved is most profitable. This period need not involve long delay, if the associations deem prompt action necessary, but mature thought and agreement on a program is an aid in securing the most effective legislative action. Nothing promotes more resistence on the part of a legislature than wrangling within a group which sponsors a bill.

●

A Record in Safety

AS a matter of record we would like to acknowledge the remarkable accomplishment of the McClintic-Marshall Co. in erecting the two towers of the Golden Gate Bridge without the loss of a life. The placing of 40,000 tons of structural steel in two 746-ft. towers under the conditions encountered, including the unloading from barges swept by the tide and wave of the Golden Gate waters, is a record of outstanding merit in the annals of construction. The record did not just happen and an active campaign for safety brought results. The McClintic-Marshall Co. deserves sincere congratulations on its record and for the example given to Western contractors to show what can be done in the way of safety on construction work.

●

Man-hours or Work?

OVERLOOKING about 14,000 man-hours of labor on a $23,000 state highway job in Washington, the low bidder has secured the court release from his contract, on the ground that he was not aware of the labor requirement item when his bid was submitted. He stated, according to report, that the figure of man-hours specified is not in accord with good engineering or construction practice. The distinction the contractor is trying to make is that up to a certain point the labor employed on a highway job represents "man-hours of work" but beyond this figure it represents just plain "man-hours."

WESTERN CONSTRUCTION NEWS
WITH WHICH IS CONSOLIDATED WESTERN HIGHWAYS BUILDER
OCTOBER, 1935

EVENT OF THE YEAR

Last October, immediately after the 1934 convention of the California Section, A. W. W. A., the Hetch Hetchy water supply system of the City of San Francisco was dedicated and placed in service, at the close of a twenty-year construction period. The picture shows the first flow entering the Crystal Springs Reservoir from the 155-mile aqueduct.

Fifteen Years of Progress In Western Water Works

A FOREWORD to this issue which is devoted to the developments in the field of water supply and treatment since the founding of the California Section, A. W. W. A., in 1920

FIFTEEN YEARS AGO next month the California Section of the American Water Works Association held its first convention, and the occasion of this fifteenth birthday is a proper time for an appraisal of the progress which has been made in the field of water works engineering in the West during the intervening period. By stopping, at intervals, to take stock of progress and accomplishments they are more readily evaluated and made available as the basis for further advances in the art.

This annual water works issue of *Western Construction News* has been planned around the theme of "Fifteen Years of Progress in the Field of Western Water Works Engineering." The papers presented cover the entire field from the changes that have occurred in the sources of water supply to developments of water department office accounting practice. Because the issue commemorates the first meeting of the California Section, it is proper that water works leaders in that state report on developments since the day when the group of fifty gathered for the first convention picture, shown on the following page. However, the information presented and the problems discussed are of fundamental interest and value to the water works fraternity throughout the eleven western states.

What are the highlights of the last fifteen years of progress in the field of water works engineering as gleaned from the articles in this issue?

Recognition of the value of group association and the exchange of information and ideas has steadily increased from the first small gathering with one exhibitor to the recent meetings of about 700 with dozens of informative showings of equipment and materials.

Watershed control and the idea of a pure water supply which would not require treatment, a principle common in 1920, have given way to the recognition that regardless of source and initial quality, safety dictates sterilization and the public is demanding more and more treatment in improving quality.

Chlorination, which was in its infancy in 1920, has become a widely adopted practice with standardized procedure, recognized as a fundamental method of safeguarding water supplies.

Filtering design and procedure has been well developed for the successful handling of waters with ordinary characteristics and from this point the future will witness further progress in: (1) the reduction of the costs of treatment through improved design or chemical application and (2) the handling of water supplies with exceptionally difficult problems of hardness, turbidity or peculiar tastes.

Perhaps, the greatest visible advance since 1920 has been in the field of materials and equipment used for building the pipeline systems used for distributing water supplies. A few terms will indicate some of the major changes: Power driven and compressed air tools, improved cast iron pipe, concrete pipe, jointing materials, welding, protective coatings, electrolysis control, automotive equipment.

Refinements in the measurement of water has kept pace, as the value of the raw and treated supplies has increased.

In the water works department office the change has been equally notable with machines taking the place of hand work in billing and accounting. Record keeping has improved to provide accurate statements covering the customers accounts, resulting in improved public relations and impression of up-to-date business practice.

An annoying note is the relatively slow progress made in the matter of handling street repaving after the laying of mains and the inherent conflict between the utility and the street department in the matter of distributing costs and insuring prompt but adequate and permanent repair.

In all, the record of the last fifteen years of progress in the field of water works engineering has been notable and the material contained in the following pages provides a valuable review of the art as it exists in the West in 1935.

Historic High Lights California Section

A sketch of the work of George Elliott in founding the Section in 1920, and the growth which has followed the initial meeting

THE CALIFORNIA SECTION of the American Water Works Association, comprising at the present time the states of California and Arizona, was organized fifteen years ago last April.

The Section owes its existence to our honored founder and first president, the late George A. Elliott, who keenly felt the need of such an organization on the Pacific Coast because of the rapidly growing interest in the development of water resources and the necessity of water works engineers getting together to discuss mutual problems and exchange ideas concerning newly developed methods and practices. The national organization, of course, furnished this opportunity, but in a limited way as regards local problems. Great distances to be traveled, as well as the expense involved and time spent in making the trips, prevented many engineers from taking advantage of the national meetings which were held in the East.

Initial work in 1916

As early as 1916 Mr. Elliott began contacting various engineers throughout the state, securing their ideas regarding the formation of a local section and attempting to obtain enough memberships in the national association, within the state, to build up the required quota necessary for the filing of a petition for recognition as a section. After five years of untiring effort and many discouragements caused by indifferent attitudes on the parts of many prominent engineers, Mr. Elliott finally succeeded in bringing together on the evening of April 17, 1920, in the board room of the Spring Valley Water Co. in San Francisco (of which company he was the engineer), a group of engineers composed of himself, George W. Pracy, San Francisco; Charles Gillman Hyde, Sacramento; C. G. Gillespie, Sacramento; R. F. Goudey, Berkeley, and Joseph R. Ryland, San Jose. This organization meeting, presided over by Mr. Elliott, who was elected acting chairman with Mr. Pracy as acting secretary, was in session two hours.

Too much credit cannot be given this little group of engineers who have contributed so much toward the success of the Section and the advancement of water works engineering.

A constitution was adopted which has been supplemented by important amendments in 1930, 1931, and 1934, the most notable providing: (1) the acquisition of Arizona members in 1931; (2) authority for organization of the Purification Division, which was formed under the sponsorship of W. W. Hurlbut, with R. F. Goudey, organizing chairman, to permit more highly technical parallel sessions covering this phase of water works engineering; (3) the election of an Ex-Officio Director to represent the Section on the National Board of Directors, serving three-year terms—S. B. Morris being the first to serve, with W. W. Hurlbut the present representative; (4) provisions governing associate memberships; (5) a larger executive committee with increased powers.

First convention

George A. Elliott, chairman; Charles Gillman Hyde, vice-chairman; George W. Pracy, secretary-treasurer, with F. N. Isaacs and C. G. Gillespie to serve with the officers as the executive committee, were elected to officiate until the last meeting of the year, which was held in San Francisco on Nov. 13, 1920, and known as the First Annual Convention of the Section. The meeting was a memorable one to the seventy-five in attendance. Three interesting papers were presented and spiritedly discussed, and there was a never-to-be-forgotten tour around the properties of the Spring Valley Water Co. during which an "oasis" was found that was really a miracle—and of much interest to water works engineers — because of such a "dry year."

The first paper delivered before a body of water works engineers ever assembled under the name of the California Section was read at the organization meeting — entitled, "Cement Joints for Cast Iron Water Pipe." This paper was timely in view of the fact that the use of cement in joints for

First Convention of the California

1. V. E. Perry, Spring Valley Water Co.
2. F. M. Faude, Loveland Engineers
3. O. E. Clemens, Spring Valley Water Co.
4. Frank Kieffer, Engineer
5. Melvin Reed, California Railroad Commission
6. J. R. Barker, Neptune Meter Co.
7. L. M. Anderson, Los Angeles Water Department
8. Charles Lee, California Water Commission
9.
10. L. E. Northrup, Neptune Meter Co.
11. P. D. Rice, Spring Valley Water Co.
12. George Pracy, Spring Valley Water Co.
13. Frank Brooks, Art Concrete Co.
14. G. H. Harlan, Attorney, Marin Municipal Water District
15. S. B. Morris, Pasadena Water Department
16. John Burt, Marin Municipal Water Department
17. John Swenson, American Cast Iron Pipe Co.
18. C. H. Loveland, Loveland Engineers
19. Tom Leary, Mueller Manufacturing Co.
20. Bob Martindale, U. S. Pipe and Foundry Co.
21. O. S. Relph, San Jose Water Co.
22.
23. C. Arrasmith, Fillmore Water Department
24. M. N. Bird, National Meter Co.
25.

From the A. W. W. A.

By H. A. VAN NORMAN
President
California Section, A. W. W. A.

cast iron water pipe was becoming rather general on the Pacific Coast but as yet had not been put in use to any great extent throughout the country. An interesting discussion followed the reading of the paper at the meeting, and formal discussion was submitted after it had been published in the July, 1920, issue of the Journal of the American Water Works Association, the official publication issued monthly to all members.

It is increasingly evident that our meetings serve as a school of water works experience, as well as a means of social contacts where lasting and valuable friendships are formed, and our Journal is an invaluable reference library.

Growth of the Section

The California Section has grown from a membership of 30 at the time of the organization meeting in April, 1920, to 327 at the present time. There has never been a year that the membership has fallen below that of the previous year.

The popularity and success of the conventions of the Section need no further proof than attendance figures, although the secretary's files are filled with congratulatory letters. In 1920 at San Francisco, with a membership of 52, there were 75 members and guests present; in 1927 at San Jose, with a membership of 219, there were 564 members and guests present; in 1928 at San Francisco, with a membership of 219, there were 650 members and guests present; in 1930 at Pasadena, with a membership of 246, there were 750 members and guests present; and at Long Beach in 1934, with a membership of 287, there were 828 members and guests present.

The growth of the Section and success of its conventions have been attributable in a great measure, since 1922, to the whole-hearted and enthusiastic coöperation given by the exhibitors—members of the Manufacturers Association—whose first committee, appointed by President George A. Elliott, was composed of four very active members, namely: C. B. Abbott, chairman, president of Water Works Supply Co.; J. R. Barker, Pacific Coast Manager, Neptune Meter Co.; R. W. Martindale, Pacific Coast Manager, U. S. Pipe & Foundry Co.; and G. H. Bailey, Pacific Coast Manager, National Meter Co.

The close coöperation of the Manufacturers Association, which, it is interesting to note, exhibits only at National and California Section Conventions, has tended toward standardizing water works equipment on the Pacific Coast.

The California Section has had only one Honorary Member—the late William Mulholland, former Chief Engineer & General Manager of the Los Angeles Bureau of Water Works & Supply, who conceived and built the Los Angeles Aqueduct and was father of the Colorado River development. He was so honored in 1923.

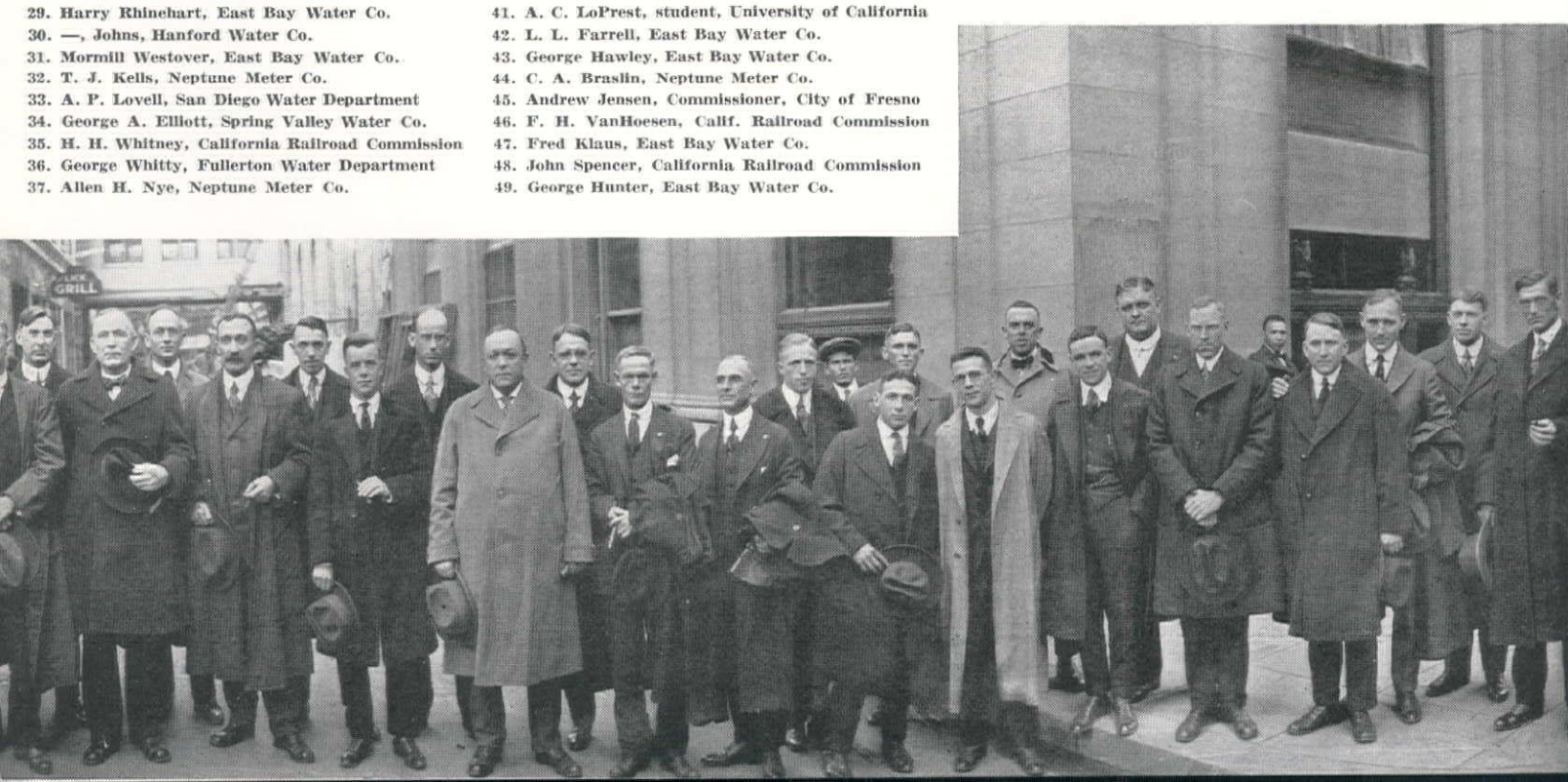
Another national convention

Our Section, due to its rapid growth and technical contributions, first gained national recognition when the American Water Works Association held its annual convention at San Francisco in 1928. We are to be again honored by having the National Association hold its annual convention in Los Angeles in 1936. It is my sincere hope that western water works engineers in every case possible honor us with their presence at that meeting.

After relating the history of the Section, I wish again to emphasize the place that the Association takes in the water works profession. It has been the medium of exchange of engineering ideas and information between water works engineers and for that reason alone it has been of great value and benefit not only to the members of the profession but to the water works themselves. The many fine papers presented at association meetings and published in the journal constitute a fine library for any water works engineer, and the opportunity of viewing the splendid exhibits provided by the manufacturers has been a source of great profit to those attending the sessions.

Section, A.W.W.A., on Nov. 13, 1920

26. —, Graf, U. S. Army Engineers
27. John Fieberling, East Bay Water Co.
28. Henry Goosen, Fairfield Water Co.
29. Harry Rhinehart, East Bay Water Co.
30. —, Johns, Hanford Water Co.
31. Mormill Westover, East Bay Water Co.
32. T. J. Kells, Neptune Meter Co.
33. A. P. Lovell, San Diego Water Department
34. George A. Elliott, Spring Valley Water Co.
35. H. H. Whitney, California Railroad Commission
36. George Whitty, Fullerton Water Department
37. Allen H. Nye, Neptune Meter Co.
38. Myron Westover, student, Univ. of California
39. Ben Benas, student, University of California
40. J. W. Ford, San Jose Water Co.
41. A. C. LoPrest, student, University of California
42. L. L. Farrell, East Bay Water Co.
43. George Hawley, East Bay Water Co.
44. C. A. Braslin, Neptune Meter Co.
45. Andrew Jensen, Commissioner, City of Fresno
46. F. H. VanHoesen, Calif. Railroad Commission
47. Fred Klaus, East Bay Water Co.
48. John Spencer, California Railroad Commission
49. George Hunter, East Bay Water Co.



Improvements in Quality And Methods of Treatment

Since 1920 the control over the safety and quality of public water supplies has shown a marked advance—Consumers are becoming more particular

By C. G. GILLESPIE
Chief, Bureau of Sanitary Engineering
State of California

THE PERIOD 1920 to 1935, and particularly the last five years, has been decidedly an age of refinement in almost all phases affecting the quality of public water supplies in California. Nearly every practice currently useful in improving the appearance, safety and palatability of water may be found somewhere in the state. Many water departments have been added to the lengthening list of places employing chlorination, a movement that started in 1915. Large numbers of these departments have incorporated ammonia with chlorine and a few have used bromine. Excess chlorination followed by dechlorination with sulphur dioxide has been employed by California Water Service Co. at Marysville and Stockton and by American States Water Co. at Culver City and Lennox. Quite a number of these installations are now to be found on well supplies.

The understanding of the operation of the water disinfectant plants and the perfection in design and installation has greatly improved their reliability and efficiency, over the bare 50% which was the average for all installations shortly before 1920. There is no comparable figure for the state at the present time but the average efficiency is certainly not far below 100%.

Among the more elaborate water treatment plants, all of the eleven that are most commanding fall in the 1920-1935 period and set these fifteen years apart from any others in the water supply history of the state. The East Bay Water Co. and its successor, East Bay Municipal Utility District, built three filtration plants since 1920, having a combined capacity of 78 m. g. d. Special process features are prechlorination, post-chlorination and liming to control corrosion.

The City of Beverly Hills has built two noted filtration plants mainly for softening well water by the excess lime process and recarbonation to overcome causticity. Still other features include use of ferric chloride as a coagulant and removal of hydrogen sulphide by aeration and chlor-ammoniation.

Sacramento has the largest single filtration plant, with a present capacity of 64 m. g. d. It was the first plant to devise rotary mixing and is still the only one manufacturing its own filter alum. California Water Service Co. also redeems the Sacramento River at an excellent filter plant located near its mouth. Here flood waters are stored and treated by filtration.

Los Angeles has built a most unique and successful filtration plant at Wilmington for removing intense color from well water. The process includes aeration, prechlorination and use of ferric chloride, all of which appear necessary to flocculate these colloids.

Los Banos has converted its slow sand filter plant into a rapid sand filter plant which utilizes lime and alum for coagulation, and post-chlorination for disinfection. A similar conversion at Calexico utilizes ammoniation ahead of the filter and post-chlorination but does not need lime. Watsonville is the only city to have slow sand filtration but the plant is quite well suited to the colored and turbid creek water which is handles.

Smaller installations

In the same period some thirteen filtration plants, generally small and less ornate, but nevertheless unique in their processes, have been installed. Such filter plants for general purification purposes were installed at Redlands, Placerville, Hillsborough, Santa Cruz, Crescent City and one by the East Bay Municipal Utility District at Lafayette. The Santa Cruz plant also employs activated carbon, and chlor-ammoniation to control algae in an open clear water basin beyond. The Crescent City plant adds lime to promote coagulation of this highly colored water.

Iron removal filter plants have been installed at Eureka and at Fortuna. Both depend on aeration to precipitate the iron. The American States Water Co. has also installed three rather intricate plants for removal of iron and Crenothrix. Its Lennox plant employs aeration, excess chlorination, ferric chloride coagulation, filtration and dechlorination. Its Sentry plant at Culver City aerates, uses excess chlorine, settles, and dechlorinates with an activated carbon filter. Its Manning Plant in Culver City aerates, chlorinates, coagulates with alum, settles and filters.

The Scotia filter plant built years ago was improved by adding activated carbon and chlor-ammoniation to control tastes and odors. Post-chlorination is employed for disinfection. The Antioch filter plant was enlarged and a settling basin installed. A unique feature is the use of ferric chloride as a coagulant.

Quite a number of places, mostly in the Sierra foothills have put in alum feeders and merely coagulate and settle the water in large reservoirs, thereby getting rid of the bulk of the turbidity. The first to use this scheme was the Pacific Gas and Electric Co. at water works in Auburn, Redding and Sonora. It is now also used at Roseville and Lincoln on waters highly polluted by mine slickings and on the Marin Municipal Utility District supply.

At least three zeolite water softening plants have been installed recently on municipal supplies. California Water Service Co. softens a part of its supply at San Mateo and in its North Bay District. More recently Menlo Park Water Co. has installed a zeolite softener.

Many processes represented

Thus there are exemplified in water treatment plants built in California since 1920: coagulation of turbidity and color by both alum and ferric chloride; softening with excess lime and recarbonation and softening with zeolites; iron removal by lime treatment and by aeration; control of Crenothrix by excess chlorination and dechlorination; filtration at slow and at rapid rates in both open gravity filters and pressure filters; odor and taste control by aeration, chlor-ammoniation and by activated carbon; simple chlorination, chlor-ammoniation for disinfection, pre- and post-chlorination; excess chlorination and dechlorination using sulphur dioxide and carbon filters, and bromination. Contrasting this list with processes in vogue prior to 1920, there was but filtration, slow and rapid, mostly pressure filters; coagulation with alum, aeration and simple chlorination.

The expansion of water treatment and processes is certainly not due to the utilization of more inferior supplies. It means that consumers are becoming more particular and exacting and that water departments, encouraged by the water purification experts, have become bolder in adapting fairly new processes.

The age-old reaction of consumers against use of chemicals in water has all but disappeared. In fact, some communities demand disinfection for the comforting knowledge that the water is safe, even in places where the dangers are not great. Many water departments also have installed convenient pipe connections whereby, in time of emergency or disaster, disinfectants can

Municipal Water Treatment Plants in California

	1920		1935	
	Filters and Chlorination	Chlorination	Filters and Chlorination	Chlorination
Supplies treated	11	14	29	48
Population supplied	529,000	188,000	1,620,000	1,768,000
Total output of plants	72 MGD	31 MGD	168 MGD	322 MGD
Average gal. cap. day	136	163	104	182

be quickly applied to the water, having in mind those parts of the water system which might be destroyed.

Watershed ownership still popular in 1920 has all but disappeared as a policy. Water departments seem less opposed to multiple uses of watersheds for purposes other than water supply, and now tolerate recreation under control, aimed mainly at centralizing recreation in places which are provided with proper sanitary facilities and supervision. Yet hunting and fishing on reservoirs is probably more objectionable than was the case years ago. Likewise, the number of those who object to swimming in water supply streams is no less and they have made a hard problem for health officers.

These are some of the signs that people still want a good sanitary background for their water supplies, notwithstanding its subsequent treatment. Another manifestation of this psychology is the tendency to go long distances for upland water of greater purity. The East Bay Municipal Utility District voted to bond itself nearly $40,000,000 to procure Mokelumne River water in the Sierra, 80 miles away, and turned down a cheaper proposal to impound the flood waters of the lower Sacramento River and reclaim it for delivery to consumers after appropriate filtration, as was done later by California Water Service Co. for its North Bay system. However, this is about the only recent instance of selection of a source of water from a river used largely for drainage but which was close at hand.

Three instances may be cited where cities have gone long distances for new supplies but mainly for abundance of supply. There is San Francisco and the Hetch Hetchy development, Los Angeles and its Mono Basin supply, and Eureka with its Mad River project. Though in all three the impelling motive was an abundant supply, it is hardly to be doubted the thought of a purer upland water helped carry the proposition.

Still another symptom of this psychology, which wants a good sanitary reputation of water supplies, is the general resentment on the part of water superintendents against the return of cooling water from air cooling back into the water mains. The view is that this is probably harmless, but it is "used" water.

Bacterial control of water supplies has been much improved in recent years. Notable laboratories have been installed within the water departments of Los Angeles, San Francisco, Sacramento, Beverly Hills, San Jose and by the enterprising California Water Service Co. for its extensive water works. Several other water departments have arrangements for systematic testing by some private laboratory and a number of health departments are now equipped for bacteriological test of water.

This summary, it is believed, gives a correct present day impression of the direction in which the weather vane points in water supply sanitation and improvement.

Advances in the Field of Materials and Equipment

Construction of distribution systems has been aided by the introduction of improved types of pipe and the mechanization of many operations

By GEORGE W. PRACY
Superintendent, San Francisco Water Department

DURING the past fifteen years the material used and the methods of doing work in the development of the distribution systems for municipal water supplies have changed considerably, much more so than would appear at first thought. Perhaps the most important change as to quantities used and savings in cost is the substitution of centrifugally cast iron pipe for the old style pit cast pipe. In 1920, the old American Water Works specifications, adopted in 1908, were the prevailing ones in use throughout the country.

The high costs brought on by the World War forced the cast iron pipe industry to study means of reducing prices to pre-war levels, and at the same time improve the quality of the pipe. Centrifugal pipe was the answer although one company has developed a low-cost high tensile cast iron pipe which has met all of the requirements of the water works user. Back in the early days of the California Section, the new type of pipe was a regular source of discussion at the meetings. Today it is accepted without comment.

The cement lining of cast iron pipe has also come up in the last decade, at least from a commercial standpoint. This has been a good addition to water works material and has proven its worth. Another smaller item that has been in vogue on the Pacific Coast for years, but which is coming more and more into broader use, is the shorter laying length of the cast iron fittings.

For the larger pipe, welded steel has entirely replaced riveted pipe. The development of welding has been quite a notable feature in many phases of water works construction and will be discussed more fully in the following paragraphs. Reinforced concrete pipe is also a newcomer in the field of water transmission under medium to high pressures. Transite pipe is the latest comer of which we will hear more.

For the installation of services, lead and galvanized pipe were standard practice at the close of the war. In addition some wrought iron service pipe was used. Today copper, and to a lesser degree brass, have taken their place as a regular material for such use, although the two older metals are still giving the newer ones keen competition.

Machines replace hand work

In the field, hand work has been supplanted to a great degree by machines. The compact self-contained portable air compressor unit has been developed and today the cutting and breaking of pavement, hand picking and tamping of the backfill by hand have become obsolete. In San Francisco, in addition to the larger machines, we have successfully mounted small, one-ton air compressors on Ford trucks; the compressor being operated from the truck engine. This enables the small crew to do much of the work by air that formerly was done by hand. These compressors are mounted on the service connection wagons and on the trucks doing routine maintenance and small construction work. They are very handy and have shown their worth.

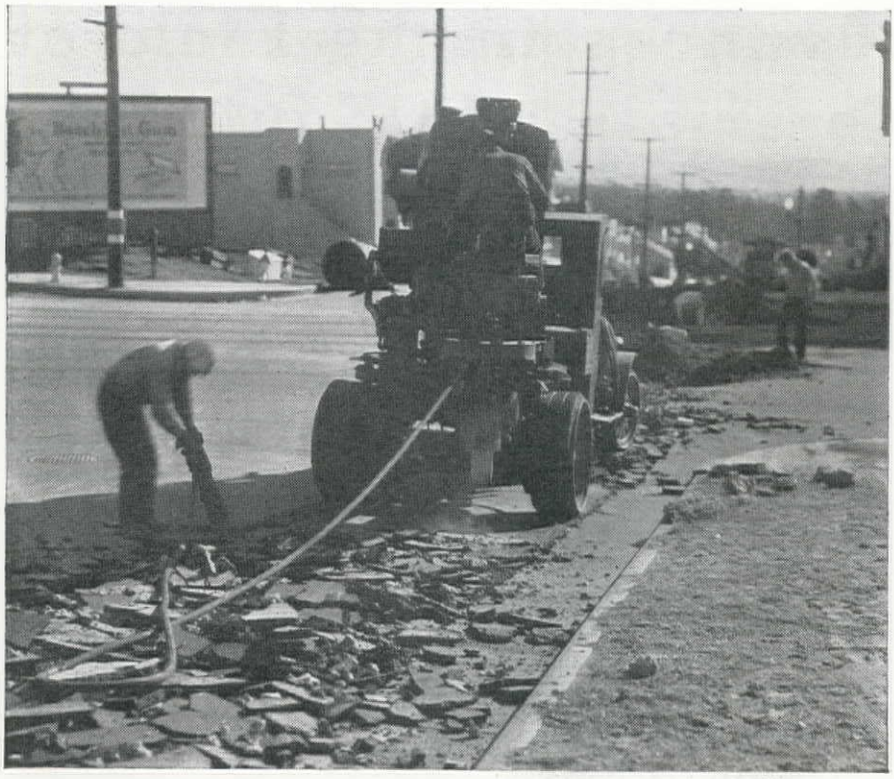
The trenching machine has come downtown in the cities. At first these machines were restricted to use in outlying territory, but improvements in their manufacture, and increased skill on the part of the operators has made it possible to use the machine in almost any section of the city, greatly decreasing the cost of excavating ditches. Mechanical means of backfilling are also an important feature in lessening the cost of main installation.

Another large item that has come into its own in the past fifteen years is that of automobile transportation, which has helped water departments as well as all other lines of work. Today automobile trucks can cover the ground in a few minutes that took hours in the old horse-drawn days.

In a minor degree the San Francisco Water Department, and I presume other water works operators, have mechanized many small items of work that were formerly done by hand. Today our lead connections are made up by a small pneumatic machine. Our washers are cut by machine. A recently devised air driven tapping machine brought on by our need of retapping some 15,000 services in connection with the PWA work being done in the city has enabled two men, with the aid of this little air driven tapping machine, to put in as many as 70 or 80 taps a day.

Advance in welding

The art of welding as applied to steel pipe lines has been one of steady development. Its first application, in San Francisco, was in 1919, when the field joints of a 22-in. riveted steel main were made with the acetylene torch.



Examples of the use of mechanical equipment in the construction of distribution systems, where hand labor was used almost exclusively in 1920.

This method of steel pipe line installation, riveted pipe with welded field joints, remained in vogue until about 1926 when welding started to replace riveting, not only in the making of the field joints, but also in the fabrication of the pipe.

The first all welded pipes were made from short sections, similar to the practice in the fabrication of the riveted pipe. As the welding art progressed, and the superiority of welding over riveting became more evident, larger welding machines and rolls were developed, until today pipe sections are fabricated with only horizontal seams in lengths varying from 30 to 40 ft. When welding of the horizontal seams of the pipe sections were first introduced, the minimum tensile strength of the weld was specified as 85% of the tensile strength of the plate. At present the tensile strength of the weld must be not less than 100% of the strength of the plate.

The method of welding the field joint has also seen many changes. The first method of welding the joint was by using an acetylene torch, with a neutral flame, that is with the flame in which all the carbon was consumed. With this process of welding, the welding rod was held so as to lead the placed metal. Later it was found that greater strength of the weld was obtained by using an acetylene flame having an excess of carbon.

This change in the flame also produced a change in the method of welding, namely the rod instead of leading the welding metal now follows. This use of acetylene welding also called for a smaller flame, thus reducing the temperature spread on the plates. This reduction in the temperature of the pipe plate materially reduced the expansion and contraction in the field joints thereby permitting larger diameter pipe lines to be laid with less difficulty, than heretofore. In 1932, a 48-in. steel main was laid in San Francisco, some of the plates being ½-in. thick, and all field joints were welded with the acetylene torch, as described above, without any great difficulty.

The electric shielded arc has now, at least in San Francisco, replaced the acetylene torch for all welding of the field joints. The lag of the use of the electric arc, for the field joint, was due to the contention that a backing up strip was required, where a butt joint was used.

During the present year it was found that by the proper application of the welding method, the arc could be used without a backing up strip on butt joints. The gap or opening of the butt joint should be about the diameter of the rod after the coating on the rod has been removed. The edge of the plates, ¼-in. or less in thickness, are square sheared. For greater thicknesses, the metal is relieved. The first pass of the arc is made from the outside penetrating about ⅝ of the metal thickness. The metal placed by the first pass of the arc, in reality, acts as a backing up strip for all subsequent welding.

The usual procedure is to complete all welding on the outside first before placing the final pass on the inside. The largest pipe line, so far, laid in San Francisco by this method was 54 in. in diameter, the smallest being 20 in. in diameter, the plates being ⅛-in. and ¼-in. thick, respectively.

With the introduction of the acetylene welding to steel pipe line construction all field joints were of the butt type. As electric welding has advanced, the bell and spigot type of joint was also developed for steel pipes.

At present the butt joint is used only when the underground obstructions are such as to prohibit the use of the bell and spigot joint or where a change in alignment occurs.

Other cities have doubtless introduced other methods and materials. At the time of the founding of the Section, it was planned to have a committee appointed each year to collect, study and report at the convention everything new that had been tried the past year, whether it had been a success or a failure. This plan has fallen by the wayside, but these improvements still go on and the real value of the annual meeting lies in the extent to which such knowledge is spread among those interested in the work.

Rocky Mountain Section, A.W.W.A.

WITH a registered attendance of 119, the Rocky Mountain Section of the American Water Works Association held its Ninth Annual Meeting September 16-18 in Denver, in conjunction with the Fifth Rocky Mountain Water Works College. The officers elected to direct affairs of the Rocky Mountain Section during the ensuing year were: D. D. Gross, chief engineer, Denver Board of Water Commissioners, chairman; K. W. Caldwell, water superintendent, Gallup, New Mexico, and O. B. Sumner, manager New Mexico Power Co., Santa Fe, trustees for a three-year term; B. V. Howe, state sanitary engineer, Colorado (428 State Office Bldg.), was re-elected secretary-treasurer. Frank Barbour, consulting engineer of Boston and national president of the A. W. W. A., attended the convention.

Discussion included the subject of registration to license water works superintendents and plant operators in Colorado. The arguments advanced regarding this proposed legislation indicated that there was no apparent opposition to such a program. Considerable interest was shown in a paper presented by Dana E. Kepner, sanitary engineer, Denver, on the method of sterilizing water by silver ionization.

An inspection trip on the afternoon of the first day included visits to the sewage disposal plants of Boulder and Loveland and the filtration plant at Longmont. A barbecue supper at the Loveland power plant in Big Thompson Canyon, following the inspection trip, was attended by 125 and was one of the highlights of the convention.

Some Modern Trends in the Practice of Chlorination

From simple sterilization, the use of chlorine has become an important aid in many phases of water treatment

By A. C. BEYER
District Manager, Wallace & Tiernan Co.
San Francisco

WHILE California was one of the earliest states to take up the use of chlorine for the protection of water supplies, it was not until about 1920 that chlorination began to be adopted generally throughout the state. By 1925 the number of installations had about doubled and since then have redoubled.

At first chlorination was used only for sterilization; therefore, at treatment plants the proper point of chlorination was in the effluent, while on other supplies the chlorine was added at some place beyond which there was no possible chance of recontamination. While sterilization is still the most important function of water chlorination, the development in the past ten years and the trend at present is toward supplementary uses of chlorine both alone and in combination with other chemicals. Most of these new applications are either integral steps in treatment processes, often indirectly aiding efficient sterilization, or are effective in the difficult problem of preventing the deterioration of water quality by organic growths in distributing reservoirs and pipe systems.

Superchlorination followed by dechlorination with sulphur dioxide or other reducing agents has proven valuable in other parts of the country for the elimination of certain types of taste. In California this process has been used in several cases. Prechlorination has been developed to a point where it is now recognized as practically established practice at treatment plants. Among the advantages are: (1) reduction in the bacterial load on the plant, (2) an increased factor of safety on account of the double (pre and post) chlorination, (3) control of algae and bacteria in settling basins and filters resulting in less sludge putrifaction in settling basins, cleaner sand beds and longer filter runs.

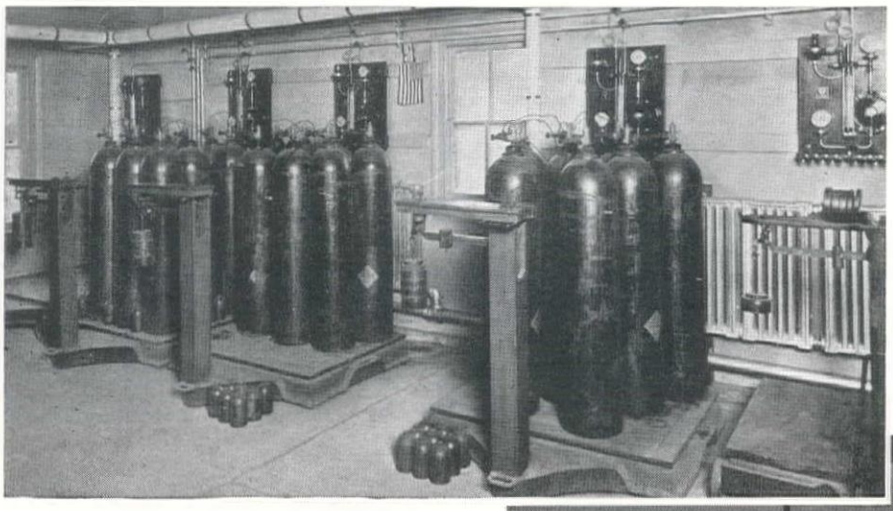
It has been found that particularly desirable results can be secured by prechlorination and the application of powdered active carbon ahead of sedimentation basins; properly applied this results in elimination of algal troubles as well as maintenance of the settled sludge in the basins in a "sweet" condition, giving the most efficient settling and eliminating the imparting of objectionable tastes to the water by putrifying sludge. Where dechlorination is desired the application of active carbon ahead of a filter bed is very efficient.

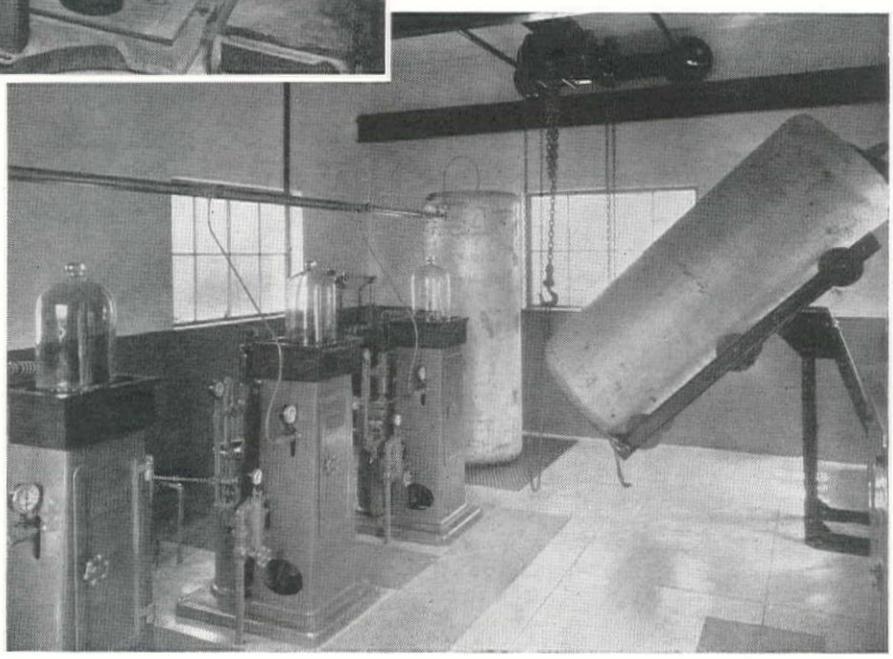
With the present discussion of and trend toward the use of ferric coagulents it is interesting to recall that chlorine played an important part in the first practical application of ferric coagulation on water in this country. I refer to the use of chlorinated copperas at Elizabeth City, North Carolina, and at other points in the Southeast, where the resultant ferric salts were particularly effective on highly colored acid waters. In the past few years the generation of ferric chloride by use of chlorine and a reaction tower filled with scrap iron, as developed by Messrs. Scott and Darcey, has given considerable promise as an economical source of this coagulent.

Chloramine process

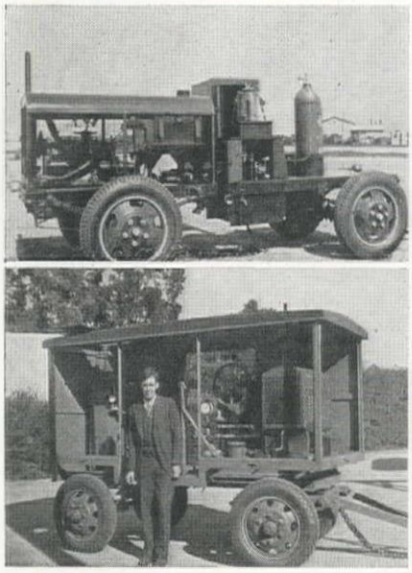
Undoubtedly, the most important development in the past few years has been the ammonia-chlorine or chloramine process. The residuals resulting from this process, as is now well known, are highly persistent and tasteless. At first the use of chloramines was for the obvious end of eliminating chloro tastes which occurred in supplies where it was difficult to prevent over-treatment at times or where the taste resulted from the combination of the chlorine with other organic compounds in the water. However, it soon became evident that the ability to carry a high, persistent residual without taste meant that algae trouble in distribution reservoirs and after growth in the distribution system could be eliminated.

At the present time there is a definite tendency towards the maintenance of chloramine residuals throughout the





In 1920 the interior of a chlorinator house usually presented the appearance shown on the left, while a modern 1935 installation, as typified by a station of the Los Angeles Water Department, is shown below.



Portable, trailer-mounted chlorinator units have been developed for temporary or emergency use. The Long Beach equipment is shown above and the unit of the San Francisco department below.

entire distribution system. Unquestionably, one of the most frequent sources of objectionable tastes in water is from the growth of small organisms in the distribution system, particularly in dead ends, with subsequent sloughing off and decomposition of the resulting accumulations. Iron bacteria or Crenothrix is one of the most frequent sources of this trouble although there are a number of other similar objectionable organisms. The carrying of a chloramine residual through the distribution system effectively eliminates such type of growth and there is increasing use of this type of chloramine treatment.

Effect on carrying capacity

There is increasing recognition of the fact that the carrying capacity of transmission lines and distribution mains can be kept at a maximum by carrying a chlorine residual; normally, the chloramine treatment is the most desirable for the reasons mentioned above. Not only does this procedure prevent organic accumulations in the pipe lines, but it has been demonstrated that tuberculation is, in many cases, of biological origin and is, therefore, corrected by this type of treatment. Incidentally, there are a number of cases in California where a chloramine residual is being carried for distances of 15 and 20 miles through transmission mains and at other points in the country for even longer distances.

Modern uses of chlorine include: sterilization of new mains before placing them in service; protection of cross connections, such as might be necessary for fire protection, by chlorination as well as with approved check valve installation; maintaining efficiency of Zeolite softening plants by prechlorination, thus eliminating algal or other organic growths in the Zeolite bed; chlorination of filter back-wash water to sterilize the sand beds during the washing operation.

Protection of well waters

Studies over the past few years, published in the Journal of the A. P. H. A., have shown that greater attention to the protection of well water supplies is justified. The fact that about 25% of the outbreaks of water borne typhoid in the United States from 1920 to 1930 were from untreated groundwater supplies and that the total number of cases of typhoid and dysentery from such outbreaks was about eight times the number of the outbreaks from untreated surface water supplies, is valuable in counteracting the popular conception that well water, particularly if it is from a deep well, is bound to be a pure water. There is a tendency toward the chlorination of water supplies, both surface and underground, as a matter of insurance, even though bacteriological tests are normally negative.

Improvement in equipment

The development of equipment has kept pace with the widening uses of chlorine and in some cases has aided in developing new uses. In 1920 the principal type of equipment was the pressure direct feed chlorinator. This has been superseded by the vacuum solution feed machine which has eliminated practically all of the operating headaches of the earlier days. In recent years the principal progress has been in the perfecting of various types of automatic chlorination setups so that now there is equipment available to take care of practically any requirements. Automatic proportioning of chlorine can be taken care of from any standard type of flow measuring device and equipment can be arranged for remote control.

Efficient, electrically operated or water-pressure operated valves and other devices have been worked out to increase the automatic protection of chlorination plants. Recording scales give an accurate check on the equipment and furnish a valuable operating and legal record.

As in many other fields the photo-electric cell is being used in the field of chlorination on equipment for the automatic control of chlorine dosage to give a constant residual of chlorine in the water, regardless of changes in the chlorine demand of the water, or changes in flow, either of which type of change would necessitate a change in the chlorine dosage. The Los Angeles Water Department has used this type of equipment with a high degree of success.

There are many fine examples of chlorinator installations in California, such as those on the systems of San Diego, Los Angeles, San Francisco, Pasadena and the East Bay Municipal Utility District, to mention only a few. The Los Angeles Water Department has been among the leaders not only in this state but in the entire country in matters of chlorination practice. Among its more recent contributions is the recently reported work which shows the value of the immediate, uniform diffusion of chlorine through a flow being treated. This is of particular importance in large conduits and is secured through multiple application; this department has used as many as eight points in 60 and 72-in. mains, placed approximately equidistant around the circumference.

Another advance step, started by the Los Angeles Water Department, is the mobile chlorination unit. This consists of a large capacity vacuum solution feed chlorinator mounted on a suitable trailer along with the booster pump to supply pressure water for operating the chlorinator under all conditions. The booster pump is normally gasoline driven but in some cases is equipped for electric drive where power is easily available. Chlorine cylinders, suitable solution hose lines and connections complete the equipment. The cities of Long Beach and San Francisco also have this type of equipment. An outstanding case of the value of such equipment was illustrated at the Long Beach earthquake in 1933, but all of the departments which have this type of equipment make continuous use of it and find it very convenient for main sterilization and various types of temporary or emergency chlorination at widely separated points.

Summing up the past 15 years, it can be said that chlorine, instead of being a somewhat new means of sterilizing water, has come to be established as one of the most valuable tools in water treatment, and that the development of equipment for its proper use has kept pace in this development.

Exhibitors at the Conventions

At the first convention meeting in October, 1920, the entire display of water works materials and equipment consisted of a Wallace & Tiernan chlorinator hung on the wall of the room where the meeting was held. The operation of this apparatus was described in a chalk talk by Alex Bell. The next year at the convention in Los Angeles there were no exhibitors.

At the meeting in Oakland in 1922, the exhibitors numbered about five and included: Wallace & Tiernan Co., Neptune Meter Co., U.S. Pipe and Foundry Co., and American Cast Iron Pipe Co. The number of exhibitors increased to about fifteen the following year and to twenty-two in 1924.

Up to 1927 the exhibitors coöperated in the handling of the exhibits and prorated the costs among themselves. Since that year the Water Works Manufacturers Association has taken charge of the handling of the exhibits at the annual conventions of the California Section.

Notable Developments in The Use of Chemicals

Major advance has been in the field of taste and odor control, with softening and corrosion prevention to witness the greatest advance during the coming decade

By RALPH A. STEVENSON
President, Stevenson Chemical Co.
Los Angeles

THE science of chemistry has played a large part in making possible the safe and palatable water enjoyed by the citizens of modern municipalities. Fifteen years ago the chemicals commonly in use for water purification purposes were chlorine, chloride of lime, aluminum sulfate, lime, sulfate of iron, soda ash and copper sulfate. With the exception of chloride of lime and sulfate of iron these chemicals are still widely used, although the methods of their application and use has in most cases changed considerably.

Chemicals that have made their appearance during the past fifteen years and are now in common use are carbon dioxide, activated carbon, ammonia, ferric chloride, ferric sulfate, and a new type of chloride of lime which carries 70% or more chlorine content.

The greatest advances in the art of purifying and improving the quality of water, due to the introduction of new chemicals, has been in the field of taste and odor control and in coagulation.

Only aeration in 1920

Fifteen years ago the only method considered practical as a process for taste and odor control was aeration of the water. Since that time two very important methods have been developed and perfected, the first of these being the introduction of ammonia gas into the water ahead of chlorine.

Chlorine has a great affinity for organic matter and in waters containing algae or other forms of organic matter a goodly proportion of the chlorine dose went to form organic chlorine compounds, some of which are extremely odoriferous. When a solution of ammonia is mixed with a solution of chlorine in the ratio of two to four parts of chlorine to one of ammonia a chloramine substance is formed which has virtually the same bactericidal ability as chlorine, but a decidedly less affinity for organic matter, so that by the use of this new chemical higher residuals can be carried over longer periods of time without the formation of odoriferous chlorine-organic compounds.

Another comparatively new development in taste and odor reduction has been the use of activated carbon for this purpose. Activated carbon first became popular in the form of a filtering medium through which the water was passed to remove tastes and odors. This practice is almost entirely confined to industrial installations today and the powdered form is universally used in large scale water works.

The active form of carbon can be made from almost any carbonaceous material but, in general, raw materials such as wood or lignite are used. There are many processes of activation, but mostly they consist of holding the charred raw material at a high temperature in the presence of oxygen or oxidizing agents. The effectiveness of the finished material is due almost entirely to its tremendous surface area which gives it more than forty times the adsorption capacity of ordinary charcoal.

A good grade of activated carbon will have in excess of 20,000 sq. yd. of surface per 1 cu. in. of this material.

Improving coagulation

Due, I believe, to the research of Professor Langelier, Univ. of California, with coagulation at Sacramento, considerably more attention has been paid to the study of coagulation and coagulants during the past fifteen years than in any previous period. Aluminum sulfate, or alum as it is called, continues to be quite widely used for the purpose of removing suspended matter from water, but this material is rapidly being replaced by iron salts such as ferric chloride and ferric sulfate.

Ferric salts have several distinct advantages over aluminum salts. In practice they produce an hydroxide floc which forms more quickly and, settles faster than aluminum hydroxide, and iron floc carried on to a sand bed does not have the same tendency to form mud balls. Settling basins are more easily cleaned and the settled floc tends to neutralize hydrogen sulfide gas sometimes formed from decomposing organic matter at the bottom of a settling basin.

Ferric sulfate has one advantage over ferric chloride in that it can be fed to the water with a dry feed machine, but so far price precludes its use on the Pacific Coast.

Previous to the 1920-1935 period, covered by this article, considerable trouble was experienced at plants using lime as a softening agent due to a delayed precipitation of bi-carbonates in meters and mains and on filter sand. For some time this situation has been controlled by the use of carbon dioxide. The gas is usually made at the plant from coke or fuel gas and is fed into the lime treated water somewhere ahead of the filters. This treatment has become a universally accepted practice and has been quite successful in accomplishing its purpose.

Other improvements

Previous to 1933 a considerable amount of chloride of lime was being used by the water works profession for general use such as sterilizing mains and as an emergency source of chlorine. Good grades of this material contained about 35% of available chlorine when fresh, but lost from 1 to 2% per month on standing. A new material has recently come on the market which in a short time has almost entirely replaced chloride of lime. This material is a dry calcium hypochlorite powder containing more than 70% available chlorine, and is highly stable. Although the price per unit of chlorine is higher than that of chloride of lime it has found favor because of its greater stability and solubility.

Caustic soda has come into rather general use recently for cleaning filter sand which has been fouled by organic matter and aluminum floc. The usual procedure for its use is to drain the filter below the bed and scatter the caustic over the sand in the amount of about 1 lb. per sq. ft. of sand surface. The water level is then brought to a point a few inches above the sand and allowed to remain 24 hrs. before back washing.

Chemicals too numerous to mention have been tried in the water purification field since 1920. Some of them, like sodium aluminate, have proven to be efficient reagents, but have failed to find a place in large scale operations because of price; others have found use in a few plants because of peculiar local conditions. Still others have been widely heralded and promptly discarded.

The next fifteen years will see many more improvements in the art of water purification. I would like to hazard a prediction that in the field of chemical treatment the greatest advance will be in water softening and corrosion prevention.

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State Engineers to Meet

A meeting of the Association of Western State Engineers will be held in Salt Lake City during the week of November 17-23. During the same week a meeting of the National Reclamation Association will also be held in Salt Lake City. The many items of interest which these groups have in common make concurrent sessions the usual procedure.

R. W. Faris, Commissioner of Reclamation for Idaho, is president of the state engineers group and Marshall N. Dana, PWA official of Portland, Oregon, is president of the Reclamation Association.

Meeting Problems Resulting from the Introduction of Hetch Hetchy Water

Sanitary and quality control over San Francisco supplies modified to meet changing conditions and varying problems following mixing of Hetch Hetchy water with local sources — Algae and Crenothrix troubles — Filtration a possibility

By F. E. DeMARTINI
San Francisco Water Department

Although not originally planned for this issue, the exceptional value and timeliness of this material on the San Francisco water supply, presented by Mr. De Martini, makes it an outstanding contribution for this annual waterworks number. It presents new and hitherto unpublished data on the characteristics of this major water-supply system of the West and discusses the unusual problems involved in the maintaining of the quality of the supply, the methods used, and results obtained. The original paper was presented before the Sanitary Division of the San Francisco Section, Am. Soc. C. E., and included a historic review of the development of the sources of supply which has been omitted from this presentation.—Editor.

ALL SOURCES of the San Francisco water supply are exceptionally good from the pollutional aspect, with an average density of population of about one person per sq. mi. on all the water sheds. Analyses of the raw waters for the past year indicate the percentage of samples showing five or more 10 c.c. tubes positive for the Coli Aerogenes Group ranges from zero for the Calaveras reservoir and well sources, to 7% for Hetch Hetchy water at the end of the Coast Range tunnel and an upper limit of 11% for the Upper Crystal Springs reservoir. These latter sources showing the 7% to 11% positive tests for the Coli group are chlorinated at least twice before delivery into the city and in two cases are chlorinated three times.

The proof of the adequacy of this treatment lies in the fact that during the past year samples collected in the distribution system, covering water from all sources of supply, were well within the requirements of the U.S. Treasury Dept. standards.

Chemical characteristics

The sources are all quite low in chlorides and sulphates, hardness varying from 5 to 10 p.p.m. for Hetch Hetchy water, to as much as 300 p.p.m. for some of the well water which furnishes only a very small portion of the total supply. The Peninsula water, when undiluted with Hetch Hetchy water, has a hardness of about 150 p.p.m. Since Hetch Hetchy water has been received in Upper Crystal Springs Reservoir, its hardness has dropped to about 80 p.p.m.

Physically, Hetch Hetchy water is crystal clear except at times of storm run-off, but it undergoes changes in pipe lines, tunnels and local reservoirs until it assumes the character of local supplies. The local supplies vary according to season and lake levels from relatively clear water with a turbidity of 2 or 3 p.p.m. to turbidities of 15 to 20 p.p.m. In the summer of 1931, when Crystal Springs Reservoir contained only 14 ft. of water the turbidity rose to 2,000 and 3,000 p.p.m. During most of the year the Peninsula Lakes have turbidities around 5 p.p.m. Algae growths occur in the local supplies, resulting in taste and odor difficulties and necessitating continual watch and occasional treatments with copper sulphate.

Natural and artificial agencies for sanitary control will be discussed under four headings: (1) watershed sanitation, (2) storage, (3) disinfection, (4) laboratory control.

The policy of watershed ownership started with the Spring Valley system and has been continued to the present time. Watersheds are patroled by rangers and reservoir keepers. Proper disposal of sewage is provided at all water department dwellings.

Storage is the natural agency which acts as a result of large reservoirs and the limited longevity of harmful bacteria in water. This factor is more important as the rainy season is left farther behind and is of much less significance during the season of heavy run-off when contaminated water may reach the outlets more directly.

Disinfection

Chlorination of the supply was started about 1924, the first chlorinator being installed at University Mound Reservoir to combat sea-gull pollution. In 1925, a second machine was installed at the outlet of College Hill Reservoir, and in 1926 chlorinators were moved back on the transmission lines, ahead of all consumers permitting higher chlorine doses and more definite sterilization. In recent years chlorinators have been installed again at the outlets of University Mound, Lake Honda and College Hill Reservoirs as a safety factor to overcome bird and wind blown contamination in the open reservoirs.

The various sources are chlorinated at least twice, in some cases three times. At present there are ten plants with a total of fifteen Wallace & Tiernan chlorinators including dry-feed, vacuum and one automatic machine regulated by a Venturi meter. The department also has a vacuum type machine mounted on a trailer, together with plunger pump equipment driven by a gasoline engine or electric motor to provide water pressure. This machine has a capacity of 300 lb. per day.

All chlorinators are equipped with scales and are visited at least once daily, frequently more often. Residual chlorine tests and scale readings are taken and recorded daily. One ton chlorine cylinders are used at all the plants except at the city distribution reservoirs. Prof. W. F. Langelier of the University of California is retained as consultant by the department and checks the chlorination plants and general chlorination practice at frequent intervals.

Laboratory control

Up to 1934 laboratory control was carried on solely by the San Francisco Health Department which started this work in 1923. The health department analyzes samples weekly from the main transmission lines, and all city reservoirs. Early in 1934 the water department instituted its own laboratory located at Millbrae. Seventy-five to 100 bacterial samples are analyzed weekly. All sources, reservoirs and distribution system samples are checked twice weekly in the Millbrae laboratory. During the past fiscal year 3,100 bacterial samples were analyzed. In addition to the bacterial work, partial chemical and complete mineral analyses are made. Considerable time is spent on investigational work and special problems bearing on algae control and general purification.

Physical improvement of the water is accomplished through algae control, aeration and coagulation.

Algae control—Algae samples from the Peninsula lakes are examined microscopically twice weekly, and from Hetch Hetchy, Moccasin, and Calaveras reservoirs once weekly. Treatment of the lakes with copper sulphate is largely based upon the results of these examinations. Professor Kofoid of the University of California has examined algae samples for the depart-

ment for over twenty years, at regular semi-weekly intervals.

The copper sulphate doses are generally 1 lb. per m.g. based on entire contents of the reservoir. The copper sulphate is applied by dragging bags of the chemical behind a launch in lanes across the lakes. Studies of the rate of dissipation and rapidity of diffusion of the copper sulphate are being made by the purification division in an effort to improve methods of application. Each lake of the Peninsula system and Calaveras Reservoir are treated three times annually, as a rule, and in some years more often, depending upon their condition. As yet there have been no copper sulphate treatments necessary in the reservoirs of the Hetch Hetchy system.

Aeration—In 1935 an aerator and screening plant was completed below Calaveras Reservoir dam, with a capacity of 80 m.g.d. The nozzles used were developed by G. E. Arnold, purification engineer of the department, and are of a baffle type. The nozzles consist of straight vertical pipes to each of which is welded a rectangular plate bent at a 45° angle above the nozzle. The water strikes this plate and is deflected into a fan shaped sheet, breaking into a fine spray. Recent tests on the operation of the plant indicate that 75 to 85% saturation with dissolved oxygen is attained in a water with no dissolved oxygen before aeration. The treated water has a much improved taste over the raw lake water.

Coagulation—During dry years when storage in the Peninsula Reservoirs has been at a minimum, turbid water has been clarified by pumping alum solution into the Crystal Springs transmission main at Millbrae pump plant. Alum solution has been prepared in large wooden tanks and pumped into the main. The flox settled out in University Mound Reservoir. This treatment is used only at times of extreme turbidities and has helped to clarify the supply. In 1931 during the low stage in the Peninsula Reservoirs and in the Spring of 1932, due to late rains, the coagulation treatment was applied. Average alum dose was 2 gr. per gal. and produced a great improvement.

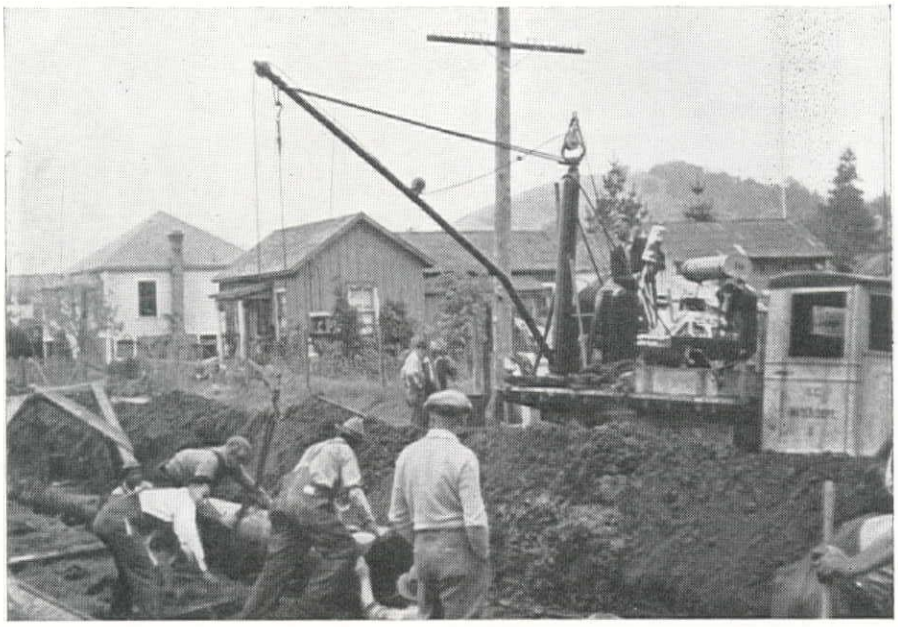
From this brief review of the character of water and treatment processes used, it is felt that while the supply is satisfactory from a health standpoint and meets Treasury Department standards, ultimately filtration will have to be resorted to, to meet the increasingly higher standards demanded for domestic water supply requiring the removal of turbidity, tastes and other objectionable conditions which occur occasionally from growths of iron bacteria and weeds which will be mentioned later.

A few of the special problems that have been encountered will be outlined in conclusion:

Cross connections

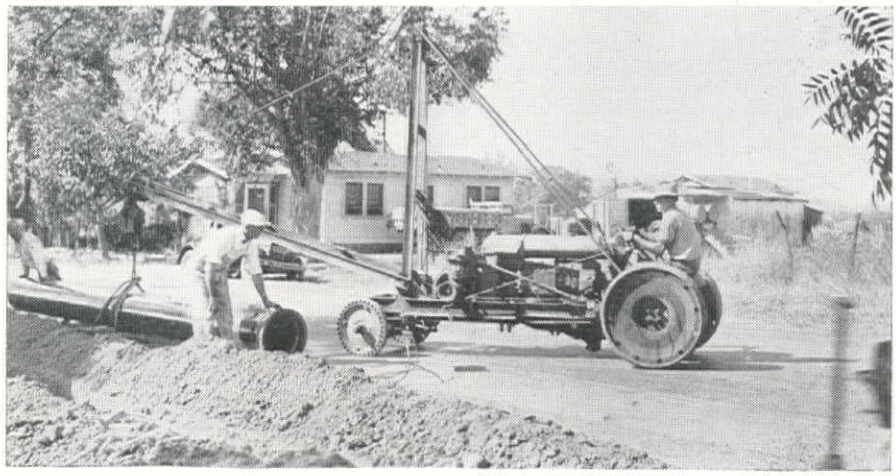
During 1934-35 a systematic survey of all premises reporting private water supplies was made. In this survey 219 active cross connections between the

Rigs to Handle Cast Iron Pipe



At Santa Cruz the water department developed this truck-mounted, gas-engine driven crane, to handle the 14-in. pipe for this PWA project.

W. J. Tobin, contractor (above), used this crawler-mounted machine to handle 16-in. cement-lined cast iron pipe on a job for the San Francisco Water Department. At Gilroy (below) this tractor-mounted machine was used to place 16-in. pipe in the trench.



city supply and other active water supplies were found. These have all been corrected either by complete severance of the two systems or by installation of double check valves approved by the State Health Department. A partial survey of buildings in the downtown and waterfront area has been made to detect cross connections between the city water supply and sewage pumps, sump pumps or ejectors and swimming pools. Buildings examined were those which were considered most likely to have such connections and about one building in three of those examined was found to have such cross connections, which are of the most serious type.

The survey was not completed due to depletion of available funds, but it is hoped that it may be completed shortly, either by the water department or under the department of health which has jurisdiction over plumbing installations. All cross connections and double check valve installations are inspected by the department every six months. New consumers are required to sign an affidavit to the effect that they have no other source of water supply on the premises served, or if there is another source, are required to obtain a written permit to maintain a cross connection. Permits are issued only if piping on the premises conforms to the requirements of the department.

Weed growths

In 1932-33-34 much difficulty occurred from weed growths in the Peninsula System—particularly in San Andreas reservoir from the weed "chara." This weed causes a musty taste and odor. San Andreas reservoir was about half full in 1932 and 1933 when the tastes were bad and the time of the year was early Fall. Copper sulphate treatment and aeration of the water in the forebay of the outlet tower were tried with little success in overcoming the odors and tastes.

Activated carbon filters operated on an experimental scale treating a flow of 2 gal. per min. were effective in removing the taste and odors. Chloramine treatment, super-chlorination followed by dechlorination, was ineffective. The reservoir was allowed to drop 8 ft. and the exposed weeds burned with kerosene torches after they had dried. It was hoped that raising the lake level the following year would be effective in keeping back the weeds, but due to the dry winter the reservoir remained low and a brief period of tastes and odors recurred the following year.

This year no weed tastes nor growths have occurred. The lake has been at a much higher level all through the year. The value of filtration plants in overcoming such difficulties is easily appreciated. Activated carbon could be added to the raw water for tastes and odor elimination and the carbon removed by sedimentation and filtration.

There have also been growths of weeds in some of the canals. These caused a reduction in flow as well as production of tastes and odors. Continuous treatment with copper sulphate was found to be effective in controlling the growths whereas intermittent treatments with copper sulphate were not successful. The canals were covered with a roof which eliminated weed-growth.

Iron bacteria

The Hetch Hetchy water was first delivered to the Peninsula reservoirs on Oct. 28, 1934. While it had been noticed that the water seeping into the Coast Range tunnels was highly mineralized and had an objectionable taste and odor, due to the large dilution with pure Hetch Hetchy water, no difficulty was experienced until February of this year. At that time the capacity of the Alameda line, which had been carrying Hetch Hetchy water for five weeks, began to decrease steadily, dropping at the rate of about 200,000 gallons per day, and undergoing a total reduction in capacity from 16.6 m.g.d. at the worst condition, in a period of a few weeks.

Pressure readings and other observations did not indicate that there were any stoppages or breaks in the line. Finally the line was opened and examined, and found to have a slimy gelatinous growth all over the circumference. The growth was from ⅛ to ¼-in. thick when moist. The material was examined microscopically and finally classified as one of the so-called iron bacteria, probably crenothrix.

In addition to the decrease in carrying capacity, it was noted that whenever the line was shut down for any length of time, so that the contact period between water and the growth was increased, the water developed a taste described as, "like iodine" or "decaying wood," and various other such terms.

Investigation disclosed that the Hetch Hetchy water was the only source affected and that the growths were abundant in the Hetch Hetchy tunnel and pipe line from Alameda Creek to Upper Crystal Springs reservoir. No growth was found at Tesla portal located at the lower end of the San Joaquin Valley pipe line nor at Oakdale portal at the lower end of the Foothill Division tunnels. Only recently an inspection was made of the 27-mi. tunnel from Tesla portal, near Tracy, to Alameda East portal. The growth occurred in varying amounts from within a mile or so of the Tesla end clear through to Alameda East portal.

Seepage water entering the Coast Range tunnels contains about 2.0 p.p.m. of iron and is highly mineralized. This water develops the bacterial growth upon standing. The conclusions to date are, that the iron bacteria is introduced into the tunnels with the seepage water and, finding favorable conditions, develops abundantly.

As to remedial measures, the use of copper sulphate was tried on an experimental scale in one of the Bay Crossing lines of the Alameda pipe line. Results were inconclusive, but it appeared that copper sulphate was not very effective as a control agent. Laboratory tests with lime, chlorine and copper sulphate did not prevent regrowth of the organism in culture media.

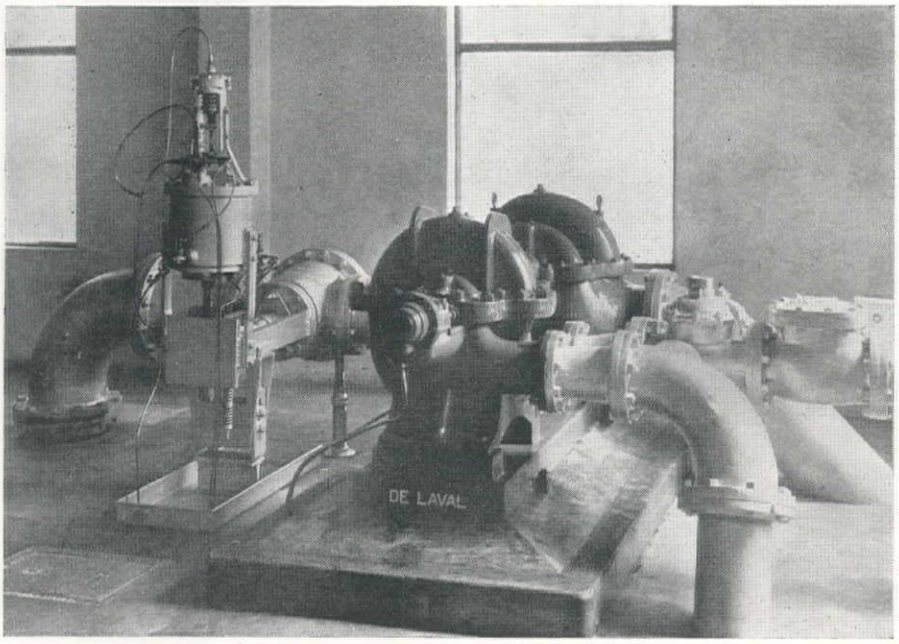
The use of chlorine and ammonia was started at Irvington portal on June 17, 1935. The addition of ammonia in conjunction with chlorine permitted the use of high chlorine doses without development of objectionable chlorinous tastes. After a week's treatment with a chlorine dose of ¾ p.p.m. the growth appeared to be dying off. Subsequent inspections have indicated marked improvement, but some growth was still apparent in small patches.

Recently, the Hetch Hetchy water has been shut off due to a break in the submarine crossing of Newark Slough, but the last inspection of the Alameda Creek-Irvington Portal tunnel, which is ahead of the treatment point, showed a much decreased growth, indicating the possibility of a seasonal aspect to the problem. The best method of control of these growths under the conditions so far discovered is the chlorine and ammonia treatment, but much remains to be learned about them. They cause objectionable tastes, presence of suspended matter in the water, reduction in carrying capacity of pipe lines and possibly further difficulties.

Another aspect of the use of Hetch Hetchy water is possible corrosive action. It is a very soft, unbuffered water and could easily remove protective lime coatings from pipe lines. Lime treatment and possibly hardening, due to the low alkalinity of the water prior to pH adjustment, may be necessary. Laboratory tests are being made along these lines. Corrosion specimens of black iron, galvanized iron, cast iron, lead and brass are suspended at the outlet of Pulgas tunnel in the channel carrying Hetch Hetchy water. They are cleaned and weighed at intervals to determine the rate of loss of weight due to corrosion.

To date, the specimens have been in the Hetch Hetchy water for about 105 days. The ratio of loss of weight of the various specimens to loss in weight of the black iron specimens are: cast iron .7; galvanized iron .4; lead .18; brass .15. Specimens cleaned and weighed at intervals of two weeks showed a somewhat higher total loss of weight than those cleaned only once at the end of the 105 day period.

Whenever a new water supply is developed, having decidedly different characteristics from the one in use, it may be expected that unusual and varying problems will result. The bacterial growths and the corrosive tendency of the Hetch Hetchy water are samples of this. The discharge of large amounts of Hetch Hetchy water into the Peninsula Reservoirs may be found to have an effect on the algae growths therein due to the changes in the mixed waters. The Hetch Hetchy water is being regularly sampled and various studies carried on to learn as much as possible, to meet these changes.



Seattle Increases Use of Hydraulically Operated Pumping Units

By J. C. LINDSEY
Pump Foreman, Seattle Water Department

ANOTHER hydraulic turbine-driven pump unit has been installed on the system of the Seattle Water Department, in accordance with the established plan to substitute, as far as practicable, these water driven units in place of electric pumps as a means of reducing costs. The latest installation is at the Foy station.

The original pumping installation at this station consisted of three 200 h. p. electrically driven units of about 3,000 g. p. m. capacity each. The equipment proved to be too large for the district served. With a result that, up to several weeks ago, only one of the electric pumps was operated from 1 to 2 hrs. per day for nine months of the year and about 4 hrs. per day during the summer months, with the cost of power totaling $3,200 per year.

The new hydro pumping unit recently installed consists of a 5 by 4 two-stage pump direct connected to a 12-in. hydraulic turbine (see illustration). The pump will deliver 700 to 800 g. p. m. at a net head of 205 ft. The turbine takes 3,800 to 4,200 g. p. m. at a head of 65 ft. for its operation.

The water supply for the turbine and the pump suction is taken from the existing 30-in. line coming from the 60 m. g. Maple Leaf reservoir. The pump discharged into a similar line leading to the 1 m. g. Foy standpipe.

The new unit is mounted on the concrete base formerly occupied by one of the 200 h. p. electric units. This arrangement leaves two of the electric pumps available for future use. Savings in power costs alone will more than pay for the hydraulic unit and its installation in less than a year. In addition, the new unit will save $1,400 in operators wages, as it is equipped for full automatic operation. For eight months of the year all pump districts are supplied from hydraulic units.

H. D. Fowler, superintendent of the Seattle Water Department, has done much to further hydraulic pumping on the municipal system and is a firm believer in making economic use of this power which exists within the system of the department.

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Ogden Awards $331,663 Contract For 5-mile Water Supply Conduit

APPROVAL of the PWA has been given to the award of a $331,663 contract by the City of Ogden, Utah, to the American Concrete and Steel Pipe Co. of Los Angeles, for constructing a 5-mi. conduit on the municipal water supply system. This 36-in. diameter concrete line will supplement the present conduit delivering water from the artesian well basin in the Ogden River valley to the terminal reservoirs at the city.

The schedule for bids called for the following alternates: (1) concrete pipe, (2) welded steel pipe, and (3) cast iron pipe. When the bids were opened September 4 the three low bidders for the welded steel pipe were:

Steel Pipe & Tank Co., Berkeley	$326,971
Utah Construction Co. & Morrison-Knudsen	336,967
C. F. Dinsmore & Co., Ogden	368,898

The two bidders on the concrete pipe were:

American Concrete & Steel Pipe Co., Los Angeles	$331,653
Ora Bundy, Ogden	339,990

No bids were received on the cast iron pipe alternate.

Contract letting

The city commission, on recommendation of C. L. Coray, city engineer, approved the award of contract to the American Concrete & Steel Pipe Co. on its bid for concrete pipe. This was the second low bid, being about $4,000 higher than the bid of the Steel Pipe & Tank Co. for the steel pipe. Award of contract was protested by the low bidder.

The reasons given for the award were based on the more permanent installation for the concrete pipe and the use of local materials and labor in the manufacture of this pipe as compared to the fabrication of the steel pipe outside the state.

PWA financing

The project is financed by the PWA and this agency had the final decision to make in reference to the award. Recently, the PWA, through state engineer R. A. Hart, approved the award made by the city commission. Work was scheduled to start at once.

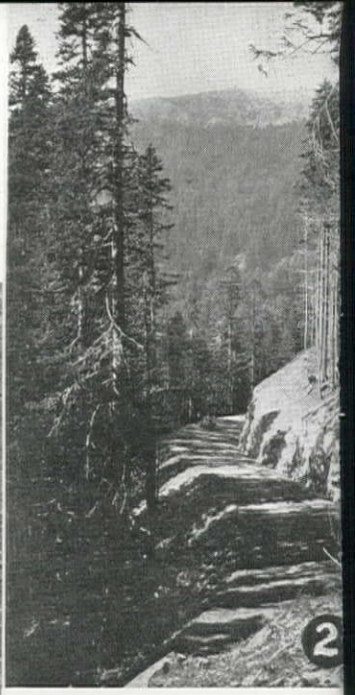
The work will involve the furnishing and laying of 7,000 ft. of 36-in. diameter centrifugal reinforced concrete pipe for a 100-ft. head, 5,600 ft. of similar pipe for a 150-ft. head, 4,000 ft. of concrete lined and gunnite coated welded steel pipe for a 200 ft. head, and the remaining distance, for heads up to 400 ft., will be the same general type of pipe. Incidental items include the removal of an electric railroad track from the right of way which is to be used for the conduit line, trenching and back filling. The work will also include the usual valves, gates, manholes, and other miscellaneous items.

This new conduit will convey water from the artesian well supply which is located in the reservoir site behind the Pine View Dam. The upper end of this system in the reservoir site, was described briefly in the article on the Pine View Dam in *Western Construction News*, September, 1935, and the terminal reservoir in Ogden was described in the same issue.

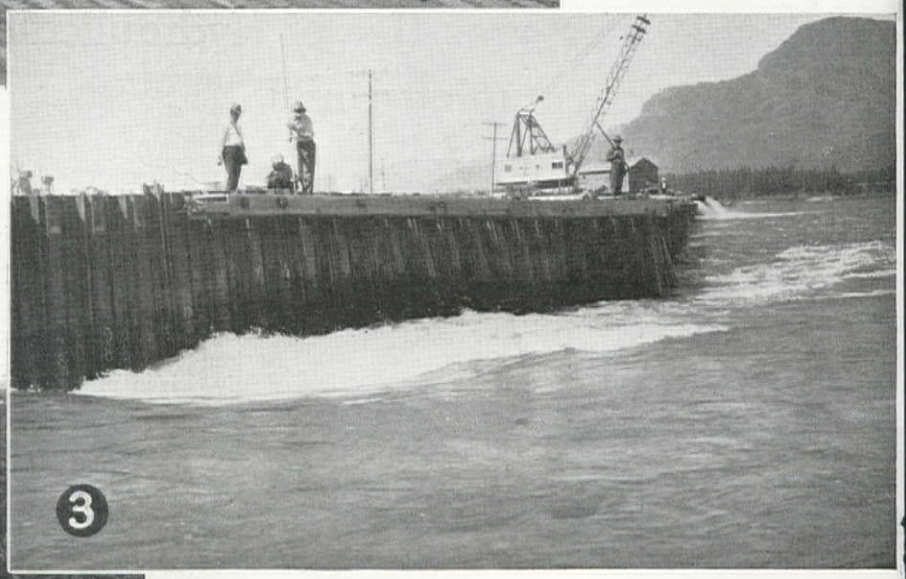
Construction of this important feature in the Ogden water supply system will be under the immediate direction of Claude L. Coray, city engineer, Ogden, Utah.

On the Western Construction Front

1—On the plains where Buffalo Bill chased Indians, the Taggart Construction Company are using Caterpillar and LeTourneau equipment on this highway grading job near Cody, Wyoming.

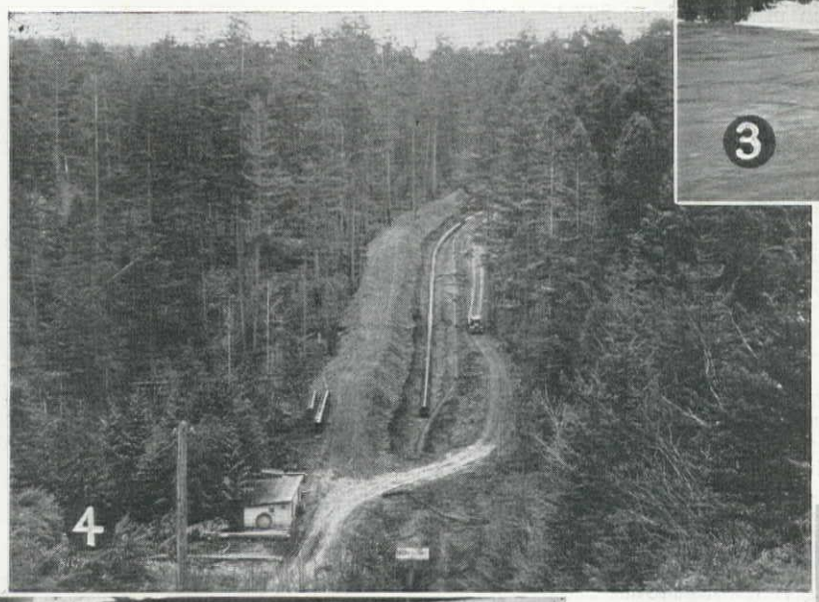


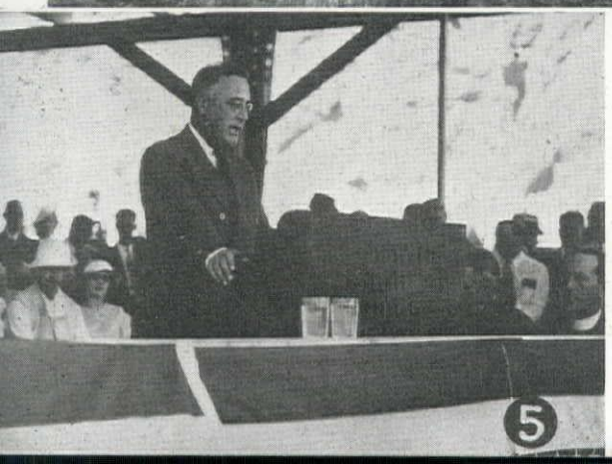
2—A. C. Greenwood Company has completed their contract for grading 2.9 miles of the West Side Highway in Mount Rainier National Park, Wash.



3—On the river side of the main cofferdam at Bonneville, following the high water season. This area was unwatered in August by the Columbia Construction Company.

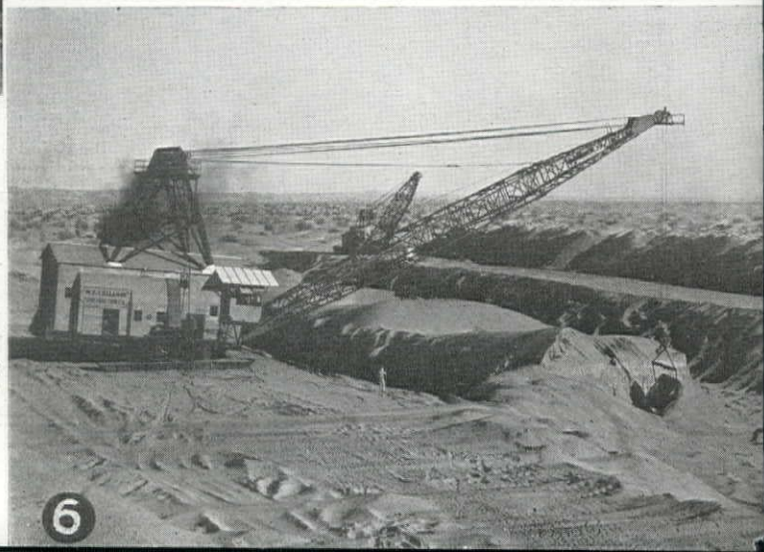
4—Along the new water supply line for Tacoma, where a 2½-mile section was fabricated and joined by the Shielded Arc process of welding.

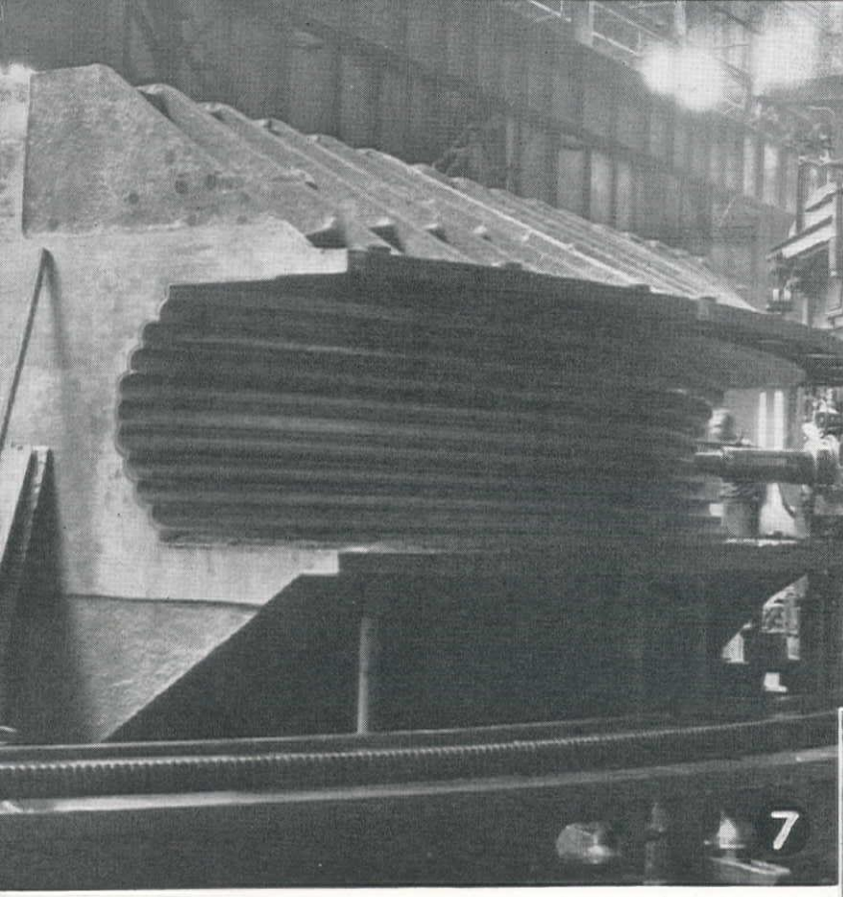




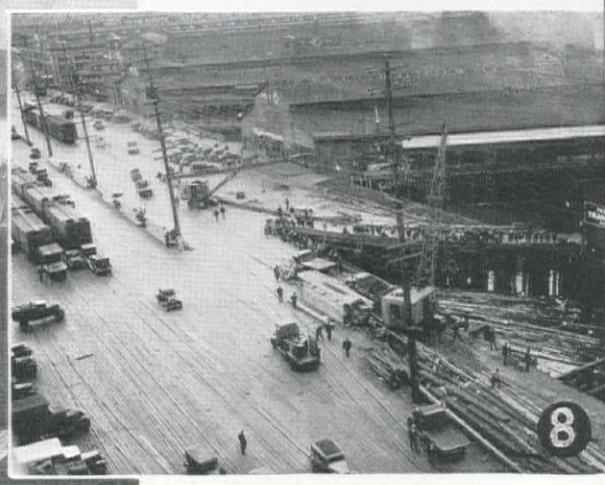
5—On September 30 President Roosevelt officially dedicated Boulder Dam.

6—The Monighan draglines of W. E. Callahan Construction Company and Gunther and Shirley are now working in the eastern edge of the sandhill section along the All-American Canal.

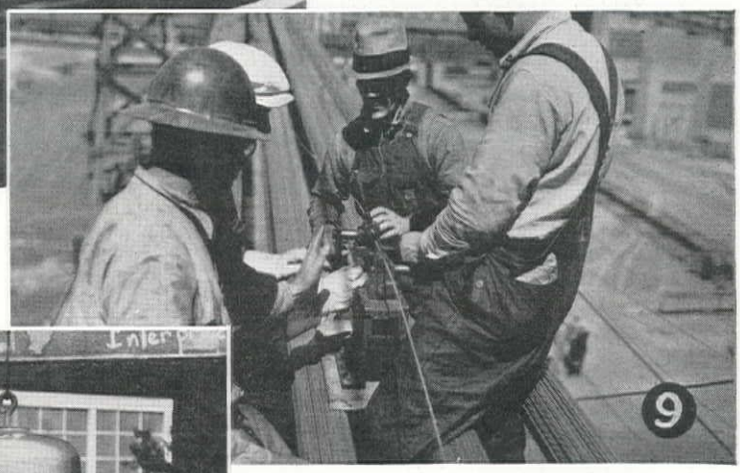




7—Milling grooves for the Golden Gate Bridge cables in the saddles castings at the Midvale plant of the Bethlehem Steel Company.



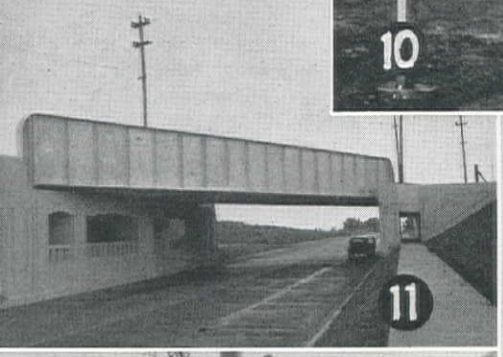
8—Seattle's seawall project nears completion. The record for slab setting has been eleven in six hours, and eighty-one batter piles have been driven in six hours.



9—Threading together the ends of the last wire to make a field splice in a strand of a Bay Bridge cable.

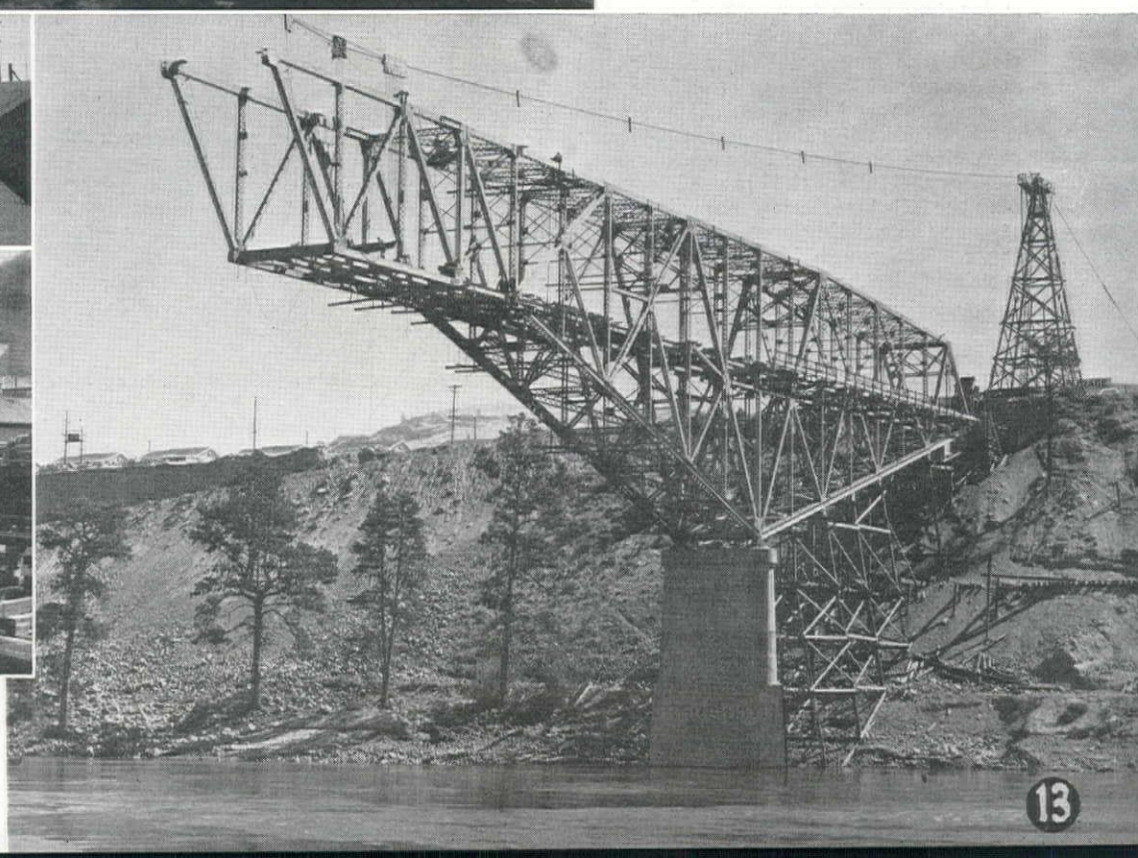
10—Navigation bells which will be placed on the piers of the San Francisco–Oakland Bay Bridge. The larger one weighs 3,000 pounds.

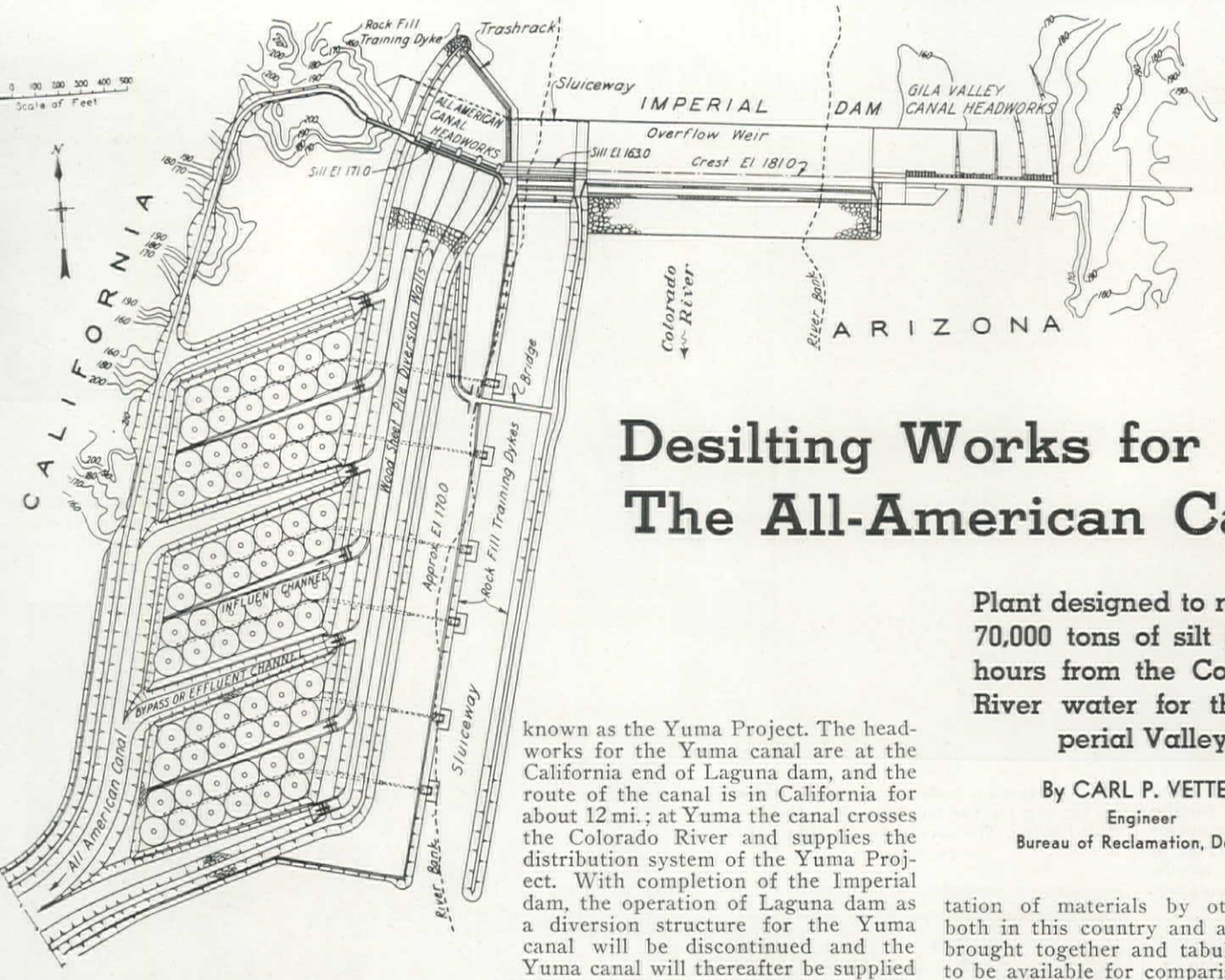
11 — Underpass built by the Utah Highway Department to correct a dangerous grade crossing on the main highway between Salt Lake City and Ogden.



12—Setting one of the precast concrete slabs in the Seattle seawall, which has a length of 6,000 feet.

13—East half of the cantilever highway bridge for the Grand Coulee dam project. Located about 2,000 feet below the dam site, the structure has a total length of 950 feet.





Desilting Works for The All-American Canal

Plant designed to remove 70,000 tons of silt per 24 hours from the Colorado River water for the Imperial Valley

By CARL P. VETTER
Engineer
Bureau of Reclamation, Denver

TO PROVIDE an adequate and clarified water supply for irrigation of the Imperial Valley, the Bureau of Reclamation is constructing the Imperial dam and desilting works on the lower Colorado River about 20 mi. north of the Mexican border. The Imperial dam will be a diversion structure, supplying water to the All-American Canal on the California side of the river, and to the Gila Valley canal on the Arizona side.

At the present time water for irrigation of the Imperial Valley is diverted at Rockwood heading, below the site of the proposed dam, and flows to the district's distribution system by way of a circuitous route through Mexican territory. Under the revised project plan the All-American Canal will largely replace the existing Imperial canal, and the route through Mexico will be discontinued by American water users.

For irrigation of the Gila Valley it is proposed to construct the Gila Valley canal from the headworks which will be provided at the Arizona end of the Imperial dam. The Gila canal as now proposed will cross the Gila River some distance above the junction of that stream with the Colorado, and will supply a part of the irrigated territory by gravity and other parts by pump lifts.

The Imperial dam will largely supplant the Laguna dam, a diversion structure about 5 mi. downstream, which now diverts water into the Yuma canal. This canal supplies a limited area on the California side of the river, and a considerable district in Arizona known as the Yuma Project. The headworks for the Yuma canal are at the California end of Laguna dam, and the route of the canal is in California for about 12 mi.; at Yuma the canal crosses the Colorado River and supplies the distribution system of the Yuma Project. With completion of the Imperial dam, the operation of Laguna dam as a diversion structure for the Yuma canal will be discontinued and the Yuma canal will thereafter be supplied by a cross-connection with the All-American Canal.

Silt problem

The inadequacy of the silt exclusion facilities at the Rockwood heading of the Imperial Irrigation District has resulted in great inconvenience and high expense to the water users dependent upon the existing supply. Large quantities of material are carried into the canals and laterals of the irrigation systems, and are deposited both in the channels and on the fields themselves. During the past ten years the Imperial Irrigation District alone has spent almost $800,000 per year for silt removal from its canals and laterals, while, in addition, the individual water users have been put to considerable expense for silt removal from fields and private ditches.

It is, therefore, considered essential that means be provided, if possible, for relieving the Imperial Irrigation District of this continual economic burden. The problem obviously embraced: (1) the general question of the mechanics of transportation of solids by the Colorado River, (2) the effect of the construction of Boulder and Parker dams, and (3) the special question of the most effective and economical method of excluding the silt from the canal.

To gain further insight into the laws governing the transportation of silt by the Colorado, a comprehensive program of silt sampling was initiated. This program was supplemented by a thorough exploration of the river bed and banks by borings. In addition, all available information on the transportation of materials by other rivers, both in this country and abroad, was brought together and tabulated so as to be available for comparison.

Bed load is negligible

Early in the investigation it became evident that the characteristics of the silt load in the lower Colorado River are unique, in that practically all the silt is transported as suspended load, a comparatively insignificant quantity being bed load. There are obviously local movements of sandbars which must take place as bed load movements, but over a long stretch of the river, taken as a whole, there does not appear to be any appreciable movement of material along the bed.

This conclusion is of considerable significance and it is at variance with previous estimates of the relation of bed load to suspended load in the Colorado River.

It was found that the entire problem could be considerably simplified if the silt load were considered in two major size groups: (1) the coarse load and (2) the fine load. The dividing size was set at about 300 mesh or 0.05 mm. The coarse silt load, which has a size range directly comparable to that of the material in the river bed, was found to move in accordance with laws very similar to those generally accepted as governing the movement of bed load, while the fine silt load originating in the banks of the river and being brought in by side-washes and tributaries was not found to conform to any definite laws of transportation.

In the future, after Boulder and Parker dams are in operation, the fine silt will be present in considerably reduced quantities. These smaller particles of silt do not readily settle out,

and hence the expense of their exclusion from the canal influent would be prohibitive. However, since the particles do not readily settle, only a very small portion of the fine silt load will be deposited in the canals and laterals, and the problem of removal will be far less serious than in the case of the coarse silt load. Efforts have hence been confined to provision for the exclusion of the coarse silt only.

A careful study was made of the rate at which the coarse silt may be expected to enter the All-American Canal headgates as the river bed gradually reduces its slope and adjusts itself to the clear water discharged from Parker reservoir. The fact was inescapably established that the stabilization process will take several decades and that during this time the difficulties of removing the enormous quantities of silt which would enter and become deposited in the All-American Canal, if desilting works were not constructed, would be economically as well as physically insurmountable.

Desilting works

Numerous types of desilting works were investigated. The fundamental requirement was a series of basins where the water might be retained for sufficient length of time to permit the silt to settle to the bottom, with some hydraulic or mechanical means of removing the silt deposits. While the laws governing the settlement of fine particles in absolutely still water have been well established both theoretically and experimentally, the process of sedimentation in turbulent water is far more complicated and the governing laws are not fully known. A considerable amount of research was required to obtain working formulas by which the settling basins could be designed.

It soon became evident that basins with some mechanical means of collecting the deposited silt in a few hoppers from which it could be hydraulically sluiced to the river, would be best suited to the conditions at the All-American Canal headworks. Typical designs and specifications were therefore prepared for the purchase of this particular type of equipment, the bidders furnishing the detail designs.

The desilting works will be located immediately downstream from the Imperial dam, between the headgates for the All-American Canal and the main channel. They will occupy approximately the first 3,500 ft. of the canal's length. The works will consist of a set of six settling basins arranged in pairs, with provisions for an additional two basins should they be required in the future. Each basin is to be 269 ft. wide by 769 ft. long, the sides being skewed to accommodate the circular scrapers selected for silt removal, with a minimum of unscraped floor area between tangent circles. Each of the basins is designed to handle a flow of 2,000 sec. ft. Each pair of basins will be fed by one influent channel, between and common to both basins.

The influent will be uniformly distributed to both sides, and will flow across the basins to effluent channels which in turn lead to the main channel of the All-American Canal. Each effluent channel is so arranged that it may be used as a bypass for the diversion of unclarified water around the settling basin and directly into the canal. Thus, in case of breakdown of the scraper mechanisms, or for other reasons, the canal can be operated without the desilting works. Both influent and combination bypass-and-effluent channels branch off from a main channel from the dam headgates and are controlled by 17 x 21 ft. radial gates.

Scraper design

The scraper units are of the rotary type, each having a pair of revolving trusses which carry the scraper blade assemblies. These blades are of special alloy steel, and force or "plow" the deposited silt into central collecting trenches by blading the silt into wind rows in such a manner that each row of material is successively plowed one row closer to the center upon each revolution. Trusses are of the cantilever type, each pair having a total span of 125 ft. They are supported from the central piers and rotated by a central driving mechanism. The trusses are triangular in cross-sectional shape, having one top chord and two bottom chords.

A novel device was developed by the manufacturer to meet a requirement of the specifications that the depth of scraper cut should be reduced in proportion to any excessive overload. The device consists of inclined hinges on the top chord and on the trailing bottom chord at their connections to the central anchorage. The leading bottom chord has no tensile connection with the center pier, but simply butts against a bearing plate in compression.

At normal silt loads the weight of the truss is sufficient to cause compression at this joint, even with the horizontal thrust of the silt load, but when this horizontal thrust becomes excessive, tension is produced in the leading bottom chord and the joint separates, permitting the truss to rise on a backward incline—that is, around the hinged connection of the other two chords. This lifting will reduce the depth of cut just sufficiently to cause the truss weight to be balanced by the horizontal silt load, and the truss will automatically return to the normal position as the obstruction is bladed away.

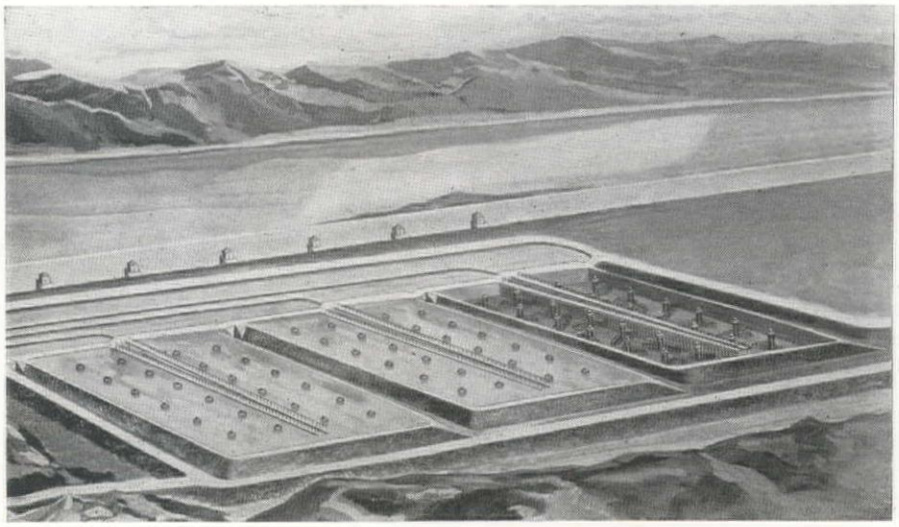
Scraper units adjacent to the influent channels are of a heavier design and larger capacity than those adjacent to the effluent channels, as the rate of silt deposition decreases with the distance from the influent channel. The total capacity of the 72 scraper units will be about 70,000 tons (dry weight) of silt per 24 hr., at the maximum permissible peripheral speed of 30 ft. per min.

To determine the physical characteristics of the silt which would have to be handled by the scrapers, especially in regard to the resistance to scraping, a comprehensive series of laboratory tests were undertaken in the bureau's laboratories in Denver. Based on the test results elaborate mathematical analyses were made to determine the resulting loading for each of the two sets of machines. The heavy units were found to require 6¼ h.p. for operation and the light units 3 h.p. The Dorr Company of New York were the successful bidders for supplying this equipment.

Concrete pipe galleries are to be constructed beneath the floor of the settling basins, and in these the silt disposal piping will be installed. From the central collecting trenches at each scraper, the silt will be washed into the disposal pipes, and flushed into the river channel downstream from the Imperial dam sluiceway.

Careful consideration has been given to the problem of the disposal of silt returned to the river. The Imperial dam will be provided with a sluiceway through which will be discharged all available water not required for irrigation, up to a maximum of 25,000 sec. ft. The sluiceway connects directly with a confined channel which at present will be constructed to a point opposite the downstream extremity of the

Artist's sketch of the Imperial dam desilting works, prepared by the Dorr Company, Inc., from preliminary designs for the plant.



desilting works. Into this channel the sludge from the desilting works will be discharged. The available excess water will be used to transport the silt down the river.

Imperial dam

The Imperial dam will raise the water surface approximately 23 ft. At the west abutment are located the All-American Canal headgates and at the east abutment, the Gila Valley canal headgates. The former are designed for a maximum diversion of 15,000 sec. ft. and the latter for a diversion of 6,000 sec. ft., while the overflow section of the dam is designed to safely pass a flood of 150,000 sec. ft. The river bed, at the damsite, consists of extremely fine river silt to a great depth so that foundation directly on bed rock was not economically feasible.

Extensive borings were made in the river bed and undisturbed samples were obtained at various depths; these samples were shipped in sealed containers to the bureau's laboratory in Denver and tested for shear resistance and percolation. The consistency of the river bed material was found to be such that a floating dam could safely be constructed directly on the silt without piling. Piling, however, is provided for all gate structures to insure against uneven settlement of the piers.

Elaborate precautions have been taken against piping and underseepage, three rows of sheet piles being provided on the upstream side of the dam and one row of sheet piles on the downstream side. The drainage system under the dam is of novel construction in that all seepage water from both upstream and downstream sides of the dam passes through a specially constructed filter to the interior of the hollow overflow section, where it is removed by ejectors above the downstream apron. This arrangement decreases the uplift pressures and permits a reduction in the required weight of the various structures.

Piles are battered alternately in the upstream and downstream direction. Thus, all shear is transferred into tension and compression and in no case has resistance of the piles to lateral movement been relied upon to transfer shearing forces. Extensive pile tests have been conducted at a spot near the damsite to determine the resistance of piles of various length to both compression and tension.

Standard hydraulic model tests have been conducted to study the dissipation of energy below the overflow section of the dam and below the sluiceway. These tests have furnished the basis for the design of the dentated sills on the downstream aprons. A large model of the complete dam, with a mile and a half of upstream channel, has been set up at the Bureau's outdoor hydraulic laboratory at Montrose, Colorado to study the gradual silting up of the reservoir and the flow of water and silt as it approaches the structures.

The All-American Canal headgates consist of four openings closed by four 75-ft. by 23-ft. roller gates. Three of the gates control the flow to the three pairs of desilting basins, while the fourth will serve the ultimate fourth pair of basins, if additional basins are required. The gates are of the general type utilized recently on the Mississippi River. One of the earliest installations of this type of gate in America was by the Bureau of Reclamation on the Grand Valley Project in Colorado.

Each gate consists of a horizontal drum 14 ft. in diameter with a lower apron forming the contact with the sill and an upper apron providing freeboard against overtopping. The gates are operated from one end by means of a sprocket chain and a hoist located on one of the end piers. They will be automatically controlled by floats in the All-American Canal below the desilting works.

The sluiceway consists of twelve radial gates 16 by 17 ft., automatically controlled from a float in the reservoir; it is intended to pass all surplus water through these gates so that the overflow weir will be utilized only at times of extreme floods. The overflow weir is about 1,200 ft. long and consists of a heavily reinforced slab supported at intervals of 20 ft. on concrete buttresses poured monolithically with the slab. The hollow interior under this slab contains a gravel fill upon the footing slab to give added weight. The footing slab rests directly on a rolled silt subgrade, and to accommodate the anticipated slight unequal settlements, the weir is made up of sections 79 ft. long connected only by flexible rubber joints.

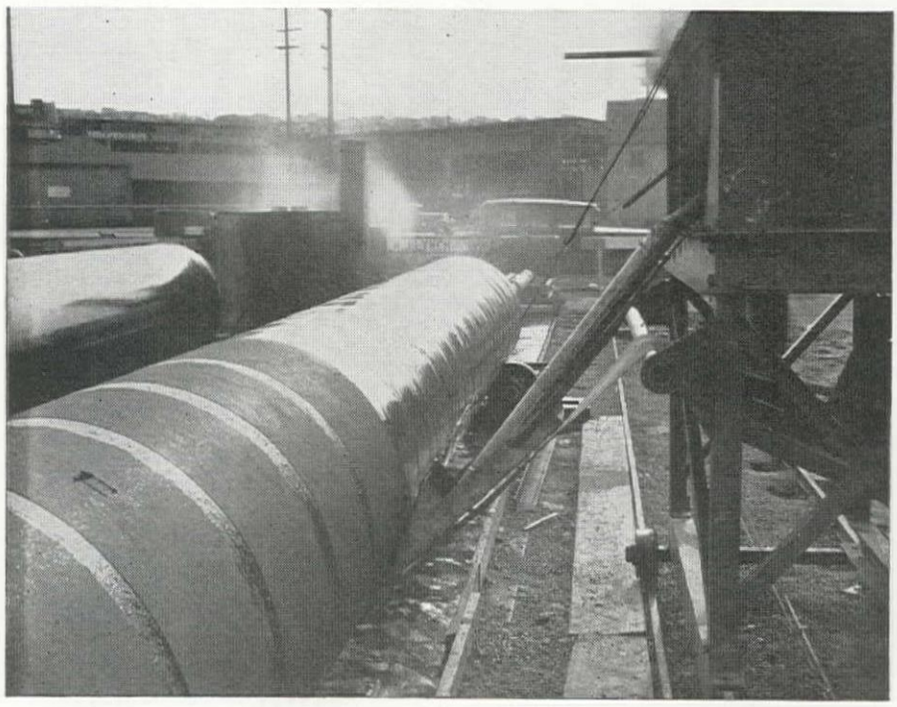
At the east end of the dam nine radial gates 36 by 15 ft. are provided for the future headworks of the Gila Valley canal.

Due to the scattered location of the various units of the structures the electrical installation is of considerable magnitude. All controls are carried to a centrally located control house from which not only all gates but also the scraper mechanisms of the desilting basins are operated.

The Imperial dam and desilting works and the All-American Canal are part of the Boulder Canyon Project, authorized by Congress in the Boulder Canyon Project Act, and being built by the Bureau of Reclamation, Interior Department. Harold L. Ickes is Secretary of the Interior and Elwood Mead, commissioner of reclamation, is administrative head of the bureau. All engineering and construction work is directed from the Denver office under R. F. Walter, chief engineer, S. O. Harper, assistant chief engineer, and J. L. Savage, chief designing engineer. R. B. Williams is construction engineer for the All-American Canal Project, with headquarters at Yuma, Arizona. Designs for the Imperial dam and desilting works have been prepared by the writer under the direction of H. R. McBirney, senior engineer, in charge of canal designs. E. W. Lane has been in charge of model testing and general silt investigations. The designs have been reviewed by the All-American Consulting Board consisting of W. F. Durand, C. P. Berkey, L. C. Hill, and the late D. C. Henny.

Machine Wrapping Sections of Steel Pipe

Placing a protective coating on steel pipe for a water main. The pipe is revolved as the hot material is discharged from the tank through the spout, immediately followed by the paper cover. The tank is moved along the tracks at the proper speed to make the pitch to the spiral wrapping.



Water Measuring Devices Become More Accurate

Improved mechanisms, electric recording, and increased dependability are some of the factors indicating progress in the field of water measurement

By M. S. JONES
Chief Engineer and General Manager
Pasadena Water Department

ACCURATE and reliable methods for the measurement of water, either in pipes or open channels, have been available to the water works fraternity for many years. As far back as 1852 James B. Francis determined the fundamental formulas for weirs and the principles on which the Venturi meter was founded, first announced in 1797 by Venturi, were adapted for use in the water works field in 1887 when Clemens Herschel proved that a definite relation existed between the difference in pressure at the inlet and contracted section, and the rate of flow. The displacement type meter was introduced in the eighties and has continued in use with few changes from the original design. It is truly remarkable how few basic changes have been made in this type of meter during the past 55 years.

In reviewing the progress made in the measurement of water since 1920, no really new principle has been introduced by which greater accuracy of measurement has been obtained. Refinements have been made in the manufacture of some types of meters which give better performance and longer service. Better methods of registering, recording and totalizing the flow have been introduced. Electricity is now being used for more accurate timing and for long distance transmission of flow measurements. However, the fact remains that the weir, the Venturi tube, the orifice, the pitot tube and velocity and displacement type meters are still the most important factors in water measurement.

The improvements in metering and measuring devices which have been introduced to the water works profession since 1920, have been many and are discussed.

Water meters

The chief, and practically the only, improvement in water meters in many years has been the oil-enclosed gear train, which was first introduced about 1920 and is now standard equipment with most of the leading manufacturers. This type of construction has proved to be a big step forward in meter design. With the oil-enclosed gear train, the gears operate in a bath of oil, and are protected from the rust and grit often carried in the water. It is obvious that this feature gives much longer service to the meter and much less trouble due to stoppage.

Rubber bushings manufactured to withstand temperatures up to 180° F. are now used in registers and gear trains, but attempts to find a satisfactory heat resisting material for the discs, does not seem to have been successful. A portable recording register for use with their meters, has been developed by the Neptune Meter Company and is useful in analyzing consumers' use of water.

Velocity type meter

The velocity type of meter for measuring the flow of water through pipe lines has been in use for many years. However, it remained for R. W. Sparling of Los Angeles to develop this device into an accurate and dependable machine. The meter consists of a six-blade propeller mounted transversely in the center of the pipe which actuates the recording mechanism. Indicating, recording and integrating instruments permit long distance electrical recordation. When the flow conditions in the pipe are taken into consideration, the meter furnishes a satisfactory means of registering the flow of water through the pipe. This type of meter has the advantage of lower first cost, with possibly a higher annual maintenance cost thereafter.

Venturi meter

The development in the Venturi meter field has brought several economies in manufacture of these instruments and this saving has been passed on to the purchaser. A shorter Venturi tube than the Herschel standard tube has been developed using more steeply tapered outlet cones. These tubes are about 60% shorter than the standard tube but are of equal accuracy where the range of flow is small. The pressure recovery, however, through the short tube is less than with the standard Venturi meters.

Improvements in recording-integrating instruments for use in measuring differential pressures in connection with pitot and Venturi tubes and orifies, have shown minor refinements, such as bettered appearance and more dependability of operation. The introduction of the electric clock into these recording instruments, has assured more accurate timing.

The outstanding change in this type of recording instruments is the electric long distance recording device brought out by several companies, which permits the recording instrument to be set any distance from the meter. A mercury unit forming a U-tube is set at the meter and is connected by wire with the recording instrument which may be as much as several miles distant. Any movement of the mercury at the meter transmits an electric impulse to the recording instrument, and immediately causes it to show the change in flow. These instruments appear to be very practical and besides the advantage of placing the register away from the meter, also will operate under less pressure head than the pressure type of instrument. The electric long distance recording devices also have been adapted for transmitting other information such as water levels, temperature, etc., and can be used over the average telephone circuits without interfering with the conversation.

Venturi flume

The Venturi principle for the measurement of water in canals and flumes was first advocated in 1915. Later additional experiments were conducted at the Colorado Agriculture Experiment Station and at the hydraulics laboratory at Cornell University, and in 1923 an improved design was submitted which possessed such characteristics as will meet the general conditions of service more successfully.

The device consists of a contracted section, set between a converging and diverging section somewhat on the principle of a Venturi tube or meter. When the flow is submerged on the outlet of the flume, the device operates in accordance with the Venturi principle, but for free flow it acts more nearly in accordance with the discharge over a weir. For free flow the discharge of the flume may be determined by a single reading, but for submerged flow two gage readings are necessary.

The Venturi flume has a decided advantage over the weir where the water to be measured carries an appreciable quantity of silt. It also has the advantage where loss of head is an item.

Water stage recorders

A considerable amount of refinement has been shown in the manufacture of water stage recorders. Special quick-drying inks and siphon pens have been developed to meet the requirements of rapidly fluctuating water levels. The latest instruments have provision for increasing or decreasing the chart speed and for marking time intervals and points of reversal on the margin of the chart.

One recent development is the duplex instrument, which will record two adjacent water surfaces, or can be adapted to record both water level and discharge by means of a special cam set to the rating curve of the flume or stream. Electrical long distance water stage recording instruments have been placed on the market and have proved themselves invaluable to water and power companies.

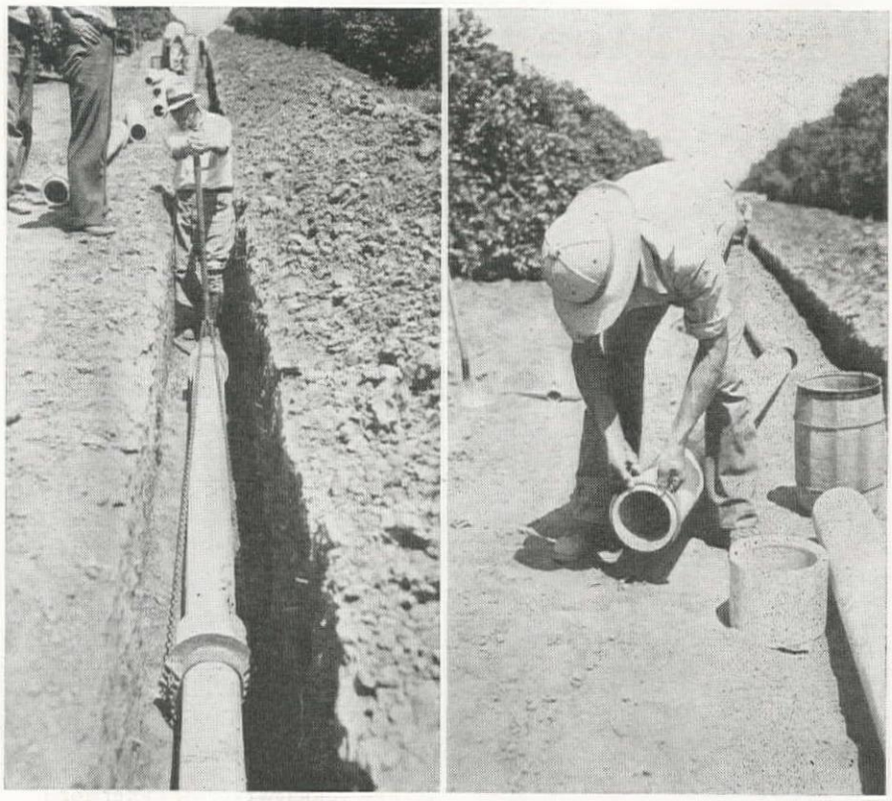
The salt velocity method of measuring the flow of water in pipes is not

new. Recently refinements in this method by the use of photography have been introduced so that an accuracy of within 1% can be assured.

Two sets of insulated electrical contacts are set in the pipe at a known distance apart and are connected to an ammeter. A strong salt solution is injected in the pipe above the first set of contacts, and as the solution passes by each contact, it permits an electrical current to pass through the solution and actuates the needle of the ammeter for an instant. The vibrations of the needle are photographed on a moving picture film, which is driven at a known speed past the ammeter by a small synchronous motor. It then remains only to measure the distance in the film between the imprint of the vibrations of the needle of the ammeter in order to determine the time that the salt solution passed the two sets of contacts and compute the velocity of the water in the conduit. The film can be speeded up so that time intervals of as little as one-tenth of a second can be determined.

This device is exceedingly useful in calibrating and checking the accuracy of other measuring devices.

Without doubt there are other improvements in the field of water measuring not listed here. The period from 1920 to 1935 has shown great progress in the development of more accurate and dependable instruments to aid the hydraulic engineer.



Steps in Installing a Water Main of Transite Pipe

Placing of the two rubber rings (right) over the end of the pipe length, followed by a sleeve is the first step in laying sections of Transite (asbestos and cement) pipe. The lengths are then placed in the trench and pulled together (left) to complete the installation.

Modern Office Practice In the Water Department

A discussion of 1935 methods in billing, collecting and accounting for water service

By E. W. GREEN
Secretary
San Jose Water Works

TRENDS in account handling in the various water department offices throughout California have reflected a marked improvement during the past fifteen years. Several factors have contributed to this improvement, one of the most prominent being the advance made in accounting methods. An important aid has been the numerous machines put out by the manufacturers of office equipment. There is, today, a machine for practically every accounting purpose, which has served to speed up all accounting operations with an absolute degree of accuracy. Further, the accounting executive of today has become more highly specialized in his work—thus, giving accounting a more important standing. The executive of 1935 not only has to be well educated to enter this growing field of skilled accountants, but has to be extremely alert to accept new conditions as they occur.

Another benefit to the accounting department of the water works industry has been the work of the American Water Works Association. The annual conventions bring together men from many departments of the water utilities, and in their various discussions and conversations numerous ideas are interchanged, which often prove beneficial to both consumers and utilities upon their application.

Methods of billing

In the matter of billing consumers with water service, it is the common practice of utilities to do this monthly. The advantages are quite evident: (1) under this plan the utility is able to collect revenue at more frequent intervals, thus having more working capital available, (2) it minimizes losses due to customers moving away leaving an unpaid bill, and (3) it enables the consumer to check on any abnormal consumption.

Fifteen years ago the majority of consumer billings were done by hand. Hand posting was also done in either a bound ledger or a loose leaf ledger. A large number of errors occurred by this method, even if adding machine tapes were run, as the manual duties performed by the human element can not guarantee accuracy. Manufacturers of office machines had presented to various businesses a machine designed for bookkeeping service, and although several pieces of equipment were on the market for such a purpose, no definite concentration of effort had been made on " machines for public utility accou ıg. Recognizing a large field which could be developed, the manufacturers of office machines proceeded toward the development of equipment to provide for public utility accounting. Numerous pieces of equipment are today on the market as the result of this endeavor, of which the billing machine is perhaps the most widely used.

The advent of the billing machine completely changed the commercial accounting procedure for the utilities so adopting them. Instead of hand billing and a bulky ledger to handle, the billing machine turns out a neat ledger stub and a follow-up stub, in addition to the regular bill and the stub presented to the consumer. The accuracy of the machine is dependable, thereby

eliminating the possibility of unpleasant scenes with consumers due to the receipt of an erroneous statement prepared by hand. The presentation of a statement prepared by machine has a more pleasing appearance to a consumer than has one made out with pen and ink. This tends to give the consumer more confidence in the company because of the feeling that the possibility of error has been minimized. The personnel required today needs special training in machine calculations.

Collectors vs. mailing

During the past fifteen years there have been two methods of presenting bills—by collectors and by mailing. The policy of presentation of statements to the consumers affords a field for controversy. Many executives advance the theory that mailing the bill is more modern than delivery by collectors; others advocate collectors. A study of the costs involved in comparison of the two methods offers but little from which to choose.

Advocates of collectors for the delivery of bills advance the opinion that their delinquent position is far superior to the mail method. This is substantiated by the fact that a consumer will immediately pay the collector, thus allowing the company immediate use of the funds so procured for the operations of the utility instead of having the account listed on the balance sheet as an account receivable. The collectors also often settle minor complaints immediately, which could not be cleared up if the consumer had received the bill by mail. By the time the consumer has called at the office for the payment of the account, he has had time to think about his complaint and when presented, instead of being of a minor nature, it has grown to such a magnitude as to require special treatment for satisfaction.

However, the mailing of the bill has the outstanding advantage of removing from the doorstep of a consumer the idea of the collector "dunning" for the bill. A large number of the consumers resent the call of a collector as they believe it casts a reflection on their credit standing through the eyes of their neighbors. A consumer feels that the company shows confidence by the mailing of the statement, which allows him the privilege of remitting at his convenience.

Consider, for a moment, the accounting records of the water departments of yesterday and today. In those days when a consumer called for an analysis of his account, confusion often resulted in trying to obtain the required information from the antiquated system of records. At the present time practically all consumers' accounts are indexed by an account number which has been affixed according to the street address. By consulting this index the account number is instantly available. It is just a matter of seconds until the clerk has the history of the consumer's account available to consult and so can intelligently answer any question covering the phase of operations over any given period. The modern method of filing various contracts and other information appurtenant to the consumer's account has been of untold benefit to assist the utility in keeping, at the finger-tips, information relative to a consumer's account which several years ago would have taken considerable time to find.

Delinquent accounts

The handling of delinquent accounts has been improved considerably during the past fifteen years. The earlier methods of dealing with the delinquent account did not show such careful study as the present system. The policy of "collect the account or turn the service off" was used. On numerous occasions the consumer had paid the account or had been granted an extension of time for payment, but due to the antiquated records these facts were often overlooked. The collectors, under the instructions of their superiors, adhered strictly to the rules and regulations governing delinquent accounts by making the collections or immediately turning the service off, deaf to the pleas of the consumer for an extension of two or three days to avail themselves of funds to pay the account.

Today, the utilities deal with the delinquent through a more thorough understanding of the problems surrounding each individual case. In the first place, the utility does not allow the account to lapse into such a delinquent position that it becomes a burden to the consumer to make payment in full. It is common practice among all utilities to effect collection of the current account at least twenty days after presentation of the bill. If the bill contains charges for two months and is not paid within twenty days after presentation, service may be subject to disconnection.

The usual policy governing such cases is to mail a notice with the information that the bill must be paid on or before a specified time to avoid the unpleasant situation of having an interruption of service. If at the close of the allotted time the bill remains unpaid, the account is placed in the hands of a field representative for collection. If payment cannot be secured, the service may be disconnected, which in many cases is the result. The field representative being thoroughly conversant with the accounts he handles, can quite readily determine if the service should be turned off. Often there are conditions prevailing, such as sickness, over which the consumer has no control, and an extension of time is granted to allow the consumer the availability of funds.

The utilities have found this delinquent problem one of huge proportions and of late years considerable development has been made in solving it in a manner satisfactory to both consumer and company. The attitude of the personnel handling the accounts is changed. Instead of being "hardboiled" about the collection of accounts, the firm representatives are more human and at the same time effect the collection of the delinquent account without creating antagonism toward the municipality or private utility.

Below Sea Level

The walkway near the top of this water tank, recently completed in Brawley, Calif., is at sea level, although it is 120 ft. above the ground. Designed by Koebig & Koebig, Los Angeles, the structure has a 10% seismic factor. It was fabricated and erected by the Chicago Bridge & Iron Works.

Handling complaints

The usual run of complaints come under the scope of the commercial accounting department of water service companies. Very marked improvement in the treatment of the consumer has been accomplished during the past fifteen years. In the past, it was the practice of a large number of utilities to ignore the complaint of consumers regarding large increases in their billings for water consumption. The policy then in vogue was to insist that the billing was correct and the consumer would have to reimburse the company for such service. Later, the various utilities began to realize that the customer might be justified in making a complaint. It is commonly known that the meter readers are not infallible and that errors do occur in the transcript of meter readings from the meters to the field books.

Another reason for a large increase in consumers' billings, which require tactful handling, is the waste of water through leakage. The utilities started a comprehensive study to try and curb the malignant feeling of the consumers toward the service companies, with the result that today when a consumer

makes a complaint, a full investigation is made. If the investigation reveals that the company has made an error, an immediate adjustment is made with the consumer to his full satisfaction, and the water department finds that the user of service feels that the department has been more than fair with him.

Should the investigation reveal that the consumer is at fault because of poor fixtures and plumbing in his building, the service man making the investigation tactfully points out to the consumer the defects and suggests an early remedy. This advice is usually gratefully received by the consumer. This service on the part of the company has regained the confidence of the consumer and has removed considerable antagonism which had been prevalent toward the water department.

Personnel selection

Another marked improvement has been in the selection of personnel. In the employment of a clerk fifteen years ago, he was subjected to lengthy questioning, being mainly satisfied with appearance and apparent ability. The past few years have shown the development of personnel departments with the duty of accepting applications for employment. Prospective employees are fully questioned as to their education, health, personal attributes and character. Before participating in regular duties, the new employee is carefully schooled in the various phases of the company's operations, to be able to answer intelligently the various questions asked by consumers. The value of this personnel department cannot be measured in dollars and cents, as the benefits derived by the water department through picked employees for the key positions of the utility are only expressed in the cordial relations of the public toward the water department.

Remarkable advance

The trend toward better service to the utility consumers has been marked by notable improvement year by year. Considering the accounting method employed in 1920 in comparison with that of 1935, it is difficult to realize that such a remarkable advancement could be made over such a short period of fifteen years. In 1920 it was believed that accounting practices were at the peak of perfection, but as each year slipped by there developed an improvement here and another there which made it possible to attain the desired information with a minimum amount of effort and a maximum degree of efficiency.

Improvements will be made in the future, and it will be interesting to follow the trends of consumers' accounting during the next few years. It is only possible to speculate as to what additional advancement will be made in methods of handling accounts during the next fifteen years, but they shall no doubt surpass the procedure which today is considered as such a marked improvement.

Repaving Over Trench Cuts Remains Unsolved Problem

The problem of backfilling and resurfacing water main trenches needs vigorous attack—Cost estimates will have to be raised

By FRED KLAUS
City Engineer
Sacramento, California

THE PROBLEM of repaving over trench cuts made to permit installing utilities through street pavements, after fifteen years of endeavor, is still unsolved. It is, and has been for these many years, a discouraging problem, both to the utility man and to the one responsible for the care and maintenance of street pavements.

About the year 1920, on the Pacific Coast, most men in charge of this type of work, due to the rapid increase in street paving of the more permanent types, realized that better methods had to be devised and used as to backfill compaction. It was quite evident at that time that the failure of pavement repairs generally was due to this feature. The use of mechanical tampers of several types came into rapid use.

In spite of the use of this equipment and the added cost, the final results have been little, if any, better than the old hand method. It is now generally agreed by engineers that time is an essential factor in the settlement of earth fills of all kinds, and that this applies equally well to the backfill of trenches. This element may be reduced by a large percentage with the proper consideration for moisture content and tamping. Nevertheless, it is the remaining small percentage which causes all the trouble. A shrinkage or settlement of one-half in. in depth in the backfill of a trench may be sufficient to remove all bearing from beneath the repaired pavement. This is the usual result, that has been observed on many occasions.

In the design of portland cement concrete paving, the slab is usually calculated to act as a beam in carrying the traffic load. A transverse cut in this slab naturally destroys this function, and it is practically impossible to correct this in replacement, as the concrete bond of the repair is seldom, if ever, as good as the original concrete. Naturally, the maintenance man objects seriously to such cuts. This objection can be partially corrected by removing the pavement over a considerably greater width than the actual width of the trench and the placing of a slab of sufficient strength to carry the load—the slab acting as a beam across the width of the trench. This is objected to by the utility man, because of the added cost.

From the street superintendent's point of view every cut in the pavement is a potential source of trouble, due to leakage of water through the cut into the subgrade. To him the protection of the subgrade is all important.

In the old days, it was quite possible, at times, to allow the backfill to stand for a considerable period of time before resurfacing, and to allow traffic to assist the compacting. This developed the fact that the kneading action of a rolling wheel was far more effective in producing the desired results than the regular vertical tamping. This principle has since been used very successfully in compacting large fills. So far as I know, no equipment has been developed to successfully operate in a trench.

Today, due to traffic conditions, it is necessary in most cities to carry on the repaving operation as quickly as possible behind the backfilling. Indeed, the public demands are so insistent on this point that early setting cements are now generally used to hurry the opening of traffic lanes.

The repairing of asphaltic pavements can only be accomplished by adding or repaving as settlement takes place. From the experience in Sacramento, it has been found that it takes an average of three such treatments, and a final planing, to even approach the bearing or riding quality of the original pavement. The cost of this operation varies from 50c to 75c per sq. ft., instead of the initial 25c per sq. ft., and during the period of this operation complaints of the driving public are usually bitter.

Considerable advancement has been made in the past twenty years in asphaltic materials. Cold mixes of cutback and emulsified oils, which can be stockpiled, are now available for the use of patching and repairing of trenches. These materials have simplified trench paving to a considerable extent, and on small jobs have cut the cost over the old method of hot oil. These materials, of course, have speeded up the final repairs on trenching.

The property owners are now much more keenly interested in the protection of the street pavements than they were twenty years ago. It is, therefore, important that this problem be more vigorously attacked. It is my belief that our present and past idea of cost for this type of work must be greatly revised upward, and that pavement repairs be considered and designed as structures, and not as mere surface blankets. The final solution will require the sympathetic coöperative effort of both the utility and street maintenance men.

Records From Several Filtration Plants

Backwashing "By the Clock"

By ARTHUR TAYLOR
Consulting Engineer
Taylor & Taylor, Los Angeles

WASH WATER reclamation basins at the two filtration and softening plants at Beverly Hills, Calif., result in the established practice to wash the filters "by the clock" rather than by the customary "loss of head" gage. Washing is done every 24 hrs. and calculations show that it costs no more for return water pumping, for less water is used. The particular advantage is in keeping one jump ahead of bacterial and mud-ball troubles. It is interesting to note that the actual water loss in these two plants is but a fraction of 1%. As a matter of fact, close to 90% of the wash water, after subsidence, is pumped back for a re-run through the plant. In a softening plant, where softened water is used for filter washing, the reclamation of this softened water is of considerable economic importance—much more so than in a straight filtration plant where nothing has been spent on softening chemicals.

Coagulation at both plants is now done with ferric chloride. At present prices of alum and ferric chloride, treatment with the latter is a little cheaper, but only due to the consideration of the relative reactions of the two coagulants on the softening; of course, alum increasing the hardness of the water. Trial application of coagulant at several points and in various split applications has shown best results when applied with the lime hydrate at the entrance to the first mixing tank.

Chlorine and ammonia application is now made at the entrance to the four-in-series secondary mixing tanks, the chlorine entering one tank ahead of ammonia and in proportions of approximately two parts chlorine to one ammonia. Dosage ahead of secondary sedimentation, recarbonation, and filtration necessarily covers a wide range in quantity depending on which wells are pumping, temperature, condition of basins; that is, whether they have been recently cleaned or in long service, and the rate of flow.

The gage of chlorine and ammonia dosage is based solely on the chlorine residual in the filter effluent. Obviously, this method of applying the sterilizing agents is of three-fold purpose, viz., algae control of sedimentation basins, filter conditioning and, ultimately, to render the filtered water sterile. Under this regime, very little filter trouble has occurred.

Both plants are equipped with modern activated carbon feed machines with ample footage of discharge hose for flexibility of application. No fixed rule is used in applying this sweetening agent, either in quantity or frequency, but for one exception: experience has shown that just prior to filter washing a fair load of carbon fed into the channel leading to the filters afford a tendency of keeping the water sweet and odorless. A good part of the carbon, of course, goes on to the wash water reclamation basin which it keeps sweet, and then in turn gets back to the influent to the primary mixing basins.

As basins approach the time for cleaning, the activated carbon demand is the greatest. After basins are cleaned and going back into service, we use carbon liberally over the works feeling that what tastes may be developed from roiling up the sludge will be absorbed by the carbon.

We have recently equipped the laboratory for bacteriological work where daily control is now being carried by John L. Perhab, the plant superintendent.

These plants were designed and built under the supervision of the writer whose good fortune it has been to direct the operations continuously since the plants were put into service.

The accompanying operating and cost tabulations tell the story better than words. However, it should be borne in mind that where the entire supply is treated through one plant, the labor costs and a number of other items would be cut nearly in half. But, offsetting these costs, but not indicated here, would be the cost of return pumping to make up the 300 ft. difference in elevation of the two sources of supply as previously mentioned.

OPERATING COSTS
Combined Two Plants 1933-1934

	Per 1,000 Gal. (in cents)
Lime	.6716c
Fe Cl_3	.1728
Chlorine	.0315
Ammonia	.0296
Carbon	.0309
Electricity	.0529
Gas Com.	.0568
Gas Dom.	.0020
Lab. Supplies	.0044
Labor Operating	.9510
Labor Repairs	.0799
Repairs	.0214
Misc. Expenses	.1361
Analysis	.0131
	2.2539c

OPERATING DATA 1933-34
La Cienega Plant

Lime hydrate	7.2	gr. per gal.
Ferric chloride	0.45	gr. per gal.
Chlorine	0.54	gr. per gal.
Ammonia	0.30	p. p. m.
Carbon dioxide	1.01	gr. per gal.
Wash water	2.86	%
Alkalinity, M. O. raw water	256.	p. p. m.
Alkalinity, treated	154.	p. p. m.
Hardness as $CaCo_3$, raw water	245.	p. p. m.
Hardness as $CaCo_3$, treated	139.	p. p. m.
pH, raw water	7.4	
pH, treated	7.8	
Residual chlorine	0.08	p. p. m.
Residual CO_2	4.7	p. p. m.
B. Coli Index	0	

Denver Continues to Use Coal

By O. J. RIPPLE
Superintendent of Filtration
Marston Lake Plant, Denver

AFTER TEN YEARS of operation using ground anthracite coal as a filtering material, the Marston Lake North Side plant of the city of Denver continues its use in preference to sand. However, it has been the author's belief that a combination of about 20 to 24 in. of the ground coal material, all as near as possible to 0.83 mm. size, supported by 15 to 18 in. of sand having an effective size of 0.50 mm., and a uniformity coefficient of 1.6 than would prove more efficient than either sand or anthrafilt used separately. As a result of favorable tests made on small filters, and to obtain further data for use in the design of a new filter plant, work has recently been started to change one of the existing filter units in the plant to this combination of materials.

Our test runs indicate that the filtration rate, with this combination, may be increased from approximately 167 m.g. per acre per day to about 200 m.g. per acre per day and the percent of wash water should not be over 1% for normal conditions.

This 64 m.g.d. plant, which was placed in operation in 1925, was designed to filter water from Marston Lake and no settling basin was considered necessary, however, it has developed that a larger coagulation basin would have been of advantage to take care of higher turbidities in the raw water caused by wind and by floods in the supply streams, and to provide a longer coagulation period during times when the plant is operated at a higher rate than the designed rate.

Alum, hydrated lime and dry sodium aluminate are used to coagulate raw water, the lime is added to reduce the amount of alum required and the sodium aluminate is added to speed up the reaction. We use from ¼ to ½ as much lime as alum and about ¼ to ½ as much sodium aluminate as lime. Copper sulphate is used to control the growth of organisms in the lake and

Seattle's *tribute* to FEDERAL Pipe

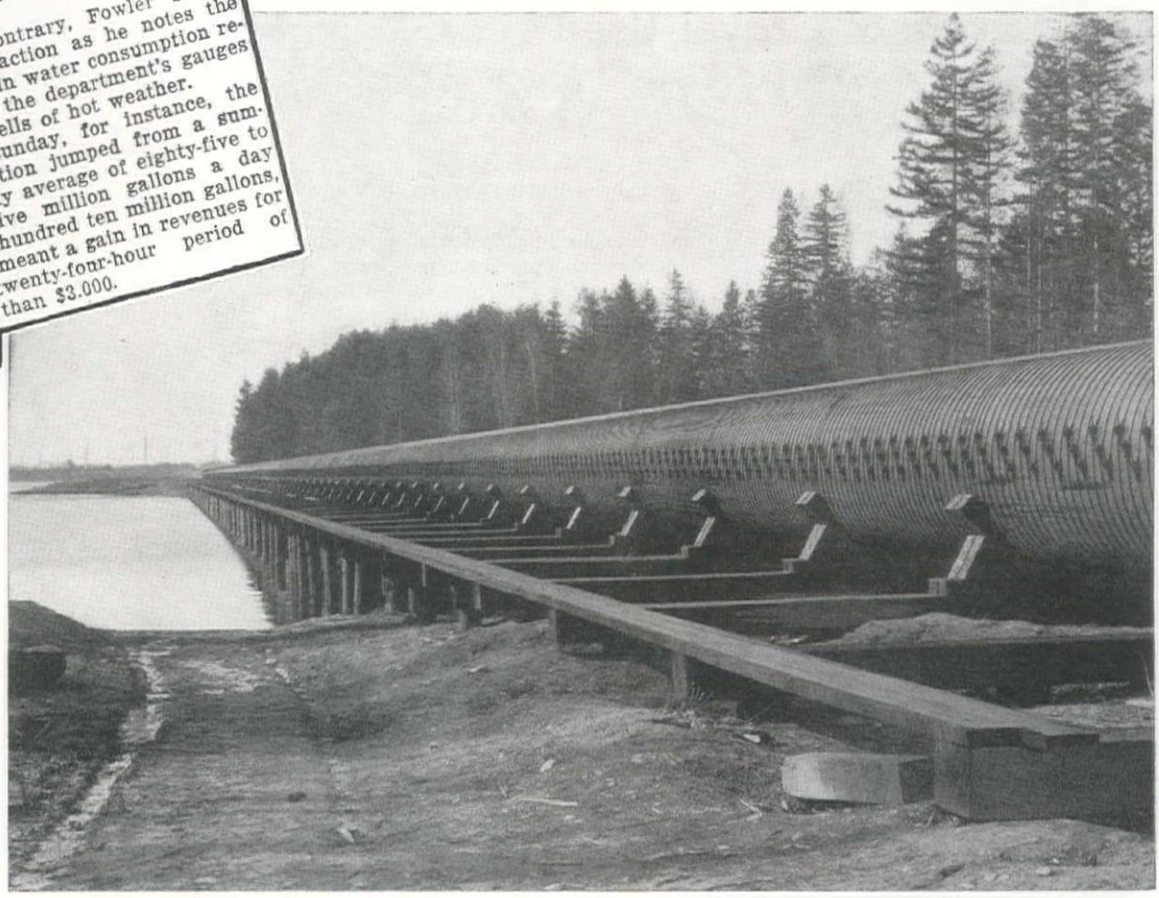
Warm Weather Aids City Water

Unlike most Seattleites, Water Supt. Harold D. Fowler doesn't fuss and fret when temperatures mount.

On the contrary, Fowler beams with satisfaction as he notes the rapid rise in water consumption recorded on the department's gauges during spells of hot weather.

Last Sunday, for instance, the consumption jumped from a summer daily average of eighty-five to ninety-five million gallons a day to one hundred ten million gallons, which meant a gain in revenues for the twenty-four-hour period of more than $3.000.

* News item appeared in the Seattle Daily Times, July 19, 1935.



When water consumption in Seattle jumps from 90 to 110 million gallons per day, the Water Superintendent beams. But, why shouldn't he? Revenue goes up . . . the charges for delivery remain constant. Of course, we mean when each unit in the system is as dependable as Seattle's 78″ Federal Creosoted Douglas Fir Pipe water supply line.

It's a foregone conclusion that this 10½-mile section will outlive the original bond issue which has a duration of 30 years. During this time, there is practically no maintenance cost. Shifting ground, settlements, or any other normal obstacle cannot interrupt its service.

Original cost can hardly be compared with that of any other type of construction, for it stands alone in its economy. The actual installation was by far the cheapest . . . for it involved no outlay of bulky equipment . . . and the entire line was completed in *five months*.

But aside from these advantages, Federal Pipe offers an intangible quality to the City of Seattle. We refer now to the purity of drinking water that is constantly delivered. It is free from foreign matter, since Federal Pipe will not corrode. In hot weather the water is cool, palatable. In winter there is no danger of freezing.

Remember, Federal Douglas Fir Pipe is used for other purposes also, including industrial, sewers, hydro-electric installations, and all other liquid handling problems . . . at a saving. *Federal Pipe & Tank Co.*, 5340 Twenty-fourth Avenue, N. W., Seattle, Washington.

FREE!

A booklet describing the uses of Federal pipe will be sent on request.

FEDERAL CREOSOTED DOUGLAS FIR PIPE

When writing to Federal Pipe & Tank Company, *please mention Western Construction News*

powdered activated carbon is used to remove any taste and odor not removed by aeration.

This plant is unusual in that it has no rate controllers on the filter effluents, the filtered water is measured over weirs which are set in glass covered inspection wells. This system, while it does not measure and control the filtered water as accurately as the rate controllers would, does permit of constant visual evidence of what each filter is doing in the way of turbidity removal.

We also retain the air wash, which is more often left out in the more recent designs and we feel that this feature, together with a heavy dose of chlorine, 40 lb. per m.g., in the wash water helps to prevent mud balls.

More Layers of Gravel Used

By W. P. HUGHES
City Engineer, Lewiston, Idaho

AFTER eleven years of operation the filtration plant at Lewiston, Idaho, has required little maintenance expense except the rebuilding of the filter beds at the end of eight years of service. Raw water flows through a grit chamber, is pumped to the chemical mixing chamber, flows through the sedimentation basin and thence to four rapid sand filters (1½ m. g. d. each), through which it passes into the clear well.

Sulphate of alumina and lime are the chemicals used, with two pounds of liquid chlorine per million gallons added to the water in the clear well as a precautionary measure. Some experimenting has been done with soda ash to eliminate traces of free alum in the system but this treatment was found to be impractical on account of prohibitive cost. Lime was added to the clear well to raise the pH in an endeavor to correct slight corrosive properties in the water but this was discontinued on account of tendency of incrustation of pump impellers and pipe interiors. We are at present experimenting with sodium aluminate in an endeavor to reduce our treatment costs but have not progressed sufficiently to arrive at a definite conclusion.

The rebuilding of the filters, about three years ago, was occasioned by the disruption of the sand in the beds. All of the material was removed by hand labor and screened. The trouble was remedied by increasing the gravel layers from four to six, without increasing the total thickness of the gravel strata, but adding intermediate sizes. It is interesting to note that no appreciable amount of sand had been lost in the eight years of operation. The total cost was slightly under $300 per filter.

Reduction in pumping costs have been effected by the installation of a capacitor with a resultant increase of power factor and reduction of demand load.

Costs per 1,000 gallons are:

Raw water delivery	0.30 cent
Filtration and purification	1.24 cents
Pumping to reservoirs	2.74 cents
General plant expense	0.88 cent
Total	5.16 cents

Court Approves Colorado Highway Plan

GOVERNOR Johnson's $35,000,000 highway loan and grant application for Colorado has been declared constitutional by the State Supreme Court, but the development of the program has been held up because of difficulties concerning the man-per-year cost of construction. However, the Bureau of Public Roads has approved the state's federal aid highway program which contemplates the expenditure of $6,791,000 in all parts of the state. Large projects included in the approved budget are:

Eagle to Gypsum, $170,000; south of Delta, $90,000; Blue Mesa road, $140,000; near Grand Junction, $200,000; near La Vete, $160,000; near Dykes, $105,000; Vallie to Texas Creek, $220,000; La Junta to Rene, $120,000; east of Vallie, $134,000; between Calhan and Matheson, $230,000; near Hugo, $150,000; north of Granite, $120,000; west of Granby, $110,000; Jefferson county, $100,000; east of Elk Springs, $190,000; Big Thompson canyon, $100,000; east of Elk Springs, $150,000; east of Idaho Springs, $100,000; Big Thompson, $158,000; north of Denver, $200,000; between Paoli and Holyoke, $110,000; east of Roggen, $250,000; south of Denver, $100,000; between Denver and Hudson, $254,000.

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Surveys Start on Gila Project

Preliminary engineering work on the Gila irrigation project in Arizona was started September 19 when a survey party of the Bureau of Reclamation began running lines over the area. This work is being done under the general direction of R. B. Williams, construction engineer in charge of the All-American Canal project. The Gila Valley investigation is being carried out under the direction of P. J. Preston with headquarters in Denver.

The survey party is working under the direction of H. G. McDowell under the general supervision of Grant Bloodgood, field engineer on the All-American canal project. The work consists of relocating some of the survey lines run two years ago for preliminary control work.

A recent Federal allotment provides a fund of $2,000,000 to carry forward the building of the first unit of this project. Construction work will depend upon the successful conclusion of a contract by the Bureau of Reclamation and the newly organized Yuma-Gila Irrigation District.

•

Denver Water Supply

MUNICIPAL officials of Denver who have been furthering a program to extend the water supply system of the municipality to provide ample water facilities for the future, were given a vote of confidence in September by the taxpayers of the city. By overwhelming majorities, the voters approved a $2,700,000 bond issue to finance the cost of completing the Fraser River (Moffat tunnel) water diversion project. The present project will only bring the water to the eastern slope and to a point on the Platte River downstream from Denver, but with the bond issue and a 45% grant from the federal government it will be possible to build a filter plant, reservoir and conduits to bring the water directly into the city mains. The taxpayers, at this same special election, also voted $1,000,000 in bonds for material and equipment for use on work relief projects.

Last spring taxpayers voted a bond issue of $2,000,000 which, together with a federal grant, is to be used for construction of a sewage disposal plant. G. E. Cranmer, manager of improvements, has studied this problem and has proposed to spend less on the plant itself and to use most of the money for diverting water from Williams Fork. Manager Cranmer considered the method of disposal would be better if the proposal is carried out. The plant is estimated to cost between $400,000 and $1,125,000, the total outlay being more than $3,125,000. A mutual water users association, having no connection whatsoever with the sewage treatment, has disrupted plans temporarily by expressing doubt as to whether Cranmer can use any of the sewage disposal plant bond issue to finance the Williams Fork project, and also questioned his power to undertake any kind of water development. Denver's water from the Fork would pass through the association's district but would belong to Denver alone.

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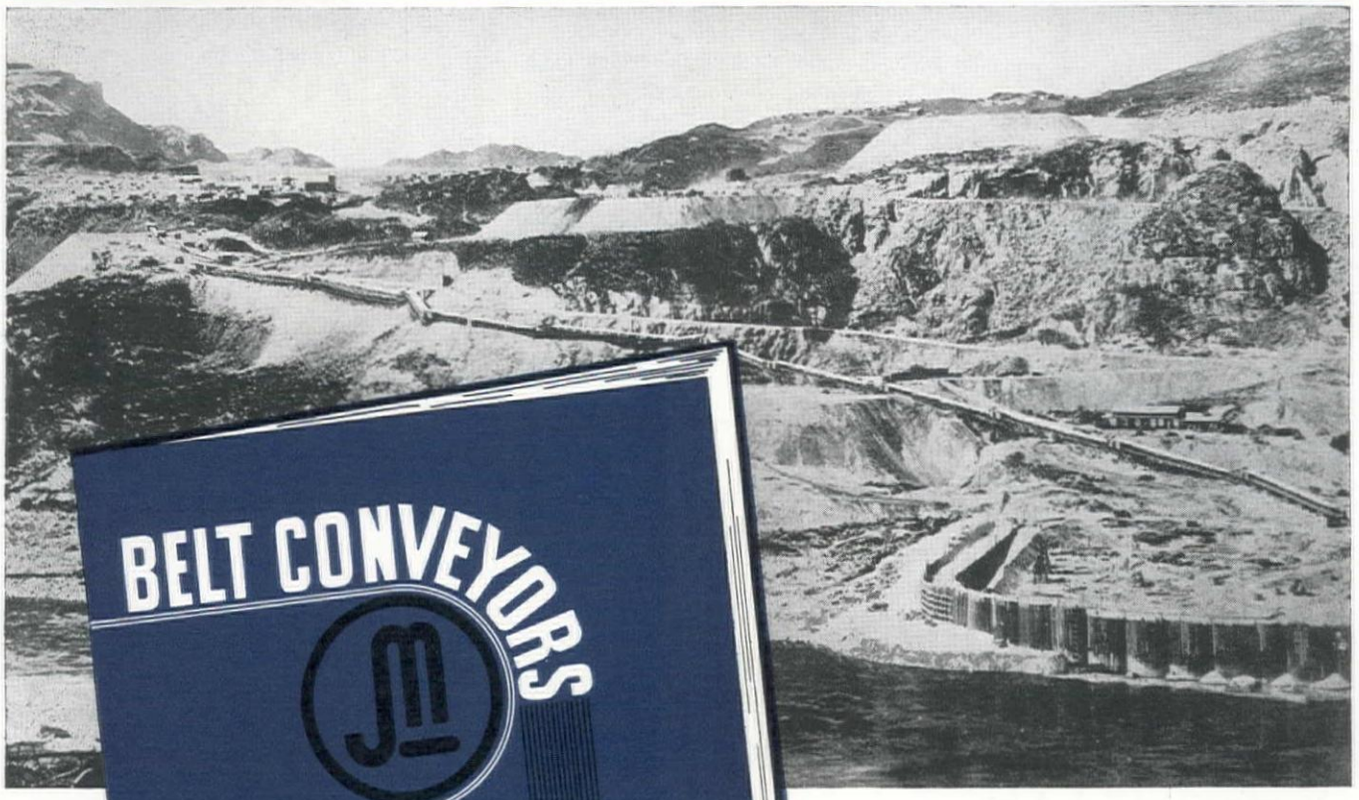
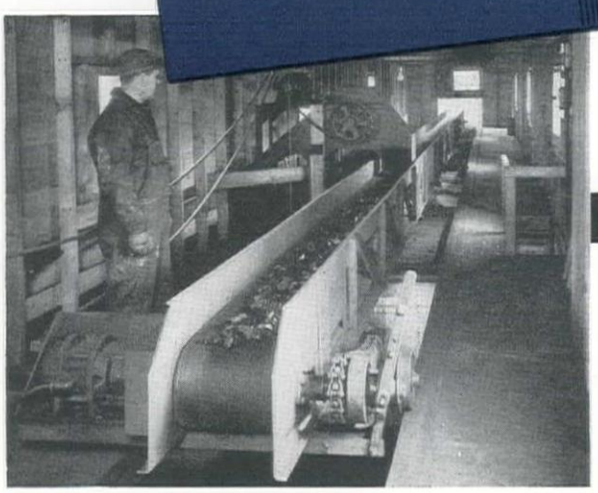
The New Mexico Interstate Streams Commission, it is reported, has filed condemnation proceedings to secure clear title to approixmately 38,330 acres of land as rights-of-way for the construction of the Conchas Dam on the Canadian River in San Miguel county.

FROM THE LARGEST TO THE SMALLEST JOB





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Jeffrey's resources, which provided the giant, are ready to deal with any conveying problem . . down to the smallest. In each case we provide economy, long life, and low maintenance.

We have prepared a NEW belt Conveyor Catalog which gives detailed information on Jeffrey Belt Conveyor service. It contains complete data on the Jeffrey Belt Conveyor . . the conveyor selected for the huge job at Grand Coulee . . which is first choice of countless plants for all sorts of bulk handling. Plenty of useful engineering data . . many illustrations of small and large installations . . make this New Catalog a valuable booklet.

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We are interested in handling.....

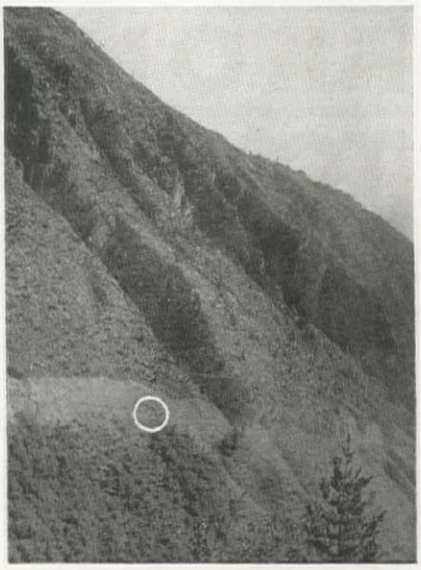
"Chutes" for Snow Slides In Unique Highway Design

By JEAN EWEN
Assistant Highway Engineer
Bureau of Public Roads, Portland

IN the construction of the Stevens Canyon Highway in Mt. Rainier National Park the engineers of the Bureau of Public Roads were confronted with a serious, unusual problem. The barren, steep slopes are cleft by several miniature canyons, extending from the top of the ridge to the bottom (see illustration). These gashes are carved by snow slides, and the erosion action is repeated every year. The crevasses are in solid rock formation, the bottoms ground smooth, almost to a polish by the sliding debris.

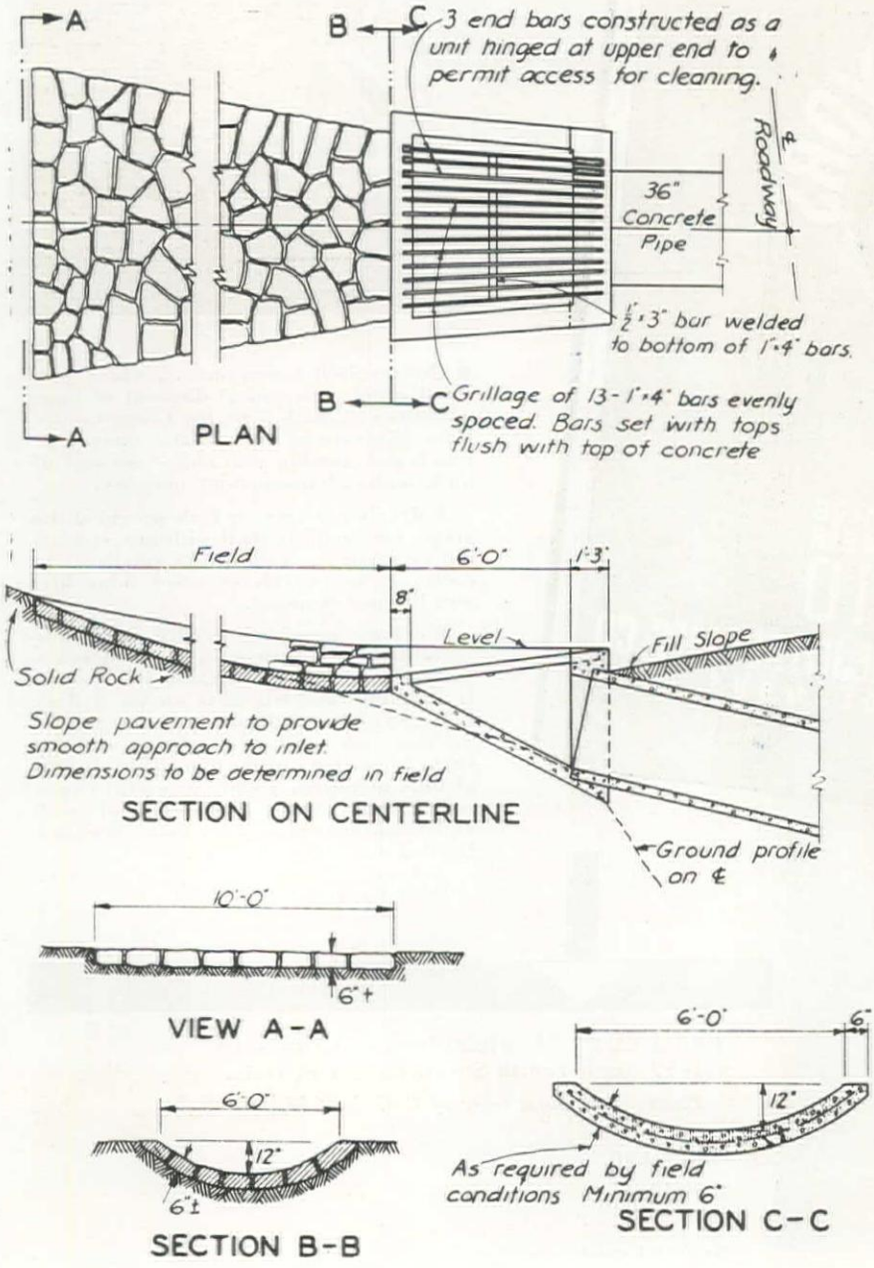
Bridges were planned at first. However, after the Colonial Construction Co., contractors for the grading of a section under construction, had left a temporary bridge across one gorge on the suspension of work during the winter, and not a single trace of the structure could be found in the following spring, it was evident that no structure could be practically planned for this location.

As a result of this experience it was decided to fill the holes, and to permit the slides to pass over rather than under the roadbed. This plan is permissible on the Stevens Canyon road, as no attempt will be made to keep the highway open for traffic during the winter.



The size of the rocky crevass, down which the snow slides move to intersect the highway location, can be judged by comparison with the power shovel (circled) at work on grading.

Details of structure designed to pass snow slides over a mountain highway.



The largest of the crevasses, shown in the photograph, is located on the next section of the Stevens Canyon route proposed for construction, and for which Elliott & Co., Seattle, submitted the lowest bid recently. Heavier gratings, and reinforced concrete box culverts will be used in the crossings of the ravines on this project, under a similar plan as used on the previous construction.

•

California Highway Budget

TOTALING $21,545,370 the budget for California highway construction was announced September 13 by the state highway commission. This budget covers the two years from July 1, 1935 to June 30, 1937. The figure is about $5,000,000 less than the original estimate made by the commission last December and results from the recent legislative act allocating another ¼ cent of tax to municipalities. However, announcement was made that the essential features of the program have not been seriously changed and this was accomplished by the state underwriting the work relief money of the federal program

OBTAIN THESE SAVINGS IN PLACING CONCRETE

When completed, Wheeler Dam will be over a mile long. Floating mixing plants offered the simplest and most practical means to mix and place concrete for a dam of this size. Three of the four mixing plants are shown above. Each is served by one Portable Fuller-Kinyon Pump. Fuller-Kinyon Pumps are the only conveyors capable of unloading barges. Note how the cement barge is located to avoid interference with the handling of aggregates. Another pump handles cement for the Lock, which will be seen at the upper left of the illustration.

FLEXIBILITY - SPEED - RELIABILITY - LOW COST

Fuller-Kinyon Portable Cement Pumps are the only conveyors capable of handling cement under all plant conditions. They unload box cars and barges and recover cement from simple storage sheds with equal facility. For additional information on the advantages of these conveyors write for our bulletin.

Many millions of barrels of bulk cement have been handled by Portable Fuller-Kinyon Pumps in building the World's greatest concrete structures. They have proved that the design and arrangement of concrete mixing plants may be based solely upon economy and convenience in handling aggregates and placing concrete, by eliminating the necessity for straight line and short distance cement conveying. As at Wheeler Dam, they have permitted the economical use of bulk cement where it would otherwise be impractical. Their capacity and rapid movement, under their own power, have assisted in establishing new records in the placing of concrete, as at Norris Dam where only two pumps were required to unload cement from box cars.

Fuller Company
CATASAUQUA, PENNA. U. S. A.

Pacific Coast Branch Office

564 Market Street, San Francisco, California

When writing to Fuller Company, *please mention Western Construction News*

which released certain state funds for highway work and the construction of state highway work within cities which was carried out by the money allocated to these municipalities.

The underwriting of the federal work relief program, as is being done in several other western states, permits the use of federal funds in the regular construction procedure and eliminates the necessity to do much of this work by hand labor. On the other hand, the state agrees to employ the required number of man-hours from relief rolls and this is to be accomplished by spreading the relief labor to a number of regular state financed projects.

The budget is divided to provide $11,805,290 of construction in the 45 counties comprising the northern half of the state and $9,740,080 for the thirteen counties in the southern half of the state. This division is in accordance with the existing law relative to appropriation of highway money. Separate budgets are now being prepared for the federal grade separation program totaling $7,486,362 and the federal work relief program, as submitted to the federal agencies, will provide thirty-three projects in the state highway system aggregating about 40% of the fund and the remaining 60% of this federal money will be distributed equally between county feeder roads and projects within cities.

The largest single item contained in the budget is a figure of $3,300,000 which provides for grading, paving, and structures on the approaches to the San Francisco-Oakland Bay bridge.

•

Man-hours Result in Suit By Washington Contractor

Fred G. Redmon, highway contractor of Yakima, Wash., contended that he was unaware of the special man-hour requirements when he bid on a highway construction project, and the superior court in Washington released him from a $22,987 road contract in Stevens county.

Mr. Redmon filed suit on the ground that he had estimated the job and accepted the contract on a figure of 8,625 man hours of work and did not understand the special labor requirements which made it essential that this job provide 22,200 man hours of work. He contended that the higher figure for man hours was not compatible with good engineering or construction practice. Further, the penalty for failing to live up to this requirement of the contract would have made him ineligible to bid on future state-federal highway work. The complaint further stated that if he had been forced to carry out the contract the loss would have been about $5,000.

In reference to the certified check on deposit in connection with this contract, the judge set a date for the hearing as to the return or forfeiting of this check.

Letters to the Editor . . . . .

Chart Is Appreciated And More Requested

As a result of the favorable response to the nomograph on timber design, by Prof. J. R. Griffith, Oregon State College, published in the September issue, we have made arrangements with Professor Griffith to continue with a series of these charts, beginning in the November issue.—Editor.

Sir—

The chart by Prof. James R. Griffith, published in your last issue, is very practical and useful. This is the opinion of several engineers and contractors on this project and we all hope you will continue with such useful articles.

CHARLES J. JOHNSON,
Office of the District Engineer,
Portland, Oregon.

•

Sir—

I wish to commend you on the article, "Loadings for Timber Beams Solved by Chart," by James R. Griffith, which was published in the September issue of *Western Construction News.*

Hardly a day passes on a construction project that there isn't an occasion to use information of this nature to advantage. The accuracy of the results obtained and the speed and ease of solving such problems are highly gratifying. A photostated copy of this article is filed within easy reach of my hand at all times during the day.

More articles of the same nature would be of great benefit to those of us who have occasion to do design or checking that requires considerable speed and a certain amount of accuracy.

WAYNE L. GOFF,
Principal Draftsman, U. S. Engineer Department, Bonneville, Oregon.

•

Sir—

Just a word in regard to the chart for solving loading conditions for timber beams which appeared in the September issue, written by J. R. Griffith of Oregon State College. It is surely something which will save the structural engineer at lot of time. I think it is something for which your editorial staff should be commended for publishing.

If Professor Griffith has any more of this type of thing for publication I am one among many who wishes your company would continue publishing the charts. In that connection, I have heard most favorable comments about the chart around the Coulee Dam area from a great many readers of *Western Construction News.*

I can assure you that all your readers in this area are "sold" on that kind of chart. May we please have more of them in future issues?

CHARLES G. PRAHL,
Coulee Dam, Wash.

•

Sir—

I read with great interest "Loadings for Timber Beams Solved by Chart" by my friend Professor Griffith, which appeared in the September issue.

With the expectancy of seeing a whole series of charts published, I hereby enter my subscription for one year, commencing with the September issue.

G. E. PRICE,
Santa Ana, Calif.

•

Sir—

Just a word of appreciation to note that you are publishing a nomograph by Prof. James R. Griffith of the Oregon State College. There have been a number of these nomographs published since the first of the year in the Conference Bulletin of the League of California Municipalities.

I hope to see more of these in subsequent issues of your worthy magazine, of which I have been a subscriber from Vol. 1, No. 1.

LELAND J. KEYS,
Stockton, Calif.

•

Sir—

May I commend both you and Professor Griffith on the article "Loadings for Timber Beams Solved by Chart," which appeared in the September issue.

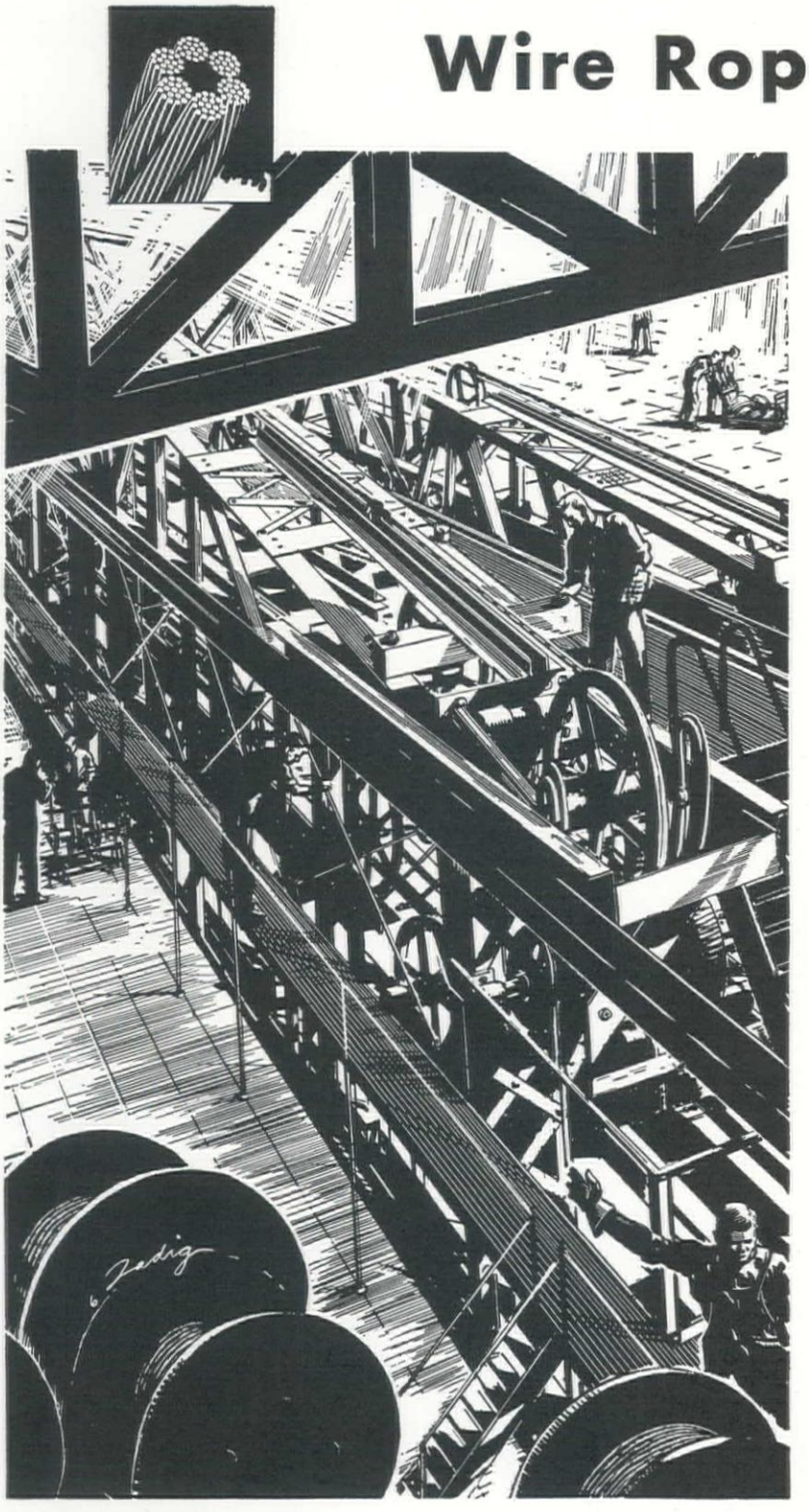
Last June I discussed with Mr. Griffith tentative material for a series of such articles and design charts. We agreed that there is great need among construction men for simple means of field design in wood. There are innumerable problems which must be solved by the non-technical man as he proceeds with construction in the field, which heretofore have been on the basis of "if it looks strong enough it'll do" regardless of dangerous underdesign or costly overdesign. I have hastily counted seven such instances in the illustrations of the September issue—loaded timbers which are seldom designed by the engineer.

You will probably receive few letters from the field, as foremen and bosses are not fan-mail minded. But I know, from discussions, that you and Professor Griffith should continue with a series of pertinent articles.

Perhaps a simple but interesting problem might be included with your news items, with no answer given. Solution would be possible through use of the design chart in the same issue.

THEODORE C. COMBS,
Field Engineer, National Lumber Manufacturers Assoc., Los Angeles, Calif.

World's Champion Wire Rope Punisher

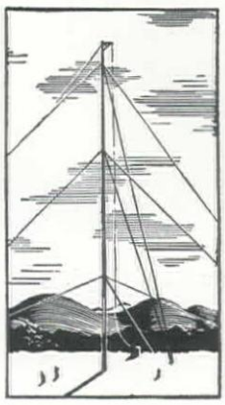


DEVELOPED BY ROEBLING FOR WIRE ROPE RESEARCH

What is this huge and complicated Roebling machine...with its maze of pulleys, belting, gears, and what not? It is a pitiless dissector of wire rope characteristics...a machine in which months of wire rope service can be crammed into days...and in which the toughest of conditions can be closely simulated.

One of several similar fatigue machines built by Roebling at various times, this unit is the largest, most elaborate, and most highly developed in existence. It is used to study the fatigue qualities of wire rope under various bending and tension conditions.

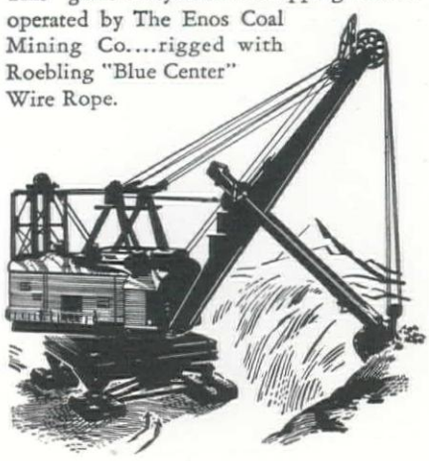
WORLD'S TALLEST TOOTHPICK



It is the new antenna of the Oregonian's radio station KEX...guyed with Roebling Cables... 3200 feet of ½" Galvanized Strand. The rigging job is claimed to be one of the most difficult ever attempted.

18 CUBIC YARDS AT A GULP!

This giant Bucyrus-Erie stripping shovel operated by The Enos Coal Mining Co....rigged with Roebling "Blue Center" Wire Rope.



TO MAKE CERTAIN that Roebling Wire Rope will give the user the highest obtainable degree of safe, economical service, Roebling has enlisted the aid of the finest and most complete research, testing and manufacturing facilities. This fatigue machine illustrated is an example. John A. Roebling's Sons Company of California. San Francisco, Seattle, Los Angeles, Portland.

ROEBLING ...THE PACEMAKER IN WIRE ROPE DEVELOPMENT

Personally Speaking . . . . .

John F. Stevens, world renowned engineer, noted as the builder of the Great Northern Railway and the Panama Canal, is to be honored by a new 5 cent stamp to be issued by the U. S. Post Office department. The stamp will bear the picture of Mr. Stevens who is now 82 years old and still active in the field of engineering. Much of Mr. Stevens' early railroad work was in the West for the Canadian Pacific and Great Northern railways. He also served, for a short time, as president of the S. P. & S. and was active in building many of the railway lines in the State of Oregon.

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Frank L. Adams, irrigation economist, University of California, and consulting engineer for the Bureau of Reclamation, has been assigned to complete the report on the investigations of water rights and conservation on the North Platte River. This investigation was being carried forward by the late Oscar Stout whose death was reported in the September issue.

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Alfred R. Golze, assistant engineer in the Denver office of the Bureau of Reclamation, has been transferred to the Washington office to become assistant to D. S. Stuver, supervising engineer.

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W. H. Spear has received the rating of assistant engineer in the Metropolitan Water District organization and has been transferred from the Distribution Division to Division 3.

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N. L. McDonald has been appointed office and field engineer of the WPA office in Spokane. Mr. McDonald had previously served as field engineer for the MWAK, contractors for the Grand Coulee Dam, in charge of field work.

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Ruskin T. Gardner, formerly superintendent of water works at Phoenix, Ariz., has joined the staff of the Wallace & Tiernan Company as engineer. His headquarters will be in Salt Lake City and he will travel over the seven Pacific Coast states.

J. F. Crowley has been appointed field engineer for the WPA office in Spokane. He was formerly engaged in work for the highway departments of Montana and Oregon.

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Kenneth Beck, county engineer, San Luis Obispo County, Calif., has been named city engineer and building inspector for San Luis Obispo.

John T. Twohy Dies At the Age of 70

John T. Twohy, pioneer railroad builder and well known western contractor, formerly of Portland, died in Los Angeles, September 29, at the age of 70. Since 1880 he had been a partner in the construction firm of Twohy Bros. of Portland, Ore. During the time he was actively associated with the company, it constructed several sections of the Northern Pacific, Great Northern and Union Pacific Railroads in the West. He retired from active work about 1925 and made his home since that time in Los Angeles.

Manufacturer and Distributor News . . . . . .

Ornitz Made Special Coast Representative

A group of eastern manufacturers have appointed Edward M. Ornitz as Pacific Coast special representative to look after their interests through the creation of a consolidated branch office. These companies are Blaw-Knox Company of Pittsburgh, Pennsylvania; Byers Machine Company of Ravenna, Ohio; Cleaver-Brooks Company of Milwaukee, Wisconsin; E. D. Etnyre & Co. of Oregon, Illinois, and French Vibrator Sales Company of Chicago, Illinois.

Ornitz is well known on the Pacific Coast. He was formerly sales manager of the construction equipment division of the Blaw-Knox Co., having been assoated with them for twenty years. In 1934 he was vice-president and general manager of the Blaw-Knox-Western Pipe Corporation, which has since been dissolved. Ornitz' knowledge of and experience with construction equipment will be of value to many contractors for bidding and other purposes.

The Blaw-Knox line includes a complete line of road and construction equipment, bins, batchers, buckets, cement weighing equipment, road forms, finishing machines for concrete, etc. The Byers Machine Company's line includes cranes, shovels, draglines, truck cranes, and the Bearcat line. The Cleaver-Brooks Co. of Milwaukee has a line of car heaters and boosters. The E. D. Etnyre & Company oil distributors and street flushers have been leaders in their field for many years. The French Vibrator Sales Company is offering the "Master Electric Vibrator," made by the Master Electric Company of Dayton, Ohio.

Mr. Ornitz' plan of activity has met with great favor among the manufacturers because it affords direct cooperation with the contractor and distributor.

Ornitz first came out to the Pacific Coast in 1916 and opened the first office for Blaw-Knox. With the United State's entry into the World War, Ornitz was a member of the Engineer Officers' Reserve Corps. He served two years, having spent fifteen months in France, as Captain of Company C-515 Engineers. Upon retiring to private life, he was made manager of the Road Department of the Blaw-Knox Co. in 1919. His present address is the Wilcox Bldg., Los Angeles.

Edward M. Ornitz

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Blaw-Knox Names Two New Distributors

The Blaw-Knox Co. of Pittsburgh, Pa., have named Smith Booth Usher Company as the exclusive representatives in Southern California for their complete line of bin and batching equipment. Arrangements have been made for the manufacture of this equipment locally for quick deliveries; and engineering services are available for lay-outs and estimates for bidding purposes.

Blaw-Knox have also appointed Brown-Bevis Equipment Co., 4900 Santa Fe Ave., as their exclusive distributor in Southern California for road equipment and other general construction equipment.

Allis-Chalmers In New Location

Allis-Chalmers Mfg. Co., tractor division, formerly located at 208 S. E. Belmont St. and more recently in the Citizens National Bank Building, has moved its office to a new location at 1311 S. E. Union Street, Portland. The office and warehouse at the old location was destroyed by fire last fall. The new quarters provide 54,000 sq. ft. of floor area in a fireproof, modern warehouse, of which the first and basement floors are used. A. E. Mills is manager of the Portland branch office.

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Wilson Welder Appoints Pacific Coast Distributor

The Wilson Welder & Metals Co., North Bergen, N. J., have appointed A. M. Castle & Company as Pacific Coast distributor of Wilson Shielded Arc Electrodes on a non-exclusive basis. They will cover the states of Washington, Oregon, and California.

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Austin-Western Appoints Brown Bevis

The Austin-Western Road Machinery Co., Aurora, Ill., report that the Brown Bevis Equipment Co., 4900 Santa Fe Ave., Los Angeles, have taken over their complete line for distribution in Southern California. Lou Gardella will act as consulting engineer working for the Brown Bevis on the Austin-Western line. Ralph Stiles is the Southern California territorial manager for Austin-Western and will make his headquarters at the Brown Bevis headquarters. Stiles has been affiliated with the machinery business for the past fifteen years.

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Byers Machine Names Smith Booth Usher Distributor

The Byers Machine Company of Ravenna, Ohio, have appointed Smith Booth Usher Company as exclusive representative in Southern California on the Bearcat Junior line, as well as their standard line of shovels, cranes, truck cranes, skimmers, draglines, etc. Smith Booth Usher will cooperate with Edward M. Ornitz, special sales representative of the Byers Machine Co.

•

Fuller Company Opens District Office

The Fuller Company has opened a district office at 564 Market Street, San Francisco, Calif., to handle both sales and servicing of Fuller-Kinyon Conveying Systems, Pneumatic Conveyors, rotary compressors and vacuum pumps in the Pacific Coast states. The engineer in charge is Jose M. Alonso, formerly manager of the Chicago office.

Fuller Company also announces it has acquired the exclusive rights to the "Fluxo" system for conveying cement and other pulverized materials in the United States, Canada and Mexico, from F. L. Smith & Company.

UNIT BID SUMMARY . . .

Note: These Unit Bids Are Extracted from Our Daily Construction News Service

Ogden, Utah—Concrete Pipeline

Contract awarded to The American Concrete & Steel Pipe Co., 4635 Firestone Blvd., Southgate, Calif., $331,653. (USING CONCRETE PIPE) by the Board of Commissioners, City Hall, Ogden, Utah, for construction of the Ogden Canyon Pipeline with appurtenant works (Project No. 3). Bids from:

WELDED STEEL PIPE

(1) Steel Tank & Pipe Co. $326,971
(2) Utah Const. & Morrison-Knuds 336,967
(3) C. F. Dinsmore & Co., Ogden 368,898
(4) Ryberg Bros., Salt Lake City 374,283
(5) A. & B. Const Co., Hynes, Calif 437,296

CONCRETE PIPE

(6) Amer. Concr. & Steel Pipe Co. $331,653
(7) Ora Bundy, Ogden, Utah 339,990

CAST IRON PIPE

(8) C. F. Dinsmore & Co., Ogden $497,324

SECTION "A"—PROP. 1 & 3	(8)	(6)	(7)
6,923 lin. ft. 36" dia. 100' head, C. I. OR conc. pipe (furn. & lay)	12.04	7.90	8.20
5,624 lin. ft. 36" dia. 150' head, C. I. OR conc. pipe (furn. & lay)	12.96	8.75	9.22
3,957 lin. ft. 36" dia. 200' head, C. I. OR conc. pipe (furn. & lay)	13.81	8.65	9.00
3,587 lin. ft. 36" dia. 250' head, C. I. OR conc. pipe (furn. & lay)	14.90	9.00	9.55
1,866 lin. ft. 36" dia. 300' head, C. I. OR conc. pipe (furn. & lay)	15.76	9.20	9.75
1,434 lin. ft. 36" dia. 350' head, C. I. OR conc. pipe (furn. & lay)	16.75	9.65	10.00
1,117 lin. ft. 36" dia. 400' head, C. I. OR conc. pipe (furn. & lay)	17.50	10.10	10.60
3,766 lin. ft. 45" dia. 50' head, C. I. OR conc. pipe (furn. & lay)	17.50	9.40	9.70
28 lin. ft. 42" dia. 100' head, C. I. OR conc. pipe (furn. & lay)	14.95	9.90	10.35
SUB-TOTALS—SECTION "A"—PROP. 1 & 3	$403,631	$248,377	$259,684

SECTION "A"—PROPOSITION 2	(1)	(2)	(3)	(4)	(5)
10,837 lin. ft. 38" dia. 5/16" thick steel pipe	7.10	8.40	8.76	8.43	10.35
4,693 lin. ft. 38" dia. 11/32" thick steel pipe	7.75	8.90	8.78	8.84	10.83
4,000 lin. ft. 38" dia. 3/8" thick steel pipe	8.35	9.40	8.95	9.47	11.18
2,039 lin. ft. 38" dia. 13/32" thick steel pipe	9.10	10.15	9.69	10.49	11.25
1,966 lin. ft. 38" dia. 7/16" thick steel pipe	9.60	10.80	10.86	11.48	11.73
3,766 lin. ft. 48" dia. 3/8" thick steel pipe	9.90	11.00	13.70	11.92	13.165
28 lin. ft. 42" dia. 3/8" thick steel pipe	14.00	10.00	16.98	20.00	11.95
973 lin. ft. 36" dia. 3/8" thick steel pipe	7.75	8.70	10.37	9.00	10.65
SUB-TOTALS—SECTION "A"—PROP. 2	$229,358	$262,498	$275,204	$268,895	$313,984

SECTION "B"	(1)	(2)	(3)	(4)	(5)	(6)	(7)
L. S. remove railroad track	$11,000	$ 6,500	$ 8,550	$ 9,700	$ 6,000	$ 6,895	$ 4,100
1,800 cu. yd. rock excavation	4.50	3.50	4.48	6.00	5.00	3.50	4.10
25,200 cu. yd. earth excavation	1.35	.85	1.26	1.75	2.50	1.25	1.20
500 cu yd. embankment	2.00	.80	2.00	.60	1.00	1.20	1.40
200 cu yd. masonry walls	17.00	8.00	16.80	10.00	3.00	10.20	13.50
2,500 cu yd. selected backfill	2.00	1.60	1.60	2.00	1.00	1.00	1.20
30 cu. yd. bridge abutments	25.00	27.00	24.00	21.60	30.00	25.80	24.00
46,400 lb. steel bridges	.10	.08	.12	.07	.20	.072	.075
L. S. Coldwater 20" line manhole	160.00	225.00	152.00	207.60	200.00	213.10	140.00
L. S. Coldwater Junction	600.00	745.00	594.00	595.20	600.00	736.90	430.00
L. S. blowoff valve manhole	300.00	370.00	312.00	327.84	360.00	408.50	150.00
7 ea. air valve manholes	125.00	220.00	127.00	175.00	185.00	178.10	110.00
L. S. Point valve box	50.00	435.00	50.00	486.00	400.00	466.25	420.00
L. S. Overflow box	600.00	$1,120	617.00	$1,089	$1,000	$1,082	865.00
L. S. Valve house	$2,500	$1,130	$4,220	808.90	$3,000	$1,388	$1,409
L. S. remove chlorinator house	20.00	210.00	70.00	180.00	75.00	180.00	90.00
L. S. remove valve house	20.00	495.00	70.00	216.00	100.00	180.00	107.00
L. S. meter house	$1,750	$2,900	$2,236	$2,885	$6,000	$2,917	$2,684
L. S. 42" valve, 50-lb.	$1,900	$2,480	$3,250	$2,200	$2,060	$2,179	$2,549
L. S. 36" valve, 50-lb.	810.00	$1,245	$1,148	916.00	898.37	976.20	$1,302
L. S. 36" valve, 150-lb.	$1,700	$2,065	$2,415	$1,835	$1,859	$1,780	$1,890
L. S. 12" valve, 400-lb.	220.00	245.00	245.00	235.00	231.78	260.00	177.00
L. S. 9" valve, 150-lb.	85.00	95.00	120.00	94.50	81.30	110.00	99.00
2 ea. 24" valves	150.00	75.00	65.00	290.00	50.00	78.00	50.00
L. S. 20" gate valve	100.00	45.00	110.00	194.00	50.00	48.00	34.00
L. S. 36" sluice gate	590.00	550.00	512.00	567.00	539.00	580.80	580.00
L. S. 36" sluice gate	660.00	625.00	572.00	626.50	600.10	780.60	633.00
L. S. 24" sluice gate	360.00	400.00	399.00	385.00	312.14	458.40	427.00
3 ea. 36" sluice gates	$1,625	570.00	540.00	573.00	622.10	747.00	554.30
5,000 lb. "Y" castings	.14	.10	.125	.12	.15	.14	.12¼
44 lin. ft. 24" steel pipe, 5/16"	6.00	5.80	5.20	9.00	7.75	4.90	6.10
207 lin. ft. 24" C. I. pipe 200' head	11.50	9.00	12.50	15.00	6.50	9.60	10.60
25 lin. ft. 9" steel pipe, ¼"	2.00	4.20	4.00	8.00	3.50	3.30	4.80
5 cu. yd. extra concrete	25.00	30.00	20.00	25.00	35.00	32.40	30.00
50 cu. yd. anchors	25.00	24.00	20.00	13.50	25.00	25.50	20.20
L. S. Venturi tube and meter	$3,500	$3,870	$3,487	$3,700	$3,230	$3,555	$4,239
8 ea. 6" air and vacuum valves	210.00	218.00	200.00	250.00	175.00	220.00	227.10
8 ea. 1" air release valve	40.00	35.00	40.00	55.00	27.50	42.00	40.40
20 ea. service taps	2.50	12.50	6.00	10.00	10.00	12.00	7.60
L. S. Reservoir by-pass manhole	300.00	375.00	318.00	327.80	360.00	300.00	183.00
24 lin. ft. 12" C. I. pipe 400' hd	8.50	5.50	8.00	5.00	3.75	3.70	3.10
135 lin. ft. salv. & relay 24" st. pipe	3.00	1.65	2.00	2.45	3.00	1.80	2.40
SUB-TOTALS SECTION "B"	$97,613	$74,468	$93,693	$105,388	$123,312	$83,285	$80,306

Denver, Colo.—City—Lining and Grading

Contract awarded to Utah-Bechtel-Morrison-Kaiser Co., Almont, Colo., $93,212, by the Board of Water Commissioners, Denver, Colo., for construction of the lined and unlined sections of the canal and grading siphon lines of the South Boulder Diversion Conduit, Moffat Water Tunnel project. Bids from

(1) Utah-Bechtel-Morrison-Kaiser Co., Almont ..... $ 93,212
(2) Driscoll Const. Co. 108,525
(3) Platt Rogers, Inc. 114,385
(4) Peter Seerie 118,917
(5) Hamilton & Gleason Co. $121,350
(6) A. P. & I. M. Atchison Co. & L. L. De Remer 186,790
(7) Engineers estimate 72,995

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
10 acres clearing R/W	108.00	200.00	75.00	125.00	150.00	250.00	75.00
212,000 cu. yd. exc. canals & siphons	.226	.31	.35	.37	.34	.59	.16
2,000 cu. yd. fill or embankm. (canal)	1.36	2.00	1.50	1.25	.50	1.50	.40
2,200 cu. yd. concr. lining (canal)	16.15	14.00	15.00	14.00	18.00	22.00	14.00
3,150 sq. yd. cobblestone lining	1.60	1.50	1.00	1.75	2.00	2.00	2.00
75 cu. yd. rubble wall	11.20	16.00	3.00	5.00	10.00	18.00	5.00
40 cu. yd. exc. for rubble wall	2.25	2.00	1.50	1.00	3.00	4.00	1.25

EITHER OF THESE WILL BRING YOU *lubrication profits*

PHONE OR WRITE FOR THE G. P. MAN*

There is a General Petroleum Engineer close by. A word from you will bring him. Sit down with this man and discuss your operating problems.

Through his training and experience he may be able to produce an idea for you that will open your eyes and add to your profits.

One thing certain he *can* do—he can tell you whether you are using the correct types of lubricant consistent with economy.

You can send for the G. P. man with no thought of obligation on your part.

**General Petroleum's Socony-Vacuum trained Engineer.*

GARGOYLE Lubricating Oils

GENERAL PETROLEUM CORPORATION

A Socony-Vacuum Company

PACIFIC COAST MARKETERS OF GARGOYLE INDUSTRIAL LUBRICANTS

When writing to General Petroleum Company, *please mention Western Construction News*

Toncan Appoints Western Sales Engineer

The Toncan Culvert Manufacturers' Association, subsidiary of the Republic Steel Corp., announce the appointment of D. R. Sanders, 3323 Continental Oil Building, Denver, Colo., as Sale Promotion Engineer in all states west of the Mississippi River. Sanders has had a long and varied experience in the culvert field and was formerly connected with the Canton Culvert Division of the Republic Steel Corp.

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G. A. Strand Dies; Sales Manager for Trojan Powder

G. A. Strand, chief engineer and sales manager of the Trojan Powder Co., San Francisco, died Oct. 9 at the age of 47. He was a graduate of the University of California. He collaborated with Frank Camp in developing the method of subaqueous blasting, using bombs, which was successful in breaking rock for the south pier of the Golden Gate Bridge.

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New Portland Distributor For LeTourneau

Loggers & Contractors Machinery Co., 211 S. E. Madison St., Portland, Oregon, with branches at Salem and The Dalles, Oregon, were recently appointed distributors for the complete line of earth moving equipment manufactured by R. G. LeTourneau, Inc., of Stockton, Calif., and Peoria, Ill., for northern Oregon, the same territory as for Caterpillar Tractor Co., whose account they also handle.

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Coast Equipment Company Moves Office

The office of Coast Equipment Company of Portland recently has been moved from the Bedell Building to 424 Henry Building, telephone Atwater 7679. This firm, managed by J. J. Burke, handles the following lines: Broderick & Bascom Rope Co., Trackson Co., Fairbanks-Morse Co., Hunt Process, concrete curing; Weco Manufacturing Co., lighting plants; and Concrete Vibrator Equipment Co.

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Joins Caterpillar Sales Force

A veteran in both engineering and sales experience, W. P. Jones, formerly Northwestern representative for the J. D. Adams Co., Indianapolis, Ind., has joined the sales force of Caterpillar Tractor Co. where he will specialize in governmental and construction sales.

Jones represented the Adams Company in the Northwest during the last eight years, and for the eight years preceding that period was county engineer in Idaho in charge of construction and maintenance. He is well known throughout the West where he took an active part in tests of construction equipment for government purchase. Due to his familiarity with conditions in the West, he will be assigned to that division by Caterpillar. His headquarters will be at Spokane, Wash.

Bridges and Culverts

Portland, Ore.—State—Steel and Concrete—Klamath County

Contract awarded to C. J. Montag & Son, Worcester Bldg., Portland, $160,735, by Oregon State iHghway Commission, Portland, Ore., for const. 92′ steel deck girder span on conc. piers and 1115 lin. ft. conc. viaduct approaches over Klamath Falls River and Great Northern RR. about 3 mi. South from Klamath Falls on Klamath Falls-Weed Highway in KLAMATH COUNTY, Oregon. Bids from:

(1) C. J. Montag & Son, Portland.....$160,735
(2) Hoffman Const. Co., Portland..... 164,205
(3) Kuckenberg-Wittman Co. $182,445
(4) Warren Northwest, Inc. 186,990

		(1)	(2)	(3)	(4)
1,660	cu. yd. excavation	16.00	12.00	20.00	15.00
100	cu. yd. excav. below elev. shown	16.00	10.00	20.00	3.00
9,000	lin. ft. foundation piling	.50	.50	.60	.70
2,600	cu. yd. "A" concrete	23.00	25.00	27.45	28.00
1,030	cu. yd. "D" concrete	22.00	25.00	22.50	31.00
640,000	lb. metal reinforcement	.045	.045	.045	.05
147,000	lb. structural steel	.065	.065	.06	.07
2,420	lin. ft. concrete handrail	3.00	4.00	4.00	3.50

Street and Road Work

Carson City, Nev.—State—Grading and Surfacing

Awards as follows by Nevada State Highway Comm., Carson City, Nev., for:

(1) HUMBOLDT Co.—To Nevada Rock & Sand Co., Box 692, Winnemucca, Nev., $103,598 (as stated issue of Sept. 18) for 18.60 mi. cr. grav. or stone surf. from Paradise Hill to Orovada, Rt. 8, Sec. 3, FAP 132. Bids from:

(1) Nevada Rock & Sand Co.....$103,598
(2) Geo. French, Jr., Stockton..... 104,561
(3) Isbell Const. Co., Reno..... 106,875
(4) Pacific Const. Co., S. F.....$108,422
(5) Engineers estimate 114,298

		(1)	(2)	(3)	(4)	(5)
362	lin. ft. remove culvert pipe	1.00	.50	1.00	.75	.75
129	ea. remove culvert headwalls	5.00	3.00	3.00	5.00	5.00
94,400	cu. yd. roadway excavation	.28	.25	.28	.30	.30
40,758	sta. yd. overhaul	.03	.02	.02	.02	.02
9,716	cu. yd. select borrow	.40	.45	.50	.40	.40
24,739	cu. yd. imported borrow	.30	.35	.30	.30	.35
1,320	cu. yd. struc. excavation	1.50	1.00	1.00	1.50	1.00
18.56	mi. subgrade	100.00	50.00	100.00	75.00	100.00
18.56	mi. finish roadway	100.00	100.00	100.00	75.00	100.00
71,900	tons cr. grav. or stone surface	.52	.55	.55	.57	.60
2,065	M. gallons water	1.00	2.00	1.50	1.00	2.00
80	cu. yd. "A" concrete	30.00	30.00	30.00	25.00	30.00
215	cu. yd. "B" concrete	30.00	30.00	30.00	25.00	30.00
13,000	lb. reinforcing steel	.07	.07	.07	.06	.07
24	lin. ft. 15″ corr. metal pipe	2.00	1.75	1.90	2.00	2.10
1,216	lin. ft. 18″ corr. metal pipe	2.25	2.25	2.25	3.00	2.35
858	lin. ft. 24″ corr. metal pipe	3.00	3.00	3.00	4.00	3.40
318	lin. ft. 30″ corr. metal pipe	3.50	4.00	4.00	5.00	4.50
364	lin. ft. 36″ corr. metal pipe	5.25	5.75	6.00	6.00	5.75
68	lin. ft. relay culvert pipe	1.50	.75	.50	.50	.75
80	ea. monuments	3.00	3.00	4.00	2.00	3.00

(2) STOREY & WASHOE CO.—To Utah Const. Co., 1st Natl. Bank Bldg., Ogden, $141,419 (as stated issue Sept. 18) for 3 mi. grad. & surf. from 8 mi. to 5 mi. S. E. of Brown's (Geiger Grade) Rt. 17, Sec. A, WPH 95A. Bids from:

(1) Utah Const. Co., Ogden $141,419
(2) Fredrickson & Watson Co., etc..... 142,775
(3) Pacific Const. Co., S. F. 141,635
(4) Isbell Const. Co., Reno $156,668
(5) Engineers estimate 135,020

114,100	cu. yd. roadway excavation	1.15	1.15	1.10	1.24	1.10
114,100	cu. yd. roadway excavation	1.15	1.15	1.10	1.25	1.10
105,999	sta. yd. overhaul	.03	.03	.05	.02	.03
370	cu. yd. struc. excavation	1.50	3.00	3.00	2.00	1.50
3.00	mi. finish roadway	100.00	100.00	500.00	$1,500	100.00
15	cu. yd. "B" concrete	30.00	40.00	50.00	40.00	30.00
220	cu. yd. cement rubble masonry	14.00	15.00	20.00	20.00	12.00
220	lin. ft. 18″ corr. metal pipe	2.00	2.50	3.00	2.40	2.00
36	lin. ft. 24″ corr. metal pipe	3.00	4.00	4.00	3.10	2.75
90	lin. ft. 30″ corr. metal pipe	3.75	4.50	5.00	4.10	3.50
160	lin. ft. 36″ corr. metal pipe	6.00	7.00	6.00	6.00	5.00
124	ea. monuments	3.50	3.00	3.00	4.00	3.00
2,400	lb. castings	.15	.20	.20	.15	.15

Carson City, Nev.—State—Grading and Surfacing—Churchill and Lander Counties

Contract awarded to Fredrickson & Watson, Fredrickson Bros., and Jones & King, P. O. Box 2026, Reno, Nev., $110.794, by Nevada State Highway Commission, Heroes Memorial Bldg., Carson City, Nev., for 9.68 mi. const. portion of St. Highway system from 8 mi. E. of Eastgate to Campbell Cr. Ranch on Rt. 2, Sec. F & A, in CHURCHILL and LANDER COUNTIES, Nev. Bids from:

(1) Fredrickson & Watson, Fredrickson Bros. and Jones & King.....$110,794
(2) Utah Const. Co., Ogden..... 120,534
(3) Dodge Const., Inc., Fallon..... 127,127
(4) Pacific Construction Co., San Francisco $146,211
(5) Isbell Const. Co., Reno..... 154,053
(6) Engineers estimate 112,062

		(1)	(2)	(3)	(4)	(5)	(6)
474	lin. ft. rem. culvert pipe	.70	.75	1.50	.75	1.00	.75
75	ea. remove culvert headwalls	3.00	5.00	6.00	5.00	6.00	1.00
126,740	cu. yd. roadway excavation	.44	.52	.52	.70	.78	.45
93,026	sta. yd. overhaul	.02	.02	.02	.02	.02	.02
23,380	cu. yd. select borrow	.36	.38	.35	.45	.40	.40
710	cu. yd. struc. excavation	1.50	1.50	1.50	2.00	1.50	1.00
9.68	mi. subgrade	150.00	75.00	100.00	100.00	100.00	100.00
9.68	mi. finish roadway	250.00	200.00	200.00	100.00	100.00	100.00
36,800	tons cr. grav. or stone surface	.55	.62	.75	.60	.60	.60
334	cu. yd. "A" concrete	30.00	28.00	30.00	30.00	30.00	30.00
40	cu. yd. "B" concrete	29.00	28.00	30.00	30.00	30.00	30.00
33,960	lb. reinforcing steel	.07	.06	.07	.07	.07	.08
0.80	M. ft. BM redwood	135.00	110.00	250.00	200.00	150.00	120.00
456	lin. ft. 15″ corr. metal pipe	2.50	1.50	2.25	2.00	1.75	1.65
592	lin. ft. 18″ corr. metal pipe	2.75	2.00	2.50	3.00	2.00	2.50
202	lin. ft. 24″ corr. metal pipe	4.00	3.00	3.25	4.00	3.00	3.25
34	lin. ft. 30″ corr. metal pipe	4.50	3.75	4.00	5.00	3.50	4.50
30	cu. yd. handlaid riprap	7.00	4.00	5.00	6.00	6.00	6.00
164	lin. ft. relay culvert pipe	.70	.50	1.00	.75	1.00	.75
233	ea. monuments	3.00	3.50	3.00	3.00	3.50	3.00
800	lb. castings	.20	.15	.15	.10	.15	.18
220	lin. ft. 4″ water pipe	2.00	1.25	1.00	2.00	1.25	2.00

FWD Develops Portable Rock Crusher Unit

A new portable rock crusher unit has been developed by the Four Wheel Drive Auto Company, Clintonville, Wis. The new machine consists of a three-ton FWD truck of the seat-over-motor type equipped with an overhead eccentric type rock crusher mounted on the rear of the frame and driven by the truck motor. The crusher is equipped with continuous bucket feeding and loading elevators of the belt type. This portable crusher is designed to answer the demands of highway officials and contractors for a machine which can be speedily moved from one road building location to another. It is especially adaptable for use along highways being surfaced.

The rock crusher is driven direct from the main shaft of the transmission. With a governed engine speed of 1,200 r. p. m. in direct drive and by means of a four-to-one reduction in the drive sprockets of the crusher, a crushing speed of 300 r. p. m. can be maintained.

The rated capacity of the unit at this speed ranges from 50 to 125 tons per day, varying in accordance with the hardness and size of the stone and gravel used.

The four driving wheels of the truck enable it to negotiate the "tough going" encountered in moving to and from location. Its short wheel base gives it the maneuverability necessary to the reaching of stone and gravel supplies located in cramped quarters.

●

Pacific States Develops New Line

An important announcement in connection with the waterworks industry, particularly of the Western States, is the development, manufacture, and sale of approved types of gate valves and hydrants by the Pacific States Cast Iron Pipe Co., Provo, Utah. An entirely new shop, especially equipped for this production, embodies the latest types of modern machine tools, jigs and fixtures which will insure interchangeability of parts.

Pacific States Valves are designed by a staff of engineers who have had thirty-five years of experience in the designing and development of some of the leading makes of gate valves now in use, the manufacturer states. The features of construction that have already been tried and proven are incorporated.

Pacific States Gate Valves are of the parallel seat, double disc type and have straightway openings the full diameter

Portland, Ore.—Government—Grading and Tunnel—Lewis County

Award to Elliott & Co., Inc., Insurance Bldg., Seattle, Wn., $189,026 (METAL PIPE), by Bureau of Public Roads, Portland, Ore., for 1.167 mi. const. or improving the Mt. Rainier Natl. Park Stevens Canyon Highway, Project 4-C2, Grading and tunnel, located in the Mt. Rainier Natl. Park, LEWIS COUNTY, Wn. Bids from:

	Metal	Concrete
(1) Elliott & Co., Inc.	$189,026	$189,548
(2) Colonial Const. Co.	194,085	194,440
(3) Myers & Goulter	194,979	195,689
(4) Sam Orino, Bonneville	198,796	199,187
(5) Rumsey & Co.	200,080	200,790
(6) L. Romano Engr. Corp.	$207,063	$207,217
(7) Joplin & Eldon, Portl.	211,841	212,275
(8) P. L. Crooks & Co., Inc.	219,118	219,888
(9) A. C. Greenwood Co., Inc.	269,810	270,205

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
3 acres clearing (extra)	$200	$200	$200	$400	$200	$100	$100	$400	$200
9 acres grubbing	$200	$200	$150	$300	$100	$200	$150	$400	$200
155,000 cu. yd. unclass. excavation	.70	.73	.72	.70	.79	.80	.77	.77	1.25
4,000 cu. yd. struc. excavation	1.75	2.00	1.50	1.50	.75	2.00	2.00	1.50	1.50
1,000 cu. yd. borrow excavation	.40	.73	.50	.75	.75	.50	.40	.77	1.25
234,000 sta. yd. overhaul	.01	.015	.015	.02	.02	.01	.02	.02	.01
1.167 mi. finish earthgraded road	$500	$300	$1,000	$500	$500	$1,000	$2,000	$500	$500
6,000 cu. yd. mi. cushion haul	.20	.20	.20	.25	.20	.20	.24	.30	.25
2,300 lin. ft. round cut slopes	.15	.15	.20	.10	.10	.25	.14	.15	.10
65 M. ft. BM untreated timber temporary tunnel lining	$60	$50	$60	$60	$50	$50	$50	$10	$70
50 M. ft. BM untreated timber temporary trestles	$55	$50	$60	$60	$60	$50	$52½	$80	$65
260 cu. yd. "A" concrete (culverts and slope paving)	$25	$30	$27	$30	$30	$30	$30	$30	$30
220 sq. yd. paved culvert inlets	4.00	3.00	5.00	$10	2.00	2.00	2.40	3.00	4.00
19,500 lb. reinforcing steel	.06	.07	.06	.06	.08	.05	.08	.10	.10
1,500 cu. yd. masonry retaining walls	$12	$13	$13	$15	$12	$10	$14	$13	$10
100 cu. yd. masonry (headw. & wing walls)	$15	$15	$13	$25	$14	$10	$15	$20	$12
670 ft. 18" reinf. conc. pipe (ALT.)	2.50	2.50	3.00	2.50	3.00	2.20	2.80	3.00	3.00
40 ft. 24" reinf. conc. pipe (ALT)	3.50	3.50	4.00	4.00	4.00	4.50	4.00	6.00	5.00
300 ft. 36" reinf. concrete pipe	6.50	7.00	8.00	7.00	8.00	$10	8.00	8.00	8.00
670 ft. 18" corr. metal pipe	1.75	2.00	2.00	2.00	2.00	2.00	2.20	2.00	2.50
40 ft. 24" corr. metal pipe	3.00	3.00	3.00	2.60	3.00	4.00	3.20	3.50	3.50
4,600 lb. structural steel (inlets)	.10	.10	.10	.10	.10	.10	.10	.15	.07
160 cu. yd. masonry guardrail (Type 2)	$17	$16	$20	$25	$14	$20	$20	$25	$16
260 ft. 8" porous tile underdrain	1.00	1.00	.50	.40	.20	.60	1.00	1.00	1.00
257 lin. ft. tunnel excavation	$90	$75	$86	$75	$85	$100	$100	$130	$70
70 cu. yd. struc. exc. (tunnel drains)	3.50	3.00	5.00	$10	4.00	$10	4.00	7.00	4.00
L. S. slope stabilization	$1,500	$1,500	$1,500	$1,500	$1,500	$1,500	$1,500	$1,500	$1,500

Denver, Colo.—Government—Grading and Surfacing—Yellowstone National Park

Award of contract recommended to J. C. Maguire Const. Co., 208 Lewisohn Bldg., Butte, Mont., $122,894, by the Bureau of Public Roads, Denver, Colo., for 16.943 miles dense graded bitum. plant-mix surf. of Proj. RTEC 1-H1, H2, H4 on the Grand Loop Highway, Yellowstone National Park, Wyoming. Bids from:

(1) J. V. Maguire Const. Co.	$122,894
(2) Taggart Const. Co., Cody	127,309
(3) Olof Nelson, Logan, Utah	133,003
(4) J. L. McLaughlin, Gr. Falls	134,094
(5) S. Birch & Sons Const. Co., Great Falls, Mont.	$147,391
(6) Stevens Bros., St. Paul	160,712
(7) Engineers estimate	134,428

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
0.20 acre clearing	$500	$150	$400	$150	$500	$1,000	$200
8,400 cu. yd. unclass. excavation	.75	.70	1.00	.75	1.00	1.25	1.00
6,550 cu. yd. borrow excavation	.75	.55	.60	.75	.50	.75	.50
1.4 mi. cut slope treatment	$800	$300	$400	$500	$700	$1,000	$400
220 cu. yd. struc. excavation	1.50	1.50	2.50	1.50	2.00	2.50	2.00
64,000 sta. yd. overhaul	.03	.02	.03	.01	.04	.02	.03
500 cu. yd. subgrade reinforcement	2.50	1.50	2.00	2.00	2.00	2.50	2.00
L. S. water plant	$350	$150	$500	$100	$150	$400	$300
75 M. gallons watering	3.00	3.00	2.50	2.50	2.00	4.00	2.50
L. S. provide and maintain roller	$250	$100	$500	$200	$150	$400	$200
400 hr. roller operation	3.00	3.00	3.00	3.00	2.50	4.00	2.50
23,600 tons aggreg. dense plant mix	2.25	2.25	2.40	2.40	2.75	3.00	2.30
294,000 gal. liq. asph. MC-4	.0725	.08	.09	.0925	.1075	.11	.11
52,000 gal. liq. asph. MC-1	.0825	.09	.10	.1125	.1075	.11	.12
14 cu. yd. "A" concrete	35.00	25.00	30.00	30.00	35.00	35.00	25.00
28 cu. yd. masonry	25.00	20.00	20.00	25.00	25.00	30.00	22.00
2,000 lb. reinforcing steel	.10	.10	.08	.10	.10	.10	.07
192 lin. ft. 8" corr. metal pipe	1.20	.70	1.00	1.25	1.20	1.50	1.25
90 lin. ft. 24" corr. metal pipe	2.75	2.25	2.50	2.50	3.00	3.00	2.40
35,000 gal. liq. asph. RC-1	.085	.11	.12	.12	.12	.14	.125
800 lin. ft. 6" vitr. underdrain	1.00	1.00	1.00	1.00	1.00	1.00	1.00
575 lin. ft. woodguard rail Type 7	1.25	1.00	1.00	1.00	1.00	1.50	.90
L. S. force account work	$1,500	$1,500	$1,500	$1,500	$1,500	$1,500	$1,500
3,530 lin. ft. masonry curb	2.50	4.50	2.00	3.00	2.00	2.50	1.60
10 ea. embankment protectors	25.00	18.00	20.00	15.00	18.00	25.00	15.00
20 sq. yd. stone paving	5.00	5.00	5.00	7.00	5.00	2.50	3.00
8 mi. center line stripe	75.00	1.00	$150	10.00	$100	60.00	$100
1,570 tons cover aggregate	3.00	3.00	3.00	3.50	3.00	3.50	3.50
254 tons supple. cover aggregate	2.50	3.00	4.00	3.50	3.00	3.50	3.20
1,760 cu. yd. mi. overhaul	.25	.25	.30	.25	.40	.25	.25
860 cu. yd. rem. & replac. cr. rock surf.	1.50	.75	1.50	.75	2.00	2.00	1.10
760 cu. yd. haul & plc. suppl. surf. matl.	2.00	1.50	1.50	2.00	2.75	1.00	1.50

Portland, Ore.—State—Grading—Tillamook County

Contract awarded to Chas. H. Leonard, Albany, Oregon, $198,560, by Oregon State Highway Commission, Portland, Ore., for 4.17 mi. grading on Brooks-Jordan Creek Section of Wilson River Highway in TILLAMOOK CO., Ore. (WPH 191-C). Bids from:

(1) Chas. H. Leonard, Albany	$198,560
(2) Parker Schram Co., Portland	199,208
(3) Oregon Const. Co. & Theo. Arenz	211,982
(4) J. A. Lyons, Portland	$215,510
(5) F. C. Dillard, Medford, Ore.	235,819
(6) A. C. Greenwood & Co.	244,300

	(1)	(2)	(3)	(4)	(5)	(6)
L. S. clearing and grubbing	$50,000	$68,000	$37,500	$50,000	$38,000	$69,000
2,600 sq. ft. felling danger trees	.50	1.50	1.00	.60	.50	3.00
6,200 cu. yd. trench excavation	1.00	2.00	1.50	2.50	1.50	1.25
157,000 cu. pd. common excavation	.50	.35	.48	.40	.50	.50
59,000 cu. yd. solid rock excavation	.50	.65	1.10	1.00	1.50	1.00
244,000 sta. yd. overhaul	.05	.02	.02	.02	.02	.02
55,500 yd. mi. truck haul	.25	.20	.20	.20	.20	.20
4.17 mi. finish roadbed and slopes	$1,000	500.00	600.00	$1,000	200.00	500.00
16,400 lin. ft. rounding cut banks	.10	.12	.10	.25	.12	.15
250 lin. ft. 6" porous drain tile	.50	.50	1.00	1.00	.40	1.00
25 cu. yd. rock backfill in drains	2.00	2.00	2.00	2.00	1.50	3.00
1,000 cu. yd. selected roadbed topping	.50	1.00	1.50	1.50	1.00	1.00
2,000 yd. mi. hauling roadbed topping	.25	.20	.20	.30	.15	.20

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LeTourneau 12-yd. Carryall building a highway toward the continental divide in Colorado.

LE TOURNEAU

When writing to R. G. LeTourneau, Inc., *please mention Western Construction News*

of the connecting pipe. They are suitable for water, steam, gas or oil, and are made in standard sizes of 2 in. and up, for low, medium, or extra heavy pressures with any style of end connection, such as: Standard hubs, flanged or screwed ends, McWane patented precalked joint hubs. They are designed and constructed to meet the need of every type of service.

Brookville Ford V-8 Engine Powered Locomotives

The Brookville Locomotive Co., builders of Ford-powered locomotives since the early days of the old Model "T," is now using the powerful Ford V-8 engine in a new series of locomotives ranging from 2½ to 6 tons in weight. These locomotives also employ the Ford four-speed truck transmission and the Ford heavy duty truck clutch, all of the Ford assembly being installed without alteration to permit servicing with standard Ford replacement parts at any authorized Ford Dealer.

The power is transmitted through the Brookville reverse, which makes all four speeds available in reverse. Models are made for any track gauge.

Catalog BV8 is available by writing Brookville Locomotive Co., Brookville, Pa.

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Marmon-Herrington Builds All-Wheel-Drive Ford V-8

By installing specially-designed driving front axle and propeller shaft, a two-speed auxiliary transmission and other necessary parts, according to the Marmon-Herrington Company, they have succeeded in developing one of the finest performing all-wheel-drive trucks ever built, having retained intact the remainder of the Ford V-8 truck just as it comes from the factory.

All installation and conversion operations are carried forward in the Marmon-Herrington factory at Indianapolis. The all-wheel-drive units are engineered and built into each truck and are not accessories.

The Marmon-Herrington Company has started production on four models. Two are four-wheel-drive units. These are the B5-4 with wheelbase of 132 inches selling at $1,295 at the factory, and the B6-4 with wheelbase of 157½ inches selling at $1,345 factory. In addition there are two six-wheel-drive units offered at unusually low prices. The four-wheel-drives have a maximum gross capacity of 13,200 pounds and the six-wheel drives a maximum gross capacity of 22,000 pounds.

Boise, Idaho—State—Surfacing—Ada and Boise Counties

Contract awarded to Triangle Const. Co., 1220 Ide Street, Spokane, Wn., $133,476, by Commissioner of Public Works, Boise, Idaho, for 12.845 mi. roadbed, drainage struc. and cr. rock surf. on the Arrowrock-Boise Basin Highway between Arrowrock Junction and Stierman in ADA AND BOISE COUNTIES, FAP 145-B, Ida. Bids from:

(1) Triangle Const. Co. $133,476
(2) Tony Marrazzo, Spokane 146,424
(3) Utah Const. Co., Ogden 152,900
(4) Morrison-Knudsen Co., Boise $167,496
(5) Engineers estimate 144,571

	(1)	(2)	(3)	(4)	(5)
L. S. clearing and grubbing	$3,500	$3,500	$700.00	$2,500	$2,000
100,000 cu. yd. excavation	.45	.45	.58	.52	.55
1,000 cu. yd. struc. excavation	1.00	1.50	1.50	1.10	1.00
50,000 sta. yd. overhaul	.02	.02	.02	.015	.03
50,700 mi. yd. haul on excavation	.20	.18	.20	.18	.20
42,000 cu. yd. selected material	.25	.23	.30	.22	.25
39,000 tons crushed rock surfacing	.90	1.28	1.05	1.60	1.00
3,700 cu. yd. binder	.20	.25	.40	.35	.25
820 M. gallons sprinkling water	1.00	1.00	1.00	1.75	2.00
7,400 mi. yd. haul on binder	.20	.18	.20	.20	.20
64 days rolling	15.00	25.00	10.00	15.00	15.00
1 each furnish roller	150.00	200.00	100.00	100.00	100.00
97 cu. yd. "A" concrete	27.00	30.00	30.00	27.00	26.00
6,700 lb. metal reinforcement	.07	.07	.07	.07	.06
2,600 lb. struc. steel	.15	.15	.15	.20	.10
580 sq. yd. mineralized asph. plank	3.15	2.80	3.00	3.15	2.50
150 cu. yd. cement rubble masonry	15.00	12.00	12.00	15.00	7.00
60 cu. yd. hand placed riprap	3.00	4.00	2.50	3.00	5.00
440 lin. ft. 12" corr. metal pipe	1.00	1.00	1.25	1.25	1.25
1,940 lin. ft. 18" corr. metal pipe	1.40	1.50	1.75	1.85	1.80
70 lin. ft. 24" corr. metal pipe	2.50	2.30	2.75	3.00	2.50
44 lin. ft. 30" corr. metal pipe	3.50	2.85	3.50	3.50	3.40
6 mi. scarifying	100.00	25.00	50.00	50.00	50.00
73 M. ft. BM tr. fir timber	90.00	95.00	100.00	90.00	90.00
6 m. ft. BM untr. fir timber	80.00	70.00	70.00	80.00	80.00
L. S. rem. lower girders & conc. Sta. 956-67.8	850.00	300.00	500.00	$1,000	200.00
L. S. rem. conc. & lower girders, Sta. 1305-97.3	850.00	300.00	500.00	$1,000	200.00
L. S. rem. conc. & lower girders, Sta. 1460-35	850.00	300.00	500.00	$1,000	200.00
2 ea. project markers	3.50	6.00	15.00	3.50	8.00
330 ea. right-of-way markers	2.30	3.50	3.00	2.50	3.00
1,200 tons maintenance material	.75	1.00	1.00	1.30	.85

Phoenix, Arizona—State—Grading, etc.—Gila County

Contract awarded to O. F. Fisher Construction Co., 516 S. Seventh Street, Phoenix, $184,783, by State Highway Commission, Phoenix, for grading and draining on the Globe-Showlow Highway beginning about 50 mi. northeast of Globe and extending northeasterly about 6.4 miles. Bids from:

(1) O. F. Fisher Constr. Co., Phoenix $184,783
(2) George W. Orr, Globe, Ariz. 188,202
(3) Lee Moor Contr. Co., El Paso 196,767
(4) Packard Constr. Co., Phoenix $223,530
(5) Daley Corp., San Diego 239,616
(6) Houser & Garnett, Glendale 286,649

Bids received on:	(1)	(2)	(3)	(4)	(5)	(6)
189,577 cu. yd. roadway excav. unclass	$.57	$.63	$.64	$.74	$.79	$.95
11,663 cu. yd. drainage excavation, uncl.	.75	.63	.52	.80	1.00	2.00
7,150 cu. yd. slides & overbreakage	.4275	.4725	.48	.555	.5925	.7125
2,849 cu. yd. struc. excav. unclass.	1.25	1.50	2.00	2.00	1.40	3.00
869 cu. yd. borrow excav. unclass.	.40	.50	.25	.80	.50	1.50
45,944 sta. yd. earthwork overhaul	.02	.03	.025	.04	.03	.04
5,481 cu. yd. mi. earthwork haul	.35	.40	.32	.40	.30	.40
1,378 cu. yd. reinf. steel bars	25.00	21.50	27.00	27.00	32.00	30.00
148,854 lbs. reinf. steel	.06	.045	.05	.06	.05	.06
70 lin. ft. 8" corr. metal pipe	1.20	1.10	1.30	.85	1.00	.80
862 lin. ft. 24" corr. metal pipe	2.75	2.85	2.80	2.50	3.00	2.50
106 lin. ft. 30" corr. metal pipe	3.50	3.40	3.50	3.25	3.50	3.00
840 lin. ft. 36" corr. metal pipe	5.35	5.00	5.00	5.00	5.40	5.00
558 lin. ft. 48" corr. metal pipe	10.00	8.00	6.47	8.50	9.00	8.00
310 lin. ft. 8" perforated C. M. P.	1.25	1.25	1.30	.85	1.00	1.00
50 cu. yd. plain riprap	2.50	2.50	2.50	3.00	3.00	8.00
1 each cattle guard	$500	$425	$450	$500	$500	$600
395 lin. ft. std. line fence	.10	.15	.10	.15	.10	.15
30 cu. yd. rock backfill over perf. C. M. P.	.60	2.00	2.50	3.00	3.00	5.00
98 ea. right-of-way markers	2.50	3.00	3.00	2.50	3.00	5.00
404 each guide posts	2.00	1.75	1.50	2.00	3.00	3.00

Denver, Colo.—Government—Grading—Yellowstone National Park

Award recommended to S. J. Groves & Sons, 509 Wesley Temple Bldg., Minneapolis, Minn., $145,577, by Bureau of Public Roads, Denver, Colo., for 6.255 mi. earthgraded and drained highway on Proj. RTEC 1-D-1, Grading of the Grand Loop Highway, located in Yellowstone National Park, Wyoming. Bids from:

(1) S. J. Groves & Sons, Minn. $145,577
(2) Morrison-Knudsen Co. 157,087
(3) Barnard-Curtis Co., Minn. 159,622
(4) Olof Nelson, Logan, Utah 166,049
(5) Taggart Const. Co., Cody $170,035
(6) A. O. Thorn, Springville 171,247
(7) The Lawler Corp., Butte 190,123
(8) Engineers estimate 180,038

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
52 acr. clearing and grubbing	$350	$350	$200	$350	$300	$250	$350	$350
170,000 cu. yd. unclass. excavations	.46	.55	.60	.56	.60	.57	.65	.60
6 mi. cut slope treatment	$400	$300	$600	$300	$300	$350	$550	$500
2,525 cu. yd. struc. excavation	1.25	1.50	1.25	1.50	1.00	1.25	1.50	2.50
400,000 Sta. yd. overhaul	.015	.01	.01	.02	.02	.0125	.02	.03
6,255 mi. finishing	$100	$200	$200	$250	$200	$250	$500	$350
7,000 cu. yd. mi. overhaul	.25	.20	.25	.25	.30	.25	.20	.25
46 cu. yd. "A" concrete	37.00	30.00	30.00	25.00	24.00	30.00	35.00	30.00
20 cu. yd. "B" concrete	37.00	30.00	28.00	25.00	20.00	30.00	35.00	28.00
155 cu. yd. masonry	25.00	23.00	20.00	20.00	20.00	25.00	26.00	25.00
6,500 lb. reinforcing steel	.10	.10	.10	.07	.07	.10	.08	.07
28 lin. ft. 8" corr. met. pipe	1.25	1.00	1.00	1.00	1.00	1.15	1.25	1.25
2,504 lin. ft. 24" corr. met. pipe	2.50	2.30	2.75	2.40	2.75	2.75	3.00	2.75
66 lin. ft. 30" corr. met. pipe	3.25	3.50	4.00	3.20	3.00	3.35	4.50	3.50
150 lin. ft. 36" corr. met. pipe	5.00	5.00	6.00	4.20	3.75	5.15	7.00	5.00
1,021 lin. ft. 12" vitr. pipe	1.50	1.00	1.00	2.00	3.50	1.90	1.50	2.00
260 cu. yd. handlaid rock embankm.	3.50	3.00	3.00	2.00	3.00	2.25	3.00	3.00
1,495 ft. 6" vitr. tile underdrain	1.00	1.00	.75	1.00	1.00	.85	1.00	1.00
3,150 lin. ft. wood guardrail	.80	1.00	.80	1.00	.90	1.15	1.00	1.00
L. S. maintenance of detours	$1,500	$1,500	$1,500	$1,500	$1,500	$1,500	$1,500	$1,500
1,650 lb. cast ir. gratings	.15	.10	.20	.15	.15	.15	.15	.12
1 ea. embankm. protector	25.00	25.00	25.00	20.00	15.00	15.00	20.00	10.00
10 sq. yd. stone paving	5.00	5.00	4.00	5.00	5.00	4.00	5.00	2.00
37,000 gal. liq. asph. SC-2	.12	.10	.12	.12	.09	.12	.14	.12
76 ac. roadside clean-up	50.00	50.00	45.00	75.00	75.00	$200	$100	30.00
L. S. miscellaneous work	$4,500	$4,500	$4,500	$4,500	$4,500	$4,500	$4,500	$4,500

CONSTRUCTION

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

Large Western Projects . . . . .

WORK CONTEMPLATED

Bond electon Oct. 31st by Pacheco Pass Water Dist., Hollister, to finance an earthfill dam and streambed improvements. Est. cost $364,000.

Sewage disposal plant, sewer line and tunnel for San Francisco. Bids in about 60 days. Est. cost $1,250,000.

Canal on Gila Valley Reclamation Project for Bur. of Reclamation. PWA allotment of $2,000,000 has been made.

Canals on Heart Mountain Div. of the Shoshoni Project, Wyoming, for U. S. Bur. of Reclamation. PWA allotment of $1,500,000 has been made.

Power plant, Diesel plant standby, and transmission line for Lodi, Calif. $466,000 in bonds have been voted.

California Division of Highways program for next biennium. Est. cost $21,545,370.

Ruby Dam and transmission lines for Seattle, Wn. PWA loan and grant of $13,500,000 has been applied for.

CALLS FOR BIDS

25.09 mi. pipeline for Metropolitan Water District, Los Angeles, bids to October 24th.

BIDS RECEIVED

518,000 cu. yd. coarse aggregate and 391,000 tons sand for Fort Peck Dam for U. S. Engr. Office. J. L. Shiely Co., St. Paul, $554,140, only bid.

Two 82,500 KVA generators for Boulder Dam Power Plant, for Bur. of Reclamation. General Electric Co., Schenectady, N. Y., $1,342,000, low.

CONTRACTS AWARDED

237 mi. of 230 KV steel tower transmission line for Metropolitan Water Dist. to Fritz Ziebarth, Long Beach, $407,246.

Electric conductor for transmission line for Metropolitan Water Dist. to Aluminum Co. of America, Pittsburgh, $614,316.

Steel towers for transmission line for Metropolitan Water Dist., to Pacific Coast Steel Co., Los Angeles, $402,300.

14.37 mi. gravel surfacing betw. Limon and Hugo for Colorado State Highway Dept., to Monohan & Kenney, Denver, $189,619.

1.8 mi. grading, etc., betw. Cooks and Underwood, for Director of Highways, Olympia, to Mirene Co., Portland, $210,058.

Steel sheet pile bulkhead for U. S. Coast Guard, Oakland, to Ben. C. Gerwick, San Francisco, $249,117.

Ogden Canyon concrete pipeline for Ogden, Utah, to American Concrete & Steel Pipe Co., L. A., $331,653.

4.103 mi. grading Secs. A and B, Rt. 61, Angeles Crest Natl. Forest Highway, for Bur. of Public Roads, S. F., to Guy F. Atkinson Co., S. F., $228,471.

4.17 mi. grading Brooks-Gordan Creek sec. of Wilson River Highway, for Oregon State Highway, Portland, to C. H. Leonard, Albany, $198,560.

Pleasant Valley Dam for Pleasant Valley Irrigation Dist., Phoenix, Ariz., to Pleasant-Hasler Const. Co., Phoenix, $650,000.

720,000 bbls. cement for Grand Coulee Dam, for Bur. of Reclamation: (1) To Superior Portland Cement Co., Seaboard Bldg., Seattle, $671,580; (2) To Lehigh Portland Cement Co., Old National Bank Bldg., Spokane, $191,880; (3) To Northwestern Portland Cement Co., Northern Life Tower, Seattle, $143,910; (4) To Spokane Portland Cement Co., Old National Bank Bldg., Spokane, $134,316; and (4) To Olympia Portland Cement Co., Ltd., Dexter Horton Bldg., Seattle, $239,900.

Street and Road Work . . . . .

CALLS FOR BIDS

PHOENIX, ARIZ.—Bids to 10 A. M., October 18th by Arizona State Highway Comm., Phoenix, for 0.3 mi. remov. and salvage old pavement, and plac. select. matl. pavement with cement concr. pavement within city limits of Holbrook, extending from the pavement on Porter Street, west on Oakland Avenue. 9-30

LOS ANGELES, CALIF.—Bids to 2 P. M., October 17th by Calif. Div. of Highways, L. A., for 1.5 mi. grading and asph. concr. paving betw. Verdugo Road and Flint Ridge Country Club, in LOS ANGELES COUNTY, Calif. 9-24

LOS ANGELES, CALIF.—Bids to 2 P. M., October 24th by Calif. Div. of Highways, State Bldg., L. A., for 0.8 mi. asph. concr. pav. through Newhall, betw. Railroad Avenue and Placenita Road in LOS ANGELES COUNTY, Calif. 10-1

LOS ANGELES, CALIF.—Bids to 2 P. M., October 24th by Calif. Div. of Highways, L. A., for 3.2 mi. place plant mix surf. betw. 4 mi. west of Westmoreland and Trifolium Canal, in IMPERIAL COUNTY, Calif. 10-1

LOS ANGELES, CALIF.—Bids to 2 P. M., October 24th by Calif. Div. of Highways, L. A., for const. an overhead crossing over A. T. & S. F. RR., ¼ mi. north of Del Mar, to be widened and approaches widened and paved with asph. conc. in SAN DIEGO COUNTY, Calif. 10-1

SACRAMENTO, CALIF.—Bids to 2 P. M., October 16th by Calif. Div. of Highways, Sacramento, for 3.8 mi. grading and asph. concr., OR conc. paving betw. 3.7 mi. North of Fairfield and 0.6 mi. South of Vacaville, in SOLANO COUNTY, Calif. 9-24

SACRAMENTO, CALIF.—Bids to 2 P. M., October 23rd by Calif. Div. of Highways, Sacramento, for 1.2 mi. water supply systems and irrigation systems; and concr. curbs and gutters to be const. and portions of roadway to be graded betw. "M" Street Subway and "M" Street Bridge and betw. Ben Ali Subway and Ben Ali Station, in YOLO and SACRAMENTO COUNTIES, Calif. 10-1

MISSOULA, MONT.—Bids to 10 A. M., October 16th by Bur. of Public Roads, Missoula, Mont., for 6.639 mi. const. or improv. the Georgetown Lake surf., slide removal and oil surfacing Proj. FHEC 17-A1, located in Deer Lodge Natl. Forest, DEER LODGE and GRANITE COUNTIES, Montana. 9-28

PORTLAND, ORE.—Bids to 10 A. M., October 16th by Bur. of Public Roads, Portland, Ore., for 6.539 mi. const. or improv. the Glacier Natl. Park, Transmountain Highway, West Side Reconstruction grading

NEWS SUMMARY

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and draining (Avalanche Creek to Lake McDonald Hotel Sect.), Proj. NR-1A, Unit 1, located in Glacier Natl. Park, FLATHEAD COUNTY, Montana. 9-28

BIDS RECEIVED

PHOENIX, ARIZ.—R. C. Tanner, Title & Trust Bldg., Phoenix, Ariz., $121,221 low to Ariz. State Highway Comm., Phoenix, for grading, draining and placing select material and A. B. C. on the Flagstaff-Fredonia Highway, beginning at the Indian Reseravtion boundary about 44 mi. north of Flagstaff and extending 8½ mi. northerly to Cameron, in COCONINO COUNTY, Ariz.

ALAMEDA, CALIF.—N. M. Ball & Sons, 1889 Yosemite Road, Berkeley, $10,480 low to Const. Quartermaster, S. F. and Vicinity, Fort Mason, Calif., for const. concr. pavement at Benton Field Air Depot, Alameda, Calif. 9-26

SACRAMENTO, CALIF.—Chas. Kuppinger, Box 356, Lakeport, Calif., $16,943 only bid submitted to Calif. Div. of Highways, Sacramento, for 0.12 mi. grading at Downieville, in SIERRA COUNTY, Calif. 9-25

DENVER, COLO.—Strong & Grant, Springville, Utah, $141,496 low to Bur. of Public Roads, Denver, Colo., for const. the Fishing Bridge Approaches, Parking Areas, etc., a distance of approx. .738 mi. on Proj. RTEC 1-E-1 Parking Area, 5-D-1, part D-2, and Secondary Roads of the Grand Loop and East Entrance Highway, located in Yellowstone Natl. Park, Wyoming. 9-16

DENVER, COLO.—Edward Selander, Greeley, Colo., $13,359 low to State Highway Dept., Denver, Colo., for 0.475 mi. paving on Eleventh Avenue, betw. Fifteenth Street and Tenth Street, in Greeley, Colo. 9-19

DENVER, COLO.—Bids received as follows by State Highway Dept., Denver, for: (1) DOLORES CO. (FAP 269-C),—C. A. Switzer, Arvada, Colo., $103,460 low for 4.602 mi. grav. surf. betw. Cortez and the Colorado-Utah State Line on St. Highway No. 10. (2) LINCOLN CO. (FAP 278-I)—Monohan & Kenney, 56 Steele Street, Denver, $189,619 low for 14.370 mi. grav. surf. betw. Limon and Hugh on St. Rd. No. 8. (3) LAS ANIMAS CO. (FAP 267-G)—Pople Bros. Const. Co., Trinidad, Colo., $48,298 low for 5.415 mi. grav. surf. betw. Tyrone and Delhi on St. Highway No. 12. 9-20

DENVER, COLO.—Bids received as follows by State Highway Dept., Denver, Colo, for: (1) DELTA CO. (FAP 23 A. R.)—J. B. Claybaugh, Grand Junction, Colo., $96,914 low for 5.657 mi. grav. surf. betw. Delta and Montrose on St. Highway No. 6. (2) GRAND CO (FAP 151-E)—Switzer & Horner, Arvada, $64,563 low for 3.529 mi. grav. surf. betw. Granby and Hot Sulphur Springs, on State Highway No. 2. 9-20

DENVER, COLO.—Sacra, Watts & Loudermilk Bros., 383 S. Vine Street, Denver, $128,195 low to State Highway Comm., Denver, for 1.545 mi. grav. surf. betw. Loveland and Drake on St. Highway No. 16, in LARIMER COUNTY (FAP 9R3), Colo.

CONTRACTS AWARDED

PHOENIX, ARIZ.—To Geo. W. Orr, Globe, Ariz., bid $133,997 to Bur. of Pub. Roads, Phoenix, Ariz., for 25.303 mi. placing laykold asph. conc. on Secs. A, B1 and 2, Rt. 1, all of Rt. 2, Peterif. For. Natl. Monum., APACHE and NAVAJO COUNTIES, Ariz. 9-20

PHOENIX, ARIZ.—To Lee Moor Contracting Co., Bassett Tower, El Paso, Texas, $25,830 by Bur. of Public Roads, Phoenix, for 31.969 mi. placing seal coat on Section H, Rt. 1, all of Rt. 10, Grand Canyon Natl. Park and on Secs. A, B, C, D and E of Cameron-Desert View Approach to Grand Canyon Natl. Park, COCONINO COUNTY, Arizona. 9-24

PHOENIX, ARIZ.—Awards as follow by State Highway Comm., Phoenix, for (1) MOJAVE COUNTY (80G)—To Lee Moor Co., 807 Bassett Tower, El Paso, Texas, $92,885 for oil processing by either road mix or plant mix method using SC-2 road oil on the Ashfork-Kingman Highway, extending from Kingman northeasterly about 23.6 mi. (2) GILA COUNTY (99H)—To O. F. Fisher, 516 S. Seventh St., Phoenix, $185,783 for grading and draining on the Globe Showlow Highway, beginning about 50 mi. northeast of Globe and extending northeasterly about 6.4 mi. 9-26

PHOENIX, ARIZ.—Award recommended to Bennett & Taylor, 1978 South Los Angeles Street, L. A., $36,136 to Bur. of Public Roads, Phoenix, Ariz., for 4.218 mi. grading Section C of Rt. 11, the Payson-Colcord Mountain Natl. Forest Highway, Tonto Natl. Forest, GILA COUNTY, Arizona. 10-1

LOS ANGELES, CALIF.—To R. E. Hazard Contracting Co., P. O. Box 1438, San Diego, $24,354 by Calif. Div. of Highways, Los Angeles, for 2.4 mi. plant mix surfacing medium curing type to be placed, shoulders to be constructed and road mix surface treatment applied at various locations betw. 4 mi. east of Bostonia and 2 mi. east of Alpine in SAN DIEGO COUNTY, Calif. 9-6

LOS ANGELES, CALIF.—To Basich Bros., 20550 Normandie Ave., Torrance, $71,074, by Calif. Div. of Highways, Los Angeles, for 42.6 mi. roadmix surface treatment and seal coat to be applied betw. northerly boundary and Baker in SAN BERNARDINO, Calif. 9-13

LOS ANGELES, CALIF.—Awards as follows by Calif. Div. of Highways, Los Angeles, for: (1) SAN BERNARDINO and KERN CO., to Basich Bros., 20550 Normandie Ave., Torrance, $39,581 for 27.4 mi. roadmix. surf. tr. and seal ct. applied betw. Johannesburg and Rt. 58. (2) LOS ANGELES CO., to Oscar Oberg, 150 N. Vista St., Los Angeles, $14,942 for const. portion of timb. bridge across Los Angeles River at Olive Street, near Compton, consisting of 8 38-ft. truss spans and reconst. exist. 90-ft. trestles. 9-17

MARYSVILLE, CALIF.—Awards as follow by District Engr., Calif. Div. of Highways, Marysville, for: (1) NEVADA, PLACER and BUTTE CO., to Hayward Bldg. Matl. Co., Hayward, $13,263, for 18.8 mi. class "A" and "B" seal coat treatm. betw. Nevada City and Washington Road; betw. Placer-Nevada County line and Soda Springs and betw. Oroville and Junction of Rts. 3 and 87, south of Chico. (2) BUTTE YOLO, COLUSA and EL DORADO CO., to Hayward Bldg. Matl. Co., Hayward, $13,870 for 27.1 mi. seal coat treatm. class "A"' "B" and "C" betw. Chico and Tehama County line; betw. Davis, Wye and Woodland; betw. Maxwell and Delevan; betw. Placerville and RR crossing; betw. Riverton and Kyburz; and betw. 2.5 mi. east of Lake-Colusa County line and 5.5 mi. east. 9-4

SACRAMENTO, CALIF.—Contract has been reawarded to A. S. Vinnell, 969 Amelia Avenue, Los Angeles, $26,010 (award previously made to

Jack Casson, Hayward, $16,414) by Calif. Div. of Highways, Sacramento, for 30.5 mi. roadmix surf. treatment to be applied betw. Johannesburg and Rt. 23, in KERN COUNTY, Calif. 9-30

SACRAMENTO, CALIF.—Awards as follow by the Calif. Div. of Highways, Sacramento, for: (1) MARIN COUNTY—To Healy Tibbitts Const. Co., 64 Pine Street, S. F., $15,000 for 0.4 mi. slides to be removed betw. Greenbrae and Alto. (2) KERN COUNTY—To Basich Bros., 20550 Normandie Avenue, Torrance, $6,950 for 5 mi. grading between 2 mi. southwest of Searles and Rademacher. 9-24

SACRAMENTO, CALIF.—To Heafey Moore Co., 344 High St., Oakland, $14,395 by County Clerk, Sacramento, for resurf. Rio Lindo Blvd. with asph. concr. 9-10

SACRAMENTO, CALIF.—To A Teichert & Son, Inc., 1846 Thirty-seventh St., Sacramento, $34,424 by County Clerk, Sacramento, for resurf. Fair Oaks Blvd. with asph. conc. 9-10

SACRAMENTO, CALIF.—To Lee J. Immel, 1031 Evelyn Ave., Berkeley, $12,518 by County Clerk, Sacramento, for placing armor coat on Franklin Blvd. 9-10

SACRAMENTO, CALIF.—To E. L. Yeager, P. O. Box 470, San Bernardino, $15,416 by Calif. Div. of Highways, Sacramento, for 21.2 mi. apply seal coat betw. Estrella River and easterly boundary in SAN LUIS OBISPO COUNTY, Calif. 9-10

SACRAMENTO, CALIF.—To C. W. Wood, Box 49, Stockton, $62,200 by Calif. Div. of Highways, Sacramento, for 54 mi. roadmix surf. treatment betw. Panamint Sink and San Bernardino County Line in INYO COUNTY, Calif. 9-10

SACRAMENTO, CALIF.—To Dunn & Baker, Klamath Falls, Oregon, $43,211 by Calif. Div. of Highways, Sacramento, for 19.7 mi. light armor coat applied betw. Fall River and Nubieber, in SHASTA and LASSEN COUNTIES, Calif. 9-16

SAN FRANCISCO, CALIF.—Award recommended to Frank C. Cuffe, San Rafael, $17,700 by Bur. of Public Roads, S. F., for 0.883 mi. grad. and plac. subgr. reinforcm. on Sec. H of Rt. 77, the Mt. Shasta-Mt. Lassen Natl. Forest Highway, Shasta Natl. Forest, SHASTA COUNTY. 9-24

SAN FRANCISCO, CALIF.—To L. F. Piazza, 296 N. Sixth St., San Jose, $16,939 by Bur. of Public Roads, San Francisco, for 9.603 mi. placing subgr. reinforcement on portions of Sec. F and G of Rt. 21, the Deer Creek Meadows National Forest Highway, Lassen National Forest, BUTTE and TEHAMA COUNTIES, Calif. 9-3

SAN FRANCISCO, CALIF.—To Jack Casson, 319 Warren St., Hayward, $29,698 by Bur. of Public Roads, S. F. for 20.699 mi. bitum. treatm. on Sec. A of FLHP No. 6, Lava Beds, Modoc County, Calif., and on Secs. B and C of Rt. 11, the Lava Beds Natl. For. Highw., MODOC COUNTY. 9-3

SAN FRANCISCO, CALIF.—To Fredrickson & Watson and Fredrickson Bros., Oakland, and Jones & King, Hayward, $14,792 by Bur. of Public Roads, S. F., for 13.323 mi. bitum. tr. cr. rock base course on Secs. D3 and D4, Rt. 1, Generals Highway, Sequoia Natl. Park, and on Sec. A, General Grant-Sequoia Park Apr. Road, Sequoia Natl. Park, TULARE CO., Calif. 9-4

SAN FRANCISCO, CALIF.—To Guy F. Atkinson Co., Russ Bldg., San Francisco, $228,471 by Bur. of Public Roads, S. F., for 4.103 mi. grading Secs. "A" and "B" of Rt. 61, the Angeles Crest Natl. Forest Highway, Angeles Natl. Forest, LOS ANGELES CO., Calif. 9-11

SAN FRANCISCO, CALIF.—To M. J. B. Const. Co., 319 Elks Bldg., Stockton, $72,733 by Bur. of Public Roads, S. F., for 7.206 mi. placing cr. grav. base course on Sec. C of Rt. 38, Sonora Pass Natl. Forest Highway, Stanislaus Natl. Forest, TUOLUMNE CO., Calif. 9-20

SAN JOSE, CALIF.—To Union Paving Co., Call Bldg., San Francisco, $41,879 by County Board of Superv., San Jose, for resurf. with asph. concr. on Stevens Creek Road, betw. Saratoga Ave. and the Saratoga-Sunnyvale Road in Superv. District No. 4. 9-16

SAN RAFAEL, CALIF.—To E. A. Forde, 640 Sir Francis Drake Boulevard, San Anselmo, $12,620 by County Clerk, San Rafael, for constructing portions of County Highway in Road. Dist. No. 3, Marin County, Calif. 9-11

UKIAH, CALIF.—To Barton & Ells, Ft. Bragg, Calif., $18,984 by County Clerk, Ukiah, for grading a portion of Leggett Valley-Rockport Road. 9-10

WILLOW GLENN, CALIF.—To A. J. Raisch, 358 Lincoln Avenue, San Jose, $10,156 by City Clerk, Willow Glen, Calif., for asph. concr. resurfacing of Lincoln Avenue betw. Willow Street and Minnesota Ave. 9-24

DENVER, COLO.—To S. J. Groves & Sons, 509 Wesley Temple Bldg., Minneapolis, Minn., who bid $145,577 to Bur. of Public Roads, Denver, Colo., for 6.255 mi. earthgraded and drained highway on Project RTEC 1-D-1, grading of the Grand Loop Highway, located in Yellowstone Natl. Park, Wyoming. 9-28

DENVER, COLO.—To C. V. Hallenbeck, 251 Klamath Street, Denver, Colo., $78,800 by Bur. of Public Roads, Denver, Colo., for 5.4 mi. slope stabilization of the Fall River Highway, located in Rocky Mountain Natl' Park, PEC 1-A, B, C, Colorado. 9-28

DENVER, COLO.—To Dudley Stone Products Co., Inc., El Paso, Texas, $79,127 by Bur. of Public Roads, Denver, for improving Project 31-E of the Carrizozo-Roswell Forest Highway Rt., located in Lincoln Natl. Forest, LINCOLN COUNTY, New Mexico. 9-20

DENVER, COLO.—To Henry Thygeson, Albuquerque, New Mexico, $33,890 by Bur. of Public Roads, Denver, Colo., for 3.726 miles earthgraded and drained highway on Project 16-A of the Ellis Loop Forest Highway, located in Cibola Natl. Forest, SANDOVAL CO., New Mexico. 9-14

DENVER, COLO.—Award recommended to Larson Const. Co., 1902 Blake St., Denver, Colo., $31,536 by Bur. of Public Roads, Denver, Colo., for 4.483 mi. dense graded bitum. roadmix surf. on the Deer Ridge-Moraine Park Highway, located in Rocky Mountain Natl. Park, LARIMER COUNTY, Colo. 9-14

DENVER, COLO.—Award recommended to J. C. Maguire Const. Co., 208 Lewisohn Bldg., Butte, Mont., $122,894 by Bur. of Public Roads, Denver, Colo., for 16.943 mi. dense graded bitum. plant-mix surf. on Project RTEC 1-H1, H2, H4 on the Grand Loop Highway, Yellowstone Natl. Park, Wyoming. (See Unit Bid Summary.) 9-14

DENVER, COLO.—To Ed. H. Honnen Construction Co., Colorado Springs, Colo., $47,381 by Bur. of Public Roads, Denver, Colo., for 3.563 mi. const. or improving Project 29-C of the Boulder-Idaho Springs Forest Highway Route, located in Roosevelt National Forest, GILPIN COUNTY, Colo. 9-3

DENVER, COLO.—To Hamilton & Gleason, 505 Tramway Bldg., Denver, Colo., $74,525 by Bur. of Public Roads, Denver, Colo., for const. approx. 13.579 mi. open graded bitum. road mix on Project 54-A2 to E2 of the Mount Evans Forest Highway Route, located in Pike Natl. Forest, CLEAR CREEK COUNTY, Colo. 9-11

BOISE, IDAHO—Awards as follow by Comm. of Public Works, Boise, Idaho, for: (1) TWIN FALLS CO. (WPMH 141-C)—To Dan J. Cavanagh, Twin Falls, Idaho, $41,528 for 3.594 mi. const. roadbed, drainage struc., including 92.9 feet concrete bridge and placing subbase gravel on Sawtooth Highway, betw. Godwin and Curry Junction. (2)

JEROME CO. (WPH 37-J, SAP 39-E)—To Dan J. Cavanagh, Twin Falls, Idaho, $27,561 for 4.971 mi. const. roadbed and drainage struc. on North Side Highway, east of Hazleton. 9-25

BOISE, IDAHO—To Triangle Const. Co., 1220 Ide Street, Spokane, Wn., $133,476 by Comm. of Public Works, Boise, Idaho, for 12.854 mi. roadbed, drainage struc. and cr. rock surf. on the Arrowrock-Boise Basin Highway, betw. Arrowrock Junction and Stierman in ADA and BOISE COUNTIES, FAP 145-B, Idaho. (See Unit Bid Summary.) 9-23

BOISE, IDAHO—Awards as follow by Commissioner of Public Works, Boise, for: (1) BOISE CO. (FAP 145-B) to Triangle Const. Co., 1220 Ide St., Spokane, Wn., $133,476 for 12.845 mi. roadbed, drainage struc. and cr. rock surf. on the Arrowrock-Boise Basin Highway betw. Arrowrock Junc. and Stierman. (2) PIERCE and CLEARWATER CO. (SAP 223) to Triangle Const. Co., 1220 Ide St., Spokane, $66,892 for 6.166 mi. grading, draining and surf. with cr. rock on the Clearwater Highway betw. Weippe and Pierce. 9-18

BOISE, IDAHO—Awards as follow by Commissioner of Public Works, Boise, for: (1) BANNOCK CO. to Hoops Constr. Co., Twin Falls, Idaho, $84,086 for 1.184 mi. const. roadbed, drain., struc. and cem. concr. paving on Old Oregon Trail in McCammon and 1.179 mi. of the Yellowstone Park Highway in Arimo. (2) TETON CO., to Gibbons & Reed, 165 E. Fourth South, Salt Lake City, Utah, $43,796 for 7.618 mi. const. roadbed and drainage struc. on the South Yellowstone Highway, betw. Driggs and Tetonia in Teton Co. 9-10

GREAT FALLS, MONT.—Awards as follow by State Highway Commission, Great Falls, for: (1) GLACIER CO. (FAP 196B and 226), to S. Birch & Sons Const. Co., Great Falls, Mont., $104,096 for 16.165 mi. surfacing with gravel subbase matl. and a top course of pl. mix. bitum. tr. cr. gravel on U. S. Highway No. 2. (2) GARFIELD CO. (FAP 256E, F and G), to Inland Const. Co., 3867 Leavenworth St., Omaha, Nebr., $94,561 for 53.131 mi. base couse cr. grav. on Sec. E, F and G of the Grass Range-Jordan Road. (3) CUSTER AND FALLON CO., to Inland Const. Co., 3867 Leavenworth St., Omaha, Nebr., $111,667 for 66.616 mi. bitum. surf. tr. on existing crushed gravel and cr. scoria surf. courses on Sec. A, D and E of Miles City-North Dakota Line Road. 9-3

GREAT FALLS, MONT.—Awards as follow by State Highway Commission, Great Falls, Mont, for: (1) JUDITH BASIN CO. (FAP 235H, Unit 1) to E. A. Studer & Sons, Excelsior, Minn., $114,624 for 12.101 mi. grad., surf. with gravel subbase matl. and with bitum. surf. tr. course of cr. gravel and const. small drain, struc. on Sec. H of the Armington-Lewistown Road. (2) FLATHEAD CO. (FAP 257-D, Unit 1), to Poston Bros., Kalispell, Mont., $86,364 for 5.337 mi. grading, surf. with grav. subbase, and with bitum. surf. tr. top course of cr. grav. and const. small drain. struc. on Sec. "D" of Kalispell-Belton Road. (3) BROADWATER and MEAGHER CO. (FAP 264-C) to McNutt Bros., 351½ E. Broadway, Eugene, Ore., $101,696 for 10.465 mi. grading, surf. with grav. subbase matl. and with bitum. surf. tr. top course of cr. grav. and const. small drain. str. on Sec. "C" of the Townsend-White Sluphur Springs Road. (4) RICHLAND CO. (FAP 325 A, B and C) to S. J. Groves & Sons, Wesley Temple Bldg., Minneapolis, Minn., $28,548 for 11.265 mi. const. bitum. tr. surf. course by roadmix method on Sidney-Fairview Road. (5) CARBON CO. (USPW-NRH 106B), to Woodward & Johnson, Joliet, Mont., $15,788 for filling of old borrow pits on Sec. B of Red Lodge-Rockvale Road. (6) FALLON CO. (FAP 86-C, Unit 3), to McNutt Bros., 351½ E. Broadway, Eugene, Ore., $75,327 for 8.436 mi. regrading, surf. with grav. subbase matl. and with top course of bitum. surf. tr. cr. grav. and const. small dr. struc. on Sec. C of the Miles City-North Dakota Line Road. (7) RAVALLI CO. (FAP 174A, 174B, 174C, 139B and 139C), to J. C. Maguire, Lewishon Bldg., Butte, Mont., $50,931 for 16.715 mi. const. an oil tr. footpath in Darby and Hamilton and and bituminous treated by roadmix method of existing top course of crushed gravel on U. S. Highway No. 93. 9-3

CARSON CITY, NEV.—Awards as follow by Nevada Highway Comm., Carson City, for: (1) CHURCHILL and LANDER CO., to Frederickson & Watson, Frederickson Bros., and Jones & King, Fernley, Nev., $110,794 for 9.68 mi. const. portion of St. Highway system from 8 mi. E. of Eastgate to Campbell Cr. Ranch on Rt. 2, Sec. F and A. (2) NYE COUNTY—To Dodge Const., Inc., Fallon, Nev., $89,837 for 24.21 mi. const. a portion of the St. H'way system. betw. 3 mi. north of Springdale and 6 mi. south of Stonewall Pass, Rt. 5, Secs. H2, J and K. 9-11

CARSON CITY, NEV.—Awards as follow by the Nevada State Highway Comm., Heroes Memorial Bldg., Carson City, for: (1) HUMBOLDT COUNTY—To Nevada Rock & Sand Co., Reno, Nev., $103,598 for 18.60 mi. cr. gravel or stone surf. from Paradise Hill to Orovada, Rt. 8, Sec. 3, FAP 132 (1936). (2) STOREY and WASHOE COUNTIES—To Utah Const. Co., First National Bank Bldg., Ogden, Utah, $141,419 for 3 mi. grading and surfacing from 8 mi. to 5 mi. southeast of Brown's (Geiger Grade) on Rt. 17, Section A, Proj. WPH 95A (1936). (See Unit Bid Summary.) 9-18

SANTA FE, NEW MEXICO—Awards as follow by State Highway Comm., Santa Fe., for: (1) DE BACA COUNTY (FAP 97-E)—To Walter H. Denison, Las Vegas, N. M., $144,994 for 16.975 mi. grad., surf. minor dr. struc., 1 triple concr. box culv. etc., on U. S. Highway No. 60, betw. Vaughn and Fort Sumner. (2) GUADALUPE COUNTY (FAP 179-A)—To Cook & Ransom, Ottawa, Kans., $143,992 for 15.059 mi. grading, surf, minor drain. struc. and misc. const. work on U. S. Highway No. 6, betw. Santa Rosa and Albuquerque. 9-20

PORTLAND, ORE.—Award recommended to Lucich & Co., 3001 Twenty-first Avenue, South, Seattle, Wn., $40,780 (METAL PIPE) by Bur. of Public Roads, Portland, Ore., for const. 1.894 mi. on the Randle-Yakima East Side Highway Grading project, 13-R, located in the Snoqualmie Natl. Forest, YAKIMA COUNTY, Wn. 9-26

PORTLAND, ORE.—To Northwest Const. Co., 3950 Sixth N. W., Seattle, Wn., $82,754 (METAL PIPE) by Bur. of Public Roads, Portland, for 4.620 mi. grading Project 6-A7, in Mt. Baker Natl. Forest, WHATCOM COUNTY, Wn. 9-14

PORTLAND, ORE.—To Elliott & Co., Inc., Insurance Bldg., Seattle, Wn., $189,026 (METAL PIPE) by Bur. of Public Roads, Portland, for 1.167 mi. const. or improv. the Mt. Rainier Natl. Park-Stevens Canyon Highway, Project 4-C2, grading and tunnel, located in the Mt. Rainier Natl. Park, LEWIS COUNTY, Wn. 9-14

PORTLAND, ORE.—To Chas. H. Leonard, Albany, Ore., $198,560 by Oregon State Highway Comm., Portland, for 4.17 mi. grading on Brooks-Jordan Cr. Section of Wilson River Highway in TILLAMOOK COUNTY, Ore. (WPH 191-C). (See Unit Bid Summary.) 9-10

PORTLAND, ORE.—To Warren Northwest, Inc., P. O. Box 5072, Portland, Ore., $6,850 by U. S. Engineer Office, Portland, for const. asphaltic concr. paving at Bonneville, Ore., under Spec. 694-36-32. 9-10

PORTLAND, ORE.—Award recommended to Heller & Gillgannon, Scapoose, Ore., $24,750 by Bur. of Public Roads, Portland, for constructing or improving the South Fork Stillaguamish Clearing Proj. 7-D, located in Mt. Baker Natl. Forest, SNOHOMISH COUNTY, Wn. 9-19

PORTLAND, ORE.—Awards as follow by Oregon State Highway Comm., Portland, for: (1) MULTNOMAH and WASHINGTON COUNTIES—To Harold Blake, 3043 S. E. Carlton, Portland, $34,538 for 1.45 mi. paving on West Portland-Washington County Line Section of West Side Pacific Highway (NRH 203-B and NRH 73). (2) CLACKAMAS COUNTY (FAP 168-A, 168-B and 168-C)—To Edlefsen-Weygandt Co., Peninsular Way and Columbia Blvd., Portland, $132,710. (3) CROOK COUNTY (FAP 175-A)—To Chas. H. Leonard, Albany, Ore., $71,526 for 5.5 mi. regrading, surfacing, oil mat surfacing and furn. cr. matl. in stockpiles on Prineville Ochoco Dam Section of Ochoco Highway. 9-7

PORTLAND, ORE.—Awards as follow by Oregon State Highway Comm., Portland, for: (1) HARNEY COUNTY (FLHP 4-G)—To J. A. Lyons, 3305 N. E. Halsey Street, Portland, $24,662 for 0.59 mi. grading on Nigger Flat Sec. of Central Oregon Highway. (2) LAKE COUNTY (FAP 136-C)—To Babler Bros., 2407 N. W. 28th Ave., Portland, $94,755 for 15.5 mi. grav. surf. and 16.4 mi. roadmix or pl. mix surf. treatment on Horse Ranch-Silver Lake Section of Fremont Highway. (3) MALHEUR COUNTY (FAP 187-D and FLHP 4-F)—To McNutt Bros., 351½ Broadway, Eugene, $68,348 for 5.79 mi. grading on Chimney Creek-Junctura Sec. of Central Oregon Highway. 9-7

OGDEN, UTAH—To G. L. Arnett & Son, Sandpoint, Idaho, $41,377 by Bur. of Public Roads, Ogden, Utah, for 1.950 mi. grad. and surf. the Priest River Road, located in Kaniksu Natl. Forest, Proj. 6-B, BONNER COUNTY, Idaho. 9-28

SALT LAKE CITY, UTAH—To Floyd S. Whiting, Salina, Utah, $20,225 by Utah State Road Comm., Salt Lake City, for 4.728 mi. gravel surf. road betw. Koosharem Reservoir and Loa in SEVIER COUNTY, Utah. 9-23

SALT LAKE CITY, UTAH—To Reynolds-Ely Const. Co., Springville, Utah, $45,485 by Utah State Road Comm., Salt Lake City, for 4.024 mi. plant mix bitum. surf. road betw. Echo Junction and Coalville, FAP 60-A and 76-A in SUMMIT COUNTY, Utah. 9-10

EPHRATA, WN.—To Diesel Oil Sales Co., 2155 N. Lake Ave., Seattle, $17,414 by County Comm., Ephrata, for 5.63 mi. bit. surf. rdmix. method on Sec. Rd. No. 20. 9-10

EPHRATA, WN.—To Joslin & McAllister, 3038 E. Trent Ave., Spokane, Wn., $28,700 by County Comm., Ephrata, for 14.36 mi. grad. and surf. on Sec. Highway No. 16, beginning at E. city limits of town of Wilson Creek and extending northerly, in Washington. 9-10

OLYMPIA, WN.—Awards as follows by Director of Highways, Olympia, for: (1) SNOHOMISH COUNTY (PWP 5960)—To J. D. Harms, Inc., First Ave. So. and Hudson Street, Seattle, $192,045 for 4.2 mi. grad. drain. and const. tr. pile and timber trestles on St. R. No. 1, Island School-North. (2) STEVENS COUNTY (WPH 154-E)—To Fred G. Redmon, 303 So. Fifth Ave., Yakima, Wn. $22,987 for 1.9 mi. grad., drain. and surf. with cr. stone on St. Rd. No. 3, Colville to Palmers Siding, Wn. (3) SKAMANIA COUNTY (WPH 112-H)—To Mirene Co., P. O. Box 5686, Kenton Sta., Portland Ore., $210,058 for 1.8 mi. grad., drain., etc. on St. Rd. No. 8, Cooks East to Underwood West, Sec. 3. (4) STEVENS COUNTY (PWP 7570)—To Tony Marrazzo, E. 618 Dalton St., Spokane, Wn., $30,267 for 2.0 mi. grading, draining and surf. with cr. stone on St. Rd. No. 22, Onion Creek to Hudson Spur. 9-19

OLYMPIA, WN.—Awards as follow by Director of Highways, Olympia, for: (1) SKAMANIA COUNTY (FAP 112-F)—To Colonial Const. Co., W. 326 First Ave., Spokane, Wn., $182,962 for 1.3 mi. clearing, grading and draining on St. Road No. 8, Cooks East to Underwood West, Section 2. (2) LINCOLN COUNTY (FAP 133-F)—To F. R. Hewitt, 420 W. 22nd Ave., Spokane, Wn., $46,386 for 3.9 mi. grading, draining and surfacing with cr. stone on St. Rd. No. 11, Sprague East. (3) SNOHOMISH COUNTY (FAP 189-D)—To Goodfellow Bros., Inc., Box 1332, Wenatchee, Wn., $85,221 for 1.4 mi. clearing, grading, draining and surf. with cr. stone on St. Rd. No. 15, Index East, Sec. "A", (4) SNOHOMISH COUNTY (PWP 7713)—To Goodfellow Bros., Inc., Box 1332, Wenatchee, Wn., $236,864 for 2.9 mi. clearing, grading, draining, surf. with cr. stone and const. a timber-framed trestle on St. Rd. No. 15, Index East, Sec. "B". (5) GRANT COUNTY (NRS 217-A)—To F. R. Hewett, 420 W. 22nd Ave., Spokane, Wn., $55,288 for 13.4 mi. grad. and surf. on County Road, Burke to Neppel, Sec. 2, Unit 2. (6) CHELAN COUNTY (FAP 190-C)—To Fred G. Redmon, 303 S. Fifth Ave., Yakima, Wn., $48,633 for 6.2 mi. ballasting and surfacing with cr. stone in St. Road No. 15, Crescent Creek to Merritt. 9-13

RITZVILLE, WN.—To Johnson & Monarch, Ritzville, Wn., $21,438 by County Board of Comm., Ritzville, for 6.5 mi. grading, draining and surfacing on Secondary Highway No. 15, known as the Lauer South road. 9-3

SPOKANE, WN.—To A. L. Mitchell & Sons, 1827 West Ninth Ave., Spokane, Wn., $17,549 by Board of County Comm., Spokane, for 15.62 mi. crushed gravel surf. on Bradshaw Road from Fairfield to State Line and Truez Road from Fairfield to the State Line. 9-18

CHEYENNE, WYO.—To Read & Vaudchi, Cheyenne, Wyo., $28,148 by State Highway Comm., Cheyenne, Wyo., for 1.088 mi. reconst. and landscaping on the Cheyenne (North Entrance) Road. 9-16

CHEYENNE, WYO.—Awards as follow by State Highway Comm., Cheyenne, Wyo., for: (1) PLATTE COUNTY (FAP 43-R and 10-R)—To John M. Kaehey, Buffalo, Wyo., $29,708 for 1.441 mi. grad., drain., base course, surf., and misc. work; also const. 1 tr. timb. bridge, 1 reinf. conc. culv., on Wheatland-Bosler Road. (2) PARK COUNTY (FAP 213-B)—To Ed Peterson, W. O. W. Bldg., Omaha, Nebr., $133,190 for 8.594 mi. grad., drain., base course surf. and misc. work, incl. 2 reinf. concr. culv. and 1 tr. timb. bridge on Thermopolis-Meeteetse Road. (3) WASHAKIE COUNTY (FAP 108 DR and 108 ER) —To Johnig & Davis, Britton, S. D., $156,362 for 10.347 mi. grad., dr., etc. on Worland-Tensleep Road. (4) SHERIDAN COUNTY (NRH 28A and NRH, 179A and NRH 42 comb.)—To R. Spatz, Cheyenne, Wyo., $18,576 for 4.866 mi. oil tr. by road mix method on Sheridan-Ranchester and Big Goose Cree Roads. (5) CARBON COUNTY (FAP 174-B)—To Blanchard Bros., 1641 S. Logan St., Denver, Colo., $111,175 for 19.578 mi. grading, etc. on the Walcott-Saratoga road. 9-16

Bridges and Culverts . . . . . .

BIDS RECEIVED

JUNEAU, ALASKA—Siems-Spokane Co., Realty Bldg., Spokane, Wn., $7,827 low to Bur. of Public Roads, Juneau, Alaska, for const. and improving 0.326 mi. of the Glacier Highway Montana Creek Bridge, Alaska. 9-14

LOS ANGELES, CALIF.—Oscar Oberg, 150 N. Vista Street, L. A., $14,943 low to Calif. Div. of Highways, State Bldg., L. A., for const. a portion of timb. bridge across Los Angeles River at Olive Street, near Compton, consisting of eight 38-foot truss spans and reconst. 90 ft. of trestle in LOS ANGELES COUNTY, Calif. 9-12

DENVER, COLO.—R. L. Hanes, Denver, Colo., $22,769 low to State Highway Comm., Denver, Colo., for const. a steel and conc. bridge with gravel surf. approaches on 0.056 mi. located north of Springfield on State Highway No. 59, Project FAP 6-E in BACA COUNTY, Colorado. 9-20

CONTRACTS AWARDED

PHOENIX, ARIZ.—To Clinton Campbell Const. Co., Phoenix, $9,590 by Arizona State Highway Comm., Phoenix, for removal of old bridge over Consolidated Canal, 2 mi. east of Mesa on the Mesa-Superior Highway and const. of new three-span conc. bridge in MARICOPA COUNTY, Arizona. 9-26

EUREKA, CALIF.—To Frank Bryant, 2911 Twenty-third St., S. F., $26,400 by Bd. of Superv., Eureka, for rectnst. of bridge over Eel River at Fort Seward. 9-3

EUREKA, CALIF.—To Fred J. Maurer & Son, Inc., Eureka, $6,380 by County Board of Superv., Eureka, for bridge across Dobbyn Creek, betw. Blocksburg and Alderpoint, in Road Dist. No. 2, HUMBOLDT COUNTY, Calif. 9-11

SACRAMENTO, CALIF.—To John Carcano, 122 Clarinda Avenue, San Rafael, $13,777 to Calif. Div. of Highways, Sacramento, for const. reinf. concrete girder bridge across Sonoma Creek, 7 mi. north of Sonoma, consisting of three 52-ft. spans on conc. piers and abutments in SONOMA COUNTY, Calif. 9-24

SAN JOSE, CALIF.—To J. D. Carlson, 1331 Sierra Ave., San Jose, $4,766 by County Board of Superv., San Jose, for reinf. concrete bridge across Stevens Creek on Moffett Blvd. in Superv. Dist. No. 5. 9-16

DENVER, COLO.—To Schwartz Const. Co., Everhart Bldg., Colorado Springs, Colo., $10,027 by State Highway Dept., Denver, Colo., for repairing and const. a steel and concr. bridge across the Republican River, located between Flagler and Seibert, on State Highway No. 4 in KIT CARSON COUNTY, Colo., ERP No. 7. 9-10

DENVER, COLO.—Awards as follow by State Highway Dept., Denver, for: (1) ARAPAHOE COUNTY (ERP No. 1)—To F. M. Kenney, P. O. Box 956, Denver, $35,170 for const. bridge and repairing present bridge across West Bijou Creek west of Byers on St. Highway No. 8. (2) ARAPAHOE COUNTY (ERP No. 2)—To F. M. Kenney, P. O. Box 956, Denver, $68,403 for const. bridge across Middle Bijou Creek, east of Peoria on St. Highway No. 8. (3) ADAMS COUNTY (ERP No. 3)—To Driscoll Const. Co., P. O. Box 733, Pueblo, Colo., $111,614 for const. bridge across Kiowa Cr., east of Bennett on St. H. No. 8. 9-10

BOISE, IDAHO—To Dan J. Cavanagh, Twin Falls, Idaho, $94,336 by the Comm. of Public Works, Boise, for const. a bridge and roadway approaches consisting of one 240-ft., two 120-ft. steel spans and an 80-ft. timber trestle, total length 0.391 mi., across the Salmon River on the Whitebird-Joseph Road, NRS 192 (1935). 9-10

BOISE, IDAHO—To Hoops Const. Co., Twin Falls., Idaho, $54,871 by Comm. of Public Works, Boise, for const. a 181-ft. concr. overhead struc. over the Oregon Short Line Railroad and grading and surf. the approaches on 0.923 mi. of the Old Oregon Trail Highway 5½ mi. east of American Falls in POWER COUNTY, Idaho, Proj. Nos. WPH 30-A and WPGH 30-A. 9-21

GREAT FALLS, MONT.—To W. P. Roscoe, Billings, Mont., $89,072 by State Highway Comm., Great Falls, Mont., for const. 4 concr. T-beam bridges; 1 steel truss bridge; 2 tr. timber pile trestle bridges, and 1 standard tr. timber stockpass on Sec. "D" of the Madison Canyon-Ennis Road. 9-3

GREAT FALLS, MONT.—Awards as follow by State Highway Comm., Great Falls, for: (1) TOOLE COUNTY—To Thomas Staunton, Great Falls, $74,976 for 6-span 541.3 ft. reinf. concr. and steel bridge over Marias River, together with const. of 0.111 mi. appr. road on Sec. B of Conrad-Shelby Road. (2) FALLON COUNTY (FAP 86-C, Unit 4)—To Prahl & Sawtelle, Miles City, Mont., $6,697 for const. 2-3 span tr. timb. pile trestle bridges and 1 std. tr. timb. stockpass on Sec. "C" of Miles City-North Dakota Line Road. (3) JUDITH BASIN COUNTY—To D. M. Manning, Hysham, Mont., $14,832 for 3 std. tr. timb. pile stock passes and 6 tr. timb. pile trestle bridges on Sec. H. of Armington-Lewistown Road, betw. Geyser and Stanford. 9-3

PORTLAND, ORE.—To W. P. Roscoe Co., Billings, Mont., $49,882 by Bur. of Public Roads, Portland, Ore., for const. or improving a 3-span steel beam bridge over North Fork of Lee Creek and a 12x8 ft. reinf. conc. box culvert at Jule Creek, Glacier Natl. Park, Kennedy Creek Cutoff, Proj. 4, Natl. Park Road project, located in Glacier Natl. Park, GLACIER COUNTY, Montana. 9-28

PORTLAND, ORE.—Awards as follow by Oregon State Highway Comm., Portland, for: (1) DOUGLAS COUNTY (FAP 140-D)—To Mt. States Const. Co., Eugene, Ore., $51,415 for const. 54 29-ft. composite pile trestle spans and 1 41-ft. 2-in. removable I-beam span with 27-ft. roadway and 2 sidewalks over Smith River on the Oregon Coast Highway near Reedsport. (2) CLACKAMAS COUNTY (FAP 53)—To Mt. States Const. Co., Eugene, Ore., $92,800 for remodeling and widening bridge over Molalla River on the Pacific Highway near Canby and const. conc. viaduct to replace wood trestle. 9-7

PORTLAND, ORE.—To C. J. Montag & Son, Worcester Bldg., Portland, $160,735 by Oregon State Highway Comm., Portland, for const. 92-ft. steel deck girder span on concr. piers and 1,115 lin. ft. conc. viaduct approaches over Klamath Falls River and Great Northern RR, about 3 miles south from Klamath Falls on Klamath Falls-Weed Highway in KLAMATH COUNTY, Oregon. (See Unit Bid Summary.) 9-10

SALT LAKE CITY, UTAH—To L. A. Young, Richfield, Utah, $16,152 by Utah State Road Comm., Salt Lake City, Utah, for const. a 26.5 ft. reinf. conc. bridge over Pleasant Creek in SANPETE COUNTY, Utah. 9-23

SALT LAKE CITY, UTAH—To Bowers Bdg. Co., 1033 S. State Street, Salt Lake City, Utah, $26,801 by the State Road Comm., Salt Lake City, for a reinf. conc. and steel grade crossing and 0.237 mi. approaches known as Merrill's Overhead north of Smithfield on U. S. 91, Proj. WPGH 84-A, in CACHE COUNTY, Utah. 9-28

CHEYENNE, WYO.—Awards as follow by State Highway Comm., Cheyenne, for: (1) PLATTE COUNTY (WPGH 142-C)—To Northwestern Engrg. Co., Rapid City, So. Dakota, $49,423 for 1 overhead crossing over C. B. & Q. RR. at Glendo, Wyo. (2) WASHAKIE COUNTY (FAP 108 DR and 108 ER comb.)—To Chas. M. Smith, Thermopolis, $52,160 for 3 tr. timb. bridges, 1 steel bridge, and 1 reinf. conc. culv. on Worland-Tensleep Road. (3) CARBON COUNTY (FAP 174-B)—To Rognstad-Olsen, Casper, Wyo., $17,447 for 1 tr. timb. bridge, 1 steel bridge, and 1 reinf. conc. culv. on Walcott-Saratoga Road. 9-16

Water Supply Systems . . . . .

WORK CONTEMPLATED

ALHAMBRA, CALIF.—City Commission, Alhambra, has authorized City Manager Roen to apply to the PWA for a 45% grant toward cost of construction of two steel water tanks (2,300,000 gallons capacity

each) to be erected at the Marengo Ave. Reservoir at total cost of $67,000. Approx. $37,000 is available from city funds toward this project. 9-5

LAGUNA BEACH, CALIF.—No protests received by South Coast Water Dist., South Laguna Beach, for replacement of water mains with new cast iron pipe from the Three Arches to Coast Royal. Estimated cost $18,000. Application has been made to the Federal Government for a 45% grant. 9-14

SANTA BARBARA, CALIF.—Special election was held October 8th by the City of Santa Barbara to vote $348,180 in bonds to aid in financing eight projects totaling $679,600. Bond issue proposals approved were detailed as follows: City's contribution, $348,180; Federal fund donation, $331,420; (1) Sheffield Dam and Reservoir, $202,500; (2) Filtration Plant, est. cost, $160,000; (3) El Cielito Reservoir, est. cost, $28,100; (4) La Mesa Reservoir, est. cost, $36,000; (5) Distribution System, est. cost, $128,000; (6) Laguna Ball Park, est. cost, $35,000; (7) Bird Refuge Tennis Courts, $30,000; (8) Open Air Swimming Pool, $60,000. 9-4

BINGHAM, UTAH—The town of Bingham, Utah, has applied to the PWA for a loan and grant of $37,062 to finance construction of a 6-in. cast iron pipeline between the source of supply in Dry Fork to the city limits. 9-11

OGDEN, UTAH—The City of Ogden, Utah, has applied for a grant of $32,750 to finance const. of a $74,000 pipeline on 23rd St. and Polk Ave. to Second and Harrison Ave. 9-11

CALLS FOR BIDS

LOS ANGELES, CALIF.—Bids to 10 a.m., Oct. 24th, by the Metropolitan Water District, Los Angeles, for construction of pre-cast concrete pipe, steel pipe, or cast-in-place concrete pipelines and appurtenant works of the Colorado River Aqueduct distribution system, between Stations 926 plus 00 and 2257 plus 50 of the Upper Feeder, involving 25.09 mi. of pipeline between point 10 mi. west of City of San Bernardino and point ½ mi. north of the City of Glendora, under Spec. No. 115. Work involves in the main: 1,937,000 cu. yd. excavation; 132,538 lin. ft. pipe; and 60,400 cu. yd. concrete. 9-25

TACOMA, WN.—Bids to 10 a.m., Oct. 18th by Board of Contracts & Awards, Tacoma, Wn., for constructing replacements and extensions to the Green River Gravity Pipeline. Work involves: 19,450 lin. ft. 42 in. to 58 in. pipeline 26 ft. x 54 ft. concrete gate house. Install gates and structures. 10-1

CONTRACTS AWARDED

SAN FRANCISCO, CALIF.—Awards as follow by the Public Utilities Comm., City Hall, San Francisco, for: (1) To Peter J. McHugh, 2086 Union St., San Francisco, $22,268 for cast iron mains in the Twin Peaks Dist., under S.F.W.D. Spec. No. 83 (laying 6 and 8 in. cast iron mains). (2) To Lowrie Paving Co., 1540 16th St., S. F., $19,358 for laying 6 and 8 in. cast iron mains in University Mound District, under S.F.W.D. Spec. No. 82. (3) To Lowrie Paving Co., 1540 16th St., S. F., $1,057 for laying 6 and 8 in. cast iron mains in Cotter Street and Cayuga Streets, under S.F.W.D. Spec. No. 87. 9-24

DENVER, COLO.—To Utah-Bechtel-Morrison-Kaiser Co., Almont, Colo., $93,212 by Board of Water Comm., Denver, for const. of the lined and unlined sections of the canal and grading siphon line of the South Boulder Diversion Conduit, Moffat Water Tunnel project. (See Unit Bid Summary.) 9-16

PAROWAN, UTAH—To Bernston & Kuhre, 2336 21st St., Salt Lake City, (price not stated) by City Clerk, Parowan, Utah, for Unit No. 2 of waterworks improvements involving construction of a headhouse. 9-23

OGDEN, UTAH—To the American Concrete and Steel Pipe Co., 4635 Firestone Blvd., South Gate, Calif., $331,653 (USING CONCRETE PIPE) by Board of Comm., Ogden, Utah, for const. of the Ogden Canyon Pipeline with appurtenant works (Project No. 3). (See Unit Bid Summary.) 9-11

EVERETT, WN.—To Puget Sound Machinery Depot, 322 First St., S. Seattle, $48,321 by City Clerk, Everett, Wn., for const. a service pipeline from Reservoir No. 2 to the Weyerhaeuser Pulp Mill. 9-10

CHEYENNE, WYO.—To Oliver Well Works, Greeley, Colo., $8,000 by U. S. Vet. Admin., Washington, D. C., for boring deep well at Cheyenne, Wyoming. 9-6

Sewer Construction . . . . . .

WORK CONTEMPLATED

JACKSON, CALIF.—Bond election will be held Nov. 5th by Jackson, Calif., to vote $50,000 in bonds to help finance construction of an intercepting and outfall sewer and a sewage disposal plant. Total estimated cost is $76,600 of which 45% has been applied for from the PWA. 9-24

SANTA ANA, CALIF.—Orange County Board of Supervisors has applied to the PWA for funds to finance storm drains as follow: $173,769 for the West Anaheim storm drain, including 3½ mi. concrete-lined drainage ditch, bottom width of 4-ft. from Ball Road at Manchester Ave. to Crescent Ave. and Brookhurst Road. $39,949 for the Laveta Ave. storm drain extending from the El Modena Station on the S. P. Railroad along Laveta Avenue to the Santiago Creek east of Tustin Avenue. 9-18

SAN FRANCISCO, CALIF.—The Dept. of Public Works, City Hall, San Francisco, has appointed Chas. Gilman Hyde, University of Calif., and C. C. Kennedy, Call Bldg., San Francisco, as consulting engineers to prepare plans and specifications for a sewage disposal plant to be located in westerly end of Golden Gate Park, adjacent to main line Mile Rock Sewer. It is expected call for bids for equipment only for the plant will be issued in about 60 days, to be opened at a later date. First work to be done will be construction of a 6,000 ft. tunnel and sewer line to divert sewage from Bakers Beach district to site of Disposal Plant in Golden Gate Park. It is expected call for bids on the tunnel will be issued in from 45 to 60 days. Total estimated cost of entire project is $1,250,000. 9-25

SONORA, CALIF.—Bond election will be held Oct. 8th by Sonora, Calif., to vote $44,000 in bonds to help finance const. of intercepting and outfall sewers and sewage disposal plant. PWA application has been filed for 45% of the cost. 9-24

SELAH, WN.—PWA loan and grant of $60,000 has been made to Selah, Wn., to finance construction of a complete sewer system and a sewage disposal plant. 9-7

CALLS FOR BIDS

CALIENTE, NEVADA.—Bids to 2 p.m., Oct. 21st by Town Council, Town Hall, Caliente, LINCOLN COUNTY, Nevada, for construction of a complete sewer system and a sewage treatment plant. 9-28

CONTRACTS AWARDED

LOS ANGELES, CALIF.—To Sutalo & Ramljak, 476 S. Camulos, L. A., $3,769 by Board of Public Works, Los Angeles, for construction of Malibu Road sewer. 9-5

SEAL BEACH, CALIF.—Award (subj. to PWA approval) to H. A. Teget, 133 Princeton St., Ontario, $47,000 by City Clerk, Seal Beach, for const. a sewage disposal plant (PWA project). 9-6

SAN RAFAEL, CALIF.—To Renati Bros., Novato, Calif., $2,768 by County Clerk, San Rafael, for constructing a sewage disposal plant at MARIN COUNTY Farm, 6 mi. northwest of San Rafael. 9-23

PORTLAND, ORE.—To Ek & Lind, 1705 Humboldt St., Portland, $2,570 by City Auditor, Portland, for const. a sewer in southeast Second Ave., from the center line of southeast Ash Street to the sewer in southeast Oak Street, under Ordinance No. 67390. 9-13

KAYSVILLE, UTAH—To Knowlton & Rupert, Layton, Utah, $3,260 by City Clerk, Kaysville, Utah, for const. a concrete septic tank for city sewer system. 9-11

River and Harbor Work. . . . .

WORK CONTEMPLATED

LAGUNA BEACH, CALIF.—Special election will be held October 14th by City of Laguna Beach to vote $55,000 in bonds to aid in financing construction of a pier and breakwater. Electors will also be asked preference for pier at foot of Broadway or Ocean Avenue or present location; also preference for combination pier and breakwater or individual project. 9-17

NEWPORT BEACH, CALIF.—City Council, City Hall, Newport Beach, has authorized City Engineer Patterson to apply to the Public Works Administration for a grant of $100,000 for use in construction of a sea wall around Balboa Island and construction of a 10-ft. walk inside the wall and erection of new street lighting standards. Total cost, $222,000. 9-5

OXNARD, CALIF.—City of Oxnard has made an agreement with the Hueneme Dock Corp. whereby City of Oxnard becomes owner of the Hueneme harbor site of approx. 275 acres of land, and leases this to the Hueneme Dock Corp. The City of Oxnard has asked the PWA for a grant of $775,000 toward construction of the harbor improvements. 9-6

VENTURA, CALIF.—City of Ventura has asked $135,000 as a grant from the PWA to finance construction of wharves, warehouses and roads along the Ventura waterfront at a cost not to exceed $300,000. 9-6

CALLS FOR BIDS

SACRAMENTO, CALIF.—Bids to 9:30 a.m., Oct. 16th by Calif. State Division of Water Resources, Sacramento, for constructing 3 sections of levee on the San Joaquin River, 10 mi. south of Manteca, SAN JOAQUIN COUNTY, in Reclamation District No. 2064. Work involves in the main: 41,750 cu. yd. place material in levee. 9-30

BIDS RECEIVED

SAN DIEGO, CALIF.—R. E. Campbell, 711 Central Bldg., Los Angeles, $13,770 low to 11th Naval Dist., Ft. of Broadway, San Diego, for repairs to concrete wharf and exposed faces of existing concrete bulkhead, under Spec. No. 8072. 9-24

PORTLAND, ORE.—Parker-Schram Co., 515 Couch Bldg., Portland, Ore., $17,064, low to U. S. Engineer Office, Portland, Ore., for const. a dock, sheet piling bulkhead and certain excavation; also const. certain loose rock embankment and handlaid riprap slopes at U. S. Govt. Moorings at No. 8010 NW St. Helens Road, Portland, Ore. 9-20

PORTLAND, ORE.—Kuckenberg-Wittman Co., Inc., Board of Trade Bldg., Portland, Ore., $16,983 low to U. S. Engineer Office, Portland, Ore., for bank clearing, bar clearing, grading of river bank, and const. approx. 4,290 lin. ft. protective gravel fill, all along the Willamette River, Oregon, between Eugene and Harrisburg, under Spec. No. 698-36-104. 9-23

PORT TOWNSEND, WN.—Puget Sound Bridge & Dredging Co., 2929 16th Avenue, SW, Seattle, Wn., $31,400, low to Treasury Dept., Procur. Div., Public Works Branch, Wash., D. C., for channel protection to boat basin at U. S. Quarantine Station, Port Townsend, Wn. 9-16

CONTRACTS AWARDED

OAKLAND, CALIF.—To Ben C. Gerwick, 112 Market St., S. F., $249,117 by U. S. Coast Guard Headq., Washington, D. C., for steel sheet pile bulkh. approx. 1,528 lin. ft. long, anchorage and bollard piles and accessories at U. S. Coast Guard, 11 Government Island, Oakland. 9-18

SACRAMENTO, CALIF.—To Franks Contr. Co., 260 California St., S. F., $28,470 by U. S. Engr. Office, Sacramento, for furn. and opr. clamshell dredging plant in Suisun Bay and San Joaquin and Sacramento Rivers. 9-12

SAN DIEGO, CALIF.—To M. H. Golden, 404 California Bank Bldg., San Diego, $72,460 by 11th Nav. Dist., San Diego, for const. of pier approach sec. 20x375-ft. land sec. 38x210-ft. at Wilson Cove, San Clemente Island, under Spec. No. 8035. 9-13

SAN FRANCISCO, CALIF.—Award recommended to A. W. Kitchen, 110 Market St., San Francisco, $4,960, by Supt. of Lighthouses, S. F., for repairs to fender system at Yerba Buena lighthouse. 9-3

Irrigation and Reclamation . .

WORK CONTEMPLATED

YUMA, ARIZ.—An allotment of $2,000,000 has been approved by the President for construction of the first unit (150,000 acres) of the Gila Valley Reclamation Project in southwestern Arizona. Water will be diverted from the Colorado River at Imperial Dam and carried to pumping plant by means of a diversion canal cut through rock. 9-17

MODESTO, CALIF.—The PWA has made a grant of $32,715 to Modesto Irrigation Dist. 823, Eleventh St., Modesto, to finance const. of lining of irrigation canals. Total estimated cost of work is $72,700. 9-13

SHOSHONI, WYO.—The Bureau of Reclamation has been allotted $1,500,000 for construction of a canal system for irrigation of the Heart Mountain Division of the Shoshoni Project in Wyoming. Total cost, $6,500,000. 9-17

CALLS FOR BIDS

ONTARIO, ORE.—Bids to 10 a.m., Oct. 18th by Bureau of Reclamation, Ontario, Ore., for const. earthwork and struc., Ward Main Drain and Ward Drain 0.57, Mitchell Butte Division, Owyhee Project, Oregon-Idaho, under Spec. No. 724-D. Work is located near Nyssa, Oregon, and involves in the main: 203,500 cu. yd. all cl. exc. for drains, 1,600 cu. yd. backfill, 125 sq. yd. dry-rock paving, 860 lin. ft. 15 and 48 in. C.M.P.

(lay), 60.0 M. ft. BM timb. in struc. (erect). Install 48 in. dia. C.M.P. culv. under RR. 9-27

ONTARIO, ORE.—Bids to 10 a.m., Oct. 18th by Bureau of Reclamation, Ontario, Ore., for const. earth work and struc., North Canal Laterals, Mitchell Butte Division, Owyhee Project, Oregon-Idaho, under Spec. 723-D. Work is located near Ontario, Ore., and involves in the main: 102,300 cu. yd. all cl. excav. for later, 6,300 cu. yd. backfill, 220 cu. yd. conqcr. in struc., 575 sq. yd. dry-rock paving, 12,500 lb. reinforcement bars (place), 1,804 lin. ft. 15 in. to 36 in. dia. concrete pipe (lay), 5,300 lb. gates and gate hoists (inst.), 5.0 M. ft. BM timb. in struc. (erect). 9-27

ONTARIO, ORE.—Bids to 10 a.m., Oct. 19th by Bureau of Reclamation, Ontario, Ore., for const. earthwork and struc., North Canal Laterals, Dead Ox Flat Division, Owyhee Proj., Oregon-Idaho, under Spec. No. 726-D. Work is located near Ontario, Ore., and involves in the main: 110,700 cu. yd. all cl, exc. for laterals, 4,000 cu. yd. backfill, 85 cu. yd. concrete in struc., 300 sq. yd. dry-rock paving, 4,500 lb. reinforcem. bars (place), 1,030 lin. ft. 15 in. to 36 in. dia. concr. pipe (lay), 2,700 lb. gates and gate hoists (install). 9-27

ONTARIO, ORE.—Bids to 10 a.m., Oct. 19th by Bureau of Reclamation, Ontario, Ore., for constructing structures, North Canal Laterals N.C. 37.6 to 38.7-1.2, Mitchell Butte Division, Owyhee Project, Oregon-Idaho, under Spec. No. 725-D. Work is located near Nyssa and Ontario, Ore., and involves in the main: 3,100 cu. yd. all cl. excav. for struc., 940 cu. yd. concrete in struc., 1,000 sq. yd. dry-rock paving, 64,000 lb. reinforcement bars (place), 940 lin. ft. 12 in. to 36 in. dia. concrete pipe (lay), 3,000 lb. gates and gate hoists (install), 5.0 M. ft. BM timb. in struc. (erect). 9-27

ONTARIO, ORE.—Bids to 10 a.m., Oct. 21st by Bureau of Reclamation, Ontario, Ore., for const. earthwork and struc., South Canal, Sta. 1340 to Sta. 2016, Succor Creek Division, Owyhee Project, Oregon-Idaho, under Spec. No. 646. Work is located near Homedale and Marsing, Idaho, and involving in the main: 290,000 cu. yd. all cl. excav. for canal, 6,400 cu. ft. all cl. excav. for struc., 13,000 cu. yd. backfill, 1,000 cu. yd. concrete in struc., 1,100 sq. yd. dry-rock paving, 77,000 lb. reinf. bars (place), 1,850 lin. ft. 18 to 60 in. concr. pipe (lay), 9.0 M. ft. BM timb. in struc. (erect), 9,000 lb. gates and misc. metal work (install). 9-27

BIDS RECEIVED

MARSHLAND, ORE.—BROOKFIELD COMPANY, Astoria, Ore., $7,946, low to Secretary, Marshland Drainage Dist., Marshland, Ore., for improvements of District's dykes and drainage ditches, PWA No. 6723. 9-30

YAKIMA, WN.—Newton Const. Co., Inc., 2653 W. Newton St., Seattle, Wn., $6,169 low to Bureau of Reclamation, Yakima, Wn., for const. of a parapet wall and curb and finishing the crest of the embankment at Cle Elum Dam, Yakima Project, Wn., under Spec. No. 702-D. 9-7

CONTRACTS AWARDED

PHOENIX, ARIZ.—To Pleasant-Hasler Construction Co., 324 Luhrs Bldg., Phoenix, at $650,000 for Pleasant Valley Dam, by Pleasant Valley Irrigation Dist. 9-6

SNOWFLAKE, ARIZ.—To Leo Frost & Rogers, Snowflake, Ariz., $73,970 by Showlow-Silver Creek Water Conservation and Power District, Snowflake, Ariz., for const. the Lone Pine Dam, near Snowflake, NAVAJO COUNTY, Ariz. 9-13

ONTARIO, ORE.—To H. J. Adler Co., 2310 So. Alaska St., Tacoma, Wn., $14,293 by Bureau of Reclam., Ontario, Ore., for const. structures, North Canal laterals N. C. 26.4 to 28.7 Mitchell Butte Division, Owyhee Project, Oregon-Idaho, under Spec. 708-D. 9-10

ONTARIO, ORE.—To H. J. Adler Co., 2310 S. Alaska St., Tacoma, Wn., $21,130 by Bureau of Reclamation, Ontario, Ore., for const. structures, North Canal, Laterals NC 28.7 to 31.8 Mitchell Butte Div., Owyhee Project, Oregon-Idaho, under Spec. No. 715-D. 9-18

SNOQUALMIE, WN.—To Everett Bros., Concrete, Wn., $2,425 by the Comm. of Drainage Dist. No. 14, care of G. A. Slade, Snoqualmie, Wn., for digging 1.5 miles of ditches for Drainage Dist. No. 14, Snoqualmie, Wn. 9-20

Dam Construction . . . . . .

WORK CONTEMPLATED

HOLLISTER, CALIF.—Bond election will be held Oct. 31st by Pacheco Pass Water Dist., Hollister, Calif., to vote $200,000 in bonds to finance construction of an earth fill dam at Pacheco Bridge and minor streambed improvements to raise the water level within the District. Total estimated cost is $364,000 and a PWA grant of 45% has been applied for. 9-27

BIDS RECEIVED

PHOENIX, ARIZ.—O. F. Fisher, 516 South 7th St., Phoenix, who bid $28,095, only bid submitted to City Commission, Phoenix, for const. of water storage dam in connection with the Horse Thief Basin Municipal summer camp. 9-14

Flood Control Work . . . . . .

WORK CONTEMPLATED

LOS ANGELES, CALIF.—County Board of Superv. has authorized County Counsel to obtain right-of-way for const. of a reinf. conc. flood control channel, 1½ miles long from Eagle Canyon to the Arroyo Verdugo Basin, consisting of approx. 7 acres in the Montrose Dist. Work will be under the direction of the U. S. Engineer Corps. Est. cost, $235,000. 9-7

SANTA ANA, CALIF.—Election was held Oct. 4 by Orange County to vote $6,620,000 in bonds to aid in financing of the Orange County Flood Control project, which has been approved by the War Dept. of the Federal Govt. and will include an allocation of $6,374,000 from federal funds. The project, totaling $9,575,000, includes the following units of work: (1) Prado Dam, 93 ft. high, 180,000 acre ft. storage capacity, $7,215,397. (2) Brea dam and channel; dam 73 ft. high, impounding 3,300 ac. ft.; Brea channel to be enlarged to cap. of 3,400 sec. ft., $697,943. (3) San Juan dam, 93 ft. high, impounding 15,750 ac. ft., $1,077,980. (4) Carbon Canyon dam, 115 ft. high, impounding 2,500 ac. ft., $481,900. (5) Fullerton dam and Loftus diversion dam, 39 ft. high, impounding 800 ac. ft.; Loftus diversion channel with carrying cap. of 190 sec. ft., $149,737. (6) Trabuco dam, 100 ft. high, impounding 3,900 ac. ft., $617,500. (7) Aliso dam, 71 ft. high, impounding 500 ac. ft., $110,850. (8) Santiago dam and channel; add 25 ft. to height of exist. dam; increase storage 22,000 ac. ft.; const. 3,000 ft. of low levees along mouth of Santiago Creek, $498,560. (9) Santa Ana River channel and spreading grounds; from Prado dam to the Pacific Ocean, includ. levees from Yerba bridge

to mouth of Santiago Creek; will conserve 97% of flow from Prado Reservoir, $375,000. (10) Carbon conduit, levee spreading grounds and concr. lined channel of 1,100 sec. ft. cap. from the spreading area to the Santa Ana River, $141,382. (11) Brea pipeline, 42-in. in diameter, extending 1½ mi. from Break Creek channel below Fullerton to old channel of Santa Ana River, $86,108. 9-5

TACOMA, WN.—Election will be held October 22nd by Pierce County, Washington, to vote on forming a flood control district along the Puyallup and Carbon Rivers. 9-6

Pipeline Construction . . . . . .

CALLS FOR BIDS

LOS ANGELES, CALIF.—Bids to 10 A. M., October 24, by Metropolitan Water Dist., 306 W. Third St., Los Angeles, for const. of pre-cast concrete pipe, steel pipe, OR cast-in place concrete pipelines, and appurtenant works for the Colorado River Aqueduct distribution system betw. Stations 926 plus 00 and 2257 plus 50 of the Upper Feeder, involving 25.09 mi. of pipeline betw. point 10 mi. west of City of San Bernardino and point ½ mi. north of City of Glendora, in SAN BERNARDINO and LOS ANGELES COUNTIES, Calif. 9-20

CONTRACTS AWARDED

SAN LUIS OBISPO, CALIF.—To Pacific Crane & Rigging Co., 6800 S. Alameda, Huntington Park, by Union Oil Co., for installation of 56,235 ft. 12-in. pipe and removal of 49,825 ft. of 8-in. pipe from the Rio Brave and McKittrick districts to Union Oil tidewater terminals at Avila. Total cost is approx. $16,400. 9-5

Power Development . . . . . .

WORK CONTEMPLATED

LODI, CALIF.—Electors of Lodi, Calif., voted favorably for the $466,000 bond issue to finance const. of a power plant on the Mokelumne River and a Diesel standby and transmission lines. A PWA loan and grant has been approved. 9-14

EATONVILLE, WN.—The PWA has made a grant of $9,900 to Eatonville, Wn., for reconst. of a transmission line to connect Tacoma's plant at La Grande with the distribution system at Eatonville and for replacement of wooden watermains in the city. Total est. cost is $22,000. 9-13

SEATTLE, WN.—PWA application of $13,500,000 has been filed by the City of Seattle, Wn., to finance construction of the following: Clearing Ruby basin, $1,250,000; Ruby dam, $7,750,000; Transmission lines, etc., $2,500,000. 9-6

CONTRACTS AWARDED

LOS ANGELES, CALIF.—To Newberry Elec. Corp., 315 W. Ninth St., Los Angeles, $73,690 by Metropolitan Water Dist., Los Angeles, for const. of 140 mi. telephone trunk line and conversion of approx. 8 mi. spur line to trunk line const. in CLARK COUNTY, Nev., and SAN BERNARDINO and RIVERSIDE COUNTIES, Calif., under Spec. No. 106. The amount of this contract plus cost of items to be furnished by the district makes a total cost of $101,990. 9-14

Miscellaneous . . . . . .

WORK CONTEMPLATED

MAXWELL, CALIF.—The Maxwell Public Utility Dist., care of Chris Lausten, Secretary, Maxwell, Calif., has applied to the PWA for a loan and grant of $53,392 to finance construction of a water and sewer system for the town of Maxwell. The dist. will hold an election shortly to vote on $34,865 in bonds. 9-10

CALLS FOR BIDS

PHOENIX, ARIZ.—Bids to Oct. 16th by City Manager, City Hall, Phoenix, as follows: (1) Construct swimming pool, (2) Install pumping plant, (3) Install light and power distribution system, (4) Construct building and swimming pool. 9-28

RENO, NEVADA—Bids to 10 a.m., Oct. 21 by Board of Trustees, WASHOE COUNTY Pub. Hospital, Reno, Nev., for furn. and install. 2 new boilers in the WASHOE COUNTY Public Hospital, at Reno, Nev. 9-20

BIDS RECEIVED

NAVAJO, NEW MEXICO—Industrial Heating & Engineering Co., Milwaukee, Wis., $56,630 for furn. and install. Diesel elec. generating equipment, and Fairbanks Morse Co., Chicago, $38,510 for furn. and install. boilers and auxiliaries in the Navajo Capitol Power Plant, New Mexico, low to Purchasing Officer, Interior Dept., Washington, D. C., under Prop. No. 897. 9-19

CONTRACTS AWARDED

FT. YUMA, ARIZ.—To J. A. Hunt, P. O. Box 146, East San Diego, Calif., $90,650 by Purch. Officer, Interior Dept., Washington, D. C., for const. hospital bldg., roads, walks, grading, etc., outside sewer and water services at Ft. Yuma Indian Agency, Ariz., under Prop. No. 891. 9-16

PHOENIX, ARIZ.—To Arizona Sand & Rock Co., Box 1522, Phoenix, $9,624 by City Commission, Phoenix, for construction of tennis courts in Encanto Park and $9,608 for construc. of tennis courts in Palm Lane and 12th St. Park and in University, Harmon and Eastlake Parks. 9-24

LOS ANGELES, CALIF.—Awards as follows by Metropolitan Water Dist., 306 W. 3rd St., Los Angeles, for furnishing electric conductor, etc., for 230 KV transmission line between Boulder Dam and Colorado River pumping plants, under Spec. 126. (1) To Anaconda Wire & Cable Corp., 430 Colyton St., Los Angeles, who bid $37,841 under Schedule No. 3, (2) To Aluminum Co. of America, Pittsburgh, Pa., who bid $614,316 under Schedule No. 2. 9-28

LOS ANGELES, CALIF.—To Pacific Coast Steel, 11100 S. Central Ave., Los Angeles, $402,300 by Metropolitan Water Dist., L. A., for steel towers for transmission line, under Spec. 105. 9-28

LOS ANGELES, CALIF.—To Fritz Ziebarth, Security Bldg., Long Beach, $407,246 by Metropolitan Water Dist., L. A., for const. 237 mi. of 230 KV steel tower transmission line between Boulder Dam power plant and the Colorado River Aqueduct pumping plants designated as Gene, Iron Mt. and Hayfield in CLARK COUNTY, Nev., and SAN BERNARDINO COUNTY and RIVERSIDE COUNTY, Calif., under Spec. 104. 9-28

EQUIPMENT and MATERIALS SECTION

This is a directory of products made by manufacturers whose advertisements appear in this issue of *Western Construction News*. If you do not find what you want, write for further information to *Western Construction News*, 114 Sansome Street, San Francisco, California.

On the following pages will be found the "Where to Buy in the West" section; and an alphabetical index of advertisers is on the last page of this issue.

Acetylene Generators
Air reduction Sales Co.

Asphalt
Asphalt Institute, The

Backfillers
Austin-Western Road Mchy. Co.
Harnischfeger Corp.
Link-Belt Co.
Northwest Engineering Co.
Thew Shovel Co.

Batchers, Concrete Aggregates
Western Pipe & Steel Co.

Bins, Storage and Hopper
Western Pipe & Steel Co.

Blades, Grader and Scraper
Adams, J. D., Co.
Austin-Western Road Mchy. Co.
Caterpillar Tractor Co.

Blasting Supplies
Apache Powder Co.
Atlas Powder Co.
Halafax Explosives Co.
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Bridges
Columbia Steel Co.

Buckets
Bucyrus-Erie Co.
Electric Steel Foundry Co.
Harnischfeger Corp.
Industrial Brownhoist Corp.
Northwest Engineering Co.
Page Engineering Co.
Wellman Engineering Co.

Bulldozers
Austin-Western Road Mchy. Co.
LeTourneau, R. G., Inc.

Cable, Highway Guard Rail
Columbia Steel Company
Leschen, A., & Sons Rope Co.

Cableways
Columbia Steel Co.
Leschen, A., & Sons Rope Co.

Carbide Torches
Air Reduction Sales Co.

Castings, Steel and Alloy Steel
Columbia Steel Company
Pacific Coast Steel Corp.
Electric Steel Foundry Co.

Cement
Pacific Portland Cement Co.
Portland Cement Association

Cement Pumping Equipment
Fuller Co.

Cement, Tan
Pacific Portland Cement Co.

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Great Western Electro-Chemical Co.

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Wallace & Tiernan Co., Inc.

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International Filter Co.
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Chicago Pneumatic Tool Co.
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Worthington Pump & Mchy. Co.

Conveyors, Belt
Jeffrey Manufacturing Co.
Link-Belt Co.

Cranes, Diesel, Electric, Gas and Steam
Austin-Western Road Mchy. Co.
Bucyrus-Erie Co.
Industrial Brownhoist Corp.
Harnischfeger Corp.
Koehring Co.
Lima Locomotive Works, Inc.
Link-Belt Co.
McKiernan-Terry Corp.
Northwest Engineering Co.
Thew Shovel Co.
Universal Crane Co.

Crushers
Austin-Western Road Mchy. Co.

Culverts
Austin-Western Road Mchy. Co.
California Corrugated Culvert Co.
Hardesty Manufacturing Co.
Pure Iron Culvert & Mfg. Co.
Washington Corrugated Culvert Co.
Western Pipe & Steel Co.

Derricks, and Derrick Fittings
Harnischfeger Corp.
McKiernan-Terry Corp.

Digestors
Chicago Bridge & Iron Works

Drills, Diamond
Chicago Pneumatic Tool Co.

Drills, Rock
Chicago Pneumatic Tool Co.
Gardner-Denver Co.
Worthington Pump & Mchy. Corp.

Dynamite
Apache Powder Co.
Atlas Powder Co.
Halafax Explosives Co.
Hercules Powder Co.
Trojan Powder Co.

Elevators, Bucket
Jeffrey Manufacturing Co.
Link-Belt Co.

Engines, Diesel, Gasoline and Steam
Caterpillar Tractor Co.
Chicago Pneumatic Tool Co.
Worthington Pump & Mchy. Corp.

Equipment, Rebuilt
(See Opportunity Section)

Equipment for Rent
(See Opportunity Section)

Equipment, Used
(See Opportunity Section)

Excavators, Ditching and Trench
Austin-Western Road Mchy. Co.
Bucyrus-Erie Co.
Harnischfeger Corp.
Lima Locomotive Works, Inc.
Link-Belt Co.
Northwest Engineering Co.
Thew Shovel Co.

Excavators, Dragline
Austin-Western Road Mchy. Co.
Bucyrus-Erie Co.
Harnischfeger Corp.
Lima Locomotive Works, Inc.
Link-Belt Co.
Northwest Engineering Co.
Thew Shovel Co.

Explosives
Apache Powder Co.
Atlas Powder Co.
Halafax Explosives Co.
Hercules Powder Co.
Trojan Powder Co.

Fence Posts
Columbia Steel Company

Fence, Wire
Columbia Steel Company

Ferric Chloride
Great Western Electro-Chemical Co.

Fire Hydrants
Columbian Iron Works

Flumes, Metal
California Corrugated Culvert Co.
Chicago Bridge & Iron Works
Hardesty Mfg. Co.
Pure Iron Culvert & Mfg. Co.
Washington Corrugated Culvert Co.
Western Pipe & Steel Co.

Flumes, Wood Stave
Federal Pipe & Tank Co.

Forms, Concrete
Western Pipe & Steel Co.

Gasoline
General Petroleum Corp.
Union Oil Co. of Calif.

Generators, Electric
General Electric Co.
Harnischfeger Sales Corp.

Generators, Turbine
Pelton Water Wheel Co.

Governors, Turbine
Pelton Water Wheel Co.

Graders, Road
Adams, J. D., Co.
Austin-Western Road Mchy. Co.
Caterpillar Tractor Co.

Gravel Plant Equipment
Austin-Western Road Mchy. Co.
Link-Belt Co.

Hoists, Diesel, Gas, Electric and Hand Power
Chicago Pneumatic Tool Co.
Harnischfeger Corp.
Link-Belt Co.
McKiernan-Terry Corp.
Wellman Engineering Co.

Hoppers, Steel
Chicago Bridge & Iron Works
Link-Belt Co.
Western Pipe & Steel Co.

Hose, Air, Steam and Water
Goodrich, The B. F., Co.

Hydrants
Columbian Iron Works
Pac. States Cast Iron Pipe Co.

Lighting Plants
General Electric Co.
Harnischfeger Sales Corp.

Liner Plates
Western Pipe & Steel Co.

Loaders, Power, Truck and Wagon
Austin-Western Road Mchy. Co.
Link-Belt Co.

Lubricants, Oils and Greases
General Petroleum Corp.
Union Oil Company of Calif.

Lumber
Baxter, J. H., & Co.

Lumber, Redwood
California Redwood Assn.

Lumber, Treated
Baxter, J. H., & Co.
Reilly Tar & Chemical Corp.

Meters
Neptune Meter Co.

Mixers, Concrete
Koehring Co.

Motors, Electric
General Electric Co.
Harnischfeger Sales Corp.
Lincoln Electric Co.

Oxygen
Air Reduction Sales Co.

Paints, Protective
General Paint Corp.

Paving Breakers
Chicago Pneumatic Tool Co.
Gardner-Denver Company
Worthington Pump & Mchy. Corp.

Penstocks
Chicago Bridge & Iron Works
Western Pipe & Steel Co.

Pile Drivers
Harnischfeger Corp.
Industrial Brownhoist Corp.
McKiernan-Terry Corp.

Piling, Creosoted
Baxter, J. H., & Co.

Piling, Steel
Columbia Steel Co.
National Tube Company
Pacific Coast Steel Corp.

Piling, Wood
Baxter, J. H., & Co.

Pipe, Cast Iron
Pacific States Cast Iron Pipe Co.

Pipe, Concrete
American Concrete & Steel Pipe Co.

Pipe, Transite
Johns-Manville Corp.

Pipe, Riveted Steel
Chicago Bridge & Iron Works
Western Pipe & Steel Co.

Pipe, Steel
Columbia Steel Co.
National Tube Co.
Western Pipe & Steel Co.

Pipe, Steel, Cement Lined
National Tube Company

Pipe, Welded Steel
California Corrugated Culvert Co.
Chicago Bridge & Iron Works
Columbia Steel Co.
Hardesty Mfg. Co.
Washington Corrugated Culvert Co.
Western Pipe & Steel Co.

Pipe, Wood
Federal Pipe & Tank Co.

Powder
(See Explosives)

Pumps
Chicago Pneumatic Tool Co.
Layne & Bowler Co.
Pelton Water Wheel Co.
Pomona Pump Co.
Worthington Pump & Mchy. Corp.

Rails and Rail Specialties
Columbia Steel Co.

Reinforcing, Steel Bar and Fabric, for Concrete
Columbia Steel Co.
Pacific Coast Steel Corp.

Road Oils
Asphalt Institute, The
General Petroleum Corp.
Union Oil Company of Calif.

Rollers, Compacting
LeTourneau, R. G., Inc.

Rollers, Road
Austin-Western Road Mchy. Co.

Rope, Wire
Columbia Steel Co.
Leschen, A., & Sons Rope Co.
Roebling's Sons Co., John A.

Rubber Goods, Mechanical
Goodrich Co., B. F.

Scarifiers
Adams, J. D., Co.
Austin-Western Road Mchy. Co.
Caterpillar Tractor Co.
LeTourneau, R. G., Inc.

Scrapers
Adams, J. D., & Co.
Austin-Western Road Mchy. Co.
LeTourneau, R. G., Inc.

Screens, Sand and Gravel
Austin-Western Road Mchy. Co.
Link-Belt Company

Second Hand Equipment
(See Opportunity Section)

Sewage Disposal Equipment
Link-Belt Company
Wallace & Tiernan Company

Sharpeners, Drill
Chicago Pneumatic Tool Co.
Gardner-Denver Company
Worthington Pump & Mchy. Corp.

Shovels, Power
Austin-Western Road Mchy. Co.
Bucyrus-Erie Company
Harnischfeger Sales Corp.
Koehring Company
Lima Locomotive Works, Inc.
Link-Belt Company
Northwest Engineering Co.
Thew Shovel Company

Smoke Stacks
Chicago Bridge & Iron Works

Stand Pipes
Chicago Bridge & Iron Works

Steel, Abrasion Resisting
Columbia Steel Company
Electric Steel Foundry Co.
Pacific Coast Steel Corp.

Steel, Hollow Drill
Pacific Coast Steel Corp.

Steel, Reinforcing
Columbia Steel Company
Pacific Coast Steel Corp.

Steel, Sheet-Galvanized Corrugated
California Corrugated Culvert Co.
Columbia Steel Company
Pacific Coast Steel Corp.

Steel, Structural
Western Pipe & Steel Co.
Chicago Bridge & Iron Works

Tanks, Metal
California Corrugated Culvert Co.
Chicago Bridge & Iron Works
Western Pipe & Steel Co.

Tanks, Wood
Federal Pipe & Tank Co.

Timber, Creosoted
Baxter & Company, J. H.

Tires, Rubber
Goodrich, The B. F.

Tools, Pneumatic
Chicago Pneumatic Tool Co.
Gardner-Denver Co.
Worthing Pump & Mchy. Corp.

Torches, Carbide
Air Reduction Sales Co.

Tractors
Caterpillar Tractor Company

Tramways, Aerial
Columbia Steel Co.
Leschen, A., & Sons, Rope Co.
Roebling's Sons Co., John A.

Tubing
National Tube Company

Turbines
General Electric Co.
Pelton Water Wheel Co.

Valves
Columbian Iron Works

Valves, Gate
California Corrugated Culvert Co.
Columbian Iron Works
Pacific Pipe Co.
Pelton Water Wheel Co.

Vibrators, Concrete
Electric Tamper & Equipment Co.

Wagons and Trailers
Adams, J. D., Co.
Austin-Western Road Mchy. Co.
Koehring Co.
LeTourneau, R. G., Inc.

Water Wheels
Pelton Water Wheel Co.

Welding and Cutting Equipment
Adams, J. D., Co.
Air Reduction Sales Co.
Harnischfeger Corp.
Lincoln Electric Co.

Welding Gas
Air Reduction Sales Co.

Welding Rods and Wire
Adams, J. D., Co.
Air Reduction Sales Co.
Lincoln Electric Company

WHERE TO BUY IN THE WEST

A directory of distributors and branch offices of the manufacturers whose advertisements appear in this issue of *Western Construction News*. Because of space limitations only the principal centers of the West are listed. If you do not find what you want, or the firm you want, write for further information to *Western Construction News*, 114 Sansome Street, San Francisco, California. In communicating with distributors or branch offices, please mention *Western Construction News*.

A directory of equipment and materials and an alphabetical index of advertisers will be found on the last pages of this issue.

Arizona

Phoenix

Allison Steel Mfg. Co.
S. 19th Ave.
4-1191
American Cable Co., Inc.

Arizona Tractor & Equipment Co.,
134 South First Ave.
3-1146
Bucyrus-Erie Co.
Caterpillar Tractor Co.
LeTourneau, R. G., Inc.

Fuller, W. P., & Co.,
117 East Jackson St.
4-2123
Reilly Tar & Chemical Corp.

General Electric Company,
441 West Madison St.
3-6139

General Petroleum Corporation of California
24th & Jackson Sts.
4-3119

Goodrich, B. F., Co.,
2nd St. and Van Buren
3-6168

McGinnis, Neil B., Company,
1401 South Central Ave.
4-1493
Adams, J. D. Co.
Allis-Chalmers Mfg. Co.
Northwest Engineering Co.

Mine & Smelter Equipment Co.,
110 South Third Ave.
3-6418
Gardner-Denver Co.
Link-Belt Co.
Page Engineering Co.

Motor Supply Co.,
315 North Central Ave.,
4-1153
Lincoln Electric Co.

Pratt-Gilbert Hardware Co.,
701 South Seventh St.,
3-5145
Air Reduction Sales Co.
Apache Powder Co.
Koehring Co.
Leschen, A., & Sons Rope Co.

Stapley, O. S., Co.,
723 Grand Ave.,
4-1116
Austin-Western Road Machinery Co.
Columbia Steel Co.
Gardner-Denver Co.

Torson Construction Co.,
220 South 7th Ave.,
Electric Tamper & Equipment Co.

Union Oil Co. of Calif.,
Grand Ave. at Six Points
3-1181

The Western Metal Mfg. Co.
Western Pipe & Steel Co.
611 South Dunlap Ave.
3-5602

Tucson

Baum & Adamson,
296 North Stone Ave.
4050
Goodrich, B. F., Co.

Corbett, J. Knox, Lumber & Hdw. Co.,
340 North Sixth Ave.
2140
Austin-Western Road Machinery Co.

Fuller, W. P. & Co.,
219 East Congress St.
2278
Reilly Tar & Chemical Corp.

General Petroleum Corporation of California,
503 E. 23rd.
710
Ronstadt Hdw. & Mchy. Co.,
92 East Broadway
680
Galion Iron Works & Mfg. Co.

Steinfeld, Albert, & Co.,
119 North Stone Ave.
882
Apache Powder Co.

Union Oil Company,
901 East 16th St.
799

California

Los Angeles

Adams, J. D., Company,
1202 Mateo St.
TRinity 8381
Adams, J. D., Co.

Air Reduction Sales Co.,
2423 East 58th St.
JEfferson 6141

American Cable Co., Inc.,
841 Petroleum Sec. Bldg.
PRospect 5753

American Concrete & Steel Pipe Co.,
4635 Firestone Blvd.
JEfferson 4211
Atlas Powder Co.,
805 Title Guarantee Bldg.
MIchigan 8896

Austin-Western Road Mchy. Co.,
4400 District Boulevard
KImball 4156

Barrett Co.,
1136 South Hayworth Ave.
YOrk 1559

Bevis Machinery Co.,
3649 Santa Fe Ave.
KImball 4149
Industrial Brownhoist Corp.

Brown-Bevis Equipment Co.,
4900 Santa Fe Ave.
JEfferson 5221
Electric Tamper & Equipment Co.
Page Engineering Co.

California Corrugated Culvert Co.,
409 Leroy St.
CApitol 13181

California Equipment Co.
4900 Santa Fe Avenue
Vernon
JEfferson 4106
Smith Engineering Works

California Redwood Association,
117 West Ninth St.
MUtual 8156

Chicago Bridge & Iron Wks.,
608 South Hill St.
TUcker 1938

Chicago Pneumatic Tool Co.,
655 Santa Fe Ave.
MIchigan 2651

Columbia Steel Co.,
2087 East Slauson.
LAfayette 1171

Columbian Iron Works,
2801 East 12th St.

Collins, Harry C., Machinery Co.,
1919 Santa Fe Ave.
Link-Belt Co.

Crook Company,
2900 Santa Fe Ave.
KImball 5137
American Cable Co., Inc.
Bucyrus-Erie Co.

Ducommun Corp.,
219 S. Central.
TRinity 0621

Electric Steel Foundry Co.,
2205 Santa Fe Ave.
JEfferson 4191

Fuller Company,
1041 South Olive St.

Fuller, W. P., & Co.,
135 North Los Angeles St.
TRinity 0711
Reilly Tar & Chemical Corp.

Garlinghouse Bros.,
2416 East 16th St.
JEfferson 5291
Leschen, A., & Sons Rope Co.,
Mall Tool Co.
McKiernan-Terry Corp.
Worthington Pump & Machinery Corp.

General Chemical Co.,
1031 S. Broadway
PRospect 2269

General Electric Co.,
5201 Santa Fe Ave.
LAfayette 0961

General Paint Corp.,
544 Mateo St.
TRinity 4941

General Petroleum Corporation of California,
508 Higgins Bldg.
MUtual 2311

Goodrich, B. F., Co.,
1000 East 8th St.
TRinity 1075

Halafax Explosives Co.,
810 South Spring St.
TRinity 8528

Harnischfeger Sales Corp.,
2029 Santa Fe Ave.
MAdison 2444

Harron, Rickard & McCone Co.,
2205 Santa Fe Ave.
JEfferson 4191
Electric Steel Foundry Co.
Gardner-Denver Co.
Harnischfeger Corp.—Welders
Koehring Co.
Wellman Engineering Co.

Hercules Powder Co.,
Fidelity Bldg.
MUtual 6397

Johns-Manville Sales Corp.,
714 West Olympic Blvd.
PRospect 8171

Layne & Bowler Corp.,
900 Santa Fe Ave.
TRinity 2543

International Filter Co.,
2309 East 8th St.
VAndyke 3155

Lincoln Electric Co.,
812 Mateo St.

Link-Belt Co.,
361 South Anderson St.
ANgelus 6171

Neptune Meter Co.,
701 East Third St.
TRinity 2879

Northwest Engineering Co.,
3707 Santa Fe Ave.
JEfferson 2196

Ornitz, Edward M.,
206 South Spring St.
MUtual 3812
Etnyre, E. D., & Co.

Pacific Coast Steel Corporation
E. Slauson Ave. and Downey Road
LAfayette 1161

Pacific Portland Cement Co.,
633 East Gage Ave.
ADams 6103

Portland Cement Association
816 West 5th St.
MIchigan 9897

Reilly Tar & Chem. Corp.,
Architects Building
MUtual 0433

Rix Company, Inc., The,
810 Santa Fe Ave.
TRinity 4134
Page Engineering Co.
Thew Shovel Co.

John A. Roebling's Sons Co.
216 South Alameda St.
TRinity 1261

Shepherd Tractor & Equipment Co.,
150 West Jefferson St.
PRospect 0247
Caterpillar Tractor Co.
LeTourneau, R. G., Inc.
John A. Roebling's Sons Co.

Smith Booth Usher Co.,
2001 Santa Fe Ave.
TRinity 6911
Lima Locomotive Works, Inc. (Shovel and Crane Division)
Page Engineering Co.
Worthington Pump & Machinery Corp.

Southwest Welding & Mfg. Co.,
3201 W. Mission.
ALhambra 6866

Standard Steel Works,
5001 Boyle Ave.
LAfayette 1138

Saint Louis Power Shovel Co.,
322 West Third St.
MUtual 2885

St. John, A. S., Co., Inc.,
126 West Third St.
VAndike 8865
Apache Powder Co.

Sparling, R. W., Co.,
945 N. Main St.
CApitol 13168

Stevenson Chemical Co.,
641 Gibbons St.
Gt. Western Electro-Chemical Co.

United States Pipe and Foundry Co.,
504 Subway Terminal Bldg.
VAndike 5166

Victor Welding Equipment Co.,
2032 Santa Fe Ave.
JEfferson 6246
General Electric Co.

Wallace & Tiernan Co.,
3923 West Sixth St.
FEderal 6823

Western Pipe & Steel Co.,
5717 Santa Fe Ave,
JEfferson 3131

Worthington Pump & Machinery Corp.
5075 Santa Fe Ave.
JEfferson 6251

Oakland

Air Reduction Sales Co.
Park Ave. & Halleck St.
OLympic 4100

Amercan Concrete & Steel Pipe Co.,
19th Ave. and Estuary
ANdover 4866

Bacon, Edw. R., Co.,
2059 Webster St.
GLencourt 7400
LeTourneau, R. G., Inc.
McKiernan-Terry Corp.
Page Engineering Co.
Roebling, J. A., & Sons Co.

Bates, Sam, Co.
1925 Dennison St.
ANdover 4327
Chicago Pneumatic Tool Co.
Page Engineering Co.

California Corrugated Culvert Co.,
5th & Parker St. (Berkeley)
BErkeley 5420

Fuller, W. P., & Co.,
259 10th St.
GLencourt 0167
Reilly Tar & Chemical Corp.

General Petroleum Corporation of California,
Fox Oakland Bldg.
HOlliday 5573

Goodrich, B. F., Co.,
254 23rd St.
GLencourt 1803

Industrial Equipment Co.,
Outer Harbor.
GLencourt 5909
Bucyrus-Erie Co.

Link-Belt Co.,
526 Third St.
HIgate 4286

Pacific Electric Motor Co.,
10th and Oak Sts.
GLencourt 1844
General Electric Co.

Robinson Tractor Co.,
1705 East 12th St.
FRuitvale 2485

Caterpillar Tractor Co.
LeTourneau, R. G., Inc.

Union Oil Co. of Calif.,
516 18th St.
GLencourt 6440

Sacramento

Air Reduction Sales Co.,
501 I St.
Main 852

Bacon, Edward R., Co.,
720 I St.
Main 445
LeTourneau, R. G., Inc.
McKiernan-Terry Corp.
Page Engineering Co.
Roebling, J. A., & Sons Co.

DeHart, S. B.
1051 34th Street
Capital 4475-W
Adams, J. D., Co.

Where to Buy in the West

Fuller, W. P., & Co.,
1013 12th St.
Main 6890
Reilly Tar & Chemical Corp.

General Paint Corp.,
11th and R
Capital 2121

General Petroleum Corporation of California
W. Sacramento
Main 720

Goodrich, B. F., Co.,
12th and I Sts.
Main 454

Union Oil Co. of Calif.,
Calif. State Life Bldg.
Capital 2400

Vandercook Gold Co.,
F & M Bldg.
Sacramento
Main 2085
Worthington Pump & Machinery Corp.

Weaver-Rye Tractor Co., Inc.,
1715 2nd St.
Main 4100
Caterpillar Tractor Co.
LeTourneau, R. G., Inc.

Western Pipe & Steel Co.,
Care of Sutter Club
Main 217

San Diego

American Concrete & Steel Pipe Co.,
Post Office Box 13
Charles N. Bottiger
209 West E.
Main 1657
Lincoln Electric Co.

Contractors Equipment & Machinery Co.
1344 National Ave.
Main 8833
John A. Roebling's Sons Co.
Worthington Pump & Machinery Co.

Fuller, W. P., & Co.,
803 7th Ave.
Main 0181
Reilly Tar & Chemical Corp.

General Electric Co.,
206 W. Market St.
Main 4288

General Petroleum Corporation of California
1302 Crosby
Franklin 7667

Goodrich, B. F., Co.,
7th and Market Sts.
Franklin 6258

San Diego Tractor & Equipment Co.,
701 First Ave.
Main 6151
Caterpillar Tractor Co.

Southern Machinery Co.,
666 State St.
Franklin 6388
Ingersoll-Rand Co.

Union Oil Co. of Calif.,
1521 National Ave.
Franklin 3144

Western Metal Supply Co.,
215 7th St.
Franklin 3111
Air Reduction Sales Co.

San Francisco

Adams, J. D., Co.,
230 Utah St.
UNderhill 5120
Adams, J. D., Co.

Air Reduction Sales Co.,
313 6th St.
SUtter 4582

American Cable Co., Inc.,
630 Third St.
SUtter 1708

Associated Equipment Co., Ltd.,
355 Fremont St.
KEarny 1181
Thew Shovel Co.

Atlas Powder Co.,
1 Montgomery St.
GArfield 8640

Austin-Western Road Mchy. Co.,
435 Brannan St.
DOuglas 2183

Bacon, Edward R., Co.,
17th and Folsom Sts.
HEmlock 3700
LeTourneau, R. G., Inc.
McKiernan-Terry Corp.
Page Engineering Co.
John A. Roebling's Sons Co.

Bucyrus-Erie Co.,
989 Folsom St.
GArfield 8192

California Redwood Association,
Financial Center Bldg.
EXbrook 7880

Chicago Bridge & Iron Wks.
116 New Montgomery St.
DOuglas 7376

Chicago Pneumatic Tool Co.,
175 First St.
KEarny 2014

Columbian Iron Works,
1072 Howard St.

Ducommun Corp.,
656 Townsend St.
HEmlock 2900

Fuller Co.,

Fuller, W. P., & Co.,
301 Mission St.
EXbrook 7151
Reilly Tar & Chemical Corp.

Garfield & Co.,
Hearst Bldg.
SUtter 1036
Industrial Brownhoist Corp.
Link-Belt Co.
Worthington Pump & Machinery Co.

General Chemical Co.,
343 Sansome St.
DOuglas 0904

General Electric Co.,
235 Montgomery St.
DOuglas 3740

General Paint Corp.,
2627 Army St.
ATwater 5100

General Petroleum Corporation of California
310 Sansome St.
EXbrook 6411

Goodrich, B. F., Co.,
11th and Howard Sts.
UNderhill 1801

Great Western Electro-Chemical Co.,
9 Main St.
GArfield 8323

Harnischfeger Sales Corp.,
82 Beale St.
DOuglas 2313

Harron, Rickard & McCone Co.,
2070 Bryant St.
ATwater 2202
Electric Steel Foundry Co.
Gardner-Denver Co.
Harnischfeger Sales Corp.
Koehring Co.
Wellman Engineering Co.

Hercules Powder Co.,
Standard Oil Bldg.
DOuglas 2330

Ingersoll-Rand Co.,
350 Brannan St.
GArfield 6330

Johns-Manville Sales Corp.,
159 New Montgomery St.
DOuglas 4353

Jenison Machinery Co.,
900 Tennessee.
VAlencia 1710
Smith Engineering Works

Kratz & McClelland, Inc.,
522 Bryant St.
SUtter 6807
Electric Tamper & Equipment Co.

Leschen, A., & Sons Rope Co.,
520 Fourth St.
GArfield 8134

Lincoln Electric Co.,
894 Folsom St.
GArfield 5507

Link-Belt Co.,
400 Paul Ave.
DElaware 6400

Neptune Meter Co.,
320 Market St.
GArfield 8144

Northwest Engineering Co.,
255 Tenth St.
HEmlock 5060

Pacific Coast Steel Corp.,
20th and Illinois Sts.
MArket 3200

Pacific Pipe Co.,
207 Folsom St.
EXbrook 6255

Pacific Portland Cement Co.,
111 Sutter St.
GArfield 4100

Pacific States Cast Iron Pipe Co.,
Rialto Bldg.,
KEarny 5075

Portland Cement Association
564 Market St.
SUtter 8159

Robinson Tractor Co.,
1175 Howard St.
MArket 8020
Caterpillar Tractor Co.
LeTourneau, R. G., Inc.

John A. Roebling's Sons Co.
646 Folsom St.
GArfield 6490

Thew Shovel Co.,
355 Fremont St.
KEarny 1181

Union Oil Co. of Calif.,
220 Montgomery St.
SUtter 1400

United States Pipe and Foundry Co.,
907 Monadnock Bldg.
GArfield 5140

Victor Welding Equipment Co.,
844 Folsom St.
GArfield 5727
General Electric Co.

Wallace & Tiernan Co., Inc.,
171 Second St.
KEarny 5072

Welding Service, Inc.,
954 Howard St.
DOuglas 3292
Harnischfeger Corp.—Welders

Western Pipe & Steel Co.,
444 Market St.
GArfield 6788

Worthington Pump & Machinery Corp.,
543 Howard St.

Young, A. L., Machinery Co.,
26 Fremont St.
SUtter 5736
Lima Locomotive Works, Inc.

Colorado

Denver

American Cable Co., Inc.,
2125 Blake St.
TAbor 0197

Atlas Powder Co.,
401 Midland Savings Bldg.

Bostwick, Frederick H.,
Denver Natl. Bank Bldg.
TAbor 5744
Western Pipe & Steel Co.

Cederberg, C. R.,
5531 East 14th Ave.
YOrk 0604
Wallace & Tiernan Co., Inc.

Clinton & Held Co.,
1637 Wazee St.
TAbor 3291
Caterpillar Tractor Co.
LeTourneau, R. G., Inc.

Corson, Ray, Machinery Co.,
1646 Wazee St.
KEystone 6632
Bucyrus-Erie Co.
Page Engineerig Co.

Denver Oxygen Co.,
901 Navajo
TAbor 4725
Air Reduction Sales Co.

Fair, Elton T., Co.,
1646 Wazee St.
TAbor 1685
Adams, J. D., Co.

Fitzgerald, Paul,
U. S. Natl. Bank Bldg.
TAbor 1841
Harnischfeger Corp.—Welders

General Chemical Co.,
1271 W. Bayaud Ave.
PEarl 2666

General Electric Co.,
650 17th St.
KEystone 7171

General Machinery & Supply Co.,
635 Walnut St.
KEystone 1500
Worthington Pump & Machinery Co.

Goodrich, B. F., Co.,
14th and Glenarm Sts.
KEystone 0175

Great Northern Tool & Sup. Co.,
2125 Blake St.
TAbor 0197
Lincoln Electric Co.

Hardesty Mfg. Co.,
3063 Blake St.
MAin 4156

Hendrie & Bolthoff Mfg. & Supply Co.
1639 17th St.
KEystone 4111
General Electric Co.
John A. Roebling's Sons Co.

Hercules Powder Co.,
1822 California St.
TAbor 5386

Leschen, A., & Sons Rope Co.,
1554 Wazee St.
MAin 1366

Liberty Trucks & Parts Co., Inc.,
615 East 18th Ave.
MAin 3241
Austin-Western Road Machinery Co.

Link-Belt Co.,
Boston Bldg.
MAin 0231

McKelvy Machinery Co.,
754 South Broadway
Adams, J. D., Co.
Koehring Co.

Mine & Smelter Supply Co.,
1422 17th St.
KEystone 3111
McKiernan-Terry Corp.
Northwest Engineering Co.

Mine & Smelter Supply Co.,
1422 17th St.
KEystone 3111
Smith Engineering Works

Moore Hardware & Iron Co.,
1529 15th St.
TAbor 2251
Harnischfeger Corp.—Welders

Moore, H. W., Equipment Co.,
Sixth and Acoma Sts.
TAbor 1361
Thew Shovel Co.
Wellman Engineering Co.

Neptune Meter Co.,
1700 15th St.
MAin 3221

Pacific States Cast Iron Pipe Co.,
1921 Blake St.
MAin 0697

Socony-Vacuum Oil Co., Inc.
(Road Oil Sales)
U. S. N. Bank Bldg.
TAbor 2809
General Petroleum Corp.

Stearns-Roger Mfg. Co.,
1720 California
KEystone 3311
Chicago Pneumatic Tool Co.

Steinbarger, Herbert N., Co.,
1711 Market St.
MAin 3460
Lima Locomotive Works, Inc.

Worthington Pump & Machinery Co.,
512 18th St.

Idaho

Boise

Bunting Tractor Co.,
926 Front St.
2649
Caterpillar Tractor Co.

Feenaughty Machinery Co.
9th and Grove Sts.
1333
Thew Shovel Co.

Fine, Jake
Post Office Box 549
3613J
Adams, J. D., Co.

General Electric Co.,
906 East Bannock St.
368

General Paint Corp.,
2218 W. Fairview Ave.
2861-W

Hardesty Mfg. Co.,
223 South Third St.
3031

Intermountain Equipment Co.,
Broadway and Myrtle St.
171
Bucyrus-Erie Co.
General Electric Co.
LeTourneau, R. G., Inc.
Page Engineering Co.
John R. Roebling's Sons Co.

Jeter, F. A.
1116 North 18th St.
2612
Austin-Western Road Machinery Co.

Olson Mfg. Co.,
214 South 5th St.
4277
Leschen, A., & Sons Rope Co.

Where to Buy in the West

Stockton-Regan, Inc.,
10th and Grove Sts.
78
Goodrich, B. F., Co.

Montana

Billings

Austin-Western Road Mchy. Co.,
2413 First Ave. N.

Connelly Machinery Co.,
2706 Montana Ave.
Bucyrus-Erie Co.
Caterpillar Tractor Co.
Leschen, A., & Sons Rope Co.,
LeTourneau, R. G., Inc.

Freeman Auto Service
Goodrich, B. F., Co.

Great Northern Tool & Sup-Co.
Lincoln Electric Co.

Hardie, W. C.,
1121 N. 32nd St.
5548
Adams, J. D., Co.

Midland Implement Co.,
2300 Montana Ave.
Koehring Co.
Page Engineering Co.

Socony-Vacuum Oil Co., Inc.
Genl. Petroleum Corp.

Butte

Atlas Powder Co.,
412 West Broadway
2-4868

Chicago Pneumatic Tool Co.,
920 South Arizona St.
2-4285

Daugherty, H. H.,
420 South Idaho St.
3884
Bucyrus-Erie Co.

General Electric Co.
20 West Granite St.
5479

Hall-Perry Machinery Co.,
812 East Iron St.
6376
American Cable Co., Inc.,
Page Engineering Co.
Smith Engineering Works
Thew Shovel Co.

Lowney & Williams,
202 South Montana St.
3352
Goodrich, B. F., Co.

Montana Hardware Co.,
823 South Montana St.
2-1295
Ingersoll-Rand Co.
John A. Roebling's Sons Co.

Socony-Vacuum Oil Co., Inc.
Genl. Petroleum Corp.

Wright, S. P., & Co., Inc.
48 East Broadway
2-3221
Lima Locomotive Works, Inc.

Great Falls

Connelly Machinery Co.,
315 2nd Street S.
Bucyrus-Erie Co.
Caterpillar Tractor Co.
Leschen, A., & Sons Rope Co.
LeTourneau, R. G., Inc.

Holdal, Milton
1306 Second Ave. South
3320

Northwest Equipment Co., Inc.,
Great Northern Tracks
3982
Koehring Co.

Socony-Vacuum Oil Co., Inc.
Strain B
6575
General Petroleum Corp.

Taylor Chevrolet Co.,
802 Central Ave.
8467
Goodrich, B F., Co.

Missoula

Hardesty Mfg. Co.

Star Garage
Goodrich, B. F., Co.

Wells, Walker J.
Austin-Western Road Machinery Co.

Westmont Tractor & Equipment Co.,
Bucyrus-Erie Co.
Caterpillar Tractor Co.
Leschen, A., & Sons Rope Co.
LeTourneau, R. G., Inc.
Wellman Engineering Co.
Worthington Pump & Machinery Corp.

Nevada

Reno

Bacon, Edward R. Co.,
649 John Fremont Drive
Reno 4043
LeTourneau, R. G., Inc.
McKiernan-Terry Corp.
Page Engineering Co.
Roebling, J. A., & Sons Co.

Bell, O. C.,
649 John Fremont Drive
Reno 4043
Adams, J. D., Co.

Collier Tractor & Equipment Co.,
502 East Fourth St.
Reno 6107
American Cable Co., Inc.
Caterpillar Tractor Co.
Harnischfeger Corp.
LeTourneau, R. G., Inc.

Flanigan Warehouse Co.,
408 Eureka St.
Reno 3852
Columbia Steel Co.
Pac. Portland Cement Co.,
Western Pipe & Steel Co.

Hinckley Tire Service, Inc.
145 W. 2nd St.
Reno 6792
Goodrich, B. F., Inc.

Reno Motor Supply Co.,
15 West Plaza
Reno 4108
Air Reduction Sales Co.

Smith, James L.,
1084 S. Virginia
Reno 8139
General Petroleum Corp.

Union Oil Co. of Calif.,
107 East 4th St.
Reno 3661

New Mex.

Albuquerque

Calhoun Independent Oil Co.,
1801 North 4th St.
3516
Goodrich, B. F., Co.

Harrison, R. L., Co., Inc.,
211 North 4th St.
3300
American Cable Co., Inc.
Bucyrus-Erie Co.
Caterpillar Tractor Co.
LeTourneau, R. G., Inc.
McKiernan-Terry Corp.
Wellman Engineering Co.

Magnolia Petroleum Co.,
1101 North First
450
General Petroleum Corp.

McChesney-Rand Equipment Co.,
Adams, J. D., Co.
Thew Shovel Co.

Morrow & Co.,
1025 North Fourth St.
4017
Hercules Powder Co.

Santa Fe

Santa Fe Motor Co.,
Goodrich, B. F., Co.

Magnolia Petroleum Co.,
General Petroleum Corp.

McChesney-Rand Equipment Co.,
Adams, J. D., Co.
Thew Shovel Co.

Oregon

Klamath Falls

General Petroleum Corporation of California
Keno Road 473-W

Locke Motor Co.,
522 South Sixth St.
49
Goodrich, B. F., Co.

Lorenz Co.,
Sixth and Broad Sts.
371
John A. Roebling's Sons Co.

Miller Tractor & Equipment Co.,
719 Market St.
314
Caterpillar Tractor Co.

People's Warehouse
1425 South Sixth St.
704
Air Reduction Sales Co.

Union Oil Co. of Calif.,
Sixth and Market Sts.
776-W

Portland

Air Reduction Sales Co.
2878 N. W. Sherlock
BRoadway 2501

Atlas Powder Co.,
833 Pacific Bldg.
BEacon 2845

Balzer Machinery Co.,
1636 S. E. Sixth Ave.
EAst 5609
Chicago Pneumatic Tool Co.

Clyde Equipment Co.,
1631 N. W. Thurman St.
BRoadway 5561
Bucyrus-Erie Co.
Electric Tamper & Equipment Co.
Smith Engineering Works

Columbia Steel Co.,
2345 N. W. Nicolai St.
BEacon 7261

Consolidated Supply Co.
139 S. W. Stark
ATwater 6511
Air Reduction Sales Co.

Cramer Machinery Co.,
Lewis Bldg.
ATwater 3852
Koehring Co.

Electric Steel Foundry Co.,
2458 N. W. York St.
BEacon 6344
American Cable Co., Inc.

Freenaughty Machinery Co.,
112 S. E. Belmont St.
EAst 2187
LeTourneau, R. G., Inc.
Page Engineering Co.
Thew Shovel Co.

General Electric Co.,
621 S. W. Alder St.
ATwater 0281

General Paint Corp.,
838 S. W. 2nd Ave.
ATwater 5205

General Petroleum Corporation of California
Woodlark Bldg.
BEacon 7101

Goodrich, B. F., Co.,
Union and Stark Sts.
EAst 4148

Gordon & Finkbeiner Co.,
112 S. W. Pine St.
ATwater 9401
Ingersoll-Rand Co.

Haag, A. C., & Co.
931 S. E. Sixth Ave.
EAst 2388
Adams, J. D., Co.
Worthington Pump & Machinery Corp.

Harmer Steel Products & Supply Co.,
120 S. W. Front
ATwater 2957
John A. Roebling's Sons Co.

Haseltine, J. E., & Co.,
115 S. W. Second Ave.
ATwater 7511
General Electric Co.

Howard-Cooper Corp.,
307 S. E. Hawthorne Ave.
EAst 8188
McKiernan-Terry Corp.

Leschen, A., & Sons Rope Co.,
Foot of S. W. Sheridan St.
ATwater 7425

Lincoln Electric Co.,
1631 N. W. Thurman St.
BRoadway 5561

Link-Belt Co.,
1637 N. W. 14th Ave.
ATwater 6481

Loggers & Contractors Machinery Co.,
211 S. E. Madison St.
EAst 4128
Caterpillar Tractor Co.
LeTourneau, R. G., Inc.
Wellman Engineering Co.

Neptune Meter Co.,
1519 N. W. Johnson St.
BRoadway 0100

Pacific Coast Steel Corp.,
American Bank Bldg.
BEacon 7238

Pacific Portland Cement Co.,
701 Lewis Bldg.
ATwater 6656

Pacific States Cast Iron Pipe Co.,
Spaulding Bldg.
ATwater 5465

Pure Iron Culvert & Mfg. Co.,
2321 S. E. Gladstone
SEllwood 2275

John A. Roebling's Sons Co.,
14th and Marshall Sts.
BRoadway 6411

Union Oil Co. of Calif.,
Yeon Bldg.
ATwater 9521

Western Loggers Mchy. Co.,
302 S. W. 4th Ave.
ATwater 7491
Harnischfeger Corp.—Welders

Western Steel & Equipment Co.,
734 N. E. 55th Ave.
TAbor 2370
Lima Locomotive Works, Inc.

Woodbury & Co., Inc.,
133 S. W. 2nd
ATwater 6644
Chicago Pneumatic Tool Co.

Texas

El Paso

Car Parts Depot, Inc.,
810 Texas St.
Main 9000
Harnischfeger Corp.—Welders
Ingersoll-Rand Co.

Chicago Pneumatic Tool Co.,
426 Mills Building
Main 976

General Electric Co.,
109 North Oregon St.
Main 5500

General Engineering & Equipment Co.,
Worthington Pump & Machinery Corp.

Goodrich, B. F., Co.,
501 Texas St.
Main 262

Magnolia Airco Gas Products Co.,
Old Fort Bliss
Main 1390
Air Reduction Sales Co.

Magnolia Petroleum Co.,
105 Wyoming
Main 1992
General Petroleum Corp.

Mine & Smelter Supply Co.,
410 San Francisco
Main 5720
Smith Engineering Works
Worthington Pump & Machinery Corp.

Momsen-Dunnegan-Ryan Co.,
800 East Overland St.
Main 7100
Apache Powder Co.

Tri-State Equipment Co.,
500 East Overland St.
Main 1507
Bucyrus-Erie Co.
Caterpillar Tractor Co.
LeTourneau, R. G., Inc.
McKiernan-Terry Corp.
Wellman Engineering Co.

Western Metal Mfg. Co.,
6th and S. St. Vrain
Main 1226

Worthington Pump & Machinery Corp.,
206 San Francisco St.
Main 863

Zork Hardware Co.,
309 North El Paso St.
Main 1040
Leschen, A., & Sons Rope Co.

Utah

Salt Lake City

Ambler & Ritter
Kearns Bldg.
Wasatch 1132
Thew Shovel Co.

Arnold Machinery Co.,
149 West Second South St.
Wasatch 3973
Byers Machine Co.
Chain Belt Co.
Northwest Engineering Co.
Page Engineering Co.

Atlas Powder Co.,
822 Continental Natl. Bank Bldg.
Wasatch 4027

Where to Buy in the West

Columbia Steel Co.,
1606 Walker Bank Bldg.
Wasatch 1076

Eastern Iron & Metal Co.,
634 South Fourth West St.
Wasatch 1118
Ingersoll-Rand Co.

Gallgher Company
228 South West Temple St.
Wasatch 900
General Electric Co.
John A. Roebling's Sons Co.

General Electric Co.,
200 S. Main St.
Wasatch 735

Goodrich, B. F., Co.,
131 East First South St.
Wasatch 5024

Hardesty Mfg. Co.,
631 South Third West
Wasatch 3141

Harrison & Company
Dooley Block
Fuller Co.

Hercules Powder Co.,
910 Kearns Bldg.
Wasatch 815

Jones, C. H., Co.
134 Pierpont Ave.
Wasatch 2580
Lima Locomotive Works, Inc.

Landes Tractor & Equipment Co.,
245 West South Temple St.
Wasatch 4020
Caterpillar Tractor Co.
Harnischfeger Corp.—Welders and Hoists
LeTourneau, R. G., Inc.

Lang Company, The
267 West First South St.
Wasatch 6693
Austin-Western Road Machinery Co.

Lund Machinery Co.
49 North Second West St.
Wasatch 5581
Adams, J. D., Co.
Koehring Co.

Mine & Smelter Supply Co.
121 West Second South St.
Wasatch 404
Smith Engineering Works

National Equipment Co.
101 West Second South St.
Wasatch 1722
Wellman Engineering Co.

Richmond, F. C., Mach. Co.
322 West Second South St.
Wasatch 742
Chicago Pneumatic Tool

Waterworks Equipment Co.
149 West Second South St.
Wasatch 2465
Neptune Meter Co.
Pacific States Cast Iron Pipe Co.

Western Machinery Co.
260 South Sixth West St.
Wasatch 3907
Ingersoll-Rand Co.

Whitmore Oxygen Co.
430 East South Temple
Wasatch 3181
Air Reduction Sales Co.

Wilson, S. A.
205 Second Ave.
General Petroleum Corp.

Z. C. M. I.
351 Z. C. M. I. Ave.
Wasatch 1010
Leschen, A., & Sons Rope Co.

Washington

Seattle

Air Reduction Sales Co.
3623 East Marginal Way
ELliott 4720

Armstrong, H. J., Co.
2244 First Ave. So.
ELliott 5940
Leschen, A., & Sons Rope Co.
Lima Locomotive Works, Inc.
(Shovel and Crane Division)
Page Engineering Co.

Atlas Powder Co.
1320 Jos. Vance Bldg.
MAin 5110

H. A. Cheever Co.
1962 First Ave., South
ELliott 6188
Lincoln Electric Co.

Chicago Pneumatic Tool Co.
1928 First Avenue South

Clyde Equipment Co.
3410 First Ave. South
MAin 1235
Bucyrus-Erie Co.
Electric Tamper & Equipment Co.
Smith Engineering Works

Columbia Steel Company
1054 Fourth Avenue South
MAin 1972

Cox, A. H., & Co., Inc.
1757 First Ave. South
MAin 1121
Austin-Western Road Machinery Co.
Link-Belt Co.
Wellman Engineering Co.

Electric Steel Foundry Co.
2724 First Ave. South
ELliott 1084

Federal Pipe & Tank Co.
5332 24th Ave. N.W.
SUnset 5878

Feenaughty Machinery Co.
1028 Sixth Ave. South
ELliott 7808
LeTourneau, R. G., Inc.
Page Engineering Co.
Thew Shovel Co.

General Chemical Company
2203 First Avenue South
ELliott 0350

General Electric Co.
821 Second Ave.
MAin 9790

General Paint Corp.
1406 Dearborn St.
PRospect 7600

General Petroleum Corporation of California
1519 Railroad Ave. South
MAin 3765

Goodrich, B. F., Co.
535 First Ave. South
MAin 8080

Grant Auto Electric Co., Inc.
1425 12th
EAst 0525
Air Reduction Sales Co.

Harnischfeger Sales Corp.
2911 First Ave. South
MAin 5576

Haseltine, J. E., & Co.
440 Holgate St.
SEneca 0626
General Electric Co.

Howard-Cooper Corp.
1520 Fourth Ave. South
ELliott 0740
McKiernan-Terry Corp.

Lima Locomotive Works, Inc.
(Shovel and Crane Division)
2244 First Ave. South
ELliott 5940

Link-Belt Co.
820 First Ave. South
ELliott 5554

Pacific Coast Steel Corp.
28th Ave. S.W. and W. Andover St.
WEst 1131

Pacific Hoist & Derrick Co.
3200 Fourth Ave. South
ELliott 1860
Northwest Engineering Co.

Pacific Portland Cement Co.
1871 16th Ave. S.W.
ELliott 4033

Portland Cement Association
903 Seaboard Bldg.
SEneca 0916

Purcell, Hugh G., Co.
Colman Bldg.
MAin 6835
Industrial Brownhoist Corp.
United States Pipe and Foundry Co.

Reilly Tar & Chemical Corp.
Central Bldg.
SEneca 1191

John A. Roebling's Sons Co.
900 First Avenue South
MAin 4992

Smith, R. G.
3223 61st Avenue S.W.
WEst 2416
Adams, J. D., Co.

Snow, L. A., Co.
1032 Sixth Ave. South
ELliott 4188
Koehring Co.

Star Machinery Co., Inc.
1741 First Avenue South
ELliott 0760

Union Oil Co. of Calif.
2901 Western Ave.
MAin 1251

Wallace & Tiernan Co., Inc.
917 Terminal Sales Bldg.
MAin 0201

Washington Corrugated Culvert Co.
4327 Roosevelt Way
EVergreen 0660

Western Tractor & Equipment Co.
2230 First Ave. South
MAin 5180
Caterpillar Tractor Co.

Worthington Pump & Machinery Corp.
922 First Avenue South
MAin 4220

Spokane

Adams, J. D., Co.
E. 14 Main St.
Main 3995

Atlas Powder Co.
1131 Old Natl. Bank Bldg.
Main 4733

Austin-Western Road Mchy. Co.
N. 1405 Ash St.
Broadway 1294

Broadway Welding & Mach. Works
1021 Broadway
Broadway 0120
Air Reduction Sales Co.

Bucyrus-Erie Co.
1805 Ninth Ave.

Construction Equipment Co.
1118 Ide
Broadway 5076
Wellman Engineering Co.

Chicago Pneumatic Tool Co.
715 Division St.
Broadway 5606

Columbia Steel Company
W. 914 Ninth Avenue
Riverside 3695

Feenaughty Machinery Co.
N. 715 Division St.
Broadway 5606
Thew Shovel Co.

General Electric Co.
421 Riverside Ave.
Main 5201

General Machinery Co.
E. 3501 Riverside Ave.
Lakeview 1134
Lima Locomotive Works
John A. Roebling's Sons Co.
Smith Engineering Works
Worthington Pump & Machinery Corp.

General Paint Corp.
713 First Avenue
Main 2166

General Petroleum Corporation of California
Havana & Sprague
Lakeview 1074

Gibson, Geo.
Pacific Hotel
Riverside 3141
Lincoln Electric Co.

Goodrich, B. F., Co.
829 Second St.
Riverside 0064

Harnischfeger Sales Corp.
S. 1314 Bernard St.
Main 6805

Howard-Cooper Corp.
134 Spokane International Rt. of Way
Main 1812
McKiernan-Terry Corp.

Hofius-Ferris Equipment Co.
728 Mallon Ave.
Broadway 1954
Caterpillar Tractor Co.
LeTourneau, R. G., Inc.

Hughes & Co.
S. 119 Howard St.
Main 4277
Neptune Meter Co.

Lundy, A. L.
Culmstock Arms Apt. Hotel
Riverside 7181
Columbia Steel Company

Nott-Atwater Co.
S. 157 Monroe St.
Main 4377
Leschen, A., & Sons Rope Co.

Snow, L. A., Co.
S. 151 Madison St.
Main 4226
Koehring Co.

Spokane Welders Supply Co.
919 1st
Main 2044
Air Reduction Sales Co.

Tri-State Equipment Co.
500 East Overland St.
Main 1507
American Cable Co., Inc.

Union Oil Co. of Calif.
Chronicle Bldg.
Main 3266

Washington Corrugated Culvert Co.
N. End Division Bridge
Broadway 3537

Washington Mchy. & Supply Co.
9 Cataldo St.
Broadway 0390

Tacoma

American Concrete and Steel Pipe Co.
459 East 15th Street
Broadway 2437

General Electric Co.
1019 Pacific Ave.
Main 2882

General Petroleum Corporation of California
520 East D
Broadway 4256

Goodrich, B. F., Co.
21st and Pacific Ave.
Main 9173

National Equipment Co.
101 West Second South St.
Wasatch 1722
American Cable Co., Inc.

Union Oil Co. of Calif.
2907 South Ainsworth St.
Broadway 3215

Wyoming

Cheyenne

Carrolls, Geo., Scout Super Service
202 East Lincoln Highway
4312
Goodrich, B. F., Co.

Moss, Glenn
423 West 19th
Austin-Western Road Machinery Co.

Socony-Vacuum Corp.
General Petroleum Corp.

Wortham Machinery Co.
410 West 19th St.
4649
Caterpillar Tractor Co.
LeTourneau, R. G., Inc.

OPPORTUNITY SECTION

OPPORTUNITY SECTION

OFFICIAL BIDS

UNITED STATES DEPARTMENT OF THE INTERIOR

Bureau of Reclamation
(Federal Emergency Administration of Public Works Project)

Construction of Earthwork and Structures

Washington, D. C., September 21, 1935. Sealed bids (Specifications No. 646) will be received at the office of the United States Bureau of Reclamation, Ontario, Oregon, until 10 o'clock a. m., October 21, 1935, and will at that hour be opened for furnishing labor and materials and performing all work for the construction of earthwork and structures, South Canal, station 1340 to station 2016, Succor Creek division, Owyhee project, Oregon-Idaho. The work is located near Homedale and Marsing, Idaho. The principal items of work and the estimated quantities involved are as follows: 290,000 cubic yards of all classes of excavation for canal; 6,400 cubic yards of all classes of excavation for structures; 5,000 station cubic yards of overhaul; 13,000 cubic yards of back fill; 1,000 cubic yards of concrete in structures; 1,100 square yards of dry-dock paving; placing 77,000 pounds of reinforcement bars; laying 1,850 linear feet of 18-inch to 60-inch diameter concrete pipe; erecting 9. M. feet b. m. of timber in structures; and installing 9,000 pounds of gates and miscellaneous metalwork. This invitation for bids does not cover the purchase of materials which are to be furnished by the Government. Materials to be furnished by the contractor and those furnished by the Government are described in the specifications which will be a part of the contract. The work shall be commenced within thirty (30) calendar days after date of receipt of notice to proceed and shall be completed within three hundred (300) calendar days from the date of receipts of such notice. Bid security 10 per cent and performance bond 50 per cent will be required. No charge to prospective bidders for copies of the specifications and drawings; to others $3.00 not returnable. For particulars, address the Bureau of Reclamation, Ontario, Oregon; Denver, Colorado; or Washington, D. C.

M. A. SCHNURR, Acting Commissioner.

OFFICIAL BIDS

Notice to Contractors

Sealed proposals will be received at the office of the East Bay Municipal Utility District, 512 Sixteenth Street, Oakland, California, until 5:30 p. m., Thursday, October 17, 1935, and will at that hour be opened for furnishing 1 Tractor, Track Layer Type.

Proposal No. 689 covering same may be obtained upon application at Room 312 of the office of the District.

JOHN H. KIMBALL, Secretary.
Oakland, California, October 3, 1935.

Notice to Contractors

Sealed proposals will be received at the office of the East Bay Municipal Utility District, 512 Sixteenth Street, Oakland, California, until 5:30 p. m., Thursday, October 17, 1935, and will at that hour be opened for furnishing 2 Electric Welding Machines.

Proposal No. 690 covering same may be obtained upon application at Room 312 of the office of the District.

JOHN H. KIMBALL, Secretary.
Oakland, California, October 3, 1935.

OPPORTUNITY SECTION

OFFICIAL BIDS

Pumping Plant Buildings

Los Angeles, California

Bids November 19

Subject to the conditions set forth in the official Notice Inviting Bids, a copy of which may be obtained at the address herein stated, sealed proposals for constructing the Intake and Gene pumping plant buildings and appurtenant works of the Colorado River Aqueduct will be received by The Metropolitan Water District of Southern California at its office building, 306 West Third Street, Los Angeles, California, until 10:00 a.m., November 19, 1935.

The work is located in San Bernardino County, 11 to 14 miles northeast of the town of Earp, California, and comprises the construction of two pumping plant buildings, together with their inlet works, outlet structures, steel delivery pipes, electrical switching stations, and other appurtenant works. The buildings are to be of reinforced concrete and steel construction and the switch and bus structures of galvanized structural steel erected on concrete foundations. No proposal will be considered for less than the whole of the work.

Each proposal must be accompanied by a certified or cashier's check for $150,000. The bidder to whom contract is awarded must furnish a faithful performance bond in an amount not less than 50% of the estimated payments to be made under the contract, and a materialmen and laborers' bond in the amount required by the California statutes, and must pay not less than the prevailing rates of per diem wages as set forth in the Notice Inviting Bids referred to above.

Printed copies of plans and specifications for this work may be purchased from the District, express charges prepaid, for $5.00 per copy. This payment will in no event be refunded.

THE METROPOLITAN WATER DISTRICT
OF SOUTHERN CALIFORNIA

By F. E. WEYMOUTH,
General Manager and Chief Engineer.

October 8, 1935.

PROFESSIONAL DIRECTORY

INDEX TO ADVERTISERS

OPPORTUNITY SECTION